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ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE BALTIC POWER OFFSHORE WIND FARM

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Contractor **MEWO S.A.**

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Gdynia Maritime University

SUBCONTRACTORS **National Marine Fisheries Research Institute**

DHI Polska Sp. z o.o.

IfAÖ

MAREA Sp. z o.o.

Declaration

I declare that I fulfill the requirements referred to in Article 74a. section 2 of the Act of October 3, 2008 on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments (consolidated test, Journal of Laws of 2022, item 1029, as amended) and that I am aware of the criminal responsibility for making a false statement.

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Table of Contents

Abbreviations and definitions

µPa	micropascal – a pressure unit
ADD	acoustic deterent devices
AIS	Automatic Identification System for all vessels with a gross tonnage exceeding 300 Mg. It provides automatic exchange of data useful for avoiding collisions between vessels and identifying a vessel for the coast vessel traffic systems.
Baltica 2	Baltica 2 Offshore Wind Farm
Baltica 3	Baltica 3 Offshore Wind Farm
Bałtyk II	Polenergia Bałtyk II Offshore Wind Farm (previously known as Bałtyk Środkowy II)
Bałtyk III	Polenergia Bałtyk III Offshore Wind Farm (previously known as Bałtyk Środkowy III)
BBC	Big Bubble Curtain – a technology aimed at limiting the spread of underwater sound
diving benthophagus	seabird species feeding on benthic organisms after which they dive to the bottom of the water reservoir
BHD	Backhoe Dredger – a type of dredging vessel
OH&S	Occupational Health and Safety
BIAS	Baltic International Acoustic Survey
biogenic substances	essential chemical elements (biogenic substances) present in each organism include: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur
BirdLife International	international NGO dealing withe the protection of birds and their habitats
BSAP	Baltic Sea Action Plan to improve the quality of the Baltic Sea state of the environment.
BOD_5	five-day biochemical oxygen demand
chiropterofauna	Bats
CO_2	carbon dioxide
C-POD	Continuous Porpoise Detector
CSD	Cutter Suction Dredger – a type vessel used for dredging works
dB	decibel – a logarithmic measure of sound (pressure) intensity
DBBC	double big bubble curtain
DBT	Dibutyltin
DHI	DHI Polska Sp. z o.o.
DPD	detection positive day
DPM	detection positive minute

DEC	decision on environmental conditions within the meaning of the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*
DEC for the Baltic Power OWF	the decision on environmental conditions, which was issued for the Baltic Power OWF by the General Director for Environmental Protection on June 29, 2022 (ref. No.: DOOŚ-WDŚZOO.420.59.2021.SP.10).
Birds Directive	Directive of the European Parliament and of the Council 2009/147/EC of 30 November 2009 on the conservation of wild birds (OJ L of 2010, No. 20, p. 7, as amended)
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L of 1992, No. 206, p. 7, as amended)
epifauna	a group of invertebrate organisms inhabiting the surface layer of bottom sediments
EUROBATS	The Agreement on the Conservation of Populations of European Bats
phytobenthos	hydrophytes, which include vascular plants rooted in the seabed (e.g. sea grass) and macroalgae, which attach themselves to a hard surface (cobbles, wrecks, structures) or lie freely on the seabed
GBS	Gravity-base foundation
GD	Grab Dredger – a type of vessel used for dredging works
GDOŚ	General Director for Environmental Protection or General Directorate for Environmental Protection
GIOŚ	Chief Inspectorate of Environmental Protection
GMDSS	Global Maritime Distress and Safety System
habituation	getting used to the constant presence of a factor that does not cause immediate danger
HCFC	Chlorofluorocarbons
HELCOM	executive body of the Baltic Marine Environment Protection Commission (Helsinki Commission)
HF	High Frequency
HF – weighted SEL	sound exposure level with frequency weighing function according to susceptibility to noise-induced hearing damage of porpoises (NMFS 2018 was used in EIAR)
HFC	Hydrofluorocarbons
HM_01	measuring point located at the central point of the OWF Area (1 NM) at a depth of approx. 38 m
HSD	Hydro Sound Damper
Hz	hertz – unit of frequency, where 1 Hz is 1 cycle per second

IALA	International Association of Lighthouse Authorities
ICES	The International Council for the Exploration of the Sea
ICES 25-26	ICES Subdivision 25-26
ICES 32 Ex GoR	ICES subdivision 32 excluding Gulf of Riga
ichthyophags	bird species feeding on fish
IM UMG	Maritime Institute of the Gdynia Maritime University
IMGW-PIB	Institute of Meteorology and Water Management – National Research Institute
IMO	International Maritime Organization
infauna	a group of invertebrate organisms living inside the sediment
IUCN	International Union for Conservation of Nature
sea ducks	ducks from the Mergini tribe
observation campaign (campaign)	counting of birds in the entire survey area carried out during one or two survey cruises
kHZ	kilohertz – unit of frequency, where 1 kHz is 1,000 cycle per second
NSDC	National Spatial Development Concept
KSBM	National Maritime Safety System
NPS	National Power System
LC	by IUCN category of endangerment the least concern species (species not qualifying for one of the endangerment or near threatened categories; common species, widespread) *Least concern*
LOI	organic matter content of the sample determined as lost on ignition *Lost Of Ignition*
Macrozoobenthos	a complex of invertebrate organisms living on the surface of bottom sediments (epifauna) or inside the sediment, remaining during the sediment flushing on a screen with a mesh size of 1 mm
MARPOL 73/78	International Convention for the Prevention of Pollution From Ships, adopted in London on November 2, 1973 along with Appendices I, II, III, IV and V and Protocol of 1978 relating to the this Convention, along with Appendix I, adopted in London on February 17, 1978
MBT	Monobutyltin
heavy metals	a group of metals characterized by high density and often toxicity (arsenic, chromium, zinc, copper, cadmium, lead, mercury, nickel)
OWT	offshore wind turbines
OWF	offshore wind farm

MGiSM	Monitoring of marine species and habitats carried out as part of the State Environmental Monitoring
NM	nautical mile
territorial sea	an offshore area of 12 nautical miles (22,224 m) wide, measured from the baseline of that sea
MVA	megavoltampere – unit of apparent power
MW	megawatt – SI power unit
MOSB	Monitoring of Wintering Seabirds carried out as part of the State Environmental Monitoring
NMFS	American Federal Agency responsible for the management of national marine resources, which published criteria for assessing the impact of noise on marine mammals, taking into account the weighted frequency of received sound *National Marine Fisheries Service*
NOAA	National Oceanic and Atmospheric Administration
NOVANA	Danish nature Monitoring Agency Program, including Natura 2000 sites
NPZDR	National Fisheries Data Collection Program
NT	by IUCN endangerment category, near threatened species (species close to, but not yet qualifying for, VU) *Near Threatened*
Baltic Power OWF Area	Baltic Power Offshore Wind Farm Area in accordance with the permit of May 9, 2012 for erection and use of artificial islands, structures and devices issued by the Minister of Transport, Construction and Maritime Economy (ref. No.: GT7/62/1165483/decyzja/2012)
OWF Area (1 NM)	offshore survey area covering the Baltic Power OWF Area together with the area around it with a width of 1,352 m with a total area of 205 km²
OWF Area (2 NM)	offshore survey area covering the Baltic Power OWF Area together with the area around it with a width of 3,204 m with a total area of 323 km²
OGT	"presence of typical species" indicator
phenological periods	changes in living nature phenomena occurring in annual cycles
omnivores	omnivore bird species, which in the open sea prefer fish, typically collect the waste generated by the initial processing of fish on fishing vessels
EIA	Environmental Impact Assessment – procedure being a part of the proceedings for issuing the decision on environmental conditions, which is carried out by the authority competent to issue the decision
LUA	limited use area
ind.	individual(s)

OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic of 22 September 1992 (OJ L of 1998 No. 104, p. 2, as amended)
TOC	total organic carbon
Baltic Power DA	Baltic Power OWF development area
OWF DA	offshore wind farm development area – an area where construction of offshore wind turbines, substations and laying of power and communication networks is planned
RES	renewable energy sources
PBPR	Pomeranian Regional Planning Office
PCB	polychlorinated biphenyls
EMF	electromagnetic field
POM	within the meaning of the Act of March 21, 1991 on *maritime areas of the Republic of Poland and maritime administration* (consolidated text, Journal of Laws of 2022, item 457, as amended)
PSE	Polskie Sieci Elektroenergetyczne S.A. (Polish Power Grid Company)
PSzW	permit for erection and use of artificial islands, structures and devices in the Polish maritime area within the meaning of the Act of March 21, 1991 on *maritime areas of the Republic of Poland and maritime administration*
PSzW No. MFW/6/12, as amended	permit of May 9, 2012 for erection and use of artificial islands, structures and devices issued by the Minister of Transport, Construction and Maritime Economy for Baltic Power Sp. z o.o., as amended by: I) decision of the Minister of Transport, Construction and Maritime Economy of April 9, 2013 (ref. No.: GT7pb/62/20871/decyzja/2013); ii) decision of the Minister of Maritime Economy and Inland Navigation of January 22, 2020 (ref. No.: DGM.WZRMPP.3.430.80.2019.JD.2); iii) decision of the Minister of Infrastructure of May 31, 2021 (ref. No.: GM-DGM-7.530.54.2021) and iv) decision of the Minister of Infrastructure of December 30, 2021 (ref. No.: DGM-3.530.45.2021)
PTS	Permanent Threshold Shift
PTS (1-h accum.)	permanent shift in the threshold of hearing due to accumulated noise from 1 hour of piling
PTS (single impact)	permanent shift of the threshold of hearing in marine organisms due to a single pile driver impact
PUWG 1992	State System of Geodetic Co-ordinates 1992
PW – weighted SEL	sound exposure level with frequency weighing function according to susceptibility to hearing damage of seals caused by noise (NMFS 2018 was used in the EIAR)
PZPPOM	The Spatial Development Plan for the Polish Maritime Areas was introduced by the Regulation of the Council of Ministers of April 14, 2021 on the *adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200,000* (Journal of Laws, item 935)

PZPWP	Spatial Development Plan for the Pomorskie voivodship
EIA Report	this Environmental Impact Assessment Report withing the meaning of the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*
EIA Report for the OWF Baltic Power (2020)	Baltic Power Offshore Wind Farm Environmental Impact Assessment Report of July 2020
RCS	Radar Cross Section
MSFD	Marine Strategy Framework Directive (Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 *establishing a framework for Community action in the field of marine environmental policy* (OJ L of 2008 No 164, p.19, as amended)
WFD	Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L of 2000 No. 327, p. 1, as amended)
resuspension	repeated turbidity, disturbance of deposits laying on the bottom of the water body, caused e.g. by waving, drilling, drawing nets; it may be an internal source of water enrichment with (biogenic) nutrients accumulated in sediments
rms	root mean square
ROV	remotely operated underwater vehicle
RP	Republic of Poland
RAO	reasonable alternative option for the project
SAMBAH	international research project, within the framework of which static acoustic monitoring of porpoises in the Baltic Sea area was carried out
SAR	Maritime Search and Rescue Service
SDF	Standard Data Form for Natura 2000 sites
SEL	Sound Exposure Level
SEL_{cum}	Sound Exposure Level accumulated over a period of one hour, such as from multiple pile driver impacts
SM2M	underwater sound recording device
soft-start	procedure consisting in gradual increase of the energy of driving impacts (pile driver impacts) and, consequently, gradual increase of the noise intensity in order to enable fish, birds and marine mammals to leave and move away from the area of the performed works
SPEC	the status of special concern assigned to a given bird species by BirdLife International, taking into account the category of endangerment and the nature of the occurrence of the given species in Europe and in the world

SPEC 2	an upgraded SPEC 2 rank status (species whose global populations are concentrated in Europe, with an unfavorable conservation status in Europe)
SPEC 3	an upgraded SPEC 3 rank status (species whose global populations are not concentrated in Europe, but have an unfavorable conservation status in Europe)
SPL	average sound pressure level
NRS	noise reduction system.
STC	Sensivity Time Control
euphotic zone	uppermost layer of a body of water, the lower limit of which is determined by the depth to which 1% of photosynthetically active radiation reaches
TBT	tributyltin – an organic compound containing tin
TSHD	Trailing Suction Hopper Dredger – a type of vessel used for dredging works
TSS	Traffic Separation Scheme
TSS Słupska Bank	“Słupsk Bank” Traffic Separation Scheme
TTS	Temporary Threshold Shift
TTS (1-h accum.)	Temporary Threshold Shift due to accumulated noise generated during one hour of piling works
TTS (single impact)	temporary shift in the threshold of hearing due to a single pile driver impact
POP	persistent organic pollutants
UAS	software by DHI for numerical modeling of underwater noise *MIKE Underwater Acoustic Simulator*
EU	European Union
UMPL	Unified Model PL – numerical atmospheric model for Poland
UNCLOS	United Nations Convention on the Law of the Sea
EIA Act	Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*
UTM33	Universal Transverse Mercator
VMS	Vessel Monitoring System
VU	by IUCN endangerment category, vulnerable species (species that may extinct relatively soon, although not as quickly as endangered species) *Vulnerable*
WGS 84	World Geodetic System 1984
VIEP	Voivodship Inspectorate of Environmental Protection

Applicant/Investor	Baltic Power Sp. z o.o.
WoRMS	World Register of Marine Species
OPA	project option proposed by the Applicant
EEZ	Exclusive Economic Zone within the meaning of the Act of March 21, 1991 on *marine areas of the Republic of Poland and maritime administration*
PAH	polycyclic aromatic hydrocarbons
WWG	indicator of sensitivity of a given bird species to the offshore wind farms impacts
zoobenthos	invertebrates inhabiting bottom sediments, living both on their surface and in the depth

1 Background

1.1 Introduction

This document constitutes the Environmental Impact Report for the Baltic Power Offshore Wind Farm (hereinafter referred to as: Baltic Power OWF) The Applicant is the Baltic Power OWF – Baltic Power Sp. z o.o., which is a special purpose vehicle whose shareholders are PKN ORLEN S.A. and Northland Power Baltic Wind B.V.

The planned project is the Baltic Power OWF with a total maximum capacity of 1,200 MW located in the maritime areas of the Republic of Poland in the Exclusive Economic Zone, in the area of 131.08 km², at a distance of approx. 22.5 km from the seashore (Figure 1.1).

The planned project covers the construction, operation and decommissioning of the Baltic Power OWF. It will consist of 76 wind turbines, a maximum of 120 km of inter array cable routes and 2 offshore substations.

Figure 1.1. Location of the planned Baltic Power OWF project [Source: own study]

On May 9, 2012, Baltic Power Sp. z o.o. obtained permit No. MFW/6/12 from the Minister of Transport, Construction and Maritime Economy to erect and use artificial islands, structures and devices in the Polish maritime areas for the project entitled: "Offshore Wind Farm Complex with a maximum total capacity of 1,200 MW together with technical, measurement, research and service infrastructure related to preparation, construction and operation stage" (ref. No.: GT7/62/1165483/decyzja/2012), amended by: i) the decision of the Minister of Transport, Construction and Maritime Economy of April 9, 2013 (ref. No.: GT7pb/62/20871/decyzja/2013); ii) the decision of the Minister of Maritime Economy and Inland Navigation of January 22, 2020 (ref. No.: DGM.WZRMPP.3.430.80.2019.JD.2); iii) decision of the Minister of Infrastructure of May 31, 2021 (ref. No.: GM-DGM-7.530.54.2021) and iv) decision of the Minister of Infrastructure of December 30, 2021 (ref. No.: DGM-3.530.45.2021)

The table (Table 1.1) summarizes the basic parameters of the planned Baltic Power OWF in the option proposed by the Applicant (OPA).

Table 1.1. The basic parameters of the Baltic Power OWF for the option proposed by the Applicant

Facility name or parameter definition	Unit	Value
The number of wind turbines	pc.	76
Nominal power of a single wind turbine	MW	15
Number of MV/HV offshore substations	pc.	2
Length of cable routes of the systems inside the OWF (maximum)	km	120

The purpose of the planned project is to generate electricity using a renewable energy source – wind.

The present Environmental Impact Assessment Report comprises appendix to the application for the amendment to the decision on environmental conditions based on the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*. The decision on environmental conditions in question was issued by the General Director for Environmental Protection on June 29, 2022 (ref. No.: DOOŚ-WDŚZOO.420.59.2021.SP.10). Therefore, the authority competent to issue the amendment to the decision on environmental conditions for the planned project is the General Director for Environmental Protection. Pursuant to Article 87 of the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*, the provisions indicating the issue of the decision on environmental conditions shall apply accordingly to any amendments to the decision on environmental conditions. The detailed scope of the requested amendments is indicated in Chapter 1.4, and the justification for their implementation is presented in Chapter 17.

The area of the planned project is covered by the spatial development plan resulting from the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of a spatial development plan for internal sea waters, territorial sea and exclusive economic zone at a scale of 1:200,000.*

The "Environmental Impact Report for the Baltic Power Offshore Wind Farm" was prepared by the Consortium of MEWO S.A. and the Maritime Institute of the Gdynia Maritime University (formerly: Maritime Institute in Gdańsk) in cooperation with subcontractors: MIR-PIB, IFAO, Marea Sp. z o.o., DHI Polska Sp. z o.o.

1.2 Project classification

Pursuant to the Regulation of the Council of Ministers of September 10, 2019 *on projects that may have a significant impact on the environment* (Journal of Laws, item 1839, as amended), the planned project is classified as a project that may always have a significant impact on the environment (pursuant to § 2 section 1 point 5) b) i.e. plants using wind energy for electricity generation located in maritime areas of the Republic of Poland.

Classification as projects that may always have a significant impact on the environment means the obligation to obtain a decision on environmental conditions after obligatory conducting of the procedure on the environmental impact assessment of the project. Due to the fact that the subject of this procedure is an amendment to the already issued decision on environmental conditions, in accordance with the aforementioned Article 87 of the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments*, the following rules shall apply accordingly in this case.

Impact of the planned project on the environment includes:

- Verification of the environmental impact assessment report;
- Obtaining opinions and approvals required by the Act;
- Ensuring the possibility of public participation in the procedure;

The environmental impact assessment procedure requires the General Director for Environmental Protection to ensure the possibility of public participation, which includes among others:

- Making public information about, among others, the instigation of the procedure and proceeding to the environmental impact assessment and also about an opportunity to get familiar with the documentation and place of making it available for review and about timing, methods and venue for giving feedback and making requests, mentioning the 30-day deadline for their submission;
- Processing of provided feedback and requests;
- Providing the grounds for the decision with information on public participation and the manner in which they were taken into account and the extent to which the comments and requests made in relation to public participation were taken into account;
- Making public information about issuing a decision on environmental conditions and an opportunity to get familiar with its content.

Everybody is entitled to make comments and file requests in the public consultation process; it applies, among others, to the environmental impact assessment procedure. Comments and requests may be submitted in writing, verbally to the minutes, by means of electronic communication without the need to provide them with a qualified electronic signature.

1.3 Premises for the implementation of the project

The planned project – Baltic Power OWF – is the project of: Baltic Power Sp. z o.o., which is a special purpose vehicle whose shareholders are PKN ORLEN S.A. and Northland Power Baltic Wind B.V. Construction of an offshore wind farm (OWF) is one of the strategic objectives of the ORLEN Group. It is in line with the assumptions of the updated Energy Policy of Poland [348], assuming the construction, in the Polish Exclusive Economic Zone (EEZ) of offshore wind farms with a total capacity of 5.9 GW by 2030 and approx. 11 GW in 2040. These activities will enable the transformation of the Polish power sector towards the use of zero-emission energy sources, which is a response to the current climate challenges faced by Poland, Europe and the world.
An important premise for the project implementation is the possibility of avoiding the emission of pollutants to the atmosphere. Assuming a conservative assumption of 40% capacity utilization and 30 years of operation, an OWF with a maximum capacity of 1,200 MW may generate 126.14 TWh/454.11 PJ of electricity, which would allow to avoid emissions of over 45 million Mg CO_2, over 618 thousand Mg SO_2, over 83 thousand Mg of nitrogen oxides and nearly 1,5 million Mg of dust in lignite-fired power plants, assuming the emissions indicated by the European Environment Agency [131].

The above indicators for the project in question will contribute to the fulfillment, by Poland, of compliance with international regulations at global and regional level.

The provisions of the United Nations Framework Convention on Climate Change, signed in 1992 in Rio de Janeiro, ratified by Poland in 1994, aimed at stabilising greenhouse gas concentrations in the atmosphere at a level that does not cause dangerous changes in the climate system are binding at global level. A regulatory mechanism of the Convention, the so-called Kyoto Protocol, was adopted in 1997, setting a timeframe for reducing greenhouse gas emissions. The Protocol entered into force in 2005 and was ratified in Poland in 2002. The Paris Agreement was reached in 2015 with the objective of limiting the increase in the global average temperature to a level well below 2°C above the pre-industrial level and of making efforts to limit the temperature increase to 1.5°C above the pre-industrial level, recognizing that this will significantly reduce the risks and impacts of climate change. The Agreement was adopted in October 2016, also in Poland.

The planned project consisting in the generation of electricity from a renewable energy source, such as wind, in maritime areas is part of the energy policy of Poland, contributing to the reduction of negative environmental impact and reduction of greenhouse gas emissions from the power sector. It is consistent with the EU's 2030 framework for climate and energy policy (Climate and Energy Package), whose main objectives are:

- Reduction of greenhouse gas emissions by 40% relative to the emission level from 1990;
- Ensuring at least 32% of the share of energy generated by renewable sources (the original target of at least 27% was corrected in 2018);
- Improvement of energy efficiency by at least 32.5% (the original target of at least 27% was corrected in 2018).

The planned investment project, through the production of energy from a renewable source and the simultaneous reduction of CO_2 emissions, is directly covered by two of the three objectives of the European Union in this respect.

The Baltic Power OWF is also part of the objective of the EU long-term strategy adopted in November 2018 "Climate neutrality by 2050" [237] – achieving zero level of greenhouse gas emissions by 2050. The Baltic Power OWF also meets the challenges posed by the idea of the European Green Deal [462], including in particular the proposals included in the "Ready for 55" package aimed at achieving the climate and energy targets for 2030 (emission reduction target by at least 55%) and 2050 (net climate neutrality). The "Ready for 55" package proposes that by 2030 the current EU target of the share of renewables in the overall energy mix be raised from 32% to at least 40%.

1.4 Scope of changes in the decision on environmental conditions

The table (Table 1.2) indicates the requested changes in the DEC issued for the Baltic Power OWF, which are the subject of this procedure (detailed justification of the requested changes is presented in Chapter 17 of the EIA Report).

Table 1.2. The requested amendments to the DEC issued for the Baltic Power OWF, being the subject of this procedure [Source: own study]

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
1.1	**The specific conditions of using the environment at the stage of construction and operation or usage of the project, with particular focus on the necessity of protecting outstanding natural values, natural resources and monuments, as well as on reducing nuisance to neighboring areas:**		
1.1.a	Land-based site back-up facilities are to be organized within the existing port area. Within the site back-up facilities the following shall be located: storage areas for construction materials. Construction materials as well as substances and preparations used at the stage of implementation of the project, from the data sheets of which it is clear that they may pose a threat to water or soil, shall be stored in the area of the site back-up facilities on a hardened and sealed ground, in places sheltered from the weather and protected from unauthorized access. These sites shall be equipped with devices or means to collect or neutralize them in case of their accidental escape from the packages. The types and quantities of devices or means shall be adjusted according to the types and quantities of stored materials, substances and preparations. The above materials, substances and preparations shall be stored and moved in the manufacturer's packaging; if they escape from the packaging, they shall be removed or neutralized immediately.	**Delete**	---
1.1.b	Land-based site back-up facilities are to be organized within the existing port area. Within the site back-up facilities the following shall be located: storage areas for oils, lubricants and other materials that can be a source of oil derivative substances. These materials shall be stored in the area of the site back-up facilities on a hardened and sealed ground, in lockable and leak-proof containers, resistant to the substances stored in them, in places sheltered from the weather and protected from unauthorized access. These sites shall be equipped with technical and chemical means of containment, removal or neutralization of oil	**Delete**	---

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
	derivative pollutants; in case of leakage of oil derivative substances, they shall be removed or neutralized immediately.		
1.1.c	Land-based site back-up facilities are to be organized within the existing port area. Within the site back-up facilities the following shall be located: waste storage sites. Hazardous waste shall be stored in the area of the site back-up facilities on a hardened and sealed ground. Places designated for the storage of hazardous waste shall be equipped with devices or means to collect or neutralize waste, in case of its accidental escape from the containers. The types and quantities of these devices or means shall be adjusted to the types and quantities of the waste stored. If waste escapes from the containers, it shall be removed or neutralized immediately.	**Delete**	---
1.2	The ground referred to in point 1.1 shall be made using waterproof and frost-resistant concrete slabs with a minimum strength class of C35/45, sealed with flexible joints resistant to weather (temperature, UV radiation, rain and air) and chemicals, or using geomembranes.	**Delete**	---
1.3	Inner array power cables in the OWF area shall be laid at a depth of 1 m to 3 m below the seabed surface.	**Change**	"If it is necessary to sink inner array power cables in the OWF area, they shall be laid at a depth up to 3 m below the seabed surface."
1.4	Inner array cables shall be laid below the seabed surface using jet trenching.	**Change**	"The selected cable laying method must not cause greater environmental impact than jet trenching."
1.5	During the construction stage, strong upward-positioned light shall not be used from dusk to dawn.	**Change**	"During the construction stage, strong upward-positioned light shall not be used from dusk to dawn, save for the lighting required by the OH&S regulations and standards."
1.6	Construction work shall be started from a single site, gradually expanding the offshore wind farm to include additional single adjacent offshore wind turbines and other structures.	**Change**	"Construction work shall be started from a single site, gradually expanding the offshore wind farm to include additional offshore wind turbines and other structures."

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
1.7	During the construction and operation stages, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials); in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.	**Change**	“During the construction and operation stages, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials) in accordance with the regulations applicable in this respect; in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.”
1.8	After the completion of the construction work of a single offshore wind turbine or accompanying infrastructure, all construction debris and possible pollution shall be removed from the seabed.	**Change**	“After the completion of the construction work, all construction debris and possible pollution shall be removed from the seabed.”
1.9	During the operation stage, small, pulsating light sources of low intensity shall be used to illuminate wind turbines; from dusk to dawn, the light shall not be directed upward.	**Change**	“During the operation stage, small, pulsating light sources of low intensity shall be used to illuminate wind turbines; from dusk to dawn, the light shall not be directed upward, save for the lighting required by the OH&S and navigation markings’ regulations and standards.”
1.10	During the operation stage, light emissions from accommodation and service platforms shall be reduced by using window covers or using blue light.	**Change**	“During the operation stage, light emission should be limited, subject to lighting required by OH&S and navigation marking regulations and standards”.
1.13	At least 24 hours before the commencement of sonar works, acoustic deterrent devices, such as pingers, shall be used.	**Change**	“At least two hours before the commencement of sonar works, acoustic deterrent devices, such as pingers, shall be used”.
3.2	Acoustic deterrent devices, such as pingers, shall be used at least 24 hours before piling of foundations or support structures;	**Change**	“Acoustic deterrent devices, such as pingers, shall be used at least two hours before piling”.
3.3	Piling of foundations or support structures shall be performed under ornithological monitoring. In the period from the beginning of August to the end of March, soft-start piling can be started after the ornithological monitoring determines that there are no common guillemots, razorbills, long-tailed ducks and velvet scoters in an area with a radius of 2 km from the	**Change**	Piling in the period from August to March should be performed under the ornithological monitoring. If the ornithological monitoring does not observe the presence of common guillemots and razorbills in a total number of more than 20 individuals, as well as long-tailed ducks in a number of more than 50 individuals in the area with a radius of 2 km from the piling site, works preceded each

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
	piling site. If the above-mentioned species are observed, piling shall be stopped until the individuals move away;		time by the soft-start procedure may be commenced.”
3.4	“While piling of foundations or support structures, noise mitigation systems, such as air curtains, acoustic screens, cofferdam systems or other technology shall be used, ensuring that the following maximum underwater noise levels are not exceeded at a distance of 9 km from the piling site: – 140 dB re 1 Pa2s SELcum and HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency noise – porpoise), – 170 dB re 1 uPa2s SELcum and PW-weighted (PW-weighting function for pinniped marine mammals – seals), – 186 dB re 1 pPa2s SELcum unweighted for fish.”	**Change**	“While piling, noise mitigation systems, such as air curtains, acoustic screens, cofferdam systems or other technology shall be used, ensuring that the following maximum underwater noise levels are not exceeded at a distance of 11 km from the piling site: – 140 dB re 1 Pa2s SELcum and HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency noise – porpoise), – 170 dB re 1 uPa2s SELcum and PW-weighted (PW-weighting function for pinniped marine mammals – seals), – 186 dB re 1 pPa2s SELcum unweighted for fish”.
3.5	Offshore wind turbines shall be divided into three groups, located in the eastern, western and central parts of the OWF area, whose rotor tips shall be painted in bright colors, assigning a different painting method (color or pattern) for each group; fluorescent paints shall be used with colors that reflect or absorb UV radiation; in one group, one of the blades shall be painted black.	**Delete**	---
3.7	During the decommissioning stage, strong upward-positioned light shall not be used from dusk to dawn.	**Change**	“During the decommissioning stage, strong upward-positioned light shall not be used from dusk to dawn, save for the lighting required by the OH&S and navigation markings’ regulations and standards.”
3.8	During the decommissioning stage, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials); in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.	**Change**	“During the decommissioning stage, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials) in accordance with the regulations applicable in this respect; in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.”
3.9	During the decommissioning stage, all above-water elements of	**Change**	“After completion of operation of the farm in question, it is

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
	the Baltic Power OWF shall be removed.		recommended to remove all its components. It is permitted to leave some of the facilities founded in the seabed/on the seabed if they constitute a habitat of valuable communities of marine organisms.”
3.10	Before starting the removal of elements of the Baltic Power OWF, an environmental inventory of the objects founded in the seabed or on the seabed shall be conducted under the supervision of an ichthyologist and bentologist. The inventory results shall be submitted to the Regional Director for Environmental Protection in Gdańsk and the General Director for Environmental Protection in Gdańsk.”	**Delete (conditional)**	In the event of changing point 3.9, there is no need to delete this point.
3.11	During the decommissioning stage of the Baltic Power OWF, the adjacent wind turbines and other structures shall be removed one by one.	**Delete**	---
4.1	**Monitoring of water and bottom sediment quality and sediment dispersion:**		
4.1.1	Pre-investment monitoring – before the commencement of the construction of the Baltic Power OWF: during winter, before the commencement of construction works, single water quality tests, including the following hydrochemical parameters shall be carried out: oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH) and concentration of biogenic substances (ammonium nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), turbidity of water, total suspended solids as well as concentration of harmful substances in water and bottom sediments, such as: mercury, heavy metals, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB).	**Change**	“If, after conducting the water quality tests performed for the purposes of the application for the decision on environmental conditions, there are extraordinary hazards which may result in the contamination of water and sediments in the Baltic Power OWF area, it is necessary to perform pre-investment monitoring, i.e. during winter, before the commencement of construction works, single water quality tests, including the following hydrochemical parameters shall be carried out: oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH) and concentration of biogenic substances (ammonium nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), turbidity of water, total suspended solids as well as concentration of harmful substances in water and bottom sediments, such as: mercury, heavy metals, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB).

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
4.1.2	**Monitoring during the construction stage of the Baltic Power OWF:**		
4.1.2.a	Immediately before the commencement of the works interfering with the seabed that cause agitation of sediments, monitoring of sediment dispersion shall be carried out by measuring: turbidity of water, determining the extent and concentration of total suspended solids and determining the thickness of deposited bottom material.	**Delete**	---
4.1.2.b	The monitoring shall be carried out for a minimum of 4 offshore wind turbines, implemented in the OWF area, in locations that have different abiotic conditions.	**Delete**	---
4.1.2.c	The monitoring of total suspended solids shall be carried out throughout the period of the works interfering with the seabed and shall be continued for 1 week after their completion.	**Delete**	---
4.1.2.d	The measurement of total suspended solids shall be described in the form of profiles with a radius of 1,000 m from the site of disturbance in the W, S, N, E directions.	**Delete**	---
4.1.3	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.1.3.a	Once per year, hydrochemical parameters of water shall be tested, such as: dissolved oxygen, total organic carbon (TOC), acidification (pH) and biogenic substances (ammonia nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), turbidity of water, total suspended matter.	**Change**	"In the fifth year after the completion of the construction, hydrochemical parameters of water shall be tested, such as: dissolved oxygen, total organic carbon (TOC), acidification (pH) and biogenic substances (ammonia nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), water turbidity, total suspended matter."
4.1.3.b	Once per year, the concentration of harmful substances in water and bottom sediments shall be measured, such as: mercury, nickel, lead, cadmium, arsenic, total chromium, chromium (VI), zinc, aluminum, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), TBT.	**Change**	"In the fifth year after the completion of the OWF construction, the concentration of harmful substances in water and bottom sediments shall be measured, such as: mercury, nickel, lead, cadmium, arsenic, total chromium, chromium (VI), zinc, aluminum, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), TBT."

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
4.2	**Underwater noise monitoring:**		
4.2.1	**Pre-investment monitoring – before the commencement of the Baltic Power OWF construction:**		
4.2.1.a	Conduct background noise measurements in the middle of the area occupied by the OWF.	**Delete**	---
4.2.1.b	Conduct background noise measurements separately for three sea states: at about 2, 4 and 6 Bft. For each sea state, conduct 4 round-the-clock measurements, one per each successive quarter.	**Delete**	---
4.2.2.a	“Monitor underwater noise levels throughout the entire period of work related to piling of foundations or support structures into the seabed. Noise measurement points to be determined at a distance of 9 km from the piling site in the W, S, N, E directions (a total of 4 measurement points) and on the border of the Słowińska Refuge [Ostoja Słowińska] PLH220023 Natura 2000 site.”	**Change**	“For 8 selected circumferential wind turbines, underwater noise monitoring during piling to be performed at 4 measurement points 11 km away from the piling site, located in 4 main directions (W, S, E, N). For other piling works, monitoring to be performed at one point at a distance of 11 km towards the main direction of noise propagation. The results of this monitoring will be subject to the same noise emission limits as the monitoring at the boundary of the Natura 2000 site – Ostoja Słowińska (PLH220023).”
4.2.2.b	For every 10th offshore wind turbine under construction, monitor underwater noise levels throughout the entire period of work related to piling of foundations or support structures into the seabed, additionally at a distance of 750 m and 1.5 km from the piling site in the W, S, N, E directions (a total of 8 measurement points).	Change	In at least 10 locations in the OWF area and the 5 km buffer, continuous underwater noise surveys to be performed during the entire piling process.”
4.2.3	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.2.3.a	Carry out control measurements of underwater noise at the operation stage no later than 12 months after commissioning of the entire OWF. Measurements shall be carried out in the middle of the area occupied by the OWF and at a distance of 100 meters from 5 randomly selected offshore wind turbines.	**Delete**	---
4.2.3.b	Perform control measurements separately for three nominal	**Delete**	---

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
	power output ranges of the OWF: "low" (at about 2 Bft), "medium" (at about 4 Bft) and "maximum" (at about 6 Bft). For each power output range, conduct 4 round-the-clock measurements, one per each successive quarters.		
4.2.5	Carry out underwater noise monitoring taking into account the current guidelines of the Bundesamt für Seeschifffahrt und Hydrographie.	**Change**	"When monitoring underwater noise, apply the measurement methods in terms of equipment, its use, and processing of measurement results, as indicated in the current guidelines of the Bundesamt für Seeschifffahrt und Hydrographie."
4.3	**Monitoring of seabirds**		
4.3.1	**Pre-investment monitoring – before the commencement of the Baltic Power OWF construction:**		
4.3.1.a	On an annual basis, prior to the start of construction works, during the day from early October to the end of May, conduct bird counts at a frequency of no less than two cruises per month. In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September.	**Change**	"On an annual basis, prior to the start of construction works, during the day from early October to the end of May, conduct bird counts at a frequency of two cruises per month (in cases justified by weather conditions, it is permissible to carry out one cruise per month). In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September."
4.3.1.b	The monitoring shall cover the OWF area and the 5-kilometer zone around the OWF borders.	**Change**	"The monitoring shall cover the OWF area, the 5-kilometer zone around the OWF borders, and the reference area."
4.3.2	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.3.2.a	In the period from the beginning of October to the end of May, during the day, conduct bird counts with a frequency of not less than two cruises per month. In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September. In order to compare survey results, the route of the survey cruise should be the same or very similar to that conducted during the pre-investment monitoring.	**Change**	"During the day, from early October to the end of May, conduct bird counts at a frequency of two cruises per month (in cases justified by weather conditions, it is permissible to carry out one cruise per month). In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September. In order to compare survey results, the route of the survey cruise should be the same or very similar to that conducted during the pre-investment monitoring."

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
4.3.2.b	The monitoring shall cover the OWF area and the 5-kilometer zone around the OWF borders.	**Change**	“The monitoring shall cover the OWF area, the 5-kilometer zone around the OWF borders, and the reference area.”
4.3.2.c	Surveys should be carried out for 3 first years of the entire OWF operation stage, if the construction is not divided into stages. Otherwise, perform surveys one year after the completion of each consecutive phase of construction and for 3 consecutive years after the completion of the entire OWF.	**Change**	“The surveys shall be performed in the 1st and 3rd year of operation of the OWF.”
4.4	**Monitoring of migratory birds**		
4.4.1	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.4.1.d	Conduct monitoring of migratory birds in two cycles in a year, resulting from two migration periods of birds, i.e. from the beginning of March to the end of May, and from the beginning of July to the end of November, in the first 3 years after the completion of the entire OWF.	**Change**	“Conduct monitoring of migratory birds in two cycles in a year, resulting from two migration periods of birds, i.e. from the beginning of March to the end of May, and from the beginning of July to the end of November, in the 1st and 3rd year after the completion of the entire OWF.”
4.5	**Monitoring of migratory birds mortality:**		
4.5.1	Conduct for a period of 5 years after the completion of construction of the entire OWF, during seasonal spring migrations (from early March to late May) and autumn migrations (from mid-July to late November).	**Delete**	---
4.5.2	Monitoring of mortality of birds should be conducted using the automatic system for recording bird collisions with offshore wind turbines / victims of collisions, with the possibility of conducting measurements at both nighttime and daytime.	**Delete**	---
4.5.3	As part of monitoring of mortality of birds, use 3 units of automatic bird collision detection systems, one for each group of offshore wind turbines referred to in point III.3.5, mounted on 3 offshore wind turbines in the OWF area.	**Delete**	---

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
4.6	**Bat monitoring**		
4.6.1	Carry out bat monitoring for a period of 3 years after the completion of the entire OWF; the monitoring should be carried out during the periods of spring migration (early April – late May) and autumn migration (early August – late October).	**Change**	“Carry out bat monitoring in the 1st and 3rd year after completion of the entire OWF. The monitoring shall be carried out during the periods of spring migration (early April – late May) and autumn migration (early August – late October).”
4.7	**Monitoring of porpoises and seals:**		
4.7.2	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.7.2.a	Survey monitoring of the presence of porpoises should be carried out for at least the first 3 years after the completion of the OWF using the same methods as during the wildlife survey.	**Change**	“Survey monitoring of porpoises’ presence shall be carried out in the 1st and 3rd year after completion of the entire OWF using the same methods as for the wildlife survey.”
4.7.2.b	Conduct surveys monitoring of the presence of seals for at least the first 3 years after completion of the entire OWF. Conduct visual surveys during survey cruises with the frequency of one cruise per month.	**Change**	“Seal surveys should be performed during seabird surveys carried out as part of the post-development analysis.”
4.8	**Monitoring of ichthyofauna:**		
4.8.3	Ichthyofauna survey stations should be located both in the OWF area and at a distance of 1000 m from the OWF area, on the water region not intended for offshore wind energy generation and characterized by similar parameters of the marine environment (depth, distance from the shore, etc.).	**Change**	“Ichthyofauna survey stations shall be located both in the OWF area and on the water region not intended for offshore wind energy generation that is characterized by similar parameters of the marine environment (depth, distance from the shore)”.
IV.	I state the obligation to carry out an assessment of the project environmental impact as part of the procedure on the issuance of decisions referred to in Article 72 section 1 point 1, to the extent consistent with Article 66 of the EIA Act, with particular regard to: 1. cumulation of impacts of the planned project with other offshore wind farms under construction and planned for construction in the Polish Exclusive Economic Zone, for which decisions on environmental conditions have been	**Change**	“There is no obligation to carry out the project environmental impact assessment as part of the procedure for issuing the decisions referred to in Article 72 section 1 point 1 of the EIA Act.”

Item	Current wording of the decision on the DEC issued for the Baltic Power OWF	Change request	Proposed new wording of the provision
	issued; 2. the impact of the project in terms of underwater noise emissions.		

1.5 Objective and scope of the report

The environmental impact assessment report was prepared for the purpose of the environmental impact assessment of the planned project in the context of the amendment to the decision on environmental conditions issued for the Baltic Power OWF.

The purpose of the report is to determine or specify in detail:

- characteristics and scale of the project;
- Possible variants of the project;
- Environmental conditions, resources and values of abiotic, natural, cultural and landscape environment;
- Existing and planned use and development of sea water areas;
- Other conditions resulting, among others, from special regulations, e.g. concerning the prevention of failures or construction disasters;
- Nature, range and significance of the expected environmental, spatial and social impacts related to the construction and operation of the Baltic Power OWF;
- The possibility of avoiding, preventing, limiting and possibly compensating the identified adverse effects of the project or hazards, taking into account potential emergency situations;
- The need to formulate recommendations to be applied at the stage of designing and preparation of the investment project, its implementation and operation, as well as decommissioning;
- The need to protect people, health and living conditions of the population against negative impacts;
- Proposal of environmental monitoring carried out at all stages of the project.

The subject of the study is the analysis of the impact of the planned Baltic Power OWF on the environment, comparison of the analyzed options of the planned project in terms of environmental protection and indication of the option most favorable for the environment, performed in the context of the amendments to the decision on environmental conditions requested by the applicant (Table 1.2).

The scope of the report results from the requirements specified in Article 66 of the EIA Act and contains information enabling the analysis of the criteria listed in Article 62 of the EIA Act (Table 1.3).

Table 1.3. Compliance of the contents of the Report with the provisions of Article 62 section 1 and Article 66 section 1 of the EIA Act [Source: own study based on the EIA Act]

Provision of the EIA Act	Chapter in the Report
Article 62 section 1	
Identification, analysis and assessment of direct and indirect environmental impact of the project	6
Identification, analysis and assessment of direct and indirect impact of the project on the population, including human health and living conditions	6.1.1.8; 6.1.2.10; 6.1.3.9;
Identification, analysis and assessment of direct and indirect impact of the project on tangible goods	6.1.1.6; 6.1.2.8; 6.1.3.7;
Identification, analysis and assessment of direct and indirect impact of the project on monuments	6.1.1.5; 6.1.2.7; 6.1.3.6;
Identification, analysis and assessment of direct and indirect impact of the project on landscape, including cultural landscape	6.1.1.7; 6.1.2.9; 6.1.3.8;
Identification, analysis and assessment of direct and indirect impact of the project on the interaction between the elements referred to above	6
Identification, analysis and assessment of the direct and indirect impact of the project on the availability of mineral deposits	6.1.1.1; 6.1.2.1; 6.1.3.1;
Identification, analysis and assessment of the risk of major failures and natural and construction disasters	2.5.8
Identification, analysis and assessment of possibilities and methods of preventing and reducing the negative impact of the project on the environment	11

Identification, analysis and assessment of the required scope of monitoring	12
Article 66 section 1	
Description of the planned project, including:	2
characteristics of the entire project and conditions of land use at the stage of implementation and operation or use	2.4
Main characteristics of the production processes	2.2
Expected types and quantities of emissions, including waste, resulting from the implementation and operation or usage phase of the planned project	2.4
Information on biodiversity, the use of natural resources, including the use of soil, water and earth surface	3.2.3; 3.7.4;
Information on energy demand and its consumption	2.4.5
Information on demolition works concerning projects likely to have a significant impact on the environment	2.4.4
The risk assessed based on scientific knowledge as regards major failures, natural disasters or structural collapse, taking into account the substances and processes used, including those related to climate change	2.5.8
Description of natural elements of the environment covered by the scope of the anticipated impact of the planned project on the environment, including:	3
Description of environmental elements under protection based on the Act of April 16, 2004 on nature protection and ecological corridors within the meaning of this Act,	3.7.2; 3.7.3
Description of hydromorphological, physical and chemical, biological as well as chemical properties of waters,	3.3; 3.7.1
Results of the environmental inventory, understood as a set of field surveys performed for the purpose of characterization of elements of the natural environment, if carried out, including a description of the applied methodology and other data on the basis of which a description of environmental elements was prepared.	Chapter 3 Appendix 1
Description of the monuments protected under the regulations concerning monument protection and care for monuments, located within the impact range of the planned project and its immediate neighborhood	3.8
Description of the landscape in which the project is to be located	3.10
Information on relations to other projects, in particular on the accumulation of impacts of implemented, completed or planned projects, for which a decision on environmental conditions was issued, located in the area where the project is planned to be implemented and in the area of impact of the project or whose impacts fall within the area of impact of the planned project – to the extent to which their impacts may lead to the accumulation of impacts along with the planned project	1.8; 7
Description of the predicted effects on the environment in case the project is not implemented, taking into account available environmental information and scientific knowledge	5
Description of variants, taking into account the specific characteristics of the project or its impact, including:	2.3
Variant proposed by the Applicant and its reasonable alternative,	2.3.2; 9
reasonable most environmentally beneficial option – with justification of the choice;	2.3.2; 9
Determination of the foreseen environmental impact of the analyzed variants, including in case of a serious industrial failure, natural disaster or structural collapse, on the climate, including greenhouse gas emissions and impacts being important in terms of adaptation to climatic changes, and a possible transboundary environmental impact	2.5; 7.4; 7.5
Comparing the impacts of the analyzed variants into:	6.1; 6.2
Human beings, plants, animals, fungi and environmental habitats, water and air,	6.1.1.8; 6.1.1.4.1; 6.1.1.2; 6.1.1.3
Earth surface, including mass earth movements and landscape,	6.1.1.1; 6.1.1.7
Tangible property,	6.1.1.6
Monuments and cultural landscape, included in scope of the existing documentation, especially in the record or register,	6.1.1.5
Forms of nature conservation referred to in Article 6 section 1 of the Act of April 16, 2004 on	6.1.1.4.2; 6.1.1.4.2.1; 6.1.1.4.3

nature conservation, including for the purposes and subject of protection of Natura 2000 sites, and continuity of ecological corridors connecting them	
Elements listed in Article 68 section 2 point 2b, if they are included in the environmental impact report or if they are required by the competent authority	Not applicable
interactions between the elements mentioned above	6.1; 6.2
Justification of the variant proposed by the Applicant, taking into account the information referred to in Article 66 section 1 point 6 and 6a of the EIA Act	2.3.2
Description of forecasting methods applied by the Applicant as well as project significant impacts of the planned project on the environment including direct, indirect, secondary, cumulated, short term, medium term and long term environmental impacts, resulting from:	1.9; 6
Existence of the project,	6.1; 6.2
Use of natural resources,	6.1; 6.2
Emissions	6.1; 6.2
Description of planned actions aimed to avoid, prevent, limit or environmentally compensate adverse impacts on the environment, in particular on the forms of nature protection referred to in Article 6 section 1 of the Act of April 16, 2004 on nature protection, including the impact on the objectives and object of protecting the Natura 2000 area, and on the continuity of wildlife corridors connecting them, along with assessing their effectiveness during project execution, operation and removal, respectively	11
In case the planned project relates to the use of a process system, comparison of the proposed process technology with technology in conformity with all the requirements stated in Article 143 of the Act of April 27, 2001 – Environmental Protection Law	10
Reference to environmental objectives resulting from strategic documents important for the implementation of the project	1.7
Justification for meeting the conditions referred to in Article 68 points 1, 3 and 4 of the Act of July 20, 2017 – Water Law, if the project affects the possibility of achieving the environmental objectives referred to in Article 56, Article 57, Article 59 and Article 61 section 1 of that Act	3.3
Indication whether it is necessary for the planned project to establish a limited use area referred to in the Act of April 27, 2001 – Environmental Protection Law, and to determine the boundaries of such area, limitations in the scope of land use, technical requirements for civil structures and methods of their use; this does not apply to projects consisting in the construction or alteration of roads and projects consisting in the construction or alteration of a railway line or an airport for public use	13
Graphical presentation of the issues	Entire document with appendices
Presentation of the issues in the cartographic form in the scale corresponding to the subject and detailed scope of the issues being analyzed in the report, also enabling a comprehensive presentation of the conducted analyses of the environmental impact of the project	Entire document with appendices
Analysis of potential social conflicts related to the planned project	14
Presentation of proposals for monitoring the impact of the planned project at the stage of its construction and operation or use, in particular on the forms of nature protection referred to in Article 6 section 1 of the Act of April 16, 2004 on nature protection, including the impact on the objectives and object of protecting the Natura 2000 area, and the continuity of wildlife corridors connecting them, as well as information on available other monitoring results which may be relevant for the determination of responsibilities in this respect	12
Description of difficulties resulting from technological deficiencies or gaps in the current knowledge which were encountered during elaboration of the report	15
Simple summary of the information included in the report related to each component of the report	23
Signature of the author, and if the author of the report is a team of authors – the leader of this team, together with the first and last name and date of preparation of the report	Before the list Abbreviations and Definitions
Declaration of the author, and if the author of the report is a team of authors – declaration of the team leader, on meeting the requirements referred to in Article 74a section 2 of the EIA Act	Before the list Abbreviations and Definitions
Information sources forming the basis for report elaboration	1817

1.6 Report background

The basis for the preparation of the EIA Report was:

- Applicant's documentation:
  - Permit for the erection and use of artificial islands, structures and devices in Polish maritime areas for the project named "Offshore Wind Farm Complex with a maximum total capacity of 1200 MW together with technical, measurement, research and service infrastructure related to the preparation, execution and operation stages" (decision MFW/6/12 of 9 May 2012), ref. No.: GT7/62/1165483/decision/2012);
  - Plan przeciwdziałania zagrożeniom i zanieczyszczeniom olejowym [Plan for prevention of hazards and oil pollution], MEWO S.A., Gdynia Maritime University, Gdańsk, 2020;
  - Ocena ryzyka nawigacyjnego [Navigation risk assessment], MEWO S.A., Gdynia Maritime University, Gdańsk 2020;
  - Ekspertyza w zakresie wpływu na bezpieczeństwo badań nad rozpoznaniem i eksploatacją zasobów mineralnych dna morskiego [Expert opinion on the impact on the safety of research on exploration and production of mineral resources of the seabed], MEWO S.A., Gdynia Maritime University, Gdańsk, 2020,
  - Documentation containing the results of environmental surveys and environmental inventory performed in the period from October 2018 to March 2020 for the purpose of this EIA Report (Appendix No. 1 to the EIA Report);
  - Decision on environmental conditions for the project named: "Baltic Power Offshore Wind Farm" of the Regional Director for Environmental Protection in Gdańsk of September 17, 2021 (ref. No.: RDOŚ-Gd—WOO.420.42.2020.AJ.21);
  - Decision of the General Director for Environmental Protection of June 29, 2022 repealing the decision of the RDEP in Gdańsk of September 17, 2021 in its entirety and specifying the environmental conditions for the implementation of the project named: Baltic Power Offshore Wind Farm (ref. No.: DOOŚ-WDŚZOO.420.59.2021.SP.10);
  - Opinion of March 31, 2022 of the Director of the National Maritime Museum in Gdańsk (ref. No.: NMM/IP/807/2022) in the scope of handling monuments located within the area of the project "Offshore Wind Farm Complex with a maximum total capacity of 1200 MW and technical, measurement, research and service infrastructure related to the preparation, execution and operation stages ("Baltic Power OWF");
- strategic documentation, programming and planning documents at international, national, regional and local level;
- applicable legal regulations, including:
  - Act of October 3, 2008 *on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments;*
  - Directive of the European Parliament and of the Council 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ L 2012, No 26, p. 1, as amended).
  - Act of December 17, 2020 on promoting electricity generation in offshore wind farms (consolidated

text, Journal of Laws of 2022, item 1050);
  - other international, EU and national regulations.

Moreover, when preparing this EIA Report, sources of information specified in Chapter 18 were used , in particular environmental impact assessment reports or other documentation for projects completed, implemented or planned, located closest to the planned project, such as:

- Environmental Impact Assessment Report for the Bałtyk Środkowy III Offshore Wind Farm (currently the Bałtyk III OWF);
- Environmental Impact Assessment Report for the Bałtyk Środkowy II Offshore Wind Farm (currently the Bałtyk II OWF);
- Environmental Impact Assessment Report for the Baltica Offshore Wind Farm;
- Environmental Impact Assessment Report for the BC-Wind Offshore Wind Farm;
- Environmental Impact Assessment Report for the FEW Baltic II Offshore Wind Farm.

1.7 Arrangements of strategic and planning documents

The sub-chapter 1.3 indicates the main premises concerning the implementation of the project. These include increasing the share of renewable energy and reducing greenhouse gas emissions to the atmosphere. Other international and national documents, the provisions of which affect the planned investment project or the provisions of which are implemented by the planned investment project, are presented below.

1.7.1 International and EU documents

The Baltic region is characterized by a long-standing international cooperation in areas such as development and spatial planning (VASAB), marine environment protection (HELCOM) and energy (BASREC). The European Union Strategy for the Baltic Sea Region (EUSBSR), which is the first EU macro-regional intra-EU strategy, was adopted in 2009.

VASAB — intergovernmental cooperation between Baltic Sea Region ministers responsible for development and spatial planning in its strategy document VASAB Long-Term Perspective for the Territorial Development of the Baltic Sea Region (2009) sets out the directions of the region's development towards 2030. One of them is to strengthen internal and external availability, and the development of offshore wind energy is indicated as a way to achieve the energy independence of the region. Measure 18 of the LTP directly indicates the need to exploit potential in Polish Maritime Areas (POS) in the short term. The planned investment project is part of the directions of development of the Baltic Sea region suggested by VASAB.

Poland is a signatory to the **1992 Convention for the Protection of the Marine Environment of the Baltic Sea Area** (Helsinki Convention). Under the Helsinki Convention, actions for the Conservation of the Baltic Sea focus on the implementation of the Baltic Action Plan (BAP), adopted at the HELCOM Ministerial Meeting in 2007. The Baltic Action Plan assumes that good ecological status of the Baltic Sea will be achieved by 2021 and sets out the fields of action to achieve this. The overarching strategic objective of segment IV “Maritime activities” is that maritime transport and economic activities are carried out in the Baltic Sea in an environmentally friendly manner. One of the priorities is the minimum risks posed by offshore structures. Countries have agreed within the framework of the BAP that they will follow relevant procedures and make efforts to eliminate, reduce or compensate potential negative environmental impacts that may be caused by offshore structures. The 2013 Ministerial Conference in Copenhagen adopted the **Recommendation 34E/1** for the protection of important bird habitats and migration routes in the Baltic Sea against the negative effects of wind and wave energy production at sea. This document emphasizes a positive aspect of the development of wind energy in the context of climate change, recommending specific steps that may help to reduce the negative impact of the investment project on the environment. It should be emphasized that the planned investment project will be implemented in accordance with Recommendation 34E/1 of HELCOM. The provisions of this recommendation refer mainly to the activities of the States Parties to the Helsinki Convention and as such do not concern the planned project, but the Applicant assumes that the project will be conducted so as to avoid or minimize the impact of the project on the environment, including in particular important habitats of birds and their migration routes.

1.7.2 Documents on national and regional level

The planned investment project directly pursues the objectives described in the national and regional documents quoted below. These objectives are mainly aimed at avoiding harmful gas emissions in various ways, increasing the share of RES in energy production and increasing the level of energy security.

National documents

The **Maritime Policy of the Republic of Poland until 2020** (with a perspective until 2030), adopted by the Council of Ministers on March 17, 2015, specifies that the real potential of development of offshore wind energy in Poland, which may bring the greatest benefits for the Polish energy balance and the Polish economy, amounts to 6 GW of power installed in the OWF until 2030, of which 1 GW in 2020 and another 2 GW until 2025. Creating conditions for the construction of offshore wind farms has been identified as an action to improve energy security.

The Energy Policy of Poland until 2030, adopted by the Council of Ministers on November 10, 2009, is a valid government document specifying the directions of development of the power system, including the indication of sources of electricity supply. In the "Forecast of fuel and energy demand until 2030", which constitutes Appendix No. 2 to the "Polish Energy Policy until 2030", the economic potential of wind energy resources in Polish maritime areas was estimated at 19 TWh per year.

In **the Energy Policy of Poland until 2040** approved by the resolution of the Council of Ministers of February 2, 2021, offshore wind energy was indicated as one of the methods of increasing the share of RES in the power sector. According to the adopted assumptions, offshore wind energy will reach in 2030 the installed capacity of approx. 5.9 GW, whereas in 2040 – approx. 11 GW.

The Strategy for Responsible Development until 2020 (with a 2030 perspective) also responds to the EU EUROPE 2020 Strategy. It specifies that the modernization of generation sources and innovative solutions in the economic sector, along with the development of available capacities from renewable sources, will contribute to the reduction of greenhouse gas emissions. The Strategy states that RES sources are mostly non-controllable sources. Continuous subsidization of RES causes serious disturbances in the functioning of energy markets – causing an increase in energy prices. Therefore, the Strategy identified as necessary, among others:

- ensuring the possibility of balancing and interaction of RES sources with other sources (not subject to limitations by forces of nature);
- evolutionary process of changes.

The development of offshore wind energy was also taken into account in the Transmission Network Development Plan for the years 2018–2027, prepared by Polskie Sieci Elektroenergetyczne S.A. (PSE). The part concerning potential directions of extension of transmission networks ensuring the reliability of the power system indicates the performance of analytical works in the scope of construction of offshore transmission networks and indicates that among the expected system effects of development of the extra high voltage networks is the preparation of the capability for connection and output of the installed power on wind farms at the level allowing to meet the RES share in the energy balance of the country. The document also presents various OWF connection scenarios.

The National Program for Development of Low-Emission Economy determines the need for greater diversification of the energy mix. Mainly coastal areas were identified as the location of wind farms. It was also specified that modernization and extension of the national power system is required to meet the requirements of the RES market. It was stated in the document that the maximum productivity of the OWF in the Polish maritime areas is estimated at 12 GW of installed capacity and 48–56 TWh of energy per year. The real investment plans until 2030 amount to 6 GW. The document specifies that for the development of offshore wind energy in Poland, it is necessary, among others:

- to conduct analyses in the scope of the grounds for the OWF development in Poland;
- development of offshore power networks.

By the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, territorial sea and exclusive economic zone at a scale of 1:200,000,* the Spatial Development Plan for Polish Maritime areas (PZPPOM) was implemented. The document takes into account the permit for erection and use of artificial islands, structures and devices decisions and other decisions issued until the commencement of works on PZPPOM (e.g. permits for laying cables or pipelines), in accordance with the assumptions presented by the maritime administration during the public consultation for the preparation of this document. Therefore, the planned project is compliant with the arrangements of PZPPOM.

The National Energy and Climate Plan for 2021–2030 indicates in its assumptions and targets, among others, the expected increase in the share of renewable energy sources in the final gross energy consumption to approx. 32% in the power sector. This document also recognizes, taking into account the existing RES development in Poland, that this is an ambitious obligation.

Regional documents

The Development Strategy of the Pomorskie Voivodship 2030 adopted by the Parliament of the Pomorskie Voivodship by Resolution No. 376/XXXI/21 of April 12, 2021 is the basic strategic document setting out the directions of the Pomorskie Voivodship development. The Strategy sets three strategic objectives: Sustainable Security, Open Regional Community and a resilient economy. They are operationalized for 12 purposes. The premises for the implementation of one of them (1.2 Energy Security) indicate that: "*Pomeranian Voivodship, due to good conditions for the development of renewable energy sources, including offshore wind energy, may contribute significantly to this objective*." Moreover, in this document, the development of offshore wind turbines was noted in a broader perspective, taking into account the related and resulting: development of seaports, specialist services, transmission networks and the creation of conditions for the transformation of the shipbuilding industry.

The Spatial Development Plan of the Pomeranian Voivodship 2030 was adopted by Resolution No. 318/XXX/16 of the Pomeranian Voivodship Parliament of December 29, 2016. In the area of spatial policy, it focuses, inter alia, on the increase in electricity production and the transformation of the region into a national leader in renewable energy production. The spatial policy activities and projects included in the Spatial Development Plan of the Pomeranian Voivodeship (PZPWP) 2030 include, i.a.: "... construction of transmission and distribution networks, as well as substations for power output from the new system and renewable energy sources (wind farms, including offshore wind farms). (.) extension of the Żarnowiec 400/110 kV substation for the possibility of connecting offshore wind farms to the National Power System (NPS). " The Spatial Development Plan of the Pomeranian Voivodeship 2030 (PBPR) outlines the vision of spatial transformations of the region. One of the elements of the vision is the thesis that as a result of installation of large power within the voivodship, in the form of a nuclear power plant, coal-fired power plant and OWT, as well as due to the development of distributed power sector, the security of energy supply of Northern Poland will be improved and the voivodship will become energetically self-sufficient. It is indicated that in the ports in Łeba, Ustka and Władysławowo, the shipyard areas should be activated for the activities related to the management of offshore areas (e.g. logistic and service and maintenance center of the OWF).

1.7.3 Summary of findings of strategic and planning documents

The planned project remains in line with the expectations of many policies and strategies, in particular concerning environmental protection (reduction of pollutant emissions), sustainable development (use of renewable energy sources) and energy security (independence from external energy sources). **The planned investment project is included in the environmental objectives of the analyzed applicable strategic and planning documents.**

1.8 Information on the connection of the Baltic Power OWF with other projects

In the Baltic Power OWF area, it is planned to launch other OWFs. Currently, seven Permit for erection and use of artificial islands, structures and devices in maritime areas in the Baltic Power Area remain in force (Figure 1.2):

- B-Wind (permit No.: MFW/10/11);
- C-Wind (permit No.: MFW/13/11);
- Bałtyk Środkowy III (Bałtyk III) (permit No.: MFW/2/12);
- Bałtyk Środkowy II (Bałtyk II) (permit No.: MFW/2a/13);
- Baltica 2 (permit No.: MFW/4/12);
- Baltica 3 (permit No.: MFW/5/12);
- FEW Baltic II (permit No.: MFW/5a/13).

Figure 1.2 Location of the planned OWFs in the Baltic Power Area [Source: own study]

At the moment none of the above-mentioned projects has been implemented. These projects are at different stages of development. Seven of them have decisions on environmental conditions (Bałtyk II OWF, Bałtyk III OWF, Baltica 2 and Baltica 3 – as Baltica OWF, FEW Baltic II, B-Wind and C-Wind).

1.9 Methodology of assessment of impacts of the planned project

When preparing the EIA Report, on the basis of which the decision on environmental conditions for the Baltic Power OWF was issued, the results of environmental surveys and environmental inventory performed in 2018–2020 for the Baltic Power OWF were used. The work also takes into account the results of the information meetings, which were used to clarify the issues of public interest and to develop the part of the EIA Report dedicated to the analysis of possible social conflicts.

The works were performed in accordance with the method of preparation of the environmental impact assessment report, including:

- Using the results of environmental surveys and environmental inventories;
- Establishing the program and planning documents at international, national and regional level and the results of the environmental impact forecasts for these documents, which may have an impact on the planned project;
- Concept of the project, including determination of activities in the following phases: construction, operation and decommissioning, including determination of hazards to the environment and their potential effects;
- Results of the information meetings.

When preparing the EIA Report, first of all the following was used:

- Guidelines, manuals and other materials concerning the preparation of the EIA Report;

- Experience of the design team and generally applicable good practices.

Three phases of the planned project were considered in the EIA Report:

- Construction:
- Operation;
- Decomissioning;

The purpose of the EIA Report is to determine potential impacts of the planned project on the environment. The assessment is a study and analytical work performed by a team of specialists. When preparing the EIA Report, analyses of descriptive and cartographic materials were carried out, the impact assessment methodology was applied, as well as interpretation of the results of the conducted surveys and inventories.

When preparing the EIA Report, the following was analyzed in particular:

- Technical and technological aspects of the planned project having effect on the magnitude of the impact;
- Environmental, spatial and social conditions of the planned project;
- Variant perparation opportunities (in terms of location, technical, process, organization and logistics);
- Size and significance of potential environmental impacts;
- The possibility of avoiding and reducing adverse environmental impacts;
- Scope of monitoring.

As part of the works on this EIA Report, the above-mentioned information was supplemented and re-analyzed in the context of data on the target parameters of the Baltic Power OWF as well as the requested changes in the DEC issued for the Baltic Power OWF. The EIA Report contains an analysis of the planned project in terms techniques and technologies and operating conditions to be used in this project. Among others, the information contained in the documentation of the planned project, including the building permit design, was used and the potential impact of similar activities that may accumulate was analyzed.

On the basis of available data, environmental surveys and environmental inventories, significant environmental, spatial and social conditions were specified (or, possibly, updated). On this basis, potential impacts and risks related to the planned project were identified, including in particular the proposed amendments to the DEC for the Baltic Power OWF. The currently forecact scope and reach of the expected environmental impact were also determined. Comparisons were made with analogous cases in terms of environmental conditions and the size and nature of impacts.

The approach used to assess the scale and significance of impacts results from the authors' experience gained during the environmental impact assessments of projects planned to be implemented in offshore areas, including OWF.

The adopted approach allowed to identify comprehensive actions aimed at avoiding, preventing and limiting negative impacts related to the planned project.

The figure (Figure 1.3) shows a diagram of the method of preparation of the EIA Report in relation to the data concerning the planned project and the conducted environmental surveys. The term “environmental surveys” means that the report on the impact of the planned project on the environment used both environmental surveys and environmental inventories performed for the purpose of this document, as well as results of other surveys, e.g. for projects located closest to the planned project, in connection with the development of such documents as protection plans for protected areas (resulting from environmental monitoring or monitoring/surveys performed in connection with other activities or projects), available to the public or in literature.

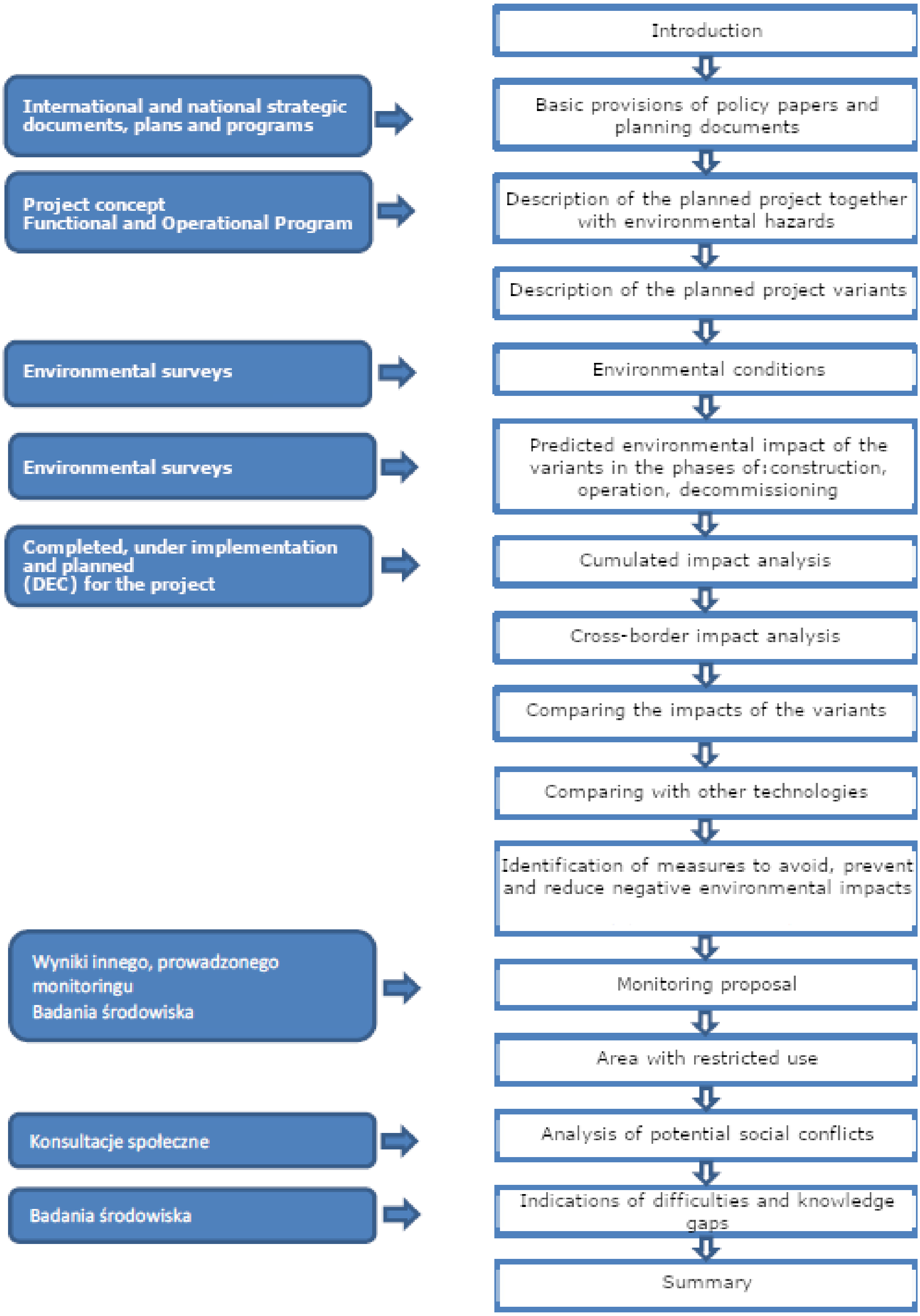

Figure 1.3. General diagram of the environmental impact assessment report preparation [Source: own study]

Table (Table 1.4) presents the characteristics of surveys of the marine environment, which were performed for the purpose of preparation of the EIA Report. Detailed testing methods for individual elements are presented in the Inventory Report constituting Appendix No. 1 to this EIA Report.

Table 1.4. Characteristics of tests of abiotic and biotic elements of the marine environment [Source: data of Baltic Power Sp. z o.o.]

Type of surveys	**Date of surveys**	**Range of surveys**	**Scope of surveys**
Abiotic elements			
Geophysical surveys	01.2019-11.2019	Area (1 Mm)	Measurements (in profiles every 80 m): • Bathymetric (multibeam sonic depth finder); • Sonar (side scan sonar); • Magnetometric; • Seismoacoustic and seismic (two sediment profile metering units operating at different frequencies, high and low). Visual inspection carried out by means of a ROV vehicle. Analysis of material collected during magnetometric, bathymetric and sonar measurements and visual inspections of selected facilities. Taking 72 core samples, in an even grid with an average density of 1 sample per 3 km^2. Measurement of thermal resistance *in situ* at 16 stations. Taking 189 samples of surface sediments in an even grid with an average concentration of 1 sample per 1 km^2.
Meteorological survey	01.2019-02.2020	Area (1 Mm)	Measurements using a measuring buoy to measure meteorological conditions. Registration: • Wind speed and direction; • Atmospheric pressure; • Air temperature and humidity.
Hydrological survey	01.2019-02.2020	Area (1 Mm)	Measurements using two sets for measurements of hydrological parameters (one under the meteorological buoy and one in the shallowest place of the OWF area). Registration: • Wave height, period and direction; • sea currents velocity and direction (in the surface, middle and bottom layers); • water temperature, turbidity and conductivity (at depths: 1, 4, 8, 16 m and above the bottom). Water sampling from the surface and bottom layers at 44 stations, including water sampling in standard vertical profiles at 6 stations. Measurement of water temperature and conductivity (during water sampling) using a CTD probe. Physical and chemical analyses of indicators in accordance with reference methods (or equivalent) specified in Appendix No. 7 to the Regulation of the Minister of Maritime Economy and Inland Navigation of July 13, 2021 *on forms and method of monitoring of surface water bodies and underground water bodies* (Journal of Laws, item 1576).
Geochemical	01.2019-07.2019	Area (1 Mm)	Taking 190 samples of surface sediments (in winter campaign) and 188 samples of surface sediments (in summer campaign) in an even grid with an average concentration of 1 sample per 1 km^2. Laboratory analyses based on PN-EN-ISO standards or, in the absence thereof, in accordance with test procedures prepared by an accredited laboratory or applicable test methods.
Acoustic	12.2018-01.2020	Area (2 Mm)	Acoustic background measurements using 1 hydrophone
Biotic elements			
Phytobenthos	06.2019	Area (1 Mm)	Analysis of bathymetric and sonar data. Visual inspection performed using a ROV vehicle on 11 transects, including 10 on the rocky bottom and 1 on the sandy bottom.

Type of surveys	Date of surveys	Range of surveys	Scope of surveys
			Analysis of film material.
Macrozoobenthos	05-06.2019	Area (1 Mm)	Taking 200 quantitative samples on a soft bottom in an even grid with an average density of 1 sample per 1 km^2. Taking 10 samples on the hard bottom, including 9 quantitative samples and 1 qualitative sample. Laboratory analysis in terms of: • Taxonomic composition; • Abundance; • Biomass.
Ichthyofauna	01.2019-10.2019	Area (1 Mm)	Acoustic measurement using a testing echo sounder. Sampling (ichthyofauna) using pelagic trawls and sets of research nets. Sampling (ichthyoplankton) using a Bongo net. Ichthyological analysis in terms of: • Length and mass of specimens; • The sex and maturity of the gonads; • Degree of stomachs filling; • Age. Technical analysis in terms of: • Taxonomic composition; • Abundance; • Larvae and fry lengths.
Marine mammals	12.2018-01.2020	Area (2 Mm)	Passive acoustic recording of porpoises using 5 continuous underwater acoustic porpoise detectors (C-POD). Aerial observations on 5 transects.
Migratory birds	03.2019-11.2019	Area (2 Mm)	Visual observations, acoustic recordings and recordings using vertical and horizontal radar at 1 station.
Seabirds	10.2018-11.2019	Area (2 NM) and three areas: Słupsk Bank, South Central Bank, strip of coastal waters	Counting of birds sitting on water and flying, along: • 4 transects in the OWF Area (2 NM); • 8 transects in the Natura 2000 site - Słupsk Bank (PLC990001); • 6 transects in the South Central Bank area; • 8 transects within the coastal waters strip.
Bats	04.2019-10.2019	Area (2 Mm)	Acoustic recording with the use of recorders at 2 stations and along 5 transects with a total length of 55 km.

Figure (Figure 1.4) presents a diagram of the methodology of the project environmental impact assessment.

At the first stage of the assessment, the activities resulting from the implementation of the planned project in its individual phases, i.e. construction, operation and decommissioning, were specified. On the basis of environmental and inventory surveys carried out for the purposes of the EIA Report, the elements of the environment (receptors) that may be affected by these activities were also determined. At the second stage of the assessment, links between sources of potential impacts and individual receptors were identified on the basis of literature and experience of experts. Specific impacts are assigned characteristics in four categories:

- Nature of impacts (positive or negative);
- type of impacts (direct, indirect, secondary/simple, accumulated/reversible, permanent);
- Impact range (local, regional) and determining whether the impact is cross-border;
- Time range of impacts (short-term, medium-term, long-term, fixed, instantaneous).

At the same time, the resistance of receivers to individual impacts in cases of possible interaction between the impact and receptor was determined. Taking into account the assigned characteristics of impacts and the determined resistance of receivers to them, the scale (size) of impacts, specific for individual relations between the impact and receiver, was determined. The size (scale) of the impact is described in a five-step scale: (1) insignificant, (2) small, (3) moderate, (4) large and (5) very large.

Taking into account the prevalence, presence of a given receiver, its significance and role in the environment, and in particular its protection status, individual receivers, treated as an environmental resource, were assigned a value (significance), also determining it on a five-stage scale: (1) insignificant, (2) small, (3) moderate, (4) large and (5) very large.

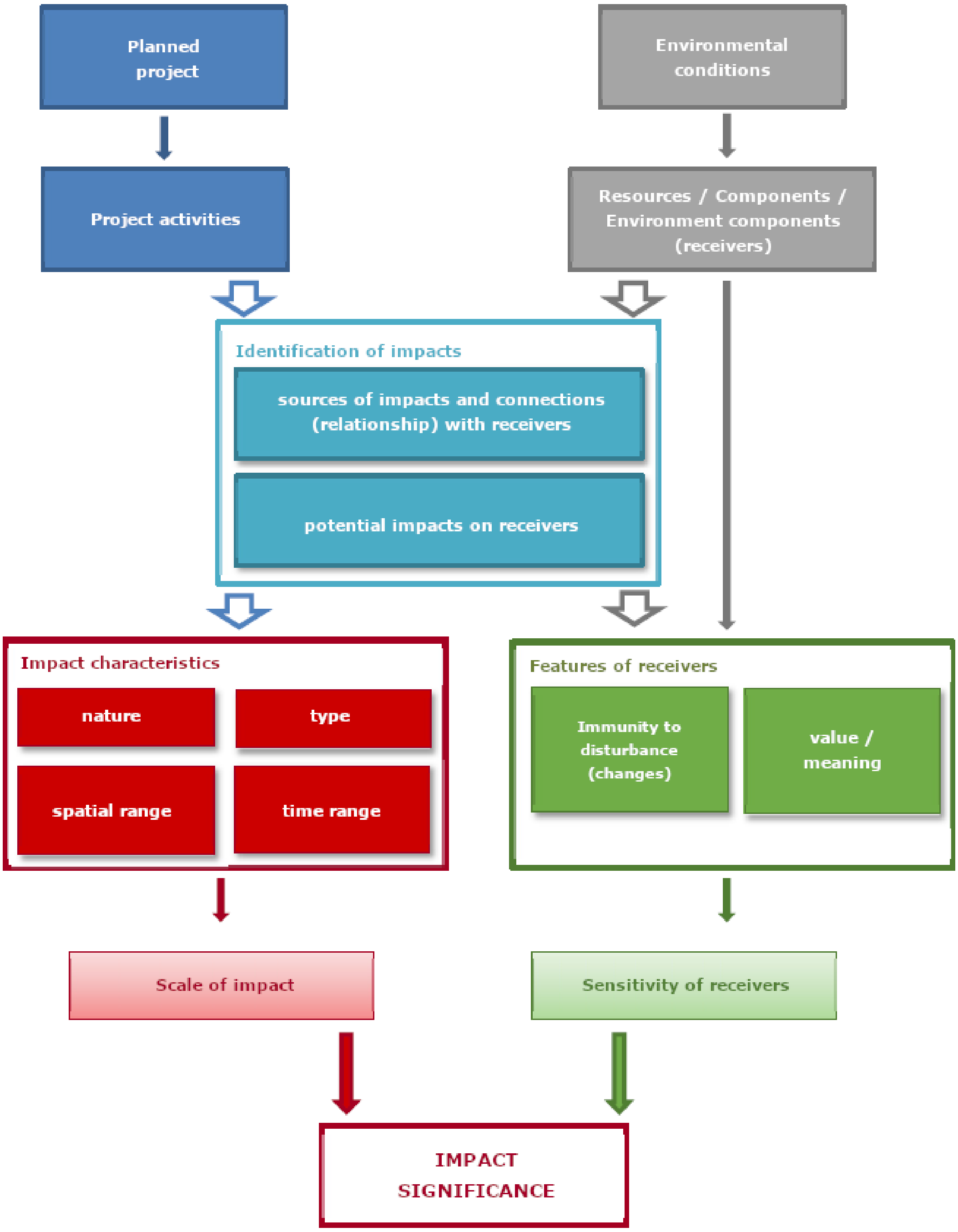

Figure 1.4. Diagram of environmental impact identification and impact assessment, including determination of impact significance [Source: own study based on ESPOO REPORT (2017) [126]]

At the next stage of the assessment, taking into account the assigned impact magnitude (scale) and receiver sensitivity, the significance of the impact was also determined in the five-stage scale (Table 1.5):

- negligible impact;

- low impact;
- moderate impact;
- significant impact;
- substantial impact.

Table 1.5. Matrix defining the significance of the impact in relation to the scale of impact and the value of the resource [Source: own study]

Impact significance		**Receiver sensitivity**				
		Negligible	**Low**	**Moderate**	**High**	**Very high**
Scale (size) of impact	Negligible	Negligible	Negligible	Negligible	Negligible	Low importance
	Low	Negligible	Negligible	Low importance	Low importance	Moderate
	Moderate	Negligible	Low importance	Low importance	Moderate	Moderate
	High	Negligible	Low importance	Moderate	Significant	**Substantial**
	Very high	Low impact	Moderate	Moderate	**Substantial**	**Substantial**

In accordance with the above described methodology of the environmental impact assessment, a significant impact may occur if a “very large” scale of impact is determined and at the same time at least a “high” sensitivity of the receiver and a “high” scale of impact with a “very high” sensitivity of the receiver.

The arrangements made as part of the above-mentioned analysis were revised accordingly and referred to detailed data on the target shape of the planned Baltic Power OWF as well as changes in the contents of the original DEC issued for the Baltic Power OWF.

2 Description of the planned project

2.1 General characteristics of the planned project

2.1.1 Subject and scope of the project

The project in question is the construction and operation of the Baltic Power OWF with a total installed capacity not exceeding 1,200 MW, together with technical, measurement, research and service infrastructure related to the preparatory, execution and operation stages, located in the Polish Exclusive Economic Zone (EEZ).

The scope of the project covers its implementation consisting of three basic stages: construction, operation and decommissioning. The entire project will be composed of the following components:

- wind turbines consisting of nacelles with rotors, a tower, transition pieces and monopiles embedded in the seabed;
- two offshore substations;
- internal power and communication lines.

Components of the Baltic Power OWF will be installed on the seabed at various depths – within the range from 34 to 45 m.

The detailed scope of project parameters for the OPA is presented in the table (Table 2.1). The options considered in this document are described in sub-chapter 2.3.

Table 2.1. List of major parameters of the project in the option proposed by the Applicant [Source: own study]

Parameter	Value
Installed power [MW] (maximum)	1200
Number of wind turbines [pcs] (maximum)	76
Wind turbine power output [MW] (minimum)	15
Rotor diameter [m] (maximum)	236
Clearance between the rotor operation area and water surface [m] (minimum)	22.3
Wind turbine height [m a.s.l.] (maximum)	258.3
Number of MV/HV offshore substations [pcs]	2
Maximum length of cable routes of the systems inside the OWF (maximum) [km]	120

2.1.2 Location of the project and area of the occupied water region

The Baltic Power area is located in the Polish EEZ, north of communes of Łeba and Choczewo at a distance of 22.5 km from the coastline (Figure 2.1). This area is described by the geographical coordinates indicated in the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, for Baltic Power Sp. z o.o. (Table 2.2). The Baltic Power OWF project will be implemented entirely within the boundaries of the area indicated in the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended.

The Baltic Power development area (Baltic Power DA) (Figure 2.1, Table 2.3) from the north and south will reach the boundary of the area with the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, the western boundary of the Baltic Power DA in the northern route will reach the boundary of the area with the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, and then will run at a distance of 500 m from the boundary of permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, to the turning point. Further on, the western boundary of the Baltic Power DA will move away from the boundary of the area from the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, up to the south-western point of the area from the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended. The eastern boundary of the Baltic Power DA in its northeastern section will be routed at the boundary of the area with the permit for erection and use of artificial islands, structures and devices No. OWF/6/12, as amended, and then at a distance of 500 m from the boundary from the permit for erection and use of artificial islands, structures and devices No. MFW/6/12, as amended.

The area of the Baltic Power area is 131.08 km^2, while the area of the Baltic Power DA is 113.72 km^2.

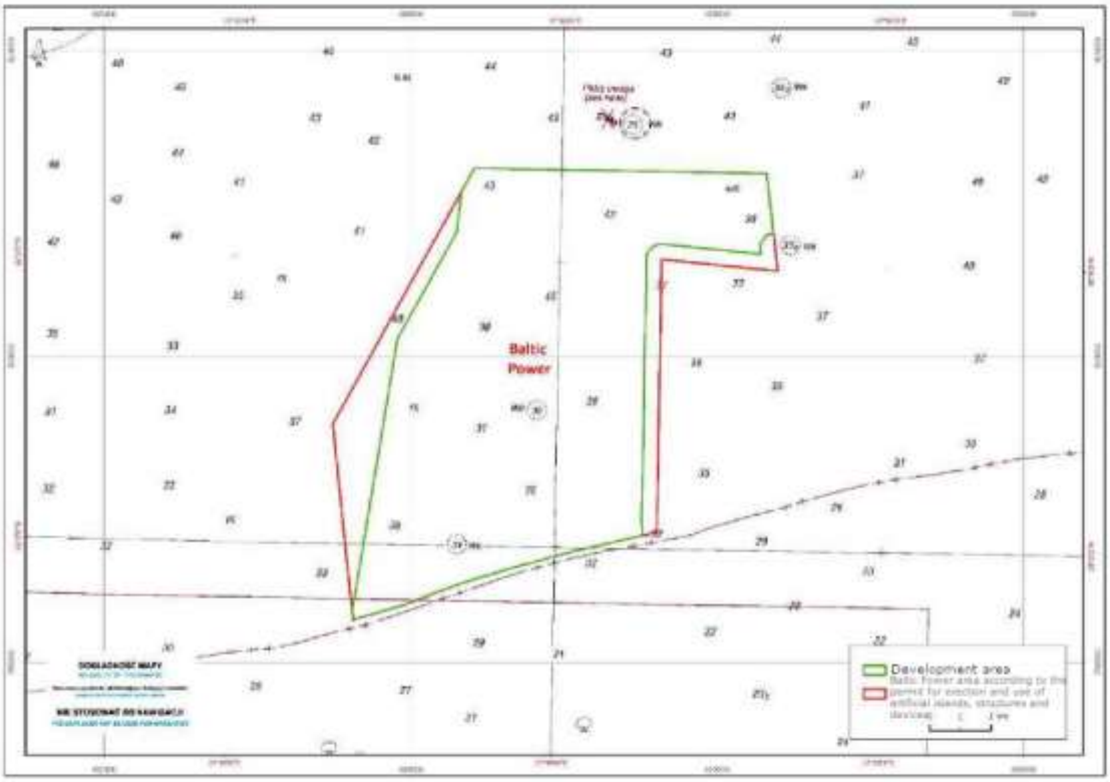

Figure 2.1. Location of the project in relation to the issued decision on permit for erection and use of artificial islands, structures and devices No. OWF/6/12, as amended [Source: own study].

Table 2.2. The coordinates of the Baltic Power OWF area in accordance with permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended for Baltic Power Sp. z o.o.:

Point number	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
A	418044.43	794268.06	17°43'05.64308" E	55°00'17.95302" N
B	416270.95	793861.41	17°41'26.24788" E	55°00'03.73399" N
C	415031.36	793574.52	17°40'16.78915" E	54°59'53.69608" N
D	413285.62	793090.28	17°38'39.07356" E	54°59'36.94600" N
E	412593.80	792887.82	17°38'00.36776" E	54°59'29.96063" N
F	411843.08	792653.71	17°37'18.38651" E	54°59'21.91016" N
G	410854.28	792313.17	17°36'23.13529" E	54°59'10.25938" N
H	409795.99	791893.32	17°35'24.07405" E	54°58'55.99045" N
I	408816.12	791611.50	17°34'29.27723" E	54°58'46.23085" N
J	408132.22	791417.00	17°33'51.03349" E	54°58'39.48611" N
K	407992.20	792718.65	17°33'41.65236" E	54°59'21.50243" N
L	407468.94	797802.46	17°33'06.28830" E	55°02'05.61664" N
M	409898.75	802193.52	17°35'18.15475" E	55°04'29.27798" N
N	412100.53	806160.53	17°37'17.88388" E	55°06'39.03617" N
O	421637.54	805984.08	17°46'16.29790" E	55°06'39.08668" N

Point number	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
P	421918.40	803497.97	17°46'34.60685" E	55°05'18.81344" N
R	421998.65	802798.80	17°46'39.82336" E	55°04'56.23860" N
S	420273.94	802971.88	17°45'02.38090" E	55°05'00.85124" N
T	418207.80	803180.16	17°43'05.63912" E	55°05'06.37854" N
U	418150.00	800028.92	17°43'05.63999" E	55°03'24.39446" N
W	418098.80	796888.09	17°43'05.99999" E	55°01'42.75044" N
Y	418054.60	794825.69	17°43'05.63999" E	55°00'36.00018" N

Table 2.3. Coordinates of the Baltic Power DA [Source: own study]

Point number	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
1	421444.52	803356.56	17°46'08.01781" E	55°05'13.96888" N
2	418258.31	803677.60	17°43'07.97346" E	55°05'22.50190" N
3	418199.00	803680.08	17°43'04.62534" E	55°05'22.54688" N
4	418159.72	803677.84	17°43'02.41201" E	55°05'22.45109" N
5	418120.88	803672.54	17°43'00.22710" E	55°05'22.25679" N
6	418082.44	803664.19	17°42'58.06711" E	55°05'21.96352" N
7	418044.62	803652.78	17°42'55.94592" E	55°05'21.57196" N
8	418007.96	803638.48	17°42'53.89300" E	55°05'21.08770" N
9	417972.54	803621.35	17°42'51.91296" E	55°05'20.51237" N
10	417938.88	803601.68	17°42'50.03481" E	55°05'19.85605" N
11	417906.57	803579.23	17°42'48.23553" E	55°05'19.11049" N
12	417876.12	803554.31	17°42'46.54414" E	55°05'18.28613" N
13	417847.73	803527.08	17°42'44.97098" E	55°05'17.38801" N
14	417808.99	803481.74	17°42'42.83317" E	55°05'15.89817" N
15	417786.85	803449.99	17°42'41.61740" E	55°05'14.85763" N
16	417766.77	803415.73	17°42'40.52038" E	55°05'13.73746" N
17	417749.76	803380.66	17°42'39.59719" E	55°05'12.59257" N
18	417735.29	803343.68	17°42'38.81993" E	55°05'11.38762" N
19	417723.90	803306.02	17°42'38.21644" E	55°05'10.16248" N
20	417715.56	803267.94	17°42'37.78585" E	55°05'08.92549" N
21	417710.15	803228.60	17°42'37.52161" E	55°05'07.64964" N
22	417707.87	803188.87	17°42'37.43444" E	55°05'06.36278" N
23	417650.07	800037.09	17°42'37.45529" E	55°03'24.36101" N
24	417598.89	796897.80	17°42'37.83492" E	55°01'42.76691" N
25	417553.25	794756.34	17°42'37.48897" E	55°00'33.45822" N
26	417558.52	794535.59	17°42'38.01445" E	55°00'26.31932" N

Point number	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
27	417573.26	794244.33	17°42'39.14663" E	55°00'16.90510" N
28	417571.23	794226.38	17°42'39.05109" E	55°00'16.32324" N
29	417566.29	794209.00	17°42'38.79119" E	55°00'15.75821" N
30	417553.74	794185.04	17°42'38.10963" E	55°00'14.97533" N
31	417542.28	794171.08	17°42'37.47867" E	55°00'14.51702" N
32	417528.68	794159.19	17°42'36.72574" E	55°00'14.12424" N
33	417513.32	794149.69	17°42'35.87113" E	55°00'13.80757" N
34	417487.89	794140.45	17°42'34.44961" E	55°00'13.49335" N
35	416270.95	793861.41	17°41'26.24788" E	55°00'03.73399" N
36	415031.36	793574.52	17°40'16.78915" E	54°59'53.69608" N
37	413285.62	793090.28	17°38'39.07356" E	54°59'36.94600" N
38	412593.80	792887.82	17°38'00.36776" E	54°59'29.96063" N
39	412593.62	792887.77	17°38'00.35733" E	54°59'29.95864" N
40	412593.61	792887.77	17°38'00.35706" E	54°59'29.95858" N
41	412588.81	792886.27	17°38'00.08864" E	54°59'29.90713" N
42	411843.08	792653.71	17°37'18.38651" E	54°59'21.91017" N
43	410854.28	792313.17	17°36'23.13529" E	54°59'10.25938" N
44	410833.17	792304.80	17°36'21.95727" E	54°59'09.97488" N
45	409792.63	791892.37	17°35'23.88620" E	54°58'55.95756" N
46	409025.18	791672.53	17°34'40.96659" E	54°58'48.34294" N
47	408257.73	791452.69	17°33'58.05157" E	54°58'40.72413" N
48	408257.72	791452.69	17°33'58.05139" E	54°58'40.72410" N
49	408230.76	791448.54	17°33'56.53944" E	54°58'40.57192" N
50	408203.60	791451.15	17°33'55.00888" E	54°58'40.63844" N
51	408177.92	791460.37	17°33'53.55386" E	54°58'40.91958" N
52	408155.30	791475.63	17°33'52.26390" E	54°58'41.39804" N
53	408142.61	791488.70	17°33'51.53537" E	54°58'41.81255" N
54	408128.05	791511.77	17°33'50.68959" E	54°58'42.54926" N
55	408121.71	791528.84	17°33'50.31295" E	54°58'43.09741" N
56	408118.26	791546.73	17°33'50.09875" E	54°58'43.67377" N
57	408118.26	791546.76	17°33'50.09854" E	54°58'43.67474" N
58	408102.51	791696.58	17°33'49.03955" E	54°58'48.51092" N
59	408105.07	791723.20	17°33'49.15293" E	54°58'49.37384" N
60	408110.33	791740.26	17°33'49.42911" E	54°58'49.92930" N
61	408410.58	793547.70	17°34'04.23605" E	54°59'48.60045" N
62	409579.37	800583.66	17°35'01.98684" E	55°03'36.98873" N
63	409822.51	801023.04	17°35'15.18976" E	55°03'51.36218" N
64	409822.53	801023.09	17°35'15.19119" E	55°03'51.36374" N

Point number	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
65	411514.10	804073.64	17°36'47.12842" E	55°05'31.14786" N
66	411678.54	805383.90	17°36'54.93856" E	55°06'13.64140" N
67	411681.90	805400.35	17°36'55.10944" E	55°06'14.17560" N
68	411691.51	805423.59	17°36'55.62569" E	55°06'14.93353" N
69	411708.73	805454.62	17°36'56.56279" E	55°06'15.94846" N
70	412068.51	806102.84	17°37'16.14119" E	55°06'37.14938" N
71	412084.70	806124.92	17°37'17.03027" E	55°06'37.87385" N
72	412105.84	806142.31	17°37'18.20390" E	55°06'38.45003" N
73	412122.05	806150.76	17°37'19.10911" E	55°06'38.73368" N
74	412139.43	806156.41	17°37'20.08375" E	55°06'38.92750" N
75	412166.65	806159.31	17°37'21.61670" E	55°06'39.03880" N
76	421541.12	805985.81	17°46'10.85397" E	55°06'39.08784" N
77	421568.69	805981.80	17°46'12.41430" E	55°06'38.97370" N
78	421586.13	805975.30	17°46'13.40475" E	55°06'38.77349" N
79	421602.22	805965.96	17°46'14.32201" E	55°06'38.48029" N
80	421616.49	805954.03	17°46'15.13974" E	55°06'38.10251" N
81	421628.55	805939.86	17°46'15.83445" E	55°06'37.65101" N
82	421638.05	805923.86	17°46'16.38620" E	55°06'37.13874" N
83	421644.71	805906.49	17°46'16.77914" E	55°06'36.58043" N
84	421648.71	805885.21	17°46'17.02593" E	55°06'35.89444" N
85	421655.60	805824.24	17°46'17.47565" E	55°06'33.92580" N
86	421861.00	804006.09	17°46'30.86649" E	55°05'35.22018" N
87	421646.42	803971.77	17°46'18.79571" E	55°05'33.98778" N
88	421412.69	803650.86	17°46'05.92985" E	55°05'23.47222" N

2.1.3 Distribution of individual components of the project

The figure (Figure 2.2) presents the detailed location of the individual components of the planned project. The table (Table 2.4) provides the geographical coordinates of wind turbines and substations, and the table (Table 2.5) provides the geographical coordinates of the inter array cable infrastructure. In accordance with the practice, the applicant assumes that, as part of further works on the design and obtaining further information at the execution stage, the location of wind turbines, substations and inner array cables will be finally specified, the location of which may change from the one indicated below to 100 m for large-diameter piles and 200 m for cables. Such location changes will not cause changes in the environmental impact of the Baltic Power OWF.

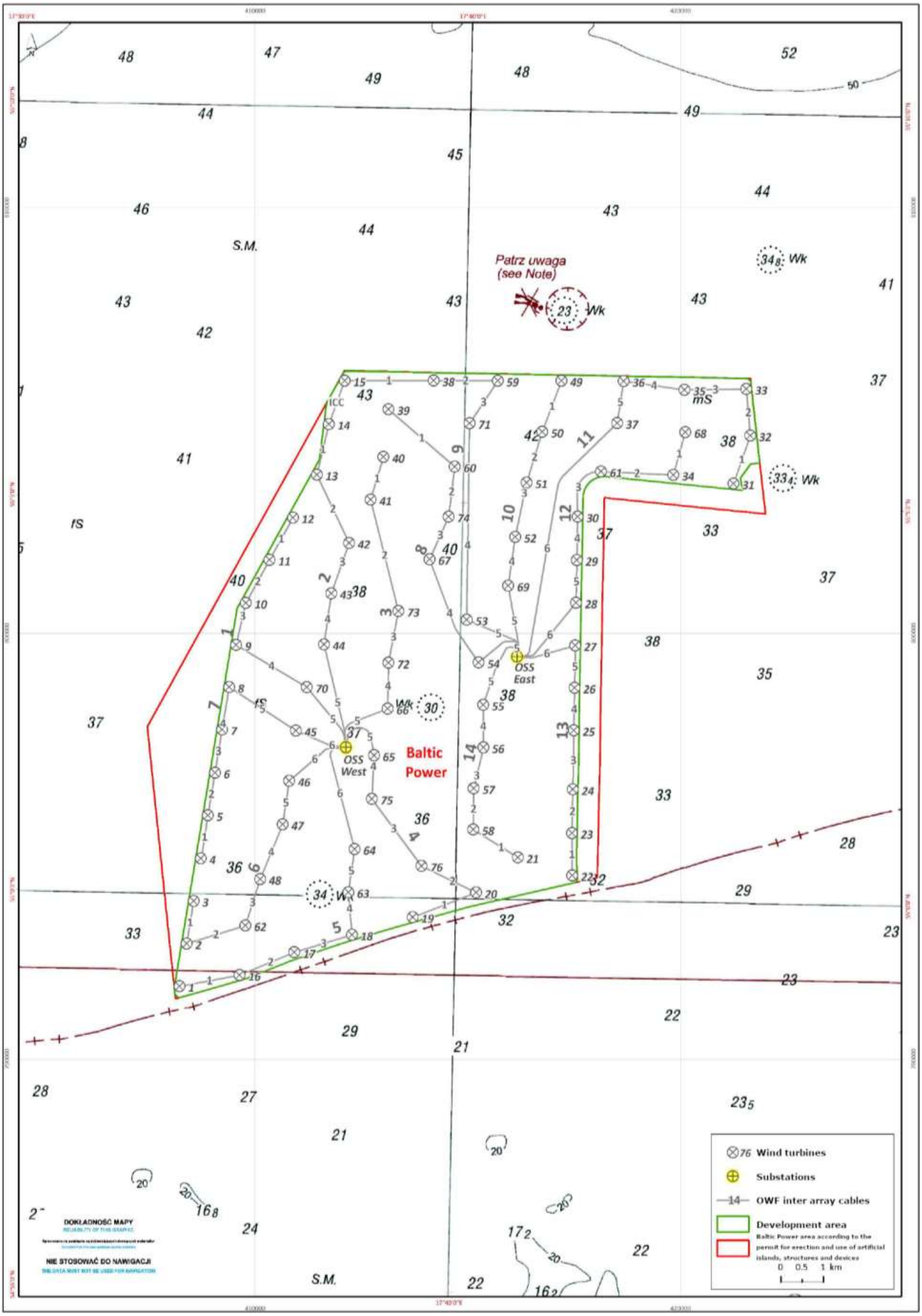

Figure 2.2. Detailed location of the individual components of the planned project [Source: own study]

Table 2.4. Coordinates of wind turbines and substations [Source: data of Baltic Power Sp. z o.o.]

Power plant/station No.	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
1	408224.18	791708.45	17°33'55.870" E	54°58'48.976" N
2	408390.74	792708.22	17°34'04.087" E	54°59'21.430" N
3	408557.15	793709.98	17°34'12.297" E	54°59'53.947" N
4	408723.66	794712.34	17°34'20.516" E	55°00'26.485" N
5	408891.67	795723.73	17°34'28.812" E	55°00'59.315" N
6	409058.43	796727.60	17°34'37.051" E	55'01'31.900" N
7	409225.12	797731.04	17°34'45.289" E	55°02'04.472" N
8	409391.08	798730.11	17°34'53.495" E	55°02'36.902" N
9	409556.08	799723.40	17°35'01.657" E	55°03'09.144" N
10	409783.96	800709.35	17°35'13.375" E	55'03'41.189" N
11	410341.87	801715.73	17°35'43.680" E	55°04'14.110" N
12	410891.16	802706.56	17°36'13.531" E	55°04'46.520" N
13	411453.55	803719.90	17°36'44.109" E	55°05'19.665" N
14	411738.10	804910.85	17°36'58.828" E	55°05'58.376" N
15	412107.86	805930.09	17°37'18.554" E	55'06'31.586" N
16	409637.51	791970.68	17°35'15.071" E	54°58'58.390" N
17	410922.50	792507.68	17°36'26.756" E	54°59'16.596" N
18	412277.28	792912.72	17°37'42.531" E	54°59'30.566" N
19	413706.72	793329.54	17°39'02.509" E	54°59'44.950" N
20	415193.60	793908.10	17°40'25.564" E	55°00'04.588" N
21	416175.28	794734.34	17°41'19.942" E	55'00'31.917" N
22	417451.78	794310.10	17°42'32.241" E	55°00'18.961" N
23	417446.98	795307.80	17°42'30.933" E	55'00'51.236" N
24	417468.82	796332.46	17°42'31.097" E	55'01'24.399" N
25	417492.79	797710.64	17°42'31.014" E	55°02'09.001" N
26	417509.01	798710.13	17°42'30.887" E	55'02'41.347" N
27	417526.47	799709.58	17°42'30.830" E	55°03'13.692" N
28	417544.12	800712.61	17°42'30.780" E	55°03'46.152" N
29	417562.68	801711.87	17°42'30.785" E	55°04'18.492" N
30	417581.49	802732.89	17°42'30.782" E	55'04'51.535" N
31	421244.03	803508.93	17°45'56.557" E	55°05'18.784" N
32	421640.06	804639.89	17°46'17.774" E	55°05'55.600" N
33	421546.91	805731.76	17°46'11.434" E	55°06'30.872" N
34	419827.37	803711.98	17°44'36.444" E	55°05'24.536" N
35	420092.73	805715.61	17°44'49.385" E	55°06'29.513" N
36	418663.56	805920.96	17°43'28.522" E	55°06'35.320" N
37	418508.75	804934.47	17°43'20.803" E	55°06'03.313" N
38	414199.29	805934.02	17°39'16.573" E	55°06'33.032" N

Power plant/station No.	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
39	413138.12	805255.85	17°38'17.435" E	55°06'10.427" N
40	413019.92	804135.15	17°38'12.000" E	55°05'34.097" N
41	412718.95	803131.15	17°37'56.132" E	55°05'01.426" N
42	412211.10	802111.63	17°37'28.623" E	55'04'28.121" N
43	411793.36	800931.62	17°37'06.385" E	55'03'49.679" N
44	411620.87	799730.58	17°36'58.003" E	55'03'10.714" N
45	410959.07	797708.29	17°36'22.981" E	55'02'04.865" N
46	410803.88	796534.19	17°36'15.560" E	55'01'26.782" N
47	410649.42	795512.42	17°36'08.013" E	55'00'53.627" N
48	410120.21	794224.02	17°35'39.677" E	55'00'11.602" N
49	417199.87	805930.02	17°42'05.910" E	55'06'34.740" N
50	416748.61	804728.90	17°41'41.710" E	55'05'55.610" N
51	416380.23	803532.71	17°41'22.193" E	55'05'16.687" N
52	416114.70	802258.10	17°41'08.568" E	55'04'35.290" N
53	414974.54	800313.01	17°40'06.368" E	55'03'31.664" N
54	415252.69	799307.67	17°40'23.121" E	55'02'59.311" N
55	415360.00	798310.33	17°40'30.234" E	55'02'27.111" N
56	415365.82	797311.43	17°40'31.628" E	55'01'54.798" N
57	415138.76	796358.33	17°40'19.858" E	55'01'23.824" N
58	415126.68	795392.16	17°40'20.211" E	55'00'52.559" N
59	415702.57	805929.94	17°40'41.412" E	55'06'33.829" N
60	414696.75	803910.18	17°39'46.832" E	55'05'27.867" N
61	418130.04	803792.88	17°43'00.619" E	55'05'26.155" N
62	409772.40	793135.24	17°35'21.338" E	54'59'36.153" N
63	412191.45	793914.76	17°37'36.594" E	55'00'02.929" N
64	412341.67	794930.77	17°37'43.927" E	55'00'35.893" N
65	412796.60	797131.02	17°38'07.119" E	55'01'47.363" N
66	413118.53	798219.75	17°38'24.057" E	55'02'22.788" N
67	414102.40	801730.60	17°39'15.675" E	55'04'16.985" N
68	420111.40	804717.90	17°44'51.448" E	55'05'57.245" N
69	415949.33	801112.14	17°41'00.461" E	55'03'58.115" N
70	411218.00	798725.19	17°36'36.427" E	55'02'37.930" N
71	415042.34	804926.87	17°40'05.232" E	55'06'00.972" N
72	413135.69	799300.08	17°38'23.840" E	55'02'57.749" N
73	413371.72	800517.64	17°38'35.807" E	55'03'37.287" N
74	414550.56	802731.54	17°39'39.860" E	55'04'49.646" N
75	412747.80	796109.52	17°38'05.494" E	55'01'14.285" N
76	413914.44	794532.59	17°39'12.895" E	55'00'24.000" N

Power plant/station No.	Coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]	
	Y	X	Length	Width
OSS East	416156.08	799443.95	17°41'13.883" E	55'03'04.272" N
OSS_West	412136.69	797317.13	17'37'29.746" E	55'01'52.965" N

Table 2.5. Coordinates of the inter array cable infrastructure [Source: data of Baltic Power Sp. z o.o.]

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS"]	
	Y	X	Length	Width
1	412127.94	797333.13	17°37'29.236" E	55°01'53.477" N
	412101.43	797534.51	17°37'27.519" E	55'01'59.975" N
	412098.43	797554.23	17°37'27.329" E	55°02'00.612" N
	412094.64	797573.83	17°37'27.094" E	55'02'01.243" N
	412090.08	797593.25	17°37'26.815" E	55'02'01.869" N
	412084.75	797612.48	17°37'26.493" E	55°02'02.487" N
	412078.65	797631.48	17°37'26.129" E	55°02'03.098" N
	412071.80	797650.22	17°37'25.722" E	55°02'03.700" N
	412064.21	797668.67	17°37'25.274" E	55°02'04.292" N
	412055.89	797686.81	17°37'24.785" E	55°02'04.873" N
	412046.85	797704.60	17°37'24.257" E	55°02'05.443" N
	412037.11	797722.01	17°37'23.689" E	55°02'06.000" N
	412026.68	797739.02	17°37'23.082" E	55°02'06.544" N
	412015.58	797755.60	17°37'22.439" E	55°02'07.073" N
	412003.83	797771.73	17°37'21.759" E	55°02'07.588" N
	411991.44	797787.37	17°37'21.044" E	55°02'08.086" N
	411218.00	798725.19	17°36'36.427" E	55°02'37.930" N
	409556.08	799723.40	17°35'01.657" E	55°03'09.144" N
	409783.96	800709.35	17°35'13.375" E	55'03'41.189" N
	410341.87	801715.73	17°35'43.680" E	55°04'14.110" N
	410891.16	802706.56	17°36'13.531" E	55°04'46.520" N
2	411738.10	804910.85	17°36'58.828" E	55°05'58.376" N
	411453.55	803719.90	17°36'44.109" E	55°05'19.665" N
	412211.10	802111.63	17°37'28.623" E	55°04'28.121" N
	411793.36	800931.62	17°37'06.385" E	55°03'49.679" N
	411620.87	799730.57	17°36'58.003" E	55°03'10.714" N
	412086.21	797777.17	17°37'26.393" E	55°02'07.816" N
	412090.12	797759.27	17°37'26.634" E	55°02'07.240" N
	412093.38	797741.24	17°37'26.837" E	55°02'06.658" N
	412095.98	797723.10	17°37'27.004" E	55°02'06.073" N
	412097.91	797704.88	17°37'27.133" E	55°02'05.485" N
	412130.44	797333.13	17°37'29.376" E	55'01'53.479" N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS”]	
	Y	X	Length	Width
3	413019.92	804135.15	17°38'12.000” E	55°05'34.097” N
	412718.95	803131.15	17°37'56.132” E	55’05'01.426" N
	413371.72	800517.64	17°38'35.807” E	55°03'37.287” N
	413135.69	799300.08	17°38'23.840” E	55°02'57.749” N
	413118.53	798219.75	17°38'24.057” E	55°02'22.788” N
	412273.60	797894.89	17°37'36.818” E	55’02'11.744" N
	412260.91	797889.60	17°37'36.109” E	55’02'11.565" N
	412248.53	797883.63	17°37'35.418” E	55’02'11.363" N
	412236.49	797876.98	17°37'34.748” E	55’02'11.141" N
	412224.84	797869.69	17°37'34.100” E	55°02'10.897” N
	412213.61	797861.76	17°37'33.476” E	55°02'10.634” N
	412202.83	797853.23	17°37'32.878” E	55°02'10.351” N
	412192.54	797844.12	17°37'32.309” E	55°02'10.050” N
	412182.76	797834.46	17°37'31.768” E	55°02'09.731” N
	412173.53	797824.27	17°37'31.260” E	55°02'09.395” N
	412164.87	797813.59	17°37'30.784” E	55°02'09.045” N
	412156.82	797802.46	17°37'30.342” E	55°02'08.679” N
	412149.38	797790.89	17°37'29.936” E	55°02'08.300” N
	412142.60	797778.94	17°37'29.567” E	55°02'07.909” N
	412136.48	797766.63	17°37'29.236” E	55°02'07.507” N
	412131.05	797754.00	17°37'28.944” E	55°02'07.095” N
	412126.31	797741.10	17°37'28.692” E	55°02'06.675” N
	412122.30	797727.95	17°37'28.481” E	55°02'06.247” N
	412119.01	797714.60	17°37'28.310” E	55°02'05.813” N
	412116.47	797701.09	17°37'28.182” E	55°02'05.374” N
	412114.67	797687.46	17°37'28.096” E	55°02'04.932” N
	412113.62	797673.76	17°37'28.052” E	55°02'04.488” N
	412113.32	797660.02	17°37'28.050” E	55°02'04.043” N
	412113.78	797646.28	17°37'28.092” E	55°02'03.599” N
	412132.94	797333.13	17°37'29.517” E	55’01'53.481" N
4	413706.72	793329.54	17°39'02.509” E	54°59'44.950” N
	415193.60	793908.10	17°40'25.564” E	55°00'04.588” N
	413914.44	794532.59	17°39'12.895” E	55°00'24.000” N
	412747.80	796109.52	17°38'05.494” E	55’01'14.285" N
	412796.60	797131.01	17°38'07.119” E	55’01'47.362" N
	412724.65	797556.76	17°38'02.598” E	55’02'01.091" N
	412721.92	797570.52	17°38'02.429” E	55’02'01.534" N
	412718.43	797584.11	17°38'02.218” E	55’02'01.972" N
	412714.18	797597.48	17°38'01.963” E	55°02'02.402” N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS"]	
	Y	X	Length	Width
	412709.18	797610.60	17°38'01.668" E	55°02'02.823" N
	412703.46	797623.41	17°38'01.331" E	55°02'03.233" N
	412697.03	797635.88	17°38'00.955" E	55°02'03.633" N
	412689.91	797647.97	17°38'00.541" E	55°02'04.020" N
	412682.12	797659.64	17°38'00.089" E	55°02'04.392" N
	412673.69	797670.86	17°37'59.602" E	55°02'04.750" N
	412664.64	797681.59	17°37'59.081" E	55°02'05.091" N
	412655.01	797691.79	17°37'58.527" E	55°02'05.415" N
	412644.82	797701.43	17°37'57.942" E	55°02'05.721" N
	412634.10	797710.49	17°37'57.328" E	55°02'06.007" N
	412622.89	797718.93	17°37'56.688" E	55°02'06.273" N
	412611.23	797726.73	17°37'56.022" E	55°02'06.518" N
	412599.14	797733.87	17°37'55.334" E	55°02'06.741" N
	412586.68	797740.31	17°37'54.624" E	55°02'06.941" N
	412573.87	797746.04	17°37'53.897" E	55°02'07.119" N
	412560.76	797751.05	17°37'53.153" E	55°02'07.273" N
	412547.40	797755.31	17°37'52.395" E	55°02'07.402" N
	412533.81	797758.82	17°37'51.626" E	55°02'07.507" N
	412520.05	797761.56	17°37'50.848" E	55°02'07.587" N
	412506.15	797763.52	17°37'50.063" E	55°02'07.641" N
	412492.17	797764.70	17°37'49.274" E	55°02'07.671" N
	412478.14	797765.10	17°37'48.483" E	55°02'07.675" N
	412421.55	797765.10	17°37'45.296" E	55°02'07.639" N
	412407.71	797764.71	17°37'44.517" E	55°02'07.618" N
	412393.92	797763.57	17°37'43.741" E	55°02'07.572" N
	412380.21	797761.66	17°37'42.971" E	55°02'07.501" N
	412366.62	797758.99	17°37'42.208" E	55°02'07.406" N
	412353.21	797755.57	17°37'41.456" E	55°02'07.287" N
	412340.00	797751.42	17°37'40.717" E	55°02'07.145" N
	412327.04	797746.55	17°37'39.993" E	55°02'06.979" N
	412314.38	797740.96	17°37'39.286" E	55°02'06.790" N
	412302.04	797734.68	17°37'38.598" E	55°02'06.579" N
	412290.07	797727.73	17°37'37.931" E	55°02'06.346" N
	412278.50	797720.13	17°37'37.288" E	55°02'06.093" N
	412267.37	797711.89	17°37'36.670" E	55°02'05.820" N
	412256.71	797703.06	17°37'36.079" E	55°02'05.527" N
	412246.56	797693.65	17°37'35.518" E	55°02'05.216" N
	412236.95	797683.69	17°37'34.987" E	55°02'04.888" N
	412227.90	797673.21	17°37'34.489" E	55°02'04.543" N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS”]	
	Y	X	Length	Width
	412219.44	797662.25	17°37'34.025” E	55°02'04.183” N
	412211.61	797650.84	17°37'33.597” E	55°02'03.809” N
	412204.42	797639.01	17°37'33.205” E	55°02'03.422” N
	412197.89	797626.80	17°37'32.851” E	55°02'03.022” N
	412192.05	797614.25	17°37'32.536” E	55°02'02.613” N
	412186.92	797601.39	17°37'32.260” E	55°02'02.194” N
	412182.50	797588.27	17°37'32.026” E	55’02'01.766" N
	412178.82	797574.93	17°37'31.834” E	55’02'01.332" N
	412175.88	797561.40	17°37'31.683” E	55°02'00.893” N
	412173.69	797547.73	17°37'31.575” E	55°02'00.449” N
	412145.44	797333.13	17°37'30.221” E	55’01'53.489" N
5	412120.69	797310.88	17°37'28.852” E	55’01'52.753" N
	411904.36	797291.96	17°37'16.689” E	55’01'52.003" N
	411893.58	797290.62	17°37'16.083” E	55’01'51.953" N
	411882.91	797288.50	17°37'15.485” E	55’01'51.877" N
	411872.43	797285.62	17’37'14.898" E	55’01'51.777" N
	411862.19	797281.98	17’37'14.325" E	55’01'51.653" N
	411852.23	797277.61	17’37'13.769" E	55’01'51.506" N
	411842.62	797272.54	17’37'13.233" E	55’01'51.335" N
	411833.40	797266.78	17’37'12.720" E	55’01'51.143" N
	411824.62	797260.36	17’37'12.233" E	55’01'50.930" N
	411816.33	797253.33	17’37'11.774" E	55’01'50.697" N
	411808.57	797245.72	17’37'11.346" E	55’01'50.446" N
	411801.38	797237.56	17’37'10.950" E	55’01'50.177" N
	411794.81	797228.91	17’37'10.589" E	55’01'49.893" N
	411788.87	797219.80	17’37'10.265" E	55’01'49.595" N
	411783.61	797210.29	17’37'09.979" E	55’01'49.284" N
	411779.06	797200.42	17’37'09.734" E	55’01'48.962" N
	411775.23	797190.24	17’37'09.529" E	55’01'48.630" N
	411772.15	797179.82	17’37'09.367" E	55’01'48.291" N
	411769.83	797169.20	17’37'09.248" E	55’01'47.946" N
	411768.28	797158.44	17’37'09.173" E	55’01'47.597" N
	411767.52	797147.59	17’37'09.143" E	55’01'47.245" N
	411767.55	797136.72	17’37'09.156" E	55’01'46.894" N
	411768.36	797125.88	17’37'09.214" E	55’01'46.543" N
	411769.96	797115.13	17’37'09.316" E	55’01'46.197" N
	411772.33	797104.52	17’37'09.461" E	55’01'45.855" N
	412341.67	794930.77	17’37'43.927" E	55’00'35.893" N
	412191.45	793914.76	17’37'36.594" E	55’00'02.929" N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS"]	
	Y	X	Length	Width
	412277.28	792912.72	17’37'42.531" E	54’59'30.566" N
	410922.50	792507.68	17’36'26.756" E	54’59'16.596" N
	409637.51	791970.68	17’35'15.071" E	54’58'58.390" N
	408224.18	791708.45	17’33'55.870" E	54’58'48.976" N
6	408557.15	793709.98	17’34'12.297" E	54’59'53.947" N
	408390.74	792708.22	17’34'04.087" E	54’59'21.430" N
	409772.40	793135.24	17’35'21.338" E	54’59'36.153" N
	410120.21	794224.02	17’35'39.677" E	55’00'11.602" N
	410649.42	795512.42	17’36'08.013" E	55’00'53.627" N
	410803.88	796534.19	17’36'15.560" E	55’01'26.782" N
	411630.39	797242.82	17’37'01.313" E	55’01'50.238" N
	411639.55	797250.21	17’37'01.821" E	55’01'50.483" N
	411649.13	797257.06	17’37'02.353" E	55’01'50.711" N
	411659.09	797263.33	17’37'02.907" E	55’01'50.920" N
	411669.41	797269.00	17’37'03.482" E	55’01'51.110" N
	411680.05	797274.06	17’37'04.075" E	55’01'51.281" N
	411690.96	797278.48	17’37'04.685" E	55’01'51.431" N
	411702.11	797282.25	17’37'05.309" E	55’01'51.560" N
	411713.47	797285.36	17°37'05.945” E	55’01'51.668" N
	411724.99	797287.79	17°37'06.591” E	55’01'51.754" N
	411736.63	797289.54	17°37'07.245” E	55’01'51.818" N
	411748.36	797290.61	17°37'07.904” E	55’01'51.860" N
	412120.69	797313.38	17°37'28.849” E	55’01'52.834" N
7	412120.69	797323.38	17°37'28.838” E	55’01'53.157" N
	411828.39	797348.95	17°37'12.347” E	55’01'53.798" N
	411815.22	797350.46	17°37'11.604” E	55’01'53.839" N
	411802.16	797352.66	17°37'10.865” E	55’01'53.901" N
	411789.23	797355.55	17°37'10.134” E	55’01'53.987" N
	411776.47	797359.12	17°37'09.411” E	55’01'54.094" N
	411763.92	797363.36	17°37'08.700” E	55’01'54.223" N
	411751.61	797368.26	17°37'08.001” E	55’01'54.374" N
	410959.06	797708.29	17°36'22.981” E	55°02'04.866” N
	409391.08	798730.11	17°34'53.495” E	55°02'36.902” N
	409225.12	797731.04	17°34'45.289” E	55°02'04.472” N
	409058.43	796727.60	17°34'37.051” E	55’01'31.900" N
	408891.67	795723.73	17°34'28.812” E	55°00'59.315” N
	408741.00	794709.00	17°34'21.496” E	55°00'26.388” N
8	413138.12	805255.85	17°38'17.435” E	55°06'10.427” N
	414696.75	803910.18	17°39'46.832” E	55°05'27.867” N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS”]	
	Y	X	Length	Width
	414550.56	802731.54	17°39'39.860” E	55°04'49.646” N
	414102.40	801730.60	17°39'15.675” E	55°04'16.985” N
	414707.56	800109.20	17°39'51.540” E	55°03'24.906” N
	415252.69	799307.67	17°40'23.121” E	55°02'59.311” N
	415795.93	799760.18	17°40'53.251” E	55°03'14.283” N
	415805.88	799767.95	17°40'53.804” E	55°03'14.541” N
	415816.30	799775.08	17°40'54.384” E	55°03'14.778” N
	415827.15	799781.53	17°40'54.988” E	55°03'14.993” N
	415838.39	799787.29	17°40'55.615” E	55°03'15.186” N
	415849.97	799792.33	17°40'56.263” E	55°03'15.356” N
	415861.84	799796.62	17°40'56.927” E	55°03'15.502” N
	415873.96	799800.16	17°40'57.606” E	55°03'15.624” N
	415886.28	799802.93	17°40'58.298” E	55°03'15.721” N
	415898.74	799804.91	17°40'58.998” E	55°03'15.793” N
	415911.31	799806.11	17°40'59.705” E	55°03'15.839” N
	415923.93	799806.51	17°41'00.416” E	55°03'15.860” N
	416074.72	799806.51	17°41'08.914” E	55°03'15.952” N
	416083.30	799806.14	17°41'09.397” E	55°03'15.945” N
	416091.81	799805.03	17°41'09.878” E	55°03'15.915” N
	416100.20	799803.21	17°41'10.353” E	55°03'15.861” N
	416108.40	799800.66	17°41'10.818” E	55°03'15.783” N
	416116.35	799797.43	17°41'11.270” E	55°03'15.683” N
	416124.00	799793.52	17°41'11.705” E	55°03'15.562” N
	416131.28	799788.97	17°41'12.120” E	55°03'15.419” N
	416138.15	799783.81	17°41'12.512” E	55°03'15.256” N
	416144.55	799778.09	17°41'12.879” E	55°03'15.075” N
	416150.43	799771.83	17°41'13.217” E	55°03'14.876” N
	416155.75	799765.10	17°41'13.524” E	55°03'14.661” N
	416160.48	799757.93	17°41'13.798” E	55°03'14.432” N
	416164.58	799750.38	17°41'14.037” E	55°03'14.191” N
	416168.01	799742.51	17°41'14.239” E	55°03'13.938” N
	416170.75	799734.38	17°41'14.402” E	55°03'13.677” N
	416172.79	799726.04	17°41'14.526” E	55°03'13.408” N
	416174.11	799717.55	17°41'14.609” E	55°03'13.134” N
	416174.69	799708.99	17°41'14.651” E	55°03'12.858” N
	416174.53	799700.40	17°41'14.651” E	55°03'12.580” N
	416159.82	799459.95	17°41'14.077” E	55°03'04.792” N
9	412107.86	805930.09	17°37'18.554” E	55’06'31.586" N
	414199.29	805934.02	17°39'16.573” E	55°06'33.032” N

Cable No.	Geographic coordinates			
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD ° MM 'SS, SSS”]	
	Y	X	Length	Width
	415702.57	805929.94	17°40'41.412” E	55°06'33.829” N
	415042.34	804926.87	17°40'05.232” E	55°06'00.972” N
	414974.54	800313.01	17°40'06.368” E	55’03'31.664" N
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	416135.15	799811.45	17°41'12.314” E	55°03'16.149” N
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	416162.32	799459.95	17°41'14.218” E	55°03'04.793” N
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	416191.34	799734.23	17°41'15.563” E	55°03'13.684” N
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	416186.77	799768.87	17°41'15.268” E	55°03'14.802” N
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	416114.70	802258.10	17°41'08.568” E	55°04'35.290” N
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Cable No.	Geographic coordinates			
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	416421.27	799526.07	17°41'28.740” E	55°03'07.089” N
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	417129.70	803512.70	17°42'04.486” E	55°05'16.493” N
	417136.36	803531.12	17°42'04.843” E	55°05'17.093” N
	417143.74	803549.26	17°42'05.240” E	55°05'17.684” N
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	417160.60	803584.60	17°42'06.154” E	55°05'18.837” N
	417170.05	803601.75	17’42'06.669" E	55’05'19.398" N
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	417214.34	803666.26	17’42'09.100" E	55’05'21.512" N
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	417240.14	803695.72	17’42'10.524" E	55’05'22.480" N
	417253.88	803709.66	17’42'11.284" E	55’05'22.940" N
	418508.75	804934.47	17’43'20.803" E	55’06'03.313" N
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	420092.73	805715.61	17’44'49.385" E	55’06'29.513" N
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Cable No.	Geographic coordinates			
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	417920.93	803769.31	17’42'48.848" E	55’05'25.268" N
	417902.25	803763.16	17’42'47.801" E	55’05'25.058" N
	417883.83	803756.29	17’42'46.769" E	55’05'24.825" N
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	417847.86	803740.41	17’42'44.757" E	55’05'24.290" N
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	417813.26	803721.75	17’42'42.824" E	55’05'23.665" N
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	417764.37	803688.80	17’42'40.101" E	55’05'22.570" N
	417748.97	803676.57	17’42'39.245" E	55’05'22.165" N
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	417719.69	803650.33	17’42'37.621" E	55’05'21.299" N
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	417625.68	803525.02	17°42'32.449” E	55°05'17.189” N
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Cable No.	Geographic coordinates			
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	417567.77	803298.53	17°42'29.418" E	55°05'09.827" N
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14	416147.32	799459.95	17°41'13.372" E	55°03'04.784" N
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Cable No.	Geographic coordinates			
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	416121.56	799612.06	17°41'11.760" E	55°03'09.690" N
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	416112.66	799626.44	17°41'11.242" E	55°03'10.150" N
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	416101.45	799639.12	17°41'10.598" E	55°03'10.553" N
	416095.09	799644.71	17°41'10.233" E	55°03'10.730" N
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	416065.63	799661.11	17°41'08.556" E	55'03'11.243" N
	416057.53	799663.59	17°41'08.097" E	55'03'11.318" N
	416049.25	799665.37	17°41'07.628" E	55'03'11.370" N
	416040.85	799666.44	17°41'07.154" E	55'03'11.400" N
	416032.39	799666.80	17°41'06.677" E	55'03'11.406" N
	415974.51	799666.80	17°41'03.415" E	55'03'11.371" N
	415966.15	799666.45	17°41'02.944" E	55'03'11.355" N
	415957.85	799665.40	17°41'02.477" E	55'03'11.316" N
	415949.67	799663.66	17°41'02.018" E	55'03'11.254" N
	415941.66	799661.25	17°41'01.569" E	55'03'11.171" N
	415933.88	799658.17	17°41'01.134" E	55'03'11.067" N
	415926.38	799654.45	17°41'00.715" E	55°03'10.942" N
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	415890.13	799620.47	17°40'58.709" E	55°03'09.821" N
	415885.94	799613.22	17°40'58.480" E	55°03'09.584" N
	415663.92	799189.67	17°40'46.420" E	55°02'55.746" N
	415655.18	799172.16	17°40'45.945" E	55°02'55.174" N
	415647.12	799154.32	17°40'45.511" E	55°02'54.592" N
	415639.77	799136.18	17°40'45.116" E	55°02'54.000" N
	415633.14	799117.76	17°40'44.761" E	55°02'53.400" N
	415360.00	798310.34	17°40'30.233" E	55'02'27.111" N
	415365.82	797311.43	17°40'31.628" E	55'01'54.798" N
	415138.76	796358.33	17°40'19.858" E	55'01'23.824" N

Cable No.	Geographic coordinates			
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	416175.28	794734.34	17'41'19.942" E	55'00'31.917" N

2.2 Description of the technology

The planned technological solutions of the electricity generation process in the OWT are presented below.

2.2.1 Description of the production process

Wind turbines are plants for the conversion of the kinetic wind energy into electricity by driving the power generator with the rotor driven by the wind force. Mechanical energy of the rotating rotor is converted in the generator to alternating electric current with low voltage, which is most often transformed to medium voltage and then to high voltage for its further transmission.

Due to the location conditions, wind farms located in offshore areas are constructed as groups of single wind turbines together with accompanying infrastructure, the purpose of which is to supply the generated electricity to an onshore substation or to supervise the availability of the OWF (Figure 2.3).

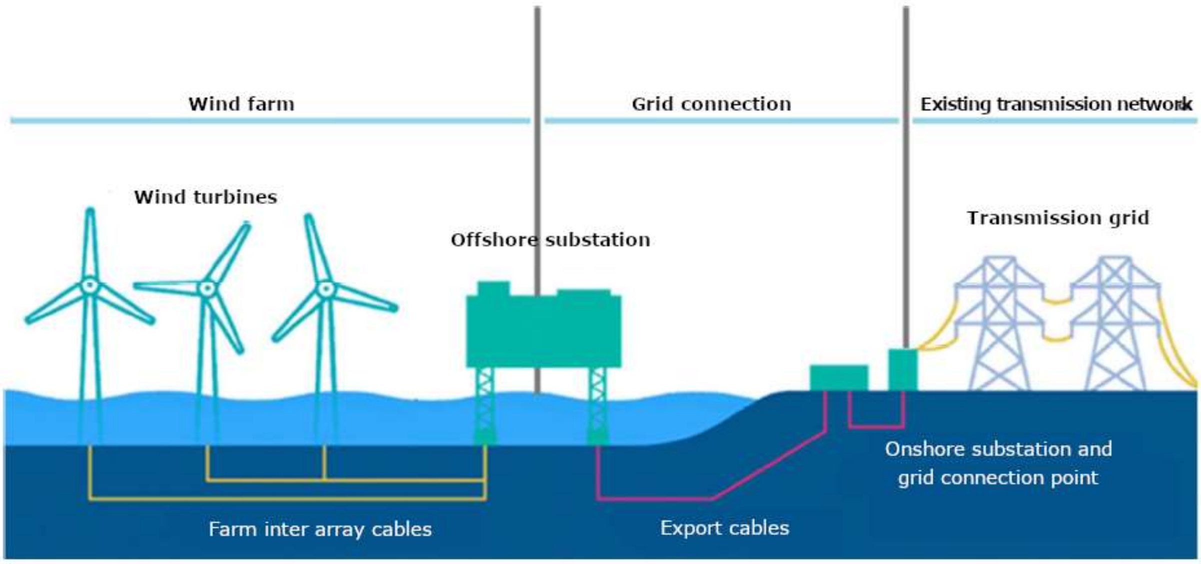


Figure 2.3 Basic elements of the offshore wind farm together with transmission infrastructure [Source: own study]

Wind turbines for electricity generation do not require the supply of other fuels and raw materials. Their proper operation does not cause pollution of the natural environment. A small amount of electricity demand occurs only in the case of windless weather. The demand for raw materials and energy, similarly as in the case of other power systems, is related to the process of construction and installation of structural elements of the individual components of the wind farm (materials used to generate fuel and other materials necessary during the construction phase), operation of service vessels and decommissioning (fuels and materials).

2.2.2 Description of the technology of individual elements of the project

The Offshore Wind Farm consists of four main components connected together in a functional and structural manner:

- wind turbines;
- monopiles;

- internal power cables;
- substations;

The individual components of the OWF are described below.

2.2.2.1 Wind turbine

A wind turbine is an essential component of a wind farm. A Vestas wind turbine, model V236-15.0 MW™, will be used in the Baltic Power OWF.

Within the OFW, three main structural elements can be identified that perform a specific function: tower, nacelle and rotor (Figure 2.4).

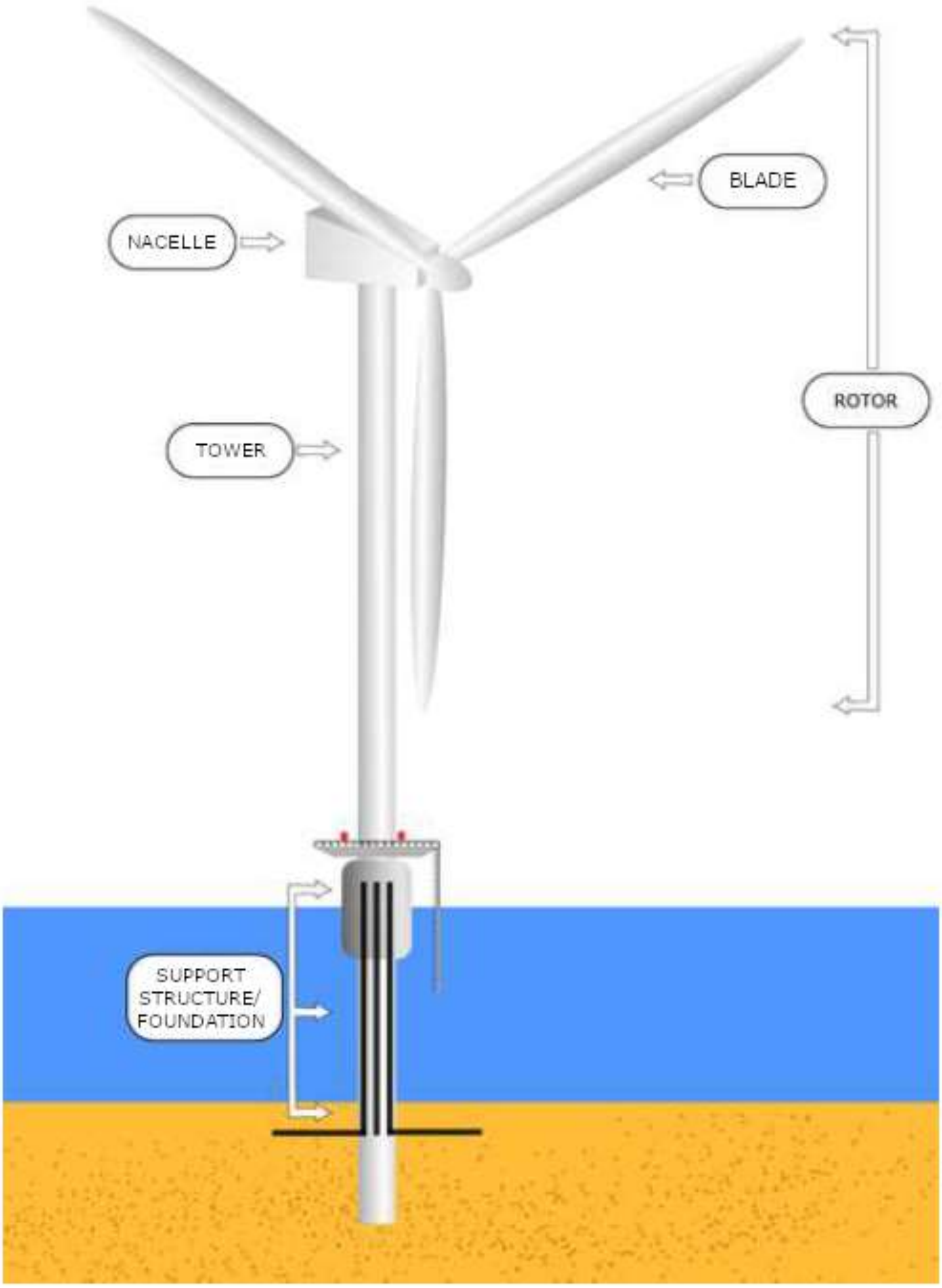


Figure 2.4. Diagram of an offshore wind turbine with a monopile. [Source: own study]

The tower is a structural element connecting the nacelle and the monopile. The tower consists of a steel pipe tapered upwards, consisting of sections which are bolted together with flange connections by means of bolts that do not require ongoing maintenance during the turbine operation period. The tower equipment includes platforms, supports, ladders etc., which are supported vertically (i.e. in the gravity direction) by a mechanical connection. In addition to its basic load-bearing function, the tower provides the basis for routing the wind turbine control cables, power cables and other systems and devices necessary for the proper operation of the entire plant. In addition, the tower may be equipped with internal and external platforms, thanks to which the service teams have access to both the nacelle and the elements of the tower itself.

The **nacelle** is a key component of a wind turbine. It consists of the drive train devices and the enclosure protecting against weather conditions (Figure 2.5). The drive train ensures the conversion of rotational energy from the rotor into three-phase alternating current. The main components of the drive train are the turbine, the rotating shaft with a gearbox and the generator. The generator generates electricity as a result of electrical induction by placing moving elements in the magnetic field.

The nacelle casing is divided into a central compartment and two side compartments. The central compartment of the nacelle contains, in the front, the load-bearing structures to which the drive train is attached. The nacelle frame attached to the central point of the nacelle is an internal bolted structure made of steel rabbets to which all auxiliary elements, platforms, casing and cooler are attached. The side compartments house a converter and a transformer.

The transformer is fixed with a dedicated support frame to the central part of the nacelle frame. The transformer is fenced off in a closed transformer room of the side compartment.

The converter ensures proper transformation of the generator supply voltage and the power supplied from the generator to the grid. The converter provides variable frequency AC conversion from the generator to constant frequency AC with active and reactive power levels and other parameters necessary for the generation of electricity supplied to the grid. The set of auxiliary equipment located in the rear part of the nacelle includes, but is not limited to, the cooling water pump unit, hydraulic pump unit, auxiliary transformer, nacelle dryer.

Access to the top part (roof) of the nacelle is provided by a ladder and manhole located in the rear part of the nacelle. This provides access to the cooler, wind sensors, aircraft marking equipment.

The weight of the standard nacelle and hub (from the blade bearing holder to the top of the tower) is 605 tons ± 3%. The overall dimensions of the nacelle are approx. 11 x 14 x 27.5 m.

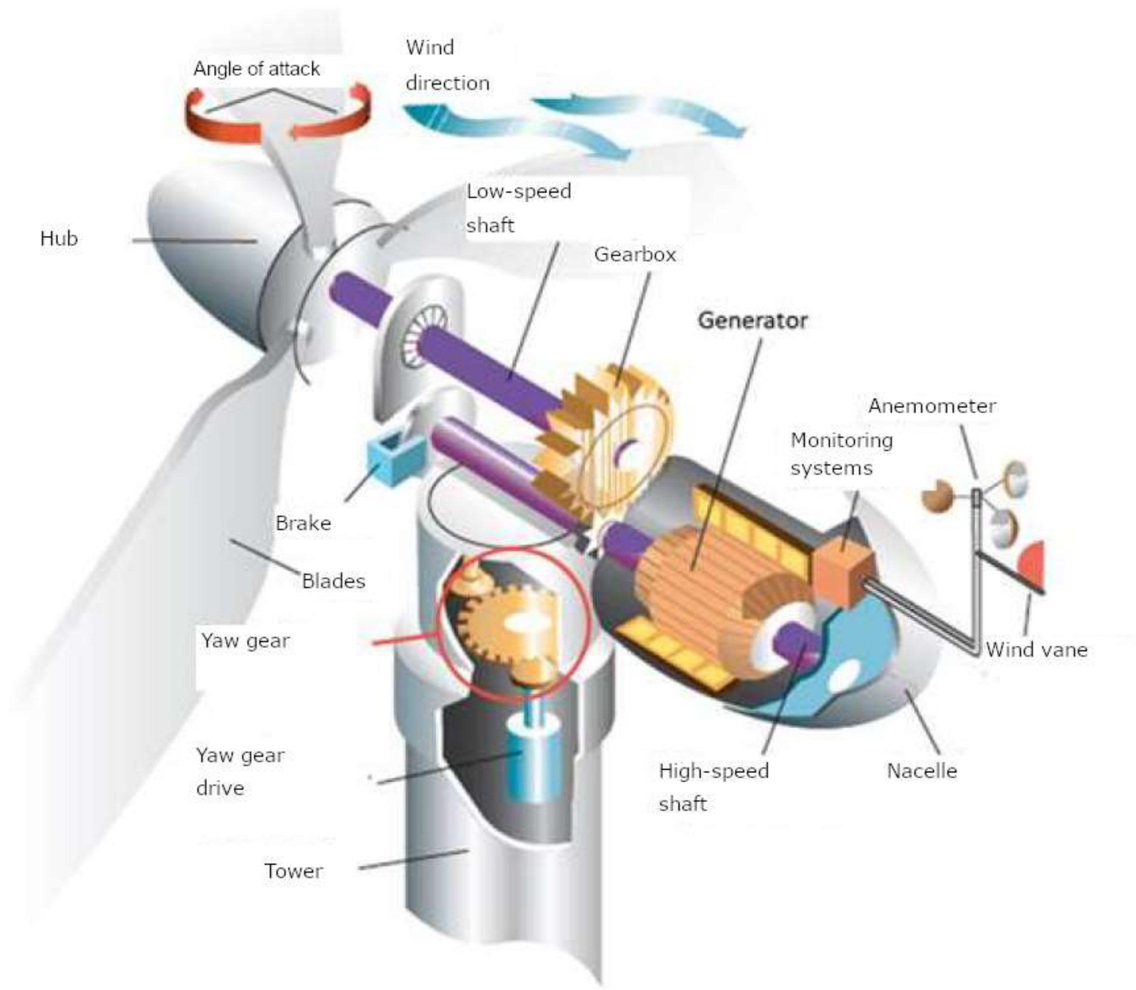


Figure 2.5. Schematic diagram of the nacelle with a gear drive system [Source: Areva]

The nacelle is assembled onshore and fully transported and installed on the wind turbine tower.

The last essential component of a wind turbine is the rotor, which includes blades and a hub. As a result of the wind impact, the rotor moves rotationally, capturing and transferring its energy to other elements of the nacelle. The blades are made of composite materials (fiberglass, carbon fiber, epoxy or polyester resins). They are equipped with electric discharge protection systems. The power output of the wind turbine depends to a large extent on the rotor size. In the planned Baltic Power OWF, V236-15.0 MW turbine models with the blade length of 115.5 m and hub diameter of 5 m will be used.

The wind turbine is equipped with a rotor consisting of three blades and a hub. Depending on the prevailing wind conditions, the pitch angle of the blades is set on an on-going basis to optimize the rotor operation. The nominal rotor rotational speed is 8.4 rpm. The rotor rotational speed range under normal operating conditions is approx. 3–9.3 rpm. The rotor is wind oriented and equipped with aerodynamic brakes.

The rotor blades have a shelled structure and are made of carbon and glass fiber and end with metal tips. The length of the shelled structure of each blade is 115.5 m and the weight is 63 tons ± 2%.

The cast iron hub supports the three blade bearings and transfers the reaction loads from the blade bearings to the main shaft. The main shaft transfers the reaction loads to the main bearings and the torque to the gearbox. The gearbox increases the rotor rotational speed to the speed required by the generator. The gearbox is lubricated with oil in the pressure system. Total oil volume in the system is approx. 2,200 L.

The conversion of shaft mechanical energy into electricity is provided by the generator. The generator is a medium speed, three-phase, low-voltage synchronous generator with a permanent magnet rotor connected to the grid via a converter. The generator casing allows the cooling air to circulate in the stator and rotor. Generator cooling is based on heat transfer between air and coolant.

The turbine is equipped with an overspeed protection system.

The overspeed protection system continuously monitors the rotational speed of the rotor main shaft, and if the permissible speed is exceeded, the protection system activates emergency rotor braking independently of the turbine controller. The system complies with IEC 61400-1:2019 standard.

The lightning protection system (LPS) helps to protect the wind turbine against physical damage caused by lightning strikes and is designed in accordance with IEC 61400-24:2019 standard. In addition, the turbine is equipped with winter lighting, overvoltage and overload protection, magnetic and electric field shielding and a grounding system.

2.2.2.2 Monopiles

The wind turbine tower, which is not a floating structure, is mounted on a support structure which is permanently affixed to the seabed. In the installation process, a monopile is founded first, followed by the wind turbine. The monopile's main tasks are to ensure:

- appropriate rigidity and strength of the wind turbine;
- support for cable systems;
- connection of the wind turbine with the seabed;
- efficient installation of the wind turbine.

The selection of an appropriate monopile depends on the size and weight of the wind turbine, on the one hand, and on environmental conditions prevailing in the OWF location, including mainly: depth of the water region and geological conditions of the seabed. Other environmental conditions (wave motion, currents, icing, biotic values) and the economic aspect are also important factors when selecting the monopile.

As part of the Baltic Power OWF, it is planned to use monopiles for foundation of both the wind turbines and the substations (Figure 2.6).

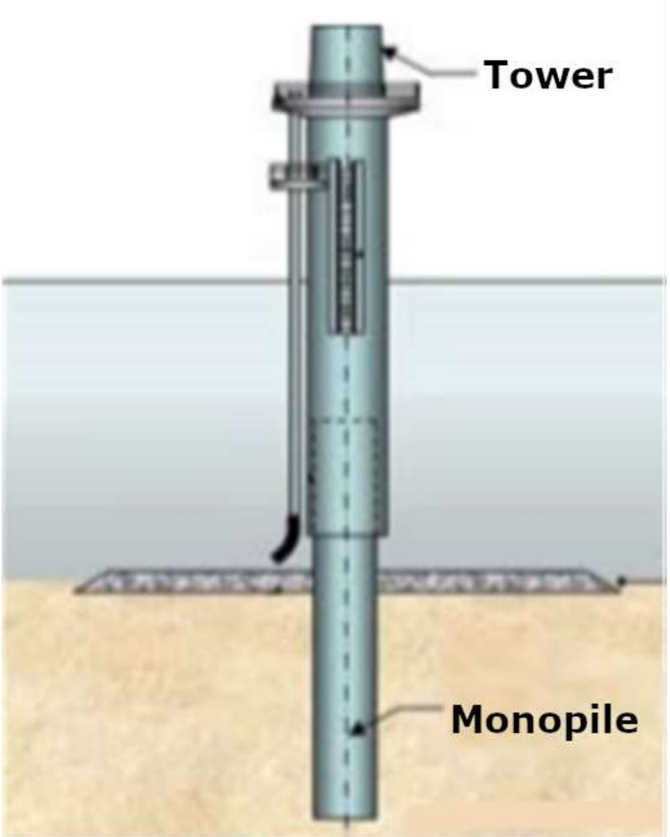


Figure 2.6. Diagram of the monopile [Source: own study based on: Foundation for Sustainable Energy, Offshore Energy – a flywheel for the development of coastal industry and regions – conference reference material, Słupsk 2013 (https://fnez.pl/biblioteka-fnez/)]

Monopile foundation (monopile) shall be used in the Baltic Power OWF. This is a simple steel structure manufactured from cylinders that are welded together. The length of the structure, depending on the foundation conditions of a specific wind turbine, may exceed 100 m. Such foundations are installed by driving them into the seabed to an appropriate depth. A transition piece is installed on the part of the monopile protruding above the sea level, and the wind turbine tower is then mounted on this transition piece.

An advantage of monopile is the fact that it is versatile and simple to make and install. The disadvantage of such solution is the limited possibility of removal from the seabed after the end of the lifetime of the wind farm, as well as the impact of underwater noise on sea animals related to driving the structure into the seabed.

It is planned to use monopiles with a diameter of up to 9.5 m and weight of up to 2,000 t. The weight of piles depends on their final length related to geotechnical conditions and depth in specific locations.

2.2.2.3 Inner array cables

Inner array cables (or inter array cables) of the OWF connect wind turbines with substations located within the wind farm.

66 kV inner array cables, which is a commonly used standard in offshore wind energy, shall be used in the Baltic Power OWF. Cables consisting of three insulated cores (made of copper or aluminum), and also provided with fiber-optic cables shall be used.

Inner array cables of the OWF are extruded cables, characterized by insulation with WTR-XLPE (cross-linked waterproof polyethylene). The insulator material is polyethylene, which undergoes the cross-linking process, similarly as in the case of rubber vulcanization, the polymer chains cross to form a lattice structure, they can be used at voltages up to 500 kV and they have an operating temperature of up to 90°C.

An example of a 3-core cable is shown in the figure (Figure 2.7).

1. core (made of copper or aluminum) used to transmit electricity

2. extruded shield

3. WTR-XLPE insulation (cross-linked waterproof polyethylene)

4. semi-conductive screen

5. screen made of copper wire with a water swelling powder (to prevent the spread of moisture along the cable in case of damage),

6. laminated aluminum coating

7. fiber-optic cables (optional) for data transmission

8. polypropylene fillers

9. binder tapes

10. polypropylene bedding for the armor

11. armor made of galvanized steel wire braid used for protection against mechanical damage

12. polypropylene outer sheath with bituminous compounds

Figure 2.7. AC 3-core cable design [Source: data of Baltic Power Sp. z o.o.]

It is assumed that in the Baltic Power OWF cables shall be buried in the seabed to a depth of up to 3 m below the seabed. In case of unfavorable geotechnical conditions (e.g. on stone field or when the seabed is too hard to bury the cables), the cables shall be laid directly on the seabed.

2.2.2.4 Substations

Substations (Figure 2.8) are used for the transformation and transmission of the energy generated by wind turbines onshore in the most efficient way. This process may include increasing the voltage and ensuring reactive power compensation.

The task of substations is to increase the voltage of the current from the wind turbines, which is 66 kV to the transmission level of 230 kV, which, in consequence, is to reduce losses, increase the transmission power and/or enable a reduction of conductor cross-section in the cables.

The substations used in the Baltic Power OWF shall consist of the following basic elements:

- transformers – basic elements used to change the current voltage;
- auxiliary transformers – used to ensure power supply for the substation equipment;
- earthing transformers – used to achieve an artificial neutral point in resistor-earthed networks or in compensated networks;
- high and medium voltage switchgears – used to switch, break and distribute electrical circuits,
- back-up generators – ensuring power supply in case of failure;

- reactors and capacitors for reactive power compensation;
- AC filters – elements used to pass or block signals with a specific frequency range or signals with specific harmonics.

Permanent stay of persons at substations is not planned.

Figure 2.8. Offshore substation on Princess Amalia Offshore Wind Farm [Source: https://isc.dk/en/northwind-vindmoellepark/]

The substations shall be installed on monopiles, similarly to wind turbines. The weight of substations (topside part) shall amount to more than 2,500 t and the total weight of the structure shall exceed 4,200 t.

2.3 Considered project options

2.3.1 Approach to determination of project options

The planned project was described using the same parameters for two options analyzed further in the EIA Report, i.e.:

- option proposed by the Applicant (OPA);
- reasonable alternative option (RAO).

With respect to these parameters, in the case of the OPA, these are values corresponding to the target parameters of the Baltic Power OWF, and in the case of the RAO, the maximum possible values were adopted. Such an assumption allows to perform an environmental impact assessment taking into account the highest expected level of project environmental impact.

The project was characterized by determination of the following parameters for each of the options:

- maximum total installed capacity of the OWF;
- maximum total number of wind turbines – a parameter resulting from the maximum installed capacity of the OWF and the assumed size of wind turbines;
- maximum rotor diameter of the wind turbine – a parameter specifying the rotor diameter (size);
- minimum clearance between the rotor operation area and the water surface – a parameter defining the distance between the rotor operation area outline and the water surface level;
- maximum height of the wind turbine structure including the rotor – a parameter specifying the maximum height of the wind turbine structure, from the water surface to the outline of the rotor operation area;
- maximum length of cable routes of the inner OWF system – a parameter specifying the total length of cable routes in which inner array cables connecting individual wind turbines with substations shall be laid.

2.3.2 Considered project options together with justification of their selection

In accordance with the requirements for preparation of EIA Reports, both options adopted for assessment are reasonable, i.e. possible to be implemented under the current legal status (including as part of issued permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended), technical and process conditions and in the current state of knowledge on environmental conditions.

2.3.2.1 Option proposed by the Applicant (OPA)

The option proposed by the Applicant is an option assuming use, to the greatest extent possible, of the latest technological solutions available on the market at the stage of development of the building permit design. It also assumes that the Baltic Power OWF will reach the maximum total nominal capacity defined in permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended. This option assumes the use of 15 MW wind turbines. It is planned to use monopiles. Implementation of the Baltic Power OWF project with the total maximum capacity specified in permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended (up to 1,200 MW) assumes installation of 76 wind turbines.

According to further analyses of the environmental impact, the OPA is an option more favorable for the environment compared to the RAO.

2.3.2.2 Reasonable alternative option (RAO)

The reasonable alternative option was based in assumptions on the existing technologies currently applied and available on the market on an industrial scale. In this option, it was assumed that the wind turbine will have the power output of 5 MW. The assumed turbine power output, with the maximum total nominal capacity of the OWF complex, indicated in permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended, determines the number of wind turbines, which in this option is 240.

In the RAO, it is assumed that it shall be possible to use wind turbines of different types and on different types of foundations or support structures.

2.3.2.3 List of technical parameters of the considered project options

The table (Table 2.6) summarizes the most important parameters of the project for both options analyzed in this EIA Report.

Table 2.6. List of key parameters of the Baltic Power OWF for the option proposed by the Applicant (OPA) and the reasonable alternative option (RAO) [Source: own study]

Parameter	Unit	OPA	RAO
Maximum installed capacity	MW	1200	1200
Maximum number of wind turbines	-	76	240
Rotor diameter	m	236	180
Minimum clearance between the area of the rotor operation and water surface	m	22.3	20
Maximum height of the wind turbine	m a.s.l.	258.3	250
Maximum number of additional structures	-	2	12
Maximum length of cable routes inside the OWF	km	120	600

2.4 Description of individual phases of the project

2.4.1 General information concerning all phases of the project

Due to the location of the planned project implemented entirely in the offshore area, all related activities in all phases of its course shall be conducted in the mode of maritime operations, taking into account their special conditions and specificity. Deliveries to and from the Baltic Power OWF area shall be performed using various types of vessels:

- construction and installation vessels – large, specialized vessels with an advanced safety level, equipped with dynamic positioning systems (with different degrees of protection), not requiring anchoring during the works; often such vessels, while performing their activities, have the possibility of full stabilization in the selected position, through a system of supports supported on the seabed;

- transport vessels – universal or specialized vessels adapted to transport large-size structures (e.g. monopiles, towers, propellers), often equipped with dynamic positioning systems;
- transport barges (platforms) – vessels used for transporting large-size structural components to the installation site, usually without their own propulsion, using push boats or tugboats;
- push boats and tugboats – auxiliary vessels used for the operation of larger vessels, transport barges or for the independent transport of large-size structural components (e.g. monopiles of wind turbines) from ports to their foundation site;
- service vessels – most frequently smaller vessels used for transport of OWF operating personnel or consumables, adapted to mooring to wind turbine towers or accompanying platforms and enabling safe transport of persons and portable equipment to the OWF structural components.

In specific cases, especially during the OWF operation phase, helicopters may be used to transport rescue teams or in emergency situations.

Activities related to the transport of large-size structural elements of the OWF must be carried out from ports that meet specific requirements, i.e. in particular:

- sufficient length and load-bearing capacity of the quayside, allowing for installation, storage and loading of structural elements of the OWF;
- appropriate depth of port basins, enabling operation of large construction vessels therein.

It is assumed that the estimated size of the area used as the storage location and potential preliminary assembly of structural components of the OWF should amount to approx. 20 ha. The quayside where works related to loading these elements onto vessels are possible should have a length of at least approx. 300 m and adequate load-bearing capacity.

At the current stage of development of the Baltic Power project, the ports in Świnoujście and Rønne are considered as installation ports. The nearest port with complete and operational infrastructure intended for offshore wind energy activities is the port of Rønne in Denmark (on Bornholm Island). The closest Polish port that can act as an installation port is the port in Świnoujście.

During the operation phase of the Baltic Power OWF, it shall be possible to use a smaller port located closer to the area of the planned project than the ports indicated above, i.e. the port in Łeba.

At the same time, it should be emphasized that ports together with their infrastructure are not a part of this project. All activities carried out in the area of ports used in connection with the implementation, operation and decommissioning of the Baltic Power OWF shall be carried out pursuant to the terms and within the limits of permits, decisions, licenses and other formal and legal conditions applicable to the specified ports.

According to Article 24.1 of the Act of March 21, 1991 *on maritime areas of the Republic of Poland and maritime administration*, the competent director of the maritime office shall be able, by way of an order, to establish safety zones around all OWF structures or their sets spaced at a distance of not more than 1,000 m, adjusted to the type and purpose of artificial islands, structures and devices or sets thereof and extending not more than 500 m from each point of their outer edge, unless another range of the zone is permitted by generally accepted international standards or recommended by the competent international organization. In the issued order the director of the maritime office shall determine the conditions of movement within the established zones, and, in particular, may introduce restrictions on navigation, fishing, practicing water sports, diving or performing underwater works.

Information on activities during the OWF construction phase, establishment of safety zones around the OWF structural components, as well as complete or partial decommissioning of the OWF shall be made public in official publications of the Hydrographic Office of the Polish Navy.

At each stage of implementation of the Baltic Power OWF, the applicable legal requirements and good practices regarding waste and wastewater handling shall be applied. Different hazardous materials shall be used during different phases of the Baltic Power OWF. The list and assumed estimated amounts of their generation are presented in the tables (Table 2.7–Table 2.9), with the description of individual phases.

All vessels participating in the entire project shall meet the requirements and comply with the regulations resulting from the provisions of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), including in particular the procedures included in the "Plans for Combating hazards and pollution" prepared in accordance with the Regulation of the Minister of Infrastructure of December 15, 2021 *on the rescue plan and the plan for combating hazards and pollution for an offshore wind farm and a set of equipment* (Journal of Laws, item 2391).

Moreover, the Baltic Power OWF systems shall implement the measures protecting against the spill of hazardous substances and measures aimed at eliminating the effects of possible spills of hazardous substances (e.g. basins for possible spills of transformer oil) and measures aimed at eliminating the effects of spills of these substances (e.g. sorbents). Oiled water produced during the works shall be collected and separated until concentrations of oil derivative substances below 15 p.p.m. are achieved, and oil obtained from the separation process shall be stored and transferred onshore to specialized disposal companies.

The same shall apply to other waste, including other hazardous waste; such waste shall be sorted, collected in specially marked and secured containers, transported onshore and handed over for disposal to specialized companies.

The following sub-chapters describe the activities and processes that shall take place in individual phases of the Project life, with particular consideration of the indication of emissions into the environment.

2.4.2 Construction phase

The construction phase of the OWF is the phase of the project that requires mobilization and involvement of the largest number of vessels, equipment and human resources. It shall be necessary to create a complex supply chain process for both goods and specialized services in various areas: manufacturing, transport, construction, erection and installation. In addition, the implementation of this phase shall require precise coordination of individual activities, taking into account the specific conditions arising from the implementation of projects in the maritime area. This phase shall cover four areas of action related to:

- preparation of the seabed before the foundation of monopiles on which substations shall be installed; the type of applied activities shall result from geological conditions in the substations locations;
- transport and foundation of monopiles in the seabed (including piling using special pile drivers);
- transport and installation of elements of wind turbines, substations on monopiles;
- laying the internal cable connections connecting the various OWF structures.

Depending on the adopted project implementation strategy, the activities indicated above can be carried out sequentially or in parallel. Thus, for example, once a part of the seabed has been prepared for foundations of monopiles, in that part of the seabed the piling activities themselves can be carried out. Therefore the point is to organize the construction process in such a way where individual phases of works are carried out sequentially in the entire Baltic Power OWF or in a specific area, i.e. in several (or all) locations of wind turbines, works related to seabed preparation will be carried out, after which piling shall commence only then and once it is completed, the area around individual locations will be cleaned after completion of the works.

It is assumed that the construction phase will be completed as soon as possible and shall take place in 2024-2026. Prior to the commencement of the Baltic Power OWF construction phase, the Investor will use the onshore site equipped with appropriate infrastructure (site back-up facilities and storage yards) where the preliminary erection of the wind turbine components will be performed and structural components of the OWF will be stored. This area will be located in the port or shipbuilding infrastructure existing for the duration of the project, with direct or very good access to the quayside dedicated to loading and unloading operations of vessels participating in the construction process and subsequent maintenance of the

OWF. Individual elements of the OWF shall be transported from this area by vessels to the area of their foundation or installation. The organization of such a place within the boundaries of the existing port or shipbuilding infrastructure will not significantly affect their functioning so far.

Transfer of sediments as a result of construction works

Depending on the depth and geological conditions in the Baltic Power OWF area, the activities will be carried out to prepare the seabed before founding the Baltic Power OWF monopiles for substations and before laying inner array cables. Such actions include:

- backfilling of the seabed with gravel material at foundation locations (as scour protection);
- moving stones from internal cable routes;
- displacing of bottom sediment layers;
- other works related to sediments.

One of the important elements resulting from the performance of works disturbing bottom sediments is the manner of their management. It is assumed that the disturbed sediment will be entirely managed within the Baltic Power OWF Area. The sediment will be transported only in the immediate vicinity of the work site. No sediment contamination was found in the Baltic Power OWF area and, therefore, it is not planned to transfer it to dumping sites or landfills.

The maximum amount of displaced sediments may occur when the cables are buried with jet trenching method used when applying the ROV trencher described below (at those sections of cables that are to be buried). If the plowing or mechanical trenching method is used, smaller amounts of displaced sediments will occur.

It is planned to use the following cable laying organizations:

- simultaneous lay and burial of the cable – SLB (simultaneous lay and burial):

  This method requires a smaller number of vessels and equipment needed to lay and protect the cable line. Thanks to the possibility of using only one cable-laying vessel and the lack of the need to make more journeys along the laying route, this method may be quicker than the PLB method. The rate of cable burial using the SLB technology is approx. 4.5 – 5 km/day. Due to the complexity of the process, a long-term weather window is required;

- burial of the cable after its prior laying on the seabed – PLB (*Post Lay Burial*):

  The PLB technology requires more equipment than the SLB method. The trenching rate is approx. 5.5 – 6.0 km/day and the cable laying rate is 14 – 15 km/day. For longer distances, the PLB method may turn out to be slower than the SLB. These disadvantages are compensated by reducing the risk of laying and burial operations and by easier management of cable unwinding. The PLB is a more versatile technology, which may be important in the case of low certainty about environmental conditions. By separating the process, a smaller weather window is required than for the SLB technology. However, the cable itself is not protected for the period from laying to burial.

Each of the above organizations has its own characteristics, with advantages and disadvantages of a given solution. The selection of the method is determined by:

- environmental conditions, i.e. topography and geological structure of the seabed along the planned route;
- level of certainty about environmental conditions;
- required depth of cable burial determined by the design and resulting from reliability requirements;
- environmental constraints – the impact of the method on the natural environment (seabed disturbances, increase in the amount of suspended sediments, destruction of organisms, agitation of pollutants settled on the seabed, noise);
- logistic conditions;
- technology recommended by the cable manufacturer or the contractor of the works.

The following equipment is used for laying of submarine cables:

a) cable plows (plowing) – used mainly in the SLB method (Figure 2.9):
   The plow must be operated with a CLV (cable laying vessel) type vessel. The plow with the cable placed in the guide

is lowered from the vessel deck to the seabed. The CLV departs at the planned distance, at the same time unwinding the cable. The vessel is anchored and the plow-pulling rope is pulled in. In one cycle, the plow makes the trench and places the cable in the trench by using mechanical force. For reducing the pulling force of the plow, some plows are equipped with a system of pressure pumps (jetting) designed to pre-soften the substrate. When the plow approaches the CLV, the operation of departing, anchoring and pulling the rope is repeated. At the end of the planned laying section, the cable is released from the guide and the plow is lifted on board the vessel.

Mainly used in the SLB method, when equipped with additional accessories, plows may be used in the PLB method. The difference in the performance of the operation consists in the necessity to catch and load the cable after lowering the plow to the seabed. Unfortunately, all advantages of SLB are lost in this case.

Advantages of using a cable plow (SLB method):

- continuous cable protection;
- simultaneous trenching and cable laying;
- suitable for use in many types of substrate from sands to very stiff loams.

Disadvantages of using the cable plow (SLB method):

- possibility of cable damage by the loading system;
- due to the required high pulling force of the plow in very stiff soils, potential damage to the cable may be more serious than in the case of other methods;
- large CLV and robust plow connection required;
- potential stresses in the cable may accelerate its degeneration;
- changing the route direction must be done gradually.

Figure 2.9. Example of a marine plow – Plough/Sea STALLION 4 DB model [Source: Boskalis: www.vbms.com]

b) ROV trencher (Figure 2.10):

These systems can be used for substrate vulnerable to liquefaction (sand and loam area). The pressure equipment shall be supplied from the vessel's deck (CLV or offshore support vessel) or by submersible pumps. In the case of supply from the surface, the operating depth of the machine is limited to 50 m due to the strength of the connecting cables. When lowered from the vessel's deck, these machines may be pulled by a vessel anchored or operating in dynamic positioning (DP) mode. They can also be equipped with their own propulsion.

Advantages of using ROV trencher:

- minimizing the risk of cable damage;
- ensuring high burial speed;
- traditionally used in areas of sand piles and leveled piles for laying purposes.

Disadvantages of using ROV trencher:

- not suitable for hard soils;
- in some coastal areas it is forbidden to use this technology (due to large disturbance/turbidity of the seabed).

Figure 2.10. Example of ROV trencher – model ROV Trencher 107-1100 [Boskalis Source: www.vbms.com]

c) jetting machines:
Jetting machines are technologically similar to ROV trenchers. Additionally, jetting machines are used for repair burial.

d) cable milling machines:
Cable milling machines are used in areas of compacted, hard or rocky substrates. By means of a wheel or cutting chain, they form a trench in which the cable is placed mechanically or by falling down spontaneously.

There are multi-functional machines combining the features of ROV trenchers and cable milling machines. Unlike ROV trenchers, the milling machines are always equipped with their own propulsion.

Once the cable is laid by the CLV, the milling machine is lowered to the seabed from the offshore support vessel deck. The machine moves along the route of the cable laid on the seabed, driving it into the seabed. After completion of the operation, the milling machine is pulled on board.

Advantages of using cable milling machines:

- suitable for use on hard substrates without the assistance of a large towing vessel;
- the possibility of using a smaller offshore support vessel allows earlier release of a large CLV;
- easier laying of DC package cables than with using cable plows.

Disadvantages of using cable milling machines:

- increased risk of cable damage due to the need to lift and insert the cable into the trench;
- required optimization of cable burial depth due to decreasing trenching speed proportionally to its depth.

Piling

The monopiles will be driven into the seabed by means of special equipment (pile drivers with weight and impact energy appropriate to the size of driven piles) from the deck of vessels adapted to these works (jacking platforms or vessels or other solutions available during construction).

During the construction phase, the contractor of installation works will apply the noise reduction system (NRS) during driving of monopiles. The NRS will consist of a hydro sound damper (HSD) system for all locations of wind turbines and substations and additionally double air curtains for wind turbines for which due to the location it is possible to exceed the values [318]:

- 140 dB re 1 µPa^2s SEL_{cum} HF-weighted for underwater noise spectrum (HF-weighting function for marine mammals with high sensitivity to high frequency noise – porpoises);
- 170 dB re 1 µPa^2s SEL_{cum} PW-weighted for underwater noise spectrum (PW-weighing function for pinniped marine mammals – seals).

For fish, the threshold values for temporary threshold shift (TTS) (1-h cumulative SEL) is 186 dB re 1 µPa^2s SEL_{cum} [350].

When using NRS, the above-mentioned limit noise levels shall not be exceeded at a distance of 11 km from the piling location, and thus also at the boundary of the Słowińska Refuge area (PLH220023), i.e. the nearest nature protection area where both fish and marine mammals are protected.

Transport routes (sea and land)

Maritime transport will be crucial and the impact of land transport should be minimal. Land transport will be carried out as part of the existing communication solutions. It is possible that the erection or production of large-size elements will take place in port or shipbuilding areas. Maritime traffic shall take place in locations where it has so far been low or negligible. Depending on the selection of the procurement concept, supply and service ports, the transport system will include handling works and vessel traffic on the routes port – OWF – port or between ports. The number of offshore specialist operations related to the construction phase of the Baltic Power OWF is proportional to the number of facilities installed and constructed in the OWF area, including also the length of the installed power grids. Therefore, the number of operations and their effects (e.g. fuel consumption, transport-related emissions) for the OPA shall be lower than in the case of RAO.

Waste

The expected types and amounts of waste generated during the construction phase of the Baltic Power OWF are presented broken down in accordance with the Regulation of the Minister of Climate of January 2, 2020 *on the waste catalog* (consolidated text: Journal of Laws of 2022, item 699, as amended) in table (Table 2.7) It is expected that waste will be generated due to normal operation of various types of vessels involved in this phase of the project and during joining of structural components (e.g. in the welding process), driving or drilling of piles (e.g. cuttings), installation of corrosion protection elements and possible abrasion of protective coatings (e.g. during piling).

Table 2.7. Summary of estimated amounts of waste generated during the construction phase of the Baltic Power OWF on an annual basis [Source: prepared on the basis of the Bałtyk II EIA Report [170]]

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	0.05
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	0.05
12 01 13	Welding waste	0.10
13 01 09*	Mineral-based chlorinated hydraulic oils	0.05
13 01 10*	Mineral-based non-chlorinated hydraulic oils	0.05
13 01 11*	Synthetic hydraulic oils	0.05
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	0.05
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.05

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
13 02 06*	Synthetic engine, gear and lubricating oils	0.05
13 02 07*	Readily biodegradable engine, gear and lubricating oils	0.05
13 02 08*	Other engine, gear and lubricating oils	0.05
13 03 01*	Oils and liquids used as insulating and heat transmission oils containing PCBs	0.20
13 04 03*	Bilge oils from seagoing vessels	0.10
13 05 02*	Sludge from oil/water separators	0.50
13 05 06*	Oil from oil/water separators	0.50
13 05 07*	Oily water from oil/water separators	0.50
13 07 01*	Fuel oil and diesel oil	0.05
13 07 02*	Petrol	0.05
13 08 80	Oily solid waste from ships	0.10
14 06 01*	Freons, HCFC, HFC	0.05
14 06 02*	Other chlorinated solvents and solvent mixtures	0.05
14 06 03*	Other solvents and solvent mixtures	0.05
15 01 01	Paper and cardboard packaging	2.00
15 01 02	Plastics packaging	2.00
15 01 03	Wooden packaging	2.00
15 01 04	Metal packaging	2.00
15 01 05	Multi-material packaging	2.00
15 01 06	Mixed packaging waste	2.00
15 01 07	Glass packaging	0.10
15 01 09	Textile packaging	0.10
15 02 02*	Sorbents, filtering materials (together with oil filters not included in other groups), wiping fabrics (e.g. rags and cloths) and protective clothing contaminated with hazardous substances (e.g. PCBs)	1.00
15 02 03*	Sorbents, filter materials, wiping cloths (e.g. rags, cloths) and protective clothing other than those mentioned in 15 02 02	1.00
16 06 01*	Batteries and rechargeable batteries containing lead	0.10
16 06 02*	Nickel–cadmium batteries and rechargeable batteries	0.10
16 06 03*	Batteries containing mercury	0.01
16 06 04	Alkaline batteries (except 16 06 03)	0.01
16 06 05	Other batteries and accumulators	0.01
16 81 01*	Waste displaying hazardous properties	1.00
16 81 02	Waste other than that mentioned under 16 81 01	1.00
17 01 01	Concrete waste and concrete debris from demolitions and renovations	50.00
17 01 03	Wastes of other ceramics and equipment	10.00
17 01 82	Waste not otherwise specified	50.00
17 02 01	Wood	2.00
17 02 02	Glass	0.10
17 02 03	Plastics	5.00

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
17 04 01	Copper, bronze, brass	0.05
17 04 02	Aluminum	0.05
17 04 04	Zinc	0.05
17 04 05	Iron and steel	1.00
17 04 07	Mixed metals	0.05
17 04 11	Cables other than those mentioned in 17 04 10	5.00
17 09 03*	Other construction, overhaul and demolition waste (including mixed waste) containing hazardous substances	20.00
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	20.00
19 08 05	Stabilized municipal wastewater sludges	1.00
20 01 01	Paper and cardboard	1.00
20 01 02	Glass	1.00
20 01 08	Biodegradable kitchen waste	1.00
20 01 10	Clothing	1.00
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.05
20 01 23*	Freon containing equipment	0.05
20 01 29*	Detergents containing hazardous substances	0.05
20 01 30	Detergents other than those mentioned in 20 01 29	0.05
20 01 33*	Batteries and accumulators including those mentioned in 16 06 01, 16 06 02, or 16 06 03, and unsorted batteries and accumulators containing these batteries	0.05
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.05
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, and 20 01 23 containing hazardous components (1)	0.05
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.05
20 03 01	Unsorted (mixed) municipal waste	20.00

2.4.3 Operation phase

Transport routes (sea)

Unlike the construction phase, this phase will be characterized by smaller movement of vessels. In general, in this phase, small and medium-sized vessels involved in the operation and maintenance of the Baltic Power OWF shall have the largest share in total maritime traffic. Two operational options are possible:

- use of medium-sized vessels – service bases, which will perform periodic service duties in the OWF area and perform regular trips to service ports, in order to supplement the supplies, replace the service personnel, or the crew. Changes in the volume of maritime traffic shall take place in the same manner as in the above case;
- use of small vessels going between the service port and the OWF area, as rapid response, during daily operation cycles. The estimated number of travels will significantly increase the volume of traffic on the navigation routes and in ports.

The number of specialist offshore operations related to the operation phase of the Baltic Power OWF is proportional to the number of facilities installed and constructed in the OWF area, including also the length of the installed power grids.

Therefore, in the list of considered implementation options of the Baltic Power OWF, the number of operations and their effects (e.g. fuel consumption, transport-related emissions) for the OPA shall be lower than in the case of RAO.

Electromagnetic Field (EMF)

The OWF operation process will be a multi-annual project. Offshore wind farms will be connected with the offshore substations by means of power grids and communication networks. It is assumed that the total length of all cable routes on which the cables shall be laid in the OWF area shall not exceed 120 km. Cables buried in the seabed are optimized for emitting residual electric field. Possible magnetic component of EMF is minimized by routing single conductors as close as possible (for individual phases of alternating current). In the case of alternating current, the use of a combined cable reduces the magnetic field, but it may remain at the level generating an electric field in seawater [327]. The remedy for this is to bury the cable in the sediment, which in itself does not reduce the effects of EMF impact but, by separating the cables from sea water, causes the impact to be much smaller.

Heat emission by power cables

The electric current flowing through the cable causes its heating due to power losses at resistance, in accordance with Joule law. As the cable temperature rises above the ambient temperature, heat is released into the environment surrounding the cable. A precise quantification of the dissipated heat is difficult because of the phenomena such as heat conductivity, convection and radiation, subject to various physical laws [412]. The sediments heating may lead to a change of the taxonomic composition of the benthos living on and in the seabed in direct proximity of the cables [298]. The OSPAR best environmental practice guide for laying and using submarine cables [327] states that burying the cable at a depth from 1 to 3 m below the seabed is sufficient for keeping the increase of the sediment temperature related to emission of heat from power cables under load below a recommended value of 2°C at the depth of 0.2 m below the seabed surface. The inner array cables laid at a depth of up to 3 m within the Baltic Power OWF fit to the referred conditions. The assessment of the impact of heat emission on benthic organisms is included in Chapter 6, and the impact significance of the heat emission was assessed as negligible.

Waste

The expected types and amounts of waste generated during the operation phase of the Baltic Power OWF are presented broken down in accordance with the Regulation of the Minister of Climate of January 2, 2020 *on the waste catalog* in the table (Table 2.8). The presented amounts of waste refer to a single OWT or an offshore substation. Therefore, it should be assumed, when comparing the analyzed project options, that the amounts of waste and wastewater shall be significantly higher in the case of RAO than in the case of the OPA.

The main factors that cause generation of waste and wastewater during the Baltic Power OWF operation phase include using of vessels and performing repairs.

Table 2.8. Summary of waste generated during the operation phase of the Baltic Power OWF by a single OWT or substation on an annual basis [Source: prepared on the basis of the Bałtyk II EIA Report [170]]

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
08 01 11*	Waste paint and varnish containing organic solvents or other hazardous substances	0.50
08 01 12	Waste paint and varnish other than those mentioned in 08 01 11	0.50
12 01 13	Welding waste	0.10
13 01 09*	Mineral-based chlorinated hydraulic oils	0.03
13 01 10*	Mineral-based non-chlorinated hydraulic oils	0.03
13 01 11*	Synthetic hydraulic oils	0.03
13 01 12*	Readily biodegradable hydraulic oils	0.03
13 01 13*	Other hydraulic oils	0.03
13 02 04*	Mineral-based chlorinated engine, gear and lubricating oils	0.03

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.03
13 02 06*	Synthetic engine, gear and lubricating oils	0.03
13 02 07*	Readily biodegradable engine, gear and lubricating oils	0.03
13 02 08*	Other engine, gear and lubricating oils	0.03
13 03 01*	Oils and liquids used as insulating and heat transmission oils containing PCBs	1.00
13 04 03*	Bilge oils from seagoing vessels	0.10
13 05 02*	Sludge from oil/water separators	0.50
13 05 06*	Oil from oil/water separators	0.50
13 05 07*	Oily water from oil/water separators	0.50
13 07 01*	Fuel oil and diesel oil	0.10
13 07 02*	Petrol	0.05
13 08 80	Oily solid waste from ships	0.10
14 06 01*	Freons, HCFC, HFC	0.05
14 06 02*	Other chlorinated solvents and solvent mixtures	0.05
14 06 03*	Other solvents and solvent mixtures	0.05
15 01 01	Paper and cardboard packaging	0.10
15 01 02	Plastics packaging	0.10
15 01 03	Wooden packaging	0.10
15 01 04	Metal packaging	0.10
15 01 05	Multi-material packaging	0.10
15 01 06	Mixed packaging waste	0.10
15 01 07	Glass packaging	0.10
15 01 09	Textile packaging	0.10
15 02 02*	Sorbents, filtering materials (together with oil filters not included in other groups), wiping fabrics (e.g. rags and cloths) and protective clothing contaminated with hazardous substances (e.g. PCBs)	0.30
15 02 03*	Sorbents, filter materials, wiping cloths (e.g. rags, cloths) and protective clothing other than those mentioned in 15 02 02	0.30
16 06 01*	Batteries and rechargeable batteries containing lead	0.10
16 06 02*	Nickel–cadmium batteries and rechargeable batteries	0.10
16 06 03*	Batteries containing mercury	0.01
16 06 04	Alkaline batteries (excluding 16 06 03)	0.01
16 06 05	Other batteries and accumulators	0.01
16 81 01*	Waste displaying hazardous properties	0.30
16 81 02	Waste other than that mentioned under 16 81 01	0.30
17 01 01	Concrete waste and concrete debris from demolitions and renovations	5.00
17 01 03	Tiles and ceramics	1.00
17 01 82	Waste not otherwise specified	5.00
17 02 01	Wood	0.20
17 02 02	Glass	0.10

Waste code (*hazardous waste)	Types of waste	Estimated quantity [Mg/year]
17 02 03	Plastics	0.50
17 04 01	Copper, bronze, brass	0.05
17 04 02	Aluminum	0.05
17 04 04	Zinc	0.05
17 04 05	Iron and steel	1.00
17 04 07	Mixed metals	0.05
17 04 11	Cables other than those mentioned in 17 04 10	5.00
17 09 03*	Other construction, overhaul and demolition waste (including mixed waste) containing hazardous substances	2.00
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	2.00
19 08 05	Stabilized municipal wastewater sludges	3.00
20 01 01	Paper and cardboard	2.00
20 01 02	Glass	2.00
20 01 08	Biodegradable kitchen waste	2.00
20 01 10	Clothing	2.00
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.10
20 01 23*	Freon containing equipment	0.10
20 01 29*	Detergents containing hazardous substances	0.10
20 01 30	Detergents other than those mentioned in 20 01 29	0.10
20 01 33*	Batteries and accumulators including those mentioned in 16 06 01, 16 06 02, or 16 06 03, and unsorted batteries and accumulators containing these batteries	0.10
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.10
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, and 20 01 23 containing hazardous components (1)	0.10
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.10
20 03 01	Unsorted (mixed) municipal waste	30.00

2.4.4 Decommissioning phase

In technical terms, the decommissioning phase is the reversal of the OWF construction phase. In the reverse sequence to the construction phase, individual elements of the OWF will be removed and transported to the disposal sites.

The number of specialist offshore operations related to the decommissioning phase of the Baltic Power OWF is proportional to the number of facilities installed and constructed in the OWF area, including also to the length of the installed power grids. Therefore, the number of operations and their effects (e.g. fuel consumption, transport-related emissions) for the OPA shall be lower than in the case of RAO.

Waste

The expected types and amounts of waste generated during the decommissioning phase of the Baltic Power OWF are presented broken down in accordance with the Regulation of the Minister of Climate of January 2, 2020 *on the waste catalog* in the table (Table 2.9). The presented amounts of waste refer to a single OWT or an offshore substation or 1 km of cable. The list assumes a higher value resulting from the comparison for these two types of structures. Therefore, it should be assumed that the amounts of waste and wastewater will be much higher in the case of the RAO than in the case of the OPA.

It is expected that the decommissioning of structures in the Baltic Power OWF area will take place to the level of the seabed (driven piles after cutting or burning at an appropriate depth will be left in the seabed because they do not cause any environmental impact and their removal may cause environmental impact – e.g. when using explosive removal methods). Moreover, underwater elements of the OWF may constitute a habitat of communities of marine organisms. In the case of decommissioning of the Baltic Power OWF, the generation of waste is related mainly to the physical removal of worn-out elements of the Baltic Power OWF, and to operations of vessels used during decommissioning.

Table 2.9. Summary of waste generated during the decommissioning phase of the Baltic Power OWF by a single OWT or substation or 1 km of cable [Source: prepared on the basis of the Bałtyk II EIA Report [170]]

Waste code (*hazardous waste)	Type of waste	Estimated quantity [Mg/structure]
13 01 09*	Mineral-based chlorinated hydraulic oils	0.05
13 01 10*	Mineral-based non-chlorinated hydraulic oils	0.05
13 01 11*	Synthetic hydraulic oils	0.05
13 01 12*	Readily biodegradable hydraulic oils	0.05
13 01 13*	Other hydraulic oils	0.05
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.01
13 02 05*	Mineral-based non-chlorinated engine, gear and lubricating oils	0.01
13 02 06*	Synthetic engine, gear and lubricating oils	0.01
13 02 07*	Readily biodegradable engine, gear and lubricating oils	0.01
13 02 08*	Other engine, gear and lubricating oils	0.01
13 03 01*	Oils and liquids used as insulating and heat transmission oils containing PCBs	82.5
13 04 03*	Bilge oils from seagoing vessels	0.1
13 07 01*	Fuel oil and diesel oil	0.05
13 07 02*	Petrol	0.05
13 08 80	Oily solid waste from ships	0.1
14 06 01*	Freons, HCFC, HFC	0.1
14 06 02*	Other chlorinated solvents and solvent mixtures	0.1
14 06 03*	Other solvents and solvent mixtures	0.1
15 01 01	Paper and cardboard packaging	0.1
15 01 02	Plastics packaging	0.1
15 01 03	Wooden packaging	0.1
15 01 04	Metal packaging	0.1
15 01 05	Multi-material packaging	0.1
15 01 06	Mixed packaging waste	0.1
15 01 07	Glass packaging	0.1
15 01 09	Textile packaging	0.1
15 02 02*	Sorbents, filtering materials (together with oil filters not included in other groups), wiping fabrics (e.g. rags and cloths) and protective clothing contaminated with hazardous substances (e.g. PCBs)	1
15 02 03*	Sorbents, filter materials, wiping cloths (e.g. rags, cloths) and protective clothing other than those mentioned in 15 02 02	1
16 06 01*	Batteries and rechargeable batteries containing lead	0.1
16 06 02*	Nickel–cadmium batteries and rechargeable batteries	0.1
16 06 03*	Batteries containing mercury	0.01
16 06 04	Alkaline batteries (excluding 16 06 03)	0.01

Waste code (*hazardous waste)	Type of waste	Estimated quantity [Mg/structure]
16 06 05	Other batteries and accumulators	0.01
16 81 01*	Waste displaying hazardous properties	1
16 81 02	Waste other than that mentioned under 16 81 01	1
17 01 01	Concrete waste and concrete debris from demolitions and renovations	7000
17 01 03	Tiles and ceramics	50
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	50
17 01 82	Waste not otherwise specified	50
17 02 01	Wood	0.1
17 02 02	Glass	2
17 02 03	Plastics	1000
17 04 01	Copper, bronze, brass	1
17 04 02	Aluminum	1
17 04 04	Zinc	1
17 04 05	Iron and steel	4000
17 04 07	Mixed metals	1
17 04 11	Cables other than those mentioned in 17 04 10	71
17 09 03*	Other construction, overhaul and demolition waste (including mixed waste) containing hazardous substances	50
17 09 04	Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	50
19 08 05	Stabilized municipal wastewater sludges	1
20 01 01	Paper and cardboard	1
20 01 02	Glass	1
20 01 08	Biodegradable kitchen waste	1
20 01 10	Clothing	1
20 01 21*	Fluorescent tubes and other mercury-containing waste	0.05
20 01 23*	Freon containing equipment	0.05
20 01 29*	Detergents containing hazardous substances	0.05
20 01 30	Detergents other than those mentioned in 20 01 29	0.05
20 01 33*	Batteries and accumulators including those mentioned in 16 06 01, 16 06 02, or 16 06 03, and unsorted batteries and accumulators containing these batteries	0.05
20 01 34	Batteries and accumulators other than those mentioned in 20 01 33	0.05
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, and 20 01 23 containing hazardous components (1)	0.05
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.05
20 03 01	Unsorted (mixed) municipal waste	20

2.4.5 Information on the energy demand and consumption

The most important factor determining the demand for energy and its consumption is the selected type of structures constructed in the OWF area, and organization of the construction process, as well as the selection of one of the OWF operation and maintenance methods presented in sub-chapter 2.4.3. The energy needed and consumed for construction of the OWF is, in nearly 100%, fuel used for transport, reloading and installation of components of the wind turbines and other OWF facilities.

Unlike commercial shipping, specialized vessels adapted to work in the construction and operation of industrial marine structures have a different operational profile. This is mainly related to a necessity of performing complex maritime operations (reloading, operation in dynamic positioning mode), which are not related to the traveled distance, but to a specific number of operating hours. Thus, estimating planned fuel consumption depends on a very large number of variable factors and is practically always subject to a significant error.

Average fuel consumption values for different types of vessels are presented in the table (Table 2.10).

Table 2.10. Average fuel consumption for different types of vessels [Source: own study based on Borkowski [54]]

Vessel size	Intended use	Average fuel consumption (diesel oil) [kg^h^{-1}]	Nominal daily operation time [h]
Small vessels	Minor supplies, personnel transport, one-day service, emergency actions – for each phase	50-200	8-10
Medium vessels	Supply, support for construction works, towing works, stationary multi-day service – for each phase	500-2000	12-18
Large vessels	Procurement, storage, construction works – mainly for the construction and demolition phase	2500-5000	12-24

The number of specialist offshore operations related to the construction, operation and decommissioning phase of the Baltic Power OWF is proportional to the number of facilities installed and constructed in the OWF area, including also the length of the installed power cables. Therefore, the quantities of fuel and emission values related to transport for the OPA will be lower than for the RAO.

As of the date of submission of the EIA Report, it is not possible to calculate the planned energy consumption at all stages of the Baltic Power OWF lifetime. It is only possible to make estimate calculations on the basis of estimated CO_{2eq} emissions for individual lifetime phases of the Baltic Power OWF.

The estimated amount of CO_2 emissions presented in chapter 6.1.1.3 covers all phases of the OWF lifetime, i.e. construction, operation and decommissioning phases. The specified values were sourced from the referenced publication. Those values were originally published by White and Kulcinski [475] and by White [474].

Taking into account the share of each phase in the life cycle of the OWF in CO_2 emissions according to Wagner et al. [464], it can be assumed that, in individual phases of the Baltic Power project, these values will be as follows:

- production and construction phase: from 0.59 to 3.36 million Mg of CO_2;
- operation phase: from 0.15 to 0.87 million Mg of CO_2;
- decommissioning phase: from 0.01 to 0.05 million Mg of CO_2.

Due to the specificity of the above calculation of CO_2 emission values, it can be assumed that, in the assessed options (OPA and RAO), there will be no significant differences in CO_2 emissions.

Thomson and Harrison [440], referring to Dolan and Heat [113], indicated the estimated CO_2 equivalent emission for offshore wind energy to range from 7 to 23 g of CO_{2eq}/kWh. Based on conversions of the indicated values according to Wagner et al. [464] and taking into account the expected production volume of the Baltic Power OWF, the emission values of CO_2 equivalent in individual phases will be as follows:

- production and construction phase: from 0.69 to 2.27 million Mg of CO_{2eq};
- operation phase: from 0.18 to 0.59 million Mg of CO_{2eq};
- decommissioning phase: from 0.01 to 0.03 million Mg of CO_{2eq}.

In the other described case, the emission values were indicated as CO_2 equivalent, i.e. the estimated values of all greenhouse gases emitted during individual phases of the planned project. Moreover, in the above calculations, the authors also took into account the stage of generation of individual elements of the OWF, which is not assessed in the EIA Report.

At the moment, it is not possible to refer to the actual results of CO_2 emissions from the vessels used for the implementation of the OWF. As indicated in the European Commission's report on CO_2 emissions from maritime transport in 2019 [362], these vessels were not subject to greenhouse gas emission monitoring.

Taking into account that the generation of 1 MWh of energy emits 0.745 mg CO_2 [493], the following energy consumption in individual phases of the OWF lifetime can be assumed on the basis of the above calculations of CO_{2eq} emissions:

- production and construction phase: from 0.85 to 4.85 million MWh;
- operation phase: from 0.21 to 1.26 million MWh;
- decommissioning phase: from 0.01 to 0.08 million MWh.

Due to the specificity of the project in question, i.e. generation of electricity from renewable energy sources, its implementation in the final balance will have a significant positive impact on the climate by reducing emissions from emission-intensive sources generating electricity from fossil fuels.

2.5 Risk of serious failures or natural and construction disasters

2.5.1 Types of failures resulting in contamination of the environment

The project involving the construction, operation and decommissioning of the OWF is associated with a period of several dozen years of complex onshore and offshore activities.

The implementation and operation of the project being the subject o f this EIA Report will not be associated with any storage of hazardous substances in amounts determining the classification of the Baltic Power OWF as a plant of increased or high risk of occurrence of a major industrial failure in accordance with the Regulation of the Minister of Development of January 29, 2016 *on types and volumes of hazardous substances present in the plant, which decide on classification of a plant as a plant of increased or high risk of major industrial failure* (Journal of Laws, item 138). Production of all elements for the construction of the OWF and its operation takes place on land. Construction, installation, service, overhaul and, subsequently, demolition works are carried out offshore. All these activities depend on the following vessels: transport, service, structural. Ports and vessels are of key importance during the implementation of the project. Large-size elements of wind turbines, monopiles, towers and substations are manufactured in ports or in the immediate vicinity. Manufacturing technologies and processes related to their production do not pose any risk of occurrence of emergency situations. Possible emergency events will not cause significant emissions of pollutants threatening the environment. Also during decommissioning or disposal of disassembled elements of wind turbines, which will take place at the port areas or industrial areas, no events that cause threat to the environment are expected.

The main hazards that may occur during the construction and decommissioning of the OWF are spills of oil derivative substances, mainly diesel, hydraulic, transformer and lubricating oils. To a lesser extent, the marine environment may be incidentally endangered by materials containing hazardous substances, if used. At the operation stage, oil spills may be the main cause of pollution of sea waters. Both within open sea waters (e.g. OWF), and in the vicinity of shores, they may pose a problem with long-term effects on fauna, flora, fisheries and beaches subject to contamination. In order to counteract this hazard, the OWF systems will be equipped with measures protecting against the spill of hazardous substances, as described in sub-chapter 2.4.1.

The volume of oil pollutants may be classified as follows:

- **Class I (a small spill of up to 20 m^3)** – minor leaks of oil derivative substances, not requiring intervention of any external forces and measures, possible to be removed with own means. These spills are of a local nature, their disposal does not create any particular technical difficulties, and does not pose a significant threat to the marine environment;
- **Class II (medium spill, up to 50 m^3)** – spills of oil derivative substances, the scale of which requires coordinated counteraction within the marine area under the supervision of the Director of the Maritime Office who decides on the scale of required countermeasures;
- **Class III (a catastrophic spill, above 50 m^3)** – spills of oil derivative substances posing an extraordinary threat to the

environment, the combating of which requires forces and measures at the disposal of more than one Director of the Maritime Office.

2.5.2 Failure pattern with the assessment of potential consequences

2.5.2.1 Leakage of oil derivative substances (during normal operation of vessels)

During normal operation of vessels, leakages of various types of oil derivative substances (lubricating and diesel oils, petrol) may occur. It should be assumed that these will be small (class I) spills.

Protected natural areas, including those designated as Natura 2000 sites [364], are particularly vulnerable to potential pollution.

Therefore, from the point of view of the environment, the most vulnerable areas in the case of possible spills are the Słupsk Bank Natura 2000 site and the coastal area approximately between the town of Ustka in the west and the village of Dębki in the east which are important for wintering seabirds. Taking into account the prevailing western direction of wind and the existing shore currents, the coastline with tourist destinations (Jarosławiec, Rowy) and ports in Ustka and Łeba in the west to the town and port in Władysławowo are subject to hazards.

It should be stressed that it is not so much the magnitude of a spill that is crucial, but the place where it occurred. There are known cases of high mortality of birds after small oil spills to the sea. Extensive oil spills drifting away from the coast, in water regions with very low bird populations, do not entail such high population losses as smaller spills in a place with numerous concentrations of marine avifauna [293]. In the area of the planned Baltic Power OWF, the bird densities were significantly lower than in other investigated areas of significant importance for seabirds. However, it should be emphasized that in the case of class I spills and with proper organization of vessel traffic, the situation in which the uncontrolled propagation of oil derivative substances reaches the environmentally important areas is highly unlikely.

Determination of the actual extent of the spill shall be possible only during the event, on the basis of current meteorological data and data on the type and potential amount of pollution. Therefore, at the stage of the EIA Report, it is not possible to perform a more detailed assessment of the impact on marine organisms that are exposed the most to the effects of oil spills.

The number of potential leakages is proportional to the number of vessels used to implement, operate or decommission the project.

Leakage of oil derivative substances (in emergency situations)

During the construction, operation or decommissioning of the Baltic Power OWF, there may be leakages of oil derivative substances which will pollute water and bottom sediments. Leakage may occur due to a failure or collision of vessels, their collision with the OWF facilities, sinking or grounding of the vessels, as well as during leakages and operational leaks from the vessels, leakage from the oil system of the wind turbine, leakage from the transformer at the substation or spill of oil related to inspections and overhauls of the OWF components. In the worst case scenario, at the construction or decommissioning stage, there will be class II spills (medium-sized spills). It has been calculated that the probability of major accidents is very low, ranging from 10^{-5} (practically impossible – once per 100,000 years) to 10^{-2} (rare – once per 100 years) [365].

Assuming the worst case scenario and release of 200 m^3 of diesel oil into the marine environment and taking into account the type, its behavior in sea water, the time during which the oil stain disperses and drifts, it is expected that the extent of pollution shall not exceed 5 to 20 km from the Baltic Power OWF [364]. The specific character of this type of oil makes it not a particularly hazardous and arduous pollution.

Pursuant to the Act of August 18, 2011 *on maritime safety* (Journal of Laws 2022, item 515, as amended), detailed rules for counteracting and combating hazards and pollution will be agreed with the maritime administration before the application for the building permit for the Baltic Power OWF is submitted.

Release of chemicals and waste

During the construction of a wind farm, on vessels, at onshore site back-up facilities (located in the port handling the implementation of the project) and in the place where the projects are to be implemented, waste directly related to the construction process will be generated. Those may include, e.g. damaged parts of OWF components being installed, cement, grouts, mortar, binders used to join the components of the turbines and other chemical substances used during construction works. They may be accidentally released into the sea.

The bulk cement is packed in bags of approx. 1 m^3 each. It was assumed that during the reloading activities, approx. 5 m^3 of the product may go under water. Grouts, mortars and other binders often contain hazardous substances. For example, epoxy (two-component) welds contain epoxy resin, alkyl-glycoside ethers and polyaminoamides in varying proportions. When released into water, these substances, due to their high density (approximately 1.3 g cm^{-1}) sink and deposit on the seabed. They are considered as a serious threat because they cannot be easily removed from the seabed and they are toxic to marine organisms.

The possibility of releasing waste or chemical substances into water is proportional to the activity related to the use of chemical agents.

2.5.3 Other types of releases

2.5.3.1 Release of municipal waste or domestic sewage

During the construction of a wind farm, on vessels and at the onshore site back-up facilities (located in the port handling the project), mainly municipal waste an others, not directly related to the construction process, as well as domestic sewage will be generated. Waste and sewage may be accidentally released into the sea while during their collection from vessels by another vessel and in the event of a failure, resulting in a local increase in nutrient concentrations and deterioration in the quality of water and sediments.

It is estimated that the possible occurrence of the above-mentioned releases will not affect the structure and functioning of marine organisms in the project area and will not cause their mortality.

2.5.3.2 Contamination of water and bottom sediments with anti-fouling agents

To protect the hulls of vessels against fouling, biocidal substances are used, which may include e.g. copper, mercury and organotin compounds (e.g. tributyltin). These substances may pass into the water and eventually be stored in sediments. It should be assumed that the emission of these compounds will be insignificant. Among the listed substances, organotin compounds are the most harmful (toxic) to aquatic organisms. The use of tributyltin (TBT) (the most harmful substance) in anti-fouling paints is currently prohibited, but the presence of those compounds in older vessels cannot be ruled out. This impact can be reduced by introducing an inspection of the type of protective coatings on the vessels used in activities in the Baltic Power OWF area.

It is estimated that the possible occurrence of the above-mentioned events will not affect the structure and functioning of marine organisms in the project area and will not cause their mortality.

2.5.3.3 Release of pollutants from anthropogenic items at the bottom

The possibility of releasing pollutants from items of anthropogenic origin located at the bottom cannot be completely excluded. During geophysical surveys in 2019, the Baltic Power OWF Area was systematically checked for the presence of items of anthropogenic origin, including packaging and containers that may contain hazardous chemical substances. Such items may come from, for example, insufficiently secured cargo of vessels sailing through the Baltic Power OWF Area. No such items were found at the seabed of the OWF Area. It is not excluded, however, that such items may be buried at the seabed and, therefore, were not detected during geophysical tests. During geophysical surveys, magnetometric surveys were also carried out, which were to reveal larger ferromagnetic items only. As a result of these surveys, in the Baltic Power DA, a torpedo and an object which is probably a naval mine were identified. Thus, it cannot be excluded that new anthropogenic items (e.g. lost small barrels or unexploded ordnance) may be revealed during preparatory works for the construction process, including in particular seabed cleanliness tests for the presence of unexploded ordnance and chemical weapons. To determine how to handle such findings, the Applicant will prepare a plan for handling hazardous items, both from the point of view of offshore works (e.g. rules of performing works in the vicinity of potentially hazardous items) and from the point of view of possible removal or bypassing of places where such items are located. The basic assumption of the plan for handling hazardous items is to avoid hazards to human life and health and to avoid the spread of pollutants from such items.

2.5.4 Environmental hazards

2.5.4.1 Construction phase

Based on the data from other OWF projects and similar projects as well as on the knowledge and experience of the authors of the report, the following potential events have been selected that endanger the environment during the construction phase, which may become the source of negative environmental impacts of the OWF:

- spill of oil derivative substances as a result of a collision of vessels, failure or construction disaster (during normal operation or in emergency situations),
- accidental release of municipal waste or domestic sewage,
- accidental release of construction materials or chemicals,
- contamination of water and bottom sediments with anti-fouling agents.

It should be noted that events and emergency situations may directly pollute the abiotic environment, especially sea water and, to a lesser extent, seabed sediments. Indirectly, those events may also have an impact on living organisms that inhabit or otherwise use the seabed, the water column and the sea surface. The pollution of water or bottom sediments with municipal waste or domestic sewage is a negative impact, direct, temporary or short-term, reversible, of local range. The impact significance is negligible.

The collision of vessels resulting in the release of hazardous substances (especially oil derivative substances) into the environment is a factor that may cause increased mortality and diseases of marine organisms. The probability of such events can be considered low. In addition, the implementation of a proper procedure to be followed in the event of collisions and leakages aims at reducing the impact of such incidents on marine organisms.

The basic threat to Natura 2000 sites during the construction phase is the release of hazardous substances (especially oil derivative substances) into the environment as a result of the collision of vessels. The factor may cause increased mortality and diseases of marine organisms, including those under protection in those areas. The probability of such events can be considered low. The implementation of the procedure in the event of collisions and leakages in accordance with the applicable provisions of law for the duration of the project is aimed at minimizing the impact of such events on marine organisms. It can be assumed that this factor will not have a significant impact on protected areas.

2.5.4.2 Operation phase

Environmental hazards may also occur during the operation of the Baltic Power OWF, in particular the pollution of water and bottom sediments with:

- oil derivative substances,
- anti-fouling agents,
- accidentally released municipal waste or domestic sewage,
- accidentally released chemicals and waste from the OWF operation.

Waste and sewage may be generated by persons on the vessels and generated during operation, maintenance of towers and transmission infrastructure.

The collision of vessels resulting in the release of hazardous substances (especially oil derivative substances) into the environment is a factor that may cause increased mortality and diseases of marine organisms. The probability of such events can be considered low. The implementation of a proper procedure to be followed in the event of collisions and leakages aims at minimizing the impact of such incidents on marine organisms.

The impacts caused by the occurrence of an emergency situation during the operation phase are identical to the impacts that may occur during the Baltic Power OWF construction phase. Only the aspect relating to accidental release of chemicals and waste is slightly different. During the Baltic Power OWF operation, the maintenance of its facilities will be carried out. One cannot rule out a possibility that small quantities of waste or operating fluids may be accidentally released into the sea. It is estimated that the possible occurrence of the above-mentioned random events will not affect the structure and functioning of marine organisms in the project area and will not cause their mortality.

During the Baltic Power OWF operation, as a result of collisions and failures of vessels involved in the operation of the project, harmful chemical substances, mainly fuels, motor oils or hydraulic fluids, may leak into the environment. Their impact on marine organisms can be a significant pathogen and result in increased mortality. However, the probability of such events can be considered low. The implementation of a proper procedure to be followed in the event of collisions and leakages aims at minimizing the impact of such incidents. This hazard can be considered negligible.

The basic threat to Natura 2000 sites during the operation phase is the release of hazardous substances (especially oil derivative substances) into the environment as a result of the collision of vessels and helicopters. The factor may cause increased mortality and diseases of marine organisms, including the subjects of protection. The probability of such events can be considered low. The implementation of a proper procedure to be followed in the event of collisions and leakages aims at minimizing the impact of such incidents on marine organisms. It can be assumed that this factor will not have a significant impact on protected areas.

2.5.4.3 Decommissioning phase

During the decommissioning of the Baltic Power OWF, there may also occur impacts resulting from the occurrence of emergency situations and other environmental hazards, in particular pollution of water and bottom sediments with:

- accidentally released municipal waste or domestic sewage,
- oil derivative substances,
- anti-fouling agents.

There is a risk that the wastewater from the vessel enters the water at the time of collection of wastewater from the vessels by another entity and in case of failure. This may result in local increase in the concentration of biogens and deterioration of water quality. However, the contaminants should be quickly dispersed, and thus they will not contribute to a permanent deterioration of the environment in the project area.

The impacts related to the environmental hazards during the decommissioning phase are identical to the impacts described above for the Baltic Power OWF construction phase.

During the Baltic Power OWF decommissioning, as a result of collisions and failures of vessels involved in the operation of the project, harmful chemical substances, mainly fuels, motor oils or hydraulic fluids, may leak into the environment. Their impact on marine organisms can be a significant pathogen and result in increased mortality. However, the probability of such events can be considered low. The implementation of a proper procedure to be followed in the event of collisions and leakages aims at minimizing the impact of such incidents. This hazard can be considered negligible.

2.5.5 Prevention of failures

The prevention of failures is a set of activities related to the protection of human health and life, the environment and property, as well as reputation of all participants of the processes related to the construction, operation and decommissioning of the OWF. These activities shall include, but not be limited to:

- preparation of plans for safe construction, operation and decommissioning of the OWF in accordance with the applicable provisions of law for the period of project implementation;
- the development of rescue plans and trainings for crews and personnel, including rules for updating and verification through regular drills, in particular the determination of procedures for the use of own rescue units, external units, including helicopters.
- the preparation of the plan for the prevention of hazards and pollution generated during the construction, operation and decommissioning of the OWF;
- the selection of suppliers and certified components and components of the OWF;

- the designation of protection zones;
- the precise marking of the OWF area, its facilities and vessels moving within the OWF area;
- the planning of maritime operations;
- the application of the standards and guidelines of the International Maritime Organization (IMO), recognized classification societies, and recommendations of the maritime administration;
- the preparation of plans for the safe navigation within the OWF, and for traveling to ports;
- the provision of adequate navigation support in the form of navigation maps and warnings;
- the provision of direct or indirect navigation surveillance using a surveillance vessel or remote radar surveillance and Automatic Identification System (AIS);
- the continuous monitoring of vessel traffic within the OWF, direct or remote throughout the period of construction, operation and decommissioning of the OWF;
- the establishment of a coordination center supervising the construction, operation and decommissioning of the OWF;
- the maintenance of permanent communication lines between the OWF coordination center and the coordinator of offshore works and other coordination centers (Maritime Rescue Coordination Center in Gdynia, maritime administration).

2.5.6 Design, process and organizational protections planned to be used by the Applicant

Design, process and organizational protections mainly consist in carrying out navigation risk assessments and developing plans to prevent:

- hazards to human life – evacuation plans, rescue plans;
- fire hazards;
- hazards of pollution of the natural environment – plan for prevention of hazards and oil pollution. The principle of the obligation to have a plan in place shall apply not only to the facility, but also to all large and medium-sized vessels participating in the process of construction, operation and decommissioning of the OWF;
- risks of construction disasters – all structures are designed taking into account possible extreme conditions for at least double operation period.

2.5.7 Potential causes of the failure taking into account extreme situations and the risk of occurrence of natural and construction disasters

Due to their intended use, OWF structures are designed and constructed to withstand extremely heavy weather conditions. All components, although subjected to extremely heavy loads, are adapted to long-term operation. All equipment is continuously monitored and each signal of deviations from the situation classified as safe operation causes automatic activation of remote service interventions or change of operating parameters, including the shutdown of the equipment. The rotor is stopped automatically at wind speed exceeding safe operation of the wind turbine. The service plan shall ensure failure-free operation.

Potentially the greatest hazards occur in the construction phase; any risk of a disaster is minimal due to the fact that weather conditions and the possibility of their change are always taken into account when planning offshore operations. Each offshore operation has its limitations in terms of visibility, wind speed, sea state (wave height) or ambient temperature. The occurrence of negative effects of climate changes in the form of too strong wind or too high wave may only result in the extension of the construction cycle and increased energy demand – fuel consumption.

2.5.8 The risk of occurrence of major accidents or natural and construction disasters, taking into account the substances and technologies used, including the risk of climate change.

The risk of a serious failure resulting in the emission of hazardous substances is minimal [364]. The probability of events such as collisions of vessels is classified as very rare events (probability of occurrence of 1/100 y.) [365], and such as contact of the vessel with the OWF structure – as very rare events with probability of occurrence once every 200 years [365]. Taking into account the effects in the form of 200 m^3 of diesel oil, the level of risk is acceptable. The emission of 200 m^3 of diesel oil will cause insignificant damage to the environment as it will be dispersed within 12 hours [364].

2.6 Relations between the project parameters and impacts

The table (Table 2.11) presents a matrix of interconnections between the parameters of the planned project and the impacts.

Table 2.11. Matrix of interconnections between the parameters of the project and the impacts [Source: own study]

Parameter	**Type of emission or disturbance**																
	Topside structures	**Substructures**	**Heat**	**EMR**	**Above-water noise**	**Underwater noise**	**Waste**	**Light effects**	**Seabed disturbances**	**Suspended matter**	**Resuspension of pollutants**	**Resedimentation**	**Formation of artificial reef**	**Water pollution**	**Air pollution**	**Increased traffic and collision risk**	**Barrier effect \ displacement or habitat loss**
The number of wind turbines	X	X			X		X	X								X	X
Number of monopiles		X				X	X		X	X	X	X	X	X			X
Width of protection against scouring						X			X	X	X	X	X	X			X
Monopile diameter		X				X			X	X	X	X	X				X
Piling parameters						X											
Total height of wind turbines	X				X			X								X	X
Rotor diameter	X																X
Length and type of cables		X	X	X						X	X	X				X	X
Depth and method of cable laying/burying			X	X		X			X	X	X						
Number and size of substations	X	X		X	X			X									X
Process organization (number of vessels, time)					X	X	X	X						X	X	X	

3 Environmental conditions

3.1 Location, topography of the water region's bottom

The Baltic Power OWF Area is located to the east of the Słupsk Bank and approximately 23.5 km to the north of Łeba. The OWF Area (1 NM) covers a section of the seabed with the depth from 28.1 to 45.4 m, the area within permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended, covers a section of the seabed with the depth from 31.9 to 45.4 m, while the development area covers a section of the seabed with the depth from 33.9 to 45.4 m. The depth increases northwards (Figure 3.1).

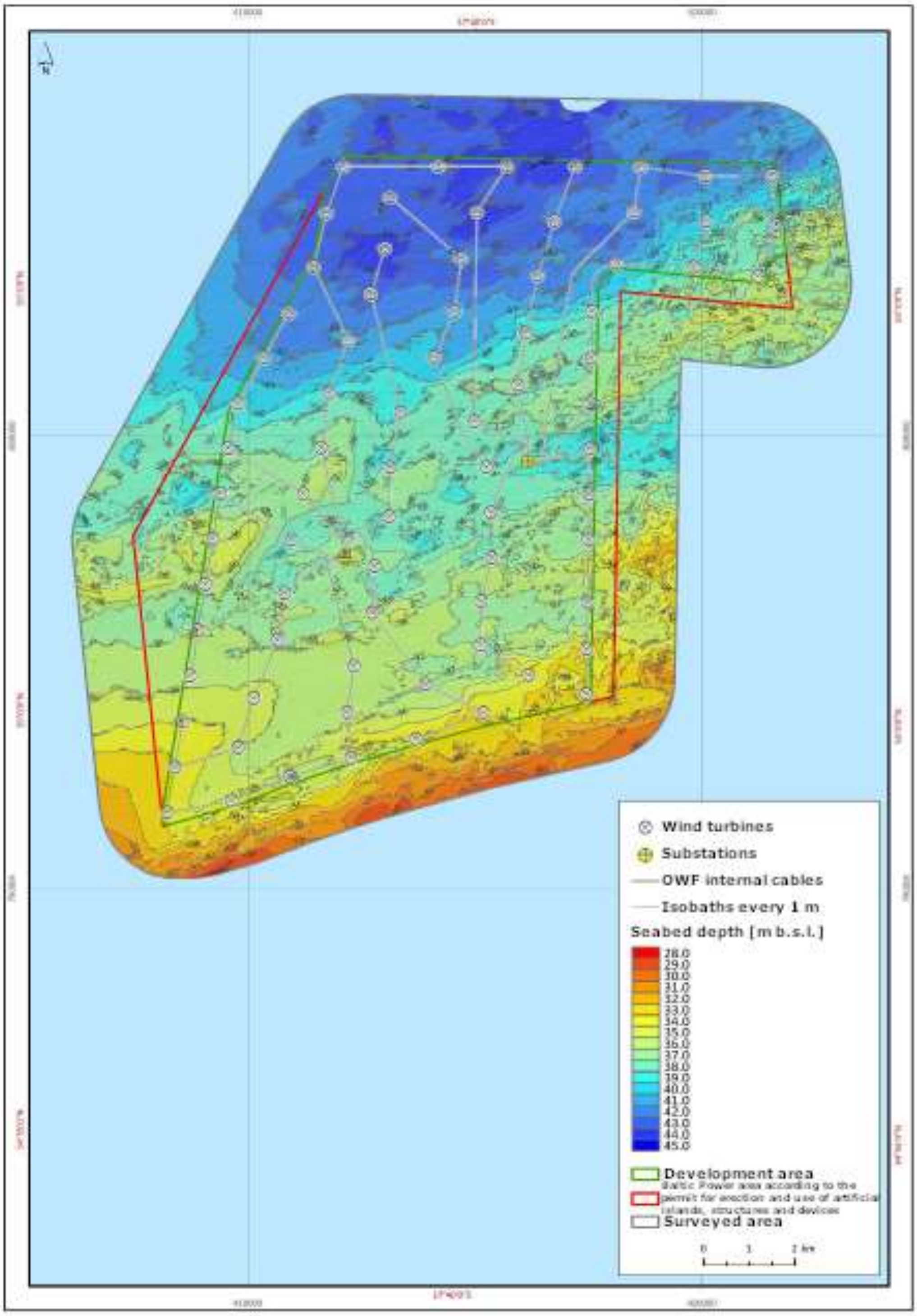


Figure 3.1. Bathymetric map of the Baltic Power OWF Area [Source: data of Baltic Power Sp. z o.o.]

Based on the analysis of bathymetric and sonar data, the topography and specificity of the seabed surface were fully recognized. On this basis, using the interpretation of seismic and seismo-acoustic data as well as data from analyses of surface samples and samples collected with a vibroprobe, and also taking into account the general knowledge about the area [91, 92, 172, 242, 243, 244, 245, 306, 343, 447, 450, 448, 449], a map of seabed surface types was prepared (Figure 3.2).

In the analyzed area, three types of seabed were distinguished, different in terms of their structure and specificity, including (Figure 3.2):

- abrasion-accumulation plain (P1);
- kame terraces (P2);
- accumulation plain (P3).

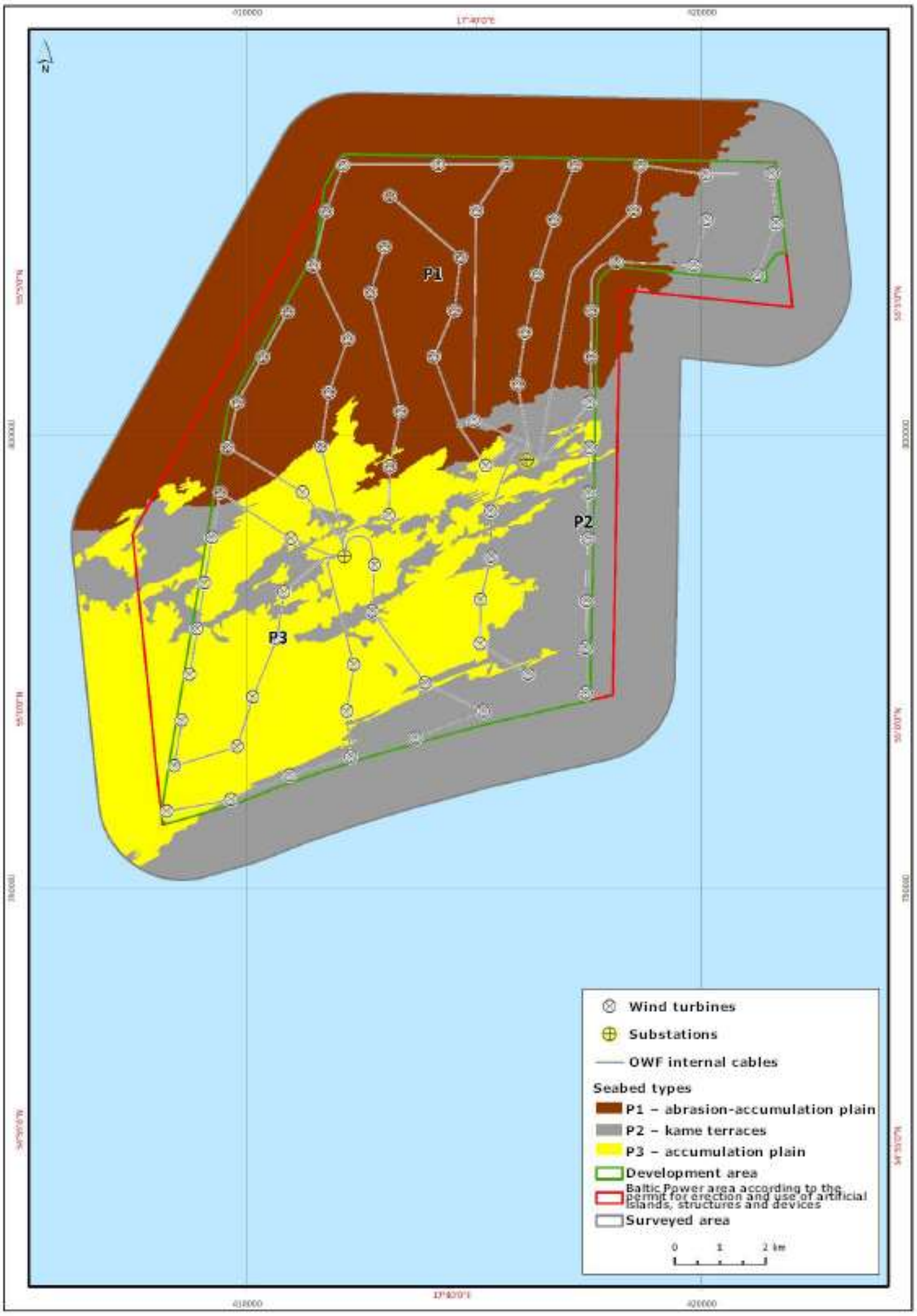


Figure 3.2. Map of seabed surface types in the OWF area; abrasion-accumulation plain – brown, kame terraces – gray, accumulation platform – yellow [Source: data of Baltic PowerSp. z o.o.]

Abrasion-accumulation plain (P1)

The northern and north-western part of the OWF area (1 NM) is an abrasion-accumulation plain (Figure 3.2). It covers the seabed with a depth ranging from approx. 37.0 to approx. 45.7 m. The seabed surface is leveled with small height differences (up to 0.5 m and max. up to 1 m) related to the presence of sand accumulations on the surface of cohesive sediments. The slopes of the seabed range from 2° to 3°.

Kame terraces (P2)

The seabed area with the most diversified topography and structure was recognized as the area of kame terraces (Figure 3.2). It covers the central, eastern and southern part of the OWF area (1 NM) with a depth ranging from approx. 28.1 to approx. 40.0 m. The seabed surface is diversified with numerous elevations with a height up to 2.0 m (maximum up to 3.0 m) above the surrounding seabed surface. The seabed slopes are up to 2–3°, locally over 20° – this applies only to slopes of moraine elevations, slotted formations and clay outcrops.

Accumulation platform (P3)

The central and south-western part of the OWF area (1 NM) is a platform-type accumulation area (Figure 3.2). It covers the seabed with a depth ranging from approx. 31.0 to approx. 37.0 m. The seabed surface is slightly undulated. There are small height differences due to the presence of sandy formations and outcrops of older sediments. The seabed slopes are up to 2–3 °, locally max. approx. 5°.

Detailed data on the shape of the seabed of the analyzed area, obtained on the basis of the conducted surveys, are included in Appendix No. 1 to the EIA Report.

3.2 Geological structure, bottom sediments, raw materials and deposits

3.2.1 Geological structure, geotechnical conditions

According to literature data [91, 172, 242, 243, 244, 245, 306, 343, 448, 449], Quaternary deposits accumulated on Paleogene and Neogene deposits were identified in the structure of the seabed of this area. Below the deposits from Paleogene and Neogene periods, Mesozoic deposits (Trias and Cretaceous period) were identified. They occur only in the southern part of the surveyed area. Under the Mesozoic deposits, in the northern part of the surveyed area, directly under the deposits from Paleogene and Neogene periods, there are deposits from the Silurian period.

3.2.1.1 Sub-Quaternary sediments

The oldest, recognized on the basis of the analysis of seismo-acoustic data, is the top of deposits classified as the top of the sub-Quaternary deposits. Most probably these are sandy and sandy-muddy deposits, locally silty deposits from Paleogene and Neogene periods. The top of these deposits is located at a depth from approx. 7–10 m under the seabed surface in the southern part and locally in the northern part to approx. 30–40 m under the seabed surface in the central part.

3.2.1.2 Quaternary cover

The Quaternary sedimentary deposits form a continuous layer composed mainly of clays with the thickness from approx. 20 m to 30 m [447]. Lacustrine sediments (loams, silts, fine sands) occur on the clay surface. The seabed surface is mainly composed of fine and medium sands, locally silty sands and sandy silts. Clays occur in the deep structure of the entire area. Locally, clays may form outcrops covered with a thin, discontinuous layer of sands and gravels.

The top surface of the clay is of different nature in the northern and southern part of the field. In the northern part, the top surface of the clays is leveled, sometimes with erosion chips on the surface. It is deposited shallow under the seabed surface, from 0.5 to 1.0 m, locally it forms outcrops on the seabed surface.

In the southern part of the analyzed area, the top surface of the clays is varied and uneven, with numerous height differences and depressions. The top surface of the southern series of clays is located at a depth of approx. 10–15 m, locally over 20 m under the seabed surface. Further to the south the depth of the clay top surface decreases and is approx. 5–10 m under the seabed surface.

Lacustrine deposits were identified in the southern part of the surveyed area. Their range overlaps with the range of the southern series of clays. Their top surface is leveled. The thickness of lacustrine deposits is from 10 to 15 m, and further to the south it decreases to approx. 5 to 10 m. The top surface of lacustrine deposits is located at a depth from approx. 0.5 to 1.0 m under the seabed surface in the southern and south-eastern part to approx. 4 m under the seabed surface in the western part.

The vast majority of the surface of the seabed in the analyzed area is covered by a discontinuous, thin layer of fine and medium sands, locally muddy sands and sandy silts. The thickness of sands is small, in most of the area it is approx. 0.5 to 1.0 m, in the central part from 1.0 to 2.0 m, locally, in depressions in the top surface of the substrate, up to 5.0–6.0 m. Locally, on the surface there is accumulation of coarse sands and gravels, as well as clusters of boulders.

Detailed data on the structure of the seabed of the analyzed area, obtained on the basis of the conducted surveys, are included in Appendix No. 1 to the EIA Report.

3.2.2 Bottom sediments and their quality

The seabed, nearly on the entire surface of the analyzed area is covered by a discontinuous layer of fine and medium-grained sands. Partly, on the surface there is accumulation of mixed-grained sediments, clusters of boulders and outcrops of fluvisol.

The seabed surface within the area of the **abrasion-accumulation plain** is made of a thin, discontinuous layer of sands with a thickness of up to approx. 0.5 m, deposited on a clayey substrate. Top surface of the clay is leveled with small height differences. The top surface of the clay is gently sloping to the north and north-west.

The bottom surface within the **kame terraces** is mainly composed of sands, locally sands and silts and clays in the form of outcrops and hills often with a stony cover of an erosion cobble character in the top surface of the clay. Below sandy and sandy-muddy deposits, the seabed is made of clays. The top of clays is uneven, with height differences up to several meters.

The seabed surface within the area of the **accumulation platform** is made of a layer of sands up to approx. 1–2 m thick (locally in the depressions in the subsoil top up to 5–6 m), deposited mainly on clayey-muddy substrate (locally muddy-sandy and clayey). The top of silty-muddy deposits is leveled, locally with height differences up to several meters.

The prepared surface sediment map for the Baltic Power OWF area (Figure 3.3) shows two types of sediments that build the bottom surface: fine- and medium-grained sand and clays with a stone and gravel abrasive boulder bed and sand cover.

Fine and medium-grained sands in the Baltic Power OWF area form mainly compact covers with a flat surface. The thickness of sands within them reaches several meters. Their range largely coincides with the range of the accumulation platform.

Clays with stony and gravel abrasive boulder and sandy cover form areas of various nature with ripple mark fields moved on the clayey surface and abrasive boulder. Locally, there is only the abrasive boulder bed on clay on the bottom surface.

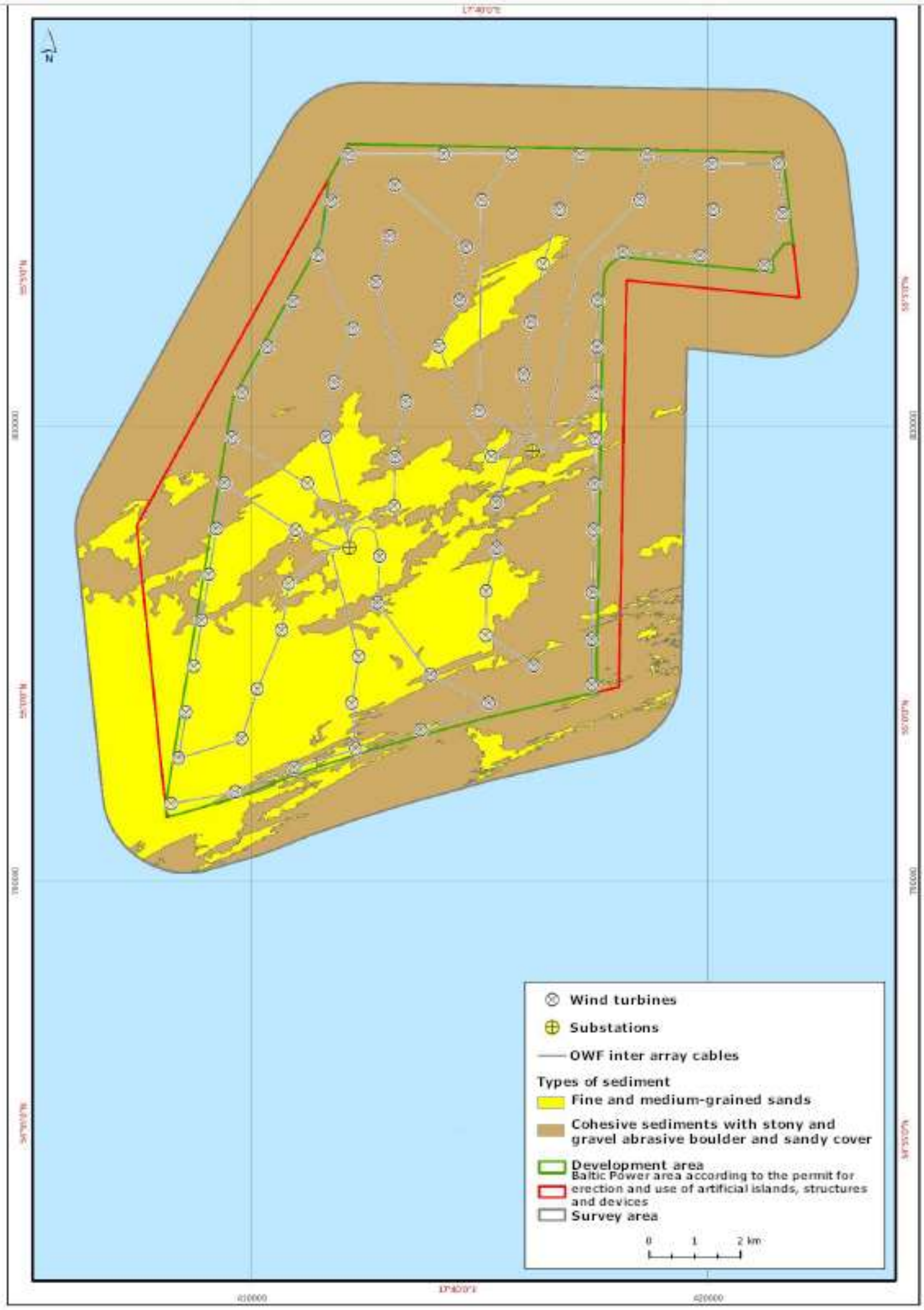


Figure 3.3. Map of surface sediments in the OWF area [Source: data of Baltic Power Sp. z o.o.]

Bottom sediments are a very important component of the aquatic ecosystem of the Baltic Sea, which is a shallow sea with limited water exchange and an area about four times smaller than its drainage basin. Such conditions mean that any interference with the marine environment, including bottom exploitation and development activities, affects the ecological balance of the sea.

The passage of pollutants from sediments into water (and thus a change in water quality) and the formation of long-lasting suspended matter depend on the type of sediment. The largest amount of pollutants and biogenic substances will be transferred to water from sediments with an increased organic matter content (e.g. muddy, silty sediments with a higher concentration of metals and persistent organic pollutants). These deposits will also contribute to the formation of more suspended matter, which will remain in the water for a long time. Intensive resuspension may cause the release of biogenic substances immobilized in the sediment and contribute to eutrophication. In case of sandy deposits with low organic matter content (e.g. coarse sandy sediments), the described processes will be less intensive. These sediments are generally characterized by a small amount of fine-grained fractions and a low concentration of metals and persistent organic pollutants.

The analyzed surface bottom sediments from the Baltic Power OWF Area belong to inorganic sediments with an organic matter content expressed by the loss on ignition (LOI) below 10%. The bottom sediments collected during the environmental surveys were analyzed, among others, for the content of biogens, persistent organic pollutants (POP) (i.e. PAH, PCB, TBT, mineral oils) and metals.

None of the tested sediment samples showed exceeded the permissible concentration values of metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) specified in the Regulation of the Minister of the Environment of May 11, 2015 *on recovery of waste outside plants and equipment* (Journal of Laws, item 796), which allows the sediment to be classified as pure in the context of practical applications and, although they do not refer to sediments moved within waters, may constitute the basis for assessment of pollution of bottom sediments with chemical compounds.

Biogenic substances

Primary processes influencing the content of biogenic substances in the sea are geophysical and geochemical processes that control not only the inflow of these elements to seawater, but are also accountable for dispersion and removal of these compounds.

Nitrogen compounds present in bottom sediments are cyclically transformed as a result of biogeochemical processes. Oxidation of ammonia and its compounds by nitrifying bacteria leads to the formation of nitrogen oxides and then nitrates. However, excessive nitrification is not desirable as nitrates are much easier to leach from the sediment than ammonium ions. Processes related to the construction (placement) of the support structure, anchoring of vessels and cable burial may result in better oxygenation of sediments and, consequently, increased intensity of nitrification processes and repeated release of nitrates to waters. This may also affect the general pattern of nitrogen circulation by reducing the intensity of anaerobic denitrification processes consisting in the conversion of nitrates into molecular nitrogen [320, 443].

In the sediments of the Baltic Sea, nitrogen occurs mainly in organic form and its regional variability is analogous to the variability of carbon [70]. Inorganic forms of nitrogen normally account for no more than 10% of total nitrogen in sediments [71]. An increase in the share of inorganic nitrogen forms is possible in the zone of erosion and transport of fine-dispersive sediments [450].

Due to the fact that the nitrogen circulation in the environment is a very complex process and its intensity depends on many factors (e.g. oxidation, temperature, season, primary production, etc.), as well as on the amount of inflow of biogenic substances from point sources, dispersed sources and deposition from the atmosphere [58, 140], it is impossible to calculate precisely the nitrogen load which will penetrate from the sediments into the water column during the construction works. During the conducted survey cycle, no analyses of total nitrogen content in the bottom sediments of the area in question were performed, thus literature data and own surveys of its content in the sediments of the central coast (own surveys) were used in a very general estimation of the load of this element that may enter the water column during the performed works. According to literature data, the nitrogen content in the sediments of the southern Baltic Sea ranges from 98 to 2604 mg N kg^{-1} of dry mass in sandy sediments, 1106 to 3094 mg N kg^{-1} of dry mass in sandy and silty sediments, 1904–9506 mg N kg^{-1} of dry mass in loams and 1694–4606 mg N kg^{-1} of dry mass in clays [341]; total nitrogen content in own surveys both in summer, as well as in winter, it was below the limit of determination capability of the applied method, i.e. 200 mg kg^{-1} of dry mass in sandy bottom sediments of the central coast. Taking into account the above data, it was demonstrated that the amount of nitrogen that could migrate from sediment to the water column during construction works would be negligible compared to approximately 190,000 tons of total nitrogen introduced annually into the Baltic Sea with river waters [450].

Phosphorus (P) in bottom sediments is conventionally divided into labile (mobile, reactive) and refractive phosphorus. Refractive forms are combinations of phosphorus with calcium, clay, loamy minerals and are resistant to organic degradation of this element. Refractive phosphorus is deposited in sediments and is removed from the circulation in the water column. Labile phosphorus is phosphorus contained in fresh organic matter, phosphates in interstitial waters, phosphorus-Fe^{3+} combinations and phosphates loosely bound to various sediment components by adsorption. These forms are easily returned to circulation in the water column, mainly as a result of mineralization of organic matter and dissolution of phosphorus combinations with Fe^{3+} as a result of a decrease in the redox potential value [8, 450]. Phosphorus may be a factor limiting the productivity of marine ecosystems [468]. In the aquatic environment, when primary production limits the amount of phosphorus, the intake of 1 mg of phosphorus results in an increase of 100 mg of dry algal matter per biological cycle [112].

The content of biogenic substances (here total phosphorus content) in the surveyed area did not exceed the values typical for sediments of the southern Baltic Sea. The amount of phosphorus that can pass into water (so-called digestible phosphorus) is estimated at 10-20% of the total phosphorus pool contained in sediments [488]. The average concentration of phosphorus in the surveyed sediments was 331 mg kg^{-1} of dry mass in winter and 336 mg kg^{-1} of dry mass in summer.

Concentrations of persistent organic pollutants (**PAHs, PCBs**) and harmful substances, such as metals or mineral oils, in the surveyed area were low and did not exceed the values typical for sandy sediments of the southern Baltic Sea.

PAHs and PCBs present in sediments can undergo many transformations and have a significant impact on the environment. The extent of the impact depends on transformations of these compounds. These can be abiotic processes such as sorption, leaching, oxidation, photodegradation and reactions with other compounds, and biological processes such as microbial transformation. They may inhibit or stimulate the development of micro-organisms, have a phytotoxic effect on or stimulate plant growth and be toxic to fauna [148]. The accumulation of PAHs and PCBs in sediments is promoted, among others, by a high share of silty and loamy fractions with a sediment particle size of < 0.063 mm, characterized by a high specific surface area and high ability to adsorb hydrophobic pollutants and organic compounds of phosphorus, sulfur and nitrogen.

Pyrogenic PAHs as well as PCBs show exceptionally high durability in bottom sediments, which is caused by occlusion of these chemicals in very fine sediment particles [51]. Therefore, desorption of the substances in question from sediments to water occurs to a limited extent. This is generally a maximum of 0.5% for PCB congeners up to 5% for PAH analytes [158, 157]. Assuming that such amounts will be transferred to water from sediments, it can be concluded that the risk of repeated pollution of water related to remobilization of PAHs and PCBs in the surveyed area is low.

PAH and PCB concentrations in the surveyed sediments (dry matter) and their availability are presented in the table (Table 3.1).

Table 3.1. PAH and PCB concentrations in the surveyed bottom sediments [Source: data of Baltic Power Sp. z o.o.]

Indicator	**Concentration in the surveyed sediments (on dry mass basis) [mg kg^{-1} of dry mass]**	**Available form [%]**
Congeners representing PCBs	<0.0001	0.5
Analytes representing PAHs	< 0.001 to 0.276	5

The concentrations of metals in the surveyed sediments from the Baltic Power OWF area were low. Additionally, their availability (i.e. the ability to pass to water) should be taken into account, which depends on the physical and chemical form in which they occur [394]. Metals permanently embedded in the crystalline network of minerals are immobilized and will not pass to water under natural conditions. On the other hand, the mobile (labile) part of metals [394, 106, 171] is susceptible to passing from sediment to water.

The labile form of metals may constitute (depending on the type of sediment for individual metals) from 30 to 80% [388, 330, 394, 445, 106, 98]. The results of the labile metal form analysis in the surveyed sediments showed that approx. 70% lead, approx. 65% copper and approx. 60% zinc may pass to water in unfavorable conditions.

In the case of nickel and chromium, which are more permanently bound to sediment, this may occur in approximately 43% and approximately 22%, respectively.

Average metal concentrations in the sediments (dry mass) and labile form concentrations are presented in the table (Table 3.2).

Table 3.2. Average metal concentrations in the surveyed bottom sediments [Source: data of Baltic Power Sp. z o.o.]

Metal	Average concentration of total content in the surveyed sediments (on dry matter basis) [mg·kg^{-1} of dry mass]	Average concentration of the available (labile) form [mg·kg^{-1} of dry mass]
Lead (Pb)	3.62	2.47
Copper (Cu)	1.19	0.78
Zinc (Zn)	9.28	5.52
Nickel (Ni)	1.73	0.75
Chromium (Cr)	4.34	0.97

Concentrations of arsenic (LOQ < 0.25 mg kg^{-1} of dry mass), cadmium (LOQ < 0.05 mg kg^{-1} of dry mass), mercury (LOQ < 0.01 mg kg^{-1} of dry mass) and TBT in the surveyed sediment were of trace value, generally below the lower limit of determination capability. For this reason, the risk of water pollution related to remobilization of these chemical compounds from the bottom sediment during the construction of the OWF was considered negligible and was not subject to further analyses.

The surveyed sediments were also characterized by low activity of radioactive ^{137}Cs isotope, typical of sandy sediments.

3.2.3 Raw materials and deposits

In order to identify potential areas of occurrence of raw materials useful for operation in the Baltic Power OWF area, seismoacoustic data, bathymetric data and data from analyses of sediment samples collected with a vibroprobe were analyzed. In the structure of the seabed of the analyzed area, no appropriate parameters of accumulation of fine and medium sands, which may constitute a mineral deposit, were identified [pursuant to the *Geological and Mining Law* of June 9, 2011 (consolidated text, Journal of Laws of 2022, item 1072, as amended) and the Regulation of the Minister of the Environment of July 1, 2015 *on the geological documentation of the mineral deposit, excluding the hydrocarbon deposit* (Journal of Laws, item 987)]. The identified sands form a layer with a thickness ranging from 0.5 to 2 m, only locally up to several meters. Sands are deposited on silty and loamy substrate, locally on clayey substrate.

In accordance with the Regulation of the Minister of Environment of July 1, 2015 *on the geological documentation of the mineral deposit, excluding the hydrocarbon deposit,* the deposit should be at least 2 m thick (limit values of parameters defining the deposit and its boundaries for individual minerals – gravel, gravel and sand and gravel deposits with a sand point below 75%). The areas, within which the sandy cover is more than 2 m thick, occupy small areas scattered unevenly along the southern part of the area (mainly in its western and south-western part), and the thickness of sands in that areas often does not exceed 2.5 m, but locally, even in spots reaching 5–6 m. Detailed results of the conducted surveys concerning potential natural aggregate deposits are included in Appendix No. 1 to the EIA Report.

It is difficult to carry out analyses aimed at identifying potential areas of occurrence of raw materials due to the fact that the applicable law does not specify the balance criteria for aggregate deposits in maritime areas.

Detailed data on the results of sediment surveys for the presence of potential mineral aggregate deposits are included in Appendix No. 1 to the EIA Report.

3.3 Quality of sea waters

The results of tests of individual chemical parameters of water in the Baltic Power OWF area, such as reaction, oxygenation, five-day biochemical oxygen demand (BOD_5), total organic carbon (TOC), biogens, PCBs, PAHs, mineral oil, cyanides, metals, phenols, cesium, strontium, did not differ significantly from the content typical for waters of the southern Baltic Sea.

These waters were characterized by alkaline reaction (pH from 7.8 to 8.4), alkalinity of approx. 1.72 mval dm^{-3} and relatively good oxygenation, with seasonal variability characteristic of the waters of the southern Baltic Sea. The assessment of the water quality index in the Baltic Power OWF area on the basis of oxygen content in the bottom layer in the summer period (June to July) indicates a good condition (no oxygen deficit). Average dissolved oxygen content in this period was above the threshold of 6.0 mg dm^{-3} [251].

In the entire measurement period (January 2019 to December 2019), the average biochemical oxygen demand (BOD **5**) in water samples collected from the Baltic Power OWF area in individual measurement periods was below 2.0 mg dm^{-3}. The suspended matter content in the individual measurement periods also occurred at the level typical of the southern Baltic Sea waters. The lowest average concentrations of suspended matter in the surveyed area occurred in the autumn and winter period, and the highest in May, which may have been caused by increased primary production, and in December due to the disturbance and mixing of waters in the storm period.

The content of biogenic substances – total nitrogen, mineral nitrogen (nitrates, nitrites and ammonia) phosphates and total phosphorus – in the analyzed waters showed seasonal variability typical of the southern Baltic Sea waters. The lowest concentrations of the surveyed substances occurred in the period from May to July, whereas in winter months (December to January) their significant increase was recorded in accordance with the seasonal trend of restoration of biogenic substances.

The waters of the analyzed region were characterized by a low content of particularly harmful substances. Concentrations of: polychlorinated biphenyls (PCB), mineral oils (mineral oil index), free and bound cyanides, metals [Pb, Cd, Cr, Cr(VI), As, Ni, Hg] and phenols were present at trace levels.

The surveyed waters were also characterized by low activity values of ^{137}Cs and ^{90}Sr typical for the waters of the southern Baltic Sea, which confirms a slow downward trend of concentrations of ^{90}Sr and ^{137}Cs in the Baltic Sea area [496].

In the Baltic Power OWF area, concentrations of PAHs were recorded slightly higher than in the literature [182, 489], which may result from differences at the stage of preparation of samples for analysis (PAHs were determined in waters without separation of suspended matter).

When comparing the obtained results of the surveyed water indicators with the limit values specified in the Regulation of the Minister of Infrastructure of June 25, 2021 *on the classification of ecological status, ecological potential and chemical status and the method of classification of the status of surface water bodies, as well as environmental quality standards for priority substances* (Journal of Laws, item 1475), it is possible to assign the status corresponding to surface water quality class I (very good condition) to physical and chemical elements analyzed in the surveyed Baltic Power OWF area, based on the value of the indicators: dissolved oxygen, inorganic nitrogen compounds (in winter), nitrite nitrogen, total phosphorus and TOC (in summer), free and bound cyanides, mineral oil index, phenols and metals [As, Cr(VI), Cu]. Due to the value of the total nitrogen indicator, which was assigned to water quality class II, and due to the value of the phosphate phosphorus indicator, which does not meet the requirements of water quality class II, the surveyed area did not attain a good condition.

Also, the limit values of water quality indicators indicated by the above-mentioned Regulation were not exceeded for PAH [anthracene, fluoranthene, naphthalene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene] and the limit values of the indicators for cadmium, lead, mercury and nickel were not exceeded.

Considering the distance of the Baltic Power OWF development area from the nearest homogeneous surface water body, i.e. Jastrzębia Góra – Rowy CWIIIWB5, which is more than 21 km, and the range of impacts of the project, it should be assumed that the implementation of the Baltic Power OWF will not affect the achievement of environmental objectives for this surface water body.

3.4 Climate conditions and air purity conditions

3.4.1 Climate and risk of climate change

The water region of the southern Baltic Sea is located in a zone of humid and moderate climate with the impact of the Atlantic climate caused by prevailing ocean winds. The vicinity of the Atlantic Ocean, due to the influx of large air masses, significantly determines the climate of the Baltic Sea region. As a result of these conditions, the winters are mild and warmer compared to the northern part of Europe, while the summers are cooler compared to the southern part of Europe. Moreover, the area of the southern Baltic Sea is characterized by regular occurrence of strong winds from the west and south-west direction and high air humidity.

The following parameters have been recorded for many years in the Polish maritime areas, including in the coastal zone: air (pressure, temperature and humidity), wind conditions (direction and force), sunshine duration, precipitation volume and types, water (temperature and salinity) and hydrodynamic conditions (sea level, flows and waves). They are recorded both at coastal stations and on the high seas. In particular, comprehensive measurements that have been carried out for operational purposes for several decades by IMGW-PIB at measurement stations and posts, and for several years also on buoys anchored in the sea, can be mentioned. Moreover, IMGW-PIB performs monitoring measurements in the southern Baltic Sea area several times a year, recording hydrophysical and physical and chemical parameters of the sea in a designated network of points. Hydrological and meteorological measurements are also performed by other research and development units. At the Coastal Research Station in Lubiatowo, owned by the Institute of Hydro-Engineering of Polish Academy of Sciences (IBW PAN) wind, air temperature and humidity are measured, as well as mean sea level, whereas the Institute of Oceanology of the Polish Academy of Sciences (IO PAN), at the monitoring station located at the jetty in Sopot, records the following: air temperature, pressure and humidity and sunshine duration, as well as sea water temperature and salinity. As part of the SatBałtyk project, implemented in 2010–2015, satellite measurements were performed that allowed to determine sea and atmosphere characteristics in the form of maps presenting, among others, temperature distributions, ice caps, instantaneous water flow velocity, water mixing and turbidity of water. At the Institute of Meteorology of the Gdynia Maritime University (IM UMG), over the recent dozen years, as part of various research projects and at the instructions of investors, parameters of the near-water layer of the atmosphere as well as hydrophysical and dynamic values in the entire cross-section of the water column were recorded in different places of the Polish Economic Zone of the Baltic Sea.

The presented surveys related to similar registrations performed by neighboring Baltic States allow to determine existing trends and expected directions of changes in the basic climate parameters of the southern Baltic Sea. Moreover, information from climate simulation calculations of numerical models of the global atmospheric circulation model available, among others, from surveys carried out as part of BALTEX assessment of Climate Change for the Baltic Sea Basin is used for this purpose.

The climate specific to the coast and adjacent areas of the sea can be classified as a coastal strip climate type, with small amplitudes of air temperature, high humidity, mild winters, cooler summers and strong winds. The prevailing winds here are from the west and southwest. In areas of the open sea, including the Baltic Power OWF, climatic conditions are characterized by the fact that air temperature amplitudes are smaller and average wind speeds are higher compared to adjacent land areas.

Based on the available data and analysis, it is possible to present the most important forecasts of changes in particular elements of the atmosphere and water in the Baltic Sea region:

- the air temperature rise is faster than the average global rise, and this trend will continue;
- the water surface temperature rise is greater than its deeper layers, which may result in greater thermal stratification and stabilization of the thermocline during the year;
- forecast changes in salinity are not clearly defined and depend, on one hand, on changes in air circulation conditions and the volume of water exchange with the North Sea, and, on the other hand, on the volume of fluvial water inflow; a decrease in salinity is forecast;
- precipitation is forecast to increase throughout the Baltic Sea basin during the winter season, while only

in the northern part during the summer; the frequency of extreme precipitation will increase;

- in terms of forecast of sea level changes, the effects of its global growth will not be significantly felt. This is due to the fact that the Baltic Sea, being a relatively small and shallow shelf sea, is connected through relatively narrow Danish Straits with the North Sea, through which ocean waters are only incidentally exchanged (these are so-called inflows). Moreover, most of its area (in the northern part) is located within the Scandinavian plate, which is characterized by visible lifting processes (so-called isostatic processes), which results in a decrease in the height of the mean sea level. However, in the southern part, the impact of these processes is practically negligible, and the height of the water level is mainly shaped by the atmospheric circulation conditions;
- forecasts of wind climate change are subject to considerable uncertainty, it is assumed that with an increase in average surface water temperature there will be an increase in average wind speed over sea areas;
- changes in the wave climate are mainly related to an increase in the frequency and intensity of storms – an increase in the number of extreme phenomena is forecast;
- model calculations indicate that there will be an increase in the surface area of areas with low oxygen content in water and anaerobic areas at the seabed.

Climate change forecasts for the territory of Poland, including also the coastal zone and maritime areas under the jurisdiction of the Polish state, as well as scenarios of adaptation actions aimed at mitigating and counteracting the effects of changes, are the subject of intensive works carried out by the Ministry of Environment (currently the Ministry of Climate and Environment) and the Institute for Environmental Protection, among others, as part of the “Strategic adaptation plan for sectors and areas sensitive to climate change until 2020, with a perspective until 2030” [304] and the KLIMADA project.

Taking into account the conclusions and recommendations relating to the coast and adjacent areas of the Baltic Sea, it was concluded that the observed and expected climate changes will have a negative impact on the functioning of coastal zones. A negative impact of periodic sea level increases is expected, mainly resulting from an increase in the frequency of occurrence and intensity of strong storms. In the case of the Baltic Sea, this refers to a possible increase in the number, intensity and duration of these events, with an increase in the irregularity of occurrence of these events, i.e. after long periods of relative calm, there may be a series of fast consecutive storms with a significant force.

An additional factor accelerating the shore erosion processes is a warming of the winters, which is expected to reduce the ice cap that constitutes a protection of beaches against the storm surge and, at the same time, coastal erosion. The scenarios of sea level changes show that in the period 2011–2030 the average yearly sea level along the whole shoreline will be higher by 5 cm in comparison to the reference period level, i.e. 1971–1990. Very significant consequences of climate changes will be higher frequency of storm flooding and more frequent inundation of lowlands, as well as degradation of cliffs and sea shore, which will create a strong pressure on the infrastructure existing on these areas.

Due to the increase in the average water temperature and the increased inflow of biogenic pollutants (nitrogen compounds and phosphorus) to the sea, the negative phenomenon will be the progressive eutrophication, especially on the water surface (algal blooms).

The measures taken to adapt the coastal zone to climate change concern areas along the coastline of the Baltic Sea. However, so far no detailed instructions and recommendations have been provided with regard to the open sea areas, including systems and structures founded there, presenting the scope of actions aimed at counteracting the effects of the forecast changes in climate conditions.

3.4.2 Meteorological conditions

Meteorological conditions of water regions covering the Baltic Power OWF area were determined on the basis of measurements of the parameters of the near-water layer carried out in the period from January 2019 to February 2020. They are characterized by wind speed and direction, temperature, pressure and air humidity recorded by the automatic air measurement station (at the height of approx. 4 m a.s.l.). The basic statistical parameters obtained for the said period are included in the table (Table 3.3).

Table No. 3.3. Statistical analysis of meteorological parameters measured at the measuring station HM_01 from January 25, 2019 (at 00:00) to February 22, 2020 (at 00:00) [Source: data of Baltic Power Sp. z o.o.]

Parameter	**Unit**	**Value**			
		Average	**Minimum**	**Maximum**	**Median**
Relative humidity	[%]	83.24	44.15	99.37	84.76
Atmospheric pressure	[hPa]	1012.98	975.68	1046.39	1013.48
Air temperature	[°C]	9.49	-3.06	28.34	7.50
Wind speed	[$m \cdot s^{-1}$]	7.29	0.07	17.94	7.22
Prevailing wind direction	-	SWW, SW, W			

3.4.3 Air quality

Due to the lack of detailed information on the existing parameters of air purity over the area intended for the construction of the Baltic Power OWF, the assessment of the air quality of the near-water layer of the atmosphere was referred to the information obtained as part of the measurements carried out by the Inspectorate of Environmental Protection as part of the State Environmental Monitoring for the nearest onshore station (Łeba). It should be borne in mind that due to the lack of significant sources of pollution emission above the sea area, the air purity parameters should not be worse than those measured on the shore.

The assessment of air quality in Poland, including at coastal stations, was carried out on the basis of Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 *on ambient air quality and cleaner air for Europe* (OJ L of 2008, No. 152, page 1, as amended). In Poland, the tasks related to the performance of environmental status tests and assessments, including air quality monitoring, are performed by the Inspectorate of Environmental Protection as part of the State Environmental Monitoring, the program of which is prepared by the Chief Inspector of Environmental Protection (GIOŚ) and approved by the Minister competent for the environment. As part of this program, tasks related to meeting the requirements included in EU regulations and Polish law, as well as international conventions signed and ratified by Poland are performed. Currently, the strategic program of national environmental monitoring for 2020–2025 is being implemented.

Due to the fact that air quality monitoring is carried out only in onshore areas, the results obtained from measurements for the Pomorskie Voivodship, and in particular for the coastal zone were assumed as the reference level for the sea water regions. In 2021, concentration criteria corresponding to purity class A were obtained for most of the substances measured by the Inspectorate of Environmental Protection, except for the levels of suspended particulate matter PM10 and benzo(a)pyrene contained in PM10.

In the sea areas, which include the areas of the planned Baltic Power OWF, no measurements were carried out to assess the air quality in terms of greenhouse gas content, dust concentration and other harmful volatile substances. The nearest place where the monitoring of the said air pollutants was carried out was the onshore station in Łeba. Based on the measurement data made available by the Chief Inspectorate of Environmental Protection (GIOŚ) in 2021 for the metering station in Łeba, the following concentration levels of substances were declared:

- sulfur dioxide (SO_2) – maximum 24-hour concentration in 2021 was 5.8 mg m^{-3} with the admissible value of 125 mg m^{-3};
- nitrogen dioxide (NO_2) – 24-hour average concentration in 2021 was 24 mg m^{-3} with the permissible value of 40 mg m^{-3};
- ozone (O_3) – the number of days with exceeded 8-hour average was 13, with the assumed number of no more than 25 days with concentration of 120 mg m^{-3}.

According to the assessment included in the report of the Regional Department of Environmental Monitoring in Gdańsk [370], the applicable criteria concerning the target level for the protection of human health and plant protection are met in the Pomorskie Voivodship.

Such a level of recorded values causes that the coastal zone area in the Łeba area has the air purity class A. However, the open sea areas planned for the construction of the Baltic Power OWF are located at a significant distance from onshore sources of emission of SO_2 and NO_2. These substances are only emitted by vessels, and this emission depends on the traffic intensity and the type of vessels. The Baltic Power OWF area is free of any physical obstacles hindering the spread of these substances. Therefore, the average concentrations of these compounds in the air should be significantly lower. Based on data on vessel traffic in 2018–2019, using the IWRAP [IALA Waterway Risk Assessment Programme, the official model of the International Association of Lighthouse Authorities (IALA) – the international organization responsible for navigational safety], it was calculated that in the area bounded by coordinates: 55°30' N; 16°00' E and 54° 00' N; 19°00' E (Figure 3.4) vessels consume over 100,000 mg of fuel per year, emitting over 300,000 mg of CO_2, over 5,000 mg of SO_2, over 9,500 mg of NO_x and over 700 mg of dust.

Taking into account the parameters of the currently used marine fuels resulting from the applicable regulations, the actual emissions from fuel combustion may be significantly lower than those calculated using the IWRAP.

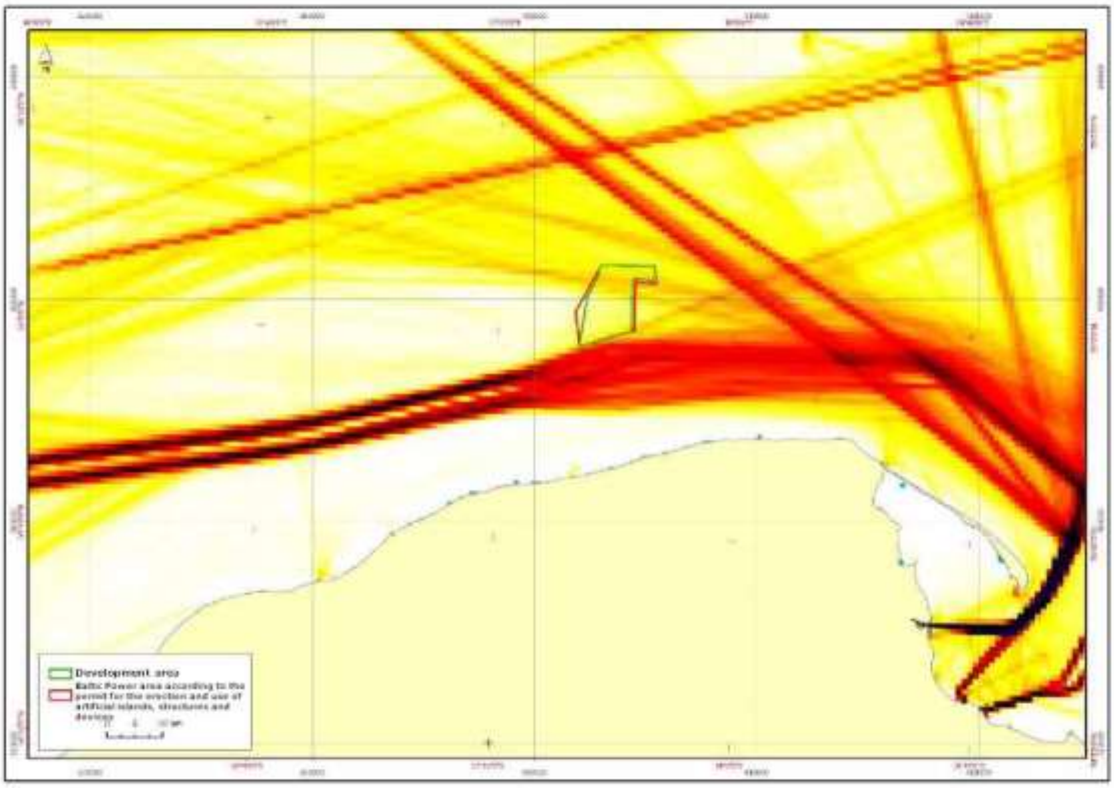


Figure 3.4. Distribution of pollutant emissions by vessels near the Baltic Power OWF in 2018–2019; darker color means higher relative value of emissions from combustion of fuels of vessels [Source: own study based on AIS data]

In the case of ozone concentrations, which are higher in the coastal area than in inland areas, it can be assumed that its concentrations in the open sea will not differ significantly from those recorded in the coastal zone, although it can be assumed that due to lower emissions from transport than on land (the ozone precursor includes nitrogen oxides from transport), these concentrations will also be irrelevant. The persistence of such ozone concentrations is largely due to natural reasons.

3.5 Underwater background noise

To determine the underwater background noise output level, noise monitoring was performed using the autonomous SM2M Wildlife Acoustics sound recorder.

The results of the background noise monitoring carried out in the period from January 2019 to January 2020 in the Baltic Power OWF area indicate that underwater noise levels (and their variability ranges) show values characteristic for the southern Baltic Sea area [233, 309]. Comparison of the results obtained with model data obtained using the BIAS Soundscape Planning Tool platform [147, 457] for the Baltic Power OWF Area showed that the results of the acoustic background monitoring presented in this report are in some compliance with the results of the BIAS project, which also confirm the seasonal variability of the noise level, as well as the occurrence of higher values of the sound pressure level (SPL) in the winter season.

Detailed information is included in Appendix No. 1 to the EIA Report.

3.6 Electromagnetic field

Electromagnetic fields occurring in the environment can be divided into natural fields and fields of anthropogenic origin (referred to as artificial fields). The geomagnetic field of the Earth, whose intensity ranges from 16 to 56 A m^{-1}, is best recognizable from natural fields. An electric charge accumulates on the Earth's surface, which is a source of natural electric field. The intensity of the natural electric field of the Earth is approx. 120 V m^{-1} under moderate weather conditions.

In the marine environment, the values of the electric field and geomagnetic field are similar. There are no artificial sources of electromagnetic field in the Baltic Power OWF area. The existing DC transmission system between Poland and Sweden (SwePol Link) is located at a distance of several dozen kilometers from the planned location of the Baltic Power OWF.

Changes in natural electric fields have no direct impact on living organisms. Natural magnetic fields vary according to geographical location. They have a significant impact on some living organisms.

Electromagnetic fields generated as a result of electric current flow may change natural migratory behavior of sea mammals and fishes, and may also be a source of thermal energy introduced into the marine environment. So far, no indicators have been developed that could be used to assess the condition of the marine environment for descriptive indicator W11, including indicator 11.4.1 entitled “Intensity and spatial range of electromagnetic and electric fields”. These factors are currently not monitored in the Polish maritime areas[161].

3.7 Description of natural components and protected areas

3.7.1 Biotic components in offshore area

3.7.1.1 Phytobenthos

Surveys performed in the zone approved for installation and in the area of 1 NM from the boundary of this zone showed lack of underwater vegetation, both established in the seabed sediments and attached to boulders and stones deposited on the seabed. Previous surveys in the Polish maritime areas showed that phytobenthos occurs up to the depth of approx. 22 m, i.e. up to the range of the euphotic zone [170, 171, 137, 250, 344]. The minimum depth of the seabed in the surveyed area is 28 m, i.e. below the range limit of phytobenthos, therefore it should be assumed that phytobenthos does not occur in the entire Baltic Power DA.

3.7.1.2 Macrozoobenthos

Macrozoobenthos (benthic macrofauna) is a group of invertebrate organisms inhabiting the surface layer of bottom sediments (epifauna), as well as a hard substrate (boulders, stones) or living inside the sediment (infauna), which remains on a screen with a mesh size of 1 mm during the sediment flushing. Macrozoobenthos consists mainly of bivalve molluscs (Bivalvia), crustaceans (Crustacea), polychaetes (Polychaeta), oligochaetes (Oligochaeta) and gastropods (Gastropoda). Most of these are sedentary organisms with a life cycle of at least one year. Macrozoobenthos plays an important role in the trophic network of marine ecosystems. Benthic invertebrates are food for many fish and seabird species. Moreover, they shape living conditions of other organisms (habitat-forming role) and affect the state of the environment (e.g. sediment oxygenation, biofiltration of suspended matter from water). Taxonomic diversity, abundance and sensitivity of individual taxons forming a complex of benthic organisms indicate the ecological quality of the seabed.

For the purpose of this report, separate macrozoobenthos surveys were performed on the soft seabed (sandy deposits) and on the hard seabed (boulders, stones). In the OWF area (1 NM), 25 taxons belonging to one type, 6 classes and one subclass were found on the soft seabed, among which the *Marenzelleria sp*. and *Pygospio elegans* polychaetes were found in the group of absolutely constant species. On the hard seabed, 16 taxons classified to 6 classes and one subclass were recorded. The *Mytilus sp.* mussel dominated in the structure of numbers and biomass.

The Baltic Power OWF Area is located in the eastern Gotland Basin. The nearest stations where macrozoobenthos surveys are performed as part of the State Environmental Monitoring are located at a distance of 15–30 km from the boundaries of the OWF Area, in a different depth range, therefore there is no historical knowledge about macrozoobenthos in the area of the planned OWF. However, the results included in the reports on macrozoobenthos surveys in the areas of the Bałtyk III OWF [171], Bałtyk II OWF [170] and Baltica OWF [27] present a small comparative material for the assessment of taxonomic composition and constancy of macrozoobenthos occurrence in the OWF area. The list of results of macrozoobenthos surveys (Table 3.4) carried out as part of the aforementioned three projects, in the years 2013–2019, in a similar depth range (21–54 m) in the area of open waters of the southern Baltic Sea on the soft seabed, showed that macrozoobenthos in none of them was distinguished in terms of composition features and taxonomic diversity. The maximum number of macrozoobenthos taxons found in the Baltic Power OWF area was slightly lower than in the areas of the adjacent projects.

Table No. 3.4. Characteristics of macrozoobenthos surveys of the soft seabed of the OWF Area (1 NM) in 2019 against the results of macrozoobenthos surveys of the Bałtyk III OWF area and Bałtyk II OWF area of 2013 and of 2014 and Baltica OWF of 2016. [Source: data of Baltic Power Sp. z o.o.]

Parameter	**Bałtyk III OWF area (2013)**	**Bałtyk II OWF area (2013, 2014)**	**Baltica OWF area (2016)**	**Baltic Power OWF area (1 NM) (2019)**
Number of stations	175	117	402	200
Depth range [m]	26-42	23-44	21-54	28-45
Number of taxons: max, range	27; 4-16	32; 3-12	33; 4-18	25; 4-15
Most often recorded taxons	*Pygospio elegans*, *Marenzelleria* sp., *Limecola balthica, Hediste diversicolor*	*Pygospio elegans, Marenzelleria* sp.	*Marenzelleria* sp., *Pygospio elegans, Limecola balthica, Bylgides sarsi, Diastylis rathkei*	*Marenzelleria* sp., *Pygospio elegans, Limecola balthica, Bylgides sarsi, Monoporeia affinis*

A multimetric B indicator was used to assess the quality of macrozoobenthos communities on the soft seabed, whereas an OGT indicator was used on the hard seabed (Appendix No. 1 to the EIA Report).

The largest area of the planned OWF Area (1 NM) is covered by sandy seabed characterized by moderate value of macrozoobenthos inhabiting it. However, the condition of macrozoobenthos communities within the area of fragments of the seabed covered with stones (up to 5% of the seabed area of the surveyed area), found in the southern and north-eastern part of the OWF Area (1 NM), was determined as good, or even very good (Figure 3.5).

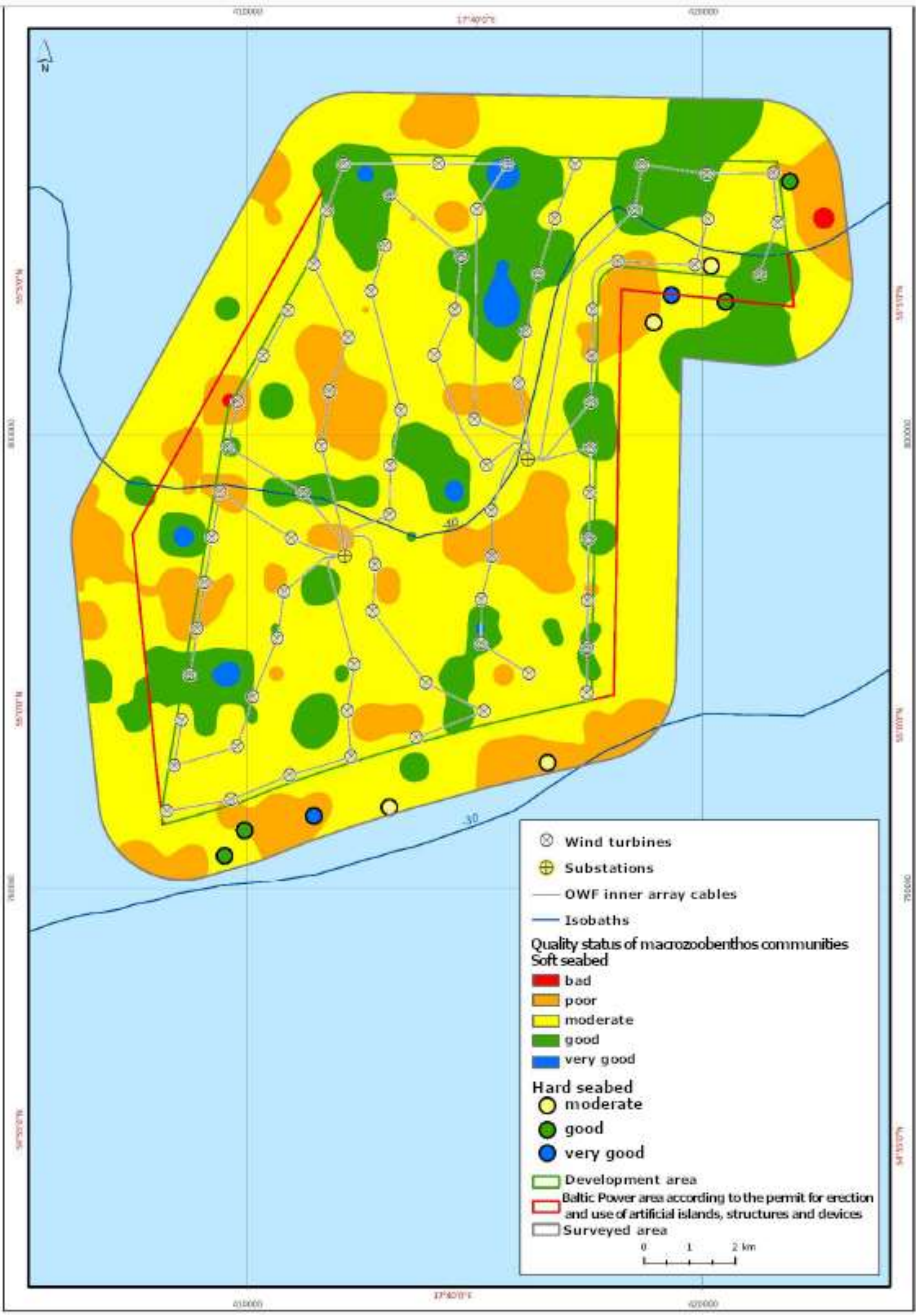


Figure 3.5. Spatial distribution of the quality status of macrozoobenthos communities in the OWF area (1 NM) [Source: data of Baltic Power Sp. z o.o.]

3.7.1.3 Ichthyofauna

Surveys of ichthyofauna in the OWF area (1 NM) aimed at determining the species composition, abundance and distribution of ichthyofauna, structure and biological characteristics of the existing fish species, including also the species composition and abundance of ichthyoplankton.

Ichthyofauna surveys were carried out on an annual basis, taking into account 4 field activities cycles covering all seasons of the year.

During pelagic research surveys at sea used to examine the proportion of the share of individual species for the estimation of pelagic fish biomass, apart from herring and sprat few specimens of garfish, stickleback, sandeel, anchovy (*Engraulis encrasicolus*), European flounder, twait shad (*Cyclopterus lumpus*) and lesser sand eel were caught.

The catch of bottom fisheries using fixed nets in the OWF area (1 NM) is 1,351.39 kg of fishes belonging to 13 taxons. The predominant species were European flounder and cod, the remaining species were small by-catches (great sand eel, plaice, shorthorn sculpin, hooknose, fourbeard rockling, turbot, herring, lumpfish, viviparous eelpout, whiting, and common dab).

All survey equipment in the OWF area (1 NM) caught fishes classified to 22 taxons (Table 3.5). Permanent fish communities of the area include cod, flounder, plaice, turbot, herring, sprats, and the sparse shorthorn sculpin, lumpfish, great sand eel and vivaparous eelpout (*Zoarces viviparus*). The observed presence of larvae of species such as gobies, fourbeard rockling, rock gunnel (*Pholis gunnellus*), longspined bullhead, or common seasnail does not indicate permanent inhabitation of the area by adult fish.

Table No. 3.5. Specification of taxons recorded during research surveys at sea in the OWF area (1 NM) [Source: data of Baltic Power Sp. z o.o.]

Species/type	**Type of fishery**		
	Pelagic ichthyofauna	**Benthic ichthyofauna**	**Ichthyoplankton**
Cod *Gadus morhua*		X	
European flounder *Platichthys flesus*	X	X	X
Plaice *Pleuronectes platessa*		X	X
Turbot *Scophthalmus maximus*		X	
Herring *Clupea harengus*	X	X	X
Sprat *Sprattus sprattus*	X		X
Great sand eel *Hyperoplus lanceolatus*	X	X	X
Lesser sand eel *Ammodytes tobianus*	X		X
Shorthorn sculpin *Myoxocephalus scorpius*		X	X
Lumpfish *Cyclopterus lumpus*	X	X	
Vivaparous eelpout *Zoarces viviparus*		X	
Fourbeard rockling *Enchelyopus cimbrius*		X	X
Whiting *Merlangius merlangus*		X	
Common dab		X	

Species/type	Type of fishery		
	Pelagic ichthyofauna	**Benthic ichthyofauna**	**Ichthyoplankton**
Limanda limanda			
Armed bullhead *Agonus cataphractus*		X	
Garfish *Belone belone*	X		
Three-spined stickleback *Gasterosteus aculeatus*	X		
European anchovy *Engraulis encrasicolus*	X		
Gobies *Gobiidae*			X
Longspined bullhead *Taurulus bubalis*			X
Rock gunnel *Pholis gunnellus*			X
Common seasnail *Liparis liparis*			X

The OWF area (1 NM) is relatively poor in terms of species diversity, with a clear predominance of cod and flounder in bottom fisheries, and herring and sprat in pelagic fisheries.

The survey area was not found to be a significant breeding ground, only in the summer period the sprat breeding area of low importance was found. In the case of herring, the survey results obtained indicate that the area of the planned investment project was, during the survey period, the place where **herring** is living, the area across which migration routes go: wintering grounds, breeding grounds (probably), and feeding grounds.

The survey results also show that the area of the planned project was a place of sprat occurrence and migration in each of the four seasons of 2019. The surveyed area was the place of seasonal occurrence and migration of the part of the population of adult sprat that took part in the spawning from January to July, which proves that this process was very prolonged in the calendar time of 2019 compared to the previous years. At the turn of summer and fall, when sprat ended spawning, fish mass nutrition and feeding migrations took place, also in the area of the planned project.

The water region of the planned project is characterized by the predominance of the presence of juvenile **cod** throughout the year, with a possible periodic increase in the share of cod from older age groups, resulting from breeding and feeding migrations. The significant share of juvenile cod in the surveyed area may, as the predominance of smaller cod in the fisheries, result from the current condition of the cod stocks, which, due to the significant fishing and natural mortality affecting mainly larger (and older) cod, is characterized by the predominance of cod of younger age groups [200]. The analysis of seasonal changes in the maturity of the cod gonads in the OWF area (1 NM) indicates that cod migrates through it and that this water region is not a breeding ground for cod. Results of tests of stomachs filling with food indicate more favorable feeding conditions prevailing in winter, summer, and fall in the surveyed area. The diversity of nutritional components found in cod stomachs indicates that the area of the planned project is beneficial in terms of food composition for representative of this species of various sizes.

The area of the planned project is the habitat of adult flounder specimens. During research surveys at sea, no significant share of juveniles was recorded in any season. The area of the planned project may be crossed by migration routes of the flounder from deep-water spawning grounds (e.g. Słupsk River) to coastal feeding grounds.

The analyzed area is not a flounder spawning ground due to too low salinity. Based on the analysis of the filling of stomachs, it can be assumed that in the surveyed area flounders have found appropriate feeding conditions.

In summary, out of 22 taxons observed during ichthyofauna surveys carried out for the needs of the planned project, four are of particular economic importance, being the subject of industrial fishing. These are: sprat (*S. sprattus*), herring (*C. harengus*), cod (*G. morhua)*, European flounder (*P. flesus*). During research surveys at sea, salmon *Salmo salar* and sea trout *Salmo trutta* were not observed (lack of standardized testing methods, low density), but these two species are present in fisheries.

In research fisheries carried out in the Baltic Power OWF area, the most numerous were: sprat, herring, cod, and flounder, which constitute the basis of industrial fishing.

In addition, during monitoring surveys, 438 goby larvae were found in ichthyoplankton samples, most probably belonging to the partially protected **sand goby** species (*Pomatoschistus minutus*), and 87 **common seasnail** larvae (*L. liparis liparis*), which is also partially protected in Poland.

In order to assess the significance of the Baltic Power OWF area with respect to ichthyofauna, its following values were considered: taxonomic diversity, occurrence of protected and endangered and commercial species, feeding or spawning site, migration routes. Based on the aforementioned functions, natural values of this area were assessed as medium. The assessment was carried out on the basis of an expert evaluation.

3.7.1.4 Marine mammals

Taking into account the specific nature of occurrence of marine mammals in the southern Baltic Sea, three species of marine mammals may appear in the Baltic Power OWF area: harbor porpoise (*Phocoena phocoena*), gray seal (*Halichoerus grypus*) and harbor seal (*Phoca vitulina*). Moreover, there is a small likelihood of presence of ringed seal (*Pusa hispida*).

Porpoise (*Phocoena phocoena*) is the only representative of cetaceans present in the Baltic Sea. According to the data from the SAMBAH project carried out in 2011–2013, the Polish maritime areas belong to areas with low detectability of porpoises, indicating a low density of this species within them (Figure 3.6). The abundance of this species in the area of the Baltic Proper was estimated at 80 to 1,091 individuals (497 on average) [386]. At present, the exact status of the porpoise population in the Polish part of the Baltic Sea is uncertain, and its abundance is described as very low [160, 239, 400].

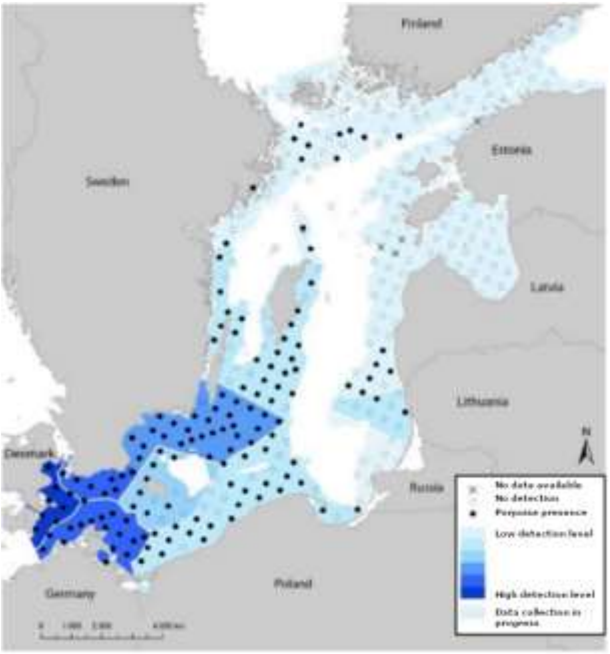


Figure 3.6. SAMBAH results presenting the distribution of the porpoise detection rate in the Baltic Sea [430]

Surveys commissioned by the Chief Inspectorate of Environmental Protection (GIOŚ) as part of the project *„Pilotażowe wdrożenie monitoringu gatunków i siedlisk morskich w latach 2015–2018*" ["Pilot implementation of marine species and habitats monitoring in 2015–2018"] in the area of the Pomeranian Bay and Słupsk Bank showed a higher detection rate of porpoises compared to the results of the SAMBAH project from 2011–2013 in the two surveyed areas. Within the Pomeranian Bay, average values of positive detection days expressed as a percentage (%DPD) were recorded at 4.56% of DPD, which was higher than the results of the SAMBAH project, which recorded 0.43% of DPD in this area. In the case of the Stilo Bank, higher values were also recorded during the pilot monitoring, where the average % value of DPD was 0.32, while the SAMBAH project recorded 0.08% of DPD. Despite higher detection rates of porpoises in Polish waters in the period from 2016 to 2018, the number of detections was still relatively low. Analyses of the data collected showed differences in the occurrence of porpoises in two surveyed areas. Additionally, differences in seasonality of its occurrence were found, while the highest DPD values in the Pomeranian Bay area were recorded in summer, while in the Stilo Bank area in the spring season [273].

The monitoring carried out as part of cooperation between WWF Polska and the Marine Station of the Institute of Oceanography of the University of Gdańsk during the implementation of the project "*Wsparcie restytucji i ochrony ssaków bałtyckich w Polsce*" (Support for Restoration and Conservation of Baltic Mammals in Poland) and the project "Ochrona siedlisk ssaków i ptaków morskich" (Conservation of Habitats of Mammals and Seabirds) showed that 70 dead specimens of porpoises were found on the Polish coast in 2009–2019, with one observation (in 2010) being made within 30 km from the Baltic Power OWF Area [494].

During the surveys for the EIA Report for the Baltic Power OWF, from December 2018 to January 2020, passive acoustic monitoring of porpoises was carried out in the OWF area (2 NM), using C-POD devices and aerial observations. Five basic and two additional acoustic devices were deployed in the surveyed area, which continuously detected sounds emitted by porpoises. The analyzed data showed that the average %DPD value from all stations amounted to 0.62. The highest values of positive detection days were recorded at the CPOD_01 Station in the fall season.

The highest value of positive detection minutes (DPM) of porpoises per day was recorded at the CPOD_01 Station on September 13, 2019, where it was 12 DPM, reaching the value of 0.83 %DPM (Figure 3.7). The number of registered porpoise clicks was low.

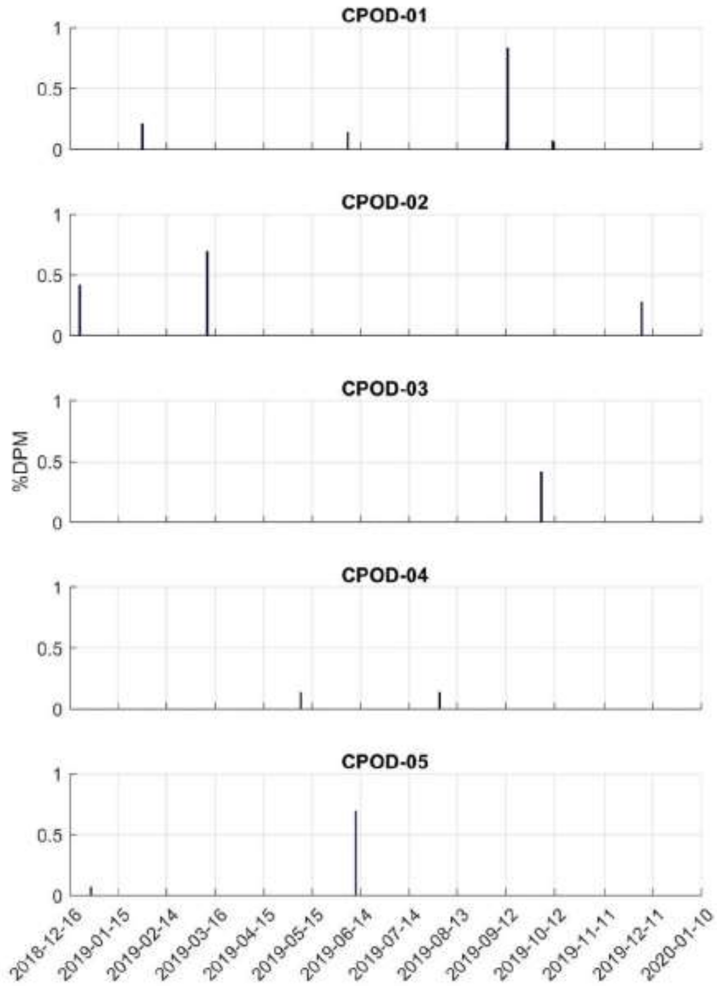


Figure 3.7. Daily activity of porpoises at five research stations in the OWF area (2 NM). Activity is expressed in percentage of positive detection minutes (%DPM) [Source: data of Baltic Power Sp. z o.o.]

During the monitoring, the largest porpoise %DPM was recorded in the CPOD_02 Station (0.0034 %DPM) and then in the CPOD_01 Station (0.0033 %DPM) (Figure 3.8). The fall season was characterized by the highest %DPM (0.0029 %DPM) in comparison with other seasons (Figure 3.9).

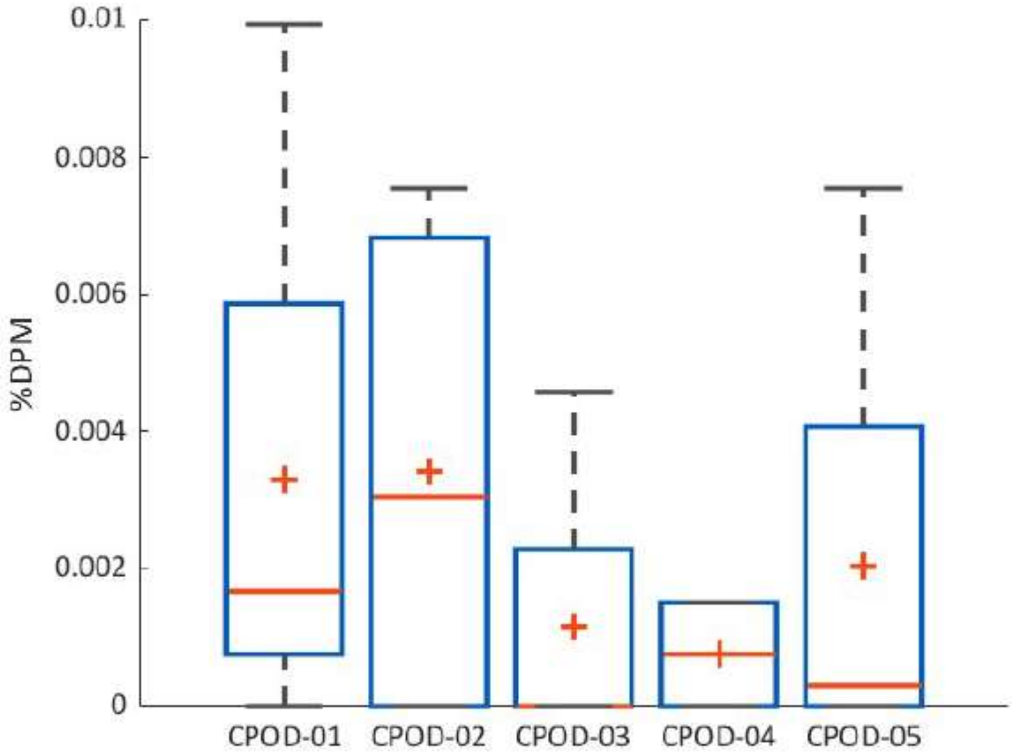


Figure 3.8. *Porpoise activity (%DPM) at each research station, throughout the monitoring period. The red cross represents the average, the red horizontal line represents the median (50th percentile), the lower edge of the box represents the lower quartile (25th percentile), the upper edge of the box represents the upper quartile (75th percentile), the whiskers represent the maximum and minimum values [Source: data of Baltic Power Sp. z o.o.]*

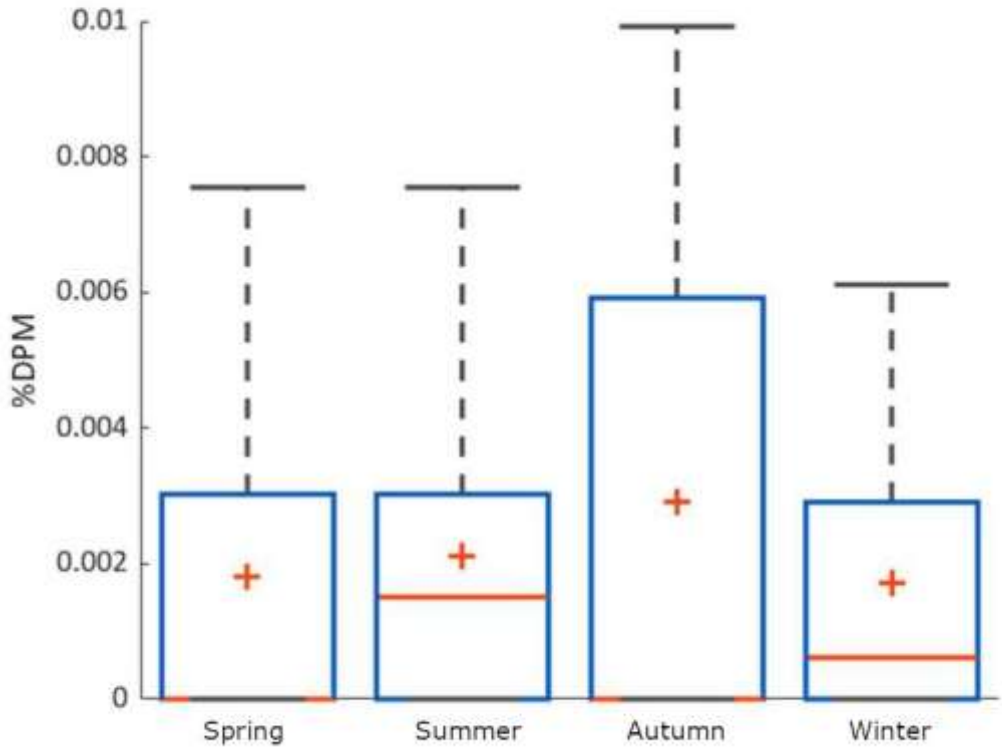


Figure 3.9. Porpoise activity (%DPM) for spring (March-May), summer (June-August), autumn (September-November) and winter (December-February) in the entire Baltic Power OWF area. The red cross represents the average, the red horizontal line represents the median (50th percentile), the lower edge of the box represents the lower quartile (25th percentile), the upper edge of the box represents the upper quartile (75th percentile), the whiskers represent the maximum and minimum values [Source: data of Baltic Power Sp. z o.o.]

During one of the observation flights carried out in the spring-summer period, a specimens of sea unidentified mammal species were observed. Apart from this no other observations of marine mammals were made in the surveyed area.

The results of the surveys of acoustic monitoring of porpoise and aerial observations in the Baltic Power OWF area (2 NM) indicate a rare occurrence of this species in the surveyed area. The detection of porpoise in the survey area during the entire monitoring period was sporadic.

There are three **seal** species in the Baltic Sea. The number of the Baltic gray seal exceeded 32,000 individuals [186]. The sub-population of the harbor seal of the southern Baltic Sea is estimated at 1563 individuals [NOVANA Census, Jonas Teilmann personal communication], while the ringed seal at 10,000 individuals [186]. According to HELCOM, gray seal regularly occurs in the Polish part of the Baltic Sea, harbor seal appears on its western side, while ringed seal may be observed in the northern part of Polish waters [185].

According to the results of seal observations within the Polish part of the Baltic Sea in recent 10 years, from the WWF database and the Marine Station of the Institute of Oceanography of the University of Gdańsk, gray seal (65% of observations), then harbor seal (5% of observations) and ringed seal (0.6% of observations) were the most frequently observed in the surveyed area (Figure 3.10).

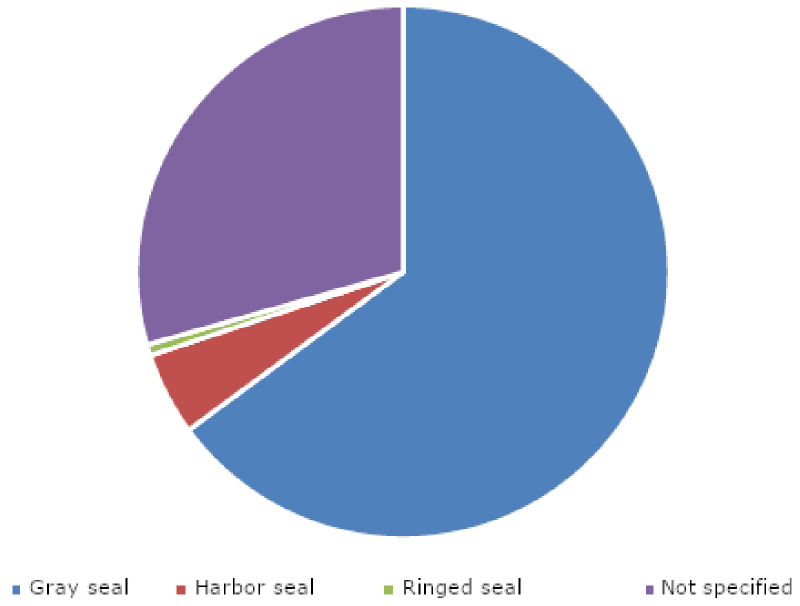


Figure 3.10. Division of seal observation results on the Polish coast obtained from the period from January 1, 2009 to December 3, 2019 on the basis of the database maintained by WWF Polska and the Krzysztof Skóra Marine Station of the Institute of Oceanography of the University in Hel as part of the project "Wsparcie restytucji i ochrony ssaków bałtyckich w Polsce" (Support for Restoration and Conservation of Baltic Mammals in Poland) and "Ochrona siedlisk ssaków i ptaków morskich" (Conservation of habitats of mammals and seabirds) [494] [Source: own study]

The largest number of gray seals is recorded in the area of the mouth of the Vistula River, Przekop Wisły, in the Nature Reserve Mewia Łacha. Currently, this nature reserve is a permanent place of occurrence of the gray seal, where this species finds good conditions for rest. In this area, there are several to 300 individuals per day (usually several dozen) [459].

The data collected in 2016–2018 as part of the project "*Pilotażowe wdrożenie monitoring gatunków i siedlisk morskich w latach 2015–2018*" [Pilot implementation of marine species and habitats monitoring in 2015–2018] confirmed the presence of a haul-out in the area of the mouth of the Vistula River, Przekop Wisły. In the specified period, the number of gray seals was approx. 200 individuals during the molting period [274]. During the observation, only one specimen of harbor seal was recorded in the haul-out [275].

In the years 2009–2019 along the coast, approximately 30 km away from the Baltic Power OWF area, the WWF Blue Patrol recorded 106 observations of the gray seal, 1 observation of the harbor seal and 2 observations of the ringed seal (Table 3.6).

Table No. 3.6. Results of seal observations on the Polish coast in the area approximately 30 km away from the Baltic Power OWF from the period from January 1, 2009 to December 3, 2019 on the basis of the database maintained by WWF Polska and the Krzysztof Skóra Marine Station of the Institute of Oceanography of the University in Hel as part of the project "Wsparcie restytucji i ochrony ssaków bałtyckich w Polsce" (Support for Restoration and Conservation of Baltic Mammals in Poland) and "Ochrona siedlisk ssaków i ptaków morskich" (Conservation of habitats of mammals and seabirds) [494] [Source: own study]

Species	Number of live individuals	Number of dead individuals	Total
Gray seal	33	73	106
Harbor seal	1	0	1
Ringed seal	2	0	2
Unidentified	11	8	19

In the period from December 16, 2018 to December 3, 2019 the WWF Blue Patrol observed 4 live and 7 dead individuals of gray seal in an area approximately 30 km away from the area of the planned Baltic Power OWF. Moreover, data in the form of GPS paths obtained from gray seal transmitters marked and released into the wild by the employees of the Marine Station of the Institute of Oceanography of the University in Hel indicate that these mammals flowed through the area of the planned Baltic Power OWF (Figure 3.11).

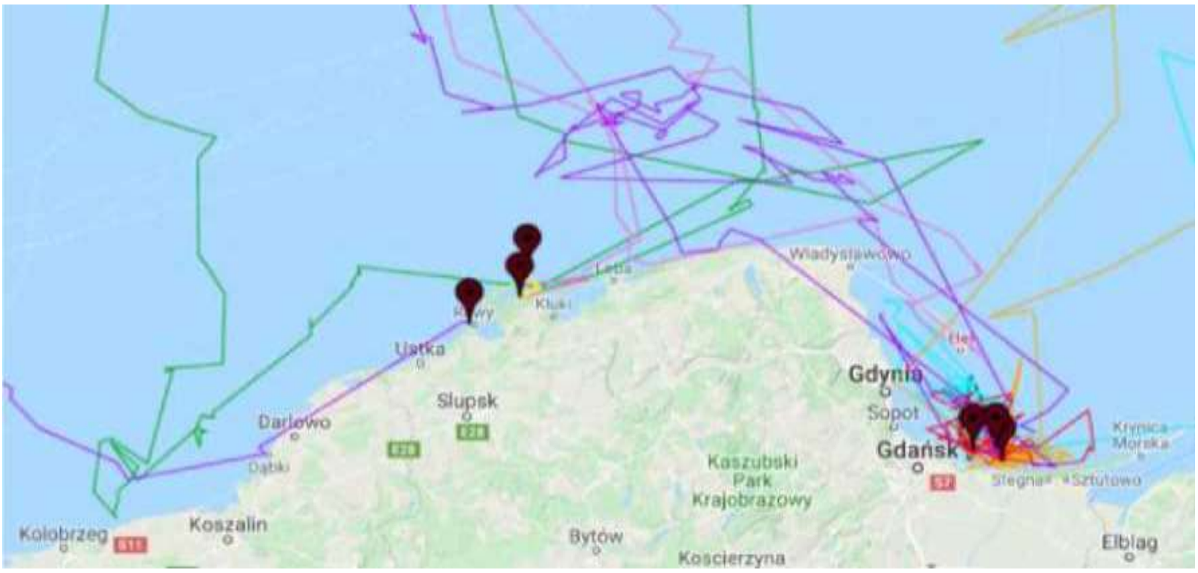


Figure 3.11. Routes of movement of gray seals released by the Krzysztof Skóra Marine Station of the Institute of Oceanography of the University in Hel from December 2018 to December 2019 [406]

In the period from December 2018 to January 2020, as part of the environmental monitoring in the OWF area (2 NM), four observation flights took place. During one of the observation flights carried out in the spring-summer period, one individual of unidentified marine mammal species was observed. Apart from this no other observations of marine mammals were made in the surveyed area.

Marine mammal surveys were also conducted as part of seabird observations, from October 2018 to November 2019, along designated transects located in the OWF Area (2 NM). During the aforementioned surveys, 3 individuals were observed: one observation was of a seal of undetermined species affiliation and the other two observations were of a gray seal.

Results from acoustic monitoring of harbor porpoise, aerial visual observations, and additional marine mammal observations from vessels made as part of seabird surveys indicate that harbor porpoises and seals are sparse in the surveyed area, which is consistent with the general conclusions reached in the projects: SAMBAH and "*Pilotażowe wdrożenie monitoring gatunków i siedlisk morskich w latach 2015–2018*" [Pilot implementation of marine species and habitats monitoring in 2015–2018].

3.7.1.5 Migratory birds

The Baltic Sea waters along the Polish coast and in the area where the planned Baltic Power OWF is located are part of the migratory bird route between breeding grounds in northern and eastern Europe and northwestern Asia [27, 347, 398]. The characteristics of migration (height and direction of flight, type of flight, day flight, overnight flight) are specific to individual groups of species. For example, sea ducks and alcids fly low above the water surface (over 90% of observed alcids, common scoters and long-tailed ducks flew at the height of up to 20 m a.s.l.).

The characteristics of the flight also depend on the weather conditions, wind direction and visibility [5].

The table (Table 3.7) presents migratory bird species observed during the surveys (categories marked only to orders or families are included in Appendix No. 1 to the EIA Report), together with their protection status and the total number of individuals observed during the surveys.

Table No. 3.7. Number of birds classified as given species (other categories in Appendix No. 1 to the EIA Report), recorded during the surveys and their status of national and international protection [Source: data of Baltic Power Sp. z o.o.]

Item No.	Species	Number of individuals	Species protection in Poland[1]	Annex I to the Birds Directive	IUCN[2]	HELCOM[3]
1.	Common scoter *Melanitta nigra*	1711	SP	No	LC	-
2.	Long-tailed duck *Clangula hyemalis*	1418	SP	No	**VU**	**-**
3.	Skylark *Alauda arvensis*	384	SP	No	LC	-
4.	Common wood pigeon *Columba palumbus*	355	GB	No	LC	-
5.	Velvet scoter *Melanitta fusca*	312	SP	No	**VU**	**VU**
6.	Eurasian wigeon *Mareca penelope*	303	SP	No	LC	-
7.	Chaffinch *Fringilla coelebs*	303	SP	No	LC	-
8.	Little gull *Hydrocoloeus minutus*	246	SP	Yes	NT	-
9.	Greater white-fronted goose *Anser albifrons*	188	GB	No	LC	-
10.	Greater scaup *Aythya marila*	184	SP	No	**VU**	**VU**
11.	Razorbill *Alca torda*	181	SP	No	NT	-
12.	Common gull *Larus canus*	164	SP	No	LC	-
13.	Great cormorant *Phalacrocorax carbo*	129	PP	No	LC	-
14.	Siskin *Carduelis spinus*	123	SP	No	LC	-
15.	Northern shoveler *Spatula clypeata*	122	SP	No	LC	-
16.	Common starling *Sturnus vulgaris*	120	SP	No	LC	-
17.	Lesser black-backed gull *Larus fuscus*	110	SP	No	LC	**VU**
18.	Common teal *Anas crecca*	83	GB	No	LC	-
19.	Eurasian curlew	83	SP	No	**VU**	**-**

Item No.	Species	Number of individuals	Species protection in Poland[1]	Annex I to the Birds Directive	IUCN[2]	HELCOM[3]
	Numenius arquata					
20.	Taiga bean goose *Anser fabalis*	82	GB	No	LC	-
21.	Common guillemot *Uria aalge*	81	SP	No	NT	-
22.	Mallard *Anas platyrhynchos*	51	GB	No	LC	-
23.	Common crane *Grus grus*	41	SP	Yes	LC	-
24.	Northern pintail *Anas acuta*	40	SP	No	LC	-
25.	White wagtail *Motacilla alba*	32	SP	No	LC	-
26.	Brambling *Fringilla montifringilla*	27	SP	No	LC	-
27.	Black-throated diver *Gavia arctica*	25	SP	No	LC	-
28.	Red-throated diver *Gavia stellata*	24	SP	No	LC	-
29.	Black-headed gull *Larus ridibundus*	21	SP	No	LC	-
30.	Barn swallow *Hirundo rustica*	20	SP	No	LC	-
31.	Whopper swan *Cygnus cygnus*	20	SP	No	LC	-
32.	Jackdaw *Corvus monedula*	18	SP	No	LC	-
33.	Red-breasted merganser *Mergus serrator*	16	SP	No	NT	**VU**
34.	Common swift *Apus apus*	15	SP	No	LC	-
35.	Rook *Corvus frugilegus*	13	SP	No	LC	-
36.	Grayleg goose *Anser anser*	12	GB	No	LC	-
37.	Gray heron *Ardea cinerea*	11	PP	No	LC	-
38.	Mute swan *Cygnus olor*	10	SP	No	LC	-
39.	Meadow pipit *Anthus pratensis*	10	SP	No	NT	-

Item No.	Species	Number of individuals	Species protection in Poland[1]	Annex I to the Birds Directive	IUCN[2]	HELCOM[3]
40.	Great black-backed gull *Larus marinus*	9	SP	No	LC	-
41.	European golden plover *Pluvialis apricaria*	9	SP	No	LC	-
42.	Common snipe *Gallinago gallinago*	8	SP	No	LC	-
43.	Yellow wagtail *Motacilla flava*	8	SP	No	LC	-
44.	Barnacle goose *Branta leucopsis*	8	SP	No	LC	-
45.	Tufted duck *Aythya fuligula*	7	GB	No	LC	NT
46.	Common linnet *Carduelis cannabina*	7	SP	No	LC	-
47.	Common merganser *Mergus merganser*	7	SP	No	LC	-
48.	Sand martin *Riparia riparia*	7	SP	No	LC	-
49.	Eurasian sparrowhawk *Accipiter nisus*	6	SP	No	LC	-
50.	Great egret *Ardea alba*	6	SP	No	LC	-
51.	Eurasian wren *Troglodytes troglodytes*	5	SP	No	LC	-
52.	Caspian gull *Larus cachinnans*	4	PP	No	LC	-
53.	Black tern *Chlidonias niger*	4	SP	No	LC	-
54.	Western osprey *Pandion haliaetus*	4	SP	No	LC	-
55.	Common goldeneye *Bucephala clangula*	3	SP	No	LC	-
56.	Great crested grebe *Podiceps cristatus*	3	SP	No	LC	-
57.	Pomarine jaeger *Stercorarius pomarinus*	3	SP	No	LC	-
58.	Pigeon hawk *Falco columbarius*	3	SP	No	LC	-
59.	Common redstart *Phoenicurus phoenicurus*	2	SP	No	LC	-
60.	House martin *Delichon urbicum*	2	SP	No	LC	-

Item No.	Species	Number of individuals	Species protection in Poland[1]	Annex I to the Birds Directive	IUCN[2]	HELCOM[3]
61.	Common sandpiper *Actitis hypoleucos*	2	SP	No	LC	-
62.	Eurasian hobby *Falco subbuteo*	2	SP	No	LC	-
63.	Robin *Erithacus rubecula*	2	SP	No	LC	-
64.	Long-eared owl *Asio otus*	2	SP	No	LC	-
65.	Mistle thrush *Turdus viscivorus*	2	SP	No	LC	-
66.	Parasitic jaeger *Stercorarius parasiticus*	2	SP	No	LC	-
67.	Song thrush *Turdus philomelos*	2	SP	No	LC	-
68.	Eurasian whimbrel *Numenius phaeopus*	2	SP	No	LC	-
69.	Honey buzzard *Pernis apivorus*	2	SP	Yes	LC	-
70.	Western marsh-harrier *Circus aeruginosus*	2	SP	Yes	LC	-
71.	Hen harrier *Circus cyaneus*	2	SP	Yes	NT	-
72.	Blue tit *Parus caeruleus*	1	SP	No	LC	-
73.	Bohemian waxwing *Bombycilla garrulus*	1	SP	No	LC	-
74.	Common redshank *Tringa totanus*	1	SP	No	LC	-
75.	Eurasian blackcap *Sylvia atricapilla*	1	SP	No	LC	-
76.	Lapland longspur *Calcarius lapponicus*	1	SP	No	LC	-
77.	Black guillemot *Cepphus grylle*	1	SP	No	LC	NT
78.	Common chiffchaff *Phylloscopus collybita*	1	SP	No	LC	-
79.	Common greenshank *Tringa nebularia*	1	SP	No	LC	-
80.	Kestrel *Falco tinnunculus*	1	SP	No	LC	-
81.	European pied flycatcher *Ficedula hypoleuca*	1	SP	No	LC	-

Item No.	Species	Number of individuals	Species protection in Poland[1]	Annex I to the Birds Directive	IUCN[2]	HELCOM[3]
82.	Fieldfare *Turdus pilaris*	1	SP	No	LC	-
83.	Gadwall *Mareca Strepera*	1	SP	No	LC	-
84.	Great tit *Parus major*	1	SP	No	LC	-
85.	Grey plover *Pluvialis squatarola*	1	SP	No	LC	-
86.	Lesser whitethroat *Sylvia curruca*	1	SP	No	LC	-
87.	Stock dove *Columba oenas*	1	SP	No	LC	-
88.	Willow warbler *Phylloscopus trochilus*	1	SP	No	LC	-
89.	Arctic tern *Sterna paradisaea*	1	SP	Yes	LC	-
90.	Common tern *Sterna hirundo*	1	SP	Yes	LC	-
91.	Short-eared owl *Asio flammeus*	1	SP	Yes	LC	-
92.	Redwing *Turdus iliacus*	1	SP	No	NT	-
93.	Common pochard *Aythya ferina*	1	GB	No	**VU**	**-**
94.	Common loon *Gavia immer*	1	SP	No	**VU**	**-**
95.	Common eider *Somateria mollissima*	1	SP	No	**VU**	**VU**

[1]Species protection in Poland SP – strictly protected species, GB – game bird, PP – partial protection
[2]IUCN species status for Europe: LC – least concern species, VU – vulnerable species, NT – near threatened species [35]
[3]HELCOM: VU – vulnerable species, NT – near threatened species [180]

During spring surveys, the most numerous (total of individuals from all visual observations) of the observed species included sea ducks: common scoter and long-tailed duck, followed by little gull and razorbill.

Among the most numerous observed categories of birds not classified as species, but only to the order or family, there were passerine birds (over 5% of all spring and fall observations) and geese whose mass flights were recorded in autumn. At that time, more than 9 thousand geese were observed at the turn of September and October, which accounts for more than 69% of all observations made in fall. The Eurasian skylark and common chaffinch along with other passerine birds were observed in fall more frequently than sea ducks.

During the entire monitoring period, geese were observed most frequently (it was influenced by mass observations in the fall of 2019), and then the common scoter and long-tailed duck. The following species were also less numerous, but still frequently observed: common wood pigeon, common guillemot, razorbill, Eurasian wigeon, little gull, greater scaup and common gull (Table 3.7). The common crane was recorded only in small numbers during spring observations, however, on the basis of surveys carried out for other OWFs in this region, it is known that this species passes through the surveyed Baltic Sea area also in autumn, with favorable wind conditions in order to move from resting places in Sweden to northern Germany [398].

Passerine birds analyzed as one category include the species presented in the table (Table 3.8), as well as the category of "unidentified passerines" in the case when identification of the flying individual as the species was not possible. In this category, the observations of two species of pigeon and swift were also taken into account due to the similar nature of the flight of these birds. The most numerous species included the skylark, common wood pigeon (formally it is not a passerine bird, but due to a similar migration phenology and behavior, pigeons were taken into account here for the purposes of this study), chaffinch, siskin and common starling.

Table 3.8. List of observed species classified as the "passerine" category analyzed in this report [Source: data of Baltic Power Sp. z o.o.]

Item	Species/category	Spring	Autumn	Total
1.	Unidentified passerine *Passeriformes indet.*	243	791	1034
2.	Skylark *Alauda arvensis*	3	381	384
3.	Common wood pigeon* *Columba palumbus*	4	351	355
4.	Chaffinch *Fringilla coelebs*	26	277	303
5.	Siskin *Carduelis spinus*	41	82	123
6.	Common starling *Sturnus vulgaris*	43	77	120
7.	Unidentified finch *Carduelis indet.*	0	51	51
8.	White wagtail *Motacilla alba*	16	16	32
9.	Brambling *Fringilla montifringilla*	27	0	27
10.	Barn swallow *Hirundo rustica*	18	2	20
11.	Swift* *Apus apus*	13	2	15
12.	Meadow pipit *Anthus pratensis*	7	3	10
13.	Yellow wagtail *Motacilla flava*	5	3	8
14.	Common linnet *Carduelis cannabina*	7	0	7
15.	Sand martin *Riparia riparia*	5	2	7
16.	Unidentified martin *Hirundo* sp.	6	0	6

Item	Species/category	Spring	Autumn	Total
17.	Eurasian wren *Troglodytes troglodytes*	5	0	5
18.	House martin *Delichon urbicum*	2	0	2
19.	Common redstart *Phoenicurus phoenicurus*	2	0	2
20.	Robin *Erithacus rubecula*	2	0	2
21.	Mistle thrush *Turdus viscivorus*	2	0	2
22.	Song thrush *Turdus philomelos*	2	0	2
23.	Blue tit *Parus caeruleus*	1	0	1
24.	Bohemian waxwing *Bombycilla garrulus*	0	1	1
25.	Common chiffchaff *Phylloscopus collybita*	0	1	1
26.	Eurasian blackcap *Sylvia atricapilla*	0	1	1
27.	European pied flycatcher *Ficedula hypoleuca*	1	0	1
28.	Fieldfare *Turdus pilaris*	0	1	1
29.	Great tit *Parus major*	0	1	1
30.	Lapland longspur *Calcarius lapponicus*	0	1	1
31.	Lesser whitethroat *Sylvia curruca*	0	1	1
32.	Redwing *Turdus iliacus*	1	0	1
33.	Stock dove* *Columba oenas*	1	0	1
34.	Unidentified thrush *Turdus indet.*	1	0	1
35.	Willow warbler *Phylloscopus trochilus*	0	1	1
Total		484	2046	2530

** Two species of pigeon and swift were included in the summary analysis of passerine birds due to similar flight characteristics*

The analysis of migration flows [the width of passage through the OWF Area (2 NM) taken into account in the analysis was 10 km] showed that the long-tailed ducks flying during spring migration accounted for 2% and in autumn for 0.97% of the biogeographical population of this species. For the common scoter, the results indicate 9.88% of the biogeographical population in spring and 0.38% in fall. Lower values were obtained for the velvet scoter: 0.6% in spring and 1.11% in autumn (species population sizes based on Birdlife International [35]). Relatively larger flight streams were obtained for geese – it is expected that in fall, up to 3% of the total population of all geese passing through the Baltic Sea will pass through the Baltic Power OWF Area during migration. The estimations obtained for spring migration of the little gull (10%) and greater scaup (1.68%) are also high (Table 3.9).

Table 3.9. Share of populations of individual species passing through the Baltic Sea on the basis of migration flows of individual species through the OWF Area (2 NM), divided into spring and autumn migration [Source: data of Baltic Power Sp. z o.o.]

Taxon	Size of migratory bird population [35]	Migration season	Estimation of flight size [number of individuals]	Share of migrating bird population [%]
Long-tailed duck *Clangula hyemalis*	1,600,000	Spring	33,023	2.06
		Autumn	15,493	0.97
Common scoter *Melanitta nigra*	550,000	Spring	54,341	9.88
		Autumn	2101	0.38
Velvet scoter *Melanitta fusca*	450,000	Spring	2715	0.60
		Autumn	4987	1.11
Ducks (Eurasian wigeon, etc.) *Anatini*	>6,500,000	Spring	11,976	0.18
		Autumn	9488	0.15
Greater scaup *Aythya marila*	310,000	Spring	5216	1.68
		Autumn	268	0.09
Geese *Anseridae*	>3,500,000	Spring	73	0.00
		Autumn	103,427	2.96
Swans *Cygnus sp.*	300,000	Spring	457	0.15
		Autumn	1286	0.43
Gaviiformes *Gaviidae*	>400,000	Spring	3036	0.76
		Autumn	217	0.05
Alcids *Alcidae*	>5,000,000	Spring	2967	0.06
		Autumn	7509	0.15
Great cormorant *Phalacrocorax carbo*	515,000	Spring	892	0.17
		Autumn	1263	0.25
Little gull *Hydrocoloeus minutus*	>72,000	Spring	7430	10.32
		Autumn	198	0.27
Black-headed gull *Larus ridibundus*	>4,770,000	Spring	321	0.01
		Autumn	369	0.08
Lesser black-backed gull *Larus fuscus*	>1,200,000	Spring	1977	0.16
		Autumn	1139	0.09
Common gull	1,200,000	Spring	3868	0.32

Larus canus		Autumn	1322	0.11
Terns *Sternidae*	>1,800,000	Spring	385	0.02
		Autumn	99	0.01
Charadriiformes *Charadriidae*	>1,600,000	Spring	429	0.03
		Autumn	1259	0.08
Common crane *Grus grus*	240,000	Spring	951	0.40
		Autumn	0	-
Passerine *Paseriformes*	100,000,000	Spring	7531	0.01
		Autumn	141,237	0.14

28 species were identified in the acoustic recordings. Most of the identified sounds belong to gulls, about one fifth to passerine birds of 22 species. Among the species of passerine birds, those were identified which migrate only at night to avoid predation [common blackbird (*Turdus merula*), robin (*Erithacus rubecula*), redwing (*Turdus iliacus*), song thrush (*Turdus philomelos*)], and more active species during the day [common chaffinch (*Fringilla coelebs*), white wagtail (*Motacilla alba*), yellow wagtails (*Motacilla flava*), meadow pipit (*Anthus pratensis*) and European goldfinch (*Carduelis carduelis*)] (Table 3.10).

Table 3.10. List of sounds of birds recorded on acoustic recordings during surveys in spring and autumn [Source: data of Baltic Power Sp. z o.o.]

Item	Species/Category	Spring	Autumn	Total
1.	Unidentified gull *Laridae indet.*	4530	4339	8869
2.	European herring gull *Larus argentatus*	95	4465	4560
3.	Redwing *Turdus iliacus*	330	847	1177
4.	Common blackbird *Turdus merula*	98	798	896
5.	Robin *Erithacus rubecula*	293	123	416
6.	Song thrush *Turdus philomelos*	92	254	346
7.	Greater white-fronted goose *Anser albifrons*	0	160	160
8.	Chaffinch *Fringilla coelebs*	80	10	90
9.	Great tit *Parus major*	0	87	87
10.	White wagtail *Motacilla alba*	48	31	79
11.	Unidentified passerine *Passeriformes indet.*	25	33	58
12.	Fieldfare *Turdus pilaris*	0	51	51

Item	Species/Category	Spring	Autumn	Total
13.	Yellow wagtail *Motacilla flava*	22	23	45
14.	Goldcrest *Regulus regulus*	6	37	43
15.	Meadow pipit *Anthus pratensis*	17	9	26
16.	Common gull *Larus canus*	18	3	21
17.	Common chiffchaff *Phylloscopus collybita*	11	3	14
18.	European goldfinch *Carduelis carduelis*	12	0	12
19.	Spotted flycatcher *Muscicapa striata*	9	1	10
20.	Blue tit *Parus caeruleus*	8	0	8
21.	Siskin *Carduelis spinus*	8	0	8
22.	Tree pipit *Anthus trivialis*	5	2	7
23.	Mistle thrush *Turdus viscivorus*	5	0	5
24.	Snow bunting *Plectrophenax nivalis*	0	4	4
25.	Wood sandpiper *Tringa glareola*	0	3	3
26.	Lesser black-backed gull *Larus fuscus*	0	2	2
27.	Brambling *Fringilla montifringilla*	0	1	1
28.	Eurasian curlew *Numenius arquata*	1	0	1
29.	Skylark *Alauda arvensis*	0	1	1
30.	Greenfinch *Chloris chloris*	1	0	1
31.	Unidentified bird	1	0	1
Total		5715	11,287	17,002

The analysis of the results obtained using the vertical radar provided information on the flight height of migratory birds throughout the day. At the beginning of spring migration, the highest migration intensity was recorded at the heights of 0–100 m, both during the night and during the day, with few recorded echoes at heights above 1,000 m. Nighttime migration peaked in April and the bird echoes were read evenly at heights between 250 and

1,500 m, but the vast majority of echoes was still recorded at smaller heights (0–250 m), both during the day and at night. Nighttime migration was the most intense in April, which means that during this period there was a massive migration of passerine birds. In May, the migration at night was still quite clear (heights of 250–1,500 m), but the greatest number of echoes was read for daytime hours at heights of 0–250 m. During the measurement campaign in August, the migration intensity was higher at night than during the day. The intensive flight was recorded at night hours at heights above 1,000 m, which is likely to reflect the flight of passerine birds migrating over long distances (crossing the equator during their migration, such as, e.g. from the warbler family). Nighttime migration in September was most likely also dominated by passerine birds, while the daytime migration was characterized by a wide range of species, with the predominant species being common scoter and passerine birds (conclusions drawn from visual observations and vertical radar data).

Among the most frequently observed groups, as well as for the most important species of sea ducks, the flight altitude distribution was presented separately for spring and autumn, due to large differences in shares and abundance in both seasons. The observations indicate that the vast majority of analyzed groups of birds and species flew at heights up to 20 m a.s.l. (Figure 3.12, Figure 3.13). It should be remembered that flight heights obtained from visual observations represent only a part of all birds flying and these values should be treated as auxiliary information. Visual observations are aimed at identifying as many birds as possible, but due to the nature of this type of monitoring, birds flying low are much more frequently recorded than birds flying at heights above 100 m a.s.l. In fall, observations were dominated by geese flying at different heights, up to 450 m (maximum value recorded during visual observations). The auxiliary nature of these flight altitude observations should be emphasized as they are subject to an error resulting from limited possibility of detecting birds at high altitudes, for birds flying lower and closer to the observers at the research station.

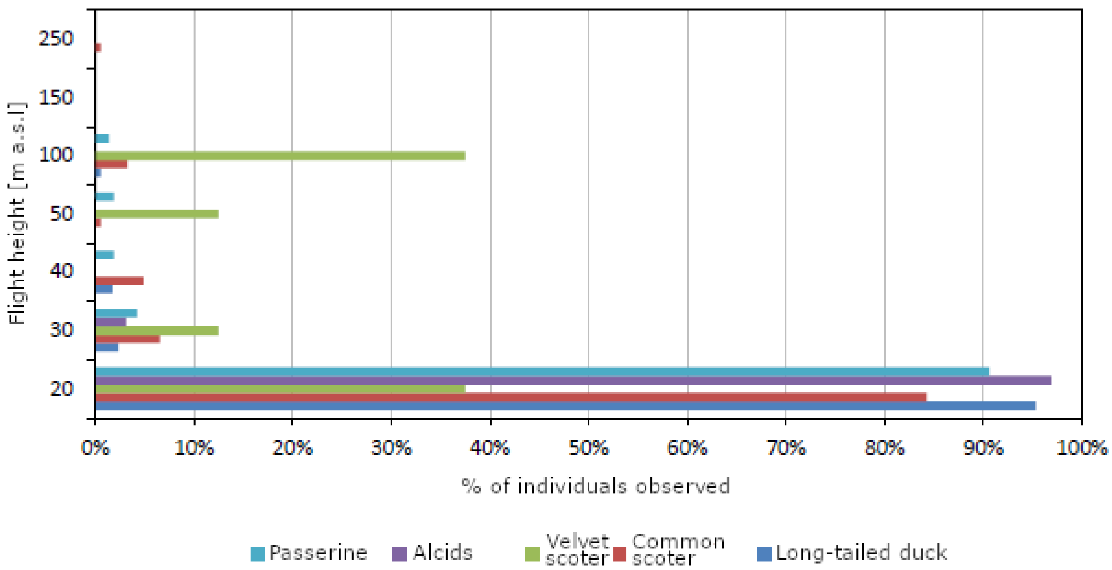


Figure 3.12. Flight altitude of species observed at the smallest distance from the water table during spring migration (March–April 2019) [Source: data of Baltic Power Sp. z o.o.]

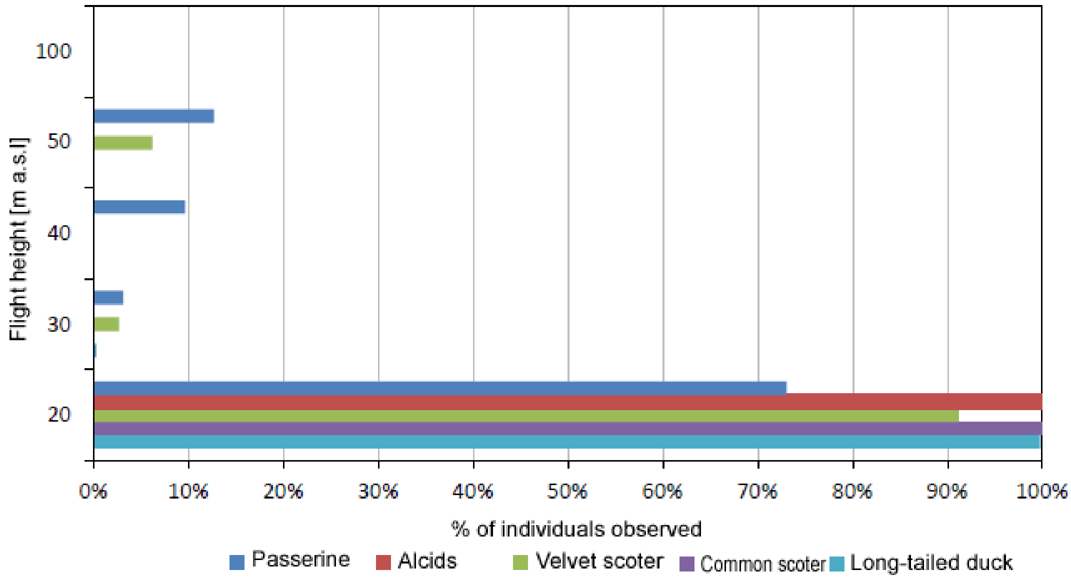


Figure 3.13. Flight altitude of species observed at the smallest distance from the water table during autumn migration (August–November 2019) [Source: data of Baltic Power Sp. z o.o.]

The analysis of all flights observed in spring indicates a uniform flight direction – north-eastern – towards breeding grounds (Figure 3.14). Such direction is recognizable for sea ducks, other duck species, passerine, loon and predatory species. In autumn, the south-western direction prevailed (Figure 3.15). Among the flight paths there were single paths, which indicated completely opposite directions (north-east, e.g. a single mallard individual). These individual cases are likely local birds that spend the whole year in the area under investigation, or migratory birds (some razorbills) that have already completed their fall migration and were registered during short local feeding flights.

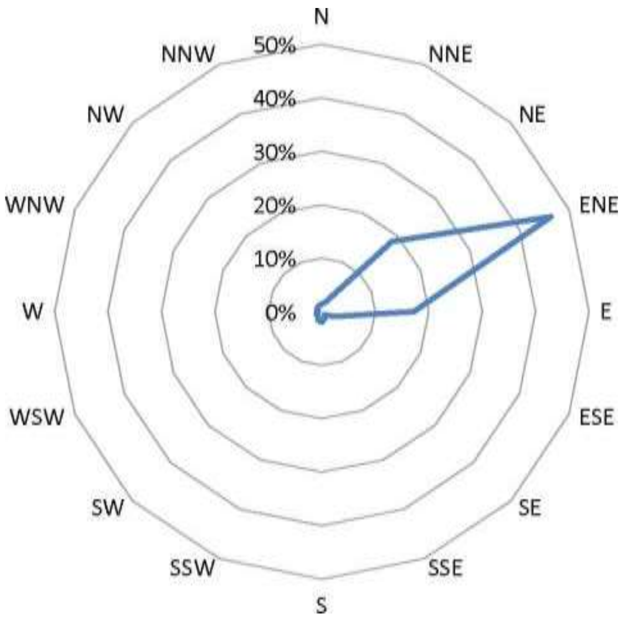


Figure 3.14. Flight directions of all bird species during spring migration (March–May 2019) [Source: data of Baltic Power Sp. z o.o.]

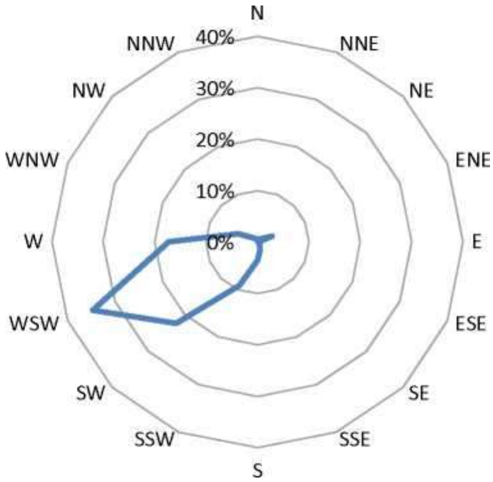


Figure 3.15. Flight directions of all birds during autumn migration (August–November 2019) [Source: data of Baltic Power Sp. z o.o.]

Out of all species and categories that were recorded during the surveys in spring and autumn, 18 most numerous species (groups of species) were taken into account for further analyses for the purposes of this EIA Report, whose estimates concerning the share of the biogeographical population passing through the surveyed area, as well as the significance based on the EIA methodology, are presented in the table (Table 3.11). Among all species recorded during the survey, seven are considered to be at risk on the European scale (according to the international IUCN scale) [35, 132]: long-tailed duck, velvet scoter, European curlew, common pochard, common eider, greater scaup and common loon, however, only the long-tailed duck was observed in large numbers in relation to its population. Seven species belong to the "near threatened" category: little gull, razorbill, common guillemot, red-breasted merganser, redwing, meadow pipit and hen harrier, but none of these species were observed in a large number. The observations of migratory birds carried out in autumn 2019 on Bornholm show that the number of common cranes traveling through the Słupsk Bank from Sweden is strongly dependent on the wind direction. In a situation where eastern winds dominate, only a few common cranes decide to cover this area (own data of DHI). Due to the fact that the abundance of geese and common cranes passing through the surveyed area show a great variability between subsequent years, in this document their classification was based (apart from the data collected for the purpose of this project) on the available survey data from the following OWF projects: Bałtyk II, Bałtyk III, Baltica 2, Baltica 3, B-Wind and C-Wind [170, 171, 27].

Table 3.11. Species and groups of species taken into account in the analyses for the purposes of this EIA Report, together with the assessment of the significance of the vulnerable population [Source: data of Baltic Power Sp. z o.o.]

Taxon/category	Migratory bird population	Migration season	Share of migrating bird population [%]	Significance of the vulnerable population	Size of vulnerable population	Value/receiver significance
Long-tailed duck *Clangula hyemalis*	1,600,000	Spring	2.06	Moderate	Local	High
		Autumn	0.97	Irrelevant	Insignificant	
Common scoter *Melanitta nigra*	550,000	Spring	9.88	Significant	Regional	High
		Autumn	0.38	Irrelevant	Insignificant	
Velvet scoter *Melanitta fusca*	450,000	Spring	0.6	Irrelevant	Insignificant	High
		Autumn	1.11	Moderate	Local	
Ducks (Eurasian wigeon, etc.) *Anatini*	>6,500,000	Spring	0.18	Irrelevant	Insignificant	Low
		Autumn	0.15	Irrelevant	Insignificant	
Greater scaup *Aythya marila*	310,000	Spring	1.68	Moderate	Local	Low
		Autumn	0.09	Irrelevant	Insignificant	
Geese* *Anseridae*	>3,500,000	Spring	0.1	Irrelevant	Insignificant	Moderate
		Autumn	1.7	Moderate	Local	
Swans *Cygnus* sp.	300,000	Spring	0.15	Irrelevant	Insignificant	Low
		Autumn	0.43	Irrelevant	Insignificant	
Gaviiformes *Gaviidae*	>400,000	Spring	0.76	Irrelevant	Insignificant	Low
		Autumn	0.05	Irrelevant	Insignificant	
Alcids *Alcidae*	>5,000,000	Spring	0.06	Irrelevant	Insignificant	Low
		Autumn	0.15	Irrelevant	Insignificant	
Great cormorant *Phalacrocorax carbo*	515,000	Spring	0.17	Irrelevant	Insignificant	Low
		Autumn	0.25	Irrelevant	Insignificant	
Little gull *Hydrocoloeus minutus*	>72,000	Spring	10.32	Very significant	Global	High
		Autumn	0.27	Irrelevant	Insignificant	
Black-headed gull	>4,770,000	Spring	0.01	Irrelevant	Insignificant	Low

Taxon/category	**Migratory bird population**	**Migration season**	**Share of migrating bird population [%]**	**Significance of the vulnerable population**	**Size of vulnerable population**	**Value/receiver significance**
Larus ridibundus		Autumn	0.08	Irrelevant	Insignificant	
Lesser black-backed gull *Larus fuscus*	>1,200,000	Spring	0.16	Irrelevant	Insignificant	Low
		Autumn	0.09	Irrelevant	Insignificant	
Common gull *Larus canus*	1,200,000	Spring	0.32	Irrelevant	Insignificant	Low
		Autumn	0.11	Irrelevant	Insignificant	
Terns *Sternidae*	>1,800,000	Spring	0.02	Irrelevant	Insignificant	Low
		Autumn	0.01	Irrelevant	Insignificant	
Charadriiformes *Charadriidae*	>1,600,000	Spring	0.03	Irrelevant	Insignificant	Low
		Autumn	0.08	Irrelevant	Insignificant	
Common crane** *Grus grus*	240,000	Spring	0.4	Irrelevant	Insignificant	High
		Autumn	-	None	None	
Passerine *Paseriformes*	100,000,000	Spring	0.01	Irrelevant	Insignificant	Low
		Autumn	0.14	Irrelevant	Insignificant	

**The average geese population size estimated on the basis of all available survey data from Polish maritime areas is 3,390 in spring and 59,190 in autumn, which corresponds to 0.10% and 1.70% of the population of local importance*

***The average common crane population size estimated on the basis of all available survey data is 360 in spring and 2,790 in autumn, which corresponds to 0.15% and 1.17% of the population of local importance*

3.7.1.6 Seabirds

Seabird observations were carried out in the OWF Area (2 NM) and in three additional areas of significant importance for birds: Słupsk Bank, a part of the Coastal Waters of the Baltic Sea and the Polish part of the South Middle Bank area. Observations were carried out in the period from October 2018 to November 2019. Detailed results of the surveys for these areas are included in Appendix No. 1 to the EIA Report.

The Baltic Sea water region is used by seabirds as a wintering site or as a stop during migration. Most of surveyed birds reach their highest population size in the high sea zone located over 1 km from the coast. Seagulls, which accompany fishing vessels in fishing grounds, are an exception to this rule, and their occurrence in the open sea is strongly dependent on human activity.

Species composition of birds sitting on water in the OWF Area (2 NM)

As part of the observation in the OWF Area (2 NM), a total of 19 species of birds staying on water were recorded, including 13 species related to the marine environment and 6 species of aquatic birds rarely encountered at sea away from the coast (Table 3.12, Figure 3.16).

Table 3.12. Abundance and percentage share in the group of individual species of birds sitting on water found in the OWF Area (2 NM) along the cruise route in the entire period from October 2018 to November 2019 [Source: data of Baltic Power Sp. z o.o.]

Species	Abundance of observed individuals	Share in the group [%]
Seabirds		
Long-tailed duck *Clangula hyemalis*	4237	76.1
European herring gull *Larus argentatus*	484	8.7
Common guillemot *Uria aalge*	417	7.5
Razorbill *Alca torda*	236	4.2
Velvet scoter *Melanitta fusca*	45	0.8
Great black-backed gull *Larus marinus*	14	0.3
Common scoter *Melanitta nigra*	11	0.2
Little gull *Hydrocoloeus minutus*	8	0.1
Black-throated diver *Gavia arctica*	8	0.1
Lesser black-backed gull *Larus fuscus*	7	0.1
Red-throated diver *Gavia stellata*	5	0.1
Black guillemot *Cepphus grylle*	2	+
Common eider *Somateria mollissima*	1	+
Waterbirds rarely encountered at sea away from the coast		
Common gull	7	0.1

Species	Abundance of observed individuals	Share in the group [%]
Larus canus		
Black-headed gull *Chroicocephalus ridibundus*	7	0.1
Great cormorant *Phalacrocorax carbo*	5	0.1
Eurasian coot *Fulica atra*	1	+
Arctic tern *Sterna paradisaea*	1	+
Greater white-fronted goose *Anser albifrons*	1	+
Birds undetermined as to the species		
Razorbill or common guillemot *Alca torda/Uria aalge*	59	1.1
Undetermined diver *Gavia* sp.	6	0.1
Undetermined goose *Anserinae*	3	0.1
Undetermined passerines *Passeriformes*	1	+
Total	5566	100

+ - percentage share less than 0.1%

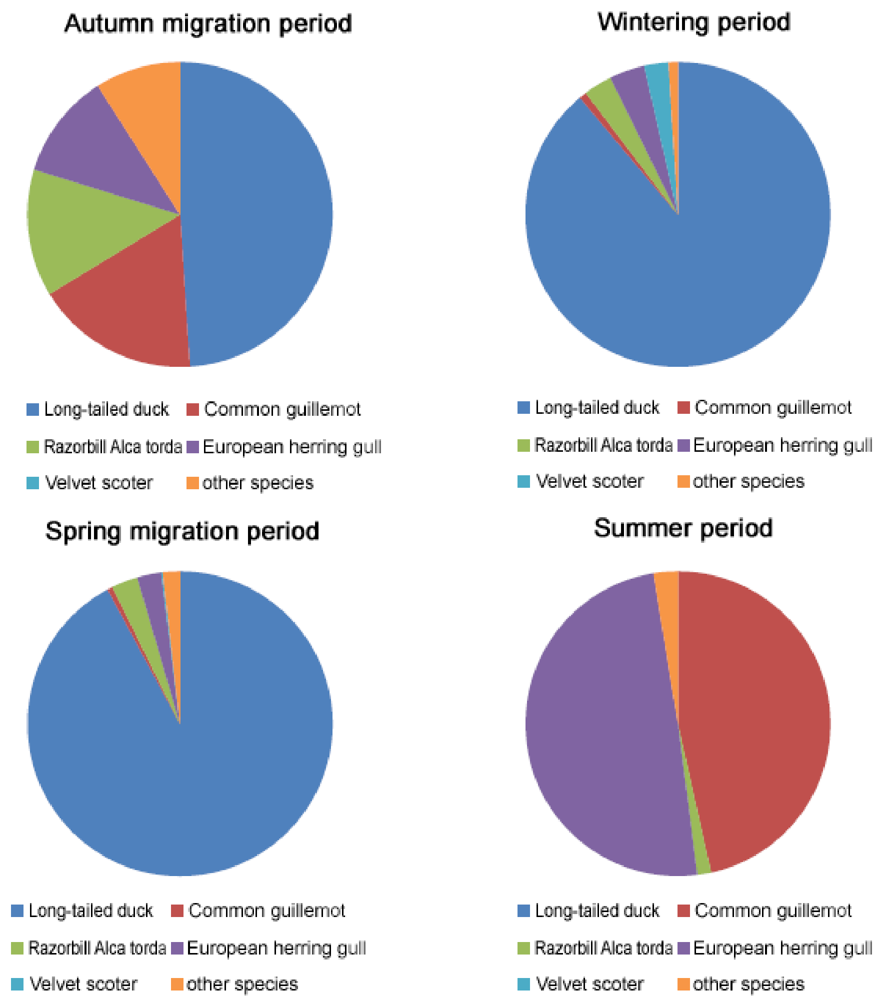


Figure 3.16. Share of dominant bird species sitting on water in the entire group of birds in the OWF Area (2 NM) in the entire period from October 2018 to November 2019 [Source: data of Baltic Power Sp. z o.o.]

In total, 5,566 seabirds staying along transects in the OWF Area (2 NM) were observed. The category "waterbirds rarely encountered at sea away from the coast" contains 6 species (common gull, black-headed gull, great cormorant, cradle, arctic tern, greater white-fronted goose). Most cases of failure to determine the species affiliation concerned razorbills and common guillemot, species very similar and difficult to distinguish from a greater distance. They feed mainly on pelagic fish and have similar habitat requirements [88] and react similarly to wind farms located in sea areas [87].

The species structure of seabird groups observed in the OWF Area (2 NM), with the domination of the long-tailed duck and a high share of the European herring gull (in the summer period) is typical for most of the water regions located in the Polish Baltic Sea zone far from the coast [78, 171, 170, 27].

The long-tailed duck in the OWF Area (2 NM) was the most numerous species, dominating in the period of autumn migration, wintering and in the period of spring migration. It is a species widely popular in the Baltic Sea, mainly concentrated in areas with moderate depths (up to 20–30 m) rich in zoobenthos, which is its food base. One of the most important wintering areas of this species in the Baltic Sea is the Natura 2000 site: the Słupsk Bank [116, 398]. The second most commonly observed species in the OWF Area (2 NM) was European herring gull (dominant species in summer), which is a species widely distributed in the Baltic Sea and is not a species with a high protection priority, covered by partial protection. Birds of this species penetrate the offshore area to seek food, mainly waste generated during fishing and fish treatment on fishing vessels [170, 171, 150, 151]. They therefore often accompany fishing vessels in fisheries far from the coast. Therefore, most of the observations of

European herring gulls during the survey concerned individuals flying over water.

The results of observation of avifauna covering four phenological periods showed that the OWF Area (2 NM) is not a place of very high concentration of seabirds in the period of their most numerous presence in the Baltic Sea (concentration maps included in Appendix No. 1 to the EIA Report). The most numerous species, i.e. the long-tailed duck, achieved density ranging from 0.1 individuals/km^{-2} in the period of fall migrations to 100 individuals/km^{-2} in the wintering period.

12 bird species under full species protection in Poland were found in the OWF Area (2 NM) (long-tailed duck, razorbill, common guillemot, velvet scoter, great black-backed gull, common scoter, little gull, red-throated loon, lesser black-backed gull, black-throated loon, black guillemot, common eider) and one species under partial protection (European herring gull). Three species of birds staying on water are listed in Annex I to the Birds Directive (little gull, red-throated loon and black-throated loon). One bird species (black guillemot) has SPEC 2 category and 4 species (velvet scoter, little gull, red-throated loon, black-throated loon) have SPEC 3 category. Three of the observed species (long-tailed duck, velvet scoter, common eider) have an increased category of VU (vulnerable) and the razorbill – NT (near threatened), according to the International Union for Conservation of Nature (IUCN) classification for the world, also used by HELCOM.

Detailed information on the results of seabird observations is included in Appendix No. 1 to the EIA Report.

Species composition of birds sitting on water in additional areas of significant importance for birds

As part of observation in additional areas of significant importance for birds: Słupsk Bank, part of the Coastal Waters of the Baltic Sea area and the Polish part of the South Central Bank area, in total 23 species of birds staying on water were recorded, including 15 species related to the marine environment and 8 species of waterbirds rarely encountered at sea away from the coast (Table 3.13). The category "waterbirds rarely encountered at sea away from the coast" contains 8 species (common gull, great cormorant, mute swan, great crested grebe, black-headed gull, Eurasian wigeon, greater white-fronted goose, red-breasted merganser).

Table 3.13. Abundance and percentage share in the group of individual species of birds sitting on water found in additional areas of significant importance for birds in the period from October 2018 to April 2019 and from October 2019 to November 2019. [Source: data of Baltic Power Sp. z o.o.]

Species	Abundance of observed individuals	Share in the group [%]
Seabirds		
Long-tailed duck *Clangula hyemalis*	82,278	66.3
Velvet scoter *Melanitta fusca*	36,853	29.7
European herring gull *Larus argentatus*	2273	1.8
Razorbill *Alca torda*	1274	1.0
Common scoter *Melanitta nigra*	409	0.3
Common guillemot *Uria aalge*	328	0.3
Black guillemot *Cepphus grylle*	80	0.1
Black-throated diver *Gavia arctica*	68	0.1
Great black-backed gull *Larus marinus*	55	+
Red-throated diver	29	+

Species	Abundance of observed individuals	Share in the group [%]
Gavia stellata		
Little gull *Hydrocoloeus minutus*	28	+
Lesser black-backed gull *Larus fuscus*	21	+
Horned grebe *Podiceps auritus*	5	+
Red-necked grebe *Podiceps grisegena*	5	+
Great skua *Catharacta skua*	2	+
Waterbirds rarely encountered at sea away from the coast	**94**	**+**
Birds undetermined as to the species	**308**	**0.2**
Total	124,110	100.0

+ - percentage share less than 0.1%

Detailed results of the survey of seabirds carried out in the Baltic Power OWF Area and in additional areas of significant importance for birds together with the analysis are included in Appendix No. 1 to the EIA Report.

Seabird species included in the impact assessment

The environmental impact assessment for the Baltic Power OWF includes birds that were present (seating on water and flying) along transects during the survey campaigns. The assessment does not take into account the results obtained from radar surveys, dealing in detail with the issue of avifauna migration. In the case of the European herring gull, which was present in the surveys carried out using both methods, the scope of assessment of potential impacts of the Baltic Power OWF is presented in the part concerning seabirds. The European herring gull is a species that accompanies fishing vessels in fishing grounds and its occurrence in the open sea is strongly dependent on human activity. The assessment took into account the most numerous species of seabirds whose share in the number of the entire group of observed birds in the OWF Area (2 NM) reached 1% in at least one phenological period or which are subject to protection of the nearest Natura 2000 sites.

Therefore, a total of 7 bird species were taken into account. The condition for share of at least 1% in the number of the entire group was met by: long-tailed duck, velvet scoter, razorbill, common guillemot and European herring gull. Species that do not meet the above condition, but are subject to protection in the nearest Natura 2000 sites are: black guillemot and common scoter. The black guillemot is subject to protection in the Natura 2000 sites: the Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002), but its abundance in the OWF Area (2 NM) was very low. In total, only one specimen was recorded during winter survey campaigns. However, the common scoter is subject to protection in the Natura 2000 site: Coastal Waters of the Baltic Sea (PLB990002), but its population in winter in this area was very low and amounted to 19 individuals found along the survey cruise route, and it was not found in the OWF Area (2 NM). In view of the above, the black guillemot and the common scoter were included in the assessment only in the context of the Baltic Power OWF impact on Natura 2000 sites (sub-chapter 6.3).

3.7.1.7 Bats

Surveys aimed at determining the impact of wind farms on bats were started at the end of the last century and were carried out on the occasion of surveys of the impact of such projects on avifauna. Numerous publications indicate that the number of dead bats sometimes exceeded the number of dead birds within onshore wind farms located in the vicinity of forest areas, but also in exposed areas [19]. Bat collisions were also recorded on wind farms located in maritime areas [4, 2, 192]. Based on surveys performed in onshore areas, it was found that 20 species of European bats die as a result of collisions with wind turbines, and 21 species are potentially vulnerable. Most of these species are migratory and using open spaces [461, 372, 165].

Comparable mortality rates for the OWT are not available as mortality at sea cannot be estimated using conventional monitoring methods. However, it is assumed that for migratory bats the risk of collision with the OWT may be increased, especially during migration periods [370].

Currently, there is little available data on bat activity on coasts and at sea. However, marine-related habitats may be of particular importance for long-distance migratory bats [82].

Ringing and direct observations showed that many species of bats from Scandinavia and North-East Europe migrate seasonally to Central Europe. For some bat species, such as common noctule (*Nyctalus noctula*), Nathusius' pipistrelle (*Pipistrellus nathusii*), parti-colored bat (*Vespertilio murinus*) and lesser noctule (*Nyctalus leisleri*), it was observed that long distances of 1,500 to 2,000 km were covered during the season [198]. Long-distance migratory flights were also detected by measuring persistent isotopes for the common noctule, especially in northern Europe [258]. These species migrating over long distances also migrate through the Baltic Sea in spring and autumn [396].

Many surveys on bat migration were carried out in Scandinavia and indicate that sudden increases in bat activity during the autumn migration season occur along the southern coast of Sweden and indicate the commencement of seasonal migrations (in small groups or individually) towards wintering grounds located in Central and Western Europe [2]. High activity of Nathusius' pipistrelle during the migration period was recorded, for example, on the west coast of Finland [204]. It is assumed that bats start migrating through the Baltic Sea from the summer hiding places in the northern part of Europe, in the south-south-west direction. Over the maritime area, bat migrations are dispersed, which makes it impossible to determine bat migration corridors [392]. Additionally, it is assumed that bats migrate along characteristic landscape elements, such as e.g. coasts. Therefore, the entire coastline of the Baltic Sea as well as the islands are of great importance for bat migration [382].

There are no binding legal regulations in Poland concerning the methodology for surveys of bats in the context of offshore wind farms. Therefore, bat activity surveys in the Baltic Power OWF Area were based on the “Guidelines for the assessment of the impact of wind turbines on bats” [224] project and on the Annex to Resolution 7.5 of the Agreement on the Conservation of Populations of European Bats (EUROBATS) [370]. Following the above-mentioned guidelines, the surveys of bats’ activity in the Baltic Power OWF area were based on the same principles as the onshore monitoring of bats. However, all checks were carried out throughout the night and the surveys themselves were limited to periods of expected seasonal migrations – in spring and fall.

The surveys of bats’ activity in the OWF Area (2 NM) were conducted from April to May 2019 (the spring migration) and from August to October 2019 (the fall migration). Acoustic signals were recorded during a vessel trip along designated transects with a total length of approx. 55 km and at two research (listening) stations. The recordings at the stations were made from the deck of an anchored vessel. In case of vessel traffic in the vicinity of the research station, it was allowed, for safety reasons, to keep the position while drifting and maneuvering with the vessel's propulsion. In total 14 survey campaigns were carried out – 6 in the period of the spring migration and 8 during the fall migration. Moreover, as part of the fall migration, the campaigns in September started 3 hours before sunset in order to identify the migration of the common noctule.

In the spring and fall migration periods, 11 and 72 audio files were recorded, respectively, which included sequences of signals characteristic of bats. The sequences of bat signals were assigned to three bat species (Nathusius’ pipistrelle, soprano pipistrelle and common noctule). Additionally, as it was impossible to assign them to a specific species, some of the signals were classified into the *Nyctaloid* group (including individuals from three genera: *Nyctalus spp., Vespertilio spp. and Eptesicus spp.* with similar sonograms which could not be attributed definitely to one of the species).

The most numerous bat species was Nathusius' Pipistrelle. Its activity for the entire survey period was low, despite the fact that a single high activity was recorded in August. It resulted from a large number of recorded bat signal sequences in a short period of time (45 minutes of recordings during one night of surveying). Due to a one-off nature of the observed phenomenon and a short recording time, the increased activity was probably caused by bats feeding in the vicinity of the survey vessel. The feeding process could be caused by the phenomenon of attracting insects by the lighting of the survey vessel from which the activity monitoring was performed. The second most numerous bat species was soprano pipistrelle, however its activity was also low. The least numerous species in the OWF Area (2 NM) was common noctule. Only two sequences of signals characteristic of this species were recorded and they also indicate its low activity. The table (Table 3.14) presents the recorded activity indices for the identified groups broken down by migration seasons.

Table 3.14. Average activity index for the entire season of spring and autumn migration broken down by individual groups of bats, including the assignment of activity categories [Source: data of Baltic Power Sp. z o.o.]

Species group	Spring migration		Autumn migration	
	Average index [n h^{-1}][2]	Activity category[3]	Average index [n h^{-1}][2]	Activity category[3]
Pipistrellus spp.	0.3	A	0.6	A
Nyctalus spp.	0.1	A	<0.1	A
Nyctaloid[1]	0.0	A	0.1	A
All bats	0.4	A	0.7	A

[1]Includes signal sequences classified in a group of genera (Nyctalus + Eptesicus + Vespertilio spp.) which cannot be assigned to a specific species
[2]Average bat activity index calculated on the basis of the arithmetic mean of the indices from the individual controls and after discarding the lowest value obtained during the period
[3]A – low activity category

During the entire survey period, the activity of three bat species (Nathusius' pipistrelle, soprano pipistrelle and common noctule) was recorded quite regularly. Two of these species, the Nathusius' pipistrelle and the common noctule, belong to species migrating over long distances. They are present in almost all parts of Europe. They use summer hiding places in the north-eastern part of Europe and hibernation takes place in the south-western parts of the continent. Changes in bat behavior due to climate change have been increasingly observed in recent years [45, 393]. As a result of climate warming, the range of presence of bats is changing, and consequently bats may shorten or cease seasonal migrations.

The Nathusius' pipistrelle is known for long-distance migration reaching up to 1,900 km between summer and winter habitats, also crossing the Baltic Sea on its route [2]. The same applies to the common noctule which migrates at a distance of approx. 1,600 km and which was also observed to fly over the Baltic Sea [224, 2]. Unlike the two aforementioned species, the soprano Ppipistrelle is not classified as a migratory species. However, it was recorded in the areas of offshore wind farms [2].

The statistics for both Nathusius' pipistrelle and common noctule demonstrate a very high risk of mortality related to wind turbines. The high risk of mortality is based on the specific behavior of these two species when they fly. Nathusius' pipistrelle and the common noctule use open areas as feeding grounds – they fly fast and high, with little agility. Compared to other bat species according to Kepel et al. [224], common noctule is a species most vulnerable to death as a result of collisions with wind turbines in Europe. These data refer to onshore wind farms. So far, similar surveys have not been carried out in regard to the OWF. Nathusius' pipistrelle is the second most vulnerable species in this context [224]. However, Nathusius' pipistrelle was the most frequently observed species among the 7 species that die due to collisions with wind turbines in Poland, according to the data from 2007–2011 collected by Gottfried et al [165].

Unlike the Nathusius' pipistrelle and the common noctule, the soprano pipistrelle hunts at lower altitudes, flying not very quickly, but quite agilely. Therefore, the risk of mortality of the soprano pipistrelle resulting from collisions with the wind turbine is relatively low. However, according to Kepel et al. [224] it is still a high risk of mortality.

Table (Table 3.15) shows the expected risk of mortality on onshore wind farms according to Kepel et al. [224] for those species that were recorded during surveys carried out in the Baltic Power OWF Area. The species collected under the group name of Nyctaloid are also listed in the table.

Table 3.15. Registered bat species and risk of their mortality on wind farms [224]

Species	Protection status (IUCN Red Book)*	Mortality recorded in Europe**	Risk of death on wind farms
Common noctule *Nyctalus noctula*	LC	+++	Very high
Lesser noctule *Nyctalus leiseri*	LC	+++	Very high
Greater noctule bat *Nyctalus lasiopterus*	VC	++	Very high
Northern bat *Eptesicus nilssonii*	LC	++	Moderate
Serotine bat *Eptesicus serotinus*	LC	+++	Moderate
Parti-colored bat *Vespertilio murinus*	LC	++	Moderate
Nathusius' pipistrelle *Pipistrellus nathusii*	LC	+++	Very high
Soprano pipistrelle *Pipistrellus pygmaeus*	LC	+++	High

**IUCN Red Book categories [206]: VU – vulnerable, LC – least concern*

***Mortality recorded on onshore wind farms in Europe: + – single, ++ – regular, +++ – very numerous*

Activity indicators for various species calculated for the entire spring migration period and autumn migration period respectively indicate a low activity of bats. Bats migrate through the Baltic Power OWF Area, but migration intensity is low, similarly to the migration over other surveyed areas of the southern Baltic Sea [171, 170, 27].

3.7.2 Protected areas including Natura 2000 sites

The Baltic Power OWF Area is located outside the protected areas indicated in the Act of April 16, 2004 *on nature conservation* (consolidated text, Journal of Laws of 2022, item 916, as amended), including the European ecological network Natura 2000.

In relation to the Baltic Power OWF area, the closest are two marine protected Natura 2000 sites located on the Polish maritime areas:

- Coastal Waters of the Baltic Sea (PLB990002);
- Słupsk Bank (PLC990001).

There is the onshore and offshore Słowińska Refuge Natura 2000 site (PLH220023) and the onshore Słowińskie Coast area (PLB220003) located at a distance of more than 20 km from the Baltic Power OWF Area.

At the distance of more than 55 km from the Baltic Power OWF Area, there is the Hoburgs bank och Midsjöbankarna (SE0330308) Swedish Natura 2000 site (Figure 3.17). In the area of Słowińska Refuge (PLH220023), there is the main complex of the Słowiński National Park, including its section located in the maritime areas.

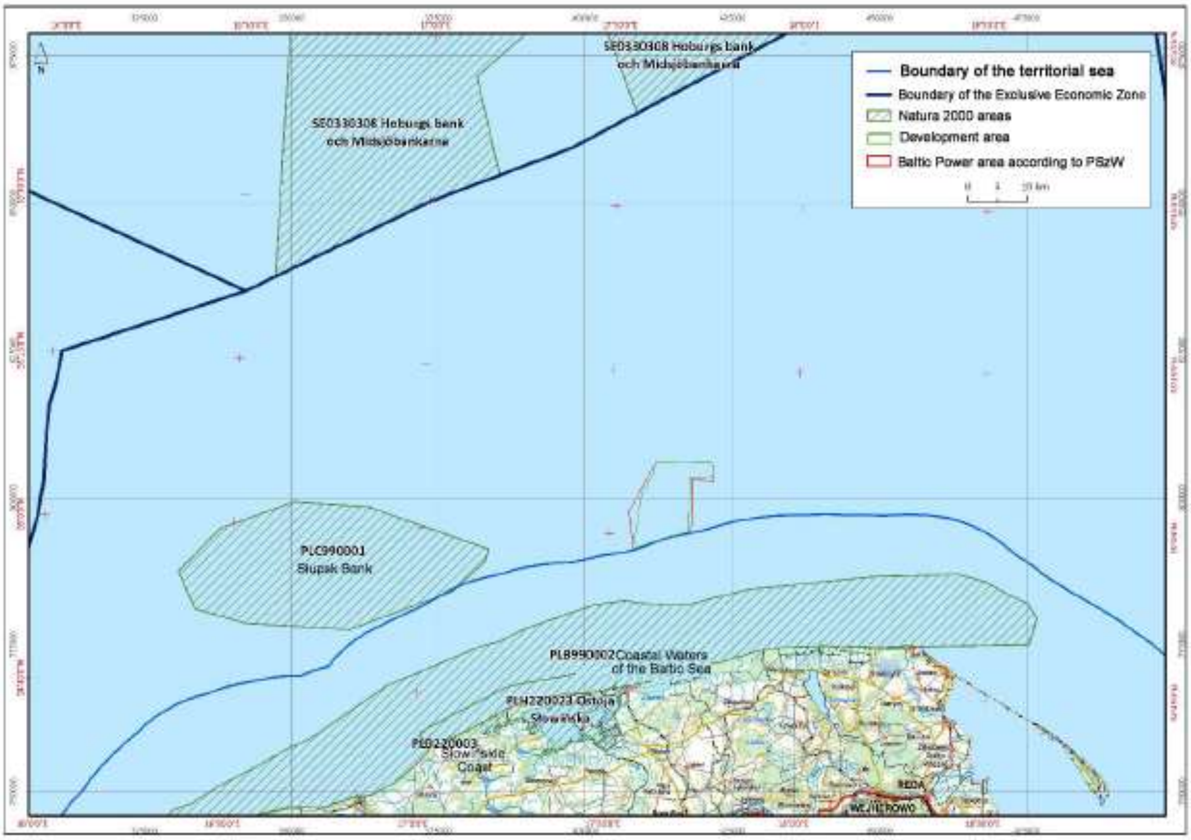


Figure 3.17. Location of the areas of the European ecological network Natura 2000 and the Baltic Power OWF area [Source: own study]

Coastal Waters of the Baltic Sea Area (PLB990002)

The nearest protected area in relation to the Baltic Power OWF area is the Coastal Waters of the Baltic Sea area (PLB990002). The distance between these areas is almost 9 km (taking into account the closest points of both areas). The Coastal Waters of the Baltic Sea area (PLB990002) includes a strip of coastal waters of the southern Baltic Sea with a depth from 0 to 20 m and a length of approx. 200 km, starting at the base of the Hel Peninsula and finishing at the Pomeranian Bay. The seabed is uneven here with the leveling of up to 3 m. Benthic fauna is dominated by small crustaceans. Two bird species from Annex I to the Birds Directive: black-throated loon and red-throated loon spend winter in this site. In winter, more than 1% of the population of the long-tailed duck migration trail and at least 1% of the population of the black guillemot and velvet scoter migration trail are present here. Of the species included in the assessment of the impact of the Baltic Power OWF on seabirds in the Coastal Waters of the Baltic Sea site (PLB990002), the wintering populations of the long-tailed duck, the velvet scoter, the razorbill and the European herring gull are protected. It is estimated that 90–120,000 individuals of the long-tailed duck, 14–20,000 individuals of the velvet scoter, and 8–15,000 individuals of the European herring gull winter in the area [292]. On the other hand, the population size of the wintering razorbill in that water region is estimated at 500 to 1,000 individuals [159]. In the Coastal Waters of the Baltic Sea area (PLB990002), the wintering and migratory populations of the common scoter and the wintering population of the black guillemot are also protected (Table 3.16). There is no protection plan for this area.

During transect surveys in the section of the Coastal Waters of the Baltic Sea area (PLC990002) carried out for purpose of the EIA Report, only a few specimens of common scoter sitting on water along the route of the survey cruise were found. On the other hand, numerous individuals of the common scoter flew through the area where the surveys were carried out. Therefore, the assessment of the impact of the Baltic Power OWF on the common scoter is included in the part concerning migratory birds. The number of black guillemot specimens in the surveyed water region was low and did not exceed the value of 1% of the bird group.

Table 3.16. Basic information on seabirds in the Coastal Waters of the Baltic Sea area (PLB990002) [Source: own study based on: Coastal Waters of the Baltic Sea SDF (2020)]

Species	**Population type**	**Site assessment for the population***	**Size of population in the area [number of individuals]**		**Percentage share of migration route population [%]**
			minimum	**maximum**	
Black-throated diver *Gavia arctica*	Wintering	D	200	500	Below 1
Red-throated diver *Gavia stellata*	Wintering	D	100	500	Below 1
European herring gull *Larus argentatus*	Wintering	C	8000	15,000	Below 1
Common gull *Larus canus*	Wintering	D	1000	1000	Below 1
Black guillemot *Cepphus grylle*	Wintering	B	1500	1500	At least 1
Razorbill *Alca torda*	Wintering	C	500	1000	Below 1
Long-tailed duck *Clangula hyemalis*	Wintering	B	90,000**	120,000**	Above 1
Velvet scoter *Melanitta fusca*	Wintering	C	14,000**	20,000**	At least 1
Common scoter *Melanitta nigra*	Wintering	C	5000	8000	Below 1
	Migratory	C	3000	3000	Below 1

**Estimation of the size of the population of a given species and its density in relation to the national population; class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

***The SDF form incorrectly stated the population size. The values cited here are from BirdLife International (http://www.birdlife.org/datazone/sitefactsheet.php?id=9563; accessed 16-06-2017) containing the data provided for the SDF.*

Słupsk Bank Area (PLC990001)

The boundary of the Baltic Power DA is located at a distance of at least 25 km from the Słupsk Bank area (PLC990001) designated under the Birds Directive and the Habitats Directive.

The Słupsk Bank area (PLC990001) covers the undersea bank with a significantly shallow seabed in relation to the surrounding areas. Its boundary corresponds roughly to the course of the 20 m isobath. It is an area with a considerably differentiated sea bed, with many hills and depressions. Shallow waters are inhabited by numerous invertebrates, at the same time constituting a food base for seabirds staying there, in particular during their wintering period.

The predominant plants are macroalgae, including, among others, red algae: Furcellaria (*Furcellaria lumbricalis*), Ceramium (*Ceramium diaphanum*), pipefish (*Polysiphonia fucoides*) [250]. Two bird species from Annex I to the Birds Directive: the black-throated diver and the red-throated diver winter in the area. In winter, at least 1% of the population of the migration route of the long-tailed duck and the black guillemot is present here. Seabirds occur in abundances exceeding 20,000 individuals.

Within the boundaries of the Słupsk Bank Natura 2000 area (PLC990001) there are three bird species subject to protection of this area (Table 3.17):

- black guillemot;

- long-tailed duck;
- velvet scoter,

and two natural habitats being the objects of protection of this area (Table 3.18):

- Sandy submarine banks (1110)
- Reefs (1170).

Table 3.17. Basic information on seabirds and marine mammals in the Słupsk Bank area (PLC990001) [Source: own study based on the Słupsk Bank SDF (2021)]

Species	**Population type**	**Site assessment for the population***	**Size of population in the area [number of individuals]**		**Percentage share of migration route population [%]**
			minimum	**maximum**	
Black guillemot *Cepphus grylle*	Wintering	C	98	556	At least 1
	Migratory		72	461	
Long-tailed duck *Clangula hyemalis*	Wintering	B	101,148	231,180	At least 1
	Migratory		76,440	214,374	
Black-throated diver *Gavia arctica*	Wintering	D	93	173	Below 1
Red-throated diver *Gavia stellata*	Wintering	D	28	66	Below 1
Velvet scoter *Melanitta fusca*	Wintering	C	910	1789	At least 1%
	Migratory	B	5565	23,611	
Harbor porpoise *Phocoena phocoena*	Migratory	D	-	-	-

**Class intervals: A: 100 ≥ p > 15%, B: 15 > p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

The long-tailed duck was the most numerous bird species observed during transect surveys in 2018–2019 and was, unlike the very rare black guillemot, taken into account in the assessment of the Baltic Power OWF impact on seabirds. During the surveys for the purposes of the EIA Report for the Bałtyk III OWF project, the average population size of long-tailed ducks wintering in the Słupsk Bank area was estimated at approx. 120 thousand. According to the literature data (surveys carried out in 2012–2014), up to 2,850 specimens of the black guillemot were observed in this area during winter [171].

Detailed information on the ornithofauna of the Słupsk Bank area and the OWF area (2 NM), including the presentation and discussion of the results of surveys of aquatic and migratory birds carried out for the purposes of the EIA Report, are included in Appendix No. 1 to the EIA Report.

The submarine sandbeds habitat (1110) (Table 3.18) in the Słupsk Bank area (PLC990001) is one of three such sites present in the Polish maritime areas. The conventional boundary of the habitat is the 20 m isobath [129]. In the Słupsk Bank, the sediment is mainly sandy and gravel with stones occurring in an island manner and glacial boulders.

The reef habitat (1170) (Table 3.18) – reefs located in the north-western part of the Słupsk Bank. It is a unique area in the southern part of the Baltic Sea due to the nature of its geological formation and the type of the rock bed [240, 244, 243]. This is the only place, identified so far in the Polish maritime areas, located far from the shore, with numerous macroalgae growing on the rocky seabed [322, 12].

Table 3.18. Basic information on natural habitats existing in the Słupsk Bank area (PLC990001) [Source: own study based on the Słupsk Bank SDF (2021)]

Habitat code	Habitat name	Coverage [ha]	Representativity[1]	Relative area[2]	Conservation status[3]	Overall assessment[4]
1110	Sandy submarine banks	30,926.7	A	A	A	A
1170	Reefs	14,331.6	A	A	A	A

[1] The ranking system for the assessment of the representativity: A: excellent representativity, B: good representativity, C: significant representativity, D: non-significant representativity

[2]Class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%

[3] Ranking system for the assessment of the degree of conservation: A – excellent, B – well conserved, C – average or partially degraded

[4] The ranking system for the global assessment: A – excellent, B – good, C – significant

Słowińska Refuge area (PLH220023)

Unlike the two previously discussed protected areas, the Słowińska Refuge (PLH220023) is an onshore and offshore area. Its offshore border is located at a distance of approx. 21 km from the Baltic Power OWF Area. The offshore part of the Słowińska Refuge area (PLH220023) includes a strip of coastal waters with a width of approx. 2 NM within the boundaries of the Słowiński National Park. The offshore area of the Słowińska Refuge (PLH220023) is a habitat of two species of marine mammals and five species of fish and lampreys related to the marine environment (Table 3.19). In the western part of the site, there is a rocky seabed area that is a natural habitat – reefs (1170) (Table 3.20).

Table 3.19. Basic information on marine mammal, fish and lamprey species related to the marine environment in the Słowińska Refuge area (PLH220023) [Source: own study based on: Słowińska Refuge SDF (2021)]

Species	Population type	Area assessment			
		Population[1]	Conservation status[2]	Isolation[3]	General [4]
Gray seal *Halichoerus grypus*	Migratory	C	B	B	B
Harbor porpoise *Phocoena phocoena*	Migratory	B	B	B	B
Twait shad *Alosa fallax*	Migratory	C	B	C	C
European river lamprey *Lampetra fluviatilis*	Migratory	B	B	C	B
Sichel *Pelecus cultratus*	Settled	C	B	C	C
Sea lamprey *Petromyzon marinus*	Migratory	C	B	C	B
Salmon *Salmo salar*	Migratory	D	-	-	-

[1]Estimation of the size of the population of a given species and its density in relation to the national population; class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)

[2] Ranking system for the assessment of the degree of conservation: A - excellent conservation status; B - good conservation status; C - medium or degraded conservation status

[3] The ranking system for assessment: A – (almost) isolated population; B – non-isolated population, but present on the periphery of the species range; C – non-isolated population within a wide area of occurrence

[4] The ranking system for the global assessment: A – excellent, B – good, C – significant.

Table 3.20. Basic information on natural habitats present in the offshore part of the Słowińska Refuge area (PLH220023)

[Source: own study based on: Słowińska Refuge SDF (2021)]

Habitat code	Habitat name	Coverage [ha]	Representativity[1]	Relative area[2]	Conservation status[3]	Overall assessment[4]
1170	Reefs	402.06	B	C	A	B

[1] The ranking system for the assessment of the representativity: A: excellent representativity, B: good representativity, C: significant representativity, D: non-significant representativity

[2]Class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%

[3] Ranking system for the assessment of the degree of conservation: A: excellent, B: well conserved, C: average or partially degraded

[4] The ranking system for the global assessment: A: excellent, B: good, C: significant

Słowińskie Coast area PLB220003

Onshore area of 21,819.43 ha, with morphological forms found in the Gardnieńsko-Łebska Spit, including unique coastal barchans and the two largest brackish water lakes, Łebsko and Gardno, together with adjacent meadows, peatlands, forests and coniferous forests. In the area of Słowińskie Coast (PLB220003), entered in the list of Ramsar Convention sites, there are at least 28 bird species listed in Annex I to the Birds Directive, but mostly related to terrestrial habitats (Table 3.21). At least 1% of the population of the migratory route of three species of water birds is found here during the migration period: smew, bean goose and common merganser. There is a relatively high abundance of great cormorants, greater white-fronted goose and Eurasian wigeon. A large population of the European herring gull also nests here. The subjects of protection of this site are the migratory populations of the greater white-fronted goose, the bean goose, the pochard, the common merganser and the cormorant, as well as the breeding population of the European herring gull. Of those species, only the European herring gull is included in Baltic Power OWF seabird impact assessment. According to the site standard data form, that population is 400 individuals of the European herring gull (less than 1% of the share in the migratory route population).

Table 3.21. Basic information on seabirds in the Słowińskie Coast (PLB220003) [Source: own study based on: Słowińskie Coast SDF (2021)]

Species	Population type	Site assessment for the population*	Size of population in the area [number of individuals]	
			minimum	maximum
Boreal owl *Aegolius funereus*	Settled	D	1	1
Eurasian wigeon *Anas penelope*	Migratory	D	1	3000
Mallard duck *Anas platyrhynchos*	Migratory	D	1	6500
Greater white-fronted goose *Anser albifrons*	Migratory	C	1000	6200
Grain goose *sensu lato* *Anser fabalis*	Migratory	A	3200	4500
Golden eagle *Aquila chrysaetos*	Producing offspring	B	1	1
Lesser spotted eagle *Aquila pomarina*	Producing offspring	D	1	1
Short-eared owl *Asio flammeus*	Migratory	D	1	2
Common pochard *Aythya ferina*	Migratory	C	1	1500

Species	Population type	Site assessment for the population*	Size of population in the area [number of individuals]	
			minimum	maximum
Eurasian bittern *Botaurus stellaris*	Producing offspring	D	2	4
Eagle owl *Bubo bubo*	Settled	B	5	5
Dunlin *Calidris alpine*	Producing offspring	D	-	-
	Migratory		140	140
European nightjar *Caprimulgus europaeus*	Producing offspring	D	30	30
Common ringed plover *Charadrius hiaticula*	Producing offspring	C	10	10
White stork *Ciconia ciconia*	Producing offspring	D	15	25
Black stork *Ciconia nigra*	Producing offspring	D	1	1
Western marsh-harrier *Circus aeruginosus*	Producing offspring	D	7	9
Hen harrier *Circus cyaneus*	Producing offspring	D	-	-
Montagu's harrier *Circus pygargus*	Producing offspring	D	4	5
Corncrake *Crex crex*	Producing offspring	C	200	250
Whopper swan *Cygnus cygnus*	Migratory	B	560	560
Common crane *Grus grus*	Migratory	C	7000	7000
White-tailed eagle *Haliaeetus albicilla*	Producing offspring	D	4	4
	Migratory		10	30
European herring gull *Larus argentatus*	Producing offspring	B	400	400
Lesser black-backed gull *Larus fuscus*	Producing offspring	D	2	2
Smew *Mergus albellus*	Migratory	B	1700	1700
Common merganser *Mergus merganser*	Migratory	C	1	2100
Black kite *Milvus migrans*	Producing offspring	D	1	1
Red kite *Milvus milvus*	Producing offspring	C	7	8
Western osprey *Pandion haliaetus*	Producing offspring	D	1	1

Species	Population type	Site assessment for the population*	Size of population in the area [number of individuals]	
			minimum	maximum
Honey buzzard *Pernis apivorus*	Producing offspring	D	1	1
Great cormorant *Phalacrocorax carbo sinensis*	Producing offspring	C	200	200
Ruff *Philomachus pugnax*	Migratory	D	380	380
Spotted crake *Porzana porzana*	Producing offspring	D	1	4
Little tern *Sterna albifrons*	Producing offspring	D	1	3
Common tern *Sterna hirundo*	Producing offspring	D	1	15

**Estimation of the size of the population of a given species and its density in relation to the national population; class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

Słowiński National Park

The Słowiński National Park is one of two onshore and offshore national parks in Poland. Its area is 32,744 ha. The main object of protection of this park is the Łebska Spit, which forms a complex of unique geomorphological forms and places where natural processes of seashore alteration take place. There are also valuable forest, non-forest communities and aquatic ecosystems in the park, including the two largest coastal lakes – Gardno and Łebsko – and the coastal sea area with a width of 2 NM.

Hoburgs bank och Midsjöbankarna (SE0330308)

The area of Hoburgs bank och Midsjöbankarna (SE0330308) is about 56 km away from the Baltic Power OWF development area. Hoburgs bank och Midsjöbankarna (SE0330308) covers the area of the central Baltic Sea, is located in Swedish maritime areas, south of Öland and Gotland. Within its boundaries, there are two natural habitats subject to protection: Sandy submarine banks (1110) and reefs (1170) (Table 3.22). In the Hoburgs bank och Midsjöbankarna area (SE0330308), populations of three bird species are protected: black guillemot, long-tailed duck and common eider (Table 3.23) and the population of porpoise present there (Table 3.24).

Table 3.22. Basic information on natural habitats found in the offshore part of the Hoburgs bank och Midsjöbankarna area (SE0330308) [Source: http://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=SE0330308]

Habitat code	Habitat name	Coverage [ha]	Representativity[1]	Relative area[2]	Conservation status[3]	Overall assessment[4]
1110	Sandy submarine banks	220,000	B	B	B	B
1170	Reefs	20,000	B	C	B	B

[1] The ranking system for the assessment of the representativity: A: excellent representativity, B: good representativity, C: significant representativity, D: non-significant representativity

[2]Class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%

[3] Ranking system for the assessment of the degree of conservation: A – excellent, B – well conserved, C – average or partially degraded

[4] The ranking system for the global assessment: A – excellent, B – good, C – significant

Table 3.23. Basic information on seabirds in the Hoburgs bank och Midsjöbankarna area (SE0330308) [Source: own study based on: http://natura2000.eea.europa.eu/Natura2000 /SDF.aspx?site=SE0330308]

Species	Population type	Site assessment	Size of the population in the site

		for the population*	minimum	maximum
Black guillemot *Cepphus grylle*	Wintering	C	1000	5000
Long-tailed duck *Clangula hyemalis*	Wintering	A	200,000	1,000,000
Common eider *Somateria mollissima*	Moving	C	5000	50,000

**Estimation of the size of the population of a given species and its density in relation to the national population; class intervals: A: 100 ≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)*

Table 3.24. Basic information on marine mammal species related to the marine environment in the Hoburgs bank och Midsjobankarna area (SE0330308) [Source: http://natura2000.eea. europa.eu/Natura2000/SDF.aspx?site=SE0330308]

Species	Population type	Area assessment			
		Population [1]	Conservation status[2]	Insulation [3]	General [4]
Harbor porpoise *Phocoena phocoena*	Permanent	A	C	B	A

[1]Estimation of the size of the population of a given species and its density in relation to the national population; class intervals: A: 100
≥ p > 15%, B: 15 ≥ p > 2%, C: 2 ≥ p > 0%; site assessment for the population D (the species is not subject to protection in the area)
[2] Ranking system for the assessment of the degree of conservation: A - excellent conservation status; B - good conservation status; C - medium or degraded conservation status
[3] The ranking system for isolation assessment: A – (almost) isolated population; B – non-isolated population, but present on the periphery of the species range; C – non-isolated population within a wide area of occurrence
[4] The ranking system for the global assessment: A – excellent, B – good, C – significant.

3.7.3 Wildlife corridors

The wildlife corridor, in accordance with the Act of April 16, 2004 *on nature conservation*, is an area allowing for migration of plants, animals or fungi. The network of wildlife corridors connecting the European Nature Protection Network Natura 2000 in Poland was established in 2011 [212], however, wildlife corridors were not identified in the Polish maritime areas. Krost et al. [249] indicate the need to designate ecological corridors for benthic organisms. However, it is a relatively poorly identified issue. There are also no relevant studies in this respect concerning the southern Baltic Sea.

According to the general classification of the migration system of wetland birds in Eurasia, Poland with its maritime areas is located within two large migration corridors: East Atlantic and Mediterranean – Black Sea corridors. The migration strategy and migration corridors of seabirds in the Baltic Sea area are very poorly understood. In summer, in July and August, sea ducks (mainly male common scoters) are observed flying from the Gulf of Finland toward the moulting areas located in the Danish Straits. They are accompanied by common eiders (*Somateria mollissima*) and velvet scoters, but the abundance of both species is much lower than that of common scoters. Those birds only on an exception basis stop in water regions in the southern Baltic Sea. The autumn migration period of seabirds extends over a very long time. Already in August, a number of waterbird species can be found within Polish marine areas. Some of them only fly through and do not stay for winter (e.g. terns of the *Sterna* and *Chlidonias* genera), while others are observed throughout their migration and wintering period (sea ducks, razorbills, loons, grebes). In spring, large flocks of sea ducks (long-tailed ducks, velvet scoters, common scoters) are observed, which, while moving towards breeding sites, stop in the Polish Baltic Sea zone [395].

Also, for marine mammals found in the southern Baltic Sea, no areas can be identified that can meet the criteria for ecological corridors. Both seals and porpoises go after food, without preferring specific routes.

3.7.4 Biodiversity

3.7.4.1 Phytobenthos

No phytobenthos is found in the Baltic Power OWF Area.

3.7.4.2 Macrozoobenthos

25 macrozoobenthos taxons belonging to 6 groups were found in the OWF area (1 NM) on the soft seabed (sandy sediment, gravel): follicles (Hydrozoa), polychaetes (Polychaeta), Hexanauplia, carnivores (Malacostraca), bivalve molluscs (Bivalvia), cyanobacteria (Gymnolaemata), one sub-group of oligochaetes (Oligochaeta) and a group of priapulides (Priapulida). Among this diversified benthic macrofauna, the group of absolutely constant species includes: polychaetes (*Marenzelleria* sp. and *Pygospio elegans*) and characterized by a wide range of tolerance to environmental factors of the clams Baltic macoma (*Limecola balthica*), antinella (*Bylgides sarsi*) and *Monoporeia affinis.* The biggest share in the dominant structure in the number of macrozoobenthos of the soft seabed of the OWF area (1 NM) was polychaetes (*Pygospio elegans*), and in biomass – Baltic macoma (*Limecola balthica*). 16 taxons of invertebrate macrofauna belonging to 6 groups were recorded on the hard seabed (boulders, stones): follicles (Hydrozoa), polychaetes (Polychaeta), Hexanauplia, carnivores (Malacostraca), bivalve molluscs (Bivalvia), cyanobacteria (Gymnolaemata) and one sub-group of oligochaetes (Oligochaeta). The bay mussel (*Mytilus* sp.) dominated the structure of the population and biomass of macrozoobenthos inhabiting the hard seabed.

The taxons found are typical and common representatives of invertebrate macrofauna in open waters of the southern Baltic Sea. Compared to the results of macrozoobenthos surveys in the areas of the adjacent investment projects: Bałtyk III OWF [171], Bałtyk II OWF [170] and Baltica OWF [27] (sub-chapter 3.7.1.2), the results of the quality structure of the macrozoobenthos association of the Baltic Power OWF Area are similar, characteristic for a shallow and medium deep seabed (up to 50 m below sea level) of the Eastern Gotland Basin, not distinguishable in terms of composition features and taxonomic diversity.

3.7.4.3 Ichthyofauna

The analysis of the results of fishing and fishing capacity of the set of fish living within the Baltic Power OWF shows that the area is typical for the southern Baltic Sea in terms of species diversity, with a clear predominance of codfish and European flounder in bottom fisheries and herring and sprat in pelagic fisheries.

In total, 144 fish species were recorded in the Baltic Sea, including 97 marine species, 7 migratory species and 40 freshwater species [428]. The predominant fish species in deeper waters of the western Baltic Sea are: for bottom dwellers – codfish and European flounder, and in the scope of the pelagic lifestyle – herring and sprat [15, 232, 485, 199].

According to the Chief Inspectorate of Environmental Protection (GIOŚ) [251], maximum 44 fish species live in the open sea area, taking into account temporarily appearing species, found in coastal and transitional waters.

During surveys in the OWF area (1 NM), a total of 22 fish species were recorded. In the case of ichthyoplankton, spawn of two fish species and larvae belonging to 11 taxons were caught. In the total number of larvae, sprat (92.1% of the total number of larvae of all species), gobies (4.5%) and European flounder (1.6%) were by far the most important during the entire survey period. Larvae of the remaining 8 species (from 0.9 to 0.05%), such as common seasnail, herring, sandeel, fourbeard rockling, shorthorn sculpin, longspined bullhead, rock gunnel, plaice, were significantly less numerous. During pelagic fisheries, 9 fish species were caught, of which 99% were sprat and herring. Individual specimens of garfish, three-spined stickleback. great sand eel, anchovy, European flounder, lumpfish and lesser sand eel were found, During demersal fisheries, fish belonging to 13 taxons were recorded. The predominant species were European flounder and cod, the remaining species were small by-catches (great sand eel, plaice, shorthorn sculpin, hooknose, fourbeard rockling, turbot, herring, lumpfish, viviparous eelpout, whiting, and common dab).

3.7.4.4 Marine mammals

Three species of sea mammals may occasionally appear in the Baltic Power OWF Area: harbor porpoise (*Phocoena phocoena*), gray seal (*Halichoerus grypus*) and harbor seal (*Phoca vitulina*). Additionally, there is a small likelihood presence of ringed seal (*Pusa hispida*). For marine mammals, the Baltic Power OWF Area may only be a temporary place to swim while they are obtaining food.

3.7.4.5 Seabirds

The species diversity of seabird complexes recorded in the OWF Area (2 NM) varied depending on the seasons in which the observations were performed (Table 3.25).

During autumn migration in the OWF Area (2 NM), 15 species were found, the most numerous of which was the long-tailed duck, accounting for 49% of all birds observed. 3 species had at least 1% share in the entire group of birds: common guillemot (17.3%), razorbill (13.5%) and European herring gull (11.2%). The remaining species were much less numerous and their total number recorded during all nine inspections did not reach 100 birds.

In the winter period, fewer species were recorded compared to the autumn migration period, i.e. 9. By far the most numerous species wintering in this water region was the long-tailed duck, which constitutes 88.9% of the entire group of birds. No other species exceeded 5% of the group share.

During the spring migration period, 12 species of seabirds were found in the OWF Area (2 NM), of which the long-tailed duck was by far the most numerous, accounting for 92.2% of all birds found. The share of 1% in the group was also exceeded by razorbill (2.8%) and European herring gull (2.5%). The other species were not numerous. In addition, 15 birds were recorded during this period, which were not marked as regards their species.

In the summer period, 8 species of seabirds and waterbirds rarely encountered at sea away from the coast were recorded in the OWF Area (2 NM). The most numerous were European herring gull and common guillemot.

Table 3.25. The number of species and the most numerous species of seabirds found in the OWF area (2 NM) in the individual phenological periods [Source: data of Baltic Power Sp. z o.o.]

Parameter	Autumn migration period	Winter period	Spring migration period	Summer period
Number of species	15	9	12	8
Most numerous species	Long-tailed duck, common guillemot, razorbill, European herring gull	Long-tailed duck	Long-tailed duck, razorbill, European herring gull	European herring gull, common guillemot

3.7.5 Nature assessment in the water region

The nature assessment of a given sea area may be based on significant differences occurring within this area, both in the context of abiotic, usually habitat-forming and biotic conditions resulting therefrom. Appropriate habitat conditions (type of seabed, quality of bottom sediments, depth, photic conditions) directly affect the organisms inhabiting them, permanently living in such conditions or temporarily using a given area.

The results of comprehensive environmental surveys performed for the purposes of the EIA Report indicate that the Baltic Power OWF Area is in most cases homogeneous in terms of abiotic conditions. Therefore, fragments of areas of different natural values cannot be indicated.

The only element of the environment differentiating the Baltic Power OWF Area that can be used for its assessment is the depth of the water region. It varies from 31.9 m in the south of the area to 45.4 m in the north. Such a situation causes that during the wintering period, the shallowest southern part of the Baltic Power OWF Area is a place characterized by higher density of seabirds (long-tailed duck and velvet scoter). This is due to the fact that in water regions with a lower depth, they can acquire food with lower energy expenditure, which is more beneficial for them. Therefore, it can be indicated that the southern part of the Baltic Power OWF Area is characterized by higher natural values due to more favorable conditions for the stay of this group of birds in relation to the remaining parts of the area.

3.8 Cultural values, monuments and archaeological sites and objects;

There are no elements of underwater cultural heritage in the Baltic Power OWF Area.

At a distance of approx. 1 km north of the Baltic Power OWF Area, there is a wreck with the status of the war grave - Wilhelm Gustloff. In accordance with order No. 9 of the Director of the Maritime Office in Gdynia of May 23, 2006 on the prohibition of diving on shipwrecks - war graves (Official Journal Voivodship Pomorskie 2006, No. 62, item 1277), in order to protect its property against piracy, as well as to protect the marine environment, it is prohibited to dive within a radius of 500 m from the position of the shipwreck.

During geophysical surveys performed in 2019 in the OWF area (1 NM), a total of 5 wrecks were found, including 2 that were previously identified and 3 previously unidentified wrecks. The newly found wrecks, in accordance with the applicable regulations, have been reported as potential elements of underwater cultural heritage to the Pomeranian Voivodeship Heritage Conservation Officer in Gdańsk, the Maritime Office in Słupsk and the Hydrographic Office of the Polish Navy. As part of the agreement with the Voivodeship Heritage Conservation Officer, the development of the Baltic Power DA has been designed so as to avoid the impact on potential elements of underwater cultural heritage (buffer zone of at least 50 m).

3.9 Use and management of the water area and tangible property;

3.9.1 Navigation

The Baltic Power OWF Area is characterized by a low degree of use for shipping (Figure 3.18).

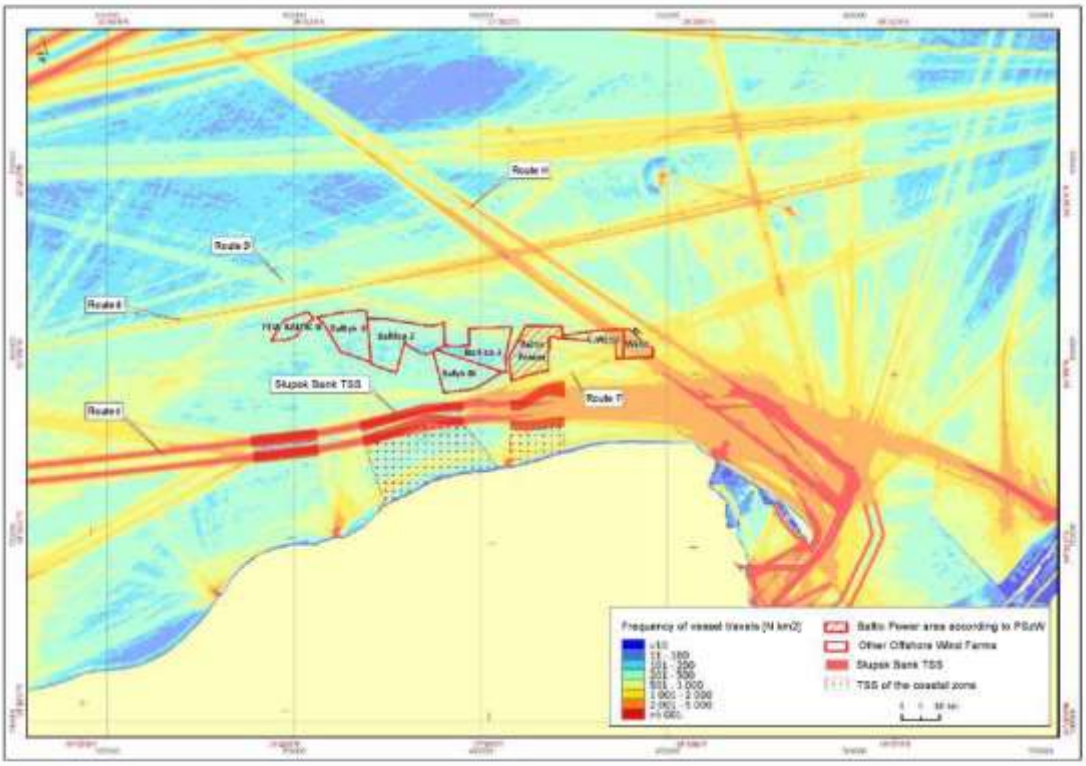


Figure 3.18. Shipping routes in the vicinity of the Baltic Power OWF Area; red – sections of routes whose possible change requires international arrangements and IMO approval [Source: own study based on AIS data]

The Baltic Power OWF Area was crossed by a customary shipping route connecting the ports of the Gdańsk Bay with the Bornholm Strait, used mainly by tankers and merchant vessels (bulk carriers) (Figure 3.18). 398 vessels used it in 2013 (commercial vessels – 53%, tankers – 17.5%, other vessels – 22%) [497]. AIS data indicate that in 2018-2019 the vessels traveled approximately 600 times along this route through the Baltic Power OWF Area. For many years, this route was a component of the deep-water route D of strategic importance (for large tankers and gas tankers) planned by the Polish maritime administration. Due to the issued location decisions for the construction of the OWF (permit for erection and use of artificial islands, structures and devices (PSzW)) in Spatial Development Plan for Polish Maritime areas (PZPPOM) , the course of this route was modified. This route currently bypasses the Baltic Power OWF Area from the north. The change of the route resulted in its slight extension, which to some extent translates into negative phenomena in proportion to the change of the route length, i.e.: increased costs and sailing time, increased emissions (CO_2, CO, SO_2, NO_x), increased probability of breakdowns and accidents (assuming that this probability is proportional to the distance traveled).

To the south of the Baltic Power OWF Area, there is the second most intensive customary shipping route leading from the Danish Straits to the Polish, Lithuanian and Russian ports of the southern Baltic Sea. 6686 vessels used it in 2013 (tankers - 16.7%, commercial vessels - 44.4%, passenger vessels - 1%, special vessels - 6.7%, other vessels - 30.6%, et al.) [497]. AIS data indicate that between 2018 and 2019, vessels made approximately 16,000 trips on this route. This route has a traffic separation scheme consisting of two sections: Łeba-Rowy and Ustka-Jarosławiec, referred to as the Słupsk Bank TSS.

To the north of the Baltic Power OWF Area, there is a customary shipping route connecting Klaipeda with the ports of the southern Baltic Sea – mainly in Świnoujście, Sassnitz-Mukran. The main users of this route are rail freight ferries (Mukran-Klaipeda) and cargo vessels. In 2013, 893 vessels used it (tankers - 1.5%, commercial vessels - 38.5%, fast ferries - 23%, other vessels - 32%) [497]. AIS data indicate that between 2018 and 2019, vessels made approximately 1700 trips on this route. The Baltic Power OWF Area is used to a small extent by recreational craft.

3.9.2 Fishery

Fishing activities are carried out in the Baltic Power OWF Area. This activity was characterized on the basis of data collected as part of the National Fisheries Data Collection Program (NPZDR), based on source data from catch reports of fishing vessels taking into account the place of catch (fishing square or geographical position), fish species, month of fishing, type of fishing gear and type of vessel (vessels up to 12 m and over 12 m).

The 12 m criterion was adopted to distinguish vessels that may be classified as coastal fishing vessels in accordance with the provisions of Regulation (EU) No 508/2014 of the European Parliament and of the Council of 15 May 2014 *on the European Maritime and Fisheries Fund* and repealing Council Regulations (EC) No 2328/2003, (EC) No 861/2006, (EC) No 1198/2006 and (EC) No 791/2007 and Regulation (EU) No 1255/2011 of the European Parliament and of the Council (Official Journal of the EU L of 2014, No. 149, page 1, as amended). Catch report data may differ from landing (final) data, but it was necessary to rely on it due to the need to carry out a geographical distribution of fishing activities. Any differences are insignificant and do not affect the resulting conclusions. The analysis provides an overview of catch data for period 2014-2018. The value of catches was estimated on the basis of average annual prices of first sales of individual fish species and the volume of catches. Since the most detailed information on catches by the fishing fleet is available for areas of fishing squares (surface area of approx. 400 km^2) not overlapping with the OWF area, in order to determine with the greatest possible accuracy the impact of the project on fishing in the OWF area itself (development area specified in the permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended), the following conditions were taken into account:

- in the case of fishing vessels over 12 m in length, equipped with a vessel monitoring system (VMS), the volume of catches on a particular day was assigned to a particular fishing square or OWF area on the basis of the proportion of the number of vessel position reports reported in a particular fishing square or OWF area to the total number of VMS reports on a particular day;
- in the case of fishing vessels up to 12 m for which VMS data is not available, information on fishing in the Baltic Sea square area was used, while the estimation of the volume of catches in the OWF area was carried out taking into account the relative share of the area occupied by the OWF in the total area of the fishing square. This is a simplification that ignores the possible variation in the volume of catches within a particular square (e.g. due to the depth or type of seabed), but the only one possible for a more precise reference to the fishing place.

The Baltic Power OWF area is located unevenly within four fishing squares: N8, O8, N7 and O7 (Figure 3.19, Table 3.26).

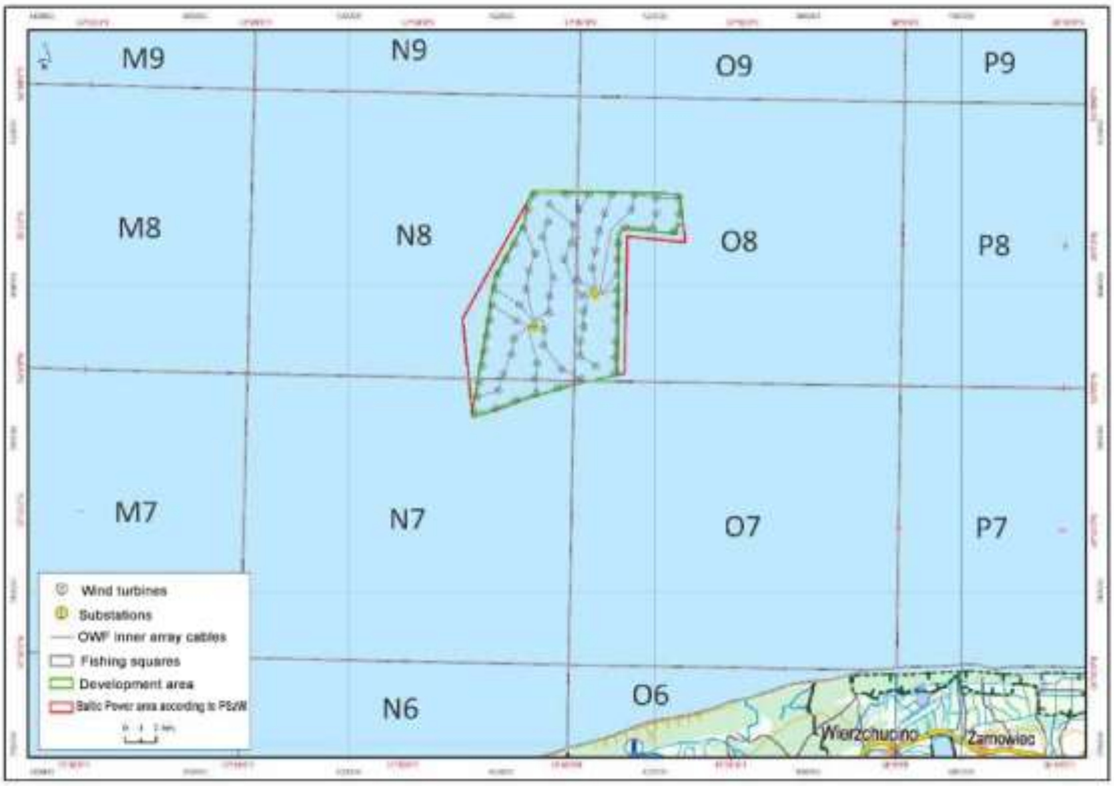


Figure 3.19. Location of the Baltic Power OWF area against the fishing squares [Source: own study]

Table 3.26. Size of the surface area occupied by the OWF area (1 NM) in the individual fishing squares used in the calculations of the volume of catches by vessels up to 12 m [Source: own study]

Fishing square	Fishing square surface area occupied by the OWF area (1 NM) [%]
N8	17.93
O8	12.89
N7	2.37
O7	0.04
Average	8.29

3.9.2.1 Volume and value of fish catches

The total volume of fish catches in the area of the four analyzed squares in 2018 amounted to 133 t, which accounted for only 0.1% of the Polish Baltic Sea catches carried out by the Polish fishing sector in that year. In 2018, Polish fishing vessels fished in 121 Baltic Sea squares located in the Polish economic zone and in 99 squares outside this zone. The value of catches was about PLN 587 thousand which accounted for 0.3% of the total value of completed landings of Polish catches in the Baltic Sea. The average multi-annual volume and value of the share of catches from the four squares area in the total Baltic Sea catches in 2014-2018 amounted to 0.2 and 0.4%, respectively. The estimated (calculated for vessels up to 12 m in length on the basis of the proportion of the area occupied by the OWF for each fishing square and on the basis of VMS data for vessels equal to or over 12 m in length) volume of catches carried out in the Baltic Power OWF area in 2014-2018 amounted, on average, to 10.5 t with the value of PLN 54 thousand per year.

The largest share of the volume and value of catches in the area of the four analyzed fishing squares in relation to total catches in the Baltic Sea is made by vessels registered in ports closest to the analyzed area. In 2014-2018, these were mainly vessels registered in Łeba and Ustka.

The area of the analyzed squares is characterized by low fishing productivity. The average volume of catches per km^2 carried out in the area of four fishing squares in the years 2014-2018 amounted to 170 kg with the value of PLN 580. This accounted for only 6% (13% in terms of value) of the average productivity of Polish Maritime Areas (POM), which in the analyzed years amounted to 2.9 t/km^{-2} with the value of PLN 4.6 $thousand/km^{-2}$. The highest productivity was recorded in the area of the O8 square, where a small (12.9%) north-eastern part of the Baltic Power OWF area is located, followed by the N7, O7 and N8 squares. Out of 123 Baltic squares located in the Polish maritime areas (in part or in whole), the O7 square occupied a remote 93rd rank in terms of volume of catches per km^2 of the surface area.

The average share of fish caught in 2014-2018 in the area of squares located in the area of the planned project in relation to the total Polish catches in the Baltic Sea was negligible and amounted to 0.2%, and for the Baltic Power OWF area it was close to zero (0.01%). When analyzing the relative importance of the area of fishing squares, which are to be partially occupied by the Baltic Power OWF area, as the catch place of fishing vessels located in different ports, it can be seen that it plays a noticeable importance (4.2%) only for vessels from Łeba (Table 3.27). For vessels registered in other ports, catches in the area of the four analyzed squares may be considered insignificant, their relative volume for none of them exceeded 1% (on average in 2014-2018). Similarly, the analyzed area was of low importance in terms of value in 2014-2018. The importance of the four analyzed squares was noticeable (7.5%) only for vessels registered in Łeba. For vessels registered in other ports, share of the value of catches carried out in the area of squares: N8, N7, O8 and O7 in total catches did not exceed 1% (Table 3.28).

Table 3.27. Average volume [t] of catches in fishing squares: N8, N7, O8, O7 in 2014-2018 in relation to the total Polish catches in the Baltic Sea broken down by ports of registration of fishing vessels and their sizes [Source: data of the National Fisheries Data Collection Program]

Port	Fishing squares N8, N7, O8, O7			Baltic Power OWF area			The Baltic Sea	Share [%]	
	<12 m	>12 m	Total	<12 m	>12 m	Total		In fishing squares	In Baltic Power OWF area
Łeba	12.4	91.4	103.8	0.9	3.2	4.1	2478,7	4.2	0.2
Władysławowo	0.0	76.9	76.9	0.0	0.0	0.0	16,159.1	0.5	0.0
Ustka	16.6	25.7	42.3	2.7	1.9	4.6	42,287.0	0.1	0.0
Dziwnów	32.5	0.0	32.5	0.1	0.0	0.1	5664,1	0.6	0.0
Świnoujście	4.1	2.9	7.0	0.7	0.0	0.7	4019,2	0.2	0.0
Hel	0.4	1.9	2.2	0.1	0.0	0.1	35,912.9	0.0	0.0
Kołobrzeg	0.5	1.8	2.3	0.1	0.1	0.2	11,645.6	0.0	0.0
Darłowo	2.8	0.2	2.9	0.0	0.0	0.0	951.3	0.3	0.0
Other	1.8	0.0	1.8	0.8	0.0	0.8	18,299.7	0.0	0.0
Total	71.0	200.7	271.7	5.2	5.3	10.5	137,417.9	0.2	0.01

Table 3.28. Average value [thousand PLN] of catches in the fishing squares: N8, N7, O8, O7 and in the Baltic Power OWF area in 2014-2018 in relation to the average value of Polish catches in the Baltic Sea broken down by ports of registration of fishing vessels and their sizes [Source: data of the National Fisheries Data Collection Program]

Port	Fishing squares N8, N7, O8, O7			Baltic Power OWF area			The Baltic Sea	Share [%]	
	<12 m	>12 m	Total	<12 m	>12 m	Total		In fishing squares	In Baltic Power OWF area
Łeba	38.0	356.5	394.5	2.2	12.8	15.0	5274,4	7.5	0.3
Ustka	93.0	156.8	249.8	14.6	17.8	32.5	25,905.1	1.0	0.1

Władysławowo	0.0	111.0	111.0	0.0	0.0	0.0	51,773.3	0.2	0.0
Dziwnów	105.6	0.0	105.6	2.7	0.0	2.7	7913,4	1.3	0.0
Świnoujście	11.7	6.9	18.7	1.9	0.2	2.0	6609,9	0.3	0.0
Darłowo	2.4	9.4	11.8	0.4	0.4	0.8	48,067.6	0.0	0.0
Kołobrzeg	6.6	0.7	7.3	0.3	0.0	0.3	13,330.5	0.1	0.0
Hel	2.3	3.7	6.0	0.3	0.0	0.3	3723,5	0.2	0.0
Other	10.5	0.1	10.6	0.1	0.0	0.1	43,466.9	0.0	0.0
Total	**269.9**	**645.2**	**915.1**	**22.6**	**31.2**	**53.8**	**206,064.6**	**0.4**	**0.03**

The volume and value of fish catches in individual fishing squares occupied by the Baltic Power OWF area is varied. As the figure (Figure 3.20) indicates, the volume of catches in the analyzed squares in individual years changed, with a decreasing trend. This was mainly due to the deteriorating state of cod stocks, noted especially in the coastal zone.

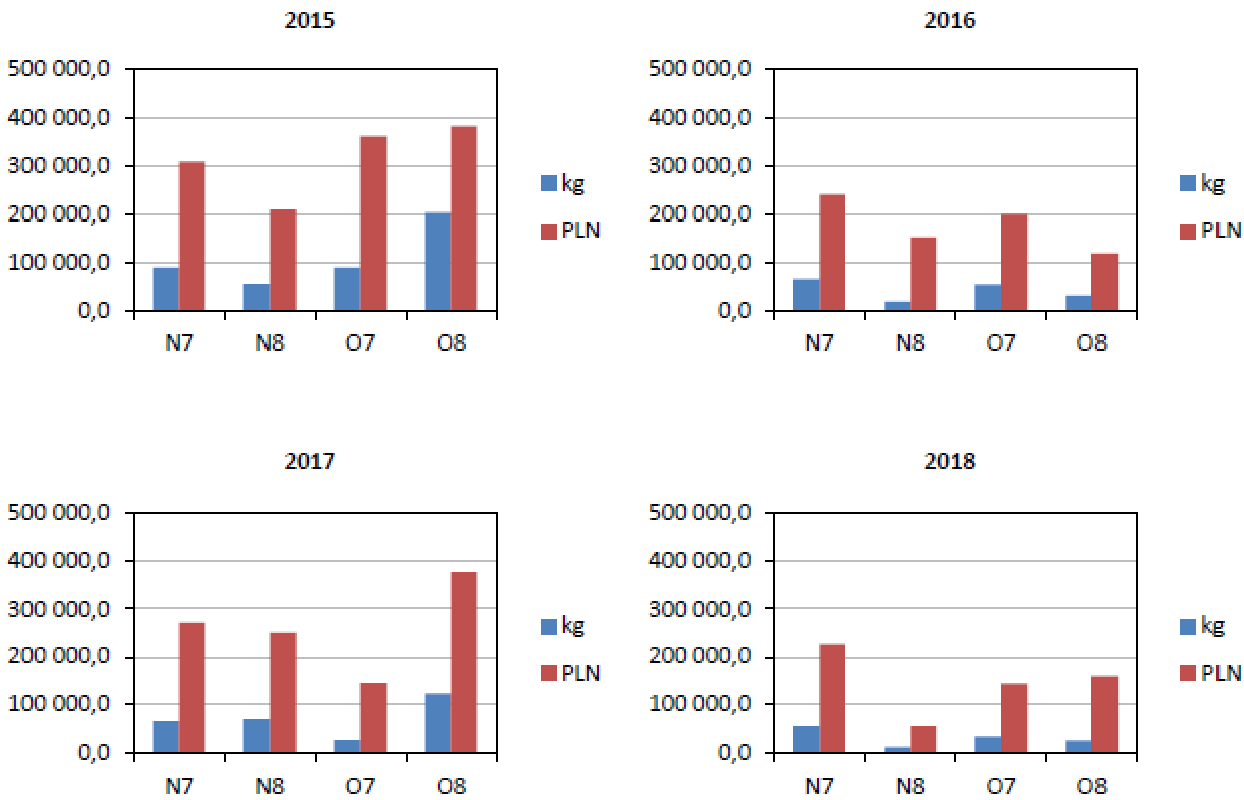


Figure 3.20. Volume [t] and value [PLN] of catches in the fishing squares N8, N7, O8, O7 [Source: data of the National Fisheries Data Collection Program]

The basic fish species caught in the area of the four analyzed squares in 2014-2018 were cod and European flounder (Table 3.29), with respectively 40 and 28% share in the total volume of catches and 56 and 12% share in the value of fish caught (Figure 3.21). The remaining part was accounted for catching other fish species, among which herrings, sprats, sea trout and turbot dominated.

Table 3.29. Volume and value of catches in the fishing squares: N8, N7, O8, O7 in 2014-2018, by major species [Source: data of the National Fisheries Data Collection Program]

Species	Catch parameter	Year				
		2014	2015	2016	2017	2018
European flounder *Platichthys flesus*	Volume [t]	126.7	75.0	56.5	50.7	62.9
	Value [thousand	174.5	104.9	75.6	82.8	101.9
Cod *Gadus morhua*	Volume [t]	141.9	199.6	85.0	74.0	45.5
	Value [thousand	663.3	901.5	408.4	368.0	230.3
Other*	Volume [t]	61.7	163.8	27.9	162.2	25.2
	Value [thousand	134.4	257.0	228.6	589.4	254.8
Total volume [t]		330.3	438.4	169.4	286.9	133.6
Total value [thousand PLN]		972.1	1,263.4	712.6	1040,2	587.0

**Mainly herring, sprat, sea trout and turbot*

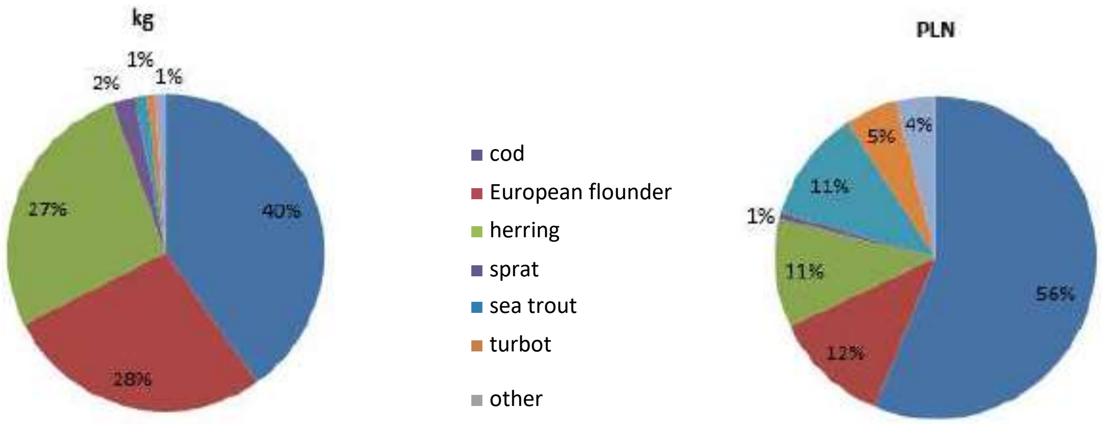


Figure 3.21. The species catch structure in the area of fishing squares N8, N7, O8, O7 in 2014-2018 [Source: data of the National Fisheries Data Collection Program]

In the analyzed period, except for 2018 (which resulted from the gradual relocation of cod fishing by larger vessels to deeper water regions), the vast majority of catches, both in terms of volume and value, were carried out by fishing vessels over 12 m of total length (Table 3.30). This was due to both outnumbering of large vessels and their higher fishing capacity. The share in the volume and value of catches of this group of vessels in 2014-2018 was 74 and 71%, respectively.

Table 3.30. Volume and value of catches in the fishing squares: N8, N7, O8, O7 in 2014-2018, broken down by length of fishing vessels [Source: data of the National Fisheries Data Collection Program]

Catch parameter	Vessel group by length [m]	Year				
		2014	2015	2016	2017	2018
Volume [t]	<12	100.0	81.3	42.4	65.8	65.3
	≥12	230.3	357.1	126.9	221.1	68.3
Value [thousand PLN]	<12	284.4	280.1	150.0	276.0	359.0
	≥12	687.7	983.3	562.6	764.3	228.1
Total volume [t]		330.3	438.4	169.4	286.9	133.6
Total value [thousand PLN]		972.1	1263,4	712.6	1040,2	587.0

The sharp decrease in catches in 2018, especially in the group of vessels over 12 m, was due to two reasons. The first one was a significant reduction in cod catches in the analyzed area (which also took place in other areas of the Baltic Sea) and concerned mainly vessels registered in Łeba. Lower catches are also a result of lower catches of herring, which was a random situation resulting from the inactivity of one of pelagic vessels in that year.

The table (Table 3.31) presents the results of calculations of the value of catches in the individual fishing squares and the value of catches carried out in the Baltic Power OWF area. As mentioned earlier, for vessels up to 12 m, the value of catches in the Baltic Power OWF area was calculated proportionally to the size of the surface area to be occupied by the Baltic Power OWF area (the area specified in permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended, including the 500 m wide buffer zone) in the particular fishing square. However, for vessels equal to or over 12 m, the value of catches in the Baltic Power OWF area was calculated on the basis of VMS records. In 2018, the estimated value of fish caught in the Baltic Power OWF area was approx. PLN 31 thousand. The highest value of catches was achieved in 2017 (PLN 83 thousand)

Table 3.31. Value of catches in the fishing squares: N8, N7, O8, O7 in 2014-2018 and estimated value of catches in the Baltic Power OWF area [Source: data of the National Fisheries Data Collection Program]

Vessel group by length [m]	**Fishing square**	**Value of catches in the fishing squares areas [thousand PLN]**					**Estimated value of catches in the Baltic Power OWF area [thousand PLN]**				
		2014	**2015**	**2016**	**2017**	**2018**	**2014**	**2015**	**2016**	**2017**	**2018**
<12	N8	71.0	145.9	36.5	76.5	44.4	12.7	26.2	6.5	13.7	8.0
	O8	76.0	12.9	2.6	34.3	111.3	9.8	1.7	0.3	4.4	14.4
	N7	123.4	103.6	104.5	158.1	150.2	2.9	2.5	2.5	3.7	3.6
	O7	14.0	17.8	6.4	7.0	53.0	0.0	0.0	0.0	0.0	0.0
Total		**284.4**	**280.1**	**150.0**	**276.0**	**359.0**	**25.5**	**30.3**	**9.4**	**21.9**	**25.9**
≥12	N8	74.6	63.5	115.4	173.4	12.2	5.4	16.0	23.0	29.6	3.5
	O8	163.6	370.0	116.7	340.1	48.6	13.4	10.2	7.5	27.0	1.6
	N7	166.6	204.8	136.1	113.0	76.2	3.7	4.5	6.4	4.1	0.0
	O7	283.0	345.0	194.4	137.8	91.2	0.0	0.0	0.0	0.0	0.0
Total		**687.7**	**983.3**	**562.6**	**764.3**	**228.1**	**22.5**	**30.7**	**36.9**	**60.7**	**5.1**
Total		972.1	1263.4	712.6	1040.2	587.0	48.0	61.0	46.3	82.6	31.0

The analysis of monthly variability of fish catches in the Baltic Power OWF area indicates a concentration of fishing fleet activity mainly in the autumn season (September-December) (Figure 3.22). These months accounted for 50% of the value of catches (PLN 2.3 million in total) in 2014-2018, of which 70% (PLN 1.7 million) accounts for cod catches. Due to the protection of cod, the lowest catches in the analyzed area occurred in the summer season (June-August). This period accounted for only 14% of the annual value of catches in 2014-2018.

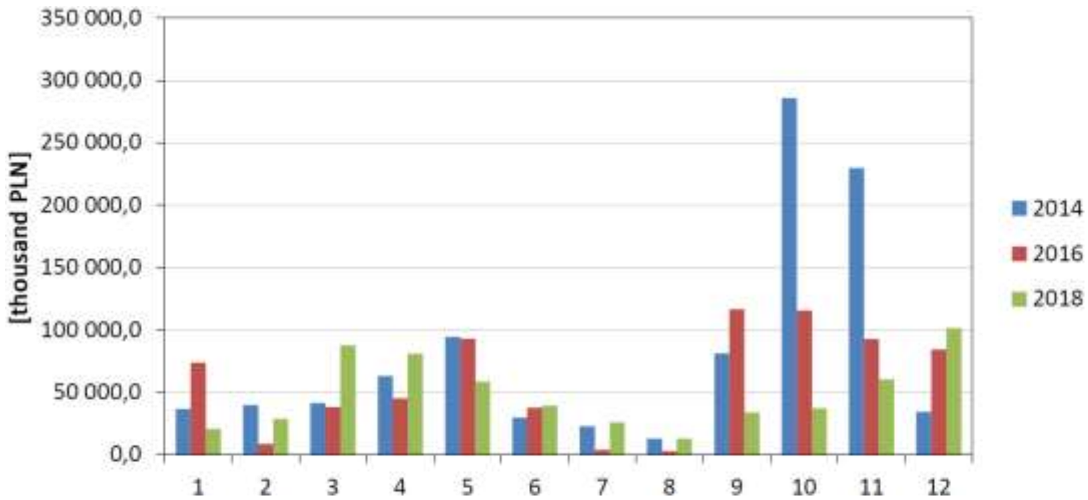


Figure 3.22. Monthly value of catches [thousand PLN] in the area of fishing squares: N8, N7, O8, O7 in 2014, 2016 and 2018 [Source: data of the National Fisheries Data Collection Program]

In the Baltic Power OWF area, in 2014-2018 set gears (gillnets and hooks) were predominantly used for fishing followed by bottom trawls and midwater trawls. The set gear (mainly cod gillnets) accounted for 50% of the total volume of catches from the area of four squares. The share of fishing using bottom trawling was 21%. The use of set gear in the area of squares occupied by the Baltic Power OWF area in 2014-2018 decreased systematically, while in the case of bottom trawls and midwater trawls it was variable (Figure 3.23). Both gear types are used for catching cod, which fully explains the observed changes. However, as mentioned above, the catch results of vessels fishing with midwater trawls should be considered to be largely random and dependent on the activity of individual fishing vessels in the analyzed area.

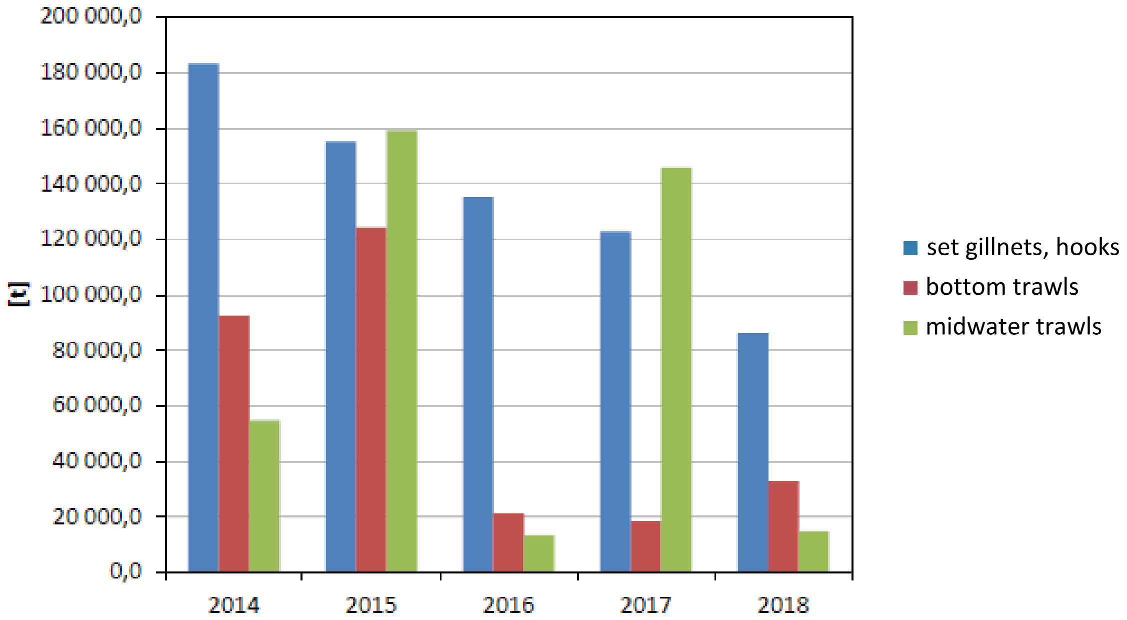


Figure 3.23. Volume of catches with individual gear in the area of fishing squares: N8, N7, O8, O7 in 2014-2018 [Source: data of the National Fisheries Data Collection Program]

The seasonality of fishing was mainly influenced by the activity of larger fishing vessels with an overall length over 12 m, which was particularly observed in the autumn-winter season (Figure 3.24). Catches of vessels up to 12 m in total length showed smaller monthly diversification, although with a noticeable increase in volume of catches in spring period – from March to June.

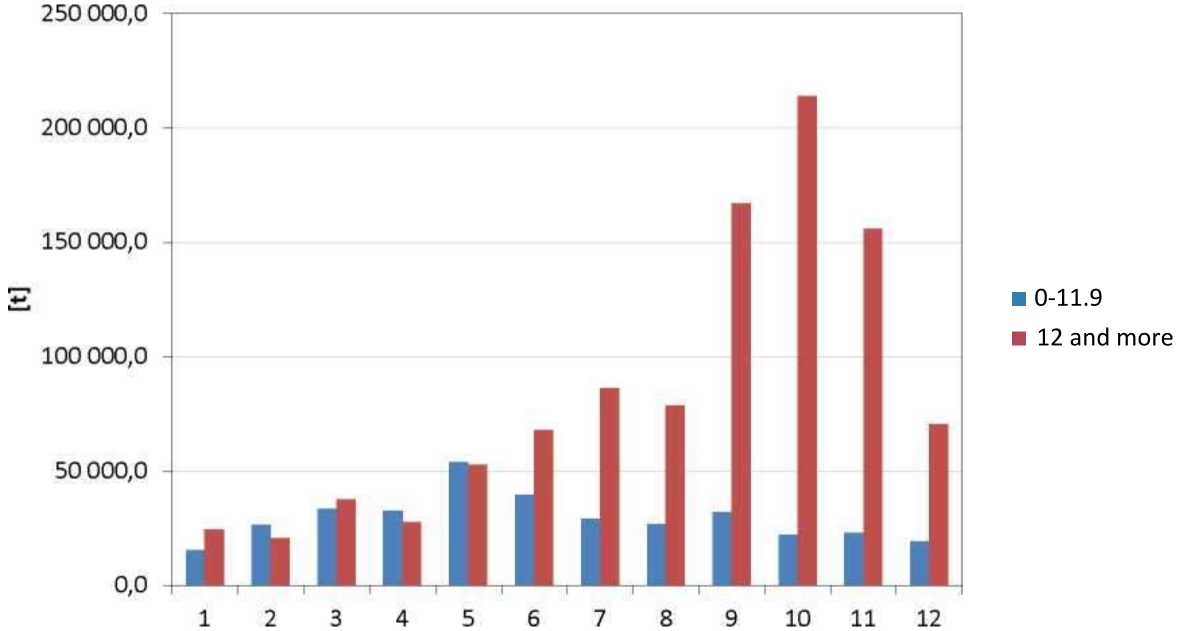
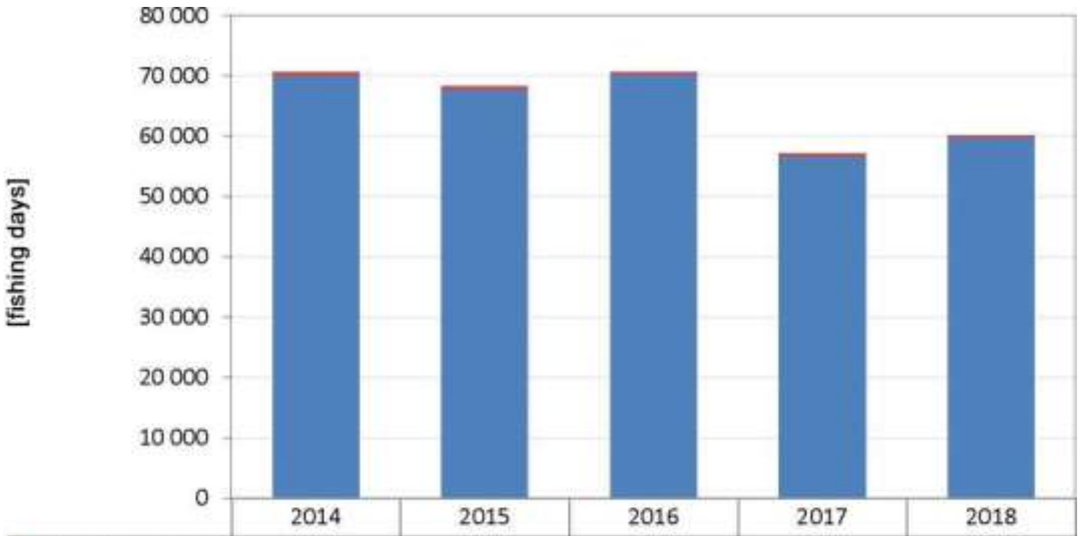


Figure 3.24. *Volume of catches in the area of fishing squares: N8, N7, O8, O7 in 2014-2018, broken down by types of vessels according to their length [Source: data of the National Fisheries Data Collection Program]*

3.9.2.2 Amount of fishing effort

In 2014-2018, fishing in the area of fishing squares N8, N7, O8, O7 was reported by 56, 59, 42, 56 and 54 vessels, respectively out of a total of 799, 767, 779, 751 and 736 active fishing vessels fishing in the Baltic Sea in a particular year. Fishing vessels over 12 m in length dominated, on average approximately 70% in the entire analyzed period, 40, 49, 34, 37, 30 vessels respectively in 2014-2018.

The total fishing effort (measured in number of fishing days) in 2014-2018 in the area of four squares ranged from 644 days in 2015 to 314 days in 2018 (Figure 3.25). The most frequently visited fishing square was the O7 square (250 days in 2014 and 267 days in 2015), followed by the N7 square (254 days in 2015). The relative importance of the area of four analyzed squares in the overall fishing effort of Polish fishing vessels fishing in the Baltic Sea in 2018 (60.1 thousand days) was negligible and amounted to 0.5%.



	2014	2015	2016	2017	2018
Baltic Power OWF	621	644	369	461	314
Other	70 039	67 690	70 254	56 696	59 847

Figure 3.25. *Number of fishing days in the area of fishing squares: N8, N7, O8, O7 in 2014-2018 and other fishing areas in the Baltic Sea [Source: data of the National Fisheries Data Collection Program]*

3.9.3 Other developments

There are no structures permanently fixed to the seabed in the Baltic Power OWF Area. Nor are licenses issued for prospecting, exploration and extraction of hydrocarbons from submarine deposits. The prospecting and exploration licenses existing in this area even several years ago expired in 2016 and have not been renewed until the date of submitting of this EIA Report. The Baltic Power OWF area is located within two water regions, i.e.: POM.45.E and POM.46.E determined by the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200,000*. For both these water regions, renewable energy generation was indicated as the basic function, at the same time allowing for the performance of other activities in the future, such as: aquaculture, scientific research, cultural heritage, technical infrastructure, prospecting and exploration of mineral deposits and extraction of minerals from deposits, fishing, artificial islands and structures, transport and tourism, sport and recreation. All allowed functions in these water regions may be performed provided that the basic function is considered as primary function.

3.10 Landscape, including cultural landscape

The Baltic Power OWF location covers the area located at a distance from approx. 22 to approx. 34 km from the land. The landscape changes according to the weather condition, as on windless days the sea is calm, monotonous, while with wind strength increased, reduced sunshine, increased cloud cover and higher humidity, including precipitation, the condition of the sea, the wave motion and the air clarity also change. Water vapor rises above the water surface, which also reduces visibility, making it difficult for the observer to determine the sea and sky contact on the horizon.

The land is rarely visible from the Baltic Power OWF area.

People are rarely present in the Baltic Power OWF area. Important navigation routes run through the Baltic Power OWF area (Figure 3.26) and in its vicinity at a distance of several to several dozen kilometers. Tank vessels, container vessels, rail freight ferries and passenger ferries, passenger and cargo vessels, freighters, tankers and other vessels are shipping along these routes. The new corridor of the north-eastern navigation route (POM.49.T water region) is passing on the northern side of the Baltic Power OWF area. Additionally, according to PZPPOM the part of the navigation traffic is to be redirected from the southern to the northern side of the Baltic Power OWF.

The Baltic Power OWF area is located in parts of four fishing squares with the fishing vessels traffic (Figure 3.19). Other nearest forms of land development are areas of licenses for prospecting and exploration of oil and natural gas deposits, and the nearest Baltic-Beta production platform is located at a distance of over 50 km, i.e. beyond the range of visibility from the Baltic Power OWF (Figure 3.26).

It was estimated that in the zone up to 50 km from the Baltic Power OWF area in 2018-2019, more than 200 vessels were present per day, which stay in the visibility zone of the Baltic Power OWF from the vessel (up to 50 km) for up to several hours.

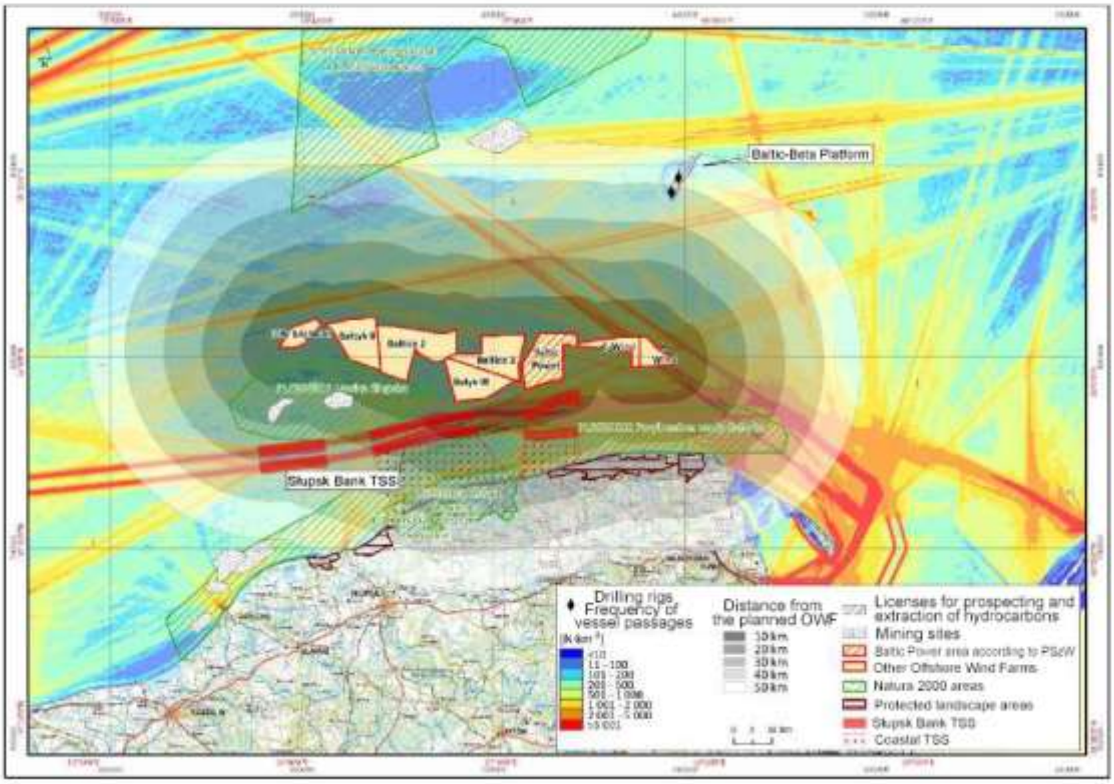


Figure 3.26. Development and use of the water region in the vicinity; red – sections of routes whose possible change requires international arrangements and IMO approval of the OWF area [Source: own study]

The maritime cultural landscape includes the anthropogenic development and the use of both the sea and the seabed, which is only accessible to divers and underwater vehicle operators. The landscape of the Baltic Sea is not subject to classification, but only the BALANCE project "Baltic Sea Management - Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning" (2005-2007) developed a concept of submarine landscapes. In the Baltic Power OWF area and in its vicinity there are no permanent development elements.

The potential zone of the Baltic Power OWF impact on the landscape includes an area of land from Ustka in the west to Jastrzębia Góra in the east. Due to the shape of the coastal zone of the Baltic Power OWF, it may be visible from beaches at this section. According to the physical and geographical division of Poland [238], this is the Słowińskie Coast, forming a narrow strip of land along the Baltic Sea shore. This area is characterized by a post-glacial relief. There are dune banks with a height ranging from several to several dozen meters above the sea level, covered with forest, obscuring the view to the sea, bogs and wetlands, as well as coastal lakes with sea-side spits. The landscape is diversified by narrow valleys of watercourses entering the sea. There are various protected areas, including landscape protection of the areas in their vicinity. These include: Protected Landscape Area "Pas pobrzeża na zachód od Ustki (The Coastal Strip West of Ustka)", nature and landscape complex "Ostoja Łabędzi (Swan Refuge)" in Ustka, Protected Landscape Area "Pas pobrzeża na wschód od Ustki (The Coastal Strip East of Ustka)", Słowiński National Park, landscape nature reserve "Mierzeja Sarbska (Sarbska Spit)", Coastal Protected Landscape Area, Coastal Landscape Park. At studied section, under special meteorological conditions, the Baltic Power OWF will be potentially visible from the observation points located higher: Czołpino lighthouse, dunes in the Słowiński National Park, Stilo lighthouse and towns: Ustka, Rowy, Łeba and Jastrzębia Góra.

3.11 Population and living conditions of people

The population of coastal districts in the Pomorskie Voivodship, in the region closest to the Baltic Power OWF area, is characterized by low natural growth and high positive migration balance. In most coastal municipalities: Ustka (town and municipality), Smołdzino, Łeba, Wicko and Krokowa, there are and are planned onshore wind turbine complexes, among others due to very favorable wind conditions. Coastal areas are characterized by rich tourist and recreational values, including those related to the use of sea. They are the basis for the existence of a significant number of inhabitants. This includes fishing, maritime tourism, marine navigation, marine sports and other human activities related to the immediate vicinity of the sea.

The Baltic Power OWF area was subject to exploration and periodic exploitation of aggregate. In these areas, prospecting and exploration of submarine hydrocarbon deposits was also carried out.

The theoretically designated Baltic Power OWF center is located at a distance to the nearest ports:

- Łeba - 32 km;
- Władysławowo - 57 km;
- Ustka - 72.5 km;
- Darłowo - 106.5 km.

Due to the size of transport vessels and vessels for the construction of the OWF, the port in Świnoujście (approx. 245 km away) or the port in Rønne (approx. 165 km away) will be the back-up facility for the construction and decommissioning of the Baltic Power OWF. The port in Łeba will be the service port.

The Baltic Power OWF area is partially located in the area of important, customarily used and planned navigation routes and routes to fishing grounds. Their importance for Baltic Sea navigation is evidenced by the number of nearly 400 vessels that used the Baltic Power OWF area in 2019.

Fishing activities are carried out in the Baltic Power OWF area. This area is located in parts of four fishing squares: O7, O8, N7 and N8. The fishing issues in this area are described in detail in sub-chapter 3.9.2.

To sum up, it should be noted that the Baltic Power OWF area is of minor importance for commercial and recreational navigation and fishing.

4 Modeling performed for the purpose of project impact assessment

For the purposes of this EIA Report, model studies were carried with the objective to:

- obtain information about the range of suspended matter propagation and concentration in water as a result of works that disturb bottom sediments (Appendix No. 2 to the EIA Report);
- obtain information about the range and intensity of underwater noise generated during installation and construction works (Appendix No. 3 to the EIA Report);
- obtain information about the potential number of collisions of flying seabirds with wind turbines (Appendix No. 4 to the EIA Report).

Moreover, on the basis of the results of the seabirds survey, their density in the studied areas was modeled. The results of this modeling are presented in Appendix No. 1 to the EIA Report.

The method of modeling the propagation of suspended matter, underwater noise, collisions with wind turbines and conclusions resulting from these studies are briefly described below.

4.1 Modeling of suspended matter propagation and concentration

The source of suspended matter formation in water are works related to preparation of the seabed for foundation of structural elements of the OWF and the driving of power and communication cables. The content of suspended matter depends, among others, on the depth of water, types of bottom sediments and dimensions of the founded support structures.

A numerical model used considers the transportation of suspended matter in a dynamic marine environment during underwater and dredging works on the seabed in the area designated for the implementation of the Baltic Power OWF project.

The performance of calculations with consideration of various forcing conditions (wind, currents) allowed for analyzing the influence of these conditions on specific parameters of suspended matter impact. The method of calculations allowed for identifying the least environmentally beneficial, i.e. the most interfering impacts of suspended matter on the marine environment, caused by works related to the construction of the wind farm. The results of the simulations have led to the following conclusions:

- underwater works releasing the largest amounts of suspended matter in the analyzed offshore wind farm include: preliminary cleaning of the seabed from boulders carried out at shallower depths in cohesive soil, cable sinking into the seabed using jetting method in cohesive soils at lower depths. Both types of works generate similar parameters of suspended matter impact on the marine environment: maximum concentrations at a distance of 100 m from the place of works reach 80 $mg \cdot l^{-1}$, and at a distance of 2 km they reach 15 $mg \cdot l^{-1}$, the volume of sediments coming from suspended matter sedimentation at a distance of 100 m does not exceed 2 mm, the retention of suspended matter with a concentration of 30 $mg \cdot l^{-1}$ does not exceed 3 hours, and with a trace concentration of 4 $mg \cdot l^{-1}$ reaches 13 hours (slightly higher parameters when sinking of the cable);
- underwater works related to linear infrastructure, where suspended matter is disturbed in a manner defined as a "moving source" (moving vessel or device), generate significantly smaller volumes of newly formed sediments from suspended matter sedimentation than in the case of stationary works. The volumes of sediments in size not exceeding 2 mm do not pose a threat to benthic habitats and benthic fauna;
- suspended matter has a greater impact on the environment when underwater works are carried out in cohesive soils with very soft or soft consistency than in non-cohesive soils;
- the use of the soil cutting method (*chain cutting*) used in the most challenging soil conditions (cohesive soils with very stiff consistency) has a minimum impact on the environment in terms of suspended matter, however, it is a method in which the progress of works will be significantly slower. Whereas, in practice, it is applied only if it is not possible to use other technological solutions;

- during the weakest environmental forces, at the lowest wind speeds generating the lowest current speeds (of several $cm \cdot s^{-1}$) and additionally with the circulating nature of currents, the concentrations of suspended matter concentrated in the immediate vicinity of the performed works are the highest ones;
- the greatest ranges of suspended matter impact occur at moderate to medium winds, the direction of which is determined during the period of underwater work releasing the finest soil fractions;
- the studies of the cumulative effect of suspended matter impact in the case of underwater works carried out in the Baltic Power OWF area and its close vicinity showed that slight increases in suspended matter concentration, the range of its impact or the retention time of suspended matter in water may occur. However, these short-term and local changes resulting from the cumulative impact are responsible only for the minimum (practically negligible) change in the suspended matter impact;
- the effect of accumulation of newly formed sediments caused by various human activities during the construction phase (preparatory works and cable sinking) is possible, however the cumulative impacts will have only a local and short-term impact. Natural sediments resuspension processes caused by storm phenomena (increase in velocity of bottom currents) will be responsible for changes in the volume of sediments in the Baltic Power OWF area and beyond this area during the operation phase of the wind farm;
- in no case of simultaneous performance of underwater works, does the level of cumulative impact of suspended matter impose limitations as to the performance of such works or impose actions mitigating this impact.

4.2 Modeling of underwater noise propagation

Underwater noise will be emitted to the environment at every stage of the Baltic Power OWF construction. However, its greatest impact is expected during construction due to the high noise level generated during pile driving. Many marine organisms may be sensitive to underwater noise (particularly fish and marine mammals) propagating through the water over significant distances. The bathymetric and hydrological conditions have a decisive impact on the propagation of noise in the water, therefore the modeling took into account the local bathymetric and hydrological conditions measured during the studies of the Baltic Power OWF area and the available data from the Baltic Sea area within a radius of over 150 km.

The analyses were carried out using numerical modeling of underwater noise for three locations of wind turbines considered as the worst case scenario. The selected turbines are located in the northern (deep waters – best propagation conditions) and south-western (shallow waters – closest to nature protection areas) part of the Baltic Power OWF area. The analyses were carried out for winter when the noise propagation conditions are the best. The analyses were carried out for a monopile with a diameter of 9.5 m. Based on the acoustic model, the noise impact zones (at different distance from the sound source) were estimated for animals for which the effect may occur in the form of permanent threshold shift (PTS), temporary threshold shift (TTS) and behavioral response (behavior change). The analyses took into account marine mammals (common porpoise, harbor seal, gray seal) and fish (with and without swim bladder).

Sound levels were also estimated taking into account two scenarios involving the use of:

1) Hydro Sound Damper (HSD),
2) HSD and double big bubble curtain (DBBC).

The HSD system includes a specially designed net with noise reduction elements. The net is installed along the entire length of the monopile, so that the sound can be mitigated directly at the noise source. In addition, the HSD can be used together with the bubble curtain to increase the noise reduction efficiency. The curtain creates a circle of air bubbles around the area where the pile is driven into the seabed, which causes underwater sound to be reflected and absorbed, thereby reducing the sound level generated by the piling. Based on the available literature data, reduction of the sound level by 9 dB was assumed with the use of the HSD and for the combined

HSD and DBBC systems by 20 dB.

The modeling results indicate that sound propagation depends on the shape of the seabed topography, which results in differences in the directionality of sound intensity. This is illustrated by numerous maps showing the horizontal propagation of sound. The conclusion based on them is that the highest sound levels are observed mainly in the north-east and north-west directions (Appendix No. 3 to the EIA Report).

Additionally, the cumulative effect was modeled due to the possibility of parallel piling in the Baltic Power OWF and in one or more areas of the nearby planned OWFs. The analyses aimed at determining the potential accumulation of noise and its impact on porpoises, seals and fish.

The calculations carried out for the SEL from a single impact indicated that for each of the three locations of turbines the impact ranges for a porpoise were higher than for a gray seal and a harbor seal. For both types of marine mammals, the greatest impact distances were found for the behavioral response. In the case of porpoises, the maximum range for this effect was found at the edge of the modeled domain, i.e. 150 km from the sound source, while for seals the range was up to 40.2 km. The maximum impact range for the cumulative TTS found for a porpoise was 82.4 km, and for seals it was 49.8 km, while for the cumulative PTS the values were 23.2 km for porpoise and 5.5 km for seals. The calculated impact ranges for TTS and PTS from a single impact were lower and amounted to 2.3 km and 0.2 km for porpoise and 0.2 and 0.1 km for seals, respectively.

In the case of fish, for all three turbines, the greatest impact ranges were recorded for the behavioral response. For both groups of fish, the maximum distance for this effect was found at the edge of the modeled domain, i.e. 150 km from the sound source. With respect to the cumulative TTS, the maximum range was 112 km, while for the cumulative PTS the distance of 9.3 km was found for fish with a swim bladder and 1.7 km for fish without a swim bladder. The TTS and PTS values from a single impact were relatively low and amounted to 0.8 km and 0.1 km, respectively.

Calculations performed with the use of HSD and DBBC indicate a decrease in the impact ranges. Taking into account the scenario with the use of HSD, the range of behavioral response for porpoise decreased to 104 km, and for seals to 9.6 km. The maximum distance for the cumulative TTS decreased to 13.1 km for porpoise and to 6.6 km for seals. In the case of PTS, the ranges reached 1.7 km and 0.6 km for porpoise and seals, respectively.

In the case of fish, the application of HSD showed that the range of behavioral response decreased to a maximum of 70.7 km for fish without a swim bladder. For fish with a swim bladder, the distances were still very high, reaching the edge of the modeled domain, i.e. 150 km from the sound source. The cumulative distance of TTS reached the maximum value of 18.7 km and the cumulative distance of PTS 0.2 km for fish without a swim bladder and 2.6 km for fish with a swim bladder.

With the use of HSD and DBBC, the ranges of behavioral response impact decreased to 20.3 km for porpoise and 2.4 km for seals. With respect to the cumulative TTS, the maximum distance was 12.2 km for porpoise and 1.7 km for seals, respectively, while for the cumulative PTS it dropped to 0.2 km and 0.1 km.

For fish, the use of HSD and DBBC showed that the range of behavioral response decreased to a maximum of 16 km for fish without a swim bladder and to 46.2 km for fish with a swim bladder. The maximum distance for the cumulative TTS reached 5.9 km and for the cumulative PTS – 0.1 km for fish without a swim bladder and 0.4 km for fish with a swim bladder.

Calculations of noise propagation resulting from piling in several locations showed that the ranges and areas of impact of all analyzed effects of noise exposure (behavioral response, TTS and PTS) increased with the increase in the number of piling sources. Such a trend occurred for all animals and all analyzed wind turbines, and the largest ranges and areas of impact were identified in the scenario with three sources. Taking into account calculations without NRS, the largest areas of impact were found for the behavioral response. Moreover, in most cases, the impact areas were larger for deep than shallow locations.

Moreover, analyses performed for simultaneous piling in several locations indicated that the use of HSD may not be sufficient for porpoise. Results showed a significant effect related to behavioral response. However, as indicated by modeling results, this impact can be reduced by using HSD and DBBC, as found for each of the three turbine locations.

It should be considered that the impact zones estimated for multiple impacts of the pile driver during piling were determined assuming the worst case scenario. Current knowledge about the accumulation of sound energy in animals is poor. Moreover, some criteria used to calculate impact zones related to multiple impacts are under discussion. Therefore, the modeling results for the series of sounds generated by multiple impacts of the pile driver during piling should be treated with caution.

Detailed results of model studies of underwater noise propagation together with a description of model and its preparation method are included in Appendix No. 3 to the EIA Report.

4.3 Modeling the bird collision risk

Wind turbines both onshore and offshore, may, due to their size, generate negative impact in the form of collisions of migrating birds with elements of wind turbines. This applies in particular to the moving components of the wind turbines, i.e. the rotor with blades. In order to determine the collision risk in the form of the number of expected collisions, a basic model prepared by Band was used [25]. The model assumes that a certain part of the population of migrating birds is within the range of rotor operation. Estimation of the bird collision risk requires quantitative data on migratory birds, as well as information on parameters of individual wind turbines and the entire wind farm. It is assumed that the probability of collision with the rotor depends on the size of the bird (wing span and area), the range and pitch angle of the blade, the rotational speed of the rotor and the flight speed of the bird. When visibility is limited (low clouds, night, dense fog), birds are able to spot OWFs from a shorter distance than in conditions with good visibility, which results in a higher risk of collision. The analyses tested both the option proposed by the Applicant and the alternative option together with different ranges of clearance height between the lower span of the rotor and the water surface. Among all species considered in this analysis, the significance of the collision risk was determined at a moderate level for the common crane, for which the maximum mortality was estimated at 116 individuals in autumn in the alternative option, while the models for the option proposed by the Applicant indicate a lower mortality by approx. 60% in both spring and autumn for all tested clearance ranges. The impact significance in the form of collision risk for the long-tailed duck, common scoter and velvet scoter was assessed to be of low importance. For these species, the estimated number of collisions concerned a few individuals. For geese, the estimated number of collisions in the worst case scenario involved more than 70 individuals due to the very large populations of the species included in this category (estimated at more than 3.5 million individuals). For the remaining species, the impact significance was considered negligible.

The estimation of collisions possible in the case of cumulative impact was carried out by multiplying the collision risk modeling results by 5.75. The factor was calculated from the ratio of the total power output of seven OWFs (included in the cumulative impact analysis) to the power output of the Baltic Power OWF. Mortality remains very low for most species. The cumulative impact in the case of common scoter means less than 10 colliding individuals, and in the case of common crane – maximum 227 individuals in autumn for the RAO and it is the highest for clearances between 35 and 50 m. In the case of cumulative impact, it should be noted that due to the flight trajectory (from the north-east to the south-west and vice versa), it is very unlikely that migratory birds should encounter more than 2 OWFs along their route, due to their linear arrangement on the west-east axis. Therefore, it is important to point out the fact that the cumulative impacts represent deliberately inflated mortality rates, in the event that birds actually encountered all OWFs along their route. Accordingly, the significance of the cumulative impact was still assessed as moderate for common cranes. The good status of the population of these species, even with the maximum values of collision mortality, will not change. The significance of the cumulative risk of collision was determined for the long-tailed duck, common scoter, velvet scoter and geese.

Detailed calculation results both for a single Baltic Power OWF and for the cumulative case considering the Baltic Power OWF and other existing, implemented and planned projects are presented in Appendix No. 4 to the EIA Report.

5 Description of the predicted environmental impacts in case the project is not implemented, taking into account available environmental information and scientific knowledge

Failure to implement the project consisting in the construction and operation of Baltic Power OWF may take place in two cases, i.e.:

- complete abandonment of offshore wind energy in the Polish maritime areas, which in consequence means the need to generate energy from the existing or other sources;
- abandonment of the Baltic Power OWF project having the power output of 1200 MW with the simultaneous implementation of other OWFs within the Polish EEZ.

The aforementioned options are essentially different. The first one would mean in the long term abandonment of the use of an alternative source of electricity having a significant power output (e.g. Baltic Power OWF itself would cover approx. 3% of domestic electric power demand), which would require compensation through operation of conventional sources having a similar power output, with emissions of gaseous and particulate pollutants from combustion of fuels (hard coal or lignite), generation of approx. 20% of waste from combustion in relation to the amount of combusted fuel, and indirectly with the effects of environmental changes in the areas where fossil fuels are extracted.

An important premise for the implementation of the project is the potential avoidance of emissions of hazardous substances to the atmosphere. With a conservative assumption of 40% utilization of capacity and 30 years of operation, the Baltic Power OWF with the maximum capacity of 1200 MW can produce 126.14 TWh/454.11 PJ of electricity, which would allow to avoid the emission of more than 45 million Mg CO_2, more than 618 thousand million Mg SO_2, more than 83 thousand Mg of nitrogen oxides and nearly 1.5 million Mg of dust in lignite-fired power plants [131].

The above option will have local benefits related to abandoning the development of offshore areas. Failure to invest in offshore wind energy (wind turbines, power cables, substations) will in practice mean that complex impacts related to the construction, operation and decommissioning of these elements of the OWF will not occur over a period of several dozen years. As a result, this would also lead to the absence of restrictions on the availability of these areas to the existing and potentially new users [navigation, fishing, tourism and possible exploitation of hydrocarbons (crude oil and natural gas extracted below the seabed)].

The second option will mean the implementation of wind farms in other water regions, with a set of impacts on the marine environment and on human activities occurring there (navigation, exploitation of hydrocarbons, fishing, maritime tourism) that is difficult to estimate. However, this option has the advantage of reducing the effects of domestic fossil fuel extraction and combustion in conventional power plants. At the same time, while limiting the share of conventional energy in electricity generation, it will be possible, in accordance with the trends in the European power sector, to deepen the integration of the Polish extra high voltage transmission systems with Germany, Denmark and Sweden.

Moreover, due to the implementation of the PZPPOM and the indication therein of a limited number of water regions where the basic function is the renewable energy generation, failure to implement the Baltic Power OWF in the planned water region would result in failure to use the energy potential of Polish maritime areas.

For each of the two situations indicated above, the expected impacts on abiotic and biotic elements of a varied degree and extent will not occur. These elements will be subject to the existing impacts resulting from the existing pressures in the marine environment.

6 Identification and assessment of project impacts

The analysis of impacts was carried out separately for the construction, operation and decommissioning phases of the OWF.

6.1 Option proposed by the Applicant (OPA)

6.1.1 Construction phase

6.1.1.1 Impact on the geological structure, bottom sediments, access to raw materials and deposits

An important part of the assessment of the investment project impact on the processes taking place on the seabed and the seabed itself is to determine the scale of impact intensity and the impact range. The impact is considered significant if the change to the nature of the surface and the structure of the seabed is greater than the size of geomorphological forms potentially occurring at the seabed. The impact range determined as local, in geological and geomorphological terms, refers to spot changes (foundations) or linear changes (laying of cables) to the topography and structure of the seabed and is no larger than the dimensions of forms possibly created in a given area.

The sensitivity, i.e. the response of the seabed topography and structure, is assessed on a five-step scale in accordance with the data from table (Table 6.1).

Table 6.1. Sensitivity of seabed topography to impacts resulting from activities related to the construction of the OWF

Sensitivity	Description
Negligible	No changes to the topography and structure of the seabed or changes similar to observed ones caused by natural processes
Low	Changes noticeable, but not altering the nature of the topography and structure of the seabed; local range
Moderate	Changes noticeable, modifying the nature of the topography and structure of the seabed to a degree not affecting the general nature of the area; local range
High	Changes affecting the topography and structure of the seabed, changing its character and affecting processes taking place on the seabed; local range, limited to the project area, possible small impact on the nature of the topography of adjacent areas
Very high	Changes significantly affecting the topography and structure of the seabed in the analyzed area, which may significantly affect geological and geomorphological processes of the investment project area and adjacent areas

6.1.1.1.1 Impact on the geological structure

Depending on its structure, the seabed may exhibit different sensitivity to the impact of the investment project during its construction phase. A clay bottom and a clay bottom with a stony cover is difficult to wash out and changes in its morphology. A sandy, sandy and silty, and silty seabed is more susceptible to the washout and material displacement over it, e.g. in the form of sandy waves. Thus, elements of the Baltic Power OWF infrastructure may be uncovered or covered both as a result of natural processes displacing rock material along the seabed and as a result of this movement being disturbed by the Baltic Power OWF infrastructure elements.

Activities connected with the project construction may cause the following types of impact on the seabed:

- point disturbance of the geological structure by driving monopiles and laying or possible burying of cables;
- changes in the shape of the seabed due to: preparing the seabed for the foundation or support structure, laying of cables, leveling of seabed unevenness along the cable route; changes in the seabed morphology will also occur as a result of the possible storage of rock material excavated to prepare the seabed for foundations or support structures;
- seabed level changes due to the settlement of rock material raised and moved during preparatory and construction works (from suspended matter);
- pits forming in the seabed at the anchoring locations of vessels installing elements of the OWF infrastructure;
- the disturbance and sedimentation of suspended matter - during construction works, suspended

matter will be locally disturbed, as a result of which water will become turbid. Suspended matter formed as a result of disturbing sediments settles at the seabed depending on the water dynamics in the area. The disturbed sediment will move mainly in the Baltic Power OWF area and no further than a dozen kilometers from its boundaries (in trace quantities), and by settling, it will cover the seabed with an average thickness of no more than 0.2 mm, which is comparable to the amount of suspended matter settling as part of natural processes during the year.

The overall impact of the project during its construction phase was assessed as negligible for the general nature of the seabed and its structure – the changes will be minor, over a small surface of the seabed, local (foundations or support structures of wind turbines) or linear (within the belt along the cable route).

6.1.1.1.2 Impact on bottom sediments

In geological terms, taking into account the nature of deposits forming the seabed surface of the Baltic Power OWF area, no significant changes in the nature of deposits are expected. In the vicinity of individual locations of the wind turbines, the nature of surface sediments will change and, locally in points, where monopiles are driven into the seabed – sediments forming the seabed will change.

The total surface area of the OWF, determined in the Permit No. MFW/6/12 for erection and use of artificial islands, structures and devices, as amended, is 131.08 km^2, of which the Baltic Power DA surface area will not exceed 113.72 km^2. Changes in the nature of surface sediments will apply to the seabed for monopiles for 76 wind turbines and two substations with the surface area of 0.00553 km^2, which constitutes 0.0053% of the Baltic Power DA surface area. In the case of inner array cable lines, the disturbed seabed surface area will amount to 0.18 km^2. In total, the surface area of the disturbed seabed as a result of the subject project will amount to 0.18553 km^2, which constitutes only 0.163% of the Baltic Power DA surface area. The impact on surface sediments will be negligible.

6.1.1.2 Impact on the quality of sea waters and bottom sediments

Water and bottom sediments constitute very important elements of water ecosystem of the Baltic Sea, which is a shallow, small sea with limited water exchange through narrow and shallow Danish Straits. The surface of the sea is approximately 4 times smaller than of its catchment. Approximately 85 million people live in this area. These conditions make any interference with the marine environment – fishing, navigation, household and industrial sewage discharge, surface runoff from industrialized and agricultural areas, but also activities related to the seabed exploitation and development – affect the delicate ecological balance of the sea [450]. Water and sediments in bodies of water are strictly connected with each other. A form of balance exists between the various components of the marine environment, and in particular between water and seabed sediment. A change to one component (e.g. sediments) causes changes in the other (in water) and vice versa.

Most pollutants (heavy metals and toxic organic compounds of low solubility and slow to degrade) which are released into the environment as a result of human economic activity and reach surface waters are retained in sediments [50].

However, sediments are not only a place where persistent and toxic pollutants released into the environment are deposited, but also where many aquatic organisms live, feed, multiply and grow. Polluted sediments pose high risks to the biosphere, because some of the harmful substances contained in sediments may pass into the water as a result of chemical and biochemical processes and be available to living organisms [145, 57].

This sub-chapter identifies, characterizes and evaluates the impact of the OWF on the quality of sea water and bottom sediments. It was found that, during its construction phase, the OWF may cause various types of impacts on the discussed recipients (water and bottom sediment); these include: release of pollutants and biogenic compounds from sediments to water, contamination of water and bottom sediments with oil derivative substances, contamination of water and bottom sediments with anti-fouling agents, contamination of water and bottom sediments with accidentally released municipal waste or domestic sewage, contamination of water and bottom sediments with accidentally released chemicals and waste from the construction of the Baltic Power

OWF.

Release of pollutants and biogenic compounds from sediments into water

The disturbance of the bottom sediments related to the construction (founding) of monopiles for the OWF facilities, anchoring of vessels or burying of the cable is a process which contributes to pollutants passing from sediments into water [450, 50, 145, 57, 106]. During construction works, substances including labile metal forms, persistent organic pollutants (POPs), i.e. polycyclic aromatic hydrocarbons (PAHs) and PCBs, biogenic substances (nitrogen and phosphorus compounds) will pass into the water.

The most important parameters influencing the impact level are: the dimensions and number of monopiles, the length of cable sections and the width and depth of the cable trench, the types and amount of pollutants accumulated in bottom sediments and the type of rock material forming the seabed.

The passage of pollutants from sediments into water (and thus a change in water quality) and the formation of long-lasting suspended matter depend on the type of sediment. The largest amount of pollutants and biogenic substances will be transferred to water from sediments with an increased organic matter content (e.g. muddy, silty sediments with a higher concentration of metals and POPs). These deposits will also contribute to the formation of more suspended matter, which will remain in the water for a long time. Intensive resuspension may cause the release of biogenic substances immobilized in the sediment and contribute to eutrophication. In case of sandy deposits with low organic matter content (e.g. coarse sandy sediments), the described processes will be less intensive. These sediments are generally characterized by a small amount of fine-grained fractions and a low concentration of metals and persistent organic pollutants. Therefore, it is estimated that the processes related to the release of biogenic substances and POPs will occur at low intensity in the entire Baltic Power OWF area.

It should be emphasized that substances released from the sediment will pass into water. However, within approx. 1 year from the end of the construction activities, these substances will move back into sediments after reaching an equilibrium.

The worst case scenario is the use of GBS in the RAO. Their construction requires the preparation of the seabed, which may involve the removal of a layer of bottom sediments, not only where the foundation or support structure is founded, but also in its direct vicinity.

In the case of other analyzed technologies (large-diameter pile, tripod structure, jacket structure), the volume of disturbed sediment will be many times smaller, because in most cases these structures do not require seabed preparation and also the diameter of driven foundation piles will be many times smaller than the GBS diameter. The sediment around the driven piles will liquefy as a result of vibrations caused by the operation of the pile driver.

An example calculation of the amount of disturbed sediment for a monopile with a diameter of 9.50 m to be used in the Baltic Power OWF is presented below. Assuming that piles of such diameter will be driven several dozen meters into the seabed, it can be assumed that sediments approx. 1 m deep within a radius of approx. 3 m from the pile will be disturbed. The volume of sediment disturbed during pile driving into the seabed was calculated using the following formula:

$$V_a = V_{tr\ cone} - V_{cyll.},$$

where:

V_a – volume of the sediment layer disturbed during pile driving into the seabed,

$V_{tr\ cone}$ - volume of the truncated cone with a height of 1 m and a base diameter of 15.5 m,

$V_{cyll.}$ – volume of a cylinder – the part of the embedded foundation 1 m in height and 9.5 m in diameter.

Once the values are substituted in the formula, the volume of sediment disturbed during the driving of one pile into the seabed amounts to approx. 70 m^3 of sediment per one foundation or support structure.

In addition, sediment will be stirred during cable laying (at those sections where it will be necessary to bury it). The width of the cable trench is approx. 1.5 m, its average depth – up to 3 m and its length – up to 120 km, which gives a total of 540,000 m^3 of disturbed sediment (for the entire inner array cable network).

Moreover, during foundation of monopiles and installation of towers, disturbance of the bottom sediments will be observed due to anchoring of vessels. The anchoring process itself is short-term, affects a small area (spot) to a depth of approx. 3 m, so the volume of disturbed sediment will be small.

Based on the above assumptions and concentrations of pollutants and biogenic substances found in the Baltic Power OWF area (sub-chapter 3.2.2), their release into water in the OPA and RAO was estimated.

The calculations assume an average sediment volumetric density of 1.52 $g \cdot cm^{-3}$ (1520 $kg \cdot m^{-3}$) and an average sediment moisture content of 17.7%. For the calculations, the volume of sediments necessary to be removed for the correct installation of the foundation or support structure was assumed as 70 m^3 (OPA) and 4,700 m^3 (RAO). In both options, a maximum cable length of 120 km was assumed.

The estimate of the amount of heavy metals, pollutants and biogenic substances that may be released in the OPA and RAO during their implementation as part of the Baltic Power OWF project is presented in table (Table 6.2). They will not be significant compared to the loads brought by rivers and by rain into the Baltic Sea [450], which is also presented in the table below.

Table 6.2. Comparison of the mass of pollutants and biogenic substances that may be released into water during the construction phase of the Baltic Power OWF (OPA, RAO) with the load brought by rivers and by rain into the Baltic Sea [Source: data of Baltic Power Sp. z o.o.]

Parameter	**One foundation (monopile for the OPA, GBS for the RAO)**	**VpA (78 foundations)**	**RWA (240 foundations)**	**1 km of cable**	**Cable routes (OPA up to 120 km RAO 600 km)**	**Annual load brought by rivers into the Baltic Sea**	**Annual load brought by rain into the Baltic Sea**
Volume of disturbed sediment	70 m^3 (OPA) 4,700 m^3 (RAO)	5460 m_3	1 128 000 m_3	4500 m_3	540,000 m^3 (OPA) 2,700,000 m^3 (RAO)	No data available	No data available
Weight of disturbed sediment	106.4 Mg (VpA) 7,144 Mg (RWA)	8299 Mg	1 714 560 Mg	6840 Mg	828,800 Mg (VpA) 4,104,000 Mg (RWA)	No data available	No data available
Dry weight of disturbed sediment	87.57 Mg (VpA) 5880 Mg (RWA)	6830 Mg	1 411 083 Mg	5629 Mg	675,480 Mg (VpA) 3,377,400 Mg (RWA)	No data available	No data available
Lead (Pb)	0.27 kg (VpA) 14.5 kg (RWA)	21 kg	3480 kg	13.9 kg	1668 kg (WPW) 8340 kg (RWA)	50 000 kg	200 000 kg
Copper (Cu)	0.07 kg (VpA) 4.6 kg (RWA)	5 kg	1104 kg	4.4 kg	528 kg (WPW) 2640 (Guaranteed Technical Parameters – RWA)	100 000 kg	No data available
Chromium (Cr)	0.09 kg (VpA) 5.7 kg (RWA)	7 kg	1368 kg	5.4 kg	648 kg (WPW) 3240 kg (RWA)	No data available	No data available
Zinc (Zn)	0.48 kg (VpA) 32.4 kg (RWA)	37 kg	7776 kg	31.0 kg	3720 kg (WPW) 18600 kg (RWA)	No data available	No data available
Nickel (Ni)	0.07 kg (VpA) 4.4 kg (RWA)	5 kg	1056 kg	4.2 kg	504 kg (WPW) 2520 kg (RWA)	700,000 kg	No data available
Cadmium (Cd)	Concentration in deposits of the Baltic Power OWF below the determination limit					7 Mg	7 Mg
Mercury (Hg)	Concentration in deposits of the Baltic Power OWF below the determination limit					2 Mg	3 Mg
Congeners representing PCBs	< 0.00004 g (VpA) < 0.003 g (RWA)	<0.003 g	<0.720 g	<0.003 g	< 0.36 g (WPW) < 1.80 g (RWA)	715 000 g	260 000 g
Analytes representing PAHs	<0.0000004 to 0.001286 kg (OPA) <0.000294 to 0.08114 kg (RAO)	< 0.00003 to 0.1 kg	< 70.56 to 19.5 kg	<0.281 to 77.68	<33.72 to 9321.6 g (OPA) <168.60 do 46 608 g (RAO)	No data available	No data available
Available phosphorus (P)	5.88 kg (VpA) 395 kg (RWA)	459 kg	94 800 kg	378.14 kg	45377 kg (WPW) 226884 kg (RWA)	12,000,000 kg (total P)	No data available
Nitrogen (N) * (sandy sediments)	1.75 kg (VpA) 117.6 kg (RWA)	137 kg	28 224 kg	112.58 kg	13510 kg (WPW) 67548 kg (RWA)	190,000,000 kg (total N)	No data available
Nitrogen (N) * (loamy sediments)	40.28 kg (VpA) 2704.8 kg (RWA)	3142 kg	649 152 kg	2589.34 kg	310721 kg (WPW) 1553604 kg (RWA)	190,000,000 kg (total N)	No data available

*In order to estimate the amount of total nitrogen released from sandy sediments, a content of 200 mg kg_{-1} of this element was assumed, whereas 4600 mg kg_{-1} of total nitrogen was assumed for clayey sediments.

The processes of disturbing seabed sediments may slightly improve their quality (increase in oxygenation and decrease in the amount of pollutants and nitrogen compounds in the sediment due to their transfer to water). Better oxygenation of sediments may reduce phosphorus transfer from sediments as this process takes place in anaerobic (reducing) conditions [8].

The sensitivity of sea waters was assessed as moderate.

The release of pollutants and biogenic substances from bottom sediments during the construction phase is a direct negative impact of a local range, short-term, reversible or irreversible, repeating during the construction period, of low intensity.

The significance of this impact during the construction phase within the VpA was determined as insignificant for sea waters and as negligible for bottom sediments.

Pollution of water and bottom sediments with oil derivatives during normal operation of vessels during construction and during their failure or collision

Pollutants entering water during normal operation of vessels form the second largest source of oil pollution of seas. This is the source of approx. 33% of oil released into the environment (mainly due to increased vessel traffic in the Baltic Sea region) [221]. In comparison, approx. 37% of oil entering the sea flows with rivers from land, and tanker disasters only rank third (12%).

During the construction phase, vessels (ships, barges, etc.) will be used, from which small leaks of oil derivatives (lubricating oil, fuel oil, petrol, etc.) into water may occur during normal operation. They may contribute to a minor extent to the deterioration of water quality.

It should be assumed that these will be small (class I) spills, up to 20 m_3. Visible traces of such contaminants may disappear spontaneously in favorable conditions as a result of evaporation and dissipation in water. The size of these spills will be virtually limited to the Baltic Power OWF area.

The sensitivity of sea waters and bottom sediments to small spills of oil derivatives occurring during the normal operation of vessels was assessed as insignificant.

Pollution of sea waters or seabed sediments with oil derivative substances released during normal operation of vessels form a direct negative impact of local range, momentary or short-term, reversible, repeatable, of low intensity.

The significance of this impact during the construction phase in the VpA was assessed as negligible for sea waters and bottom sediments.

Leakage of oil derivatives which will pollute water and bottom sediments may also occur in emergencies (as a result of a failure or a collision of vessels, a construction disaster of one of the Baltic Power OWF facilities, as well as during maintenance works). Such events may contribute to the deterioration of coastal waters quality (if the spill reaches the shore). In the event of a collision of vessels, a 3rd degree spill, i.e. one above 50 m^3 and up to approx. 200 m^3, can be expected.

A visible effect of an oil spill is an oil slick which, under the influence of gravity and surface tension, spreads at a speed depending on the type of oil and ambient conditions. The influence of factors such as oil volume, density, viscosity, temperature, wind speed and time determine the size of the spill. The estimated speed of an oil slick movement in large water bodies is about 2-3% of the wind speed. It was found that a spill of 1.6 t (1.8 m_3) of oil spreading over the surface of 1 km_2 during one day causes a film 2 µm thick and dark in color to form. On the other hand, 40 kg of oil causes a spill over an area of 1 km_2 with a film thickness of 0.05 µm [174].

Oil film formed on the water surface may cause:

- impeded exchange of gases, especially of oxygen, between water and the atmosphere;
- a 5-10% decrease in light intensity under the water surface (mainly due to the presence of heavy fractions of oil and sulfur) limiting photosynthesis;
- an increase in the temperature of water during the day as a result of light absorption by the oil

layer.

While an oil slick is spreading, other degradation processes are progressing which lower the concentration of hydrocarbons on the water surface (e.g. the release of low molecular weight hydrocarbons). Heavier oil fractions may undergo sorption on the surface of organic and mineral suspensions, which may increase their specific gravity and gradually make them sink to the bottom. Thus, heavier oil fractions may be bound by bottom sediments, contaminating them. The susceptibility of bottom sediments to contamination depends on the grain size of the sediment and its packing. Loose sandy sediments are more susceptible to pollution absorption. Compact loamy sediments inhibit the penetration of pollutants into the sediment. However, due to the type of sediments in the Baltic Power OWF area (small amount of organic matter and low content of fine fractions), oil spills will not cause a noticeable deterioration of their quality.

The probability of a failure or a collision of vessels in the Baltic Sea is low. Approx. 2 thousand vessels sail the Baltic Sea every day (including 200 tankers transporting oil and other liquids), and the number of collisions and failures in recent years has remained more or less constant (with a slight increase), i.e. approx. 120 - 190 sea accidents every year. The majority of accidents in the Baltic Sea cause no pollution. The number of accidents with pollution spilling into water is up to 21 (which occurred in 2017) per year. However, it must be kept in mind that even one large-scale accident may seriously threaten the marine environment. In 2017, 139 vessel accidents occurred in the Baltic Sea area, 21 of which resulted in pollution. None of the accidents that resulted in water pollution and required clean up occurred in the Polish exclusive economic zone [187]. In 2017, there occurred 8 confirmed oil spills less than 1 m^3 in volume, one with a volume in the range of 1-10 m^3 and one larger accident with a volume of 200 m^3 [187].

For the area of the south-eastern Baltic Sea where the analyzed Baltic Power OWF Area lies, the risk of a collision with a spill of over 5,000 tons was estimated to be 1 in 1,060 years, whereas the areas under the greatest threat are around the Wolin and Rüggen Islands and the Hel Peninsula [495].

During construction work vessels sail at low speeds, and then the risk of damage to the fuel tank is very low. A vessel generally holds fuel in several tanks, which reduces the risk of a major leak in case of a collision. Vessels used in the construction of wind farms may have fuel tanks with the total capacity of approx. 1200 m^3. Assuming a failure or a collision of the largest vessels used at the construction phase of the Baltic Power OWF (during inspections, maintenance and emergency repairs) and the destruction of the largest tanks of one vessel, no more than 200 m_3 of fuel oil, 15 m^3 of machine oil and approx. 2.5 m^3 of hydraulic oil may escape from one vessel (in the worst-case scenario) [456].

In the event of a construction disaster at the OWF (a wind turbine falling over or a vessel colliding with the wind turbine or a substation), a leak of fuel oil (up to 100 m_3), machine oil (up to 15 m^3), hydraulic oil (up to 2.5 m^3) or transformer oil (up to 80 m^3) may occur.

The most important parameters affecting the level of impact are: type and amount of released oil derivatives, weather conditions and the type of rock material forming the seabed.

The sensitivity of both receivers may be high in case of emergency or collision situations.

Moreover, a plan has been prepared and approved for the Baltic Power OWF to prevent risks and pollution during the construction, operation and decommissioning of the OWF. This plan specifies the potential area under threat for various failure and disaster scenarios, as well as the methods of preventing and eliminating oil spills.

The pollution of water or seabed sediments with oil derivatives released during an emergency forms a direct negative impact of regional range, short-term, reversible, repeatable, of high intensity.

The significance of this impact during the construction phase in the VpA due to the random and sporadic nature of failures and collisions was assessed to have low significance for sea waters and bottom sediments.

Accidental contamination of water and bottom sediments with anti-fouling agents containing organic tin compounds (e.g. TBT)

Hulls of vessels are protected against fouling with biocides, which may contain e.g. copper, mercury and organotin compounds (e.g. TBT). These substances may pass into the water and eventually be stored in the sediment. It should be assumed that releases of those compounds will be limited by their dilution in the water. Of the substances listed, organotin compounds are the most harmful (toxic) to aquatic organisms. The use of TBT (the most harmful substance) in anti-fouling paints is now prohibited, but the presence of those compounds in older vessels cannot be ruled out. The sensitivity of sea waters and bottom sediments to biocides released from hulls was assessed as medium.

Vessels (ships, barges, etc.) will be used at each phase of the project and their hulls may release certain amounts of antifouling substances into the water during normal operation. They can then contaminate sediments. To avoid this, it is recommended to use vessels, at every stage of the project, whose hulls have not been coated with anti-fouling paint containing TBT. This will eliminate this most harmful impact on aquatic organisms.

The most important parameters influencing the level of impact are: type and amount of antifouling substances released, type of rock material forming the seabed.

The sensitivity of both receivers is moderate.

Contamination of water or seabed sediments with antifouling substances during the construction phase forms a direct, negative impact of a local or regional range, short-term, reversible, repeatable during the construction period, of low intensity.

The significance of this impact during the construction phase in the VpA was assessed as negligible for sea waters and bottom sediments.

Pollution of water and bottom sediments by accidental releases of municipal waste or domestic sewage

At each investment project stage, waste - mainly municipal and other, not directly related to the construction process - and domestic sewage will be generated on vessels and at the onshore site back-up facilities (located in the port supporting project construction). Waste and sewage may be accidentally released to the sea while being received from vessels by another vessel and during a failure, resulting in a local increase in biogenic substance concentrations and the deterioration of water and sediment quality. However, the pollutants should be dispersed quickly, and thus would not contribute to a permanent deterioration of the environment in the project area. The sensitivity of sea waters and bottom sediments to this type of impact is assessed as low.

The most important parameters affecting the level of this impact are: type and quantity of released waste or sewage, weather conditions and type of rock material forming the seabed.

The sensitivity of both receivers is insignificant.

The pollution of water or seabed sediments with municipal waste or domestic sewage is a direct negative impact of a local range, short-term or momentary, reversible, repeatable during the construction period, of low intensity.

The significance of this impact during the construction phase in the VpA was assessed as negligible for sea waters and bottom sediments.

Pollution of water and bottom sediments by accidentally released chemicals and waste from the construction of the OWF

During the construction of the offshore wind farm, waste directly related to the construction process will be generated on vessels, at onshore site back-up facilities (located in the port handling the construction of the project) and where the project is being constructed. These may include, among others, damaged parts of OWF components, cement, joint grouts, mortars, machine fluids and other chemical substances used or replaced during construction works. They may be accidentally released into the sea.

The waste is mainly generated during the construction and decommissioning phases (most often waste from group 17 of the Annex to the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog). Waste produced during the construction phase will include e.g. cable scrap, sanitary waste from ships, flammable waste, oil and chemical waste, as well as construction waste. Waste should be neutralized in accordance with the applicable regulations concerning industrial waste.

The most important parameters affecting the level of this impact are: type and quantity of released waste or sewage, weather conditions and type of rock material forming the seabed.

Bulk cement is packed in bags of approx. 1 m^3 each. It was assumed that during the reloading activities, approx. 5 m^3 of this product may sink. Grouts, mortars and other binders often contain hazardous substances. For example, epoxy (two-component) binders contain various proportions of: epoxy resin, alkyl-glycidyl ethers and polyaminoamides. When released into water, these substances, due to their high density (approximately 1.3 g cm^{-1}) sink and deposit on the seabed. They are considered a serious threat because they cannot be easily removed from the seabed and are toxic to marine organisms.

For projects such as the Baltic Power OWF, a detailed plan is generally prepared to prevent the risks and pollution generated during the construction, operation and decommissioning of the OWF, which contains mitigating measures and a procedure to be followed in case of such events.

The sensitivity of both receivers to this impact is moderate.

The pollution of water or bottom sediments connected with the OWF construction process is a direct, negative impact of a local range, short-term or momentary, irreversible, repeatable during the construction period, of medium intensity.

The significance of this impact at the construction phase in VpA was assessed as negligible for sea waters and as of low significance for bottom sediments.

6.1.1.3 Impact on the climate, including emission of greenhouse gases and impact significant in terms of adaptation to climate changes, impact on the air (atmospheric purity)

As part of identifying the project's impact on meteorological conditions, annual meteorological measurements including the wind, pressure, humidity and air temperature were analyzed and the available literature concerning the air quality and climatic conditions for the Baltic Sea was reviewed.

During the construction phase of the Baltic Power OWF, an increased emission of pollutants into the atmosphere (including greenhouse gases) can be expected, due to the increased traffic of vessels involved in project construction. The magnitude of these atmospheric emissions cannot be assessed at this stage, as the number, type and duration of use of specialist vessels will only be determined in the detailed design. It was assumed that only vessels that comply with national standards and those resulting from international agreements on pollution emissions would be used.

According to the findings of the GP WIND project [167], the production of electricity from OWE is associated with the emission of 6 to 34 kg of CO_2 per 1 MWh in all phases of the life of the OWF, which, with the expected production of 126.14 TWh during 30 years of operation, means the emission of 0.76 to 4.29 million Mg of CO_2. The larger of the quoted values refers to the case when a GBS with the high proportion of cement is used. Even in this case, the emissions will be more than 10 times lower than from producing energy from other sources fired with hard or brown coal (emission reductions of over 45.8 million Mg of CO_2 are expected – without taking into account the emissions related to the construction of these sources).

During the construction phase, the significance of the impact of the planned investment project on climate and greenhouse gases will be negligible, as there will be no factors that could have a noticeable impact on their change.

The impact during the construction phase of the planned project on the air quality will be temporary and will disappear after the works have ceased. In addition, due to an open space without obstacles, the concentration of pollutants will decrease rapidly. Therefore, the significance of the impact will be negligible.

6.1.1.4 Impact on nature and protected areas

6.1.1.4.1 Impact on biotic components in offshore area

6.1.1.4.1.1 Phytobenthos

No impacts due to the absence of any phytobenthos in the Baltic Power OWF Area before the start of project construction.

6.1.1.4.1.2 Macrozoobenthos

During the construction phase of the Baltic Power OWF, works carried out on the seabed will cause the following impacts affecting the condition of macrozoobenthos inhabiting this area:

- disturbance of the bottom sediment structure;
- increased concentration of suspended matter in water;
- sedimentation of suspended matter at the bottom;
- redistribution of pollutants from sediments into water.

The assessment of the impact of wind turbines in the OWF Area (1 NM) in the construction phase was carried out separately for:

- soft seabed macrozoobenthos;
- hard seabed macrozoobenthos.

These two complexes of benthic fauna differ in taxonomic composition, abundance and biomass of their constituent species. Therefore, they differ in sensitivity and importance of the evaluated group of organisms. The sensitivity of macrozoobenthos depends on the type of impact and preferences resulting from the very biology of the species concerned. On the one hand, it is the ability of the population to adapt to various changes occurring in the environment as a result of the implementation of the project and, on the other hand, the ability of a complex of organisms to reconstruct the quantitative structure after the impact factor ceases to exist.

The complex of the soft seabed macrozoobenthos occupies the sandy seabed with the largest surface area in the area of the planned investment project and is characterized by a moderate ecological quality. This group is of low importance, as it is made up of species common and characteristic on the soft seabed of the southern Baltic Sea, and their biomass is dominated by organisms tolerant to environmental degradation.

The complex of hard seabed macrozoobenthos inhabiting the surface of boulders and stones, found in the southern and north-eastern part of the OWF Area (1 NM), occupies up to 5% of its surface area. The assessment of the hard seabed demonstrated a higher natural value of this type of habitat, which is in a good ecological condition. The significance of this group of benthic fauna is moderate because, despite the small area it occupies, it consists of habitat-forming clams, including Mytilus sp. mussels, which play an important role in the trophic chain. The local range of this complex results from the fact that it is limited to a specific area of the occupied stone field.

The first of the described impacts negatively affecting macrozoobenthos and causing the physical destruction of natural communities, is the **disturbance of the bottom sediment structure**. Disturbance of seabed sediments in places where works related to foundation and laying of cables are carried out, as well as operation of jack-up vessels are factors having the strongest impact on macrozoobenthos species inhabiting the surface of sandy, gravel, muddy sediments and rocky seabed, which are not able to move within the sediment [235, 498, 37]. Increased macrozoobenthos mortality will also occur when invertebrates are brought to the sediment surface, resulting in their physical elimination or predation pressure. Only mobile macrozoobenthos species, i.e. crustaceans of the *Malacostraca* class, occurring in both the soft and hard seabed macrozoobenthos complexes, will avoid adverse environmental conditions by escaping.

The disturbance of the bottom sediment structure is the most negative type of impact of all those occurring during the construction phase. The sensitivity of soft seabed macrozoobenthos to this impact is low. This means that the ability to restore macrozoobenthos complexes and its restoration to the original condition after the impact factor ceases to exist will take place within a year, except for places permanently occupied by structural elements. On the other hand, the sensitivity of clams, which are a group of absolutely constant taxons within the hard seabed complex, is moderate, which means that some of the species in the benthic complex will be destroyed and the survival of the remaining ones may be limited. Once the impacting factor disappears, the longest living species in this group - clams - may need several years before they are able to restore their quantitative structure.

Finally, as part of the OPA, it was assumed that the wind turbines will be founded on monopiles. The total area of the OWF, determined in the Permit for erection and use of artificial islands, structures and equipment No. MFW/6/12, as amended, is 131.08 km_2, of which the footprint area will not exceed 113.72 km_2. Macrozoobenthos will be physically destroyed on the seabed area disturbed by the installation of monopiles for 76 wind turbines and two substations (0.00553 km2) and along the route of internal array power cables (0.18 km_2, assuming the width of the cable ditch as 1.5 m), i.e. on the total area of 0.18553 km2, which constitutes only 0.163% of the Baltic Power DA.

The Baltic Power OWF area is not unique in terms of the qualitative and quantitative composition of macrozoobenthos compared to similar benthic habitats in the remaining part of the Polish maritime area within the same depth range in open waters of the southern Baltic Sea. The scale of the described impact is small for soft seabed macrozoobenthos and moderate for hard seabed macrozoobenthos, so in the case of soft seabed macrozoobenthos, which is highly able to recover its resources in a relatively short time, this impact should be considered negligible, whereas in the case of the hard seabed macrozoobenthos, with clams being able to re-colonize underwater parts of wind turbines, this impact will be of low significance.

Another type of impact on the macrozoobenthos of the Baltic Power OWF area consists in **an increased content of suspended matter in water**. As a result of the structure of bottom sediments being disturbed by works interfering with the seabed and during laying and burying of power and communication cables in the seabed, suspended matter from the seabed rises and disperses in water [451, 465]. When there is an excessive suspended matter concentration in water, organisms that filter or feed on suspended matter and organic matter deposited in sediments feed less effectively. When suspended matter concentration rises above 250 $mg \cdot l_{-1}$, the growth of macrozoobenthic organisms is restricted [443]. In addition, clams suffer increased mortality due to the clogging of their filtering system [453]. What is more, clams from the Baltic Sea are physiologically less suited to filtering suspended matter at high concentrations because they are not adapted to life in conditions of strong currents or tides [443, 440].

It follows from the conducted model analyses of suspended matter propagation in the Baltic Power OWF Area that the installation of cables using the hydraulic trenching method for the OPA or installation of the GBS system for the RAO would be the least beneficial for macrozoobenthos in terms of impact of suspended matter introduced into the marine environment (for the sake of order, it should be noted that the target solution used in the Baltic Power OWF will be monopiles). The ranges of suspended matter dispersal will be the greatest when moderate winds blow in constant direction, and the greatest concentrations of suspended matter when there are slow sea currents (range of several cm·s-1) and if these currents are circulating. Higher suspended matter concentrations caused by dredging works, ranging from several to several tens of mg·l-1 depending on the depth of the water region, the diameter of the foundation or the support structure of the wind turbine, and the type of sediment, occur within a local range around the place of works not exceeding 2000 m, and – in the worst case scenario – their impact on the marine environment will not last longer than a dozen hours, counting from the moment the works start at the seabed. In the Baltic Power OWF Area, where depths range from 28.1 to 45.4 m, there are slightly more sandy sediments and cohesive soils with a significant share of dust and clay fractions which cause greater release of suspended matter into the marine environment as they get suspended in water during dredging works. During power cable laying, the maximum suspended matter content will reach higher values than during works to install monopiles. Detailed results of model calculations of suspended matter propagation in the Baltic Power OWF area are included in Appendix No. 2 to the EIA Report. Taking into account the above results and the insignificant sensitivity of the soft seabed macrozoobenthos complex (the stressor has a very small impact on changes to the structure and functioning of this complex) as well as the low sensitivity of the hard seabed macrozoobenthos (the survival of some benthic species may be limited), mainly clams, to this type of effects, the impact of an increased suspended matter concentration in the OWF Area (1 Mm) on the macrozoobentos will be negligible for the soft seabed complex and of small significance for the hard seabed complex.

Sedimentation of suspended matter on the seabed presents an impact causing the benthic habitat to be covered with an additional layer of sediment [465]. The macrozoobenthos is quite tolerant to being covered by an additional, sedimenting layer of suspended matter up to 0.2-0.3 m thick [443]. This is because many macrozoobenthic organisms must adapt to life under natural conditions of sediments lifting and settling on the seabed as a result of e.g. storms or the tidal cycle [447, 438]. The covering of the macrozoobenthos fraction living on the sediment surface (epifauna) will restrict its survival to a greater extent, because when these organisms are covered with an additional layer of sediment, they cannot move. However, the most important factor influencing survival in these conditions is access to oxygen dissolved in water, which can diffuse 1 to 2 mm deep into the sediment [447].

The maximum thickness of newly formed sediments at the distance of 100 m from the place of works disturbing bottom sediments will not exceed 2 mm (cohesive substrate slightly prevailing in the Baltic Power OWF Area: clayey sand, sandy clay, sandy loam, sandy silts, compact clay) and 1 mm in the case of non-cohesive sediments (fine, medium and coarse sands, gravel). However, 1000 m from the place of works, the thickness of new sediments in the maximum option will be unnoticeable. The sedimentation of the disturbed bottom sediments in the Baltic Power OWF Area and outside its boundaries will be of a local and short-term nature. Just as for the impact of the increased suspended matter content of water, the sensitivity of the macrozoobenthos complex to this type of impact is insignificant for the soft seabed macrozoobenthos complex and low for the hard seabed macrozoobenthos complex. Because oxygen penetrates through a sediment layer 1.35 mm thick on the average, even organisms that cannot generate energy in an anaerobic environment will be able to survive in such conditions, so the impact was assessed as negligible for the soft seabed macrozoobenthos complex and of low significance for the hard seabed macrozoobenthos complex. Results of hydrochemical measurements of the oxygen content taken in the bottom layer of the Baltic Power OWF Area in the summer season (July, August) of 2019 indicate good conditions (no oxygen deficit) [27].

As a result of bottom sediment disturbance during installation works on the seabed, burying of power and communication cables or anchoring of vessels, **pollutants from sediments are redistributed into water.** This has a harmful impact on the macrozoobenthos [57, 498, 450] by exposing benthic fauna to an increased concentration of pollutants contained in sediments (e.g. heavy metals, toxic organic compounds) which escape into water as a result of chemical and biochemical processes. The accumulation of toxic substances, particularly by filter organisms, mainly in soft tissues of clams, leads to diseases and increased mortality, and thus a decrease in the abundance and biodiversity of the bottom fauna [420, 148, 169].

The impact on the macrozoobenthos was indirectly determined using surveys of the physical and chemical condition of sbenthic sediments in the Baltic Power OWF area with regards to their contamination. These surveys have shown that the analyzed benthic surface sediments from the OWF Area are inorganic and characterized by low concentrations of persistent organic pollutants (i.e. PAH, PCB, TBT, DBT, MBT) and harmful substances such as heavy metals (arsenic, total chromium, zinc, copper, cadmium, lead, mercury, nickel) or oil derivative hydrocarbons, and do not differ significantly from literature data for sandy bottom sediments of the southern Baltic Sea [182, 106, 241, 387, 421, 422, 450, 489, 170]. Moreover, the concentrations of labile forms of metals, which determine, among others, their toxicity, bioavailability or accumulation in bottom sediments of the Baltic Power OWF Area, were very low. The concentrations of the labile forms of the elements studied were roughly evenly distributed across the entire Baltic Power OWF Area [27]. The sensitivity of the soft seabed macrozoobenthos complex to the described impact is insignificant and is low only for the hard seabed macrozoobenthos complex. Therefore, this impact on the soft seabed macrozoobenthos should be considered negligible, and on the hard seabed macrozoobenthos – of low significance.

The analysis of the pressure factors during the construction stage of the Baltic Power OWF has shown that the impacts are assessed as negligible or of low significance, whereas the most adverse impact will be the disturbance of the structure of bottom sediments in places where the hard seabed macrozoobenthos currently occurs (especially in the southern and north-eastern part of the examined sea area).

It should be noted that even if the impacts described here occur together, they will be staggered over time, e.g. a reduction of the suspended matter concentration in water will be accompanied by a growth of the layer of deposited sediments.

6.1.1.4.1.3 Ichthyofauna

The main impacts on the ichthyofauna will be as follows:

- emission of noise and vibration;
- increased suspended matter content;
- release of pollutants and biogens from sediments into water;
- habitat change;
- barrier creation.

Emission of noise and vibration

The main source of noise and vibrations is the foundation of monopiles using the piling method. According to Popper and Hastings [349], this is the only noise impact, apart from underwater explosions, that may result in fish deaths. The noise emitted during piling depends on the diameter of the driven pile and can reach from about 230 dB re: 1 μPa$_2$s (pile diameter 1.5 m) [437] to close to 260 dB re: 1 μPa$_2$s (pile diameter 4.5 m) [298]. A slightly lower noise level should be expected during cable laying works (178 dB re: 1 μPa$_2$s) [480]. The range of this impact is highly dependent on noise intensity and seabed morphology which may affect sound propagation.

Fish have acoustic stimulus receptors and their sensitivity to sound depends on the receptor structure. Species with an inner ear connected to the swim bladder (e.g. herring) are capable of detecting sound pressure and hear sounds with the frequency of up to 3000-4000 Hz. The second group are fish without a swim bladder, capable only of feeling the movement of water particles generated by acoustic waves (e.g. adult flatfish). They can detect only sounds of a much lower frequency, not exceeding 500 Hz [352].

Depending on the intensity of noise and the distance from its source, the impact can have various effects ranging from behavioral changes to the death of fish (Table 6.3).

Table 6.3. Potential impact of noise on ichthyofauna; based on Popper et al. [350]

Impact effect	Impact characteristics
Death	Death as a result of injuries caused by exposure to noise
Tissue damage; physiological disorders	Examples of injuries: internal hemorrhages; damage to gas-filled organs such as the swim bladder and surrounding tissues
Hearing system damage (TTS, PTS)	Hair cell damage, temporary (TTS) or permanent threshold shift (PTS) of hearing
Masking	Masking of important biological acoustic signals from the environment, including from other individuals
Behavioral changes	Disturbance of normal activities such as feeding, spawning, formation of shoals, migration, displacement from preferred areas, avoidance reaction

Thomsen et al. [437] suggest that cod is able to detect sounds generated by piling at a distance of even 80 km, while salmon and flatfish hear them from a distance of several kilometers.

A noise level higher than that normally prevailing in the environment may cause problems with detecting natural sounds, which in turn cause problems with spatial orientation and locating prey (masking effect).

At the scale of local ichthyofauna groups, the disturbance of the normal noise level may lead to behavioral effects such as abandoning feeding grounds, hiding places and changing spawning territory [402], thus affecting the survival of individuals and their reproductive success. Fish may react to an increased level of noise by leaving the affected region (avoidance response) [312, 308, 11]. The avoidance effect may be particularly important in case of spawning areas if there are no areas with equally favorable conditions for reproduction in the vicinity of the abandoned area. In experimental studies, Thomsen et al. [439] showed that a sound of 144-178 dB re: 1 µPa^{2}s for sole and 140-161 dB re: 1 µPa^{2}s for cod caused an acceleration of movements in both species or a freezing reaction of cod. However, as this reaction lessens as a result of subsequent exposures to noise emission, the authors believe this may suggest a kind of acclimatisation to conditions of an increased noise level. The main cod spawning ground (the Bornholm Basin) is located more than 90 km from the Baltic Power OWF area, whereas in the case of sprat, the spawning area affected by the noise impact is relatively small compared to the spawning grounds of this species found in the entire southern Baltic Sea. It should be added that a noise level exceeding 140 dB will not have its effect in the entire water column, but in acoustic channels. For example, in the north-western direction, at the distance of 80 km from the noise source, this noise level will occur at a depth of 40–60 m.

Other effects of fish exposure to an increased noise level may be a temporary (TTS) or permanent (PTS) threshold shift of their hearing. Tissues and the swim bladder may also be damaged and fish may die. Popper et al. [351] give a specific value of the noise level to be assumed as causing bodily injury to fish. These authors follow the precautionary principle (assuming the TTS as a proxy of a bodily injury), propose assuming sound exposure levels (SEL) and sound pressure levels (SPL) of, respectively, 187 dB re: 1 µPa^2 sec and 208 dB re: 1 µP as limit values above which bodily injury may occur in fish. Similar values are given by Woodbury and Stadler [492].

The table (Table 6.4) prepared on the basis of the work of Popper et al. [350] and literature sources presents intensity values of the sound generated during piling, causing various effects on fish with different structure of hearing organs.

Table 6.4. Impact of noise caused by a pile driver operation on the ichthyofauna, taking into account the morphology and development stage [Source: Popper et al. [350]]*

Type of organism	**Mortality and potential lethal damage**	**Renewing damage**	**Temporary threshold shift of hearing**	**Masking**	**Behavioral disturbances**
Fish without a swim bladder (particle movement detection) e.g. flatfish	> 219 dB SELcum > 213 dBpeak	> 216 dB SELcum > 213 dBpeak	> 186 dB SELcum	(B) moderate (U) low (D) low	(B) high (U) moderate (D) low
Fish with a swim bladder not connected to the inner ear (particle movement detection) e.g. Atlantic salmon	210 dB SELcum > 207 dBpeak	203 dB SELcum > 207 dBpeak	> 186 dB SELcum	(B) moderate (U) low (D) low	(B) high (U) moderate (D) low
Fish with a swim bladder connected to the inner ear (acoustic pressure detection) e.g. Atlantic cod, herring	207 dB SELcum > 207 dBpeak	203 dB SELcum > 207 dBpeak	186 dB SELcum	(B) high (U) high (D) moderate	(B) high (U) high (D) moderate
Eggs and larvae	> 210 dB SELcum > 207 dBpeak	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low	(B) moderate (U) low (D) low

** For effects of impact for which it was impossible to determine the sound level, relative risk (low, moderate, high) was determined depending on the distance from the sound source: (B) near – several dozen meters, (U) moderately far – several hundred meters, (D) far – several thousand meters. Units for peaks: dB re 1 µPa and for the cumulative SEL value: dB re 1 µPa^{2}s*

Models showing a maximum SEL range of 142 dB re: 1 µPa2s for VpA (SRH applied) predict that the range of impact causing behavioral reactions will not exceed 87.9 km. In the case of noise and vibration causing TTS, the range will not exceed 0.1 km for a single impact and 29.5 km for a cumulative SEL within one hour (Table 6.5).

Moreover, the use of a "soft start" procedure, which is to scare the ichthyofauna away from the affected area before works start, should additionally reduce the impact causing TTS. Consequently, the possibility of increased ichthyofauna mortality or tissue damage is not considered in the analysis.

Because of the hydrological conditions prevailing here, the Baltic Power OWF Area is not a place where cod spawns or a spawning ground of the deep water spawning of European flounder which dominates in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. The presence of herring larvae in the vicinity of the project indicates that this species may spawn in this area. However, their number was very low compared to typical spawning grounds, so it can be assumed that possible disturbances of the reproductive process will not affect the recruitment of this species at the population level.

Table 6.5. Summary of distance ranges to threshold values for fish, obtained for the Baltic Power OWF using SRH [Source: data of Baltic Power Sp. z o.o.]

Effect of factor impact		**SEL limit (dB re 1 µPa²s)**	**Impact range**	
			Average distance [km]	**Maximum distance [km]**
Fish without swim bladders	Behavioral response	142	26.1	50.2
	TTS (Single impact)	186	0.1	0.1
	TTS (1-h cumulative SEL)	186	10.8	29.5
	PTS (Single impact)	216	0.1	0.1
	PTS (1-h cumulative SEL)	216	0.1	0.1
Fish with swim bladders	Behavioral response	135	38.5	87.9
	TTS (Single impact)	186	0.1	0.1
	TTS (1-h cumulative SEL)	186	10.8	29.5
	PTS (Single impact)	203	0.1	0.1
	PTS (1-h cumulative SEL)	203	0.9	1.0

The impact of noise and vibration on adult fish will be: negative, direct, short-term and reaching beyond the OWF area (regional).

The sensitivity of cod, herring and sprat to the impact was assessed as very high, of European flounder, sand goby and of common seasnail as high.

The significance of the impact was assessed as moderate for all investigated fish species. With regard to protected fish, only larval stages were found during the surveys, and for them the impact will be local in nature.

Increase in suspended matter content

During works that disturb the seabed, sediments will be disturbed, which will result in increasing the content of suspended matter in water and deterioration of visibility. Such situations may occur mainly during the construction phase (installing monopiles of wind turbines, execution of excavations for cables) and during decommissioning of the project (removal of structural elements of the Baltic Power OWF).

The significance of the suspended matter impact on fish depends both on physical factors resulting from local conditions of the abiotic environment and related to the biology of ichthyofauna.

The first group of factors includes sediment characteristics such as grain size distribution, mineral composition, adsorption and absorption capacity, hydrological parameters (salinity, temperature, oxygen concentration), seabed morphology or area hydrodynamics (direction of currents, waves) [122]. The effect of suspended matter on fish is also dependent on suspended sediment content and the exposure time of the organism [316]. It should be emphasized that the type of sediment is a very important factor affecting the intensity of the impact. In the case of sandy sediments, especially those with coarser grain-size distribution, both the spatial range and the impact time will be much lower than in the case of silty sediments or silty and sandy sediments.

The main biological factors that may affect the intensity of the impact are the mode of life, mode of reproduction, development stage and condition of fish.

The impact of suspended matter on ichthyofauna may result in a whole range of negative effects, starting from avoidance reaction, by slowing down the rate of growth and reducing the success of reproduction up to an increase in mortality.

Early stages of fish development are particularly sensitive to the impact of increased suspended matter content. According to Engell-Sørensen and Skyt [122], in the case of juvenile and adult fish, the fatal effects of suspended matter may occur at a level of grams per dm_3, whereas earlier development stages may similarly react to a level of milligrams per dm_3. The higher sensitivity of juvenile stages is due to higher oxygen demand than in adult fish associated with a higher rate of metabolism of juvenile stages [17, 331]. Suspended matter particles penetrating into the gills hinder the respiration process and may cause an increase in mortality rates [101].

The experimental studies showed the inhibition of herring larvae growth at suspended matter content above 500 mg dm_{-3}, whereas at concentration of 19 g dm_{-3}, larvae mortality of 100% was observed [301]. Particularly high sensitivity is observed for the earliest development stages. Westerberg et al. [471] found an avoidance reaction for cod larvae with yolk sac already with a suspended matter content of 3 mg dm_{-3}, whereas values up to 10 mg dm_{-3} increased mortality rates.

The impact of increased suspended matter content may not only directly disturb the physiological processes of fish, but also affect their behavior. The reduction in visibility caused by the presence of suspended matter lowers the efficiency of larvae sensing and consuming food [52]. This is confirmed by Utne-Palm research [452] showing that the increase in turbidity (80 JTU) had a negative impact on the ability of herring larvae to obtain food.

For the earliest development stages, increased suspended matter content may have a negative impact on the growth and survival of roe. Sediment particles adhering to the chorion may limit gas exchange and the removal of metabolites [76, 226, 14]. Suspended matter content exceeding 100 mg dm_{-3} may result in increased mortality of cod roe [373]. In the case of pelagic roe, its buoyancy may also be reduced due to adhesion of sediment particles to its surface. This results in eggs falling to lower water levels or to the bottom. This may result not only in deterioration of oxygen conditions, but also in an increase in the pressure of predation of benthic organisms and physical and physiological stress. According to Rönnbäck and Westerberg [373], a suspended matter content of 5 mg·dm_{-3} occurring for 4 days may cause cod roe to fall to the bottom.

In the case of demersal roe (spawned on the seabed), the negative impact of increased suspended matter content is much lower than in the case of roe developing in the water column. Research carried out by Messieh et al. [301] did not show any significant impact of suspended matter content up to 7 g·dm_{-3} on herring roe. Similar conclusions were reached by Kiørboe et al. [227] during the experiments carried out for the suspended matter content of 300-500 mg·dm_{-3}. However, these authors suggested that the impact of the increased content f suspended matter may be significant in the event of a deterioration of oxygen conditions. However, an indirect negative impact on herring reproduction cannot be excluded. De Groot [101] points to the possibility that specimens of this species may spawn in random places as a result of problems with finding traditional spawning grounds. Unless there is a clear negative impact of the increased suspended matter content on demersal roe, the harmfulness of covering the grains deposited on the sediment surface by a layer of sedimenting particles cannot be excluded. The limitation of visibility resulting in the loss of benthic vascular plants may also cause deterioration of spawning conditions for certain fish species laying roe on plants.

Increased suspended matter content rarely increases mortality of juvenile and adult ichthyofauna stages. This results from the possibility of active movement of fish to areas not affected by this factor (avoidance effect). The values of suspended matter content that produce this effect vary depending on the species and development stage of fish. For young herrings, it was observed at 12 mg·dm^{-3} [301], whereas for adult fish the reaction was observed at a slightly lower level (10 mg·dm_{-3}) [213]. According to the Westerberg research, referred to in the Environmental Impact Assessment Report for the Kriegers Flak Wind Farm [419], the avoidance reaction for herring and sprat was already observed at concentrations above 3 mg·dm $_{-3}$, whereas according to Hansson (quoted therein) such a reaction should be expected only at concentrations above 100 mg·dm_{-3}.

Apart from the avoidance reaction, effects of an increased suspended matter content were also observed, such as disorientation, reduced response time, increased or reduced predation, disorders in food intake. A reverse reaction to avoidance responses is also possible for species that prefer an increased level of turbidity, limiting the pressure of predation [120, 229].

The literature data mentioned above indicate an increase in fish larvae mortality at suspended matter content of approx. 10 $mg \cdot l^{-1}$. According to the results of model calculations of suspended matter propagation in the Baltic Power OWF area, performed for cable sinking by hydraulic milling or boulder removal, the contents of 15 $mg \cdot l^{-1}$ may occur during works on the seabed covered with cohesive soils under the most unfavorable conditions (envelope of maximum contents for the entire simulation period) at a maximum distance of 2000 m from the place of works.The total area impacted should not exceed 15 km^2.

With reference to the pelagic roe, the negative impact of the suspended matter may occur at the content of 5 $mg \cdot l^{-1}$. In the most unfavorable scenario (depth of $32 < h < 38$ m, cohesive substrate, hydraulic milling or boulder removal from the seabed), the impact of such content may cover the area of approx. 30-60 km^2 (estimated value) around the work site. Therefore, it can be assumed that increased mortality of pelagic roe may occur in the area of approx. 60 km^2. In assessing the significance of this impact, it should be taken into account that during the surveys preceding the preparation of the report only relatively few instances of pelagic roe of sprat were found. The area affected by the negative impact of the suspended matter constitutes a very small part of the extensive sprat spawning ground, therefore, its importance for the population of this species is irrelevant.

An important factor determining the impact of the suspended matter is the duration of the increased content in water. The results of model works indicate that the impact of suspended matter on the marine environment in the least favorable scenario does not last longer than 15 hours, counting from the moment of commencement of sediment disturbing works. Thus, such environmental impact will be short-term.

A re-deposition of the suspended matter at the bottom leads to covering it with a new layer of sediments, the thickness of which, according to the model calculations, may reach 2 millimeters at a distance of 100 m from the place of works. This may lead to a negative impact on the reproduction of herring, common seasnail and gobies by covering the spawn laid by these species at the bottom. However, taking into account the small Baltic Power OWF Area, compared to the coastal areas offering more favorable environmental conditions for the spawning, as well as the nearby Słupsk Bank, a very local effect of the possible impact may be assumed.

Because of the hydrological conditions prevailing here, the Baltic Power OWF Area is not a place where cod spawns or a spawning ground of the deep water spawning of European flounder which dominates in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. The presence of herring larvae in the investment project area indicates that spawning of this species may occur in this area. However, compared to typical spawning grounds, their population size was very low, so it can be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

The increase in suspended matter content will concern relatively small areas in relation to the entire surface of spawning and feeding areas. At the same time, the results of modeling of the spread of suspended matter in the OWF Area indicate that the increase of its content in water will be short-term and local. Detailed results of the suspended matter spread modeling are included in Appendix No. 2 to the EIA Report.

The impact related to the increase of suspended matter content will be negative, direct, local, and short-term.

The sensitivity to the impact for cod, European flounder, common seasnail and sand goby was assessed to be moderate and for sprat and herring – large. The significance of the impact is assessed to be negligible for all investigated fish species.

Release of pollutants and biogens from sediments

The occurrence of pollutants and biogens in water may result from spillage as a result of failure or collision of vessels, as well as through their release from sediment during the performance of works related to the construction of wind farms.

The greatest sensitivity of fish to harmful substances is observed in maturing females and early larval stages. The exposure of maturing females to even low concentrations of harmful substances may have an impact on their reproductive organs and their effects are often visible in the next generations. Morphological changes caused by this factor include deformations of spine, jaws or reduction of the size of hatching larvae. Research performed in the North Sea showed the occurrence of morphological changes in species such as common dab, European flounder, cod [108] and herring (Clupea harengus membras) [271].

Physiological changes as a result of toxic substances the most frequently include reduced pulse and hormonal disorders that may affect ovulation and spawning. There may also be behavioral disorders resulting in a decrease in the feeding efficiency of fish [375, 414, 467]. A potentially high hazard may be caused by emission of oil derivative substances (hydrocarbons), including PAHs, whereas light fractions cause a much higher hazard than heavy ones. In the case of juvenile stages, a clear negative impact of even low concentrations of PAHs on embryonic growth was identified [85]. However, according to the assessment of the U.S. National Oceans and Atmosphere Administration (NOAA), the impact of oil derivative substances on fish is largely limited to coastal and closed water regions where active risk avoidance is hindered. Also, the research of Koehler [234] and Vethaak and Wester [458] did not show a statistically significant link between the concentrations of PAH and the occurrence of liver tumors in flounder in Danish and German waters of the North Sea, although the researchers did not exclude the possibility of tumors being triggered by these substances [234, 459].

Toxic chemicals may release from sediment during foundation of monopiles of wind turbines, laying power cables on the seabed and decommissioning of the OWF structure. According to the Helsinki Commission, harmful substances that may penetrate sediment water include heavy metals (cadmium, chromium, copper, lead, mercury, nickel, zinc, arsenic), chlorinated biphenyls, chloro - and phospho-organic pesticides, TBT and its decomposition products, the sum of hydrocarbons, polychlorinated dibenzodioxins, polychlorinated dibenzofurans and PCBs. However, the risk of releasing larger amounts of these substances from sediments in the Polish Exclusive Economic Zone appears to be low due to their low concentrations found in sediments in the area of the southern Baltic Sea.

Tests of the content of PCBs, organochlorinated pesticides and heavy metals (copper, zinc, cadmium, lead, mercury) in sediments from different Polish maritime areas locations did not show the presence of the above substances in sediments in concentrations that could cause a negative biological effect [100]. Concentrations of heavy metals (copper, zinc, cadmium, lead, mercury) in sediments and tissues of European flounder from the area concerned performed in 2011 indicate a low level of accumulation of harmful substances in fish tissues [346]. Also during the tests on DDT, HCB, polychlorinated dibenzodioxins and dibenzofurans content in the sediments of the southern Baltic Sea, no concentrations of these pollutants that may have toxic effects on marine organisms were found [423].

The impact related to releasing pollutants and biogenic substances from the sediments to the body of water will be negative, direct, temporary and local.

The sensitivity to impact on cod, European flounder, common seasnail, sand goby, sprat and herring was assessed to be moderate.

The significance of the impact is assessed to be negligible for all investigated fish species.

Habitat change

During the performance of works at the construction stage, there may be a temporary significant reduction in the availability of the project area for fish. If this area is an important spawning ground, such exclusion, even for a small area, may be important for the greater part of the water region [30]. The scale of the impact of loss is specific to individual taxons and the life stages of fish [482]. Moreover, the following factors seem to be equally decisive: the size of the lost area, the season of works and their long-term nature.

Physical changes in the environment may directly affect living and reproductive conditions, causing disturbance or cessation of reproduction [201, 202, 342, 353, 40]. Changes in the sediment structure may have a negative impact on the reproduction of fish species spawning demersally. Such a reaction may, for example, concern herrings requiring a seabed covered with sediment for attaching the spawn [227, 353].

Changes in the physical parameters of sediment or occupation of the seabed surface by structural elements may result in loss of habitat for some benthic organisms and, consequently, in reduction of the food resources of benthic fish.

The sensitivity of the ichthyofauna to the loss of habitat which may occur during the construction of hard substrate elements at the bottom is specific to the species and stage of the fish life. This is related to different habitat requirements of a given development stage and a given species [482]. The scale of impact is influenced by the size of the lost area, length and season of works.

A change of habitat during construction will lead to the permanent destruction of benthos in the monopiles location and temporary destruction in the areas of cable trenches. This will result in a depletion of food resources for benthivorous fish. However, the area where habitat change completely eliminates benthic organisms will be relatively small. Given the active movement of fish in search for food, this loss of organisms in the benthophagic fish diet can be considered insignificant.

Also, the potential reduction of the fish food resources caused by the negative impact of the increase in suspended matter concentration in water and covering the seabed with a layer of fine sediment from water on zoobenthos will probably be insignificant. The assessment of the sensitivity of zoobenthos to both factors was assessed as low and the significance of their impact was negligible.

The OWF Area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the Baltic Power OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

The impact was considered as related to relatively small areas in relation to the entire area of spawning and feeding grounds.

The impact related to the change of habitat will be negative, direct, temporary and local.

The sensitivity to impact on cod, European flounder, common seasnail, sand goby, sprat and herring was assessed to be high. The significance of the impact is assessed to be negligible for all investigated fish species.

Barrier creation

The construction of underwater structures may constitute a migration barrier for fish whose routes may run in this place. Intense maritime traffic during the construction period may also reinforce the effect. The observations carried out in the areas of the Danish OWFs indicate that due to the possibility of an active movement of fish, these factors do not significantly disturb migration processes [263]. The scale of the impact will probably be local and short-term, causing only temporary avoidance of the area during the performance of works.

The density of OWF turbines is so low that it will not affect the migration possibilities of ichthyofauna.

The impact related to the creation of the barrier will be negative, direct, local and temporary for cod and European flounder, long-term and permanent for other fish species.

The sensitivity to impact on cod, European flounder, common seasnail, sand goby, sprat and herring was assessed to be moderate. The significance of the impact is assessed to be negligible for all investigated fish species.

6.1.1.4.1.4 Marine mammals

In order to assess the impact of the Baltic Power OWF on sea mammals, a calculation matrix was created, using which the significance of the individual effects related to the implementation of the project in relation to a given species was estimated.

The matrix covered various project stages along with the impacts that may occur during them. The impacts were analyzed in terms of receptors – species of marine mammals (porpoise, gray seal, harbor seal). Each of the impacts was assessed taking into account different parameters, as well as using appropriate weights, which were taken into account in the final estimation.

The analyzed parameters were divided into three groups: impact characteristics, significance of the receptor and scale of impact. As part of the impact characteristics, the duration (short-term/long-term) or directionality (directly/indirectly) were assessed. The receptor's sensitivity, the size of the vulnerable population, the receptor's importance in the range of the impact, as well as the receptor's level of protection were used to assess the receptor's overall significance. As regards the parameters related to the scale of the impact, the following were taken into account: the impact boundary (whether the impact crosses the border of the OWF or the country) and the impact on the protected areas and species.

Each parameter was scored taking into account the specific characteristics of each receptor, including, among others, the abundance of the species in the analyzed area and the percentage of the population vulnerable to the impact. After each parameter was evaluated, it was weighted, using appropriately selected ranks. At the final stage, all numerical values of the individual parameters were summed up, obtaining a final estimation of the significance of the impact on a given species, which was classified as: negligible, insignificant, moderate, significant or major. It was considered that the impact identified as "negligible" does not cause significant changes in the analyzed population of the species.

The results of the impact assessment based on the above described methodology were presented in the table (Table 6.7). The assessment was performed for the most relevant effects, taking into account the use of a hydro sound damper (HSD) and a double big bubble curtain (DBBC).

During the construction phase of the Baltic Power OWF, marine mammals may be subject to impacts resulting from:

- underwater noise from piling works;
- noise generated by the traffic of vessels;
- increased content of suspended matter in water;
- habitat changes;
- spillage of oil derivative substances into the environment as a result of vessel failures.

Piling noise

The analysis of the noise impact from piling showed that in the case of using HSD, the impact on marine mammals ranged from insignificant to major, and after taking into account HSD and DBBC – from insignificant to moderate. Modeling results indicated that the effects that deserve special attention are cumulative TTS, PTS and behavioral response. In the case of TTS and PTS from a single impact, for all analyzed marine mammals, the impacts were assessed as negligible, mainly due to small impact ranges in the modeled area (Appendix No. 3 to the EIA Report) (Table 6.6).

In the case of the harbor seal, it was found that the impact resulting from piling in the Baltic Power OWF was of minor importance for the species. Such results were obtained for all wind turbine locations and both NRS scenarios. The results of the assessment are related, among others, to the low probability of occurrence of the analyzed species within the impact range. Harbor seal is scarce in the Baltic Sea and its population is estimated at 1563 individuals in the south-western part of the Baltic Sea (NOVANA, Jonas Teilman, personal contact) and approx. 1200 individuals in the Kalmarsund population [186]. Most seals in the south-western Baltic Sea gather in Falsterbo, Saltholm and Bøgestrømmen, far west of the Baltic Power OWF Area. Seals of the Kalmarsund population are found closer to the Baltic Power OWF Area, but usually they do not move more than 50-100 km from their permanent locations (haul-outs) [323]. Monitoring conducted in the surveyed area and adjacent waters did not reveal the presence of harbor seal (3.7.1.4). Moreover, this species is not a subject of protection in the neighboring Natura 2000 sites.

Based on the assessment performed for the **gray seal** with the use of NRS in the form of HSD, moderate impact related to the cumulative TTS and behavioral response was found for all turbines, as well as moderate impact similarly in the case of the cumulative PTS for turbines 40 and 49. Monitoring surveys indicate that the gray seal appears in the Baltic Power OWF Area at a low frequency (sub-chapter 3.7.1.4). After taking into account the HSD, the ranges of noise impact in the modeled area were relatively small for this species (Appendix No. 3 to the EIA Report), which allows to conclude that the number of animals vulnerable to the impact related to the construction phase will be small. However, it is worth noting that the gray seal is protected in the nearby Natura 2000 site, therefore impacts on this species should be considered with particular attention. The analysis performed taking into account NRS in the form of HSD and DBBC showed that the impact on the gray seal for all wind turbines decreases and in the case of cumulative TTS was assessed as negligible. The effects of cumulative PTS (turbines 40 and 49) and behavioral response (turbine 1) were assessed similarly, which allows to conclude that the use of HSD and DBBC is more appropriate for the gray seal.

In the case of **porpoises,** an important part of the impact assessment was the estimation of the percentage of the Baltic Sea population affected by the construction of the Baltic Power OWF. Modeled impact areas were used for the assessment (Appendix No. 3 to the EIA Report, chapter 4.2). The dimensions of the areas are determined by the maximum impact ranges. The number of animals affected by the impact was then estimated on the basis of SAMBAH's porpoise density estimates. Due to the very large variability of estimates, the lower and upper confidence limit specified by SAMBAH (0.00060-0.00823 individuals/km^2) was used [386]. The proportion of the animals in the population affected by the impacts was calculated by dividing the number of porpoises in the affected area (lower and upper confidence limit) by the overall population size (corresponding to lower and upper confidence limit) (95% CI 80–1091) [386]. The analyses were carried out for each of the three wind turbine locations, and the results are presented in the table (Table 6.6). It was assumed that the significant level of impact is achieved when the potential number of porpoises exposed to noise at the cumulative 1 h TTS level, is not higher than 0.33% of the population. For the density indicated in the SAMBAH project, this means an area corresponding to a circle with a radius of more than 11 km. The adoption for the definition of such a circle surface is a conservative assumption.

The presented estimates are included in the impact assessment matrix. It is worth noting that for three wind turbine locations, the use of NRS allows to reduce the percentage of individuals exposed to TTS and PTS from a single impact (Table 6.6) to a negligible one (Table 6.7). In addition, the results showed that without NRS, up to 8.09% of the porpoise population may be affected by cumulative TTS and up to 0.74% by cumulative PTS, which was found for turbine 1 (shallow location). With respect to behavioral response, the highest share of affected animals was found for the turbine 49 (deep location) – up to 26.04%. After application of NRS, these values were significantly lower. For the HSD scenario, the percentage of animals affected by the cumulative TTS was reduced to a maximum of 0.21% and the cumulative PTS to 0% (turbine 1). Behavioral responses were found to affect up to 6.72% of the population. Calculations for HSD and DBBC showed that the percentage of animals affected by cumulative TTS decreased to a maximum of 0.01% (turbine 1), while the behavioral response decreased to a maximum of 0.71% of the population (Table 6.6).

The impact assessment carried out for porpoise, taking into account HSD, showed moderate impact related to the cumulative TTS (all turbines) and the cumulative PTS (turbines 1 and 49). In the case of behavioral response, the impact turned out to be significant for turbines 40 and 49, and moderate for turbine 1. The assessment drew attention to the protection status of porpoise in the Baltic Sea as well as in nearby Natura 2000 sites. An important factor was also the low frequency of porpoise in waters adjacent to the Baltic Power OWF (sub-chapter 3.7.1.4), as well as the ranges of impact identified in the model study (Appendix No. 3 to the EIA Report). Modeling showed that even with the use of HSD, the ranges of behavioral response impact were large, reaching Natura 2000 sites for turbines 40 and 49. Such a result was reflected in the impact assessment, which assessed the significant impact of the behavioral response in the case of turbines 40 and 49. Analyses showed that the use of HSD and DBBC may reduce the significance of this impact to moderate. It was also found that for turbine 49, the use of HSD and DBBC may reduce the cumulative impact of PTS to insignificant. The results obtained indicate that with respect to the impact on porpoises, the use of HSD could be insufficient and therefore both HSD and DBBC will be used in the NRS.

Table 6.6. Proportion of porpoises affected by the impact in the area of turbines 1, 40 and 49 of the Baltic Power OWF without and with the noise reduction system (NRS) applied. The number of population specimens is above and below 95% of the population size estimated together with the density obtained as part of the implemented SAMBAH project [386] [Source: data of Baltic Power Sp. z o.o.]

Effect		Impact area [km²]			Estimated number of specimens in the Baltic population [NE]	Number of porpoises under impact in the modeled area			Estimated density in the modeling area [sp. km⁻²]	Percentage of porpoises in the population under impact [%]		
		Turbine 1	Turbine 40	Turbine 49		Turbine 1	Turbine 40	Turbine 49		Turbine 1	Turbine 40	Turbine 49
PTS (single impact)	without NRS	0.05	0.03	0.03	80-1091	0	0	0	0.00060–0.00823	0	0	0
PTS (1-h accum.)		984	655	670		1/9	1/6	1/6		0.74	0.49	0.50/0.51
TTS (single impact)		7.7	3.8	3.8		1	1	1		0	0	0
TTS (1-h accum.)		10728	9966	10476		7/89	6/82	7/87		8.05/8.09	7.47/7.52	7.86/7.90
Behavioral response		21143	32412	34519		13/174	20/267	21/285		15.86/15.95	24.31/24.45	25.89/26.04
PTS (single impact)	from HSD	0.03	0.03	0.03	80-1091	0	0	0	0.00060–0.00823	0	0	0
PTS (1-h accum.)		5.3	2.6	3.4		0	0	0		0	0	0
TTS (single impact)		0.03.	0.03.	0.03.		0	0	0		0	0	0
TTS (1-h accum.)		279	188	197		1/3	1/2	1/2		0.21	0.14	0.15
Behavioral response		1807	6789	8910		2/15	5/56	6/74		1.36	5.1	6.68/6.72
PTS (single impact)	from HSD and DBBC	0.03	0.03	0.03	80-1091	0	0	0	0.00060–0.00823	0	0	0
PTS (1-h accum.)		0.1	0.03	0.03		0	0	0		0	0	0
TTS (single impact)		0.03	0.03	0.03		0	0	0		0	0	0
TTS (1-h accum.)		12.2	6.5	6.4		0/1	0/1	0/1		0.01	0	0
Behavioral response		361	824	947		1/3	1/7	1/8		0.27	0.62	0.71

Noise caused by vessel traffic

Small, fast ships, such as barges and delivery ships, generate mainly noise with frequencies from < 1 kHz to > 10 kHz [117, 190]. It is likely that their movement will lead to an increase in the sound field during the construction phase, including frequencies that partly concern marine mammals [190]. Porpoises, gray seals and harbor seals are more sensitive to higher frequencies and studies have shown that porpoises react to lower levels of high frequencies of vessel noise components [117, 487]. Wiśniewska [487] also discovered that exposure to sudden high-frequency noise, which could be caused by a fast-moving vessel, resulted in a vigorous caudal fin waving, disturbance to feeding and even occasionally disappearing echolocation in the case of free living porpoises. These behavioral changes were observed at a distance of several kilometers from the vessel. Increased noise from vessels related to the construction phase may thus potentially pose a problem for animals, and the presence of boats in the area may result in porpoises migrations or incurring energy expenditure due to the reduction of feeding ground and the need to move away from the boat. The intensity of disruptive factors depends on the type and number of boats, which in this case will be small- or medium-sized vessels, which are maintenance vessels, construction vessels and lifting gears.

Given that some of the areas with the greatest vessel traffic in Danish waters are also areas with many porpoises [418], they are very often exposed to low ship noise level [487]. However, any movements of porpoises caused by marine noise will be short-term and at relatively short distances (<10 km). The same applies to the two seal species in question, as seals are also often observed in areas with high maritime traffic intensity [215].

Ambient noise levels should not increase significantly due to increased traffic of shipping related to the construction phase. This will be a short-term impact. Therefore, the noise caused by the vessel traffic was assessed as insignificant despite its direct nature.

Increase of suspended matter in water

It is expected that the suspension of sediments related to the construction will be short-term, therefore it will probably not affect porpoises, gray seals and harbor seals. The increase in pollutant concentration as a result of suspended sediments is likely to be of low importance.

Habitat changes

Habitat changes related to construction include changes of the seabed and increasing presence of vessels, which indirectly affects marine mammals. None of these changes will have a significant impact compared to the noise effect generated during the construction phase. The importance of this factor for porpoises and seals has been assessed to be of low importance.

Spillage of oil derivative substances into the environment as a result of vessel failures

Vessel collisions causing oil spillage in the project area may adversely affect marine mammals present in adjacent waters. However, fuel spillage is very unlikely. Taking this into account, the significance of this factor for porpoises and seals was assessed as moderate.

Assessment of the significance of impacts during the construction phase

For the assessment of impacts, the methodology developed for the purposes of the EIA Report was adopted. The significance of the impact of the Baltic Power OWF was assessed for the construction phase after the use of SRH. The results are presented in the table (Table 6.7). The basis for assessment were the results of numerical modeling, which are included in Appendix No. 3 to the EIA Report. After application of the SRH system, all impacts on porpoises, gray seal and harbor seal were assessed to be of low importance or moderate.

Table 6.7. Significance of the impact on marine mammals resulting from piling during the construction phase after application of the SRH system [Source: data of Baltic Power Sp. z o.o.]

Species	Impact	Impact description	Location	Impact significance	
				HSD	HSD and DBBC
Common porpoise *Phocoena phocoena*	PTS (single impact)	Permanent shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	PTS (1-h accum.)	Permanent shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Moderate	Moderate
			Turbine 40	Low importance	Low importance
			Turbine 49	Moderate	Negligible
	TTS (Single impact)	Temporary shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	TTS (1-h accum.)	Temporary shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Moderate	Moderate
			Turbine 40	Moderate	Moderate
			Turbine 49	Moderate	Moderate
	Behavioral response	Behavioral response to pile driving (moving away from the construction site)	Turbine 1	Moderate	Moderate
			Turbine 40	Significant	Moderate
			Turbine 49	Significant	Moderate
	Shipping noise	Behavioral response to shipping noise (moving away from the construction site)	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Suspended sediments	Behavior changes due to suspension of sediments released during construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Habitat change	Changes in behavior caused by habitat change resulting from the construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for construction (e.g. fuel spillage)	Turbine 1	Moderate	Moderate
			Turbine 40	Moderate	Moderate
			Turbine 49	Moderate	Moderate
Gray seal Halichoerus grypus	PTS (single impact)	Permanent shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	PTS (1-h accum.)	Permanent shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Moderate	Moderate
			Turbine 40	Low importance	Low importance
			Turbine 49	Moderate	Low importance
	TTS (single impact)	Temporary shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	TTS (1-h accum.)	Temporary shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Moderate	Low importance
			Turbine 40	Moderate	Low importance
			Turbine 49	Moderate	Low importance
	Behavioral response	Behavioral response to pile driving (moving away from the construction site)	Turbine 1	Moderate	Low importance
			Turbine 40	Moderate	Moderate
			Turbine 49	Moderate	Moderate
	Shipping noise	Behavioral response to shipping noise (moving away from the construction site)	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance

Species	Impact	Impact description	Location	Impact significance	
				HSD	HSD and DBBC
	Suspended sediments	Behavior changes due to suspension of sediments released during construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Habitat change	Changes in behavior caused by habitat change resulting from the construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for construction (e.g. fuel spillage)	Turbine 1	Moderate	Moderate
			Turbine 40	Moderate	Moderate
			Turbine 49	Moderate	Moderate
Harbor seal Phoca vitulina	PTS (single impact)	Permanent shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	PTS (1-h accum.)	Permanent shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	TTS (single impact)	Temporary shift in the threshold of hearing due to a single hammer impact	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	TTS (1-h accum.)	Temporary shift in the threshold of hearing due to accumulated noise from 1 hour of piling	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Behavioral response	Behavioral response to pile driving (moving away from the construction site)	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Shipping noise	Behavioral response to shipping noise (moving away from the construction site)	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Suspended sediments	Behavior changes due to suspension of sediments released during construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Habitat change	Changes in behavior caused by habitat change resulting from the construction	Turbine 1	Low importance	Low importance
			Turbine 40	Low importance	Low importance
			Turbine 49	Low importance	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for construction (e.g. fuel spillage)	Turbine 1	Moderate	Moderate
			Turbine 40	Moderate	Moderate
			Turbine 49	Moderate	Moderate

6.1.1.4.1.5 Migratory birds

During the construction phase of the OWF, the space above the sea area where erection and construction works are carried out is gradually disturbed. Both the vessels participating in these works and the erected OWF structures create obstacles for migratory birds. Taking also into account the parameters of bird flights, i.e. their height and direction, the impact on different bird species will have different significance. This assessment took into account, first of all, the presence of construction vessels during the performance of works. Impacts on migratory birds resulting from the barrier effect and collision with the structures of the Baltic Power OWF were assessed for the operation phase, when their effects are the greatest. Detailed assessment of the impact of the Baltic Power OWF during the construction phase on migratory birds is included in Appendix No. 4 to the EIA Report.

The significance of the impact of the Baltic Power OWF, i.e. the barrier effect and risk of collision on migratory birds during the construction phase was assessed to be of low importance at the most.

6.1.1.4.1.6 Seabirds

Identification of key factors affecting seabirds during the construction phase

The impact of the planned investment project during the construction phase will be mainly local, i.e. limited to the construction site – the Baltic Power OWF will be located outside the protected areas, including the Natura 2000 sites.

In order to determine the significance of the impact, the scale of the impact was assessed as high for the long-tailed duck and velvet scoter, moderate for the razorbill and the common guillemot, and as insignificant for the European herring gull.

The identified factors and assessment of their impact on marine avifauna during the construction phase are presented below.

Vessel traffic

Construction works will require the presence of various types of vessels which will disturb seabirds by their physical presence, noise (including noise generated by driving piles), and light emission. The first two factors should not affect the change of the flight route of those species of aquatic birds that do not use the area, but only fly over it (e.g. common scoter). However, it cannot be excluded that such impact will be marked at night, especially when the construction site is heavily illuminated. Birds navigate as they migrate according to natural light sources such as stars and the sun. It has been noticed that at night they also head towards lighthouses, drilling towers and other structures illuminated by artificial light [476]. The range of impact will depend on the number of vessels involved, their size, the way the vessel is illuminated and the intensity of light sources. The duration of the construction phase and the location of the power plant within the Baltic Power OWF Area, where increased vessel traffic will take place, are also affected. The period in which the works will take place is important, as most species of seabirds, including the long-tailed duck, indicate very large differences in abundance in individual phenological periods. The disturbance effect will increase with the progressing development of the Baltic Power OWF area. Initially, it will be of local nature and birds will be able to find feeding grounds in the vicinity (e.g. in the neighboring Natura 2000 site of the Słupsk Bank), however, at the end of construction phase the range of this impact will significantly increase, strongly limiting feeding and resting possibilities for birds in the Baltic Power OWF Area.

On the other hand, the presence of vessels and fixed structures protruding from the water will result in a higher number of gulls that use such elements as resting sites and seek food in the vicinity of the vessels. Three species of large gulls, including the most numerous European herring gulls, gather on the open sea around fishing vessels. If, during construction (or future operation), commercial fishing is reduced in this water region during the wind farm operation, these gulls will move (at least partially) to other fishing sites.

Vessel traffic during the construction phase will cause direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). For razorbill, common guillemot, European herring gull and velvet scoter, this is a medium-term impact, and for the long-tailed duck – short-term and temporary.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Emission of noise and vibration

The presence and traffic of construction vessels will be the main cause of disturbance of seabirds in the water region covered by the construction of the Baltic Power OWF. This impact will be much higher than other pressures related to the construction phase, such as underwater noise emission.

However, it is worth noting that the monitoring of birds during the construction works of the Egmond aan Zee OWF in the Netherlands did not show any noticeable reaction to piling on the part of bird species insensitive to disturbances related to the presence of vessels (mainly the gull and the tern) [265].

The environmental impact assessment for the Baltic Power OWF Area showed the presence of a possible significant impact of underwater noise on fish, constituting the food base for certain species of seabirds (diving ichthyophages). The use of the NRS and the use of a mitigation measure (soft-start procedure during piling) will make the negative impact reduced.

Noise and vibrations during the construction phase are direct negative impacts on seabirds of local range (for the long-tailed duck of regional range, due to possible impact on the biogeographical population of the species), medium-term, reversible, repeatable during the construction phase, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other birds species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Lighting of the project site

Birds navigate as they migrate according to natural light sources such as stars and the sun. It has been noticed that at night they also head towards lighthouses, drilling towers and other structures illuminated by artificial light [476]. Research on the behavior of birds near oil rigs has shown that lighting causes gathering of seabirds around these structures not only during the migration period. This was mostly the case for tubenoses (*Procellariiformes*) which are most often active at night, but also observed were concentrations of the little auk (Alle alle) [476], being closely related to the razorbill and the guillemot, found in the area of the planned project. However, in the case of most species of typical seabirds (sea ducks, Gaviiformes), the impact of artificial lighting on birds present in the immediate and further vicinity of light sources remains very poorly explored.

Lighting of the Project site during the construction phase will cause direct negative impact on seabirds of local range (for the long-tailed duck of regional range, due to possible impact on the biogeographical population of the species), medium-term, reversible, repeatable during the decommissioning period, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Barrier creation

The structures of the power plant, gradually appearing during the construction phase, will deter birds. The influence of this impact on birds depends on the progress of constructing the OWF. At the outset, individual wind turbines will have little impact on birds, but the deterring effect will gradually increase [411]. Literature data clearly indicate that seabirds avoid the area occupied by wind turbines and their population decreases within a radius of up to 2 or even up to 4 km [79, 337, 266, 247]. Adult birds will most likely be able, to some extent, to get used to the presence of wind farms. However, specimens undertaking migration towards overwintering areas for the first time in life may have problems with bypassing an extensive barrier, created by a group of wind farms. This may result from their lower experience, which causes higher bird mortality in the first year of life [83, 360, 286]. Lack of data on bird behavior in the vicinity of the area-wide OWF indicates the necessity to plan post-investment monitoring surveys. It should also be noted that the parameter affecting the level of impact is the number of wind turbines under construction. The distance between individual wind turbines on the farm and neighboring OWFs is also important. Both the construction and operation of wind turbines located close to the Baltic Power OWF will result in the accumulation of the barrier effect for birds.

In addition, the presence of a large number of vessels used for the construction of the wind farm may result in an additional barrier effect, thus reducing the possibility of birds moving between the resting areas during the migration. The range of the impact will depend on the number of vessels involved in the construction phase, their size, the duration of the construction phase and the phenological period in which the works will be carried out.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Collisions with vessels

Collisions between birds and the vessels used to build wind farms may occur, mainly during the night hours when the birds are lured by the light they emit. The range of the impact will depend on the number of vessels involved in the construction phase, their size, illumination configuration and its intensity, the duration of the construction phase and the phenological period in which the works will be carried out.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact of collisions with vessels varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Destruction of benthic habitats

The foundation of monopiles and laying of internal array power cables will cause numerous disturbances of bottom communities at the project site.

Some of the habitats used by seabirds stopping during migration will be lost due to the construction of the foundations of monopiles. This process will have a direct impact on the seabed and will have an impact on the water column. Natural benthic environments will be lost, but most likely they will be replaced by new ones (artificial reef effect).

Bird species exposed to impacts related to the loss of bottom habitats as a result of occupied space are mainly sea ducks feeding on benthos. However, those species are very sensitive to disturbance caused by boats presence and other human activities at sea, therefore it is estimated that the disturbance impact due to the presence of construction vessels will be the main impact in the area, thus resulting in the movement of sensitive species to other areas. Therefore, those birds will not experience an additional impact related to the occupation of space in the construction phase.

The analysis of the EIA Report shows that the destruction of benthos habitats during construction works is an indirect negative, local-range, medium-term, reversible, repeatable impact on sea birds (mainly benthivorous ones) during the construction period (for each wind turbine or infrastructure component), with intensity depending on the species.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and the common guillemot as moderate, and for the long-tailed duck and velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters.

Increase of suspended matter content in water and depositing of disturbed sediment

These factors may affect the ability of benthophagus and diving ichthyofagus to obtain food.

During the OWF construction, the bottom sediments will be disturbed and the concentration of suspended matter in water will increase.

Direct transfer of sediments and their resuspension will result in reducing water transparency. If it exceeds the natural level, it could cause difficulties in hunting for birds that use their eyes when searching for food (gaviiformes, sea ducks, razorbill), and thus result in the movement of birds preferring more transparent waters. No impact on birds feeding on the water surface (gulls) is expected.

The local decrease in water transparency in the Baltic Power OWF Area will be short-term and its impact will be eliminated by other, more intensive disturbances causing birds to leave the area.

Sediment deposition related to preparation of the OWF bottom for foundation of monopiles of wind turbines may affect benthic environments located in the Baltic Power OWF Area and in its vicinity. A layer of disturbed sediments will be deposited on benthic organisms, which may disturb the possibility of gas exchange by these organisms and collection of nutrients by them. This phenomenon may lead to a reduction of benthic resources and fish that feed on it (reduction of biomass, reduction of growth and productivity) and, consequently, affect the food base for seabirds in this area.

The increased suspended matter content in water during construction works and deposition of disturbed sediments are indirect negative, local-range, medium-term, reversible, repeatable impacts on sea birds (birds diving in water searching for food) during the construction period, with low intensity.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and the common guillemot as moderate, and for the long-tailed duck and velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters.

Table (Table 6.8) presents a summary of the significance of individual impacts of the Baltic Power OWF on seabirds during the construction phase.

Table 6.8. Significance of the project impact on seabirds during the construction phase [Source: data of Baltic Power Sp. z o.o.]

Species	**Impact**	**Impact description**	**Impact significance**
European herring gull *Larus argentatus*	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of construction works, operation of machines and equipment necessary for the implementation of the project	Negligible
	Emission of noise and vibration	Presence and movement of construction vessels	Negligible
	Lighting of the project site	Attracting and gathering birds around the project	Negligible
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	Negligible
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines	Negligible
	Destruction of benthic habitats	Loss of habitats due to the foundation of monopiles	Negligible
	Increase of suspended matter content in water and depositing of disturbed sediment	Disturbance of bottom sediments	Negligible
Razorbill *Alca torda,* Common guillemot *Uria aalge*	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of construction works, operation of machines and equipment necessary for the implementation of the project	Moderate
	Emission of noise and vibration	Presence and movement of construction vessels	Moderate
	Lighting of the project site	Attracting and gathering birds around the project	Moderate

Species	Impact	Impact description	Impact significance
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	Moderate
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines	Moderate
	Destruction of benthic habitats	Loss of habitats due to the foundation of monopiles	Low importance
	Increase of suspended matter content in water and depositing of disturbed sediment	Disturbance of bottom sediments	Low importance
Velvet scoter *Melanitta fusca*	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of construction works, operation of machines and equipment necessary for the implementation of the project	Significant
	Emission of noise and vibration	Presence and movement of construction vessels	Significant
	Lighting of the project site	Attracting and gathering birds around the project	Significant
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	Significant
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines	Significant
	Destruction of benthic habitats	Loss of habitats due to the foundation of monopiles	Significant
	Increase of suspended matter content in water and depositing of disturbed sediment	Disturbance of bottom sediments	Significant
Long-tailed duck *Clangula hyemalis*	Vessel traffic	Disturbance of the species as a result of transport to and from the project site and as a result of construction works, operation of machines and equipment necessary for the implementation of the project	Significant
	Emission of noise and vibration	Presence and movement of construction vessels	Significant
	Lighting of the project site	Attracting and gathering birds around the project	Significant
	Collisions with vessels	Attracting birds to vessels at night and collisions with vessels	Significant
	Barrier creation	Creation of a barrier by the structures of subsequent wind turbines	Significant
	Destruction of benthic habitats	Loss of habitats due to the foundation of monopiles	Significant
	Increase of suspended matter content in water and depositing of disturbed sediment	Disturbance of bottom sediments	Significant

6.1.1.4.1.7 Bats

During the construction phase, the following activities shall be performed, among others, which may directly or indirectly affect migratory bats:

- allocation of installation/transport vessels including structural members to the construction site;
- foundation of monopiles;
- installation of individual components of wind turbines (towers, nacelle, rotor);
- laying (embedding cables into the seabed or laying them on the seabed).

Works that take place under the sea surface do not have a direct impact on bats. However, as a result of these works, vessel traffic in the OWF Area as well as light and noise emissions will increase. Migratory bats may be attracted by the vessel and construction site lighting [345]. Studies on the feeding and migratory behavior of bats off the coast of Sweden and Denmark have provided evidence of the presence of at least 11 species of bats above the sea area [2]. The survey showed that both species of bats taking seasonal migrations and sedentary species feed above the sea area. Based on surveys [2] which were carried out off the Swedish coast, it was found that feeding was common in areas with high density of insects on the water surface. No correlation was found between the concentration of the food base and the distance from the shore. Most likely, the concentration of the food base depends on weather conditions. According to literature [383, 55, 2], concentrations of insects can move actively or passively through the action of wind.

During the construction phase, vessels and newly erected structures may serve as shelters or resting places for migratory bats [2, 384]. There may then be a risk of collision with vessels and structural members in the construction area.

Due to construction works and increased vessel traffic in the vicinity, the noise will increase. An increase in noise may cause dispersion of bats during flight and act as a barrier effect. Therefore, noise may cause bats to change their flight direction, which in turn means additional energy expenditure [133].

Surveys in the spring and autumn migration seasons indicated a possibility of bats migrating in the Baltic Power OWF Area, however, the migration intensity was low due to the low activity of bats.

The described impacts on bats during the construction phase will be negative, direct, local, and short-term.

Sensitivity to the impact was assessed as insignificant, whereas the significance of the Baltic Power OWF impact during the construction phase was assessed as negligible due to the low activity of bats found during the surveys carried out in the seasonal migration period.

6.1.1.4.2 Impact on protected areas

6.1.1.4.2.1 Impact on protected areas other than Natura 2000

Given the location of the Baltic Power OWF at a significant distance from the protected area of the Słowiński National Park, there will be no significant impact on this area, including any element for which it was established, i.e. biodiversity, resources, objects and elements of inanimate nature and the landscape of the Park.

In the Appendix to the Regulation of the Minister of the Climate of December 23, 2019 on protection tasks for the Słowiński National Park for 2020-2022 (Official Journal of the Minister of the Climate of 2019, item 4, as amended), in which the existing and potential internal and external threats and methods of elimination or mitigation of these threats and their effects were identified and assessed, the existing external threats category indicates the risk resulting from increasing the areas for construction of wind farms in the municipalities adjacent to the park. It was stated under the category of potential external threats that only the construction of wind farms in the buffer zone of the Park constitutes a potential external threat and, consequently, it should be stated that through its location, the Baltic Power OWF will not pose a threat to the Słowiński National Park.

Considering that protected areas may be classified as receivers of very high sensitivity, and at the same time taking into account the scale of impact on them at the phase of construction of the Baltic Power OWF as insignificant, the significance of this impact is of low importance.

6.1.1.4.2.2 Impact on the Natura 2000 protected areas

The identification and assessment of impact on areas protected under the European Natura 2000 ecological network are presented in sub-chapter 6.3.

6.1.1.4.3 Impact on wildlife corridors

The wildlife corridor, in accordance with the Act of April 16, 2004 on nature conservation, is an area allowing for migration of plants, animals or fungi. The network of wildlife corridors connecting the European Nature Protection Network Natura 2000 in Poland was established in 2011 [212]; wildlife corridors were not identified in the Polish maritime areas. Regular migrations of birds take place in the Baltic Sea area in spring and autumn, however, the migration tactics and their routes are very poorly known.

In case of the velvet scoter, long-tailed duck and razorbill, an increase in the number of migrating specimens in the spring period ran parallel to the significant presence of these species in water in the area of planned Baltic Power OWF. Also, an increase in the number of specimens of these species passing through in the autumn period ran parallel to an increase in their number in the surveyed water region. Therefore, one can presume that some of the observed flights of the long-tailed duck, the velvet scoter and the razorbill, even in the periods of spring and autumn migrations, still concerned local movements between feeding grounds [27].

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Taking into account the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea maritime area, including the increasing effect of spatial development, it was assessed that the impact of the Baltic Power OWF during the construction phase on the potential migration routes of migratory species will be negligible.

6.1.1.4.4 Impact on biodiversity

Macrozoobenthos

Disturbance of the bottom sediments structure will result in physical destruction of the macrozoobenthos association only at 0.163% of the Baltic Power DA, at the location of foundation of monopiles and along the route of laying cables inside the OWF. However, this will not result in a significant change in the quality structure of the soft seabed macrozoobenthos groups, consisting of typical and common taxons in open waters of the southern Baltic Sea.

Ichthyofauna

Impacts occurring during the construction phase may reduce the diversity of ichthyofauna by deterring fish due to noise. Fish may react to an increased level of noise by leaving the affected region (avoidance reaction) [312, 308, 11]. Avoidance response will be stronger in the case of clupeidae and codfish, but probably to a lesser extent it will concern flatfish due to the absence of swim bladder and the associated low sensitivity to noise impact. An increased concentration of suspended matter may cause a similar reaction to avoid and periodically reduce diversity. Similarly as in the case of noise emission, the impact effect will be small in relation to fish living at the seabed (flatfish, common seasnail, gobies). However, in the case of the last two species, there may be a restriction of reproduction caused by backfilling of the bottom spawn through sedimentation from the water column. A local drop in diversity may occur throughout the construction period.

Marine mammals

There are three species of sea mammals in the Baltic Power OWF Area and in adjacent waters. During the construction of the OWF, underwater noise may be generated, having a significant impact on the biodiversity of marine mammals, including in particular porpoises. The application of appropriate noise reduction measures may significantly reduce this negative effect. The modeling results show that the use of a HSD and a double big bubble curtain (DBBC) should effectively reduce the impact of noise generated during piling on all three species of marine mammals and thus reduce the impact on biodiversity of these animals in the analyzed area.

Seabirds

The analysis of possible impacts resulting from the construction activities performed in the OWF construction phase shows that their effects will in most cases be temporary and local. This applies to all types of emissions (noise, suspended matter, release of biogenic substances from bottom sediments).

As a result of construction works being performed, there may be a temporary change in the species structure in the Baltic Power OWF Area and in the direct vicinity of this area. In the case of seabirds, the most sensitive species will be displaced from the farm area already during the construction phase, and the number of sea ducks will gradually decrease. An increase in the number of gulls and great cormorants is expected, which use structures protruding from water as resting places. Therefore, it cannot be said in the case of birds that biodiversity will remain unchanged. It should be emphasized that this change concerns the site where the wind farm will be constructed and its nearest vicinity. After completion of the Baltic Power OWF construction phase and start-up of wind turbines, a part of birds from species more sensitive to the impact of wind farms (razorbills, sea ducks) may leave the Baltic Power OWF Area and move to the adjacent feeding grounds. The loss of zoobenthos in quantities not relevant from the perspective of food resources for seabirds will not cause disturbances in food dependencies, which will not disturb the existing balance and will not lead to permanent elimination of species.

The sea habitat will not be fragmented in such a manner that the populations related to the Baltic Power OWF Area and adjacent areas could be isolated permanently or temporarily.

To sum up, the impact of the project in question on biodiversity can be considered to be of low importance due to the local range of this impact limited to the area occupied by the wind farm together with the surrounding buffer with a width of 2–4 km.

6.1.1.5 Impact on cultural values, monuments and archaeological sites and facilities

The assessment was carried out on the basis of the results of geological investigation and geophysical surveys of the seabed in the construction area, which are included in Appendix No. 1 to the EIA Report, as well as the project impact.

The assessment covered the probability of occurrence of deposits from the Stone Age in the area of planned project. Implementation of the Baltic Power OWF project may cause the following types of impacts on so far unrecognized objects, which may be uncovered and identified, and which may be important for the protection of cultural heritage (archaeological relics dating to the Stone Age):

- damage to or complete destruction of archaeological relics by vessel anchors;
- damage to or complete destruction of archaeological relics during laying of cables;
- damage to archaeological relics during installation of pile foundations;
- subsidence of soil;
- exposing archaeological objects;
- sedimentation of disturbed sediment;
- discovery of new objects (of positive nature).

During the construction works, new unidentified archaeological sites, objects or artifacts may be discovered which, due to a lack of knowledge about their existence at this stage, have not been included in the impact assessment presented in this EIA Report.

Based on the conducted analysis, it was found that the significance of the impact caused by the project in question on the prehistoric archaeological relics from the Stone Age will be from insignificant to of low importance.

It was found that all potential impacts of the Baltic Power OWF on potential Stone Age relics will be insignificant, except for the impact related to the embedding of pile foundations, the significance of which was assessed to be of low importance. The results of the assessment showed that the project consisting in the construction of the Baltic Power OWF will not have a significant negative impact on objects of great importance for the protection of cultural heritage in any OPA in the construction phase.

When considering the problem of the presence of Stone Age relics (mainly residues of late-Paleolithic and Mesolithic settlement) in the area of planned project, it should be taken into account that the relevant area potentially inhabited by Stone Age communities underwent irreversible transformations or destruction due to natural factors. Its identification is not only impossible from the perspective of conventional land archeology, but is also extremely complex from the perspective of underwater archeology methods.

The scale of paleolandscape transformations from the turn of Pleistocene and Holocene is confirmed by the results of geological surveys carried out in the Baltic Power OWF Area. Their dynamics led to a total erosion of stratification, which may have contained human settling-related relics in this area during that period, namely the Pleistocene and early Holocene. As a consequence, the chance of accidental penetration of Stone Age relics during the construction phase should be considered as close to zero in this area.

Although the current state of knowledge on the history of the Pomerania settlement in the Stone Age does not exclude the possibility of settlement in the late Paleolithic and Mesolithic periods in the areas overlapping with the project area, the possibilities of observing and identifying its relics in the form of:

- archaeological sites of the Stone Age (the so-called compression wood);
- anthropogenic in-ground objects;
- single stone and organic artifacts.

Even if the said relics potentially exist as a component of bottom layers in the Baltic Power OWF Area, the possibilities of capturing and locating them are extremely small. Moreover, the Register of Underwater Archaeological Sites does not contain information on any submarine archaeological sites dating to the Stone Age located in the area of planned project.

The reason for such a situation is the identified strong erosion of the areas located so far north of the current shoreline of the southern Baltic Sea [451] and sedimentation processes which seized paleolandscape relics, which was confirmed as a result of the conducted geological and geophysical surveys included in Appendix No. 1 to the EIA Report.

In the context of the most important conclusions of geophysical surveys aimed at identifying anthropogenic relics in the Baltic Power OWF Area, it should be mentioned that:

- searches using seismoacoustic, geological methods and ROV inspections did not confirm the presence of settlement residues from the Stone Age;
- the geophysical surveys carried out in order to identify the topographic profile and structure of the seabed, as well as the reconstruction of the paleolandscape, did not confirm the occurrence of anthropogenic objects related to prehistoric settlement;
- the inspection of geological core samples carried out in terms of the presence of archaeological relics (i.e. elements of cultural heritage from prehistoric periods) did not confirm the possibility of finding them in the project area.

Appendix No. 1 to the EIA Report describes the wrecks found in the Baltic Power OWF Area in the number of five vessels. All the wrecks were reported to the relevant authorities. Two of them were previously found and their positions are shown in nautical charts. The Applicant assumes preventive limitation of activities related to seabed disturbance (systems, anchoring, foundations) at a distance of up to 50 m from the reported wrecks, in agreement with the Pomorskie Voivodship Heritage Conservation Officer.

To sum up, the planned project of the Baltic Power OWF at the construction stage will not have a negative impact on potential objects of high importance for the protection of cultural heritage from the Stone Age. The surveys carried out in the area in question did not show any archaeological objects or strata related to the settlement in the Stone Age.

6.1.1.6 Impact on the use and development of the water area and tangible property

During the construction phase of the Baltic Power OWF, this area will be gradually excluded from shipping, fishing, research and tourist cruises due to safety reasons. Only the presence of vessels related to the project implementation will be allowed. The construction of the Baltic Power OWF will not disturb the use of the MW P-18 and MW P-19 military training areas. The elements of cultural heritage identified during the research should be protected by establishing zones excluded from construction works at a distance of up to 100 m. Increased traffic of vessels serving the construction of the OWF may mean difficulties in the vessel traffic on the route located south of the OWF.

Limitations resulting from the gradual exclusion from the previous use of the Baltic Power OWF Area will have the greatest impact on fishing, including in terms of places of fishing, as well as the necessity to extend the routes to the fisheries located north of the Baltic Power OWF Area. The impact on fishing will be negative (resulting from the fact of limitations) and direct (directly affecting the receiver). Moreover, due to the assumed duration of the construction phase (from 2024 to 2026), this impact will be long-term and local (limited to the Baltic Power DA).

Taking into account the fact that the previous use of the Baltic Power OWF Area for fishing activities was small and that this activity can be carried out in neighboring water regions, it should be assumed that the significance of the Baltic Power OWF impact on fishing will be of low importance.

6.1.1.7 Impact on landscape, including the cultural landscape

During the construction phase of the planned Baltic Power OWF, the following potential impacts of the project on the landscape, including the cultural landscape, were identified:

- traffic of vessels, mainly the vessels of contractors for construction works, as well as tests, supervision and other works;
- transport of OWF structural components, including large-size components;
- successively built offshore structures, such as OWTs and substations.

The impact on the landscape will be objective, changing its nature from natural to industrial, but also subjective, depending on individual characteristics of the receiver, and may be perceived as negative, positive and indifferent.

The offshore structures shall be constructed gradually. It is expected that the OWF construction phase may last from 2024 to 2026. The offshore structures will be painted, marked and illuminated at night to ensure maritime and aviation safety.

The impact of the OWF on the landscape during the construction phase depends on:

- the traffic of construction-related vessels, size of structures transported;
- the size of the structure, diameter of the rotor and its position in relation to the viewer;
- the number and location of OWTs and facilities;
- meteorological conditions and the sea state;
- the location, where the landscape observer is located and individual visual perception characteristics of the observer.

In the OWF Area, people not directly associated with the OWF are present temporarily. These are workers on board of vessels, passengers of tourist ferries, fishermen and deep-sea anglers, tourists on recreational crafts, participants in search and rescue operations flying over the sea in airplanes, scientists and others. The planned OWF will be the most visible to this group but more people will be able to observe the OWF during the day rather than at night when, for example, some of ferry crews and passengers will be asleep. During the construction, this group will be increased by employees of OWF construction vessels. The impacts on the landscape will be short-term, temporary, they will depend on how long the observer can see the construction of the OWF, and the transported components.

During the construction phase, the landscape will change not only at sea, but also in ports where offshore structures will be built. The impacts on the landscape in this respect will be short-term, temporary and, above all, they will take place in industrial and port areas, depending on the location of the production area, they will be more or less visible to a third-party observer; these will be medium-size and large ports. The landscape of port and industrial areas is transformed, there are many facilities and structures changing the landscape to industrialized, anthropogenic; they may partially or even completely obscure the observer view of the structures constructed for the needs of the OWF.

The impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF and the type of the landscape affected. In the open sea, the landscape is not disturbance-resistant, but its value is not high, as very few people and over a short period will be exposed to the landscape change and some of them (e.g. tourists) may perceive it as beneficial or interesting. The spatial range of the impact will be large, it will decrease as the distance from the OWF increases, the vessel traffic will increase from time to time, and at ports the impact will be local.

6.1.1.8 Impact on population, health and living conditions of people.

During the Baltic Power OWF construction, the population will be affected at different intensity levels in onshore and offshore areas. Basic components of wind turbines will be stored and erected in harbor and shipyard areas, namely: foundations or support structures, towers, nacelles with rotors. In other plants, substations and rigs supporting the infrastructure required for the correct functioning of the Baltic Power OWF will be constructed. They will be produced for several years using various technologies, and then transported by vessels to their target location. The construction phase of planned project will result in ensuring work for many people in the shipbuilding, power, power engineering and maritime transport industries. Potentially large factories and ports from Świnoujście and Szczecin will be involved in the production and shipping of wind turbine components for the needs of the Baltic Power OWF. Within the boundaries of the plants and port infrastructure located there, Baltic Power OWF structures and equipment will be manufactured; moreover, the components transported from other production plants may be transshiped there. In these centers, there will be impacts on the health and living conditions of the employed persons related to noise emission, air pollution, sewage and waste. The port in Łeba will act as a service port or a quick response port, in which similar impacts on the health and living conditions of the employed persons will occur, related to noise emission, air pollution, wastewater and waste generation, but on a much smaller scale.

In the offshore areas, the three-year period of Baltic Power OWF construction will cause significant changes to navigation routes in its vicinity and significant disturbances in the navigation of all sea-going vessels because the areas overlap with the main navigation routes of the South Baltic Sea. It will increase the risk for the safety of navigation of all types of vessels, including recreational crafts, and for the functioning of the fishing industry in this region of the sea. The construction of an offshore wind farm of the size of Baltic Power OWF may require more than 4000 passages per year of vessels of various sizes between the Baltic Power OWF and the port in Świnoujście and port in Łeba. It will have a significant impact on the safety of navigation. During the construction period, the fishing industry will have to abandon fishing in some of the fishing squares: N7, N8, O7 and O8 in the water regions covered by construction works.

The on-going exploitation of crude oil and natural gas in B3 and B8 reservoirs and the planned exploitation of B4 and B6 submarine natural gas reservoirs will not be disturbed due to a significant distance of several dozen kilometers, separating the said reservoirs from the Baltic Power OWF Area.

The process of Baltic Power OWF construction will limit the offshore activities related to crisis management and emergency response. It applies to various types of emergency events and accidents involving vessels, rescue operations, rescuing property or combating oil pollutants.

In offshore areas, the potential impact on health conditions and human life will be related to the transport and erection of structures of individual wind turbines and possible collisions of vessels with the OWF structures.

To sum up, the scale of impact on people's population, health and living conditions during the construction phase will be small, and when assessing the significance of the receiver as very large, it can be assumed that the significance of impact will be moderate.

6.1.2 Operation phase

6.1.2.1 Impact on the geological structure, bottom sediments, access to raw materials and deposits

Changes within the seabed associated with the impact of the project will be local and within the entire area occupied by the project – insignificant for the overall character of the seabed and its structure.

Depending on its structure, the seabed may exhibit different sensitivity to the impact of the project during its operation phase. A clay bottom and a clay bottom with a stony cover is difficult to wash out and changes in its morphology. A sandy, sandy and silty, and silty seabed is more susceptible to the washout and material displacement over it, e.g. in the form of sandy waves. Thus, elements of the OWF infrastructure may be uncovered or covered both as a result of natural processes displacing rock material along the seabed and as a result of this transport being disturbed by OWF infrastructure components.

Activities connected with the project operation may cause the following types of impact on the seabed:

- local changes in the topography of the seabed associated with the presence of OWF infrastructure components and their impact on the processes of sediment transport and settling: seabed dilution upstream/downstream of OWF infrastructure components, formation of sediment accumulation upstream/downstream of infrastructure components (sandy drifts), cavities in the seabed created at the parking places of OWF maintenance vessels.

It is not expected that there will be any changes in the seabed structure during the project operation phase. The overall impact of the project in the operation phase can be assessed as negligible.

6.1.2.2 Impact on the dynamics of sea waters

As part of the assessment of the project impact on sea waters, undulation and sea currents were analyzed. The measurements performed show that in the Baltic Power OWF Area, the velocities and directions of water flows constantly change. As a result of Baltic Power OWF construction in this area, these flows may change. This may be influenced by factors such as:

- flow field characteristics (flow velocity, prevailing direction, etc.);
- seabed formation with particular consideration of surface gradients and natural obstacles.

As a result, the velocities and directions of water flow and pressure in the direct vicinity of each structure may change, which manifests itself in a local increase in water flow velocity due to narrowing of the flow stream and formation of swirls around the structure. The swirls may develop both downstream the current and immediately upstream the obstacle. The range of impact of the support structure on water flows in the sea column is only equal to several diameters of this structure, i.e. not more than several dozen meters. However, the distances between individual wind turbines will amount to at least 944 m, i.e. they will several times exceed the range of this impact. This means that overlapping of these impacts should not be expected and disturbances will be only local.

The resulting modifications of the wave motion can be noticed only in the close vicinity of individual OWTs. However, they are of local nature and should not be present outside the Baltic Power OWF Area.

Wind waves on the free sea surface, faced with obstacles in the form of OWT towers, flow around them, while losing part of their energy. If the diameters of OWT towers are smaller than one fifth of the length of waves propagating in their direction [282], such towers may be treated as streamlined structures. This means that they will not cause a significant disturbance of the wave field. Otherwise, the waves, approaching the structure on the windward side, will be partially reflected, and on the leeward side – diffracted, i.e. subject to symmetrical deflection of the wave radius behind the obstacle encountered. In the shadow area, i.e. directly downstream the obstacle encountered by waves, there is no wave motion, but there may be swirls of water. However, upstream the construction, the reflected waves interfere with the incoming waves, as a result of which standing waves are formed. In the consequence, when applying the linear theory for simplification reasons, vertical orbit velocities increase twice immediately upstream the structure. If such waves are long enough to affect the seabed, they may, in connection with sea currents, contribute to entraining the sediment from the seabed and, consequently, lead to erosion in the immediate vicinity of the monopile. The resulting disturbances of wave motion can be noticed only in the leeward zone. However, they are of local nature and should not be present outside the Baltic Power OWF Area. The impact of wind turbines on the wave field and sea current field will be local and will not have a key impact on these elements.

The Baltic Power OWF is located outside the Słupsk Furrow water region, through which cold, oxygenated and more saline waters from the North Sea are transported, and which flow through the Słupsk Furrow to the Gdansk and Gotland Deeps during rare inflows which are very important for the Baltic Sea ecosystem. The Baltic Power OWF will not affect these processes.

Significance of the impact of the Baltic Power OWF on the dynamics of sea waters in the OPA during the operation phase was assessed as negligible.

6.1.2.3 Impact on the quality of sea waters and bottom sediments

During the Baltic Power OWF operation, works affecting the quality of water and bottom sediments will be carried out in its area. These will mainly be service works and interventions in case of an emergency situation.

It was found that the OWTs, during their operation phase, may cause various types of impacts on the discussed receivers (water and bottom sediment); these include: release of pollutants and biogenic compounds from sediments to water, contamination of water and bottom sediments with oil derivative substances, contamination of water and bottom sediments with anti-fouling agents, contamination of water and bottom sediments with accidentally released municipal waste or domestic sewage, contamination of water and bottom sediments with accidentally released chemicals and waste from operation and maintenance of the OWF, contamination of water and the bottom sediments with compounds from anti-corrosion agents and change of bottom sediments and water through the reception of heat from transmission cables.

Release of pollutants and biogenic compounds from sediments into water

During the Baltic Power OWF operation, works will be carried out causing disturbance of bottom sediments, e.g. maintenance of foundations, cables or anchoring of vessels. They will favor the transfer of pollutants and biogenic compounds from sediments to water.

Labile metal complexes, organic pollutants, i.e. PAHs and PCBs, biogenic compounds (nitrogen and phosphorus) may enter the water.

As the bottom sediment in the surveyed area is characterized by low content of harmful substances (metals, PAH, PCB, TBT) and biogenic substances, the risk of their penetration to water is low (will slightly deteriorate the water quality). Sensitivity of waters and bottom sediments to the above impact was assessed as insignificant.

The release of pollutants and biogenic substances from bottom sediments during the operation phase is a direct negative impact of local range, being short-term, reversible, repeatable during the operation period, and of low or medium intensity.

The significance of this impact during the operation phase in the OPA was assessed to be of low importance for sea waters and as negligible for bottom sediments.

Contamination of water and bottom sediments with oil derivative substances during normal operation of vessels during routine maintenance activities and during failures or collisions

During normal operation of vessels when carrying out turbine service works, leakages of various types of oil derivative substances (lubricating and diesel oils, petrol) may take place.

They may contribute slightly to the deterioration of water quality. Heavier oil fractions may be subject to sorption on the surface of organic and mineral suspended matter, which will increase their specific gravity and gradually make them sink onto the seabed. They may also be bound there by bottom sediments.

During the maintenance of wind farm components, leakages of various types of oil derivative substances may occur as they are being replaced while servicing wind turbines and substations. The transformers should be equipped with devices reducing such threat – have tight oil pits – and the rainwater drainage system should be equipped with an oil/water separator [415]. If such solutions are applied, no significant spills outside the facility are expected.

Contamination of sea waters or bottom sediments with oil derivative substances released during normal operation of vessels when operating the OWF is a direct negative impact of local range, being temporary or short-term, reversible, repeatable, and of low intensity.

The significance of this impact during the operation phase in the OPA was assessed as negligible for sea waters and bottom sediments, whereas in case of a failure or collision, it was assessed to be moderate.

Accidental contamination of water and bottom sediments with anti-fouling agents containing TBT

Contamination of water or bottom sediments with anti-fouling substances during the operation phase is a direct, negative impact of local range, being short-term, reversible, repeatable during the operation period, and of low intensity.

The significance of this impact during the operation phase in the OPA was assessed as negligible for sea waters and bottom sediments.

Contamination of water and bottom sediments by accidental release of municipal waste or domestic sewage

The sensitivity of both receivers is insignificant.

Contamination of water or bottom sediments with municipal waste or domestic sewage is a direct, negative impact of local range, being short-term or momentary, reversible, repeatable during the operation period, and of low intensity.

The significance of this impact during the construction phase in the OPA was assessed as negligible for sea waters and bottom sediments.

Contamination of water and bottom sediments with accidentally released chemicals and waste from the OWF operation

During the OWF operation, the maintenance of its facilities will be carried out. One cannot rule out a possibility that small quantities of waste or operating fluids may be accidentally released into the sea.

The waste most frequently generated in this phase of the project is waste from groups 13, 15, 16 and 17 of the Appendix to the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog [415]. It is necessary to comply with the procedures concerning waste handling.

The sensitivity of both receivers in the case of this impact is moderate.

Contamination of water or bottom sediments related to the process of OWF operation is a direct, negative impact of local range, being short-term or momentary, non-reversible, repeatable during the operation period, and of low intensity.

The significance of this impact during the construction phase in the OPA was assessed as negligible for sea waters or bottom sediments.

Contamination of water and bottom sediments with compounds from anti-corrosion agents

Foundation steel structures or support structures of the wind turbine and substations will corrode in the marine environment. It will therefore be necessary to apply appropriate safeguarding measures.

The most common corrosion protection method used in the marine environment is cathodic protection. It can be implemented as a galvanic or electrolytic protection.

Galvanic cathodic protection consists in installation of aluminum or zinc anodes on foundations or support structures. The anodes are gradually worn out and aluminum or zinc are transferred to the water and accumulate in the bottom sediments.

Zinc is the most common steel protection agent for sea water. Its current efficiency reaches 90% at a relatively low production cost. The disadvantage of zinc is a small potential difference compared to steel, amounting to approx. 0,25 V. Zinc is used as pure metal (99,99%, with a limited pollutant content of Fe, Cu and Pb) or as a metallic matrix containing: Zn
+ 0.1–0.15% Hg, Zn + 0.12–0.18% Al + 0.05–0.1% Cd, Zn + approx. 0.5% Al + approx. 0.1% Si [417].

Aluminum is used only in the form of alloys: zinc (3–6% Zn), tin (0.1–1% SN), Zn + In, Zn + Hg, Zn + Sn. The current efficiency of these alloys is high, of the order of 80%. Aluminum alloys are used in the same manner as zinc. Apart from zinc and its alloys, they are low-potential protectors [417].

The advantages of the galvanic cathodic method are independence from current sources, ease of installation, possibility of local protection and low impact on neighboring structures. On the other hand, the most important defects include: irreversible loss of anode material, possibility of contamination of the environment with corrosion products of the protector, limited use due to environmental resistance and low protective current.

In the initial period of operation, the emission of zinc and aluminum from anodes will not be observed. This process will take place over the years and as the damage to the protective coating on the elements subject to corrosion protection progresses. It is assumed that anodes dissolve completely within approx. 20 years. The metals in question will first be transferred to water from which they can be precipitated and collected in the sediment. This applies in particular to aluminum compounds, as its solubility in natural waters (with pH of approx. 8) is very small. It will be largely absorbed by bottom sediments in the form of stable compounds. Zinc compounds may be present longer than aluminum in water, as most of them are soluble in water. Zinc will be adsorbed and co-precipitated with hydrated Fe, Mn and Al oxides, present in sediments, however, this process will take place slowly due to the low content of silty minerals in the Baltic Power OWF Area, which favor zinc adsorption [8, 377].

Ecotoxicity tests have shown a significant toxicity of aluminum to aquatic organisms such as algae, fish and first-order consumers [231, 302]. Excess aluminum causes decalcification and deformation of bones as well as anemia and hardening of cellular membranes [302]. Harmful effects on fish are probably associated with the process of precipitation of this metal on gills as a result of defensive mechanisms (e.g. release of neutralizing compounds Al_{+3})[216]. The biological role of aluminum for humans has not yet been fully clarified, but it is suspected that it may cause Alzheimer's disease. Aluminum accumulates in the brain [123, 302].

Zinc is one of the more movable metals in deposits, influenced by its replaceable forms as well as its binding with the organic substance [216]. It regulates the metabolism of carbohydrates and proteins in plants. Its excess (100–400 $mg \cdot kg_{-1}$ depending on the species) causes the development of chloroses and necroses. This phenomenon is related to iron shortage and inhibiting photosynthesis. In vertebrate organisms, zinc also contributes to the metabolism of proteins and carbohydrates, to the detoxification of heavy metals in cells, and it increases the activity of enzymes and hormones. Zinc also has a positive effect on brain activity, tissue regeneration and healing of wounds. In the case of acute zinc poisoning, there may be a shortage of copper in blood, hypocalcemia, pancreatitis, vomiting, diarrhea and kidney damage [302].

In the electrolytic cathodic protection, the protected object becomes a cathode of an electrolytic cell supplied with direct current from an external source. The anode used in this circuit is most often insoluble. The most persistent anode materials used in this method are platinum and titanium electrodes covered with a 2–3 µm platinum layer. When electrolytic cathodic protection is used, no impact on the quality of water and sediments is observed.

If electrolytic cathodic protection is used, metal (Al, Zn) emissions to the water environment will not be observed due to the use of insoluble anodes. This impact was not assessed.

The most important parameters affecting the impact level are: type and quantity of released elements, water quality in the project area, type of rock material forming the seabed.

The sensitivity of both receivers in the case of this impact is moderate.

Contamination of the environment with aluminum or zinc released during operation with the use of galvanic cathodic protection is a direct, negative impact of local range, being long-term, irreversible, permanent, and of medium intensity.

The significance of this impact during the operation phase in the OPA was assessed as negligible for sea waters and bottom sediments.

Change of water and sediment temperature by heat reception from transmission cables

The electric current flowing through a power cable causes the cable heating caused by power losses due to resistance, in accordance with the Joule's law. As the cable temperature rises above the ambient temperature, heat is released into the environment surrounding the cable.

A precise quantification of the dissipated heat is difficult because of the phenomena such as conductivity, convection and heat radiation, subject to various physical laws [412].

Increasing the temperature of sediments in which the cable is buried and interstitial waters (water filling the spaces between sand grains in the sediment) may cause:

- increased bacterial activity resulting in accelerated distribution of organic matter;

- decrease of oxygen content in water;
- release of harmful substances, including metals, from sediment into water;
- adverse effects on benthic organisms.

The most important parameters affecting the impact level are: depth of cable burying and type of seabed.

For example, on the operating Nysted Offshore Wind Farm, the temperature increase emitted by the transmission cable (132 kV) buried at a depth of 1 m did not exceed 1.4°C in a layer of 20 cm above the cable, and the temperature changes were not visible already on the seabed surface [298]. This cable was buried in gravel sediments, which favors much higher heat loss in interstitial spaces between sediment grains than in the case of fine sediments [298]. Both types of sediment are common in the Baltic Power OWF Area. It should be assumed that the heat dissipation (24 $W{\cdot}h_{-1}$ m_{-1} on the cable surface) emitted by inter-array 66 kV cables belonging to the Baltic Power OWF will be smaller than (or at the most similar to) that recorded in the Nysted OWF.

The heat emission over the Baltic Power OWF cables in the sediment will be local, and the effect will be imperceptible if the cable is laid on the seabed or buried, which is in line with the technical assumptions of the project for array power cables, which are to be buried up to a maximum depth of 3 m, where geotechniocal conditions allow to bury the cable.

Heat emission by the cables is a direct, negative impact of local range which is long-term, irreversible, constant over the operation period, and of medium intensity.

The significance of this impact during the operation phase in the OPA was assessed as negligible for sea waters and bottom sediments.

6.1.2.4 Impact on the climate, including greenhouse gas emissions and impacts significant in terms of adaptation to climate change, impact on the atmospheric air (air purity)

The wind turbines will locally reduce wind energy and disturb atmospheric pressure directly in the area of the rotor operation. The wind turbine towers may locally disturb the velocities and directions of water flows and reduce the energy of sea waves locally, which is reflected in their height drop.

Due to the significant distance of the Baltic Power OWF Area from the coastline and other potential sources of pollutants emission, it should be assumed that the air purity within this area will correspond to class A purity. Due to the fact that the emission generated during the OWF operation will be minimal (coming mainly from Diesel emergency generators installed in substations, if any, and air conditioning equipment and, to a small extent, from service vessels), it is practically possible to assume no emission of dust pollutants and only a slight emission of gaseous pollutants, including carbon dioxide being a greenhouse gas. Therefore, it is not expected that air purity will deteriorate and its purity class will be reduced.

During the operation phase, the planned project will have both negative and positive impacts on the climate. Negative impacts involve the greenhouse gas emission caused by fuel combustion by service vessels. The positive impact on the climate will be the generation of electricity by the Baltic Power OWF from a renewable source at the level of 1200 MW, which in the case of carbon dioxide emission of the conventional old-type electricity generation at the level of 900–960 kg of CO_2 per 1 MWh will enable noticeable reduction of this gas emission in Poland.

According to the findings of the GP WIND project [167], the production of electricity from OWT is associated with the emission of 6 to 34 kg of CO_2 per 1 MWh in all phases of the life of the OWF, which, with the expected production of 126.14 TWh during 30 years of operation, means the emission of 0.76 to 4.29 million Mg of CO_2. The Baltic Power OWF emissions will be at least 10 times lower than from producing energy from other sources fired with hard or brown coal (emission reductions of over 45.8 million Mg of CO_2 are expected – without taking into account the emissions related to the construction of these sources).

During the operation phase, local greenhouse gas emissions will slightly increase as a result of fuel combustion by service vessels handling the wind farm, but their impact will be compensated by reduction of emissions in the generation of wind energy.

Climatic conditions of the southern Baltic area related to the formation of weather phenomena (mainly temperature, precipitation and wind) over a multiannual period are subject to continuous changes, which, although related to global climate changes, are generally of a regional nature. Due to the fact that the expected range and scale of these changes in the period of several dozen years for which the operation of the Baltic Power OWF is planned is relatively small, the forecast climate changes in the Baltic Sea area will have little impact on the area of the planned OWF area and will have a small impact on the operating conditions and safety of wind turbines. However, it should be noted that in order to ensure proper operation of the wind farm, it is necessary to take into account the possibility of extreme weather conditions at a scale greater than currently observed, as well as the fact that the range of their variability throughout the year and in individual years will increase, taking into account the expected tendencies of changes over several dozen years.

The observed increase in intensity and frequency of storm phenomena at sea should cause some increase in the productivity of the Baltic Power OWF. However, on the other hand, it may result in a higher failure rate of wind turbines and a periodical deterioration of navigation conditions in the OWT area. Therefore, the risk of more frequent occurrence of winds above 10 Beaufort degrees than in the current conditions should be foreseen. A possible increase of the mean sea level as well as changes in the thermal conditions and salinity of water will have no noticeable impact on the operation, operating conditions and safety of the Baltic Power OWF equipment. In practice, the forecast increase of sea surface temperature will exclude the risks related to ice phenomena. However, the forecast increase in the amount of precipitation and humidity of the lower atmosphere layer will increase the risk of icing of the wind turbine (in the case of negative air temperatures – in this respect, however, it is expected that the number of frosty and very frosty days will decrease) as well as the increase in the frequency of situations with limited visibility.

For open sea areas, shortening and mitigation of ice seasons will have a beneficial impact on navigation conditions and offshore operation of the equipment.

Progressing eutrophication of sea waters may cause some difficulties in the operation of the planned OWF, especially in the summer period. Temperature increase in the winter period may cause disappearance of species typical for cold water and occurrence of species present in warmer waters.

During the operation phase, direct and local impact of the planned project (related to the use of vessels and fuel consumption by them) will not have a significant impact on the change of climatic conditions. Despite long-term impact, its range will be local. However, indirectly the operation of the wind farm will result in reduction of greenhouse gas emissions to the atmosphere by other sources, e.g. coal-fired power plants located in other areas of the country. Therefore, despite the significant importance of the climate and air quality and the small scale of impact of the Baltic Power OWF in the Option proposed by the Applicant during the operation phase, it may be concluded that the impact in terms of greenhouse gas emissions from vessels to the atmosphere will be negligible. The impact of the reduction of greenhouse gas emissions is positive but difficult to estimate. It results from the fact that the emission reduction will be assigned to a completely different area (location of an equivalent conventional, fossil fuel fired power plant).

6.1.2.5 Impact on systems using EMF

It follows from the operation of offshore wind farms so far that the operation of wind turbines and certain types of tower structures may adversely affect the operation of marine and onshore navigation support equipment or other applications. This applies in particular to radars, communication systems and radar equipment, such as AIS, on board of any vessel with a gross tonnage of more than 300 Mg.

In accordance with the Act of August 18, 2011 on maritime safety, the Applicant prepared and agreed with the maritime administration (Maritime Office in Gdynia) expert opinions on the assessment of the impact of the Baltic Power OWF on the safety and efficiency of navigation in Polish maritime areas, GMDSS and SAR communication systems and the National Maritime Safety System. As part of these arrangements, it was agreed to introduce remedial measures that allow to maintain the impact of the Baltic Power OWF on communication and radiolocation systems at an acceptable level. Therefore, despite the importance of these systems for society and state interest, it should be assumed that the significance of the impact of Baltic Power OWF on these systems will be negligible. The same measure will be carried out in the context of military and Border Guard systems after preparation of expert opinions set forth in the Regulation of the Minister of National Defense of October 10, 2022 on the detailed scope of technical expert opinions in the scope of assessment of the impact of the offshore wind farm and the set of power output equipment on the state defense systems and on the system of protection of the state border at sea (Journal of Laws, item 2115), which entered into force on October 29, 2022.

6.1.2.6 Impact on nature and protected areas

6.1.2.6.1 Impact on biotic components in the offshore area

6.1.2.6.1.1 Phytobenthos

During the operation phase, support structures of wind turbines and accompanying infrastructure located under the water surface in the euphotic zone may be overgrown by macroalgae (e.g. [38, 39, 195, 235, 262, 317, 339, 498, 478, 225, 56, 376]). Although phytobenthos does not occur in the area of the planned OWF, macroalgae spores may appear in this area due to various natural and anthropogenic factors. The first group should include the transport of spores with sea currents from areas where macroalgae are present [319, 453, 155, 64]. Macroalgae or their fragments brought with currents from natural places of occurrence, separated from the substrate by, e.g. storms may also be the source of spores [319, 156]. The anthropogenic factors include mainly the transport of spores in ballast waters of vessels [142, 267] e.g. vessels involved in the construction and maintenance of the wind farm infrastructure. They may also be caused by macroalgae growing in the hull of vessels [260, 319]. To sum up, it is likely that the macroalgae spores are present in the Baltic Power OWF Area and once a hard substrate appears in the euphotic zone, they will find favorable conditions for the development and start of the colonization process. This process is likely to start already in the first vegetation season after the OWF structure is erected. Literature data indicate that in the initial phase of colonization, macroalgae with thread-like structured thallus appear first, then displaced by species with dense thallus [262]. At this stage, it is not possible to determine which species of macroalgae will inhabit the OWF structures, however, some preconditions may result from the research performed for the Utgrunden 1 OWF located in the southern part of the Kalmar Strait [65]. In 2007, i.e. 7 years after the commencement of operation of the OWF in question, the support structures of wind turbines found the presence of string *Chlorophyta* (*Cladophora sp*.) and red algae (*Ceramium tenuicorne, Polysiphonia fucoides and Rhodocorton purpureum*). The example of *C. tenuicorne* indicates that among macroalgae growing on structures, there may also be species subject to strict protection under the Regulation of the Minister of the Environment of October 9, 2014 on the protection of plant species (Journal of Laws, item 1409).

Macroalgae and animal organisms (e.g. mussels) overgrowing components of the OWF will create the “artificial reef”, a factor causing local increase in biodiversity of plant and animal species per se and indirectly affecting the increase in the species richness and quantitative resources of the marine fauna – mainly fish and nekton crustaceans, which will search for food and places convenient for refuge and reproduction within it [9, 10, 483, 482, 478, 270]. Therefore, the effect of overgrowing submerged structures of the OWF by macroalgae should be considered as positive, however it should also be noted that the natural character of the maritime area will be disturbed. Locally and in the long term, the functioning of the marine ecosystem will be changed, for which the anthropogenic factor will be responsible.

In conclusion, the significance of the impact was considered positive and negligible.

6.1.2.6.1.2 Macrozoobenthos

Operation of the Baltic Power OWF will result in the following impacts:

- increase in the temperature of bottom sediments,

- loss of a fragment of macrozoobenthos habitat;
- “artificial reef” effect.

The assessment of the impact of wind turbines in the OWF Area (1 Mm) at the operation stage was carried out separately for:

- soft seabed macrozoobenthos;
- hard seabed macrozoobenthos.

These two complexes of benthic fauna differ in taxonomic composition, abundance and biomass of their constituent species. Therefore, they differ in sensitivity and importance of the evaluated group of organisms. The sensitivity of zoobenthos depends on the type of impact and preferences resulting from the very biology of the species concerned. On the one hand, it is the ability of the population to adapt to various changes occurring in the environment as a result of the implementation of the project and, on the other hand, the ability of a complex of organisms to reconstruct the quantitative structure after the impact factor ceases to exist. The soft seabed macrozoobenthos complex is of low importance and the hard seabed macrozoobenthos complex is of moderate importance.

As part of the environmental surveys carried out for the EIA Report in the scope of benthic organisms, no species sensitive to an increase in the temperature of bottom sediments were recorded. Moreover, the Investor assumes the possibility of laying inner array cables on the seabed surface using appropriate mechanical protections on selected seabed fragments, depending on geological conditions. In such a case, the issue of heating bottom sediments will be practically negligible, as heat from cables will be directly dissipated in the water column.

The main impact in this phase of project implementation is the loss of a fragment of macrozoobenthos habitat [235, 498]. Seabed development will prevent biological life on the sediment surface occupied by the support structure of the wind turbine (monopile). Estimated calculations indicating the amount of loss of macrozoobenthos resources in the development area are presented below.

In accordance with the technical concept in the OPA, permanent loss of habitats with macrozoobenthos complexes under 78 monopiles will occur on the surface of 0.00553 km^2, which constitutes 0.005% of the Baltic Power DA with the surface of 113.72 km^2.

The loss of a part of the habitat is a negative impact occurring during the operation phase. The sensitivity of the soft seabed macrozoobenthos and hard seabed macrozoobenthos to this impact is very high, as a part of the benthos complex will be permanently destroyed under the impact of stress acting during the entire operation phase.

Given the moderate scale of the impact on the soft seabed macrozoobenthos, the importance of this impact will be insignificant.

When assessing the impact on the hard seabed macrozoobenthos complex, which is a resource of moderate importance, it should be taken into account that an important component of the food resources of fish and seabirds will be eliminated from the environment. Permanent destruction of the mussel aggregation (Mytilus *sp.*) may occur only on the area of 0.00553 km^2 at maximum, and the protected long-tailed duck will be deprived of food with a biomass of no more than 13,300 kg, with an average biomass of the hard seabed macrozoobenthos of approximately 2,400 g·m-2, with the mussel (Mytilus *sp.*) having more than 99% share in this complex. Taking into account this fact that hard seabed was found in less than 5% of macrozoobenthos research stations in the Baltic Power DA and that the macrozoobenthos resources of the hard seabed have a high capacity to restore, this impact was assessed as insignificant.

Once the support structures are introduced into the environment, taking into account the high reproductive potential of macrozoobenthos, the colonization of artificial hard substrates by animal and plant periphyton communities, as well as mobile epifauna – the so-called artificial reef effect, should be expected here. Although this impact is extensively documented in literature [e.g. 38, 262, 36, 478, 225, 56, 376, 210, 477], there are no studies from the waters of the Polish maritime areas of the southern Baltic Sea, where no OWF has been constructed so far and it was not possible to monitor the "artificial reef" phenomenon, but where only experimental research was carried out on the structure artificially introduced into the environment [119].

Based on the literature, it is known that in the place where the hard substrate has not occurred so far, the qualitative and quantitative structure of the macrozoobenthos group will be altered. The process of overgrowing the support structures with periphyton organisms (invertebrates and macroalgae) begins after reproduction of periphyton species and settlement of larvae on the hard surface of the structure, most often in late spring. Periphyton communities have a significant impact on the marine environment at the ecosystem level, although it is difficult to clearly determine the nature of this impact. On the one hand, this is a positive phenomenon, as local biodiversity will increase: species and habitat diversity, increase in biological production and change in natural values of this micro-habitat. There will be a new shelter for the fry, an attractive feeding ground and spawning ground for many fish species, and the mussel (*Mytilus sp.*) communities, quickly colonizing the hard substrate and usually dominating on support structures, will constitute a new food resource for fish and seabirds, and will also act as biofilters, especially in polluted and eutrophic waters [463, 255]. On the other hand, the "artificial reef" effect can be considered a negative impact, as the original nature of the seabed habitat fragment will be lost. The artificial environment of underwater, hard structures, as a new micro-habitat, which was created in the place of naturally occurring habitats of the sandy seabed, favors the possibility of spread of foreign and invasive species. In the Polish maritime areas, non-indigenous species belong to the following groups: phytoplankton, zooplankton, macrophytes, zoobenthos, avifauna and ichthyofauna. On the basis of the surveys carried out as part of the update of the preliminary assessment of the condition of the marine water environment, in the years 2011–2016, five new, introduced foreign species were identified and all were representatives of the macrozoobenthos. Foreign species quickly supplant indigenous species, leading to changes in the existing balance in the trophic network [252]. Another negative effect of the artificial reef may be changes in the resources and structure of zooplankton filtered by periphyton organisms [477], as well as an increase in the biomass of the gelatinous zooplankton (medusae), whose polyps (sedentary stage) attach to the hard surfaces of the structure [210].

An unambiguous scenario of colonization of artificial substrates during the operation phase in the Baltic Power OWF Area is difficult to predict. It is assumed that first barnacles (*Amphibalanus improvisus*) and mussels (*Mytilus sp.*) will appear, followed by mobile crustaceans (including *Gammarus spp., Corophium volutator* and *Monoporeia affinis*) as well as macroalgae. The "artificial reef" will partially compensate for the destroyed macrozoobenthos complex occurring there before human interference with the environment. However, during the operation phase, monitoring will be necessary to further study the specificity of the "artificial reef" effect.

In the case of this impact, an assessment of its impact on the natural environment was carried out. The "artificial reef" effect is a long-term and permanent phenomenon, but due to its local range, the impact was considered moderate.

6.1.2.6.1.3 Ichthyofauna

During the Baltic Power OWF operation phase, the impacts on ichthyofauna will result from:

- emission of noise and vibration;
- habitat changes;
- creation of a barrier;
- EMF emissions.

Emission of noise and vibration

The impact of noise at the OWF operation stage should be much lower than observed during construction and decommissioning. It will depend on the environmental conditions, i.e. depth, type of sediment, seabed morphology and wind speed. According to Thomsen et al. [437], sound generated by operating wind turbines will be audible to salmon and common dab at a distance of approx. 1 km, and 4–5 km for cod and herring. The maximum range of the masking reaction (interference with sound perception) should be close to the range of audibility. However, for herring, it is likely to be much smaller [437].

Very few data relate to possible avoidance and behavioral changes caused by noise generated by operating wind turbines. Observations carried out in the area of one of the Swedish wind farms showed no changes in behavior of eels swimming at a distance of 500 m from the operating wind turbine. Comparison of roach and cod catches in the vicinity of the wind turbine shut down showed a significantly larger accumulation of fish in the immediate vicinity of the structure (100 m) than at a distance of 800–1000 m, which can be attributed to the artificial reef effect. However, in the case of an operating wind turbine, the catch volume decreased twice in the zone of 100 m. This result can be interpreted as the effect of the noise emitted, but other causes cannot be excluded [473, 470, 437]. According to Wahlberg and Westerberg [465], the avoidance effect can be expected at a distance of only a few meters from the wind turbines.

During the operation of the wind farm, ongoing and unforeseen operational and repair works will be carried out. This will involve a periodically increased vessel traffic. This impact may result in both the avoidance response and the TTS. According to the report of the International Council for the Exploration of the Sea [203] on the impact of sound emitted by research vessels, the avoidance responses may occur when the noise level exceeds the audibility threshold of a given species by 30 dB and the impact range usually reaches 100-200 m. Typical responses include diving or change of movement direction [102]. The experimental studies also found TTS in freshwater fathead minnow exposed to sound emitted by a boat outboard engine [390]. According to Thomsen et al. [437], there are, however, no scientific grounds for determining the universal noise level of vessels that would not be detrimental to fish.

Fish are capable of acclimating to changing environmental conditions. During the experiments carried out on sole and cod, it was observed that during the first sound exposure tests the fish flow rate was much faster than during the subsequent tests. This effect is most likely the result of fish getting accustomed to noise [308]. However, in the case of fish-produced sounds used for communication, one way to adapt them is to temporarily modify them. Usually, the length, amplitude or frequency of sound changes [356]. In addition, adult specimens are able to actively avoid the effects of hazardous factors.

The OWF Area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

Emission of noise and vibrations generated during the OWF operation may directly affect the ichthyofauna. The above impacts will be of negative, direct, local, long-term and permanent nature.

The sensitivity to the impact for cod, sprat and herring was assessed to be high and for European flounder, sand goby and common seasnail - moderate.

The significance of the impact is assessed to be negligible for all investigated fish species.

Habitat change

The presence of structural elements of wind turbines involves the creation of additional hard substrates forming a new habitat. Such artificial structures constitute the so-called artificial reef – a new habitat that may be inhabited by periphyton organisms and, at the next stage, also by other organisms (including different fish development stages). The scale of this phenomenon depends on both the size of the reef and the complexity of its structures, as well as the environmental conditions in which it came into existence and the composition of ichthyofauna in its area [175]. At the project design stage, it is possible to increase this effect by using materials and structural solutions expanding the structure surface available to organisms, e.g. structures protecting the seabed around monopiles against erosion [256].

In the first stage, the reef becomes inhabited by periphyton organisms, macrophytes and invertebrates [136]. As early as after several months, numerous populations of fish [444, 413, 49] appear in the reef area, both those returning after the end of disturbances related to construction [361] and those not present in this area so far (increase in biodiversity). According to Bohnsack and Sutherland [48], the process of forming a stable artificial reef system usually takes 1 to 5 years.

Artificial reef is an attractive habitat that can offer rich food resources, shelter and create favorable conditions for reproduction for many fish species, both at adult and roe stages, larvae and juvenile specimens. Extensive hard structures (e.g. submerged structural elements of a wind turbine) are attractive shelters for young (2-3 years old) cod [366]. They are sheltered from sea currents, predators [48, 479] and fishing pressure. Artificial reefs may also provide favorable breeding conditions for many fish: herring (*Clupea harengus*), hooknose (*Agonus cataphractus*), garfish (*Belone belone*), lumpfish (*Cyclopterus lumpus*), and rock gunnel (*Pholis gunnellus*) [498]. According to Spanggaard [404], the artificial reef area also provides the conditions preferred for spawning by gobies, which include species protected in Poland.

Research carried out by Bergström et al. [31] in the area of the "Lillgrund" OWF located in the Sund Spit showed a clear accumulation in the area of the project of fish species such as cod, shorthorn sculpin, black goby, vivaparous eelpout and eel. The assessment of whether the artificial reef effect is limited only to attracting fish to its area from the nearby water region or whether there is a real increase in productivity is ambiguous. Results of research performed by Reubens et al. [367] carried out in the area of Belgian wind farms located in the North Sea show not only the accumulation of cod in these areas, but also the increase in local production. However, it was limited to the area in the immediate vicinity of the OWF, but this effect was not visible on a regional scale. If there are no restrictions on fishing in the OWF area, there may be a situation where large groupings of fish attracted by favorable living conditions become an easy fishing target. As a result, it may lead to a reduction of fish resources and biodiversity in the area bordering with the wind farm [164].

The results of the research of the long-term impact of the Horns Rev 1 OWF on the number and taxonomic composition of fish showed that the artificial reef effect was significant enough to cause an increase in the number of fish that prefer a hard substrate and, at the same time, too small to cause a decrease in the number of fish that prefer a sandy substrate [410].

If possible restrictions on fishing and shipping are introduced in areas occupied by projects (e.g. wind farms), anthropogenic pressure will decrease and artificial reef areas may be a specific refuge for fish, both adult and their early development stages – larvae and fry – becoming an equivalent to protected areas [105].

It is possible that artificial reefs offering environmental conditions significantly different from those prevailing in a given area may constitute an environment facilitating invasion of foreign species [256]. However, the information available in literature concerns mainly the appearance of periphyton organisms and crustaceans. However, it is possible that "artificial reefs" may create an environment that also favors foreign fish species.

The new habitat created as a result of the construction of the OWF, with its hard substrate and relatively rich feeding resources for benthivorous fish, may constitute a favorable environment for the colonization by the invasive round goby *(Neogobius melanostomus)*.

Since the first report in 1990 on the introduction of the round goby with the ballast waters of the vessels to the Gdańsk Bay, the presence of this species has been recorded in the Polish area of the Baltic Sea, both in deeper waters (up to 40-60 m), and in the zone of shallow waters of the coast, in the Pomeranian Bay and in the Vistula Lagoon and its tributaries.

The round goby spreads in new habitats also due to its tolerance to a wide range of changing environmental conditions: depth, nature of the substrate, salinity, oxygen scarcity, and diversified feeding resources. The spawning of the round goby takes place many times in several portions during the season at a depth ranging from 0.2 to 1.5 m on various substrates [466]. It can live in marine, salty, but also freshwater environments [77]. Therefore, the greater depth of the Baltic Power OWF Area will not foster the reproductive processes of this species.

It is unlikely that the area of planned project will be colonized by round gobies migrating from coastal areas due to the lack of plankton larval stages and a limited range of movements of adult fish. This species rarely migrates far. The range of migrations is short and usually does not exceed 100 m [401]. The longest migrations take place in late autumn and early spring when fish move between shallow and deep waters [29].

The above information indicates that it should not be expected that this species will effectively inhabit the OWF area.

The impact related to the change of habitat will be positive, direct, local, permanent and long-term.

The sensitivity to the impact for cod, European flounder and herring was assessed to be high and for sprat, common seasnail and sand goby - moderate. The significance of the impact is assessed to be negligible for all investigated fish species.

Barrier creation

The construction of underwater structures may constitute a migration barrier for economically important fish whose routes run in this place. The observations carried out in the areas of the Danish OWFs indicate that due to the possibility of an active movement of fish, these factors do not significantly disturb migration processes [263].

The impact related to the creation of a barrier will be negative, direct, local, long-term and permanent.

Sensitivity to impact was assessed to be moderate for all studied fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

Electromagnetic field emission

Submarine cables through which electric current flows become a source of electromagnetic field. The current flowing through them generates a magnetic field, which in turn becomes a source of induced electric field. Direct emission of electric field occurs only in case of solutions with the use of electrodes placed in the sediment [329, 75]. The nature of the electromagnetic field depends on the flowing current, the type of cable and whether it is located on the sediment surface or covered with a layer of sediment. Depending on the type of cable and its depth in the sediment, the range of magnetic impacts may vary from several to several hundred meters, whereas in the case of induced electric field it reaches several meters [325, 121].

The specific dimensions of the generated fields depend on the applied technical solutions. The spatial range of the induced electric field usually reaches up to several meters from its source [121, 325]. For the electric field resulting from the application of the electrode solution, the field strength of approx. 3 V m-1 above the electrode may be expected to be below 0.5 V m-1 at a distance of 40 m (assumptions: DC cable, 400 kV voltage, 1330 A current) [329].

The sensitivity of ichthyofauna to the impact of electromagnetic field depends on:

- the species-specific detection threshold;
- the type of sensor of the fish (magnetic, electrical);
- the lifestyle (demersal, pelagic) – bottom dwellers are exposed to a higher force of the electromagnetic field) [121].

The magnetic field detection threshold is, depending on the species, between 0.01 µT and 0.05 µT.

According to Taormin et al. [424], the electromagnetic field caused by cables may affect navigation and orientation capabilities of marine organisms, cause avoidance or attraction effects, as well as cause physiological and developmental disturbances.

Disturbances in the natural field may cause problems with the orientation of migratory fish, such as European eel, whose experimental research confirmed sensitivity to changes in the magnetic field [222]. However, the previous field research do not indicate a significant impact of this factor on migration capabilities of this species.

In surveys carried out in the southern Baltic Sea, Westerberg and Öhman et al. [473, 321] did not observe any disturbances in the migration of eels flowing at a distance of 500 m from the wind turbine. Also Westerbeg and Begout-Anras [472] did not find that the high-voltage DC cable constituted a barrier to migration of this species. Also, no significant impact of the long-term exposure of the European flounder on the increased permanent magnetic field was observed [47].

Research on the impact of the electric field on salmonidae and eels indicate the possibility of occurrence of such reactions as accelerated pulse (field strength of 0.007 – 0.07 V m^{-1}) as well as gills and fins vibration (field strength of 0.5 – 7.5 V m^{-1}) [276]. Harmful effects such as paralysis and temporary loss of consciousness were observed in fish exposed to an electric field with a force above 15 V m^{-1} [24, 141].

The Baltic Power OWF Area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the Baltic Power OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

The impact related to the emission of electromagnetic field will be negative, direct, local, long-term and permanent.

Sensitivity to impact was assessed to be moderate for all studied fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

6.1.2.6.1.4 Marine mammals

During the Baltic Power OWF operation phase, the impacts on marine mammals will result from:

- emission of noise generated by wind turbines;
- emission of noise generated by vessels;
- habitat change;
- vessel collisions;
- collisions with vessels.

Noise generated by wind turbines

Underwater noise generated during the OWF operation phase comes mostly from vibrations generated by the generator and the gearbox, transferred through the foundation or support structure to water, and it is much lower than the noise generated during the OWF construction phase [32, 434, 442]. However, it should be noted that the noise emission will be present throughout the project lifetime, which is expected to be 30 years.

The pre-2006 knowledge on emissions generated during the OWF operation was summarized by Madsen et al. [272] and Thomsen et al. [437]. Both studies showed that the existing wind farms only increase the level of ambient noise to a very limited extent and, consequently, their impact on marine mammals was assessed to be low.

Nedwell et al. [313] carried out a measurement campaign covering the OWFs in the operation phase: North Hoyle, Scroby Sands, Kentish Flats and Barrow located in United Kingdom (pile diameter from 4 to 4.7 m). The studies concluded that the noise generated during their operation was very low and no evidence was found that the noise had reached a level that would have contributed to the avoidance of this area by marine mammals.

Tougaard et al. [442] measured operational noise from three smaller turbines (0.45-2 MW) in three OWFs: Middelgrunden and Vindeby in Denmark and Bockstigen-Valar in Sweden. Wind turbine noise was measured only above the ambient noise level for frequencies below 500 Hz, for which the hearing of marine mammals is generally poor [437]. They discovered that with the increase of wind speed, only the peak noise levels increase, not the frequency, as the turbines were kept in continuous rotation, which confirmed that the noise comes mainly from the gearbox. They also estimated a very small range of noise heard by porpoises (< 100 m) and, depending on the propagation losses assumed, the audibility for seals ranged from 2.5 to 10 km from the source.

One of the most extensive studies of noise generated during the operation of the wind farm was the RAVE (Research at Alpha Ventus) program, in which the operational noise of the Alpha Ventus wind farm in the North Sea was measured over a period of 165 days in 2010 and 2011 [32, 259]. The analysis focused on the operational noise of two wind turbines of different manufacturers, each with a rated power of 5 MW. For one of the turbines, very characteristic 90 Hz tonal noise was measured with harmonics at 450 Hz, 630 Hz and 810 Hz (Figure 6.1), which dominated the operational noise of the wind farm, especially at full operational load. However, contrary to expectations, this project also showed that in the area of the wind farm noise quiesced with an increase in wind speed and output power, as background noise (e.g. from remote vessels) was obscured due to an increase in the sea level and this decrease more than compensated for the increase in turbine noise. Based on this study, Betke [32] also suggested that although noise levels may increase as the turbine size increases, they are likely to be outside the frequency range that marine mammals hear.

As part of the MarVEN project [434], measurements were taken from two Belgian wind farms with 3 MW turbines on large-diameter steel piles (Belwind and Northwind) and one with 5 and 6.15 MW turbines on jacket foundations of the C-Power OWF [434]. The recordings revealed peaks at 50, 150, 400, 500 and 1200 Hz in 1/3 octave bands. The measurements were performed at several distances from the source, and the values recorded from the Northwind OWF turbine were comparable to the measurements from the C-Power OWF. Noise measurements were significantly higher for Northwind when the distance increased to 150 m, which suggests that the type of foundation may also contribute to the noise level generated by wind turbines, especially at higher distances.

Noise modeling of the 6 MW wind farm carried out by Marmo et al. [277] showed that, depending on the type of foundation or support structure and wind speed, noise emissions from the modeled wind farm were detectable at a distance of up to 20 km from the source. However, these ranges were based on the levels of ambient noise from Wenz [469], which is a very cautious approach as these levels are old and relatively low.

Noise levels from the tests described above have been standardized up to a distance of 25 m and are summarized in table (Table 6.9.). The water depths refer to the depths of the wind turbines subject to measurements, the entire wind farm or the measuring point and serve as guidance only. The 1/3 octave mid frequencies refer to the maximum sound pressure level of 1/3 octave. Appropriate distances for the specified sound pressure level were assumed as measuring distances. If the noise level has already been determined (e.g. for Alpha Ventus), the value is shown below. For North Hoyle, Scroby Sands, Kentish Flats and Barrow wind farms, measurements performed within or outside the wind farm were adopted.

Table 6.9. Recorded noise levels normalized to a distance of 25 m [Source: own study]

Wind farm/data source	**Turbine rated power output [MW]**	**Water depth [m]**	**Maximum broadband sound pressure level at a distance of 25 m [dB re 1 µPa]**	**Maximum 1/3 octave band levels at a distance of 25 m [dB re 1 µPa]**	**1/3 octave band middle frequency [Hz]**	**Measurement distance [m]**	**References**
Vindeby	0.45	4	120	120	125	14	Tougaard et al. [442]
Bockstigen - Valar	0.5	10	109	106	160	20	Tougaard et al. [442]
Utgrunden	1.5	-	-	118	160	1	Thomsen et al. [435]
Middelgrunden	2	5	105	102	25	20	Tougaard et al. [442]
North Hoyle	2	12	125	-	-	Within the farm area	Nedwell et al. [313]
North Hoyle	2	12	117	-	-	Outside the farm area	Nedwell et al. [313]
Scroby Sands	2	5	127	-	-	Within the	Nedwell et

Wind farm/data source	Turbine rated power output [MW]	Water depth [m]	Maximum broadband sound pressure level at a distance of 25 m [dB re 1 µPa]	Maximum 1/3 octave band levels at a distance of 25 m [dB re 1 µPa]	1/3 octave band middle frequency [Hz]	Measurement distance [m]	References
						farm area	al. [313]
Scroby Sands	2	5	129	-	-	Outside the farm area	Nedwell et al. [313]
Northwind	3	20	135	-	-	40	Thomsen et al. [434]
Northwind	3	20	142	-	-	150	Thomsen et al. [434]
Kentish Flats	3	5	111	-	-	Within the farm area	Nedwell et al. [318]
Kentish Flats	3	5	110	-	-	Outside the farm area	Nedwell et al. [318]
Barrow	3	-	121	-	-	Within the farm area	Nedwell et al. [318]
Barrow	3	-	119	-	-	Outside the farm area	Nedwell et al. [318]
Alpha Ventus	5	30	-	123	90	1	Van Radecke and Benesch [454]
C-Power	5	25	137	-	-	40	Thomsen et al. [434]
C-Power	5	25	131	-	-	60	Thomsen et al. [434]
C-Power	5	25	131	-	-	150	Thomsen et al. [434]

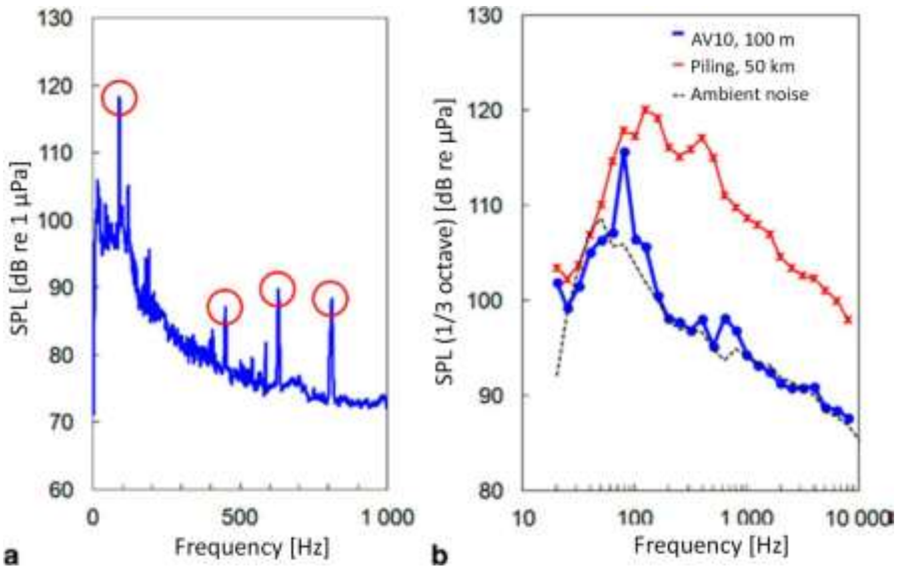


Figure 6.1. Noise from the 5 MW wind turbine measured at a distance of 100 m from the Alpha Ventus offshore wind farm; a) noise spectral density – red circles indicate the tonal component at 90 Hz and harmonics at 450 Hz, 630 Hz and 810 Hz; b) noise spectrum in the 1/3 octave bands from Figure a (blue line), acoustic background at the same wind speed and without operation of the turbines (dashed line) and noise from deep piling (red line) [32] [Source: own study]

Although porpoises and seals may detect noise from the operation of wind farms from closer distances than during piling, the number of marine mammals does not necessarily decrease in relation to the number from before the construction phase. Scheidat et al. [389] demonstrated that in the Egmond aan Zee OWF, porpoises returned to the OWF area in operation even in a larger number than in the surrounding monitoring areas. They suggested that the area of the wind farm where vessel traffic and trawling are prohibited may be a refuge compared to areas with increased shipping. Artificial reefs increasing the possibility of feeding are also important. It is known that in the southern North Sea, where this wind farm is located, the number of porpoises has generally increased [336, 435]. An increase in the number of animals could simply follow a more general trend, which was not related to the wind farm. However, no similar increase in the number of porpoises was observed in the reference areas. During another research, a 10-year monitoring period [425], a strong decrease in the number of porpoise detections was found after the construction of the Nysted OWF in the Danish part of the Baltic Sea. The level of porpoises detection was restored to 29% of the initial level probably due to positive effects accompanying wind farms (e.g. artificial reef effect). Teilmann et al. [427] on the other hand, did not state that the presence of wind turbines had an impact on the number of porpoises in the area of the Rødsand II OWF, which is located in the Nysted vicinity. It should be mentioned that in Nysted the acoustic activity of porpoises (number of detections) was relatively low from the beginning. Therefore, the results may not be representative due to the small size of the samples. To sum up, different types of wind farms under different environmental conditions may have different impacts on the distribution of porpoises in a given area.

The impact of OWF operation was also examined in the context of seals. The study prepared by Russell et al. [381] indicated that several marked harbor seals actively sought foundations or support structures of wind turbines on the Alpha Ventus OWF (Germany) and Sheringham Shoal (United Kingdom), probably in order to search for food, as indicated by the pattern of their movement. McConnell et al. [284], on the other hand, noted that seals totally ignored the wind turbines of Nysted and Rødsand II wind farms, suggesting that, as in the case of porpoises, seals do not give an impression of being deterred and are even attracted under certain conditions.

Impacts will be of low importance in the case of porpoises, gray seals and harbor seals.

Noise generated by vessels

It is likely that small and medium-sized vessels will be used to service and maintain the OWF. These types of vessels emit mainly sounds between 160-180 dB re 1 µPa at 1 m, covering frequencies of <1 kHz to > 10 kHz. It is possible that they will lead to an increase of the local sound field during operation, including frequencies that are partially relevant for marine mammals. The total number of service and maintenance works of the wind farm is unknown. However, it is possible that only one vessel will be used at a time. Hence, the audible field and short-term impacts may be very limited locally and therefore, the significance of the impact may be considered o be of low importance.

Habitat change

The visual impact of the operated wind farm under water will probably be minimal. Underwater parts of foundations or support structures and scour protection are quickly overgrown, resembling other reefs present at sea. On the surface, wind turbines together with rotor blades represent a significant change in the surrounding landscape, but it is not clear whether and how this may affect porpoises and seals under water. On the other hand, the increase of porpoises is weak and seals, although they have keen sight, do not know to what extent the view of wind turbines would cause their scaring.

Introduction of hard substrates in the form of foundations or support structures and erosion protection on the sandy seabed will cause changes in the environment and may have a positive effect over a longer period of time, as they can serve as artificial reefs or refuges with a lower noise level compared to areas with high vessel traffic intensity [389, 425].

Gray seals and harbor seals can benefit from the same effects of an artificial reef [381], and since the wind farm is not close to their laying areas, habitat change will most likely not cause significant disturbances.

Vessel collisions

Vessel collisions causing oil spillage in the project area may adversely affect marine mammals present in adjacent waters. However, fuel spillage is very unlikely. Given the above, the significance of this impact was assessed to be moderate for porpoises and seals.

Collisions with vessels

Collisions with vessels involve in general large whales. However, data suggest that this factor may also be a significant source of mortality among small whales in areas with high density and intensive vessel traffic [455]. High speed ferries raise particular concerns due to the high speed with which they move (often above > 40 knots) and the relatively low noise levels they generate [72]. Collisions with vessels were also documented for seals, but in a small number and mostly for juvenile individuals [162]. In the case of the Baltic Power OWF, collisions with vessels are unlikely due to low density of porpoises and seals in the surveyed area, as well as due to lower movement speeds of vessels participating in the OWF maintenance and servicing. The importance of this factor was assessed to be of low importance for porpoises and seals.

Assessment of the significance of impacts during the operation phase

The results of the assessment of the impact of factors during the operation phase of the wind farm are presented in the table (Table 6.10). The effect on porpoises and seals is generally negligible, of low importance or moderate during the operation phase. In some cases, positive factors may even be indicated, such as reef effects, which may contribute to greater opportunities for feeding for all species of marine mammals concerned [253].

Table 6.10. Overall effect on marine mammals associated with activities in the operation phase after application of the NRS system [Source: own study]

Species	Impact	Impact description	Impact significance
Porpoise *Phocoena phocoena*	Noise from operating turbines	Behavioral response to noise generated by wind turbines (moving away from the operation site)	Low importance
	Operation and maintenance noise	Behavioral response to noise related to the operation and maintenance of the OWF (moving away from the operation site)	Low importance
	Visual effects	Behavior changes caused by obstacles (moving away from the operation site)	Low importance
	Reef effects	Increase in feeding opportunities due to increased fish abundance	Low importance
	Vessel collisions	Pollution caused by vessel collisions used during the operation phase (e.g. fuel spillage)	Moderate
	Collisions with vessels	Physical injuries caused by collision of marine mammals with vessels	Low importance
Grey seal *Halichoerus grypus*	Noise from operating turbines	Behavioral response to noise generated by wind turbines (moving away from the operation site)	Low importance
	Operation and maintenance noise	Behavioral response to noise related to the operation and maintenance of the OWF (moving away from the operation site)	Low importance
	Visual effects	Behavior changes caused by obstacles (moving away from the operation site)	Low importance

Species	Impact	Impact description	Impact significance
	Reef effects	Increase in feeding opportunities due to increased fish abundance	Low importance
	Vessel collisions	Pollution caused by vessel collisions used during the operation phase (e.g. fuel spillage)	Moderate
	Collisions with vessels	Physical injuries caused by collision of marine mammals with vessels	Low importance
Harbor seal *Phoca vitulina*	Noise from operating turbines	Behavioral response to noise generated by wind turbines (moving away from the operation site)	Low importance
	Operation and maintenance noise	Behavioral response to noise related to the operation and maintenance of the OWF (moving away from the operation site)	Low importance
	Visual effects	Behavior changes caused by obstacles (moving away from the operation site)	Low importance
	Reef effects	Increase in feeding opportunities due to increased fish abundance	Low importance
	Vessel collisions	Pollution caused by vessel collisions used during the operation phase (e.g. fuel spillage)	Moderate
	Collisions with vessels	Physical injuries caused by collision of marine mammals with vessels	Low importance

6.1.2.6.1.5 Migratory birds

In the Baltic Power OWF operation phase, the impacts on migratory birds will result, similarly as in the construction phase, from two main elements, i.e. the barrier effect and collisions with the OWF structures. Due to the largest assumed occupation of space above the Baltic Power OWF Area, the size of these impacts will be higher than in the construction phase. Detailed assessment of the impact of the Baltic Power OWF during the operation phase on migratory birds is included in Appendix No. 4 to the EIA Report.

Impact on migratory birds is considered through the barrier effect and risk of collision with OWF components. As a result of the barrier effect, birds approaching the OWF perceive it as a barrier and change the direction of flight. Birds may adapt their flight to bypass the OWF, which makes their migration route longer. The conducted analyses indicate that in each phase of the project, the energy expenditure related to the extension of the migration route is minimal. The migration route is not the same for all specimens of a given species and differences resulting from individual selection of the route and impact of weather phenomena may be greater than those resulting from the barrier effect, therefore the significance of this impact was considered negligible.

The impact in the form of a risk of collision, i.e. mortality as a result of collision with OWF components, is presented in the form of the total number of collisions of a given species obtained as a result of modeling in the spring and autumn seasons. Among all species considered in this analysis, the significance of the risk of collision was determined at a moderate level for common crane. For the common crane, the maximum mortality was estimated in the worst-case scenario at 116 individuals in autumn in RAV, while the models for VpA indicate a mortality lower by about 60% both in spring and autumn for all tested clearance ranges. The significance of the impact in the form of a risk of collision was assessed to be of low importance for the long-tailed duck, the common scoter and the velvet scoter. For these species, the estimated number of collisions did not exceed a few specimens. The estimated number of collisions for geese in the worst case scenario exceeded 70 specimens, but due to very large populations of species included in this category (estimated at more than 3.5 million specimens), the significance of the impact was assessed as of low importance. For other species, the significance of the impact resulting from the risk of collision was assessed as negligible.

A summary of the analysis of the impact of the barrier effect and collision on migratory birds during the operation phase is presented in the table (Table 6.11).

Table 6.11. Summary of impacts of the Baltic Power OWF on migratory birds during the operation phase [Source: Baltic Power Sp. z o.o. data]

Species	Value/receiver significance	Impact	Reversibility of the impact	Impact magnitude	Impact significance
Long-tailed duck Clangula hyemalis	High	Barrier effect	Reversible	Insignificant	Negligible
		Risk of collision	Irreversible	Insignificant	Low importance
Common scoter Melanitta nigra	High	Barrier effect	Reversible	Insignificant	Negligible
		Risk of collision	Irreversible	Insignificant	Low importance
Velvet scoter Melanitta fusca	High	Barrier effect	Reversible	Insignificant	Negligible
		Risk of collision	Irreversible	Insignificant	Low importance
Geese Anseridae	Moderate	Barrier effect	Reversible	Insignificant	Negligible
		Risk of collision	Irreversible	Moderate	Low importance
Common crane Grus grus	High	Barrier effect	Reversible	Insignificant	Negligible
		Risk of collision	Irreversible	Moderate	Moderate

6.1.2.6.1.6 Seabirds

Identification of key factors affecting seabirds during the operation phase

The potential impact of wind turbines located in the high seas on seabirds relates to the increased mortality as a result of collisions with wind turbines and changes in the distribution and behavior of birds. The highest mortality occurs in the case of wind farms located on feeding grounds and on regular flight routes.

In order to determine the significance of the impact, the scale of the impact was assessed as high for the long-tailed duck and velvet scoter, moderate for the razorbill and the common guillemot, and as insignificant for the European herring gull.

The identified factors and assessment of their impact on marine avifauna during the operation phase are presented below.

Vessel traffic

The presence of vessels and fixed structures protruding from the water shall result in a higher number of gulls and great cormorants that use such elements as resting sites and seek food in the vicinity of vessels. Three species of large gulls, including the most numerous European herring gulls, gather on the open sea around fishing vessels. If commercial fishing is reduced in this water region during the wind farm operation, these gulls will move (at least partially) to other fishing sites.

Operation of the Baltic Power OWF will involve the traffic of various types of water vessels servicing the OWF. The traffic of vessels during the operation phase will cause direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species), long-term, reversible, repeatable during the operation period, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and as insignificant for both species of ducks – the long-tailed duck and velvet scoter.

Scaring away and displacement from the habitats

After construction of the OWF, most bird species will avoid staying in its vicinity, as a result of which they will largely lose access to their feeding grounds.

Operation of the OWF will result in scaring away and displacing some part of seabirds from their habitats in the water region occupied by the wind turbines and in the adjacent water strip of approximately 2 or even 4 km wide. The degree and area of birds displacement from this water region and its surroundings will depend on bird species.

A single OWF is a barrier for birds, which, in the vast majority of cases, avoid the water region with wind turbines. Such a behavior reduces the risk of collision, especially during the day when the visibility is good. However, the OWF area will be excluded for a large part of the population as a feeding ground for a long time, which may have a negative impact on some species.

After construction of the OWF, most bird species will avoid staying in its vicinity, as a result of which they will lose access to their feeding grounds.

The most important parameters influencing the level of impact are:

- number of wind turbines;
- density of wind turbines;
- clearance between the sea surface and the lower level of the rotor blade (most flights take place up to 20 m above the water surface);
- rotor diameter;
- distance from the neighboring OWFs – neighboring wind farms increase the barrier effect.

Scaring and displacement from the habitat during the operation phase will cause direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). For razorbill, common guillemot, European herring gull and velvet scoter, this is a long-term and permanent impact, and for the long-tailed duck – short-term and temporary.

Sensitivity to the impact on the European herring gull was assessed as low and for other species, it was assessed as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed duck and velvet scoter.

Barrier creation

The structures of wind turbines will occupy a part of the OWF water region, creating a barrier for seabirds traveling on a local scale between feeding or resting grounds, which reluctantly fly over obstacles. The range of the barrier effect will depend on the number and size of constructed wind turbines. However, selection of the option will not have a significant impact on the size and significance of the project impact on seabirds. It is noted that seabirds clearly avoid the area occupied by wind turbines and their population decreases in the vicinity of wind turbines – e.g. for the long-tailed duck within a radius of up to 2, and even up to 4 km [79, 337, 266]. The only exceptions are European herring gulls and great cormorants, which often use structures protruding above water as resting sites, so that their number may even increase.

The barrier effect that will be created by the Baltic Power OWF applies primarily to migratory birds. A part of seabirds migrating through the OWF Area may, however, target nearby Natura 2000 sites of the Słupsk Bank, Coastal Waters of the Baltic Sea and the Słowińskie Coast, where they may have their landing sites, overwintering sites or breeding grounds. The creation of a coherent barrier in this area may also hinder the movement of those populations between the closest similar wintering sites being the Słupsk Bank, the South Middle Bank and the Hoburgs Bank. Today, there are no scientific data on the significance of connections between these areas, but they cannot be dismissed.

The new structures present in the operation phase of the OWF will be a source of direct negative impacts on seabirds that will be of local range, long-term, reversible, permanent during the operation phase, and of intensity dependent on the species.

Operating wind turbines will be a physical barrier, causing the risk of collision and, on the other hand, deterring birds and causing a loss of feeding grounds. The bird deterrent effect of wind farms minimizes the risk of collisions. However, the risk of collision to a larger extent applies to migratory birds flying at night and in conditions of limited visibility than to birds staying in the project area.

Creation of a barrier during the operation phase will cause direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). For razorbill, common guillemot, European herring gull and velvet scoter, this is a long-term and permanent impact, and for the long-tailed duck – short-term and temporary.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed duck and velvet scoter.

Collisions with wind turbines

During the operation phase of the planned project, collisions of seabirds with vessels may occur. However, due to the higher intensity of vessel traffic in the OWF Area during the construction and decommissioning phases, this impact will be the smallest in the operation phase of the planned project. Along with the progressing construction of the OWF, the risk of bird collision with wind turbines will increase. It will reach its peak during the OWF operation phase.

Wind turbines cause changes in the way birds use space, which also applies to offshore areas. In the vast majority of cases, wind turbines scare away birds and migrating seabirds bypass wind turbine farms at a distance from 100 to even 3000-4000 m [79, 337, 266]. As a consequence, the areas directly adjacent to the wind turbine are much less used as feeding grounds and resting sites. The area where wind turbine masts stand largely stops being available as a feeding ground for birds, and, in some cases, significantly lower density of birds can be observed at a distance of up to 2 or even 4 km from the wind turbine [338]. The fact that seabirds avoid the area where wind turbines are located and the low flight altitude between the masts reduce the risk of collisions, result in low mortality caused by collisions with offshore wind turbine structures. However, with poor visibility resulting from fog and rainfall, the risk of collision increases. The number of collisions with wind turbines increases significantly when they are located in areas attractive to birds and densely populated, and when the wind turbines are located on regular migration or local migration routes.

The risk of collision also depends on the species of bird. Large seabird species, such as swans, are more vulnerable to collisions with wind turbines due to difficulties in carrying out rapid mid-air manoeuvres [66]. Most seabird species fly low above the water and, when they are between turbines, they move down and maintain equal distances from obstacles [107, 197, 337]. This means that the risk of collision is influenced by the clearance between the lower position of the rotor blade and the sea surface. The smaller it is, the greater the chance of birds colliding with an operating rotor.

Collisions with wind turbines during the operation phase will cause direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). For razorbill, common guillemot, European herring gull and velvet scoter, this is a long-term and permanent impact, and for the long-tailed duck – short-term and temporary.

The sensitivity to the impact on the European herring gull was assessed as low, for the razorbill, common guillemot and velvet scoter as moderate, and for the long-tailed duck as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, moderate for the velvet scoter, and as significant for the long-tailed duck.

Creation of an artificial reef

Habitat changes caused by the formation of an artificial reef may have a certain positive impact on benthic-feeding seabirds thanks to an increase in the food base. Rich benthic communities are formed on the underwater parts of the structure and at the bottom of the water region occupied by the OWF, which may result in an increase in the number of fish. However, these resources will be little or not at all exploited by birds. The effect of bird deterrence by structures protruding high from water will prevail here. The most important parameters influencing the level of impact are the shape, the diameter of the base and the number of monopiles.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and the common guillemot as moderate, and for the long-tailed duck and the velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters.

Establishment of a closed water region

The OWF area may be, during the operation phase, a totally or partially closed water region for commercial fishing. In the case of such partial or complete closure of the water region, it can be expected that fish will find very good living conditions in the OWF area (no fishing, rich benthic communities). However, birds will benefit to a small extent from such a food base due to the prevailing deterrent effect of structures protruding high from water.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the long-tailed duck and velvet scoter as moderate, and for the razorbill and common guillemot as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull and moderate for other species.

Table (Table 6.12) presents a summary of the significance of individual impacts of the Baltic Power OWF on seabirds during the operation phase.

Table 6.12. Significance of the project impact on seabirds during the operation phase [Source: own study]

Species	Impact	Impact description	Impact significance
European herring gull *Larus argentatus*	Establishment of a closed water region	The OWF Area may be partially closed for fishing	Negligible
	Vessel traffic	Scaring caused by the traffic of vessels	Negligible
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Negligible
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Negligible
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Negligible
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Negligible
Razorbill *Alca torda*, Common guillemot *Uria aalge*	Establishment of a closed water region	The OWF Area may be partially closed for fishing	Moderate
	Vessel traffic	Scaring caused by the traffic of vessels	Moderate
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Low importance
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Moderate

	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Moderate
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Low importance
Velvet scoter *Melanitta fusca*	Establishment of a closed water region	The OWF Area may be partially closed for fishing	Moderate
	Vessel traffic	Scaring caused by the traffic of vessels	Significant
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Significant
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Significant
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Significant
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Moderate
Long-tailed duck *Clangula hyemalis*	Establishment of a closed water region	The OWF Area may be partially closed for fishing	Moderate
	Vessel traffic	Scaring caused by the traffic of vessels	Significant
	Creation of an artificial reef	Creation of a new hard substrate for macrozoobenthos	Significant
	Scaring away and displacement from the habitats	Caused by the operation of wind turbines	Significant
	Barrier creation	Depending on the number of wind turbines, light and noise emitted	Significant
	Collisions with wind turbines	Depending on bird migrations, density, flight altitude, WT parameters	Significant

6.1.2.6.1.7 Bats

The potential impact of the Baltic Power OWF on migratory bats during the operation phase will be caused by:

- collisions with wind turbines;
- emission of noise and light;
- barrier effect;
- habitat change.

Collisions with wind turbines

Studies show that in the late summer, wind turbines in the Baltic Sea at a distance of up to 10 km from the Swedish coast attract bats [2]. Increased activity of bats probably results from a high concentration of the food base, which entices bats migrating over the Baltic Sea. Additionally, species of bats that do not migrate seasonally may be attracted to the OWF area [383, 392].

Bats may collide with masts or rotor blades, there is also a risk of barotrauma. Barotrauma is caused by vacuum produced by rotating rotors. The studies showed that most of the bats killed in the area of onshore wind turbines are likely to be lost due to internal injuries caused by barotrauma [21, 165].

Migratory bats fly over the sea at low altitudes. However, if they come across a wind turbine, they can change the flight height from the water surface to the top of the wind turbine within only a few seconds [2]. Moreover, bats may be enticed by concentrated food base accumulating around wind turbines in favorable weather conditions, such as low wind speeds, high temperatures, and no precipitation [345]. Insects can be attracted by a temperature growth due to the operation of the wind turbine. Wind turbine towers absorb heat during the day, thus attracting insects whose concentrations constitute an attractive feeding ground for bats [385]. Insects may gather at the top of a wind turbine as a result of the phenomenon known as hill-topping [385]. This phenomenon is associated with the migration of insects that, when coming across an obstacle like the OWF, move upwards along the obstacle and accumulate at its top. As a result, bats thus lured may be more exposed to collisions as a result of collision with rotor blades.

Most bats migrate over the sea at night when the wind speed does not exceed 10 $m \cdot s^{-1}$, and the highest activity of bats is recorded at the wind speed below 5 $m \cdot s^{-1}$ [3]. The highest feeding intensity of bats was observed during windless weather. Very low wind speeds are rare in the open sea. Therefore, it is rather unlikely that bats will gather for feeding on days of the OWE operation.

Emission of noise and light

Ultrasonic noise generated by the nacelle may attract bats, but this hypothesis has not been confirmed and seems unlikely [385]. The same applies, according to Rydella et al. [385], to the assumption that the red warning lights of wind turbines lure bats. However, it has been proved that red light is more attractive to bats than the white one [460]. Taking into account the fact that the alleged impact of noise and light emission on bats is considered unlikely, the effects of these impacts are classified as local and permanent, but of low intensity, which results in minor structural and functional changes for bats.

Barrier effect

The operating wind farm may exert a barrier effect on migrating bats. Noise emitted by operating wind turbines can contribute to the barrier effect. Due to the barrier effect, bats may be forced to change the migration direction. This, in turn, will result in additional energy expenditure unfavorable for migratory bats [133].

Habitat change

Structural components may be used as resting sites along a migration route or may be attractive hiding places due to the aforementioned insect concentrations [2, 385].

Surveys in the spring and autumn migration seasons indicated a possibility of bats migrating in the OWF Area, however, the migration intensity was low due to the low activity of bats.

The described impacts of the Baltic Power OWF during the operation phase will be negative, direct, and long-term.

Sensitivity to the impact was assessed as low, whereas the significance of the Baltic Power OWF impact during the operation phase was assessed as insignificant due to the low activity of bats found during the surveys carried out in the seasonal migration period.

6.1.2.6.2 Impact on protected areas

6.1.2.6.2.1 Impact on protected areas other than Natura 2000 sites

Given the location of the Baltic Power OWF at a significant distance from the protected area of the Słowiński National Park, similarly as during the construction phase, no significant impact on this area will occur during the operation phase, including any element for which it was established, i.e. biodiversity, resources, objects and components of inanimate nature and landscape values of the Park.

In the Appendix to the Regulation of the Minister of the Climate of December 23, 2019 on protection tasks for the Słowiński National Park for 2020-2022 (Official Journal of the Minister of the Climate of 2019, item 4, as amended), in which the existing and potential internal and external threats and methods of elimination or mitigation of these threats and their effects were identified and assessed, the existing external threats category indicates the risk resulting from increasing the areas for construction of wind farms in the municipalities adjacent to the park. It was stated under the category of potential external threats that only the construction of wind farms in the buffer zone of the park constitutes a potential external threat and, consequently, it should be stated that the Baltic Power OWF, due to its location, will not pose a threat to the Słowiński National Park.

Considering that protected areas may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact on them at the stage of operation of the Baltic Power OWF as insignificant, the significance of this impact is of low importance.

6.1.2.6.2.2 Impact on the Natura 2000 protected areas

The identification and assessment of impact on areas protected under the European Natura 2000 ecological network are presented in sub-chapter 6.3.

6.1.2.6.3 Impact on wildlife corridors

The issue of wildlife corridors in maritime areas is described in sub-chapter 6.1.1.4.3.

Due to the same pre-conditions in terms of knowledge about wildlife corridors in maritime areas and the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea, including the constant effect of space development, it was assessed that the impact of the Baltic Power OWF considered separately in the operation phase, similarly as in the construction phase, on migration routes of migratory species will be negligible.

6.1.2.6.4 Impact on biodiversity

Phytobenthos and macrozoobenthos

During the Baltic Power OWF operation phase, structures permanently submerged in water will be founded in the environment, creating favorable conditions for the development of animal and plant epiphyte organisms. On a local scale, within the range of structural components, there will be an increase in species diversity, although the nature of natural value of this habitat may be ambiguous. This results from the fact that, on the one hand, epiphyte associations will be a new biocenosis component of this area, additionally increasing the food base for fish, birds and, incidentally, for marine mammals. On the other hand, this location may favor the spread of foreign species, which lowers the ecological quality of this micro-habitat.

Ichthyofauna

The artificial reef effect present during the operation phase will probably result in an increase in biodiversity due to the appearance of a new habitat providing favorable conditions for the living and reproduction of many fish species. The results of the research of the long-term impact of the Horns Rev 1 OWF on the number and taxonomic composition of fish showed that the artificial reef effect was significant enough to cause an increase in the number of fish that prefer a hard substrate and, at the same time, too small to cause a decrease in the number of fish that prefer a sandy substrate [410].

Possible reduction or cessation of fishing in the OWF Area caused by legal regulations or navigation problems may have a positive impact on diversity. Probably, the artificial reef effect will have only a local impact, without increasing diversity in a larger area.

Marine mammals

The Baltic Power OWF operation phase should not have a negative impact on the biodiversity of marine mammals in the surveyed area and adjacent waters. It is also worth noting that an artificial reef effect may occur, contributing to an increase in the number of fish living in the surveyed area and, consequently, to an increase in the number of marine mammals.

Seabirds

The analysis of possible impacts resulting from the operation of the OWF indicates that their effects in terms of changes in biological diversity of seabirds will be local.

It will consist in a potentially increased mortality as a result of collisions with wind turbines or vessels. The highest mortality occurs in the case of wind farms located on feeding grounds and on regular flight routes. The risk of collision also depends on the species of bird. Large seabird species, such as swans, are more vulnerable to collisions with wind turbines due to difficulties in carrying out rapid mid-air manoeuvres [66].

Moreover, another identified threat to biodiversity is scaring away and displacing some part of seabirds from their habitats in the water region occupied by the wind turbines and in the adjacent water strip of approximately 2 or even 4 km wide. The degree and area of birds displacement from this water region and its surroundings will depend on bird species. During the operation phase, it will cause a direct negative impact on seabirds of local range (for long-tailed duck of regional range, due to possible impact on the biogeographical population of the species). Another scaring factor is the emission of light and noise. In the first season of operation, birds will gradually get used to the situation in which the water region intended for the project becomes inaccessible to them (known as "habituation"), which will result in changes in their distribution. Therefore, this period can be treated as a transition one and only in the second year after the total project construction completion the scale of the impact of the Baltic Power OWF on the seabirds staying in this region will stabilize. However, the habituation will not cause the birds to return to the area occupied by the wind farm.

The barrier created by the Baltic Power OWF applies primarily to migratory birds. However, a part of seabirds migrating through the OWF Area may target nearby Natura 2000 sites, where they may have their landing sites, and overwintering areas. The creation of a coherent barrier in this area may also hinder the movement of those populations between the closest similar wintering sites being the Słupsk Bank, the South Middle Bank and the Hoburgs Bank. Currently, there are no scientific data on the significance of the links between these areas, but they cannot be excluded based on the precautionary principle. Seabirds clearly avoid the area occupied by wind turbines and their population decreases in the vicinity of wind turbines – e.g. for the long-tailed duck within a radius of up to 2, and even up to 4 km [79, 337, 266]. The only exceptions are European herring gulls and great cormorants, which often use structures protruding above water as resting sites, so that their number may even increase. This impact may be significant for species of seabirds sensitive to them, which may have a negative impact on biological diversity in the Baltic Power OWF Area.

To sum up, the impact of the Baltic Power OWF on biodiversity in terms of seabirds largely coincides with the effect of the loss of their habitats.

6.1.2.7 Impact on cultural values, monuments and archaeological sites and facilities

Because no risk of impact on the objects of great importance for the protection of cultural heritage was found in the Baltic Power OWF Area, therefore there is no justification for specifying monitoring activities in this respect. One cannot exclude that the wrecks reported to the Pomeranian Voivodeship Heritage Conservation Officer will be covered by conservation care and will require determination of protection zones in which the possibility of development will be limited. The Applicant will limit the activities related to interference with the seabed (installations, anchoring, foundation works) at a distance of up to 50 m from the reported wrecks, in accordance with the agreement with the Pomorskie Voivodship Heritage Conservation Officer.

6.1.2.8 Impact on the use and management of the water region and tangible property

During its operation, the Baltic Power OWF Area will be excluded from regular navigation due to safety reasons. Traffic of other vessels (fishing, research or tourist vessels) may be permitted depending on the location of offshore wind turbines under the conditions agreed upon with investors. Decisions on permits for vessels other than vessels handling the OWF in the Baltic Power OWF Area will be made by relevant maritime administration authorities.

Exclusion of the Baltic Power OWF Area from the possibility of free passage by fishing vessels may result in extension of their routes to and from the fisheries. However, taking into account the location of the Baltic Power OWF in relation to the shortest routes to fisheries in the area of the Słupsk Furrow from the ports in Władysławowo and Łeba, the extension of these routes may occur only after taking into account subsequent areas of the planned OWF. In no manner will the exclusion from free passage through the Baltic Power OWF Area affect fishermen from other ports fishing in the Słupsk Furrow area. This is described in detail in the sub-chapter 7.4.3.4.

As a result of the Baltic Power OWF occupying the maritime area, this area may be excluded from the possibility of fishing. The Baltic Power OWF Area is located within four fishing squares. This area is characterized by low fishing productivity, therefore the significance of the impact was assessed to be of low importance.

6.1.2.9 Impact on landscape, including the cultural landscape

During the Baltic Power OWF operation phase the following potential impacts of the project on the landscape, including the cultural landscape, were identified:

- operating offshore structures such as wind turbines, substations;
- vessel traffic required for the Baltic Power OWF operation.

Objectively the landscape within the OWF will be industrial, but its impact will also be subjective and will depend on individual characteristics of the receiver and may be perceived negatively, positively and indifferently.

The impact of the OWF on the landscape during the operation phase depends on:

- the size of the structure, diameter of the rotor and its position in relation to the viewer;
- the number and location of wind turbines and facilities;
- the traffic of vessels related to the operation of the OWF;
- meteorological conditions and the sea state;
- the location where the landscape observer is located and individual visual perception characteristics of the observer.

The offshore structures will operate in an open sea area for 30 years.

In the OWF Area, people not directly associated with the OWF are present temporarily. During the operation phase, these will include employees on board vessels, i.a. used for regular operation of the OWF, as well as passengers of tourist ferries, fishermen and deep-sea anglers, tourists on recreational craft, participants in search and rescue operations, flying over the sea in airplanes, scientists. The planned OWF will be the most visible to these groups but more people will be able to observe the OWF during the day rather than at night, when, for example, some of ferry crews and passengers will be asleep. The impacts on the landscape will be long-lasting (30 years), temporary, because after completion of the operation the OWF is to be decommissioned.

In this phase, it is important for how long the observer will be able to see the OWF. It is expected that the above-mentioned persons will stay in the area from which the OWF will be best visible, occasionally, some of them only once.

The meteorological conditions, and more specifically the visibility understood as the range of visibility of and ability to differentiate facilities that depends on weather and ontogenetic conditions, are the basic factor which will determine whether wind turbines will be visible from the coastline or not. The figures below (Figure 6.2) show the number of hours per year for a given visibility (how often it happens that visibility is greater than a specific value) based on data from the atmospheric model UMPL (Unified Model for Poland) (calculated by the University of Warsaw Interdisciplinary Center for Mathematical and Computational Modeling – data from approx. 5 years). These values are shown for 4 locations – Łeba, Lubiatowo, Dębki and Jastrzębia Góra. The charts clearly show that in the case of Jastrzębia Góra there will be no situation in which the OWF will be visible from this place. In the case of Łeba, single wind turbines may be visible even for approx. 5000 hours per year, but 100% of wind turbines installed in the Baltic Power OWF may be visible for a very short period of time (several dozen hours per year). In the case of Lubiatowo, single wind turbines may be visible for more than 5000 hours per year, and all wind turbines installed in the Baltic Power OWF may be visible for up to 500 hours per year. The observer from Dębek can see more than 1000 hours per year, but in practice he/she will never see all wind turbines.

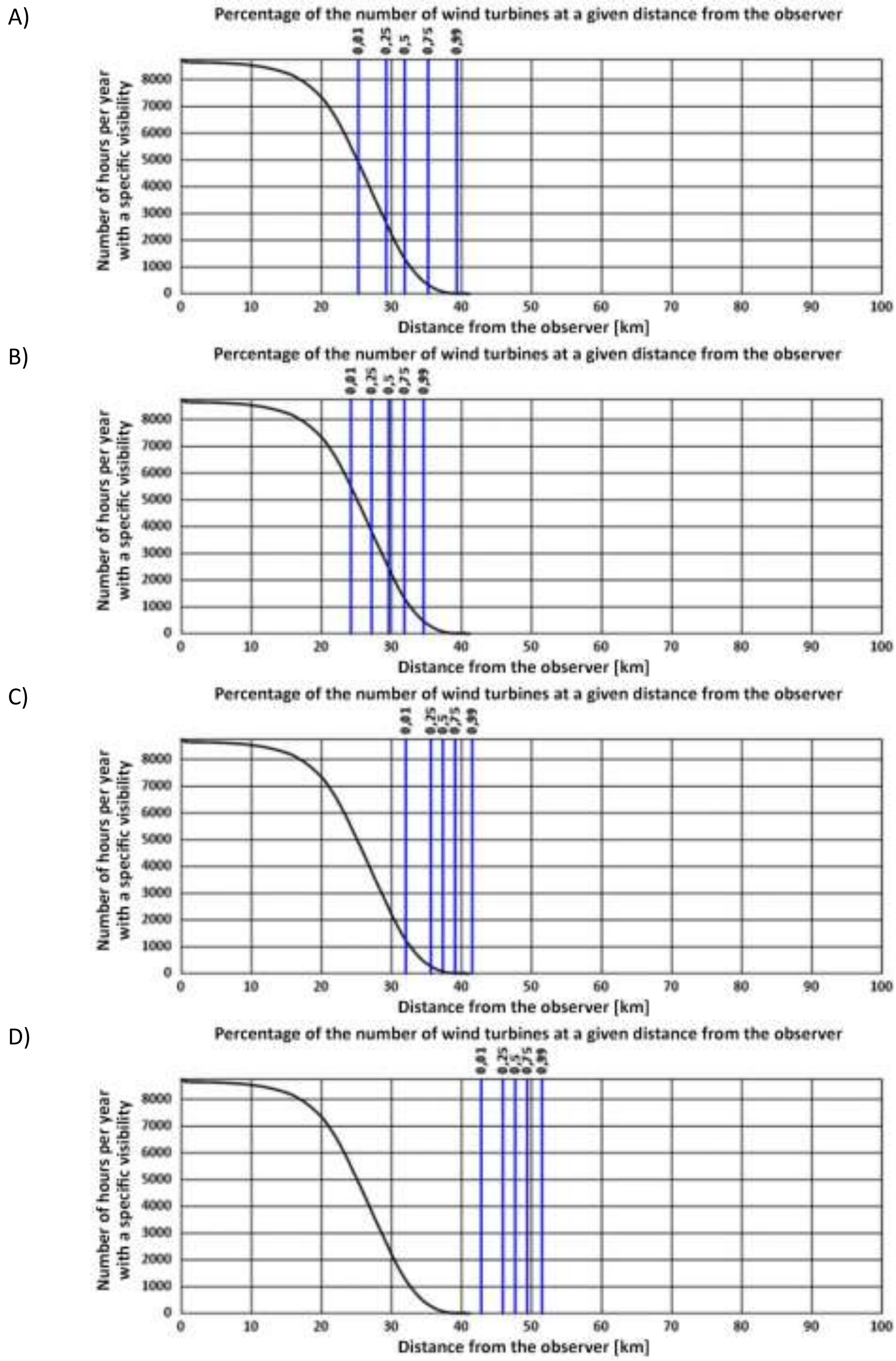


Figure 6.2. Number of hours per year for the preset visibility (distance from the observer) together with marked distances of offshore wind turbines in the option proposed by the Applicant (assumed total number of offshore wind turbines and other large-size structures – 132); [Chart A – Łeba, B – Lubiatowo, C – Dębki, D – Jastrzębia Góra Source: own study]

Additionally, the limitation related to the visibility of wind turbines from the mainland is the Earths' curvature and the related limitation of the height of facilities that can be seen from a large distance. In practical terms, this limitation manifests itself by the phenomenon that the further the offshore wind turbines are located from the observer, the fewer of them can be seen. However, the planned structures are so large that the number of wind turbines/structures visible will be influenced by atmospheric visibility and not by the Earth's curvature. Photographs (Photo 6.1, Photo 6.2) show visualization of the view on the Baltic Power OWF from Lubiatowo and Dębki. Visualizations on a larger scale are shown in Appendix No. 5 to the EIA Report and are placed in the form of graphical files on a disk.

Photo 6.1. Visualization of the view on the Baltic Power OWF from Lubiatowo (summer season) [Source: data of Baltic Power Sp. z o.o.]

Photo 6.2. Visualization of the view on the Baltic Power OWF from Dębek (autumn season) [Source: data of Baltic Power Sp. z o.o.]

In the OPA, the maximum height of the wind turbine will be 258.3 m, and the maximum rotor diameter will be 236 m. Both parameters are greater than those assumed for the RAO, but for an observer, for example on board of a vessel, it will not be a noticeable, significant difference. Also due to the distance of approx. 22.5 km from the land, the height of several dozen meters will not be noticed as differentiating.

From the land, the highest parts of the OWF structure will be visible in the horizon line, under favorable weather conditions, i.e. very good visibility. For most days of the year, the OWF will be practically not visible. The potential zone of the OWF impact on the landscape includes an area of land from Wicko in the west to Jastrzębia Góra in the east. Whether the OWF will be visible to people on the mainland, it will depend on the place from where they will observe the sea. For persons on the beach the OWF will be less visible than for persons staying at a higher altitude above sea level, for example in such places on the coast as: Ustka, Rowy, Czołpino lighthouse, dunes in the Słowiński National Park, Łeba, Stilo lighthouse, Jastrzębia Góra. For each of the observers staying on the mainland in good visibility conditions, the OWF will be on the horizon line (Photo 6.1, Photo 6.2). The operating OWF will not have a negative impact on the onshore forms of nature and landscape protection.

During the operation phase of the Baltic Power OWF, which will be located at a distance of approx. 22.5 km from the shore, it will not cause any impact on land, such as the effect of rotation of the rotor blades, the flickering of light or noise, because they occur only in closely operating structures and their range will not reach the mainland. The offshore structures will be painted, marked, illuminated at night as it is necessary to ensure maritime and aviation safety.

The significance of the impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF. In the open sea, the landscape is not disturbance-resistant, but its value is not high, as very few people and over a short period will be exposed to the landscape change and some of them (e.g. tourists) may perceive it as beneficial or interesting. The scale of impact will have a large spatial range but the further the distance from the OWF the smaller it will be. It will be a long-term but reversible change. On the mainland, the upper parts of the OWF (Photo 6.1, Photo 6.2) may be visible occasionally.

Visualization of the view on the Baltic Power OWF is included in Appendix No. 5 to the EIA Report.

6.1.2.10 Impact on population, health and living conditions of people.

The start-up and operation of subsequent offshore wind turbines requires regular maintenance services. During operation, the scheduled inspections and interventions undertaken as a result of faulty operation shall cover, for instance: Wind turbines, foundations or supporting structures of the OWF, substations and submarine cables. These activities will be carried out with the use of, among others: specialist vessels, service vessels, working boats, submersible vehicles. During the Baltic Power OWF operation, the number of passages of vessels servicing the OWF may reach 1000 thousand per year. These vessels will move between the port in Łeba and the Baltic Power OWF Area. The number of possible passages on the route the Bay of Gdańsk – the Baltic Power OWF – the Bay of Gdańsk during the operation phase will be much smaller, about 100 per year.

Regular services provided to the OWF during the operation phase will consolidate changes in the navigation of oceangoing vessels. The intensity of vessel traffic between the port in Łeba and the Baltic Power OWF will be close to the maximum during the construction phase, which will have an adverse impact on the risk of emergency events.

For safety reasons, access to the Baltic Power OWF Area may be limited for fishing vessels and may mean, for instance, limitation of availability to the currently exploited fisheries and extension of routes for fishing vessels from certain ports to the fisheries located north of the Baltic Power OWF Area. The range of these impacts will apply to several dozen keelboats, mainly from the ports in Łeba and Władysławowo.

One of the types of sea fishing is recreational fishing practiced by both seagoing fishermen and angling enthusiasts and by the owners of sport and recreational vessels. In these cases, it is a small group of people whose material situation will deteriorate due to the construction and operation of the Baltic Power OWF.

The living standards of coastal cities, municipalities and settlements depend to a large extent on the development of coastal tourism and recreation. In some municipalities, e.g. Łeba, the income of local government and inhabitants is mostly derived from services provided to tourists and qualified tourism and recreation. The tourist and recreational potential of this part of the Baltic coastline is one of the highest in the country, and thousands of inhabitants provide various services to travelers mainly during the summer season, with a tendency to extend the rest season.

Due to a large distance from the coast (approx. 22.5 and more kilometers), noise from wind turbines and service vessels will not reach the coastal zone. During most of the weather conditions (wind, waving, cloud cover, air humidity), the operation of the Baltic Power OWF will not be noticeable from the level of the beach or dunes. Only from higher viewing points and under suitable visibility conditions will, it be possible to observe a larger number of wind turbines (parts of the tower and the rotor). The number of visible wind turbines will depend on their spacing, alignment and distance from the coastline.

For such long distances weather conditions will result in maximum reduction of the shadow impact onshore. However, the elements of the OWF lighting will be well visible at night from the shore along the long section of the coast.

Human health and life is related to direct or indirect impacts related to the emission of: noise, air pollution, electromagnetic fields and radiation as well as wastewater and waste.

These impacts will mostly not have any significant impact on human health and living conditions due to their separation from facilities and systems. Due to the occurrence of electromagnetic fields originating from the equipment at offshore substations and the transmission power of radiolocation and radio communication equipment, a potential hazard will be present during the entire period of operation of substations for the maintenance personnel of such equipment. Bystanders will never be within the range of electromagnetic impact of this equipment. Persons staying within the Baltic Power OWF Area because of their work duties will be subject to the provisions of the labor law and OH&S regulations. Therefore, in case of occurrence of the above-mentioned emission hazards, they will be provided with personal protection equipment or their working time under such conditions will be optimized accordingly so that the exposure does not exceed the time permitted by the OH&S regulations.

Other types of events that may affect health and living conditions may involve different types of collisions of vessels at sea. Such events are random, and the operation of the OWF may hinder rescue operations at sea.

Although the resource such as population, health and living conditions of people, is of great value, due to the fact that the distance of the Baltic Power OWF from permanent places of residence and work of people is large, the impact of the Baltic Power OWF was considered negligible in this case.

6.1.3 Decommissioning phase

6.1.3.1 Impact on the geological structure, bottom sediments, access to raw materials and deposits

Impacts occurring during the close-out and decommissioning phase of the project will be similar to impacts present during the construction phase, but they will be less intense. The extent of seabed interference works will not be as large as for driving monopiles. A part of structural members may be left on and in the seabed. Transmission cables may be completely or only partially removed or left in the seabed.

Changes within the seabed associated with the impact of the project will be local and within the entire area occupied by the project – insignificant for the overall character of the seabed and its structure.

Depending on its structure, the seabed may exhibit different sensitivity to the impact of the project during its close-out and decommissioning phase. A clay bottom and a clay bottom with a stony cover is difficult to wash out and changes in its morphology. A sandy, sandy and silty, and silty seabed is more susceptible to the washout and material displacement over it, e.g. in the form of sandy waves. Thus, elements of the Baltic Power OWF infrastructure left in the seabed may be uncovered or backfilled both as a result of natural processes displacing rock material along the seabed and as a result of this transport being disturbed by the remaining components of the Baltic Power OWF infrastructure and changes in the seabed topography resulting from the removal of the Baltic Power OWF infrastructure components.

Activities connected with the project close-out and decommissioning phase may cause the following types of impacts on the seabed:

- local changes in the topography of the seabed related to the removal of infrastructure components (cables, components of monopiles of the Baltic Power OWF), cavities in the seabed made at places of anchoring vessels decommissioning the Baltic Power OWF.

No changes are planned in the structure of the seabed during the close-out and decommissioning phase.

The overall impact of the project in the closure and decommissioning phase can be preliminarily assessed as negligible.

6.1.3.2 Impact on the quality of sea waters and bottom sediments

During the decommissioning phase, most of the OWF facilities will most likely be removed from the seabed, in accordance with international regulations for offshore systems and structures (United Nations Convention on the Law of the Sea – UNCLOS).

These regulations define the conditions for removal of components and systems of wind farms in the continental shelf areas and the Exclusive Economic Zone. Decommissioning works should be carried out in such a manner that they do not hinder navigation and do not adversely affect the marine environment.

These standards also define exceptional situations in which there is no obligation to completely remove infrastructure components. It is possible to leave such components when:

- the weight of the foundation in the air exceeds 4000 tons or it is located at a depth of more than 100 m, provided that it does not hinder the use of maritime areas by other sectors of the economy;
- removal of the components is technically impossible or too expensive;
- there is a threat to the life of the OWF decommissioning personnel;
- decommissioning involves an unacceptable risk of polluting the marine environment.

In certain locations, such as straits or archipelago waters, used for international navigation, it is necessary to completely remove the systems and structures of the facilities, without any exceptions.

If some components are left on the seabed, relevant tests should be carried out to determine whether the remnants of the OWF will not interfere with vessel traffic and will not have a negative impact on biotic and abiotic elements of the environment. It should be ensured that the left behind parts of the structure do not start to move under the influence of waves, tides, currents or storm surges, causing a hazard to maritime navigation.

During the Baltic Power OWF decommissioning, identical impacts on the discussed receivers (water and bottom sediments) are expected to occur as during the OWF construction phase.

Release of pollutants and biogenic compounds from sediments into water

As a result of the disturbance of seabed sediments during the OWF decommissioning, pollutants and biogenic substances may be released.

During the extraction of monopiles and cables from the seabed, the impact on the quality of water and sediments will be similar to that from the phase of embedding them in the seabed during the construction phase. If the monopiles are left in the seabed, the impact on the quality of sediments and water will be negligible.

The release of pollutants and biogenic substances from sediment into water during the decommissioning phase has a direct negative impact of regional range, being short-term, reversible, repeatable, and of intensity from medium to large, depending on the location.

The significance of this impact during the decommissioning phase in the VpA was assessed to be of low importance for the quality of sea waters and as negligible for bottom sediments.

Contamination of water and seabed sediments with oil derivative substances during normal operation of vessels and in case of failure

As a result of intensive traffic of ships and vessels during the OWF decommissioning, small oil spills and failures or collisions may occur.

Contamination of sea waters or bottom sediments with oil derivative substances released during normal operation of vessels is a direct negative impact of local range, being temporary or short-term, reversible, repeatable, and of low intensity.

The significance of this impact during the decommissioning phase in the VpA was assessed as negligible for the quality of sea waters and bottom sediments.

Contamination of water or seabed sediments with oil derivative substances released in an emergency is a direct negative impact of regional range, being short-term, reversible, repeatable, and of high intensity.

The significance of this impact at the decommissioning phase in the VpA due to random and sporadic nature of failures and collisions was assessed for the quality of sea waters and bottom sediments to be of low importance or as moderate.

Contamination of water and bottom sediments with anti-fouling agents

Contamination of water or seabed sediments with anti-fouling substances during the decommissioning phase is a direct negative impact of local or regional range, being short-term, reversible, repeatable during the construction period, and of low intensity.

The significance of this impact during the decommissioning phase in the VpA was assessed as negligible for the quality of sea waters and bottom sediments.

Contamination of water and bottom sediments by accidental release of municipal waste or domestic sewage

Contamination of water or seabed sediments with municipal waste or domestic sewage is a direct, negative impact of local range, being short-term or momentary, reversible, repeatable during the decommissioning period, and of low intensity.

The significance of this impact during the decommissioning phase in the VpA was assessed as negligible for the quality of sea waters and bottom sediments.

Contamination of water and bottom sediments with accidentally released chemicals and waste from the offshore wind farm decommissioning

During the OWF decommissioning, it seems inevitable that water and bottom sediments will become contaminated with waste from the process. The magnitude of this impact will depend on the adopted work method (cf. description of the decommissioning phase).

Waste should be neutralized in accordance with the applicable regulations concerning industrial waste.

Contamination of water or seabed sediments related to the process of OWF decommissioning is a direct, negative impact of local range, being short-term or momentary, non-reversible, repeatable during the construction period, and of moderate intensity.

The significance of this impact at the decommissioning phase in the VpA was assessed as negligible for the quality of sea waters and as of low importance for bottom sediments.

6.1.3.3 Impact on the climate, including greenhouse gas emissions and impacts relevant for adaptation to climate change, impact on atmospheric air (air quality)

Due to the significant distance of the Baltic Power OWF Area from the land, it should be assumed that the planned project in the decommissioning phase will not affect the climate and condition of air quality. Because the emission generated during the OWF decommissioning will be minimum (coming mainly from the vessels performing dismantling works), it can be assumed that there will be no emission of dust pollutants and a slight emission of gaseous pollutants, therefore it is not planned to change this situation.

During the decommissioning phase, there may be a slight increase in greenhouse gas emissions as a result of fuel combustion by vessels handling the demolition of wind turbines.

During the construction phase, the significance of the impact of the planned project on climate and emission of greenhouse gases will be negligible, as there will be no factors that could have a noticeable impact on its change.

The impact of the planned project in the decommissioning phase on the air quality will be temporary and will disappear after the works are completed. Furthermore, as the area is open and unobstructed, pollutant concentrations will decrease rapidly. Therefore, the significance of the impact on the air quality will be negligible.

6.1.3.4 Impact on systems using EM field

The significance of the impact of the Baltic Power OWF on systems using the EM field, such as radar, communication and radiolocation systems, will be negligible in the decommissioning phase.

6.1.3.5 Impact on nature and protected areas

6.1.3.5.1 Impact on biotic components in offshore area

6.1.3.5.1.1 Phytobenthos

The decommissioning phase may involve the removal of support structures of wind turbines and accompanying infrastructure from the maritime area. In such a case, the macroalgae growing on the structures in the euphotic zone will also be removed, so the original conditions from before the project implementation will be restored. Restoration of natural conditions is theoretically a positive phenomenon, however, it should be remembered that structural members overgrown with organisms of flora and fauna will constitute the "artificial reef", which locally increases biodiversity and attracts numerous species of nekton fauna. The dismantling of structural members of the OWF will, thus, result in the loss of the habitat of anthropogenic origin, but significantly shaping the functioning of the local marine ecosystem. Taking into account the fact that the artificial factor will cause a local and relatively long (the wind farm operation period may amount to several dozen years) increase in biotic qualitative (taxonomic composition) and quantitative (number and biomass) resources of phytobenthos, it should be considered that its removal, despite its unnatural origin, will have a negative impact on the environment of the marine area in the region of the planned OWF.

In conclusion, the significance of the impact was considered negative and negligible.

6.1.3.5.1.2 Macrozoobenthos

In the phase of closure and decommissioning of the Baltic Power OWF, the following impacts on macrozoobenthos are expected to occur:

- disturbance of the bottom sediment structure;
- short-term increase in suspended matter concentration in water;
- sedimentation of suspended matter at the bottom;
- redistribution of pollutants from sediment into water;
- removal of artificial substrates of underwater wind turbine systems from the marine environment.

The assessment of the impact of wind turbines in the OWF Area (1 NM) in the decommissioning phase was carried out separately for:

- soft seabed macrozoobenthos;
- hard seabed macrozoobenthos.

These two complexes of benthic fauna differ in taxonomic composition, abundance and biomass of their constituent species. Therefore, they differ in sensitivity and importance of the evaluated group of organisms. The sensitivity of zoobenthos depends on the type of impact and preferences resulting from the very biology of the species concerned. On the one hand, it is the ability of the population to adapt to various changes occurring in the environment as a result of the implementation of the project and, on the other hand, the ability of a complex of organisms to reconstruct the quantitative structure after the impact factor ceases to exist.

During the closure and decommissioning of the Baltic Power OWF, there will be impacts similar to those from the construction phase (sub-chapter 6.1.1.4.1.2). This assessment assumes that most OWF facilities will be removed from the seabed in their entirety (subject to the possibility of leaving fragments of monopiles that do not threaten the navigational safety, if they constitute valuable habitats).

As a result of removing monopiles and cables, as well as during operation of jack-up units, **the structure of bottom sediments will be disturbed**. This will cause physical destruction of the benthic organisms which, during the OWF operation, recolonized the seabed in the vicinity of monopiles and along the route of cables [235, 498, 37]. Due to low sensitivity of the soft seabed macrozoobenthos and moderate sensitivity of the hard seabed macrozoobenthos to this impact, it is assumed that full regeneration of habitats in the place of removed facilities may take up to several years from the moment of the impact factor cessation. This process is shorter for polychaetes and longer for clams. After this time, it is expected that a stabilized quantitative structure of the macrozoobenthos association characteristic for the Baltic Power OWF Area will be achieved. In the case of a soft seabed macrozoobenthos association that is going to be eliminated, this impact should be considered as negligible. However, for the hard seabed macrozoobenthos association, this impact is of low importance.

The increase of suspended matter content in water will occur as a result of disturbing the structure of bottom sediments related to disassembly of monopiles and cables when suspended matter from the seabed raises and its propagation in water occurs [261, 498]. However, it should be assumed that the disassembly works are carried out in phases and have a slightly smaller intensity than during the construction. Therefore, the range and intensity of suspended matter propagation may also be slightly lower than during the construction phase. The most negative effect of this impact is clogging of the filter system of macrozoobenthos filtering agents. However, the significance of this impact will be negligible for the soft seabed macrozoobenthos association and it will be of low importance for hard seabed macrozoobenthos.

The negative nature of **sedimentation** of suspended matter **on the seabed** is related to covering benthic organisms with an additional layer of sediment [498]. The epifauna, i.e. the fraction of macrozoobenthos living on the sediment surface, is at particular risk. The results of model calculations of suspended matter propagation in the Baltic Power OWF Area included in Appendix No. 2 to the EIA Report indicate that the average thickness of sediments in the entire area of the Baltic Power OWF deposited as a result of the works may not exceed 1.4 mm and due to the local nature of this impact, the entire benthic association will be subject only to short-term exposure to unfavorable conditions. Similarly as in the case of other impacts, the impact of suspended matter sedimentation on the seabed on the soft seabed macrozoobenthos was assessed as negligible, whereas in the case of hard seabed macrozoobenthos – as of low importance.

During the OWF decommissioning phase, **redistribution of pollutants from sediments to water** may occur again, and the intensity of negative impact on macrozoobenthos will depend on the level of concentration of heavy metals and persistent organic pollutants identified in bottom sediments of the OWF Area (1 NM). According to the results of geochemical surveys included in Appendix No. 1 to the EIA Report, this impact, of negligible significance, will not affect significant changes in the physiology of macrozoobenthos of the soft seabed inhabiting the OWF Area (1 NM) or in the case of macrozoobenthos of the hard seabed (low importance of the impact).

Removal of artificial underwater substrates of the wind turbine systems from the marine environment will result in irreversible, permanent elimination of the periphyton communities of the "artificial reef" and destruction of benthos around each monopile and reconstruction of the qualitative and quantitative structure of the macrozoobenthos association created as a result of several dozen years of OWF operation. At the current state of knowledge, it is difficult to clearly predict how quickly the environment will return to the state from before the impact of the factor and what nature of this impact (negative or positive) will prevail. The process of closure of OWFs built in Europe has only started and so far only 4 OWFs have been decommissioned (2 in Sweden, the first of which was closed in 2015, 1 in Denmark and 1 in the Netherlands), with particular attention paid to the cost of such investment and recovery of steel, and not to environmental monitoring [441]. It is known that in connection with the removal of artificial substrates, biodiversity will be reduced and the resources of macrozoobenthos will be locally reduced, which is an additional food base for fish and seabirds. On the other hand, the original natural status of seabed habitats in the OWF Area will be restored, which is a positive action. Analysis of pressure factors showed that the significance of the impact of removing artificial reef with moderate importance of the resource was assessed as moderate.

6.1.3.5.1.3 Ichthyofauna

The impact analysis is hindered by the lack of experience in decommissioning, as well as the lack of possibility to predict which technologies will be available in the perspective of twenty years and more, when the OWF will be demolished [326]. The list and nature of the impacts related to decommissioning of the Project should be similar to those occurring during the operation phase.

Emission of noise and vibration

The noise source will be works related to the removal of the OWE structure and increased traffic of vessels. The intensity of the impact depends to a large extent on the propagation of sound, depending on the seabed morphology, as well as the distance between the receiver and the noise source. The lethal effect may occur up to several dozen meters [480], whereas hearing and tissue damage may occur up to several hundred meters [312] from the sound source. The avoidance reaction may appear even at a distance of several tens of kilometers, extending beyond the Baltic Power OWF Area. The effects of the impact on ichthyofauna are similar to those in the operation phase. According to Wilhelmsson et al. [480] blasting or cutting noise can cause death or severe injury to nearby fish (negative effect). Therefore, it is necessary to avoid blasting of structural members as the most harmful method. The aforementioned lack of experience makes it difficult to assess the risks posed by the impact related to the removal of structural members from the environment. However, it seems that the time needed for their disassembly will be shorter than the time of their construction, which in combination with a possible reduction of the intensity of works in the spawning season should limit any impact.

Moreover, it should be remembered that the OWF area is not a spawning ground for codfish or a deep-water spawning ground for the dominant in this area European flounder. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

Emission of noise and vibrations generated during removal of the OWF foundation piles may directly affect the ichthyofauna. These will be negative, direct, short-term, and regional impacts.

Sensitivity to the impact was assessed as very high for the codfish, sprat, and herring, and high for the flounder, sand goby, and common seasnail. The significance of the impact is assessed to be of low importance for all investigated fish species. With regard to protected fish, only larval stages were found during the surveys, and for them the impact will be local in nature.

Increase in suspended matter content

During the works related to the dismantling of infrastructure components, sediments will be disturbed and water turbidity will occur. The sensitivity of the ichthyofauna is specific to the species and stage of life. The impact magnitude depends on the concentration of suspended matter, exposure time and nature of suspended matter particles. Covering of eggs, change in buoyancy of eggs, obstruction to gaseous exchange, obstruction to respiration, change in visibility – depending on the species and development stage may result in increased susceptibility to predation or feeding efficiency, decreasing of the growth rate, disruption in physiology, avoidance reaction (negative/positive effect). This applies to relatively small areas in relation to the entire surface area of spawning and feeding grounds.

The OWF Area is neither a codfish spawning ground nor a deep-water spawning ground of the dominant in this area European flounder. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

The impact related to the increase of suspended matter content will be negative, direct, local, and short-term.

Sensitivity to the impact was assessed as high for the sprat and herring, as moderate for the codfish, European flounder, sand goby, and common seasnail.

The significance of the impact is assessed to be negligible for all investigated fish species.

Release of pollutants and biogens from sediments

During the dismantling works, the sediments will be disturbed and pollutants will be released (i.a. heavy metals, chlorinated biphenyls, pesticides, oil derivative substances), and the biogenic substances will be released from the sediments into the body of water.

Exposure of ichthyofauna to an increased concentration of impurities and biogens may cause increased mortality and diseases (e.g. skin disease, liver and gill damage). Wilhelmsson et al. [480] assess the risk of adverse effects as small and spatially confined.

However, the risk of releasing larger amounts of harmful chemical substances from sediments (according to the HELCOM classification) is low, due to their low concentrations found in the sediments of the South Baltic

Sea, confirmed by the results of tests carried out for the project (Appendix No. 1 to the EIA Report). Low concentrations of pollutants were found in the survey results, often below the lower limit of determination.

The impact related to releasing pollutants and biogenic substances from the sediment into the body of water will be negative, direct, local, and short-term.

Sensitivity to the impact was assessed as moderate for all investigated fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

Habitat change

During the OWF decommissioning, a significant part of the artificial reef is destroyed, which provides the places of living, feeding, shelter and reproduction for many fish species. This may result in a decrease in the abundance and diversity of ichthyofauna. This negative effect may be partially limited by leaving anti-erosion protections on the seabed, which are an important element of the habitat created during the operation phase. Decommissioning of the Baltic Power OWF infrastructure will enable fishing in this area. This may reduce the potential beneficial impact of ceasing fishing activities on ichthyofauna, in particular on the reproduction processes of certain fish species (the common seasnail, gobies).

The OWF area is neither a cod spawning ground nor a deep-water spawning ground of the European flounder dominant in this area. Ichthyological surveys found sprat spawning, but the water region is small in comparison with the large area of spawning grounds of this species. Herring spawning may occur in the OWF area, but it may be assumed that any disturbances in the reproductive process will not affect the recruitment of this species at the population level.

The impact related to the change of habitat will be negative, direct, local, long-term and permanent.

Sensitivity to the impact was assessed as high for all investigated fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

6.1.3.5.1.4 Marine mammals

In general, the decommissioning process will take place in a reverse sequence to the OWF installation procedure, which means that many activities present in the decommissioning phase will be similar to those in the construction phase. However, both piling and the use of explosives will not be required. Removal of the large-diameter piles from the Baltic Power OWF Area may include the following activities, which may generate underwater noise:

- mobilization of a floating crane, a transport pontoon with a tugboat and a working vessel;
- connecting a hook to the transition piece of the large-diameter pile foundation;
- cutting of cables;
- removal of soil from the monopile up to the cutting height;
- cutting, cutting out or burning off the large-diameter pile with an appropriate cutting tool at an appropriate height;
- lifting the large-diameter pile;
- placing the large-diameter pile on the pontoon and mounting it, or applying other technology allowing to provide the disposed element with buoyancy and tugging it away to the place of disposal;
- transporting ashore,
- recycling and disposal of materials.

From the above list, the most probable noise generating activities to be assessed, are vessel traffic (to and from the area and during decommissioning works) as well as cutting and drilling. There is no data on noise emissions during cutting. Therefore, the focus was on noise from shipping and drilling from rigs.

Drilling noise depends largely on the drilling rig. Drillships generate the highest noise level [253, 368], while noise from drilling rigs anchored to the seabed, such as jack-up rigs, is likely to be low both in terms of noise source level and low frequencies [124]. Kyhn et al. [253] recorded noise from the Stena Forth drillship in Baffin Bay in Greenland. The recorded broadband noise amounted to 184 dB re 1µ Pa rms during drilling and 190 dB re 1µ Pa rms during maintenance. Noise from two drillships is shown in the figure (Figure 6.3.). The spectral energy of noise was mainly below 1 kHz, and its impact on the local acoustic background was largely related to low frequency sound. Kyhn et al., however [253], found increased noise levels and peaks at frequencies above 10 kHz, but they were highly correlated with the performance and use of on-board machinery [368]. In the Baltic Sea, drilling noise will increase the local acoustic field, which is already dominated by the noise generated by vessels.

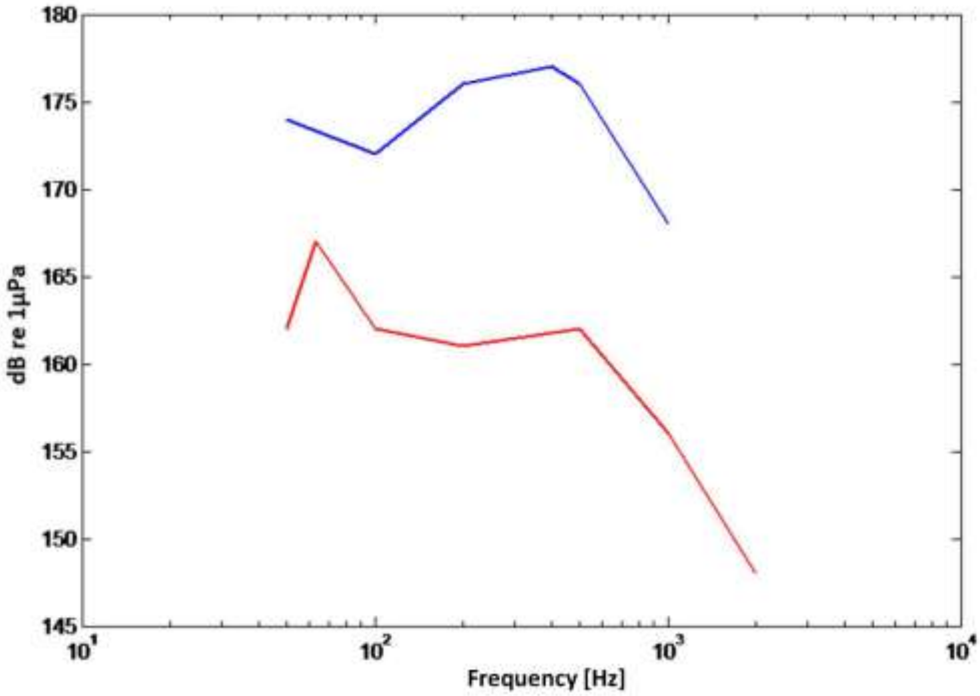


Figure 6.3. Noise levels from two different drilling vessels in 1/3 octave bands. Modified after Richardson et al. [368] [Source: own study]

Similarly as during the construction phase, during the decommissioning phase of the wind farm, noise from small and medium-sized vessels will be present (mainly noise of 160-180 dB re 1 µPa at a distance of 1 m, covering frequencies from <1 kHz to >10 kHz). It is likely that they will lead to an increase in the local sound field during dismantling, including frequencies that are partially significant to marine mammals.

Removal of monopiles will involve activities such as cutting, burning off, drilling, and vessel traffic. Apart from cutting, for which the noise levels are unknown, the last two actions will only temporarily and locally increase the low frequency levels of the existing background noise in Baltic Power OWF Area. However, the impact on the sound field would still be local and short-term. As a consequence, the significance of the sound field emitted during the wind farm decommissioning was assessed to be of low importance or as moderate (Table 6.13). As mentioned above, ship collisions leading to oil spillage in the project area may have a negative impact on marine mammals present in the adjacent waters. However, oil spillage is very unlikely.

Table 6.13. Impacts on marine mammals related to activities in the decommissioning phase [Source: own study]

Species	**Impact**	**Impact description**	**Impact significance**
Porpoise *Phocoena*	Shipping noise	Behavioral response to shipping noise (moving away from the decommissioning site)	Low importance

Species	Impact	Impact description	Impact significance
phocoena	Drilling	Behavioral response to drilling noise (moving away from the decommissioning site)	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for decommissioning (e.g. fuel spillage)	Moderate
Grey seal *Halichoerus grypus*	Shipping noise	Behavioral response to shipping noise (moving away from the decommissioning site)	Low importance
	Drilling	Behavioral response to drilling noise (moving away from the decommissioning site)	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for decommissioning (e.g. fuel spillage)	Moderate
Harbor seal *Phoca vitulina*	Shipping noise	Behavioral response to shipping noise (moving away from the decommissioning site)	Low importance
	Drilling	Behavioral response to drilling noise (moving away from the decommissioning site)	Low importance
	Vessel collisions	Pollution caused by collision of vessels used for decommissioning (e.g. fuel spillage)	Low importance

The significance of the impact in the decommissioning phase was assessed as moderate at the most.

6.1.3.5.1.5 Migratory birds

With the commencement of works related to the decommissioning of the Baltic Power OWF, the space will gradually be cleared of structural components. Therefore, the same impacts on migratory birds that occurred during the operation phase, i.e. the barrier effect and collision with the OWF structures, will be reduced until their complete cessation, after removal of the last structural component of the OWF from the space. Detailed assessment of the impact of the Baltic Power OWF during the decommissioning phase on migratory birds is included in Appendix No. 4 to the EIA Report.

The significance of the impact of the Baltic Power OWF, i.e. the barrier effect and collision on migratory birds during the decommissioning phase was assessed to be of low importance at the most.

6.1.3.5.1.6 Seabirds

Identification of potential impacts on seabirds during the decommissioning phase

The impact of the OWF on marine avifauna during the decommissioning phase will be similar as in the construction phase of the planned Project. It was assumed that the medium-term impact of the Project in the construction and decommissioning phases will be similar in the case of vessel traffic, increased noise level, lighting of the demolition site and disturbances in benthic communities. The specific impact of the decommissioning phase is the gradual disappearance of the tall OWF structures resulting in the disappearance of a barrier blocking access to rich benthic communities that will develop in the OWF Area during its operation.

With the gradual removal of wind turbine towers, the impact of deterring birds from the area occupied by high protruding structures will decrease. Increased traffic of vessels and noise related to the dismantling of the wind farm will still be scarring birds away. However, it should be expected that after the complete removal of all wind turbines, this area will attract birds from the group of diving benthophagus (mainly the long-tailed duck and the velvet scoter), because during the period of wind turbines operation at the seabed of the area occupied by wind turbines, zoobenthos associations are going to form which will become a food for these birds. Benthophagus have a very strong impact on the population of its prey, leading to a significant reduction in their population and biomass [173, 268]. The decrease in the number of birds in the area occupied by the wind farm during their operation will cause the zoobenthos biomass to be high, as their populations will not be used as much by the birds as in their normal presence in this area. This effect will probably be of periodic nature, although it is difficult to predict how long the area after the wind farm will constitute an attractive feeding ground for this group of birds.

In order to determine the significance of the impact, the range of the impact was assessed as high for the long-tailed duck and velvet scoter, as moderate for the razorbill and common guillemot, and as insignificant for the European herring gull.

The identified factors and the assessment of their impact on marine avifauna during the decommissioning phase are presented below.

Vessel traffic

Demolition works will require the presence of various types of vessels that will disturb seabirds because of physical presence, noise and light emission. The range of the impact will be similar as during the Project construction phase. This impact will decrease gradually with the progress of demolition works.

For all the assessed species, the traffic of vessels constitutes a negative impact and is accumulating. For the long-tailed duck, common guillemot, European herring gull and velvet scoter, this is a direct and medium-term impact, and for the long-tailed duck, it is assessed as temporary or short-term. Apart from the European herring gull, for which sensitivity was assessed as low, birds are highly sensitive to the vessel traffic.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

Emission of noise and vibration

The presence and traffic of construction vessels during demolition works will be the main cause of disturbance of seabirds in the water region covered by the construction of the Baltic Power OWF. This impact will be much higher than other pressures related to the construction phase, such as underwater noise emission. Noise and vibrations during the decommissioning phase are direct negative impacts on seabirds of local range (for the long-tailed duck of regional range, due to possible impact on the biogeographical population of the species), medium-term, reversible, repeatable during the decommissioning period, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

This impact will decrease gradually with the progress of demolition works.

Lighting of the project site

Birds navigate as they migrate according to natural light sources such as stars and the sun. It has been noticed that at night they also head towards lighthouses, drilling towers and other structures illuminated by artificial light [476]. Lighting of the Project site during the decommissioning phase will cause direct negative impact on seabirds of local range (for the long-tailed duck of regional range, due to possible impact on the biogeographical population of the species), medium-term, reversible, repeatable during the decommissioning period, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

This impact will decrease gradually with the progress of demolition works.

Barrier creation

Civil engineering structures and the presence of vessels necessary to handle the dismantling works of the OWF will be a source of direct negative impacts on seabirds of local range, reversible, repeatable during the decommissioning period, with intensity depending on the species.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

This impact will decrease gradually with the progress of demolition works.

Collisions with vessels

During the decommissioning phase of the planned Project, collisions of seabirds with vessels may occur. The range of the impact will be similar as during the Project construction phase. For all assessed species, collisions with vessels are negative impacts and are subject to accumulation. For the razorbill, common guillemot, European herring gull and velvet scoter, it is a temporary or short-term impact and for the long-tailed duck it is assessed as permanent or long-term.

Sensitivity to the impact on the European herring gull was assessed as low and for other species as high.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, moderate for the razorbill and common guillemot, and important for both species of ducks – the long-tailed duck and velvet scoter.

This impact will decrease gradually with the progress of demolition works.

Destruction of benthic habitats

The analysis of the EIA Report shows that the destruction of benthos habitats during demolition works is an indirect negative, local-range, medium-term, reversible, repeatable impact on seabirds (mainly benthivorous ones) during the decommissioning period (for each wind turbine or infrastructure component), with intensity depending on the species.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and common guillemot as moderate, and for the long-tailed duck and velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters.

This impact will gradually decrease with the progress of demolition works and the damaged habitats will be restored within a few years after the completion of works.

Increased concentration of suspended matter in water

These factors may affect the ability of benthophagus and diving ichthyofagus to obtain food. During the OWF construction, the seabed sediments will be disturbed and the concentration of suspended matter in water will increase. The range of the impact will be similar as during the Project construction phase.

For all assessed bird species, it constitutes a negative impact subject to accumulation. For the razorbill, common guillemot, European herring gull and velvet scoter, this is a temporary or short-term impact, and for the long-tailed duck, it is assessed as long-term or permanent.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and common guillemot as moderate, and for the long-tailed duck and velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters. This impact will decrease gradually with the progress of demolition works.

Sedimentation of disturbed sediments

These factors may affect the ability of benthophagus and diving ichthyofagus to obtain food. During the OWF decommissioning, the seabed sediments will be disturbed and the concentration of suspended matter in water will increase. The range of the impact will be similar as during the Project construction phase.

For all assessed bird species, this is a secondary, negative impact subject to accumulation. For the long-tailed duck, common guillemot, European herring gull and velvet scoter, this is a medium-term impact, and for the long-tailed duck, it is assessed as long-term or permanent.

The sensitivity to the impact on the European herring gull was assessed as insignificant, for the razorbill and common guillemot as moderate, and for the long-tailed duck and velvet scoter as large.

The significance of the impact varies for individual species and is assessed as negligible for the European herring gull, insignificant for the razorbill and common guillemot, and as significant for both species of ducks – the long-tailed ducks and velvet scoters. This impact will decrease gradually with the progress of demolition works.

Table (Table 6.14) presents a summary of the significance of impacts of the Baltic Power OWF on seabirds during the decommissioning phase.

Table 6.14. Significance of the project impact on seabirds during the decommissioning phase [Source: own study]

Species	Impact significance
European herring gull *Larus argentatus*	Negligible
Razorbill *Alca torda*, Common guillemot *Uria aalge*	Moderate
Velvet scoter *Melanitta fusca*	Significant
Long-tailed duck *Clangula hyemalis*	Significant

6.1.3.5.1.7 Bats

The decommissioning phase will include activities similar to those of the construction phase. Therefore, it can be assumed that the impacts in the decommissioning phase will also be similar to those listed in the construction phase. The following activities during the decommissioning phase may affect migratory bats:

- the presence of vessels;
- dismantling works under and above the sea surface.

Removal of the Baltic Power OWF elements and related vessel traffic will lead to an increase in noise. Bats may be scattered by noise, which may also act as a barrier. Ship lighting and dismantling locations may attract bats [345]. There may then be a risk of collision with vessels and structures to be removed. The vessels and elements of the OWF to be removed may serve as rest sites for migratory bats [2].

Surveys in the spring and autumn migration seasons indicated a possibility of bats migrating in the OWF Area, however, the migration intensity was low due to the low activity of bats.

Impacts on bats during the decommissioning phase will be negative, direct, local and short-term.

Sensitivity to the impact was assessed as insignificant, whereas the significance of the impact of the Baltic Power

OWF at the decommissioning phase was considered negligible due to the low activity of bats found during the surveys in the period of seasonal migrations.

6.1.3.5.2 Impact on protected areas

6.1.3.5.2.1 Impact on protected areas other than Natura 2000

Given the location of the Baltic Power OWF at a significant distance from the protected area of the Słowiński National Park, there will be no significant impact on this area, including any element for which it was established, i.e. biodiversity, resources, objects and elements of inanimate nature and the landscape of the Park.

In the Appendix to the Regulation of the Minister of the Climate of December 23, 2019 on protection tasks for the Słowiński National Park for 2020-2022 (Official Journal of the Minister of the Climate of 2019, item 4, as amended), in which the existing and potential internal and external threats and methods of elimination or mitigation of these threats and their effects were identified and assessed, the existing external threats category indicates the risk resulting from increasing the areas for construction of wind farms in the municipalities adjacent to the park. It was stated under the category of potential external threats that only the construction of wind farms in the buffer zone of the park constitutes a potential external threat and, consequently, it should be stated that the Baltic Power OWF, due to its location, will not pose a threat to the Słowiński National Park.

Considering that protected areas may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact on them at the phase of decommissioning of the Baltic Power OWF as insignificant, the significance of this impact is of low importance.

6.1.3.5.2.2 Impact on the Natura 2000 protected areas

The identification and assessment of impact on areas protected under the European ecological network Natura 2000 are presented in sub-chapter 6.3.

6.1.3.5.3 Impact on wildlife corridors

The issue of wildlife corridors in maritime areas is described in sub-chapter 6.1.1.4.3.

With respect to seabirds, the impact of the OWF decommissioning process on wildlife corridors will have an effect contrary to that of the construction phase. As individual structural elements are removed from the space, the possibility of free migration of birds will increase.

6.1.3.5.4 Impact on biodiversity

Phytobenthos and macrozoobenthos

With the removal of artificial substrates, the plant and animal periphyton communities present on these structures will be destroyed and (habitat and taxonomic) biodiversity will decrease and the resources of macrozoobenthos being the feeding base for fish and seabirds will decrease locally. On the other hand, the original natural status of seabed habitats in the OWF area will be restored (subject to the possibility of leaving fragments of monopiles that do not threaten the navigational safety, if they constitute valuable habitats).

Ichthyofauna

Works related to the decommissioning of the wind farm may have a negative impact on species diversity, and the nature of this impact should be similar to the one observed during the construction. After the decommissioning phase, the ichthyocenosis can be expected to return to the original state.

Marine mammals

According to the current knowledge, the decommissioning phase of the wind farm should not have a significant impact on the biodiversity of marine mammals in the surveyed area and in adjacent waters.

Seabirds

The analysis of possible impacts resulting from the demolition activities performed at the OWF decommissioning phase shows that their effects will in most cases be short-term, local and reversible. This applies to all types of emissions (noise, suspended matter, release of biogenic substances from bottom sediments). The intensity of environmental impact will decrease as the distance from their source increases. Mobile species (fish, marine mammals, birds) will avoid spaces in which they find their optimum conditions to deteriorate. As the effect of scaring these species away is limited in time and the space of the marine environment is of a large capacity, the species (fish, marine mammals) will return to the area from which they were scared, or will use the adjacent areas, after the emissions cease and the living space conditions are back to what they were before. Demolition works will result in restoration of the original conditions in the habitat which are changed as a result of the construction of the OWF. Therefore, it is expected that the structure of the zoobenthos will be renewed in terms of its quality and quantity to achieve the pre-investment condition.

The sea habitat will not be fragmented as a result of the implementation of the project in such a way that the populations permanently or temporarily related to the Baltic Power OWF Area and adjacent areas could be isolated permanently or temporarily.

There will also be no direct or indirect destruction of benthic and pelagic habitats following the construction works performed which could, as a consequence, lead to the extinction of the species living there. As a result of the works performed, no physical barriers will be created which marine organisms could not overcome.

Considering the above, it can be stated that the decommissioning phase of the OWF may lead to a short-term change in the number of species present in the development area. Individual species may be temporarily scared off to the adjacent areas where they will not be exposed to disturbances. However, such a movement of individuals does not mean a change of biodiversity at the species level. The works carried out will also not lead to changes in the level of ecosystem and genetic diversity.

The impact of the project in question on biodiversity can be considered insignificant.

6.1.3.6 Impact on cultural values, monuments and archaeological sites and facilities

In the Baltic Power OWF Area, the presence of anthropogenic objects was found. As of the date of submission of the EIA Report, there is no confirmation that these structures have cultural values, and they are not entered into the register of monuments. There are also no archaeological sites.

If it is found that anthropogenic objects present in the Baltic Power OWF Area have cultural values or are monuments, the significance of the impact is assessed as negligible. The assessment results from the assumption of designating a zone around such structures in which no activities resulting in disturbance of the seabed will be carried out.

6.1.3.7 Impact on the use and development of the water area and tangible goods

Currently, the Baltic Power OWF Area is not used intensively by other users (i.e. fishing, shipping, raw materials), therefore, the release of the area as a result of the OWF decommissioning will be of minor importance for the said elements. Accordingly, the significance of the impact was assessed as negligible.

6.1.3.8 Impact on landscape, including the cultural landscape

The impact of the OWF on the landscape in the Baltic Power OWF decommissioning phase will be similar to the impacts in the construction phase, but the order will be reversed. First, the structures and systems will be dismantled, then collected by vessels and transported ashore. Impacts on the landscape during this phase will decrease as the decommissioning works progress.

Depending on the adopted foundation technology, it may be necessary to leave parts of the structure under water, e.g. due to the fact that they will form an artificial reef. In this case they will be properly protected and marked for safety reasons. After complete decommissioning of the OWF, the landscape on the sea surface within the OWF will return to the condition from before the implementation of the project, whereas there may be a permanent change in the underwater landscape which will be available only to divers or underwater vehicles equipped with cameras allowing ongoing observation or subsequent restoration. Such places may also become tourist attractions.

The significance of the impact of the Baltic Power OWF on the landscape, including the cultural landscape, at the decommissioning stage is assessed to be negligible.

6.1.3.9 Impact on population, health and living conditions of people

Decommissioning of the OWF in marine conditions will be a very complex, long-term task with increased risk for the vessels disassembling the OWF and for other users of the water areas. It should be expected that, in the period when it will be necessary to decommission the OWF, the intensity of navigation will be much higher than currently on shipping routes in the OWF area, and the number of additional cruises of technical vessels of various sizes involved in the dismantling of wind turbines and other structures of the Baltic Power OWF will be close to those involved in the construction, i.e. over 4,000 cruises.

At the same time, it should be emphasized that the routes of these additional cruises of technical vessels dedicated to decommissioning of the OWF, moving between the Baltic Power OWF and small ports of the central coast and ports of the Tricity, will cross the routes of the vessels moving on navigation routes of the South Baltic Sea.

In the same way as during the construction, fishing activities in part of the fishing squares N7, N8, O7 and O8 will be limited.

Also, emergency response in case of emergency events involving vessels shall be limited to conducting rescue operations or combating oil spills.

The significance of the impact of the Baltic Power OWF during the decommissioning phase on the population, health and living conditions of people was estimated to be negligible, despite the high significance of the resource itself. This results from the fact that, during the decommissioning phase, all users of the sea will be already familiar with the restrictions related to the existence of the Baltic Power OWF, and its gradual decommissioning will only increase the availability of the Baltic Power OWF water area for other forms of use.

6.2 Reasonable alternative option (RAO)

Descriptions of the variant proposed by the Applicant (VpA) and the reasonable alternative option (RAO) are included in sub-chapter 2.3. The options differ in two key parameters, i.e. the maximum number of wind turbines and the maximum rotor diameter (Table 2.6). These two main parameters of the Baltic Power OWF may generate different environmental impacts.

The analysis of impacts was carried out separately for the construction, operation and decommissioning phases of the Baltic Power OWF.

When assessing the impact on individual elements of the environment in all phases of the project implementation no differences were found in the significance of the impact between the two options under consideration. There were only differences in modeling results between the VpA and the RAO in the assessment of collision on migratory birds during the operation phase. The results of collision modeling showed the same or higher risk of collision of migratory birds for the RAO. However, these higher collision risk levels for the RAO did not increase the significance of the impact. A detailed assessment of the impact of the Baltic Power OWF for the VpA and the RAO on migratory birds is included in Appendix No. 4 to the EIA Report.

6.2.1 Construction phase

6.2.1.1 Impact on geological structure and bottom sediments

Activities related to the construction of the project in the RAO could cause impacts on the geological structure of the seabed and bottom sediments, including: changes in the structure, shape and level of the seabed, disturbances in the geological structure and changes resulting from the disturbance and sedimentation of suspended matter.

The general impact of the project during the construction phase on the geological structure of the seabed was assessed as negligible for the general nature of the seabed and its structure. The changes would be small, on a relatively small surface area of the seabed.

In geological terms, taking into account the nature of deposits forming the seabed surface of the Baltic Power OWF Area (1 NM), no significant changes in the nature of deposits are expected. Changes could occur very locally where it is necessary to replace weak soil with soil of appropriate parameters, but this would mainly depend on the selected technology. In the places of individual locations of the wind turbine, the nature of surface sediments and locally in points, where monopiles are driven into the seabed, would change. The impact on surface sediments would be negligible.

6.2.1.2 Impact on the quality of sea waters and bottom sediments

The Baltic Power OWF during the construction phase could have an impact on the water and bottom sediments through:

- release of pollutants and biogens from sediments into water;
- pollution of water and sediments with oil derivative substances;
- pollution of water and sediments with anti-fouling agents;
- pollution of water and sediments with accidentally released municipal waste or domestic sewage;
- pollution of water and sediments with accidentally released chemicals and waste generated during construction.

The release of pollutants and biogenic substances from bottom sediments in the construction phase is an impact which is direct, negative, regional, short-term, reversible or irreversible, repeatable during the construction period, of low intensity. The significance of this impact during the construction phase within the RAO was determined as insignificant for sea waters and as negligible for bottom sediments.

Pollution of sea waters or bottom sediments with oil derivative substances released during normal operation of vessels form a direct negative impact of local range, momentary or short-term, reversible, repeatable, of low intensity. The significance of this impact during the construction phase in the RAO was assessed as negligible for sea waters and bottom sediments.

The pollution of water or bottom sediments with oil derivatives released during an emergency forms a direct negative impact of regional range, short-term, reversible, repeatable, of high intensity. The significance of this impact during the construction phase in the RAO due to the random and sporadic nature of failures and collisions was assessed to have low significance for sea waters and bottom sediments.

The pollution of water or bottom sediments with municipal waste or domestic sewage is a direct negative impact of a local range, short-term or momentary, reversible, repeatable during the construction period, of low intensity. The significance of this impact during the construction phase in the RAO was assessed as negligible for sea waters and bottom sediments.

The pollution of water or bottom sediments connected with the OWF construction process is a direct, negative impact of a local range, short-term or momentary, irreversible, repeatable during the construction period, of medium intensity. The significance of this impact at the construction phase in RAO was assessed as negligible for sea waters and as of low significance for bottom sediments.

6.2.1.3 Impact on the climate, including emission of greenhouse gases and impact significant in terms of adaptation to climate changes, impact on the air (atmospheric purity)

During the construction phase of the Baltic Power OWF in the RAO, an increased emission of pollutants introduced into the atmosphere could be expected, which would be related to an increased traffic of vessels involved in the implementation of the project. During this phase, the significance of the impact of the planned project on climate and greenhouse gases will be negligible, as there will be no factors that could have a noticeable impact on their change.

The impact of the planned project in the construction phase on the air quality in the RAO would be temporary and would disappear after the works are completed. Furthermore, as the area is open and unobstructed, pollutant concentrations would decrease rapidly. Therefore, the significance of the impact would be negligible.

6.2.1.4 Impact on nature and protected areas

6.2.1.4.1 Impact on biotic components in offshore area

During the construction phase of the Baltic Power OWF, there would be no impact on **phytobenthos** in the RAO.

During the construction phase of the Baltic Power OWF, the works carried out on the seabed would cause the following impacts affecting the condition of **macrozoobenthos** inhabiting this area by: (i) disturbance of the structure of bottom sediments, (ii) increase in the concentration of suspended matter in water, (iii) sedimentation of suspended matter on the seabed, and (iv) redistribution of pollutants from sediments to water. The analysis of the impact during the construction stage of the Baltic Power OWF in the RAO has shown that the impacts are assessed as negligible or of low significance, whereas the most adverse impact would be the disturbance of the structure of bottom sediments in places where the hard seabed macrozoobenthos currently occurs, especially in the southern and north-eastern part of the Baltic Power OWF Area.

The main impacts on **ichthyofauna** in the RAO would be: (i) noise and vibration emission, (ii) increase in suspended matter concentration, (iii) release of pollutants and biogenic substances from sediment to water, (iv) change of habitat, and (v) creation of a barrier.

The impact of noise and vibration on adult fish would be: negative, direct, short-term and reaching beyond the Baltic Power OWF Area. The significance of the impact was assessed as moderate for all investigated fish species.

The impact related to releasing pollutants and biogenic substances from the sediments to the body of water will be negative, direct, temporary and local. The significance of the impact is assessed to be negligible for all investigated fish species.

The impact related to the change of habitat would be negative, direct, temporary and local. The significance of the impact is assessed to be negligible for all investigated fish species.

The impact related to the creation of the barrier would be negative, direct, local and temporary for cod and European flounder, long-term and permanent for other fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

Marine mammals at the construction phase of the Baltic Power OWF in the RAO could be subject to impacts resulting from: (i) underwater noise from piling works, (ii) noise generated by the traffic of vessels, (iii) increased content of suspended matter in water, (iv) habitat changes, and (v) spillage of oil derivative substances into the environment as a result of vessel failures.

The most important impact on marine mammals during the construction phase would be the emission of underwater noise generated as a result of foundation works. The use of NRS would significantly reduce this impact. The significance of this impact was assessed as moderate at most.

During the construction phase of the OWF, the space above the sea area where erection and construction works will be carried out is gradually disturbed. Both the vessels participating in these works and the erected OWF structures create obstacles for **migratory birds**. Impacts on them resulting from the barrier effect and collision with the structures of the Baltic Power OWF were assessed for the operation phase, when they are the greatest. The significance of the impact of the Baltic Power OWF in the RAO, i.e. the barrier effect and collision on migratory birds during the construction phase was assessed to be of low importance at the most.

The most important impacts on **seabirds** during the construction phase include: (i) vessel traffic, (ii) emission of noise and vibration, (iii) lighting, (iv) creation of a barrier, (v) collisions with vessels, (vi) destruction of benthic habitats and (vii) increase in suspended matter content in water and sedimentation of disturbed sediments. The impact assessment was carried out for the five most numerous birds: long-tailed duck, velvet scoter, razorbill, common guillemot and European herring gull.

The significance of the above-mentioned impacts for the European herring gull was assessed as negligible, for the razorbill and common guillemot as moderate at most, and for the sea ducks (velvet scoter and long-tailed duck) as significant.

During the construction phase of the Baltic Power OWF in the RAO, there could be impacts on bats resulting from the presence of vessels and gradual spatial development. Therefore there could be a risk of collision with vessels and structural components in the construction area. Moreover, the presence of vessels would result in an increase in noise levels and disturbances resulting from their use of lighting.

The impact on bats during the construction phase will be negative, direct, local, short-term, whereas the significance of this impact was assessed as negligible.

6.2.1.4.2 Impact on protected areas

Given the location of the Baltic Power OWF at a significant distance from the protected area of the Słowiński National Park, there will be no significant impact on this area, including any element for which it was established, i.e. biodiversity, resources, objects and elements of inanimate nature and the landscape of the Park.

The identification and assessment of impact on areas protected under the European Natura 2000 ecological network were presented in sub-chapter 6.3.

6.2.1.4.3 Impact on wildlife corridors

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Taking into account the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea, including the increasing effect of spatial development, it was assessed that the impact of the Baltic Power OWF in the RAO during the construction phase on the potential migration routes of migratory species will be negligible.

6.2.1.4.4 Impact on biodiversity

Taking into account the nature of impacts during the construction phase of the Baltic Power OWF and animal species present in the area, including the role played by this area for them, it can be assumed that at this stage of the project there may be a short-term change in the number of species present in the development area. Individual species may be temporarily scared off to the adjacent areas where they will not be exposed to disturbances. However, such a movement of individuals does not mean a change of biodiversity at the species level. The works carried out will also not lead to changes in the level of ecosystem and genetic diversity. Therefore, the impact of the project on biodiversity was considered to be of low importance.

6.2.1.5 Impact on cultural values, monuments and archaeological sites and facilities

The Baltic Power OWF at the construction phase in the RAO would not have a negative impact on potential objects of high importance for the protection of cultural heritage from the Stone Age. The surveys carried out in the area in question did not show any archaeological objects or strata related to the settlement in the Stone Age.

6.2.1.6 Impact on the use and development of the water area and tangible property

Limitations resulting from the gradual exclusion from the previous use of the Baltic Power OWF Area will have the greatest impact on fishing, including as the area of fishing, as well as the necessity to extend the routes to the fisheries, this impact in the RAO would be negative and direct. Moreover, due to the assumed duration of the construction phase, this impact would be long-term and local.

Taking into account the fact that the previous use of the Baltic Power OWF Area for fishing activities was small and that this activity can be carried out in neighboring water regions, it should be assumed that the significance of the Baltic Power OWF impact on fishing will be of low importance.

6.2.1.7 Impact on landscape, including the cultural landscape

During the construction phase of the Baltic Power OWF, potential impacts of the project on the landscape, including the cultural landscape, were identified, resulting from: (i) vessel traffic, (ii) transport of structural components of the OWF and (iii) gradual development of the area.

The impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF and the type of the landscape affected. In the open sea, the landscape is not disturbance-resistant, but its value is not high, as very few people and over a short period will be exposed to the landscape change and some of them may perceive it as beneficial or interesting. The spatial range of the impact would be large, it would decrease as the distance from the OWF increases, the vessel traffic will increase from time to time, and at ports the impact will be local.

6.2.1.8 Impact on population, health and living conditions of people.

During the Baltic Power OWF construction, there will be impact on the population at different intensity levels in onshore and offshore areas. This impact will directly affect the persons involved in the construction process. The entire process will be subject to regulations resulting from occupational health and safety regulations. During the construction period, fishermen will have to abandon fishing in the area of works and carry them out in other water regions. An increase in vessel traffic related to construction could also affect the navigational safety.

The scale of impact on people's population, health and living conditions during the construction phase would be "small", and when assessing the significance of the receiver as "very large", it can be assumed that the significance of impact would be moderate.

6.2.2 Operation phase

6.2.2.1 Impact on the geological structure, bottom sediments, access to raw materials and deposits

Changes within the seabed associated with the impact of the project in the RAO would be local and within the entire area occupied by the project – insignificant for the overall character of the seabed and its structure. It is not expected that there could be any changes in the seabed structure during the project operation phase. The overall impact of the project in the operation phase can be assessed as negligible.

6.2.2.2 Impact on the dynamics of sea waters

As a result of the presence of structural components of the Baltic Power OWF, water flow rates and directions as well as water pressure in the immediate vicinity of each structure could change, which will manifest itself in a local increase in water flow velocity due to narrowing of the flow stream and formation of whirlpools around the structure. This means that overlapping of these impacts should not be expected and disturbances would be only local. The resulting modifications of the wave motion could be noticed only in the close vicinity of individual offshore wind turbines. However, they would be of local nature and should not be present outside the Baltic Power OWF Area. The impact of wind turbines on the wave field and sea current field would not have a key impact on these elements.

Significance of the impact of the Baltic Power OWF on the dynamics of sea waters in the RAO during the operation phase was assessed as negligible.

6.2.2.3 Impact on the quality of sea waters and bottom sediments

During the Baltic Power OWF operation in the RAO, works affecting the quality of water and bottom sediments would be carried out in its area. This would be mainly maintenance and intervention works in the event of an emergency situation. The impacts would be similar as in the case of the construction phase, however, their scale, due to the size of resources used in both phases of the project, would be many times smaller than in the construction phase.

New impacts not occurring during the construction phase would result from: (i) contamination of water and the bottom sediments with compounds from anti-corrosion agents and (ii) change of bottom sediments and water through the reception of heat from transmission cables.

Contamination of the environment with aluminum or zinc released during operation with the use of galvanic cathodic protection is a direct, negative impact of local range, being long-term, irreversible, permanent, and of medium intensity. The significance of this impact during the operation phase in the RAO was assessed as negligible for sea waters and bottom sediments.

Increasing the temperature of sediments in which the cable would be buried and waters filling the spaces between sand grains in the sediment could cause: (i) increased bacteria activity, ii) reduction of oxygen content in water, iii) release of harmful substances, including metals, from sediment into water, and iv) adverse effects on benthic organisms. The most important parameters influencing the impact size are the depth of cable burial and the seabed type.

The heat emission over the Baltic Power OWF cables in the sediment would be local and the effect would be imperceptible if the cable is laid on the seabed (then the heat would be efficiently removed by seawater) and also if the cable would be buried at a depth of up to 3 m, which is in line with the technical assumptions of the project for array power cable.

Heat emission by the cables is a direct, negative impact of local range which are long-term, irreversible, permanent over the operation period, and of medium intensity. The impact significance in the operation phase in the RAO for sea waters and bottom sediments was determined as negligible.

6.2.2.4 Impact on the climate, including emission of greenhouse gases and impact significant in terms of adaptation to climate changes, impact on the air (atmospheric purity)

The wind turbines in the RAO would locally reduce wind energy and would disturb atmospheric pressure directly in the area of the rotor operation. The wind turbine towers could locally disturb the velocities and directions of water flows and reduce the energy of sea waves locally, which is reflected in their height drop.

During the operation phase of the Baltic Power OWF in the RAO, direct and local impact of the planned project (related to the use of vessels and fuel consumption by them) would not have a significant impact on the change of climatic conditions. Despite long-term impact, its range would be local. However, indirectly the operation of the wind farm would result in reduction of greenhouse gas emissions to the atmosphere by other sources, e.g. coal-fired power plants located in other areas of the country. Therefore, despite the significant importance of the climate and air quality and the small scale of impact of the Baltic Power OWF in the RAO during the operation phase, it may be concluded that the impact in terms of greenhouse gas emissions from vessels to the atmosphere will be negligible.

6.2.2.5 Impact on systems using electromagnetic field

It follows from the operation of the OWF so far that the operation of wind turbines and certain types of tower structures may adversely affect the operation of marine and onshore navigation support equipment or other applications. This applies in particular to radars, communication systems and radar equipment.

In accordance with the conditions included in the permit for erection and use of artificial islands, structures and devices, the Applicant will be obliged to make arrangements with users using EMF systems to implement remedial measures that will allow to accept the impact of the Baltic Power OWF on communication and radar systems for these users. Therefore, it should be assumed that the significance of the impact of the Baltic Power OWF on these systems would be negligible.

6.2.2.6 Impact on nature and protected areas

6.2.2.6.1 Impact on biotic components in offshore area

During the operation phase in the RAO, support structures of wind turbines and accompanying infrastructure located under the water surface in the euphotic zone could be overgrown by macroalgae. Despite the fact that **phytobenthos** does not occur in the area of the planned OWF, macroalgae spores may appear in this area due to various natural and anthropogenic factors.

Macroalgae and animal organisms (e.g. mussels) overgrowing components of the OWF would create the so called artificial reef, a factor causing local increase in diversity of plant and animal species *per se* and indirectly affecting the increase in the species richness and quantitative resources of the marine fauna – mainly fish and nekton crustaceans, which will search for food and places convenient for refuge and reproduction within it. Therefore, the effect of overgrowing submerged structures of the OWF by macroalgae should be considered as positive, however it should also be noted that the natural character of the maritime area would be disturbed. Locally and in the long term, the functioning of the marine ecosystem would be changed, for which the anthropogenic factor would be responsible. The significance of the impact was considered positive and negligible.

The operation of the Baltic Power OWF in the RAO would cause the following impacts on **macrozoobenthos**: (i) loss of a fragment of the habitat, and (ii) artificial reef effect.

The main impact in this phase of project implementation would be the loss of a fragment of macrozoobenthos habitat. The seabed development would eliminate biological life from the seabed surface area, in the worst case scenario it will be occupied by the gravity-base foundations with the largest base diameter from among the proposed types of support structures, including a scour protection layer

The loss of a part of the habitat is a negative impact occurring during the operation phase.

Given the moderate scale of the impact on the soft seabed macrozoobenthos, the importance of this impact would be insignificant. Taking into account the high capacity of recovery of the hard seabed macrozoobenthos resources, this impact was assessed as insignificant.

Once the support structures are introduced into the environment, taking into account the high reproductive potential of zoobenthos, the colonization of artificial hard substrates by animal periphyton communities, as well as mobile epifauna – the so-called artificial reef effect, should be expected here. It would partially compensate for the destroyed macrozoobenthos association existing there before human interference with the environment. The artificial reef effect is a long-term and permanent phenomenon, but due to its local range, the impact significance was considered moderate.

During the Baltic Power OWF operation phase in the RAO, the impacts on **ichthyofauna** would result from: (i) noise and vibration emission, (ii) habitat change, (iii) creation of a barrier, and (iv) EMF emission.

The impact of noise in the operation phase of the Baltic Power OWF should be much lower than observed during construction and decommissioning. It will depend on the environmental conditions (depth, type of sediment, seabed morphology) and the type and size of the wind turbine and wind speed.

Emission of noise and vibrations generated during the OWF operation may directly affect the ichthyofauna. The above impacts would be of negative, direct, local, long-term and permanent nature. The significance of the impact is assessed to be negligible for all investigated fish species.

The presence of structural components of wind turbines involves the creation of additional hard substrates forming a new habitat. Such artificial structures constitute the so-called artificial reef – a new habitat. As early as after several months, numerous populations of fishes appear in the reef area, both those returning after the end of disturbances related to construction and those not present in this area so far, affecting the increase in biodiversity. The development of a stable artificial reef system usually takes 1–5 years.

Moreover, the introduction of possible restrictions for fishing and navigation in the Baltic Power OWF Area would reduce anthropogenic pressure, and the areas of artificial reefs could constitute a specific refuge for fishes, both adults and their early stages of development. However, it is possible that artificial reefs could create an environment that also favors foreign fish species.

The impact related to the change of habitat would be positive, direct, local, permanent and long-term. The significance of the impact is assessed to be negligible for all investigated fish species.

The construction of underwater structures may constitute a migration barrier for economically important fish whose routes run in this place. The impact related to the creation of a barrier would be negative, direct, local, long-term and permanent. The significance of the impact is assessed to be negligible for all investigated fish species.

The sensitivity of ichthyofauna to EMF impact depends on: (i) a species-specific detection threshold, (ii) a type of fish sensory (magnetic or electrical) and (iii) a species lifestyle (demersal or pelagic).

The impact related to the EMF emission will be negative, direct, local, long-term and permanent. The significance of the impact is assessed to be negligible for all investigated fish species.

During the operation phase of the Baltic Power OWF in the RAO, the impacts on **marine mammals** would result from: (i) emission of noise generated by wind turbines, (ii) emission of noise generated by vessels, (iii) changes in the habitat, (iv) collisions of vessels, and (v) collisions with vessels.

The most significant impact on marine mammals during the operation phase of the Baltic Power OWF in the RAO would result from a potential collision of vessels and, consequently, from the risk of a significant spill of fuel. In this case, the significance of the impact was assessed as moderate. In other cases, the significance of the impact was assessed as insignificant.

During the operation phase of the Baltic Power OWF in the RAO, the impacts on **migratory birds** would result from two elements, i.e. the barrier effect and collision with the OWF structures. Due to the largest assumed occupation of space above the Baltic Power OWF Area, the size of these impacts will be higher than in the construction phase.

The significance of the impact of the barrier effect was assessed for all migratory bird species as negligible. However, the significance of the impact in the form of the risk of collision was considered moderate in the case of geese (not determined as to the species) and common cranes, insignificant in the case of long-tailed duck and velvet scoter and negligible for other species.

The most important impacts on **seabirds** during the operation phase include: (i) vessel traffic, (ii) scaring away and displacement from the habitat, (iii) creation of a barrier, (iv) collisions with wind turbines, (v) creation of an artificial reef and (vi) creation of a closed water region. The impact assessment was carried out for the five most numerous birds: long-tailed duck, velvet scoter, razorbill, common guillemot and European herring gull.

The significance of the above-mentioned impacts for the European herring gull was assessed as negligible, for the razorbill and common guillemot as moderate at most, and for the sea ducks (velvet scoter and long-tailed duck) as significant at most.

The impact of the Baltic Power OWF in the RAO on **bats** during the operation phase will be caused by: (i) collisions with wind turbines, (ii) noise and light emissions, (iii) barrier effect, and (iv) habitat changes. The significance of the impact of the Baltic Power OWF during the operation phase was assessed as insignificant.

6.2.2.6.2 Impact on protected areas

Given the location of the Baltic Power OWF at a significant distance from the Słowiński National Park, no significant impact on this area will occur during the operation phase, including any element for which it was established, i.e. biodiversity, resources, objects and components of inanimate nature and landscape values of the Park.

As a result of the conducted proper assessment of the impact of the Baltic Power OWF in the RAO, it can be concluded that the planned project would not cause significant impacts on the analyzed Natura 2000 sites.

Considering that protected areas may be classified as receivers of very high sensitivity, and at the same time taking into account the scale of impact on them at the stage of operation of the Baltic Power OWF as insignificant, the significance of this impact is of low importance.

6.2.2.6.3 Impact on wildlife corridors

Due to the same pre-conditions in terms of knowledge about wildlife corridors in maritime areas and the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea, including the constant effect of space development, it was assessed that the impact of the Baltic Power OWF in the operation phase, similarly as in the construction phase, on migration routes of migratory species will be negligible.

6.2.2.6.4 Impact on biodiversity

During the operation phase of the Baltic Power OWF in the RAO, structures permanently submerged in water would be founded in the environment, creating favorable conditions for the development of animal and plant epiphyte organisms. On a local scale, within the range of structural components, there would be an increase in species diversity, although the nature of natural value of this habitat may be ambiguous. This results from the fact that, on the one hand, periphyton communities would be a new biocenosis component of this area, additionally increasing the food base for fish, birds and, incidentally, for marine mammals. On the other hand, this location could favor the spread of foreign species, which would lower the ecological quality of this micro-habitat.

An artificial reef would create favorable conditions for the living and reproduction of many fish species. A positive impact on biodiversity could have a long-term reduction or cessation of fishing in the Baltic Power OWF Area. Probably, the artificial reef effect would have only a local impact, without increasing diversity in a larger area.

In the case of seabirds, as a result of scaring away and displacement from habitats, there could be changes in the distribution of birds in the Baltic Power OWF Area. After the disturbance period, birds would gradually become accustomed to the new situation. In the case of species sensitive to the presence of wind turbine structures, the Baltic Power OWF Area could be clearly avoided and thus the biodiversity of this area could be reduced.

6.2.2.7 Impact on cultural values, monuments and archaeological sites and facilities

In the Baltic Power OWF Area, no risk of impact on the objects of great importance for the protection of cultural heritage was found. It may not be excluded that the wrecks reported to the Pomeranian Voivodeship Heritage Conservation Officer will be surrounded by conservation care and will require determination of protection zones in which the possibility of development would be limited in the RAO. The Applicant assumes preventive limitation of activities related to the seabed at a distance of up to 100 m from the discovered wrecks.

6.2.2.8 Impact on the use and management of the water region and tangible property

During its operation, the Baltic Power OWF Area will be excluded from navigation due to safety reasons. Decisions on permits for vessels other than vessels handling the OWF in the Baltic Power OWF Area will be made by relevant maritime administration authorities.

As a result of the Baltic Power OWF occupying the maritime area, this area may be excluded from the possibility of fishing. The Baltic Power OWF Area is located within four fishing squares. This area is characterized by low fishing productivity, therefore the significance of the impact was assessed to be of low importance.

6.2.2.9 Impact on landscape, including the cultural landscape

During the operation phase of the OWF, potential impacts of the project on the landscape, including the cultural landscape, resulting from the presence of marine structures and vessels were identified.

Objectively the landscape within the OWF will be industrial, but its impact will be subjective and will depend on individual characteristics of the receiver and may be perceived negatively and positively.

The significance of impacts was assessed as negligible.

6.2.2.10 Impact on population, health and living conditions of people.

The operation of the Baltic Power OWF will require regular maintenance services. All related works will be performed by specialized teams of employees and will be subject to high occupational health and safety requirements.

The access to the Baltic Power OWF Area may be limited for fishing vessels and may mean, for instance, limitation of availability to the currently exploited fisheries and extension of routes for fishing vessels from certain ports to the fisheries located north of the Baltic Power OWF Area.

During most meteorological situations, the Baltic Power OWF will not be noticeable from the shore. Only from higher lookout points and under suitable visibility conditions will, it be possible to observe a larger number of wind turbines.

Other types of events that may affect health and living conditions may involve different types of collisions of vessels at sea. Such events are random, and the presence of the OWF may hinder rescue operations at sea.

Although the resource such as population, health and living conditions of people, is of great value, due to the fact that the distance of the Baltic Power OWF from permanent places of residence and work of people is large, the impact of the Baltic Power OWF was considered negligible.

6.2.3 Decommissioning phase

During the decommissioning phase, most of the Baltic Power OWF facilities in the RAO would most likely be removed from the seabed, in accordance with international regulations. These regulations define the conditions for removal of components and installations of wind farms. Decommissioning works should be carried out in such a manner that they do not hinder navigation and do not adversely affect the marine environment. These standards also define exceptional situations in which there is no obligation to completely remove infrastructure components of the OWF. It is possible to leave such structures, among others, when:

- removal of the components is technically impossible or too expensive;
- there is a threat to the life of the OWF decommissioning personnel;
- decommissioning involves an unacceptable risk of polluting the marine environment.

If some components are left on the seabed, relevant tests and analyses should be carried out to determine whether the remnants of the OWF will not interfere with vessel traffic and will not have a negative impact on biotic and abiotic elements of the environment. It should be ensured that the left behind parts of the structure do not start to move under the influence of waves, tides, currents or storm surges, causing a hazard to maritime navigation.

The decommissioning process of the Baltic Power OWF in the RAO would start in several dozen years. During this time, there will be experience resulting from the decommissioning of other OWFs. This will allow for the development of a detailed plan for the decommissioning of the OWF, taking into account all environmental aspects, including the determination of the part of structural components removed from the environment. There is no doubt that all above-water components will be removed, transported onshore and disposed of there. To a large extent, the underwater parts will also be removed. Most probably, parts of foundations in the seabed will remain in the environment, as their total extraction will involve too much effort and resources, and at the same time their removal could cause significant environmental impact.

When assessing the impact of the planned activities during the decommissioning phase of the Baltic Power OWF in the RAO, no higher significance of these impacts on individual assessed elements of the environment was found than during the construction or operation phase.

As a result of the decommissioning process of the Baltic Power OWF in the RAO, the condition of biocenotic balance created during the several decades of operation would be disturbed. Removal of structural components from water would lead to removal of the substrate for the development of periphyton fauna and flora. Periphyton communities living on these structures will be destroyed. This applies in particular to plant organisms which, without the OWF structure, did not occur in the Baltic Power OWF Area. As a last resort, depending on the scale of decommissioning, a new state of biocenotic balance, closer to the current one, would be created. This balance will also be affected by natural processes taking place in the southern Baltic Sea.

The release of the marine space from the structural components of the Baltic Power OWF will enable its re-use by the existing users, in particular in navigation. The possibility of using this area in terms of fishing will depend on the degree of removal of structural components in water.

6.3 Impact assessment for Natura 2000 sites

6.3.1 Preliminary assessment for the OPA

The primary objective of protection of Natura 2000 areas is to maintain or restore the proper conservation status of species and natural habitats which are being protected and for the protection of which these areas have been designated.

The Baltic Power OWF project is not directly related to or necessary for the management of Natura 2000 sites. It follows from these premises that it is necessary to carry out an assessment of the impact on these areas.

Detailed information on Natura 2000 sites located in a direct or further vicinity of the Baltic Power OWF area is presented in Chapter 3.

An essential element of the preliminary assessment of the Baltic Power OWF impact on the Natura 2000 areas is to determine whether a given Natura 2000 site is within the range of potential impacts of the Baltic Power OWF. The location of the Baltic Power OWF Area against the background of the location of Natura 2000 sites is presented in the figure (Figure 3.17).

The main reasons for concluding whether the planned project may have impacts on the Natura 2000 protected area are the distance between this area and the project execution area and the range of the impacts. Due to the specific nature of the functioning of the Natura 2000 areas and possible functional connections between these areas, it is also important to locate the investment project area in relation to the Natura 2000 sites. Table (Table 6.15) shows distances (understood as distances from the nearest points of both areas) of Natura 2000 areas from the Baltic Power OWF area and a list of the subjects of protection present in these areas.

Table 6.15. Marine and coastal Natura 2000 sites located closest to the Baltic Power OWF [Source: own study]

Area name/code	**Distance from the Baltic Power OWF Area [km]**	**Subjects of protection in the area**		
		Marine habitats	**Species of marine animals**	**Bird species**
Coastal Waters of the Baltic Sea (PLB990002)	8.96	-	-	**Long-tailed duck (A064)** Common scoter (A065) **Velvet scoter (A066)** **European herring gull (A184)** Razorbill (A200) **Black guillemot (A202)**
Słowińska Refuge	20.19	Rocky seabed, reefs (1170)	Minóg morski (1095)	-

(PLH220023)			Minóg rzeczny (1099) Parposz (1103) Łosoś (1106) **Morświn (1351)** Foka szara (1364) Ciosa (2522)	
Słupsk Bank (PLC990001)	25.50	Submarine sandbanks (1110) Rocky seabed, reefs (1170)	-	**Long-tailed duck (A064)** **Black guillemot (A202)** **Velvet scoter (A066)**
Hoburgs bank och Midsjobankarna (SE0330308)	55.47	Submarine sandbanks (1110) Rocky seabed, reefs (1170)	**Porpoise (1351)**	Common eider (A063) **Long-tailed duck (A064)** **Black guillemot (A202)**

Additionally, table (Table 6.15) distinguishes the species of birds and other marine animals which are subjects of protection in at least two areas. The species identified include the porpoise (1351) and four bird species: the long-tailed duck (A064), the European herring gull (A184), the velvet scoter (A066) and the black guillemot (A202). Assigning these animal species as subjects of protection to Natura 2000 sites indicates that these areas are important places where they stay and, at the same time, that these species are likely to move between these areas. In view of the aforementioned, it can be assumed that the long-tailed duck and the black guillemot are more likely to fly between the following areas: Coastal Waters of the Baltic Sea (PLB990002), Słupsk Bank (PLC990001) and Hoburgs bank och Midsjöbankarna (SE0330308). The velvet scoter (A066) may also fly between the Coastal Waters of the Baltic Sea (PLB990002) and the Słupsk Bank (PLC990001). In the case of the European herring gull, which is protected in the Coastal waters of the Baltic Sea (PLB990002) and is not a subject of protection in other Natura 2000 sites analyzed, a lesser probability of migration of this species between the coastal water zone and the water areas located north of it may be assumed.

The porpoise (1351) is not a migratory species. It uses the area of stay in connection with feeding or reproduction. This area may change but there is no migration between these areas. Therefore, there is a small link between the various Natura 2000 sites which would require an assessment of the impact on the network of links between these areas [426, 110].

6.3.1.1 Determination of the project impact ranges

The Baltic Power OWF area is located outside the areas of the European ecological network Natura 2000 (Table 6.15). Therefore, when determining the impact of the planned project on Natura 2000 sites, impacts that go beyond the Baltic Power OWF Area were assumed. Identification and assessment of the impacts on individual elements of the environment are presented in sub-chapters 6.1 and 6.2. The table (Table 6.16) shows the impacts that may extend beyond the Baltic Power OWF Area and protected elements of Natura 2000 sites that may be affected by these impacts.

Table 6.16. List of impacts and elements of Natura 2000 sites that can be affected by them [Source: own study]

Impact	Element of Natura 2000 sites
Increased concentration of suspended matter in water and its sedimentation	Subjects of protection: fish species and habitats
Underwater noise	Subjects of protection: species of marine mammals and fish
Space disturbance	Subjects of protection: bird species, integrity of the Coastal Waters of the Baltic Sea area (PLB990002), network coherence

6.3.1.1.1 Suspended matter and its sedimentation

When determining the impact range of the increase in the suspended matter content in water and the resulting sedimentation, the following assumptions were made:

- the maximum range of the suspended matter with a concentration of 4 mg dm^{-1} is 4.5 km from the place of its generation;
- the maximum range of the suspended matter sedimentation area with a volume of 1 mm is no more than 2 km.

The aspects of the impact of the increase in the suspended matter content on biotic elements are described in sub-chapters 6.1 and 6.2. Only in the case of fish roe stages and juvenile forms, literature data are available showing suspended matter contents at which significant impacts may occur. The values specified there, from which there is a significant negative impact on the organisms described, are 10–12 mg dm^{-1}, and already with a suspended matter content of 3–5 mg dm^{-1} avoidance reactions are observed. Therefore, using a conservative approach, it was assumed that the limit of significant impact is the increase of the suspended matter content to 4 mg dm^{-1}.

The destruction of benthic organisms could indirectly deteriorate the food base for birds. To determine the range of significant impact of suspended matter sedimentation, a conservative value of 1.5 mm of deposited sediment was used, assuming that dissolved oxygen reaches the depth of 2 mm inside the sediment in the diffusion process [191].

The increase in concentration of suspended matter and its sedimentation due to the maximum range of those phenomena will not impact the following habitats: Sandy submarine banks (1110) and Reefs (1170) in the Słupsk Bank (PLC990001) site, as well as Reefs (1170) in the Słowińska Refuge (PLH220032) site. Changes in the morphology of the seabed will be caused by works related to the erection of monopiles of the OWF and activities related to laying cables within the Baltic Power OWF Area. They will be local and limited to the places where these activities are carried out. Taking into account the distance of the nearest structures of the Baltic Power OWF from the boundaries of the aforementioned habitats and the maximum range of suspended matter sedimentation, the boundaries of the habitat will not change. For the same reason, i.e. a significant distance of protected habitats (receptors) from the source of impact, the increase in suspended matter content and its sedimentation will not result in fragmentation of these habitats, nor will they affect their structure and function (Figure 6.4, Figure 6.5).

Figure 6.4. *Range of impact of the increase in suspended matter content and the resulting sedimentation for the Baltic Power OWF [Source: own study]*

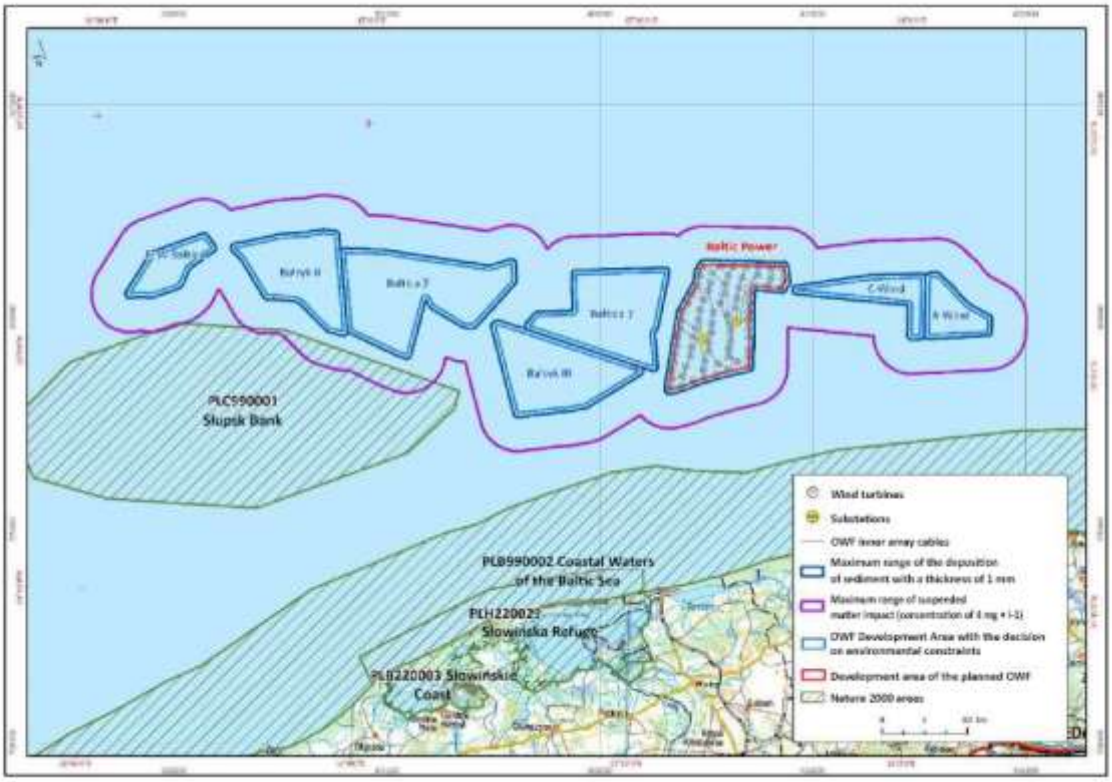


Figure 6.5. *Range of impact of the increase in suspended matter content in water and the resulting sedimentation – cumulative for the Baltic Power OWF and other offshore wind farms [Source: own study]*

6.3.1.1.2 Underwater noise

To determine the ranges of impact of underwater noise on marine mammals and fish, numerical modeling of noise propagation was performed. The calculations were made for noise generated as a result of single piling in the Baltic Power OWF Area and as a result of simultaneous piling within the OWF area: Baltic Power, Baltica 2, Baltica 3, Bałtyk II, Bałtyk III, FEW Baltic II and BC-Wind (when at least one piling takes place in the Baltic Power OWF Area). The modeling took into account three wind turbine locations considered as the worst case scenario. Detailed methodology of determining the range of impact of underwater noise is described in Appendix No. 3 to the EIA Report.

The noise reduction system, which is an integral part of the Baltic Power OWF at the construction stage, is aimed at limiting underwater noise generated during piling works to such an extent that it is insignificant for marine organisms, i.e. it does not exceed the TTS values within Natura 2000 sites where these organisms are subject to protection.

The TTS value accumulated within 1 hour was assumed as the boundary of significant impact of underwater noise on organisms. In the case of behavioral response of organisms to underwater noise, its impact is discontinuous, short-term and does not cause such changes as TTS accumulated within 1 hour. Moreover, the behavioral response is used to deter animals from the area of significant impact, therefore, possible inclusion of the Natura 2000 site in the scope of behavioral response as part of the EIA Report was not treated as a manifestation of a significant negative impact on this area. The underwater noise threshold values for marine mammals and fish are presented in sub-chapters 6.1 and 6.2.

Therefore, on the basis of model studies, the ranges of cumulative TTS were examined, taking into account the Natura 2000 sites where the surveyed species of marine mammals are protected, to determine the scenarios in which the ranges of TTS exceed the boundaries of the relevant Natura 2000 sites. In the case of porpoises, two areas were taken into account – the Polish Natura 2000 network: Słowińska Refuge (PLH220032) and the Swedish area: Hoburgs bank och Midsjobankarna (SE0330308), whereas for seals, the Słowińska Refuge was taken into account, where the subject of protection is the gray seal. The results of the analyses showed that both in the case of porpoises and seals, the TTS ranges crossed the relevant boundaries of the Natura 2000 network only in the scenarios without NRS. In the case of porpoises, for all turbine locations, the cumulative impact of TTS was noted both in the Słowińska Refuge and in the Hoburg bank och Midsjobankarna area. The analyses carried out for seals showed that in the case of turbine 1, there was the impact on the Słowińska Refuge. In all scenarios under consideration using NRS (both single and double), the cumulative TTS impact was not recorded in Natura 2000 sites.

For fish without and with swim bladders, the cumulative TTS range (in scenarios with the NRS) did not cross the boundary of any of the two previously mentioned Natura 2000 sites. Only in the scenario without the NRS (for turbines 40 and 49) it was found that the ranges of cumulative TTS may cross the boundary of the Hoburgs bank och Midsjobankarna area.

The results of all analyses are shown in the figures (Figure 6.6 to Figure 6.37).

Figure 6.6. *SEL weighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD [Source: data of Baltic Power Sp. z o.o.]*

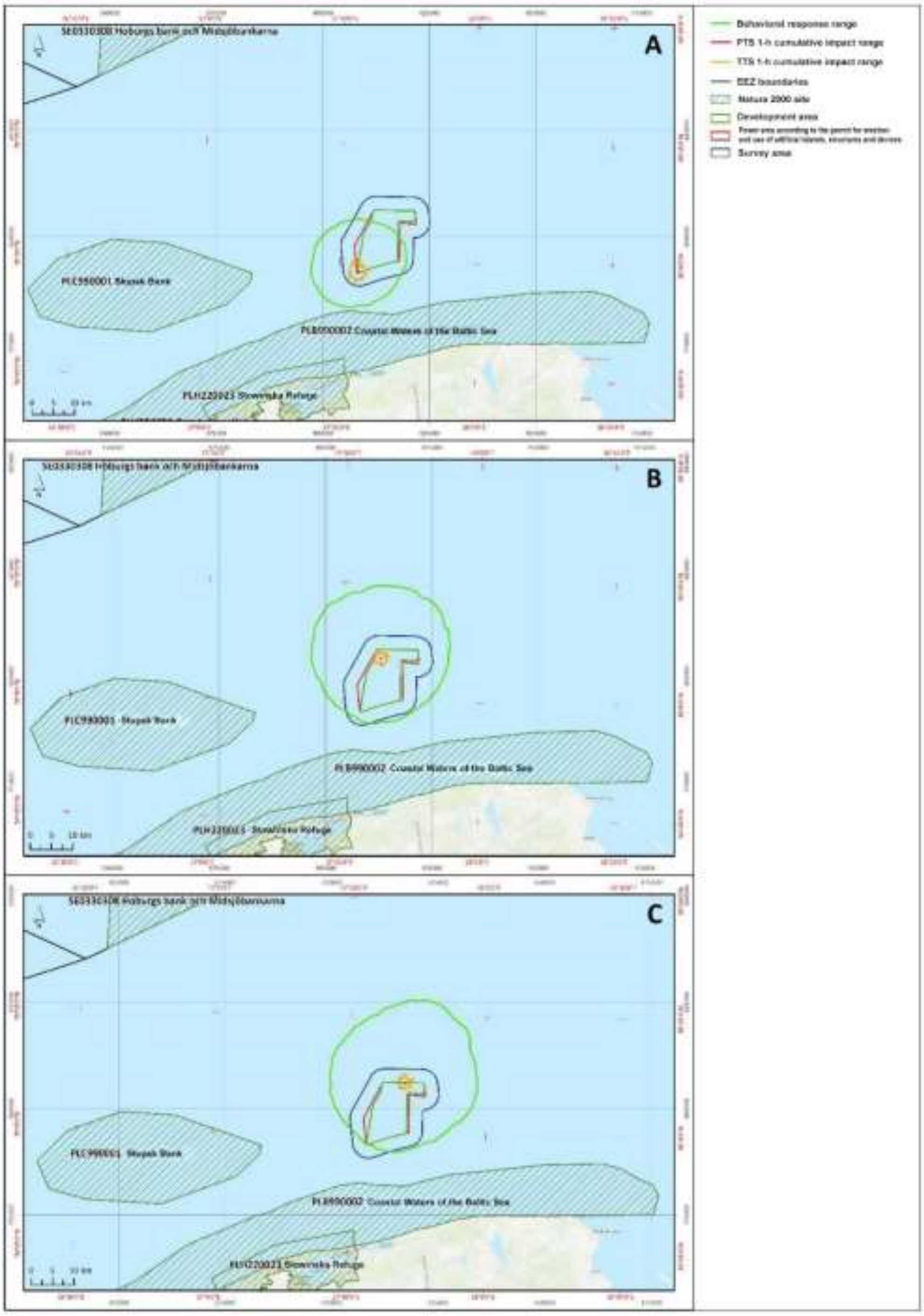


Figure 6.7. *SEL unweighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

Figure 6.8. *SEL weighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for the harbor seal and gray seal, including use of HSD [Source: data of Baltic Power Sp. z o.o.]*

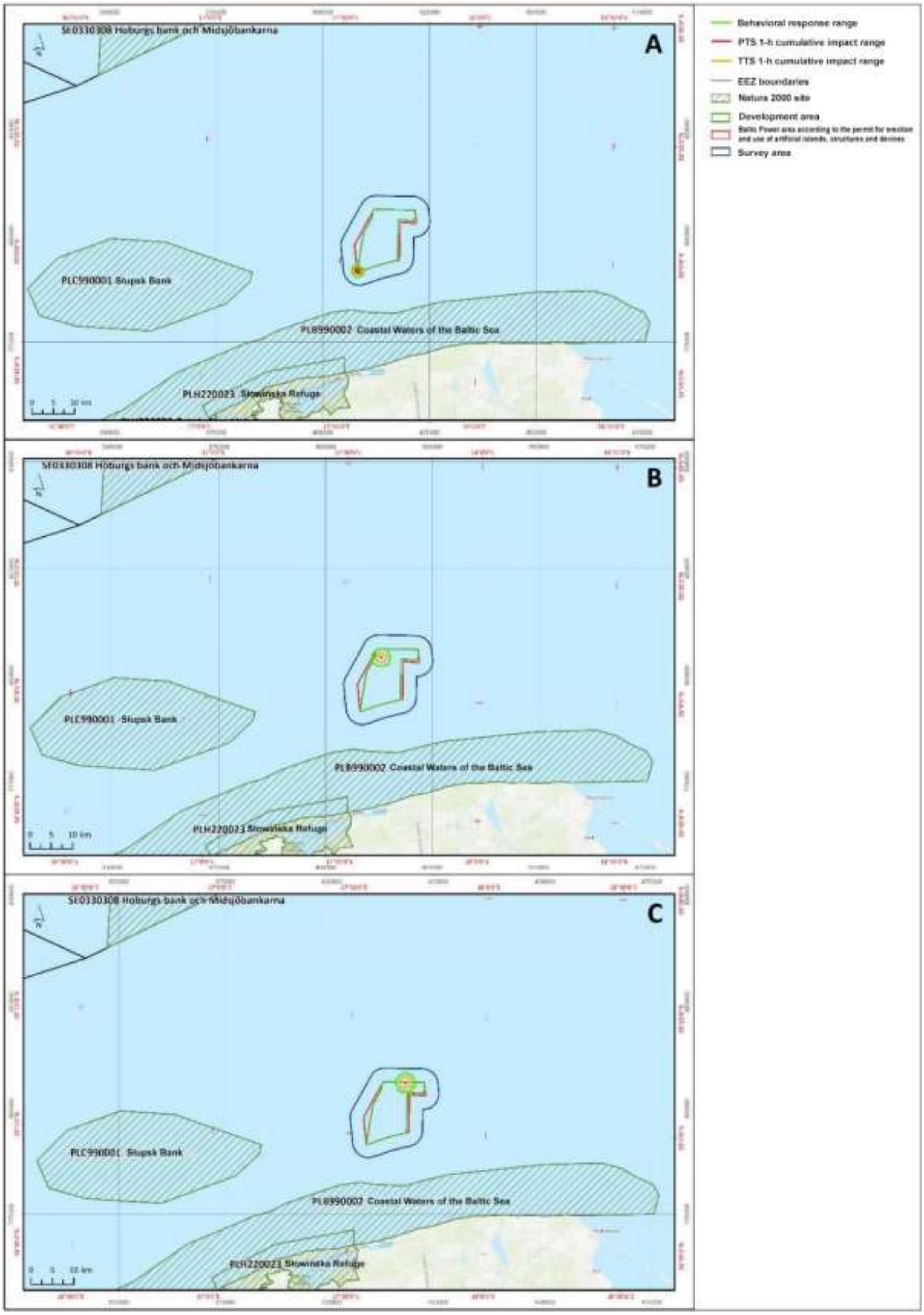


Figure 6.9. *SEL weighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for the harbor seal and gray seal, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

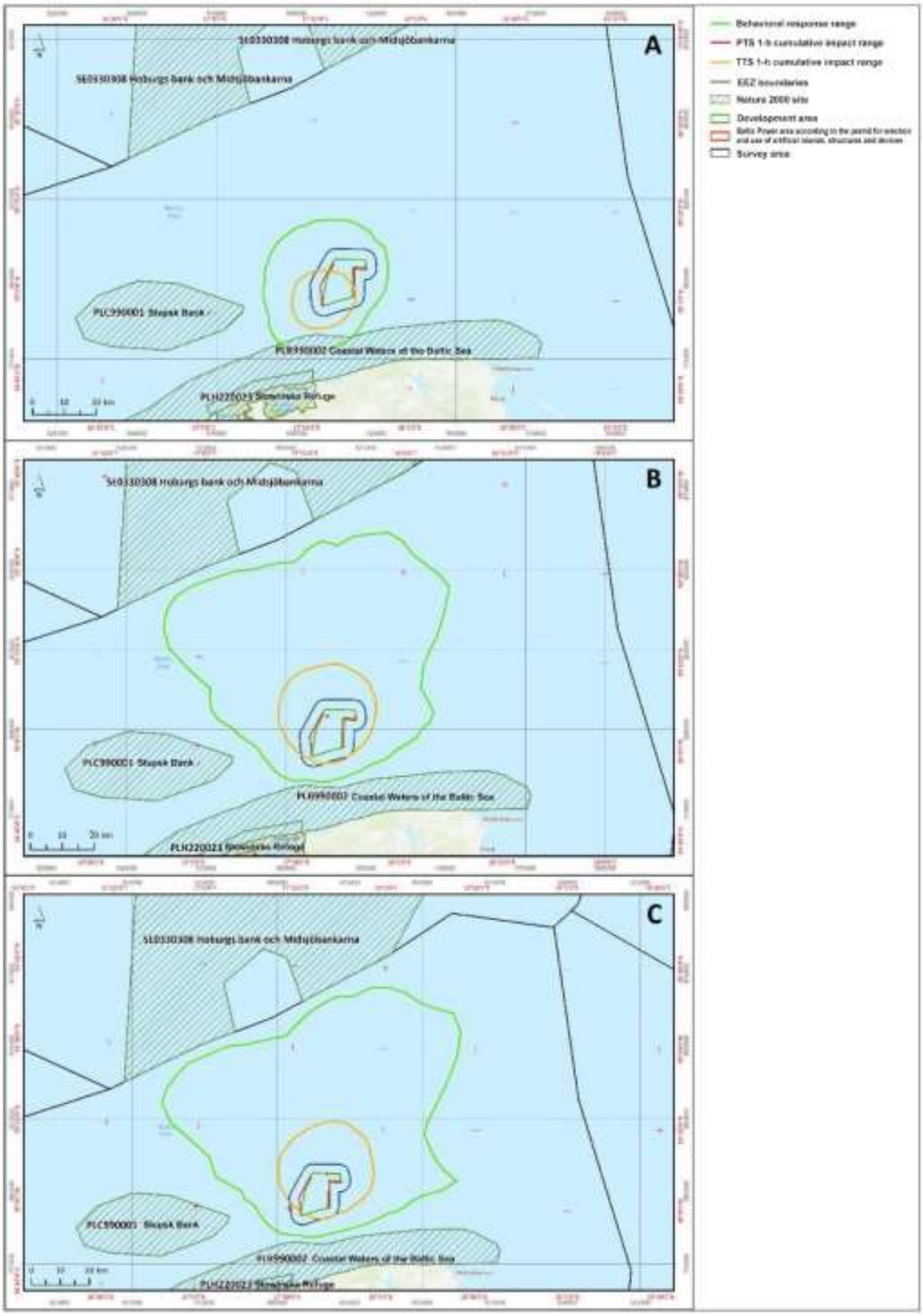


Figure 6.10. SEL unweighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

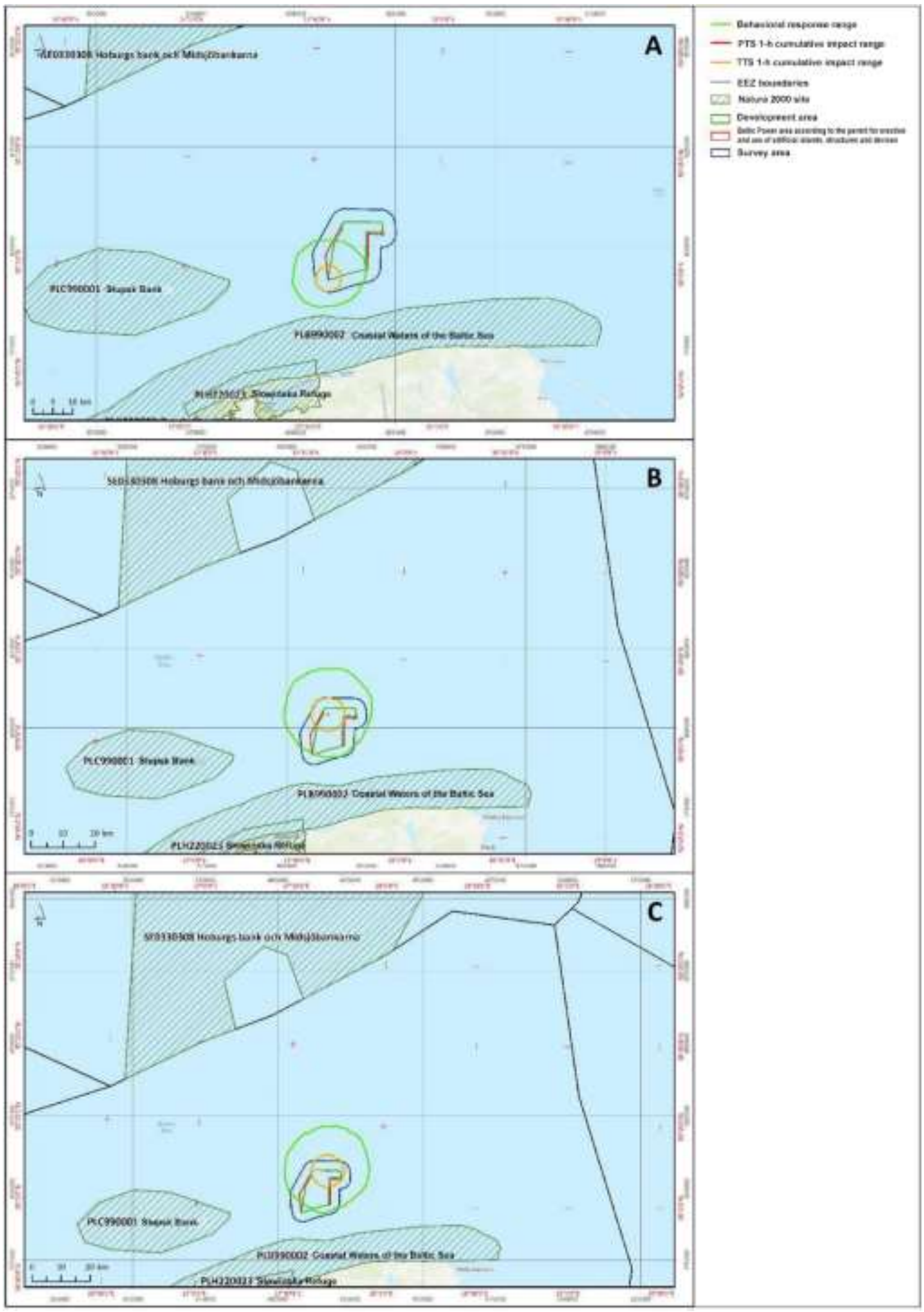


Figure 6.11. *SEL unweighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

Figure 6.12. SEL unweighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with w swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

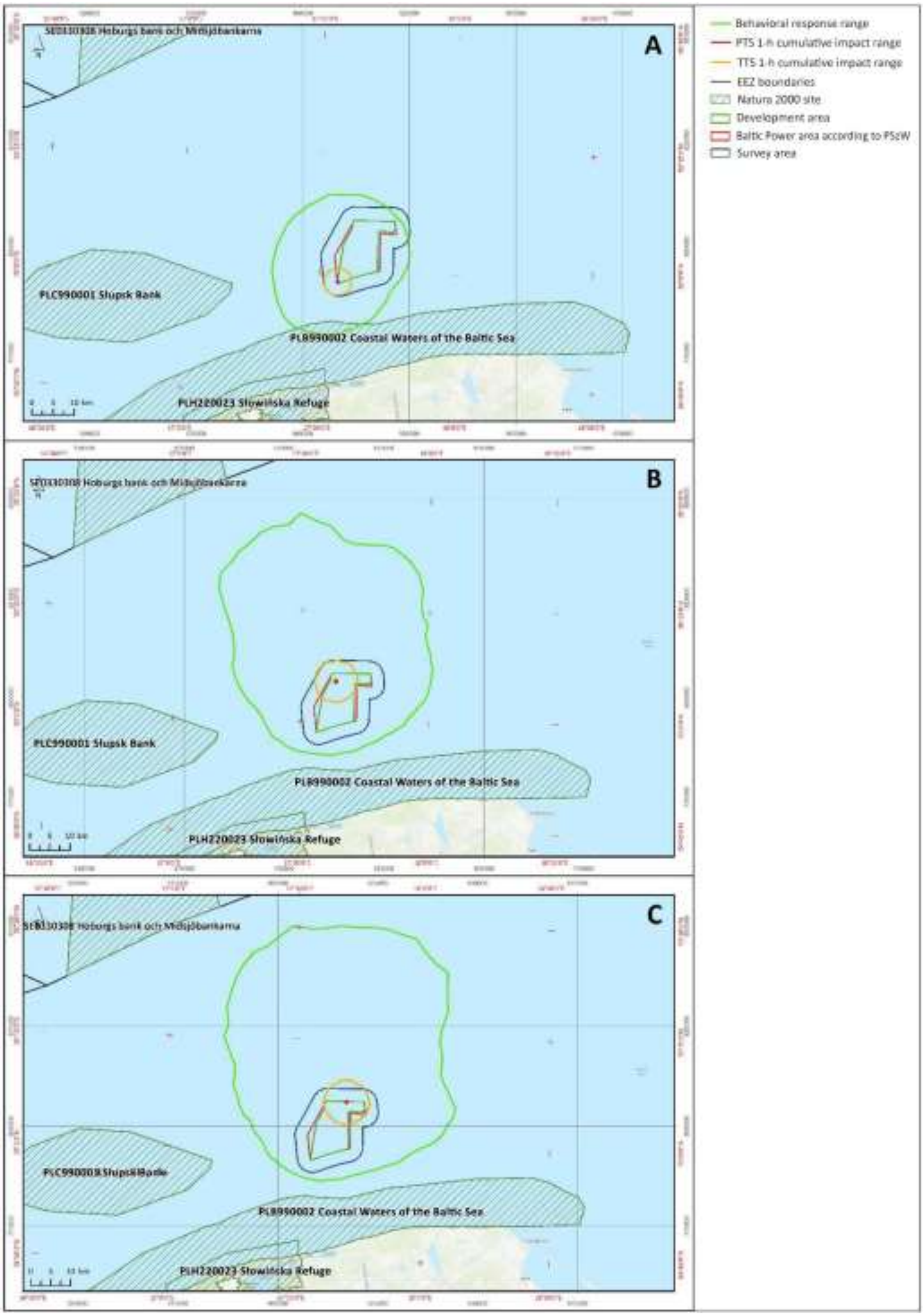


Figure 6.13. SEL unweighted noise propagation map for a single impact for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

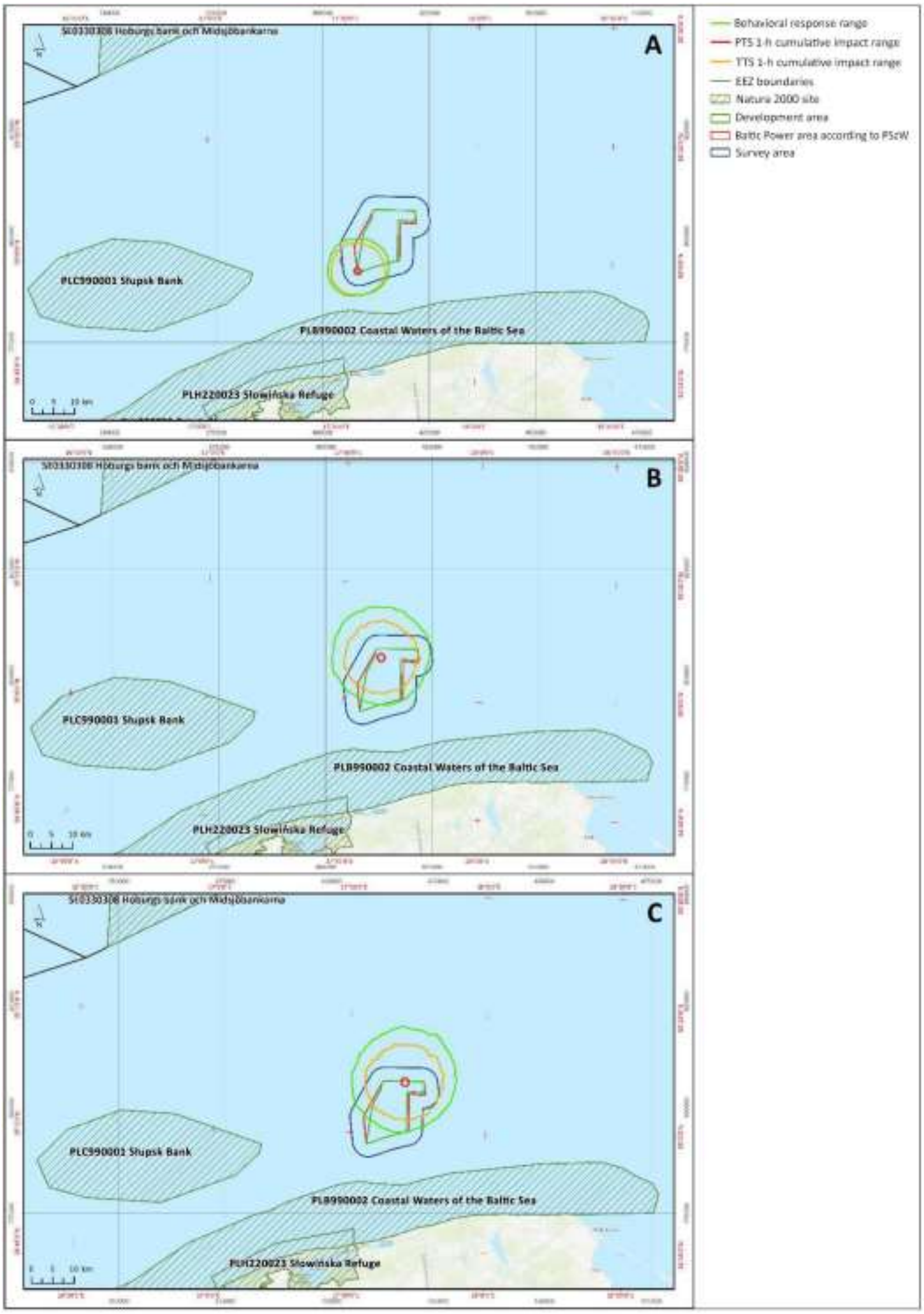


Figure 6.14. SEL weighted noise propagation map for seals from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for harbor and gray seal, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

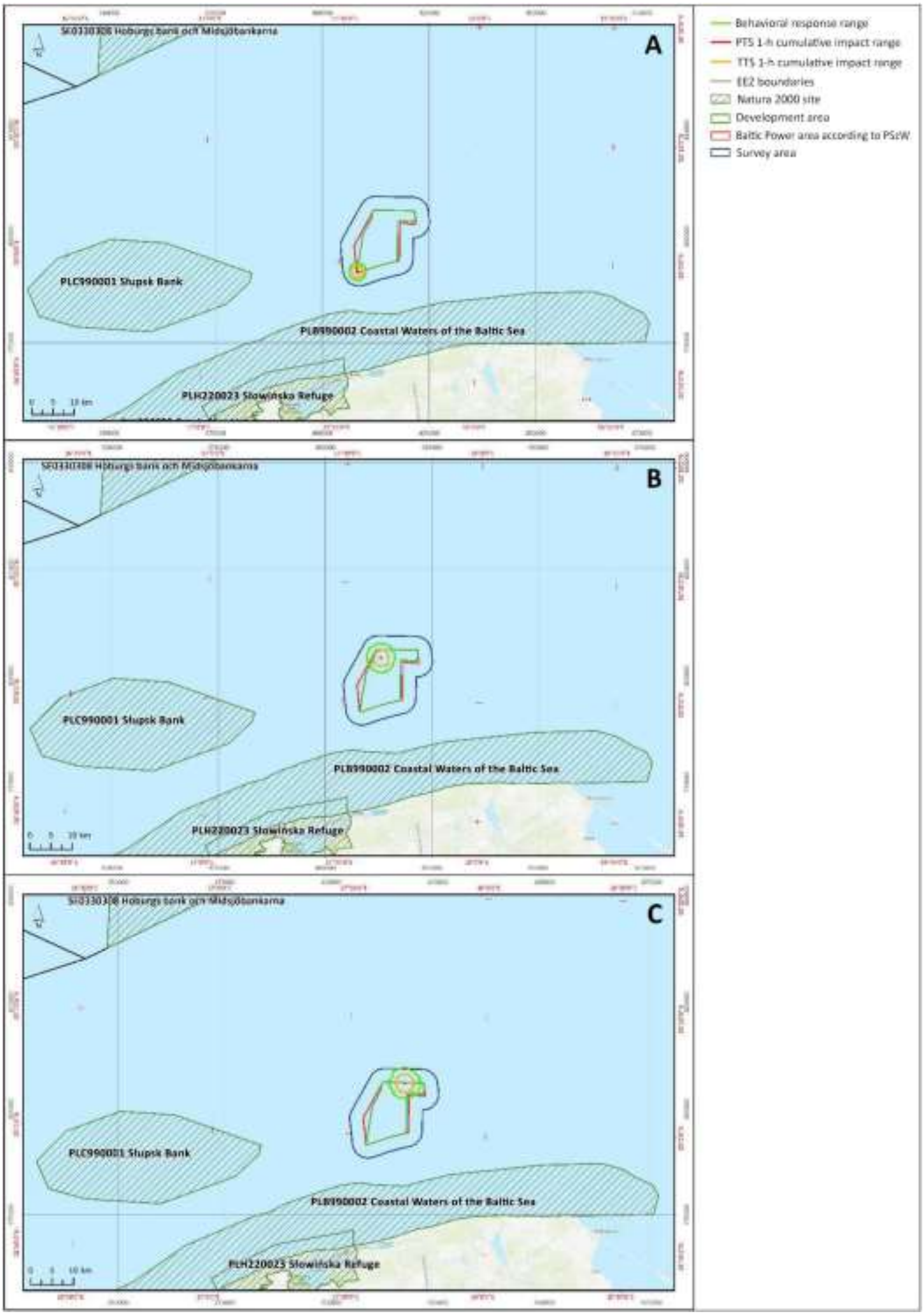


Figure 6.15. *SEL weighted noise propagation map for seals from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for the harbor and gray seal, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

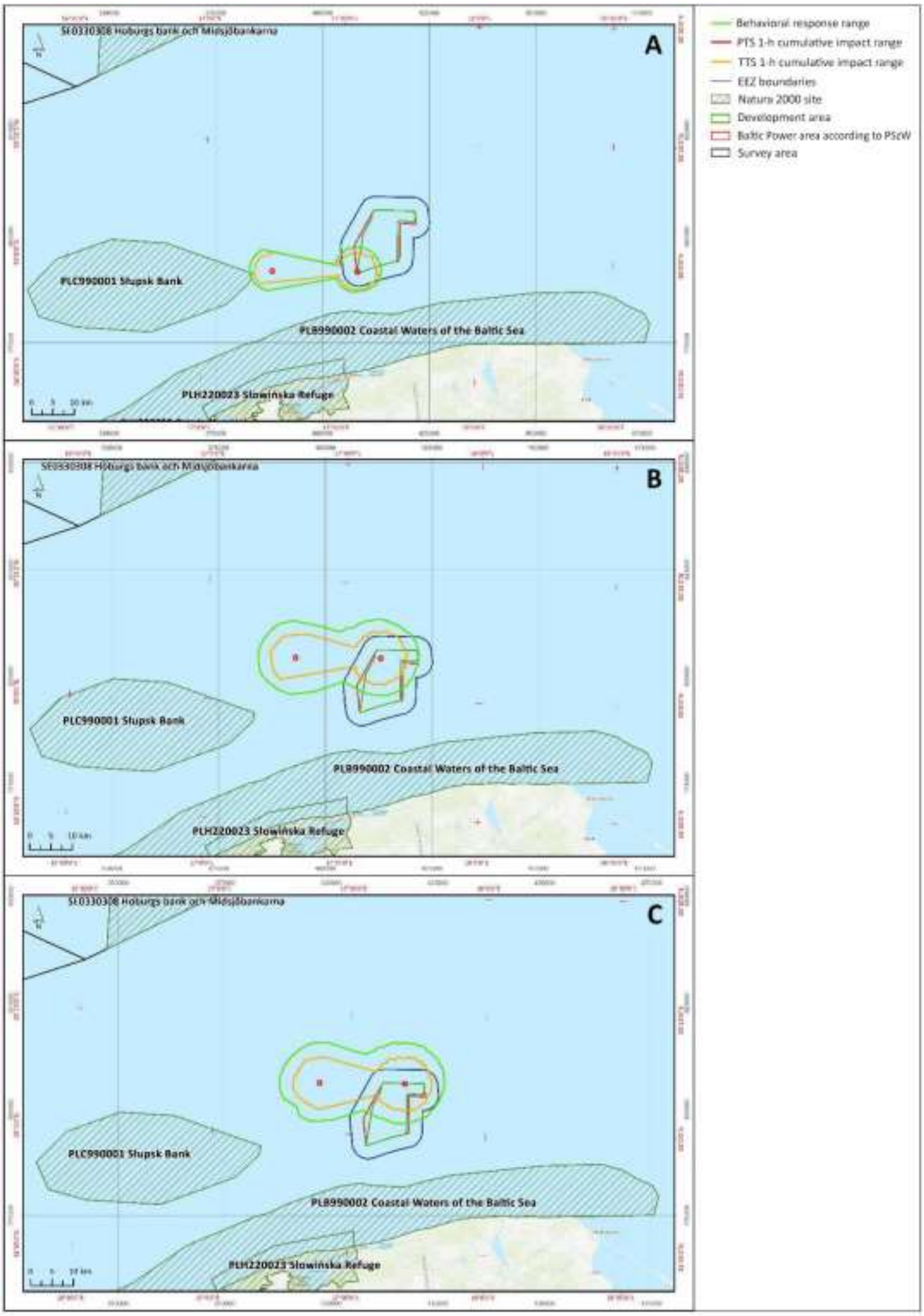


Figure 6.16. SEL weighted noise propagation map for seals from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for harbor and gray seal, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

Figure 6.17. SEL weighted noise propagation map for seals from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for the harbor and gray seal, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

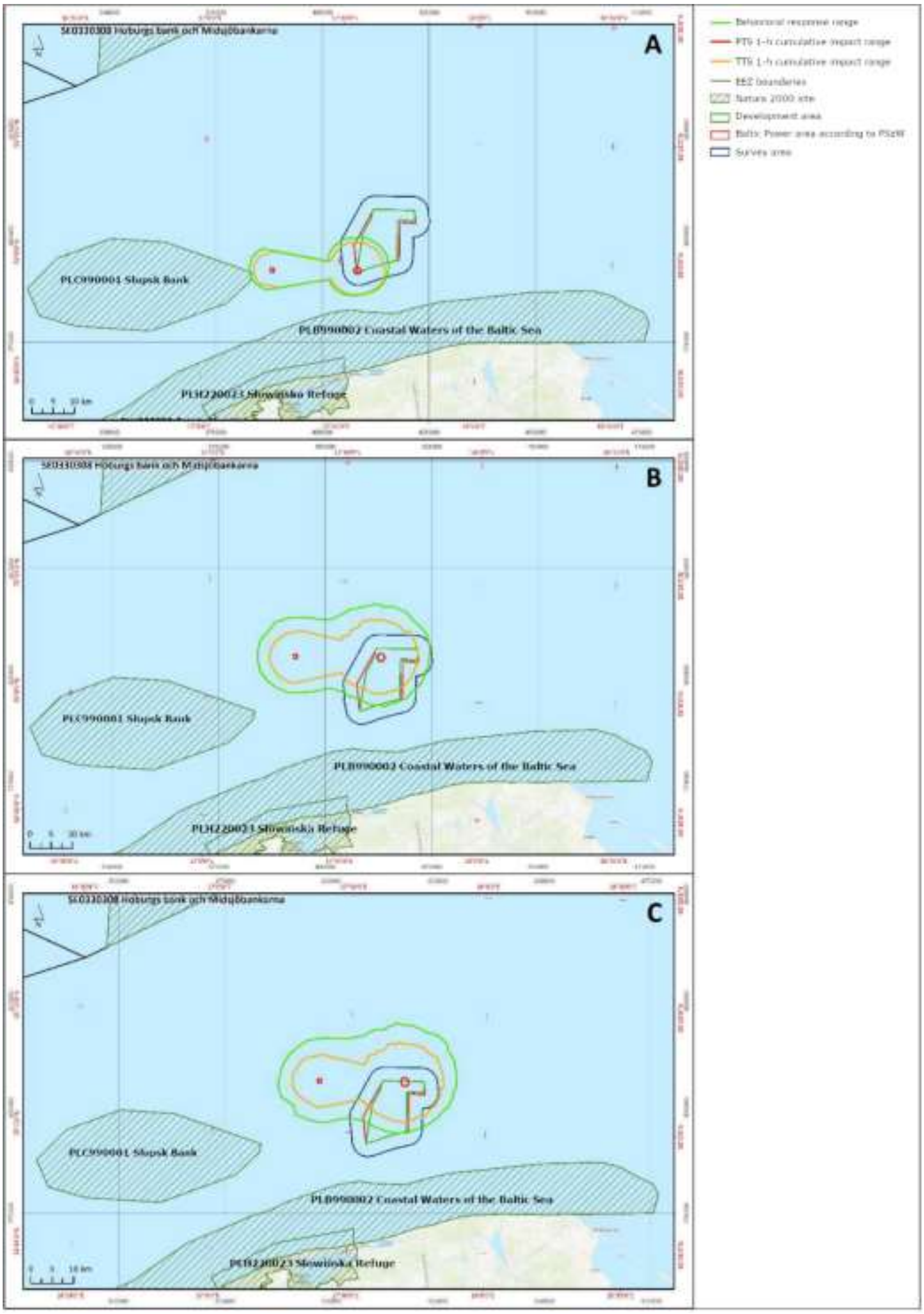


Figure 6.18. SEL weighted noise propagation map for seals from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for harbor and gray seal, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

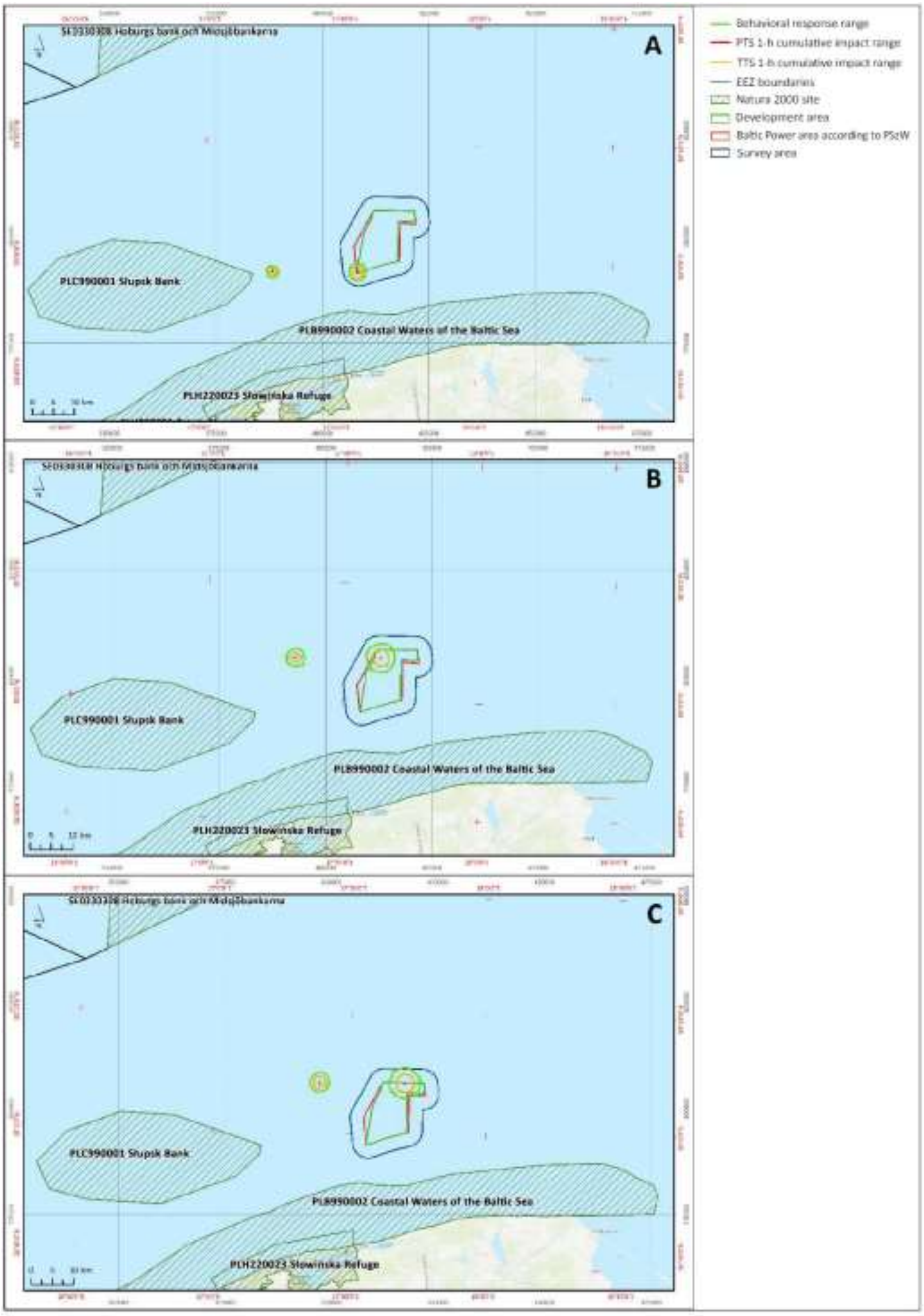


Figure 6.19. *SEL weighted noise propagation map for seals from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for the harbor and gray seal, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

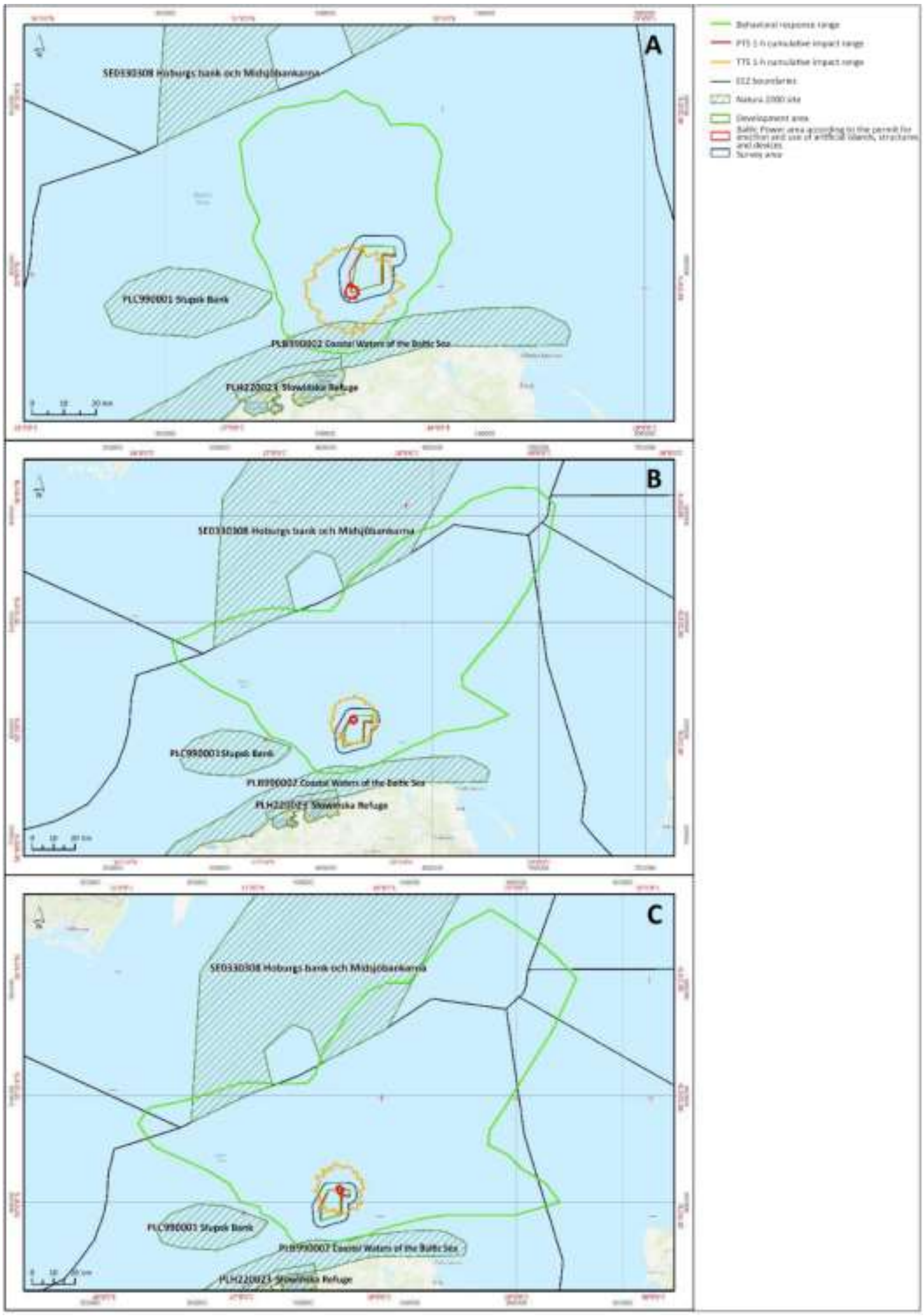


Figure 6.20. SEL weighted noise propagation map for the porpoise from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

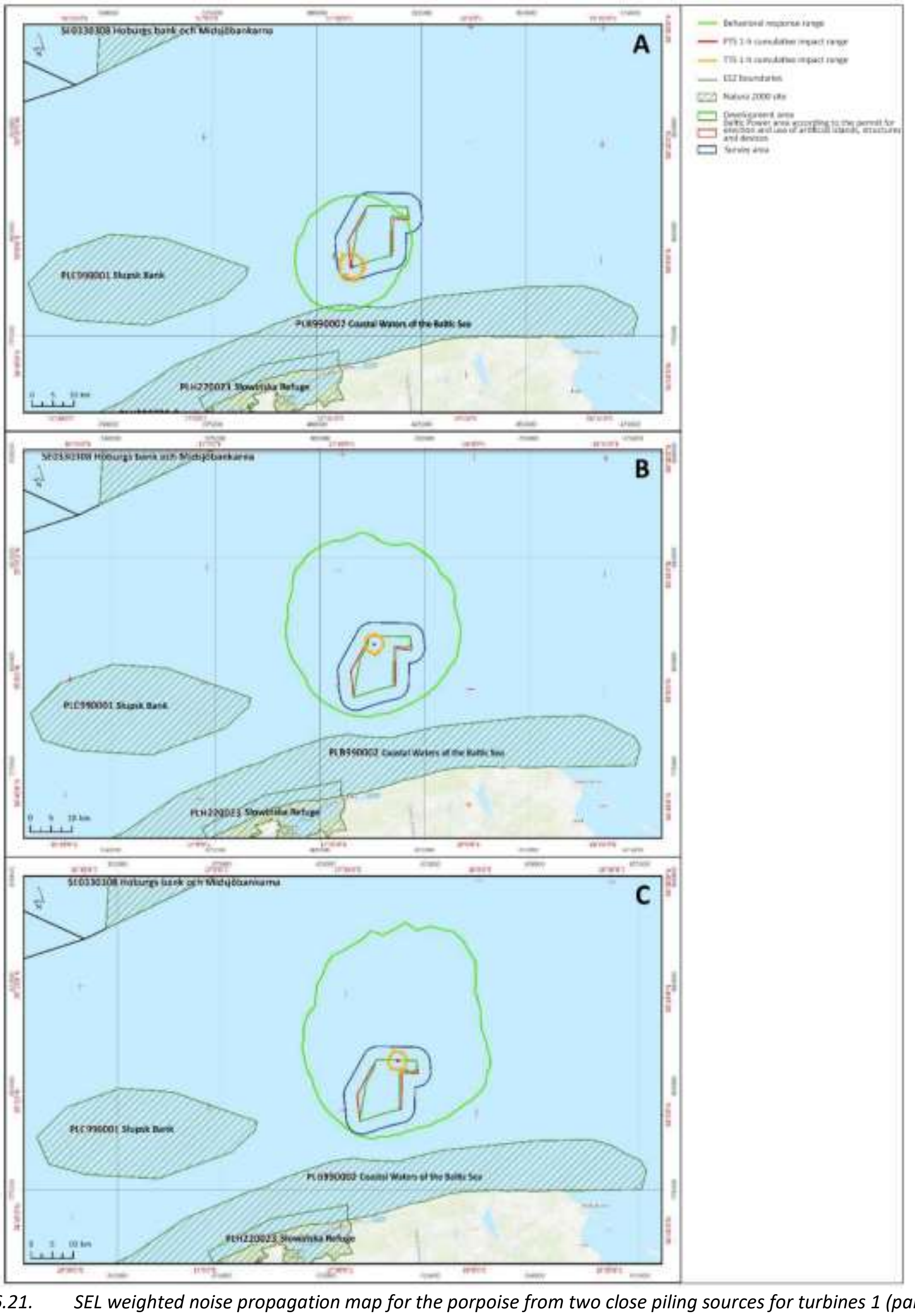


Figure 6.21. *SEL weighted noise propagation map for the porpoise from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises after using HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

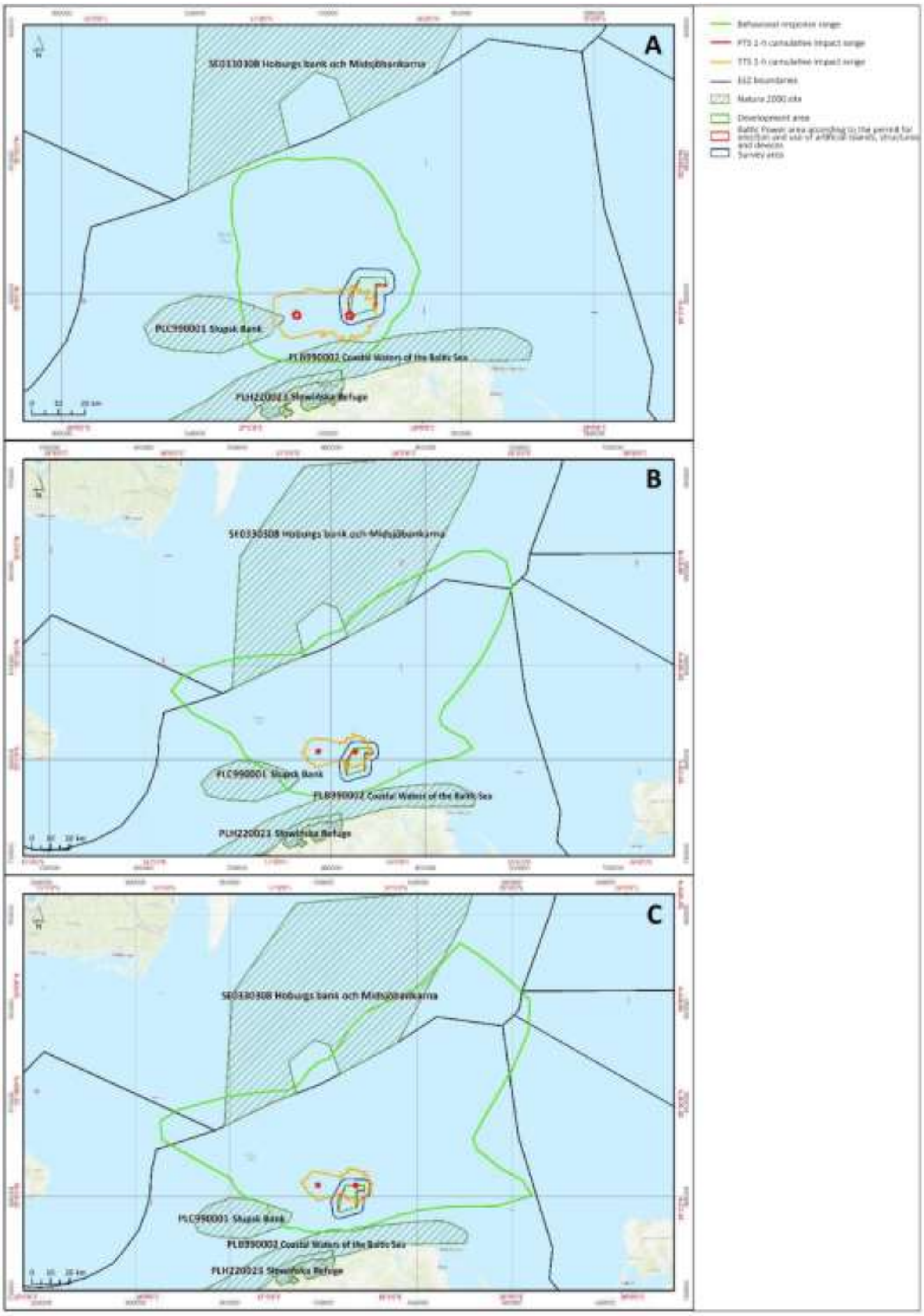


Figure 6.22. SEL weighted noise propagation map for the porpoise from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

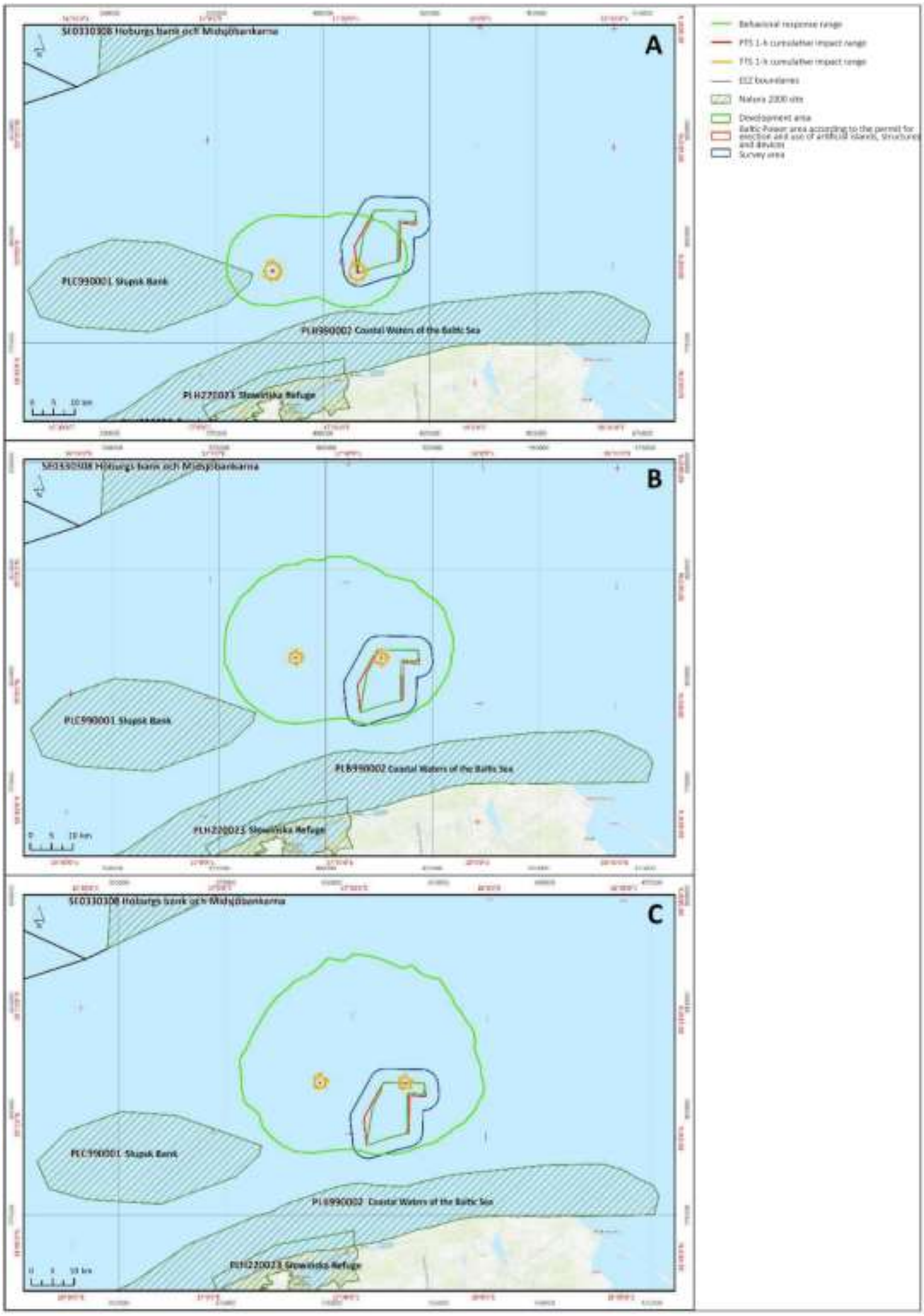


Figure 6.23. *SEL weighted noise propagation map for the porpoise from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

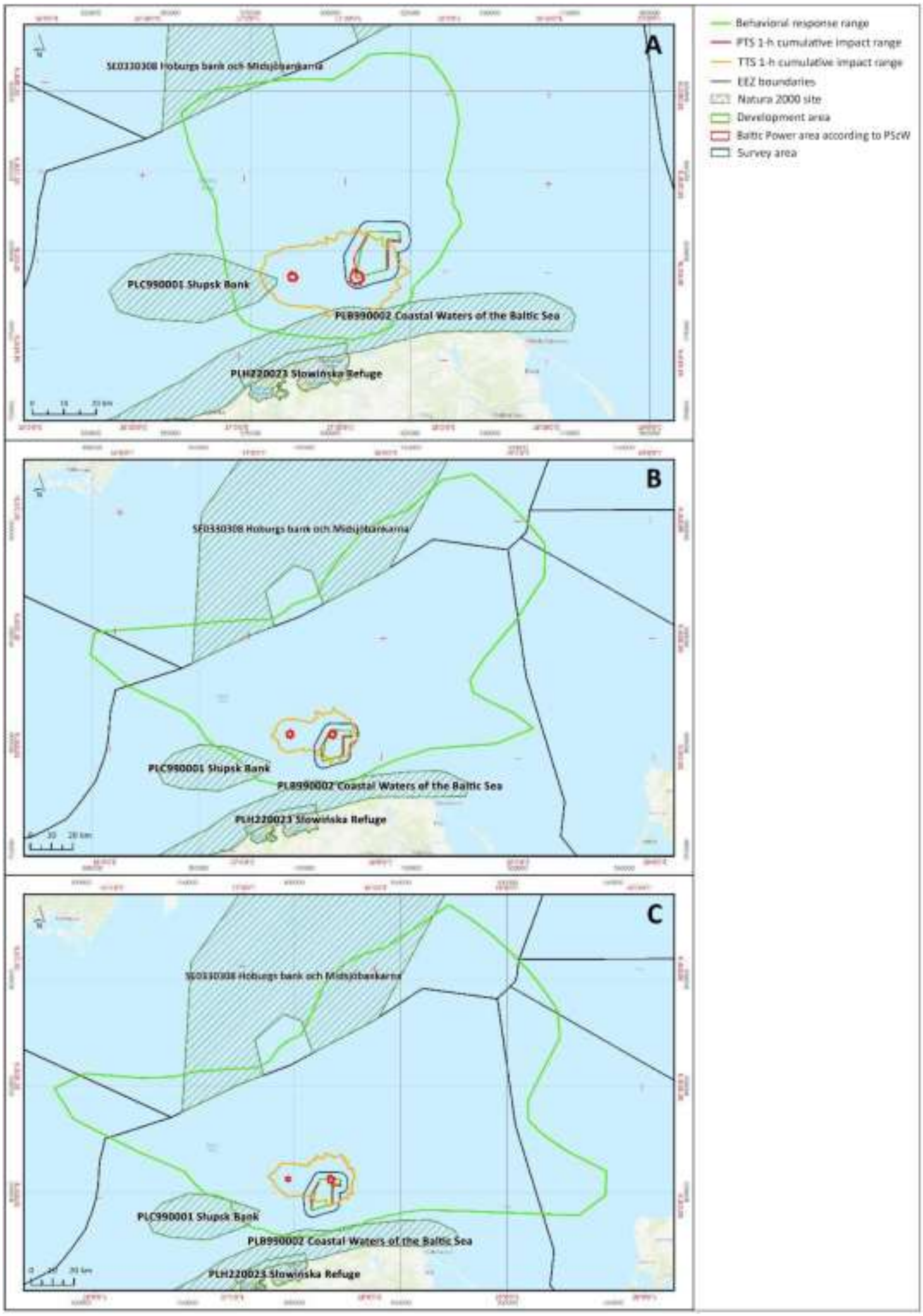


Figure 6.24. *SEL weighted noise propagation map for the porpoise from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD [Source: data of Baltic Power Sp. z o.o.]*

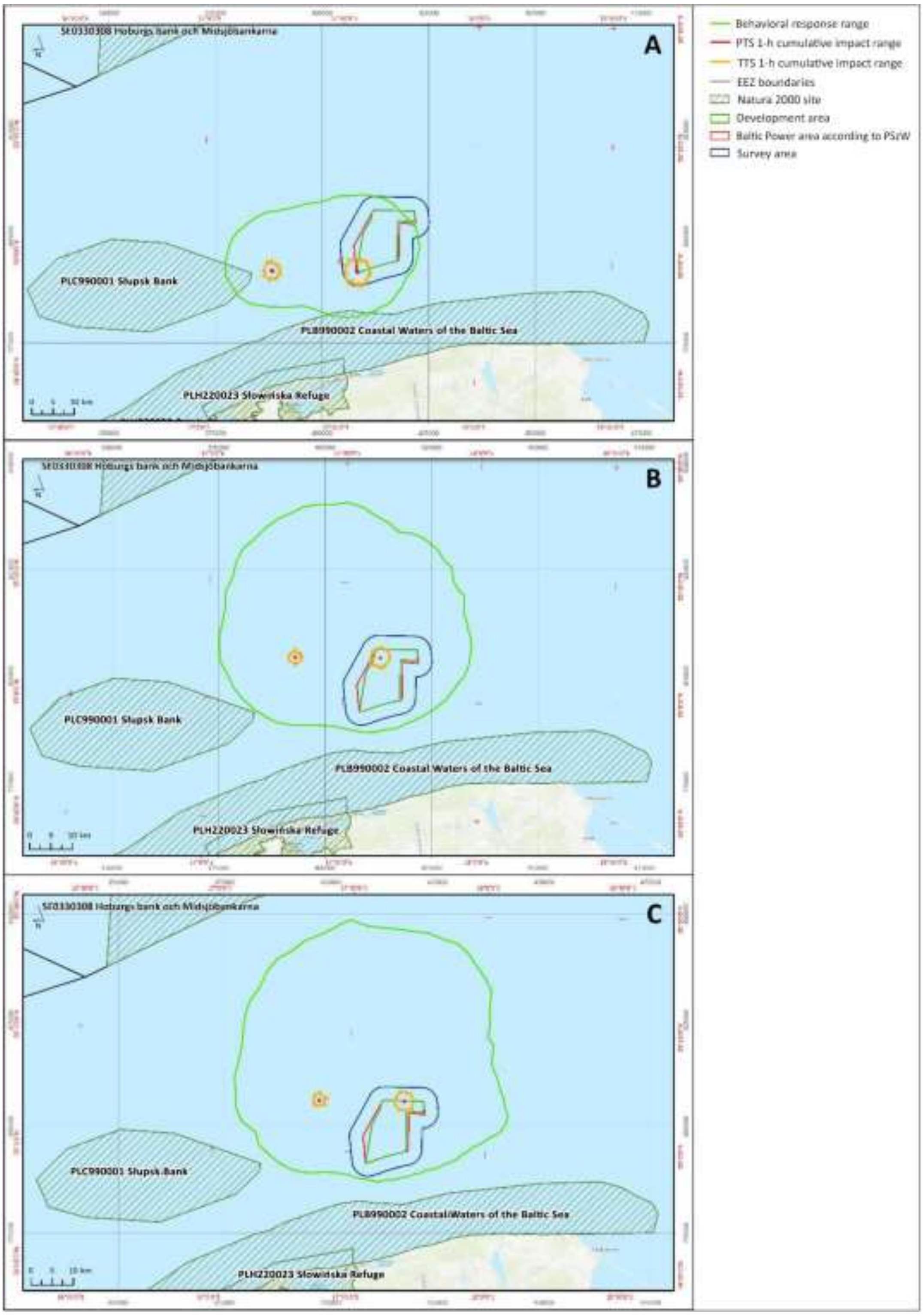


Figure 6.25. *SEL weighted noise propagation map for the porpoise from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for porpoises, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]*

Figure 6.26. SEL unweighted noise propagation map for fish with a swim bladder from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

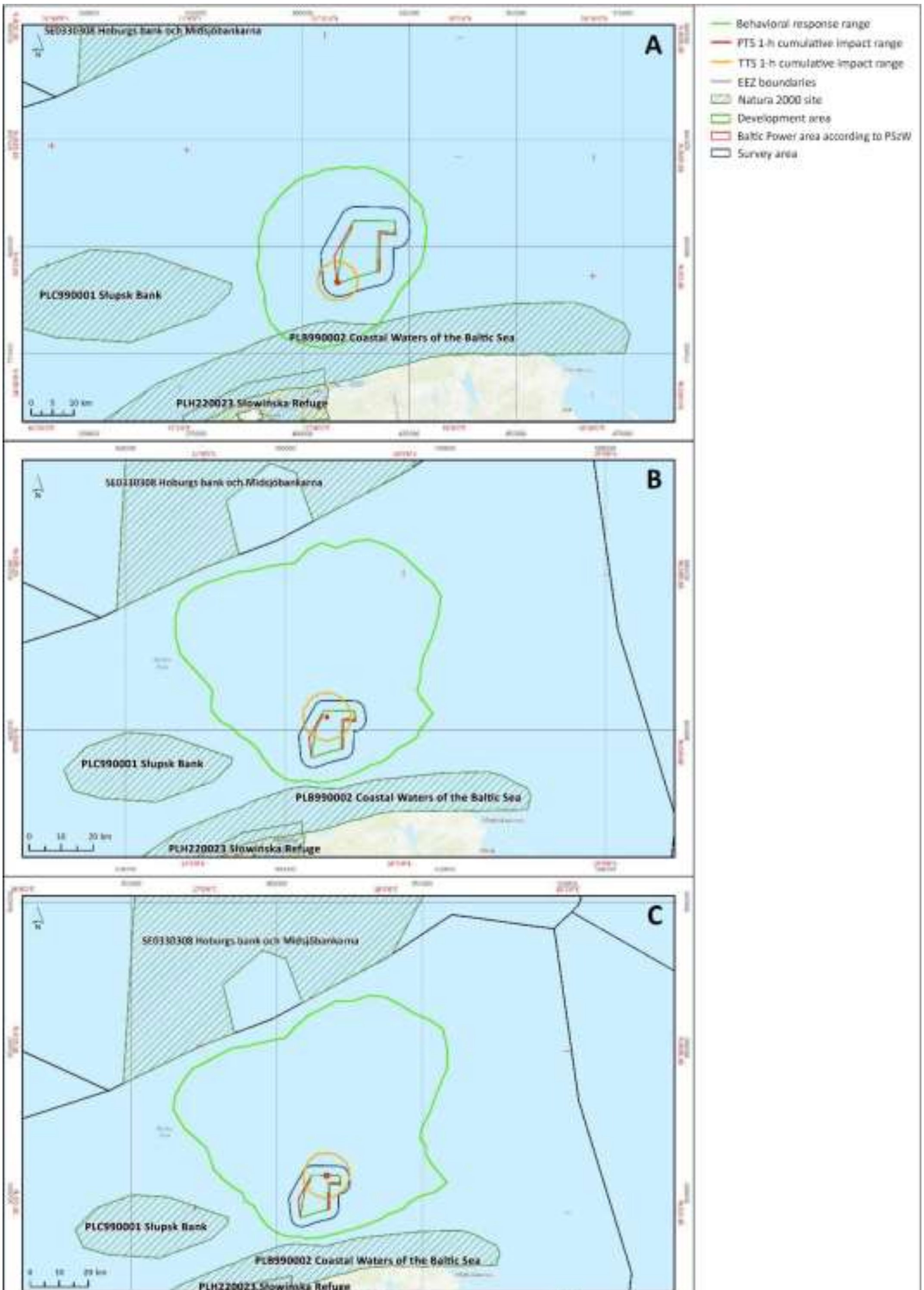


Figure 6.27. SEL weighted noise propagation map for fish with a swim bladder from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

Figure 6.28. *SEL unweighted noise propagation map for fish with a swim bladder from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]*

Figure 6.29. SEL weighted noise propagation map for fish with a swim bladder from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

Figure 6.30. *SEL unweighted noise propagation map for fish with a swim bladder from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]*

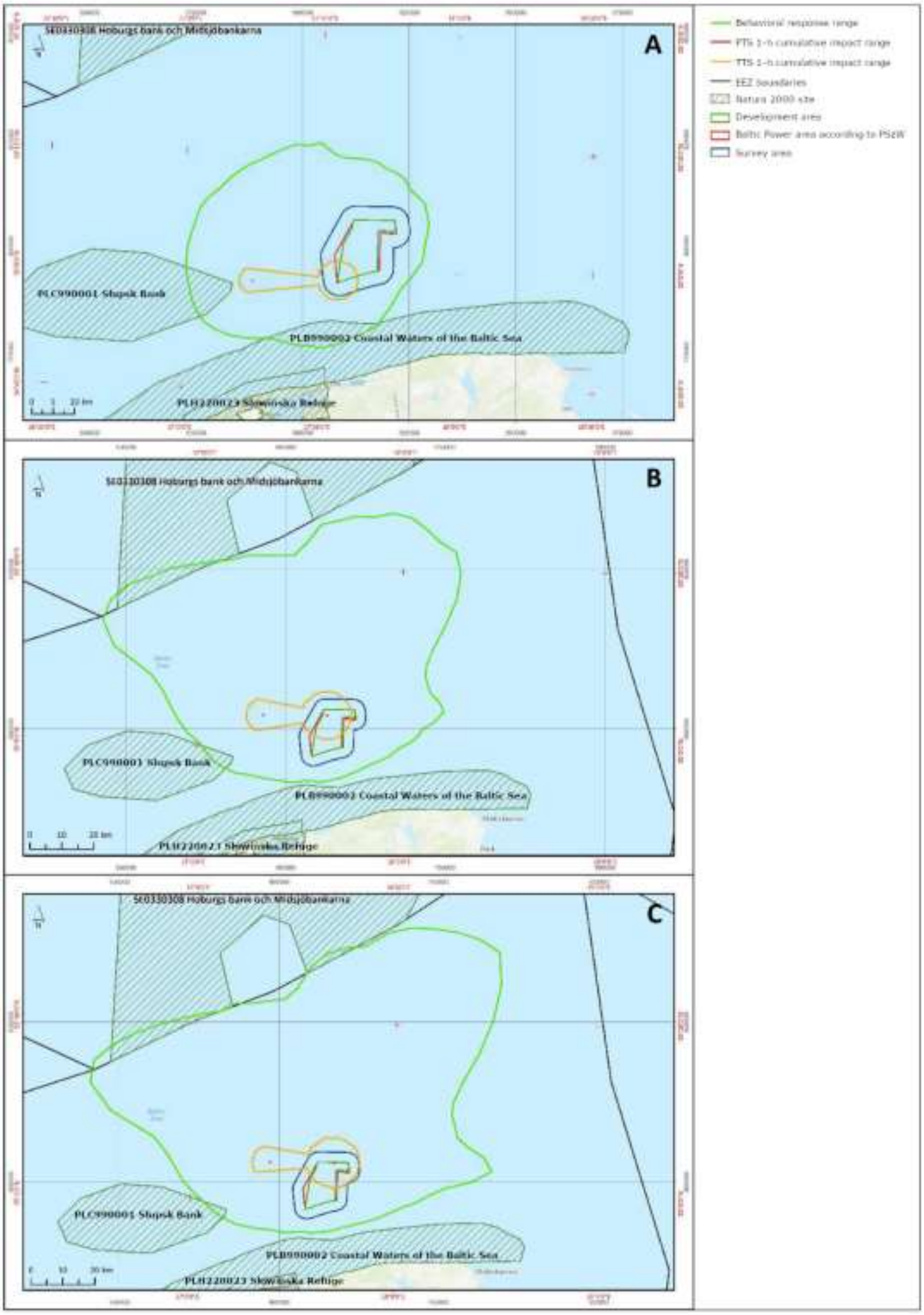


Figure 6.31. SEL weighted noise propagation map for fish with a swim bladder from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish with a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

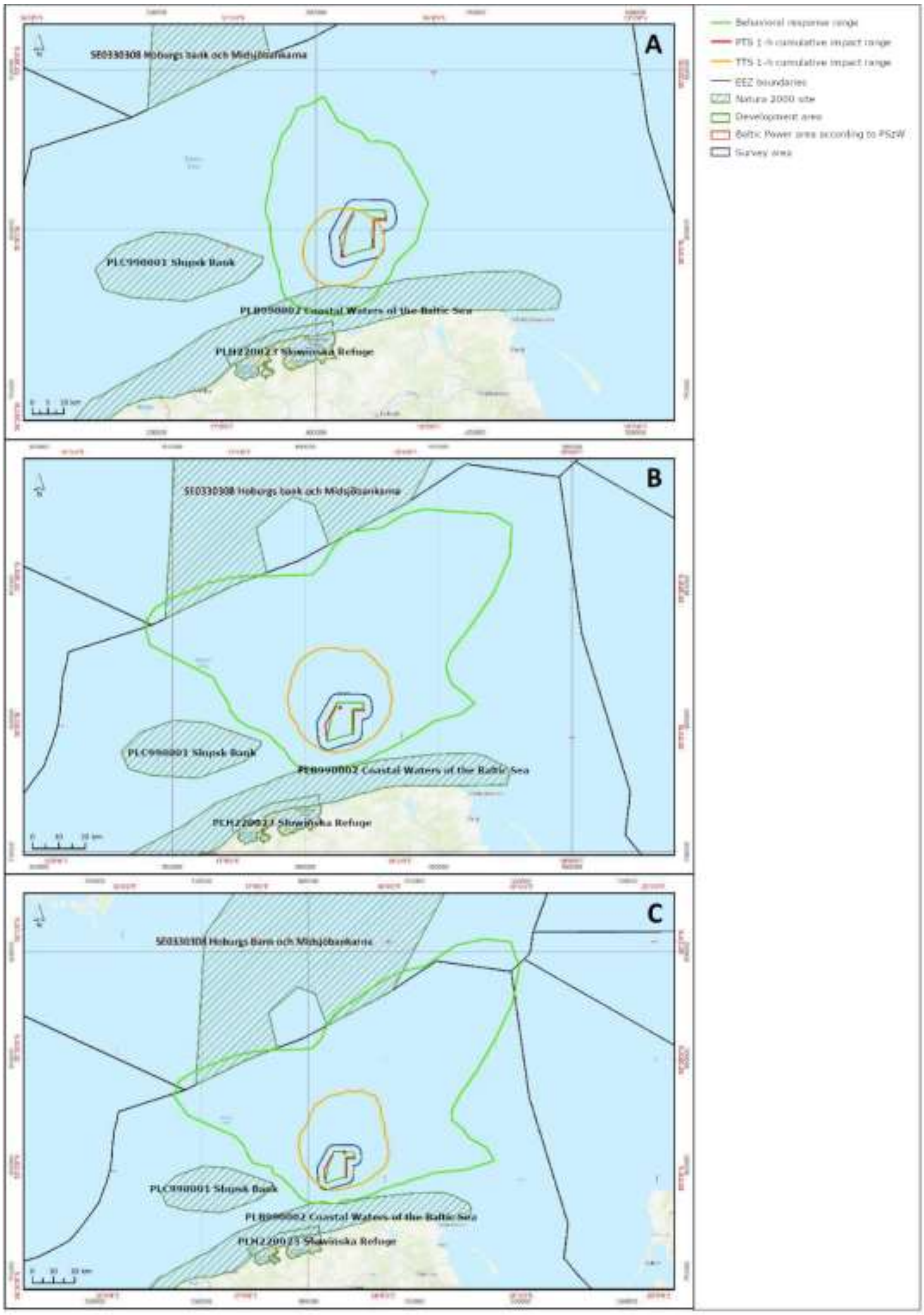


Figure 6.32. SEL unweighted noise propagation map for fish without a swim bladder from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

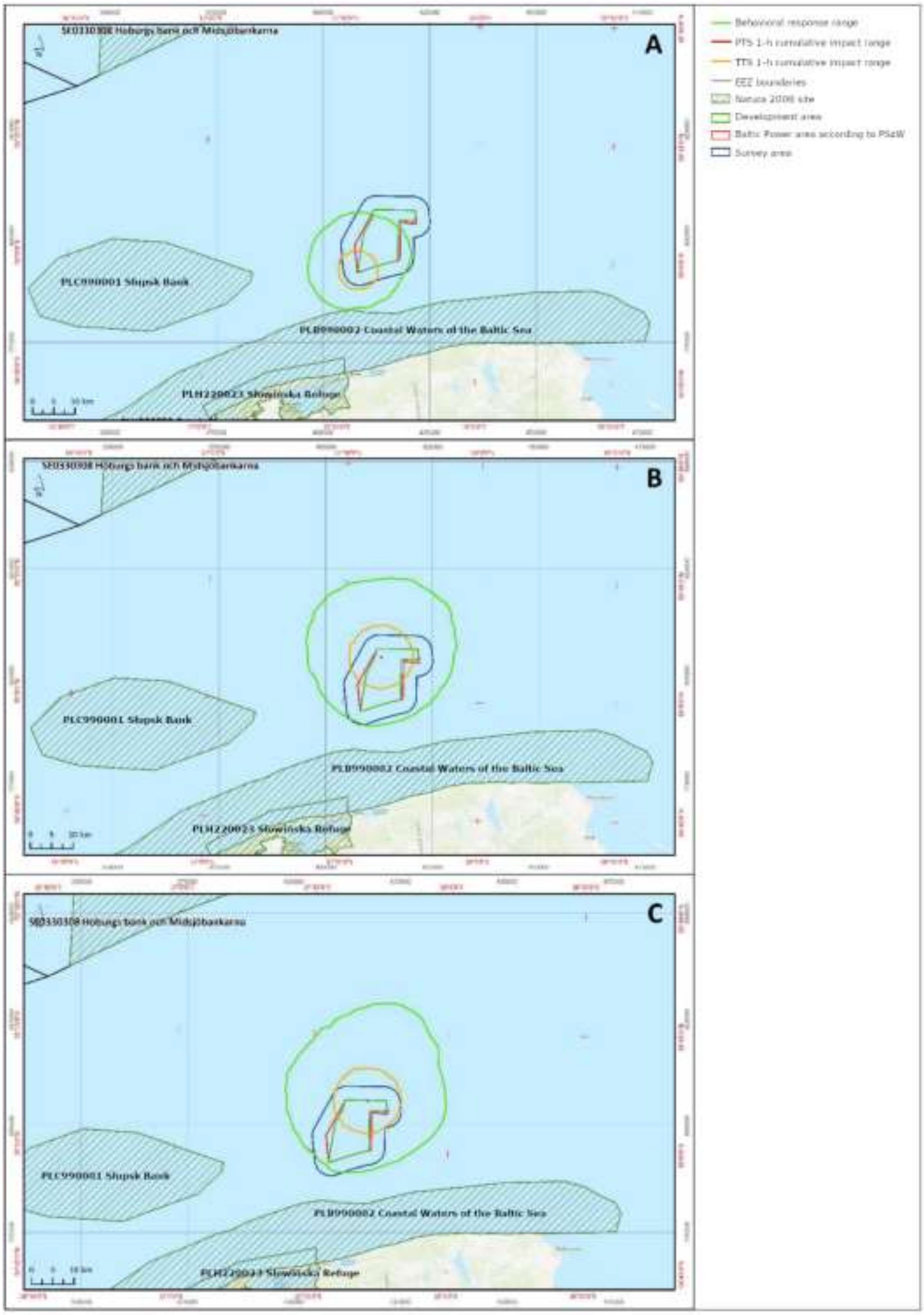


Figure 6.33. SEL weighted noise propagation map for fish without a swim bladder from two close piling sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

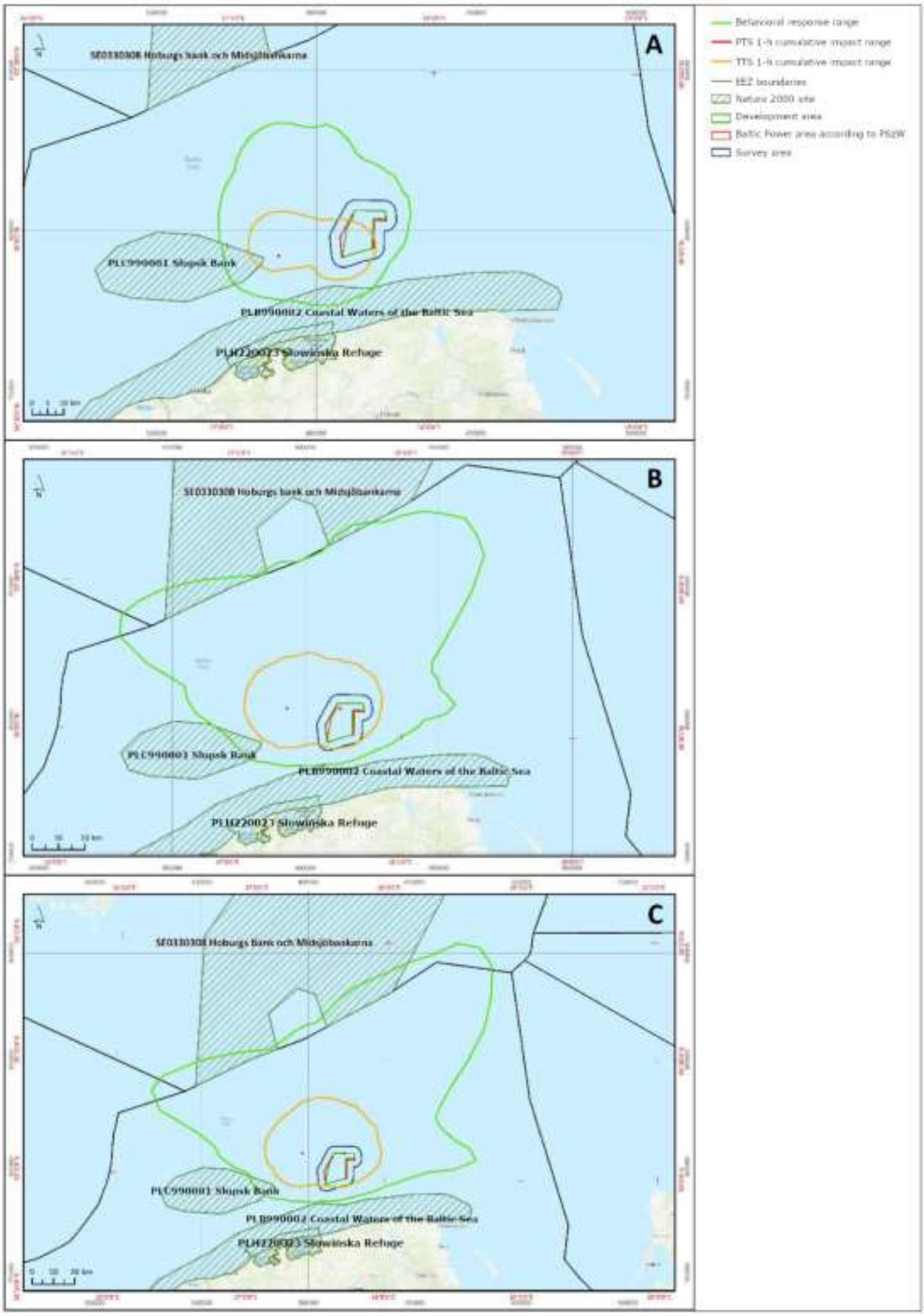


Figure 6.34. SEL unweighted noise propagation map for fish without a swim bladder from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

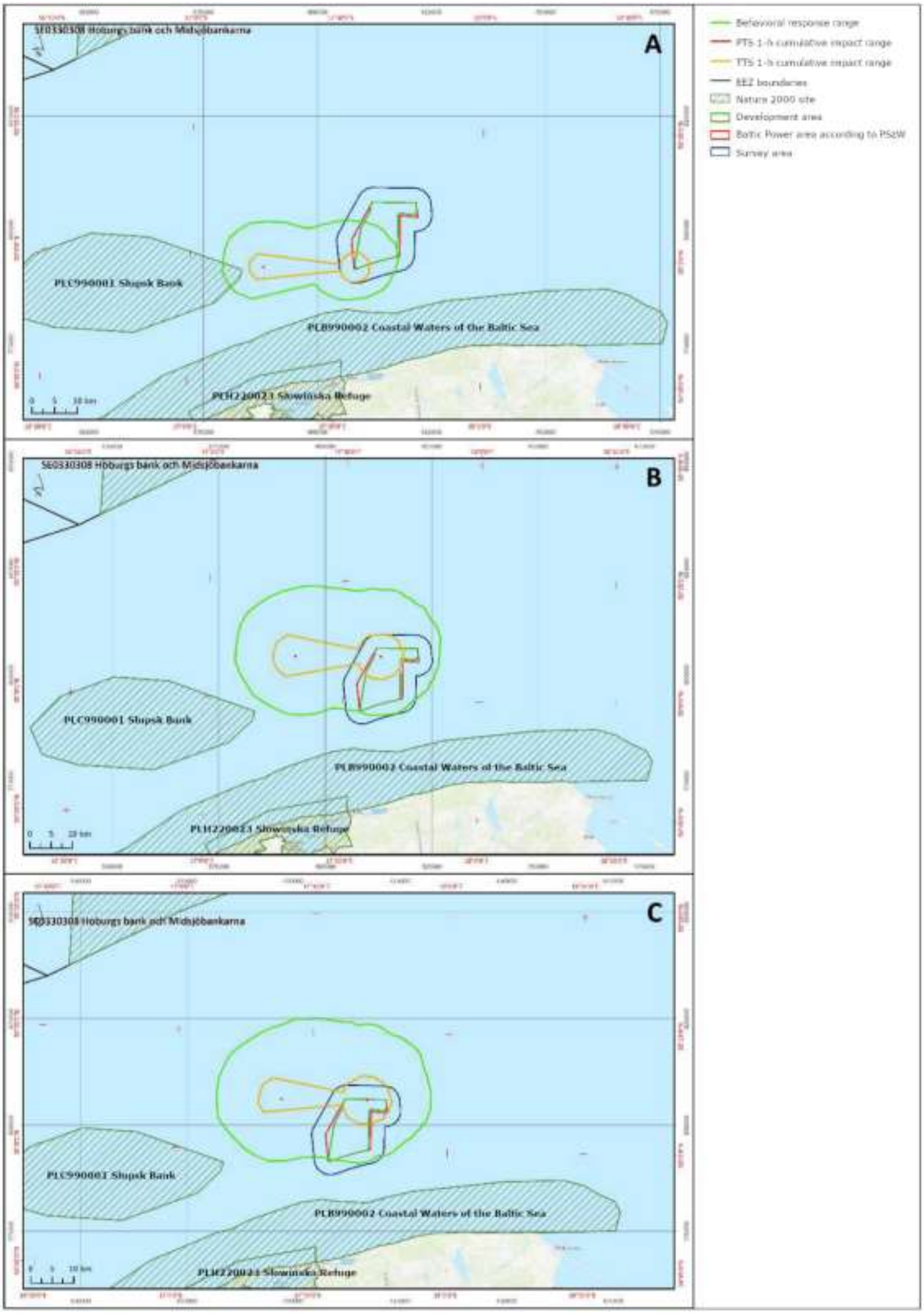


Figure 6.35. SEL weighted noise propagation map for fish without a swim bladder from two piling sources located 20 km (average distance) apart for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

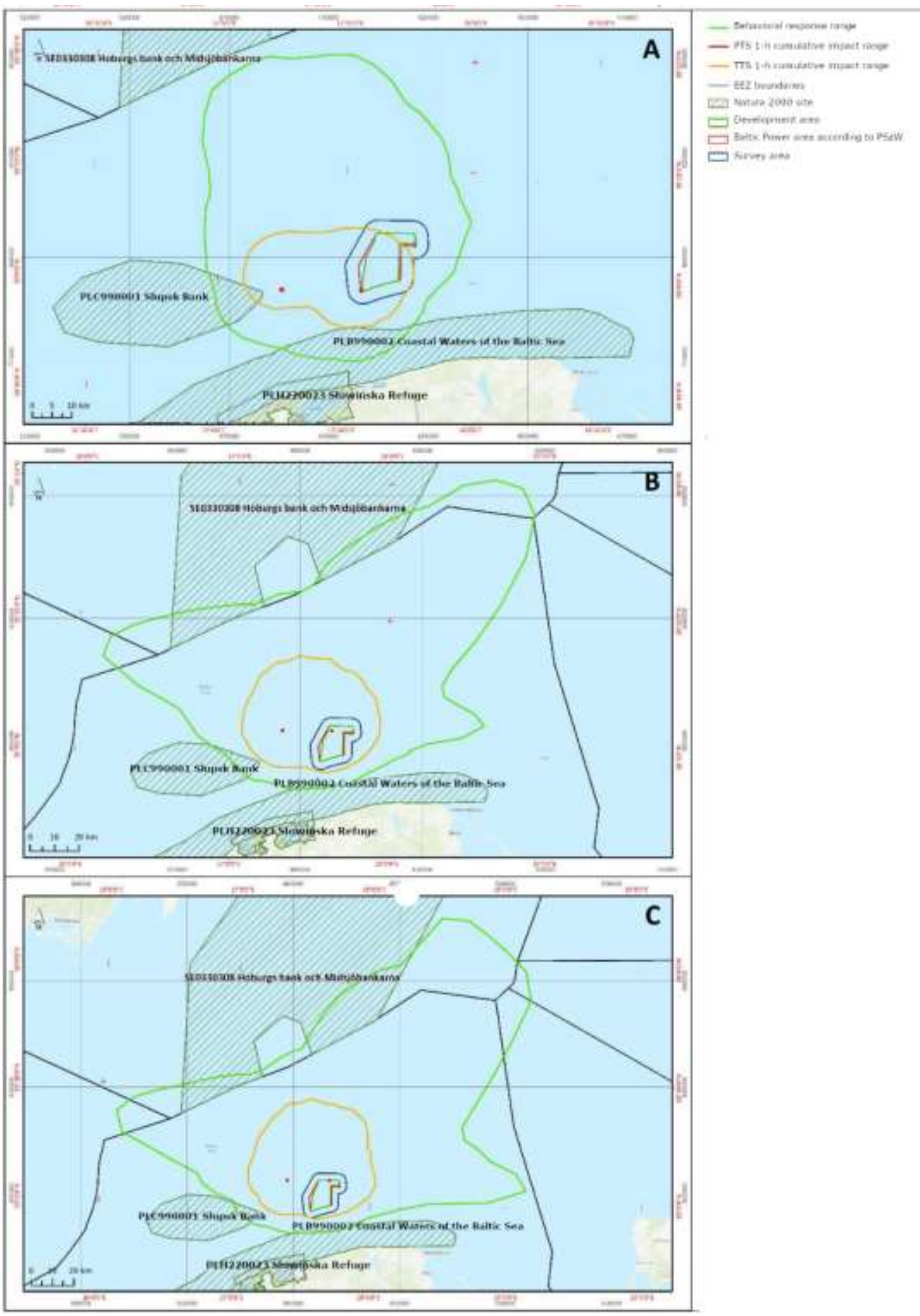


Figure 6.36. SEL unweighted noise propagation map for fish without a swim bladder from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD [Source: data of Baltic Power Sp. z o.o.]

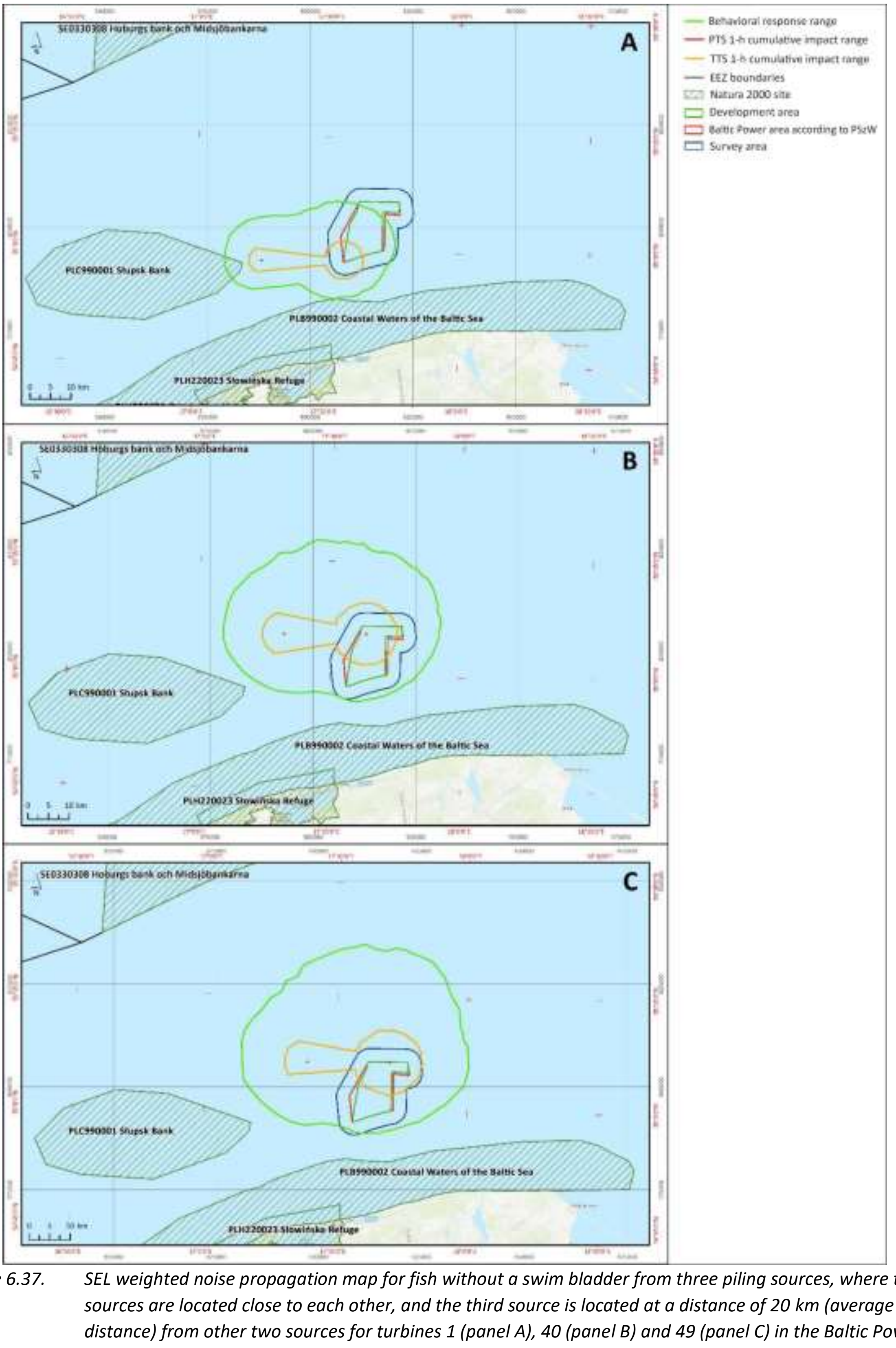


Figure 6.37. SEL weighted noise propagation map for fish without a swim bladder from three piling sources, where two sources are located close to each other, and the third source is located at a distance of 20 km (average distance) from other two sources for turbines 1 (panel A), 40 (panel B) and 49 (panel C) in the Baltic Power OWF Area. The range of impacts was presented for fish without a swim bladder, including use of HSD and DBBC [Source: data of Baltic Power Sp. z o.o.]

6.3.1.1.3 Space disturbances

As a result of the execution of the Baltic Power OWF, large-size structures will be built on the currently undeveloped marine and air space above the maritime area. The height of the wind turbines will be 258.3 m above sea level and the rotor diameter will be 236 m. In the OPA, the number of wind turbines will be 76, and the number of additional structures will be 2.

Compared to the current situation (initial state), construction of such a number of large-size structures in the environment may result in a significant disturbance of the coastal space within the Baltic Power OWF development area. All constructed structures will not form a uniform barrier. The distances between individual wind turbines will be at least 944 m.

When comparing these two areas, they will be occupied to a greater extent within the airspace above the maritime area. The diameter of submerged structures connecting the monopiles with the towers of the wind turbines will be 10 m, whereas the rotor diameter will be 236 m. The occupation of airspace above the maritime area will also vary at different heights of the structure. The area from the sea surface to the height of 22.3 m will not be occupied (excluding parts of the wind turbine towers).

The maritime space, understood as the sea surface including water column, is used by fish, marine mammals and birds sitting on water. Observations carried out in the Danish OWF areas indicate that, due to the possibility of active movement of fish, the construction of structural components in the maritime space does not significantly disturb their migration processes [263]. A similar situation will occur in the case of marine mammals for which the possibility of active movement will cause that sparse arrangement of structural components in the maritime area will not significantly affect their previous behavior. In the case of birds sitting on water, given the minimum distance of the rotor ends from the water surface (20 m), the limitation of space to be used will also be negligible, just like for the submarine space for fish and marine mammals.

The airspace above the maritime area is used by migratory birds or sea birds both in seasonal migrations and in local flights between feeding grounds. Disturbances of these flights may affect the populations of birds subject to protection in Natura 2000 sites – Coastal waters of the Baltic Sea (PLB990002) and Słupsk Bank (PLC990001). In the event of a significant impact of the OWF on birds caused by a disturbance of the airspace, the coherence of the Natura 2000 network could be compromised.

6.3.1.2 Summary of the preliminary assessment

As a result of the preliminary assessment of the impact of the planned project on Natura 2000 sites, given the ranges and nature of impacts, both the Baltic Power OWF and, in the case of the cumulative impact with impacts from other projects, it was indicated that none of the Natura 2000 sites is within the range of significant impacts. The absence of impacts applies in particular to the subjects of protection (species and habitats) within the areas for which protection was established.

In view of the above, the proper assessment of the impact of the Baltic Power OWF on Natura 2000 sites covered the aspect related to the probable impact caused by the disturbance of the airspace over the Baltic Power OWF development area in the context of integrity of the Coastal Waters of the Baltic Sea area (PLB990002) and coherence of the Natura 2000 network.

6.3.2 Proper assessment for the OPA

The Baltic Power OWF operation phase was included in the proper assessment due to the nature of the impact. During this phase, the airspace above the maritime area will be occupied as much as possible by the structures of both wind turbines and substations, so the impact will be the greatest in relation to the remaining phases of the project. During the construction phase, the effect of airspace disturbance will increase from the initial undisturbed state to the maximum state, lasting throughout the entire operation phase. During the decommissioning phase of the project, the situation will be reversed – from the maximum state to the undisturbed state.

6.3.2.1 Natura 2000 network coherence

In the context of protection of the seabird populations within the Natura 2000 network, the following are important features of the areas of Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002):

- the location of these areas along the migration route of the Eurasian seabird populations to their wintering sites;
- the availability of these areas for the populations of wintering birds and resting birds during migration;
- appropriate habitat conditions that make these areas attractive as wintering grounds or resting places during seabird autumn or spring migration.

In the context of maintaining the coherence as part of the Natura 2000 network, it is important above all to maintain the possibility of dislocation of seabird populations between the areas without the risk of significant depletion of the population or significant energy inputs that could affect the ecology and biology, including the survivability of the specimens of those populations.

Currently, prior to the construction of the Baltic Power OWF and other OWF projects in the Polish maritime areas, the conservation status of birds wintering and migrating in the areas of the Słupsk Bank (PLC990001) and the Coastal waters of the Baltic Sea (PLB990002) is appropriate.

The assessment of the impact of the Baltic Power OWF on Natura 2000 sites with respect to birds used the results of ornithological research performed for the EIA Report, information from Standard Data Forms for the areas of the Słupsk Bank (PLC990001) and the Coastal waters of the Baltic Sea (PLB990002), as well as recommendations of the European Commission's Guide "Wind energy developments and Natura 2000".

The results concerning the maximum population of selected bird species in the Baltic Power OWF area and Natura 2000 sites are presented in the table and in the figure (Table 6.17, Figure 6.38). For the comparison, the results of modeling the population during wintering of seabirds in accordance with the adopted standards were used, as long-distance dislocation of birds in the winter period are less likely than in other phenological periods. Therefore, the assessment covered the suitability and importance for seabirds of the Baltic Power OWF area and the neighboring Natura 2000 sites of the Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002) (Table 3.11).

Table 6.17. Comparison of the population of wintering seabirds in the Baltic Power OWF area and Natura 2000 sites

Species	**Population of birds wintering in the areas [individuals]**			
	Baltic Power OWF	**Słupsk Bank (PLC990001)**	**Part of the Coastal Waters of the Baltic Sea area (PLB990002),**	**Total**
Long-tailed duck *Clangula hyemalis*	857	56,656	26,151	83,664
Velvet scoter *Melanitta fusca*	83	28,386	40,957	69,426
Razorbill *Alca torda*	75	51	545	671
European herring	117	164	819	1100

gull *Larus argentatus*				
Black guillemot *Cepphus grylle*	1*	21*	0	22
Common scoter *Melanitta nigra*	0*	0*	19*	19
Total	1133	85,278	68,491	154,902

**Field survey results*

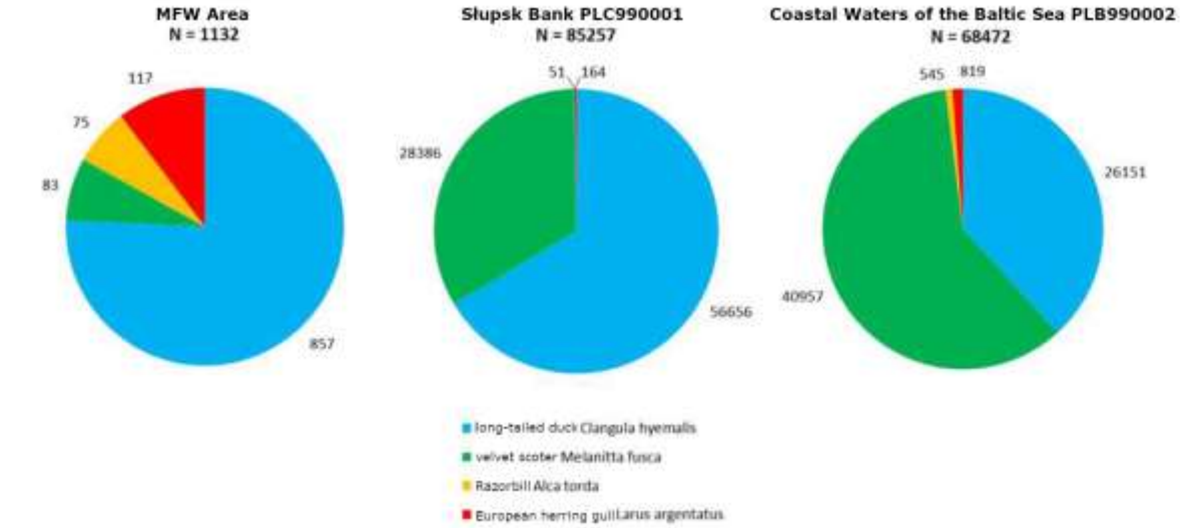


Figure 6.38. Species breakdown of seabirds covered by the assessment within the Baltic Power OWF and Natura 2000 sites [source: data of Baltic Power Sp. z o.o.]

For the comparison, the results of modeling the maximum population of wintering seabirds subject to protection in Natura 2000 sites were used: the long-tailed duck, the velvet scoter, the razorbill, and the European herring gull, prepared as part of the EIA Report. The assessment included also the black guillemot and the common scoter. The black guillemot is subject to protection in the areas of the Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002), but its abundance in the Baltic Power OWF Area was very low. In total, only one specimen was recorded during winter survey campaigns. No black guillemot was found in the Coastal waters of the Baltic Sea area (PLB990002), and 21 specimens were recorded in the Słupsk Bank (PLC990001). It should be noted that these populations refer only to specimens observed along the route of the survey cruise and are not identical to the total number of black guillemots present in these areas.

The common scoter is subject to protection in the Coastal Waters of the Baltic Sea area (PLB990002), but its population in winter in this survey area was very low and amounted to 19 specimens found along the survey cruise route, and it was not recorded in the Baltic Power OWF Area.

The winter period was considered representative as long-distance movements of birds in the winter period are much less likely than in other phenological periods and the abundance of birds is the highest. The Słupsk Bank (PLC990001) and the Coastal waters of the Baltic Sea (PLB990002) areas are located on the migration route of the Eurasian seabird populations to their wintering sites. The local distribution and abundance of birds results mainly from the availability of food. From the point of view of habitat conditions that make these areas attractive, the obtained results clearly show that the Baltic Power OWF Area, in relation to the compared Natura 2000 sites, is used to a much lesser extent by birds. This confirms the value and importance of Natura 2000 sites. Seabirds show strong attachment to the wintering site and are reluctant to move over longer distances [207, 228, 324]. This fact is also confirmed by supplementary studies carried out in 2020 as part of migrations of local overwintering birds. Radar surveys of migratory birds showed that passing birds which overwinter in this part of the Baltic Sea move in all directions without a clear pattern, which is a sign of short flights to feeding grounds rather than long-distance movement. It was found that at observation points located along the Coastal Waters of the Baltic Sea area, birds fly more frequently in the west-south and north-east directions, i.e. along the coastline. The most recorded flights were documented in the strip between the Słupsk Bank and the Coastal Waters of the Baltic Sea Natura 2000 sites.

Although the availability of the Baltic Power OWF Area for the populations of birds wintering and resting during migration and subject to protection in the neighboring Natura 2000 sites will be limited, this impact was assessed as negligible for the long-tailed duck and the European herring gull, and there will be no impact for the black guillemot and the common scoter.

The European herring gulls focus on the open sea in the area where fishing vessels operate. If fishing is limited in this water area during the construction (or subsequent operation) of the Baltic Power OWF, the gulls may move to other sites where fishing will be carried out or use new structures protruding from the sea as resting places. Underwater parts of these structures will act as an artificial reef constituting a hard substrate for the macrozoobenthos – food for birds.

Long-tailed ducks, velvet scoters and razorbills staying in the Baltic Power OWF area before the commencement of construction works will mostly permanently leave this area, moving to the neighboring ones. Populations wintering so far in the areas of the Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002), where better habitats are located, are not at risk due to the significant distance of these areas from the Baltic Power OWF area. The possibility of increasing the density of the long-tailed duck, the velvet scoter and the razorbill in both Natura 2000 sites as a result of the movement of birds previously present in the water region of the planned project will not have a negative impact on them. In the area of the planned OWF, these species occupied suboptimal habitats, mainly due to a too high depth to dive for food, whereas in the Natura 2000 sites, the feeding conditions for the above-mentioned species are optimal, which is indicated by very high values of their density.

Moreover, the existence of corridors (an area free from development) to the west and east of the Baltic Power DA and between the Baltica 2 OWF and the Baltica 3 OWF will significantly increase the possibility of migrating birds flying within offshore wind farms in this area.

To sum up, it should be concluded that given a low population of seabirds in the planned project area, no significant negative impacts of the Baltic Power OWF consisting in the displacement of bird species subject to protection from habitats within the area of the Słupsk Bank (PLC990001) and the Coastal Waters of the Baltic Sea (PLB990002) is expected.

6.3.2.2 Integrity of the Natura 2000 site

Due to the location of the Baltic Power OWF, the issue of the impact of the planned project on the integrity of the Natura 2000 site could be considered in the context of the nearest Natura 2000 site, i.e. the Słupsk Bank area (PLB990002).

The key impact of the Baltic Power OWF on the long-tailed duck is its scaring off and loss of significant habitats where the species winters. As pointed out in the publication of Petersen et al. [337], many years of pre-development and post-development surveys in the Nysted OWF in Denmark show that the long-tailed duck avoids the area of the constructed wind farm. It is also largely displaced from the 2 km zone, and to a lesser extent also from the 2-4 km zone around the boundaries of the area on which the wind turbines are built. The decrease in abundance from the 2-4 km zone was no longer statistically significant.

In this context, the area of the Coastal waters of the Baltic Sea (PLB990002) is quite much away from the Baltic Power OWF area (over 8 km) and, at the same time, these birds will not be scared away from their habitats located in the Coastal waters of the Baltic Sea (PLB990002). Moreover, due to large distances between them and the presence of other suitable habitats at a similar distance, it should not be expected that a large number of birds displaced from the Baltic Power OWF area will move to the Coastal Waters of the Baltic Sea area (PLB990002). Therefore, it is unlikely that in the Coastal Waters of the Baltic Sea area (PLB990002) there will be negative impacts of the OWF associated with the increase in bird density, especially as the population of avifauna in the Baltic Power OWF Area is low. As a result, negative impacts on the Coastal waters of the Baltic Sea area (PLB990002) due to the long-tailed duck scaring and displacement from habitats may be excluded.

To sum up, it should be concluded that the Baltic Power OWF is not expected to cause significant negative impacts consisting in the displacement of bird species subject to protection from the habitats within the Coastal waters of the Baltic Sea area (PLB990002).

6.3.2.3 Summary of the proper assessment

As a result of the proper assessment of the impact of the Baltic Power OWF on the bird species subject to protection in the Słupsk Bank (PLC990001) and Coastal Waters of the Baltic Sea (PLB990002) areas, on the integrity of the Coastal Waters of the Baltic Sea area (PLB990002) and coherence of the Natura 2000 network, it can be concluded that the planned project in the OPA will not cause any significant impacts on the analyzed Natura 2000 sites.

Considering that the Natura 2000 sites may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact of the Baltic Power OWF on them, the significance of this impact is moderate.

6.3.3 Preliminary assessment for the RAO

The primary objective of protection of Natura 2000 areas is to maintain or restore the proper conservation status of species and natural habitats which are being protected and for the protection of which these areas have been designated.

The Baltic Power OWF project in the RAO is not directly related to or necessary for the management of Natura 2000 sites. It follows from these premises that it is necessary to carry out an assessment of the impact on these areas.

An essential element of the preliminary assessment of the impact of the Baltic Power OWF in the RAO on the Natura 2000 areas is to determine whether a given Natura 2000 site is within the range of potential impacts of the Baltic Power OWF.

The main reasons for concluding whether the planned project may have impacts on the Natura 2000 protected area are the distance between this area and the project execution area and the range of the impacts. Due to the specific nature of the functioning of the Natura 2000 sites and possible functional connections between these areas, it is also important to locate the project area in relation to the Natura 2000 sites.

The Baltic Power OWF Area in the RAO is located outside the areas of the European ecological network Natura 2000. Therefore, when determining the impact of the planned project on Natura 2000 sites, impacts that go beyond the Baltic Power OWF Area were assumed, i.e.: (i) increased concentration of suspended matter in water and its sedimentation, (ii) underwater noise, and (iii) space disturbance.

Taking into account that from the nearest structures of the Baltic Power OWF in the RAO, the source of suspended matter generation, to the boundaries of protected habitats, the distance is many times larger than the maximum range of suspended matter sedimentation, there will be no impacts on these habitats, both in the context of changing their boundaries, fragmentation or on their structure and function.

The noise reduction system, which is an integral part of the Baltic Power OWF in the construction phase in the RAO, is aimed at limiting underwater noise generated during piling works to such an extent that it does not exceed the TTS values within Natura 2000 sites where these organisms are subject to protection. It is assumed that in order to avoid significant impacts on Natura 2000 sites for other OWFs, the prerequisite for implementation of these projects will be to meet the underwater noise levels safe for organisms subject to protection in these areas.

As a result of the preliminary assessment of the impact of the planned project on Natura 2000 sites, given the ranges and nature of impacts, both the Baltic Power OWF in the RAO and, in the case of the cumulative impact with impacts from other projects, it was indicated that none of the Natura 2000 sites is within the range of the impacts: (i) increased concentration of suspended matter in water and its sedimentation, and (ii) underwater noise. The absence of these impacts applies in particular to the subjects of protection (species and habitats) within the areas for which protection was established.

The proper assessment of the impact of the Baltic Power OWF in the RAO on Natura 2000 sites covered the aspect related to the probable impact caused by the disturbance of the airspace over the Baltic Power OWF development area in the context of integrity of the Coastal Waters of the Baltic Sea ("Przybrzeżne wody Bałtyku") area (PLB990002) and coherence of the Natura 2000 network.

6.3.4 Proper assessment for the RAO

The operation phase of the Baltic Power OWF in the RAO was included in the proper assessment due to the nature of the impact. During this phase, the airspace above the maritime area will be occupied as much as possible by the structures of both wind turbines and substations, so the impact will be the greatest in relation to the remaining phases of the project.

In the context of the protection of seabird populations within the Natura 2000 network, the following are important features of the Słupsk Bank (PLC990001) and Coastal Waters of the Baltic Sea (PLB990002) areas: (i) the location of these areas along the migration route of birds, (ii) appropriate habitat conditions, and (iii) the availability of these areas for the populations of wintering birds and birds resting during migration.

In the context of maintaining the coherence as part of the Natura 2000 network, it is important above all to maintain the possibility of dislocation of bird populations between the areas without the risk of significant depletion of the population or significant energy inputs that could affect the ecology and biology of those populations.

Although the availability of the Baltic Power OWF Area in the RAO for the populations of birds wintering and resting during migration and subject to protection in the neighboring Natura 2000 sites will be limited, but this impact was assessed as negligible for the long-tailed duck and the European herring gull, and there will be no impact for the black guillemot and the common scoter. Moreover, the existence of corridors (areas free from development) to the west and east of the Baltic Power OWF development area in the RAO and between the

Baltica 2 OWF and the Baltica 3 OWF will significantly increase the possibility of migrating birds flying within offshore wind farms in this area.

Due to the location of the Baltic Power OWF in the RAO, the issue of the impact of the planned project on the integrity of the Natura 2000 site could be considered in the context of the nearest network site, i.e. the Coastal Waters of the Baltic Sea area (PLB990002). The Baltic Power OWF in the RAO is not expected to cause significant negative impacts consisting in the displacement of bird species subject to protection from the habitats within the Coastal Waters of the Baltic Sea area (PLB990002).

As a result of the proper assessment of the impact of the Baltic Power OWF on the bird species subject to protection in the Słupsk Bank (PLC990001) and Coastal Waters of the Baltic Sea (PLB990002) areas, the integrity of the Coastal Waters of the Baltic Sea area (PLB990002) and coherence of the Natura 2000 network, it can be concluded that the planned project, both in the RAO, will not cause any significant impacts on the analyzed Natura 2000 sites.

Considering that the Natura 2000 sites may be classified as receptors of very high sensitivity, and at the same time taking into account the scale of impact of the Baltic Power OWF on them, the significance of this impact is moderate.

7 Cumulative impacts of the planned project (taking into account the existing, implemented and planned projects and activities)

In the assessment of the cumulative impact of the implementation of the Baltic Power OWF in connection with other projects, the projects were included that were implemented, are being implemented or planned. In the case of projects at the planning stage, the ones for which decisions on environmental constraints were issued were taken into account. This made it possible to reference the conducted impact assessment of the Baltic Power OWF to the results of the assessments conducted for other projects in the context of possible effect of accumulation of these impacts.

At present, no other projects that may cause cumulative impacts are being implemented and will not be implemented in the Baltic Power OWF Area. Implementation of the OWF in all its phases, due to the correct and safe functioning of this project, prevents carrying out other activities in the same area. Therefore, the impacts that possibly may accumulate with the impacts of the Baltic Power OWF will have their source outside its area.

7.1 Existing, implemented and planned projects having a decision on environmental conditions

In the POM (Polish maritime areas), there are being implemented or are planned projects related to the extraction of hydrocarbons and gas from under the seabed (Figure 7.1) for which decisions on environmental conditions have been issued, i.e.:

- Return pumping of formation water through selected existing boreholes to the B3 oil reservoir located in the Polish EEZ – existing license No. 108/94 granted by the Minister of Environmental Protection, Natural Resources and Forestry on July 29, 1994 and the "Łeba" mining operations area with the surface area of 31.168 km^2, covering the boundaries of the mining operations area (decision No.: RDOS-22-WOO.6670/62-5/09/AT dated October 19, 2009) (hereinafter referred to as the B3 reservoir);
- Production of the natural gas from undersea B4 and B6 hydrocarbon reservoirs, as well as its transmission to the systems within the area of the CHPP in Władysławowo (decision No.: RDOŚ-Gd-WOO.4211.12.2014.ER.8 dated May 16, 2014) (hereinafter referred to as the B4 and B6 reservoirs);
- Production of oil and associated natural gas from the B8 reservoir located in the area of the Polish EEZ using an offshore rig with the possibility of water pumping into the rock mass (decision No.: RDOŚ-Gd-WOO.4211.16.2015.ER.6 dated August 11, 2015) (hereinafter referred to as the B8 reservoir);

Moreover, eight projects related to construction of the OWF and to the connection infrastructure in the POM (Figure 7.1) have obtained decisions on environmental conditions, i.e.:

- Construction of the Bałtyk Środkowy III OWF (decision No.: RDOŚ-Gd-WOO.4211.12.2015.KP.22 dated July 7, 2016) (Baltic III);
- Construction of the offshore electricity transmission infrastructure (decision No.: RDOS-Gd-WOO.4211.2016.KSZ/AJ.29 dated March 12, 2016);
- Construction of the Polenergia Bałtyk II OWF (decision No.: RDOŚ-Gd-WOO.4211.26.2015.KSZ dated March 27, 2017) (Baltic II);
- Construction of the Baltica OWF (decision No.: RDOŚ-Gd-WOO.4211.21.2017.MJ.PW.AJ.37 dated January 24, 2020) (Baltica 2 and Baltica 3);
- Construction of the FEW Baltic II offshore wind farm (decision No.: WONS- OŚ.420.20.2020.KK.30 of November 30, 2021) (FEW Baltica II);
- Baltica B-2 and B-3 OWF grid connection infrastructure (decision No.: RDOŚ-GD-WOO.420.47.2021.AJ.31

of August 11, 2022);

- Baltic Power Offshore Wind Farm grid connection infrastructure (decision No.: RDOŚ-Gd-WOO.420.16.2021.AJ.36 of September 6, 2022);
- BC-Wind Offshore Wind Farm (decision No.: RDOŚ-Gd-WOO.420.50.2021.KSZ.AM.10 of September 16, 2022) (B-Wind and C-Wind).

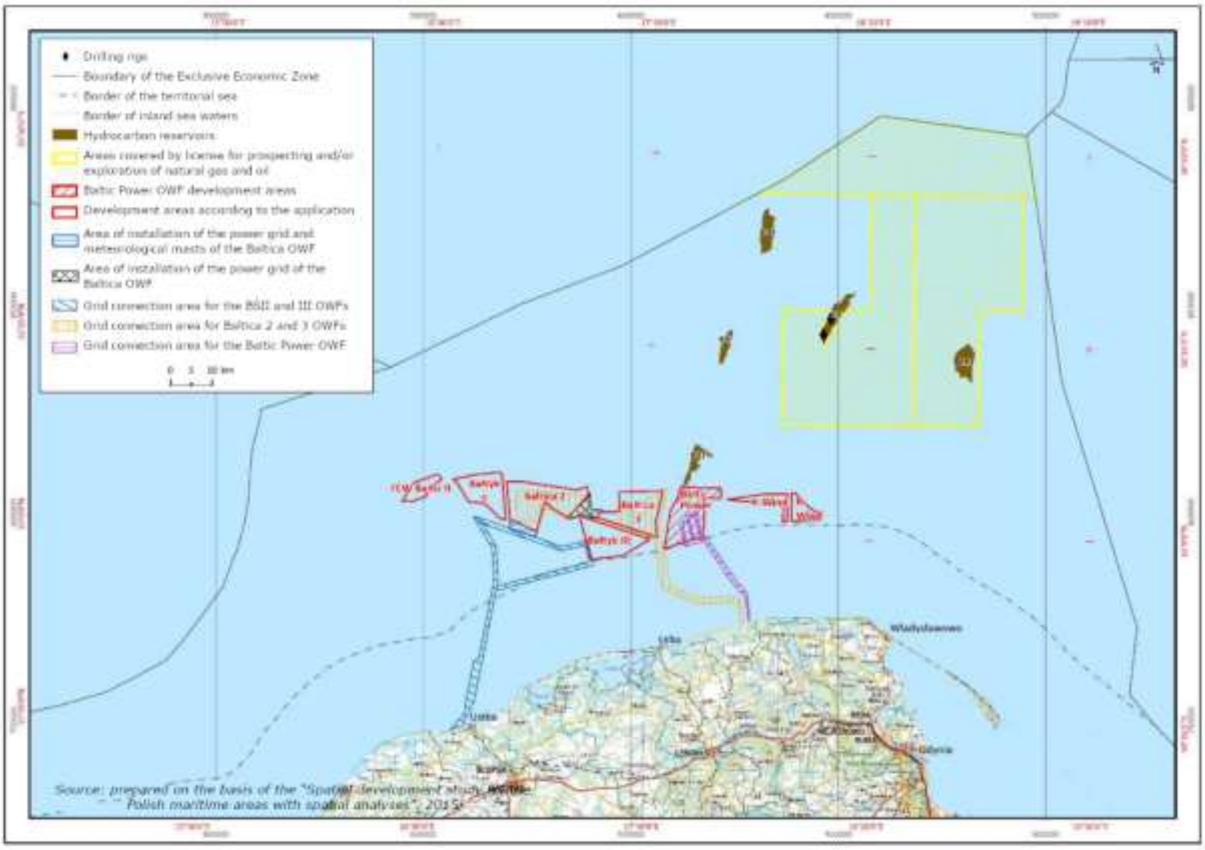


Figure 7.1. Site location of the Baltic Power OWF Area in the vicinity of other projects located in the Polish maritime areas holding a decision on environmental conditions [Source: own study]

Currently, preparatory works are in progress before commencing the OWF construction phases. They are at different stages of progress at different Investors, therefore, among others, the dates of construction works commencement and their detailed schedules are unknown. The possibility of cumulative impact occurrence at the construction phase, due to the temporary limitation of the impacts themselves, may take place only in the case of carrying simultaneous or short time interval works of the same nature. With the general assumption of all Investors that their OWF construction phase will last several years, it is not possible to clearly indicate which activities will be performed simultaneously or in a short time interval. However, taking into account the fact that OWF projects of different Investors will be implemented independently, it cannot be excluded, based on the precautionary principle, that these cumulative impacts will not occur.

After completion of the construction phases, the operation phases of individual OWFs will start. As a last resort, the beginning of the operation phase at the last of the above-mentioned Investors will cause the highest possible cumulative impact resulting from the cumulation of individual impacts indicated for this project phase.

In the case of the OWF decommissioning phases, both the time and the scale of their implementation are currently unknown. With the assumed OWF lifetime, the decommissioning phases will start in several dozen years. The environmental impacts associated with this phase will be of a different nature and will be not be greater than in the case of the construction and operation phases. As a result of commencing the removal of the above-water structures, the space will be gradually released until the original condition is restored. Also the removal of underwater structures will be a process of gradual restoration of the condition prior to the OWF construction phase. Assuming that the OWF decommissioning process will be a long-term process, carried out in accordance with the applicable regulations and safety standards with respect to the vessels used, and that all disassembled structural components will be transported to land and subjected to treatment there, it may be indicated that even in the case of simultaneous decommissioning in several locations as part of one or several OWFs, no cumulative impacts will occur.

7.2 Types of impacts that may cause cumulative impacts

Assessment of impacts of the Baltic Power OWF on individual items of the environment, including their range and significance, is presented in chapter 6. Cumulative impacts of the Baltic Power OWF with other projects implemented in the POM may occur, if the activities generating similar impacts are carried out simultaneously. In the case of impacts that have been classified as temporary, simultaneous implementation of the same activities by different Investors should be considered as rare. Also the impacts that have been identified as local will not cause cumulative impacts, as in most cases their range will not exceed the Baltic Power OWF Area.

In view of the above, in the impacts of the Baltic Power OWF that may cause cumulative impacts with other projects impacts were included that are at least medium-term and their impact range exceeds beyond the Baltic Power Area, i.e.:

- underwater noise;
- increase of the suspended matter concentration and its sedimentation;
- landscape disturbances;
- disturbances in radar operation;
- restrictions on fishing.

The first two indicated impacts will occur during the construction phase, while the others will occur during the operation phase.

7.3 Identification of projects that may cause cumulative impacts

The above-mentioned projects, which were granted the decisions on environmental constraints, can be divided into two groups, i.e. related to the extraction of hydrocarbons and gas as well as those related to the generation of wind energy in maritime areas. Each of these groups of projects is characterized by its specificity, including also various environmental impacts – with respect to their type, range, time scope and scale.

The environmental decisions for the projects related to the extraction of hydrocarbons and gas indicate their impacts and significance. In the context of the impacts characterizing the Baltic Power OWF, which may cause cumulative impacts, the impacts related to the extraction of hydrocarbons and gas are insignificant to the extent that they will not cause any cumulative impacts.

The decision on environmental constraints for the B8 Reservoir indicates that the noise related to the operation of machinery on the rig will not be emitted to water, therefore no harmful impact on the marine environment is expected. Similarly, for B4 and B6 Reservoirs and B3 Reservoir, the impact of noise generated during works related to these projects will be irrelevant. In the case of B4 and B6 Reservoirs, it was indicated that laying the gas pipeline will only cause local and periodic water turbidity in the direct vicinity of the works being performed. Table (Table 7.1) contains provisions included in individual decisions on environmental constraints, indicating possible impacts resulting from the implementation of these projects.

Table 7.1. Provisions included in the decisions on environmental constraints for projects: B3 Reservoir, B4 and B6 Reservoirs and B8 Reservoir in the context of environmental impacts [Source: own study based on issued decisions on environmental constraints]

Project	Provisions of the decisions on environmental constraints
B3 Reservoir	Emission of noise to the environment, related to the operation of pumps and other equipment included in the Water Treatment and Pumping Plant. The noise intensity applies to the area limited by the structure of the drilling rig. The noise has no hazardous impact on the surroundings and water environment and as such it is not emitted to the waters around the drilling rig.
B4 and B6 Reservoirs	Since the planned boreholes will be drilled one by one by the same drilling rig, no accumulated impact is expected from the execution of planned production boreholes on B4 and B6 reservoirs and from prospecting and exploratory drillings on neighboring lands covered be exploratory licenses.
	Pursuant to the results of the EIA Report, undersea noise emitted in connection with the planned works will not exceed the background parameters.
	Impact on ichthyofauna will consist of the local and periodic water turbidity during the excavations execution and the gas pipeline backfilling that may have an impact especially on the individuals in the early development stage. It was ordered to abandon the works in the spawning seasons of species permanently present or moving for spawning season in the area of works being performed.
	No negative impact on marine mammals is expected due to the low probability of their occurrence in the area of works.
B8 Reservoir	No negative impact of the B8 reservoir, including the pumping of formation water, on the geological structure and pollution of seabed sediments in the production area is expected.
	No noise related to the operation of machinery on the rig will be emitted to water, therefore no harmful impact on the environment and marine environment is expected.

In the case of implementing seven OWFs, i.e. FEW Baltic II, Bałtyk III, Bałtyk II, Baltica 2, Baltica 3, B-Wind and C-Wind, due to the similar nature of the projects and their almost identical impacts and relatively close location, cumulative impacts may occur. Each of these projects allows for a similar method of foundation of wind turbines and installation of large-size structures above the water surface. Moreover, regardless of the date of construction works commencement, the operation phase of each of these projects is planned for several dozen years, which indicates that from a specific time, the related environmental impact may occur.

7.4 Assessment of cumulative impacts for the OPA

7.4.1 Underwater noise

The assessment of cumulative impacts generated as a result of foundation piling for wind turbines in the Baltic Power OWF Area, at simultaneous piling in the areas of Bałtyk II, Bałtyk III and Baltica are described in detail in Appendix 3. The modeling took into account different possible scenarios of simultaneous piling as well as two types of activities, i.e. HSD and DBBC. Based on the results obtained, it was found that taking into account the HSD type shield, in the case of turbines 40 and 49, a significant impact related to the behavioral response in porpoises is recorded. The analysis showed that this effect can be reduced to moderate if the double action of HSD and DBBC is used.

7.4.2 Increase of suspended matter content and its sedimentation

The issues of increased concentration of the suspended matter and its sedimentation in the context of cumulative impacts of the Baltic Power OWF with Bałtyk II, Bałtyk III, Baltica 2, Baltica 3, FEW Baltic II, B-Wind and C-Wind may be characterized on the basis of the results of modeling of suspended matter propagation presented in Appendix No. 2 to the EIA Report. From the calculations made, it can be indicated that in the case of concentration of suspended matter in water, the greatest impact ranges from approx. 2000 m and lasts for at most several hours, whereas in the case of sedimentation, layers of at most 0.5 mm will be deposited already at a distance of 500 m from the performance of works on the seabed. This means that only for the works carried out on the perimeter of the Baltic Power DA, there may be accumulation of impacts related to the content of suspended matter provided that there are sea currents in opposite directions. In practice, such a case does not occur. Additionally, it should be noted that there would still have to be an event of simultaneous performance of works on different OWFs in the immediate vicinity.

Based on the conducted model calculations, it was found that the cumulative effect of the increase in suspended matter content is possible as a result of various anthropogenic activities in the construction phase, but the cumulative impacts will be local and short-term.

Additionally, if works disturbing seabed sediments are carried out in two locations 4 km away from each other on non-cohesive soils, the cumulative impacts do not occur, and on cohesive soils these impact are negligible already at a distance of 1 km.

Due to the temporal and spatial separation between the activities carried out within the OWF and in the area of the external connection infrastructure, there will be no cumulative impacts as a result of the increase in the suspended matter content and its sedimentation.

7.4.3 Space disturbances

7.4.3.1 Physical barrier creation

The space disturbance created as a result of the construction of the OWF is due to the presence of the structure above the water surface, in the water areas free from any physical obstacles to date. Formal conditions indicated in the Permit for erection and use of artificial islands, structures and equipment (PSZW) for the Baltic Power OWF as well as other OWFs introduce restrictions on the possibility of this development. They indicate that the distances between individual offshore power plants may not be smaller than four times the diameter of the rotors. Therefore, the space disturbed is practically limited to the range of rotors operating height. Thus, within the Baltic Power OWF and on other OWFs, there will be a partial, long-term (limited to the operational time) reduction in the use of airspace. Undisturbed space will remain within all OWF development areas (between individual wind turbines and accompanying structures) and around individual OWF areas. Non-continuous nature of development, with significant distances between individual OWF structures (at least 944 m), will make the space disturbance non-continuous and uneven. This unevenness will also occur within the structures themselves. The greatest space disturbance will occur within the operating range of the rotor, i.e. above 20 m above the water surface.

Airspace above maritime areas is regularly used by birds, including in particular migratory birds. If it is disturbed by the creation of a physical barrier, it will have to be avoided, both by spring and autumn migration.

Similarly as in the case of fishing, taking into account the significance of the potential cumulative impact of the OWF on migratory birds, these OWFs, for which the decision on environmental conditions have been issued (Bałtyk II, Baltica 2, Bałtyk III, Baltica 3, FEW Baltic II, B-Wind and C-Wind) were taken into account for the assessment of these impacts. Upon construction of the last of the indicated OWFs, there will be a maximum space disturbance caused by the presence of the above-water structures located in a significant area covering 113.72 km^2.

When assessing the cumulative impacts of the OWF, in accordance with the worst-case scenario principle, the condition in which the operational phase of the last of them will start was taken into account. This condition will make the barrier effect the greatest.

The creation of a physical barrier has an impact on long-distance migrating bird species by changing the route and altitude of their flight, which in turn causes an increase in energy expenditure. To determine the quantitative impact of the barrier effect of the Baltic Power OWF and other planned projects in this region, the migration route was modified assuming that migratory birds will perceive the OWF areas as a physical barrier that they will avoid at a distance of approx. 1–2 km. Energy costs taking into account the route modification were calculated by including the aerodynamic principle in the calculation of energy expenditures of individual migratory bird species found in the area, while the data concerning the span and surface of wings and body weight before the commencement of migration were taken from professional literature. Detailed results of model calculations and assessment of the impact of the physical barrier on migratory birds are included in Appendix No. 4 to the EIA Report. Taking into account the investment projects related to the wind energy in the central part of the southern Baltic Sea (PZPPOM water regions: POM.43.E, POM.44.E, POM.45.E and POM.46.E) and assuming that they will be implemented, it can be indicated that a build-up space with a length of approx. 130 km will be developed. For birds migrating in accordance with the prevailing migration directions in this area, the actual width of the barrier will amount to approx. 90 km. Space disturbance in such a long section of maritime areas could lead to a significant disturbance in bird migration.

The development of this space will vary and will depend on the location of wind turbines on individual wind farms. The space between the Baltica 2 OWF and Baltica 3 OWF areas shall remain free from any developments, in accordance with the decision on environmental conditions for the Baltica OWF [104]. This area will enable migration of migratory birds from and to the Słupsk Bank area. It constitutes a real division of the OWF development area line. In order to further divide the OWF development line, it is important to plan further areas free from any developments in the area of the created barrier, in particular between the Baltica 3 OWF and the Baltic Power OWF. Moving the development area away from the western boundary of the Permit for erection and use of artificial islands, structures and equipment for the Baltic Power OWF will bring the area free from any development closer to the prevailing direction of birds passage in this area, and at the same time it will extend this area in its narrowest section. Assuming that the optimal width of the corridor between the development areas is 4 km and taking into account the relatively close location of the corridor between the Baltica 2 OWF and the Baltica 3 OWF from the area between the Baltica 3 OWF and the Baltic Power OWF, it can be assumed that this area will have an auxiliary role for the passage of birds during their migration, taking over the migration flow of less sensitive species.

Taking into account the possibility of further separation of the OWF development line in the eastern direction, it is justified to consider designation of an area free from any developments with a width of 4 km along its entire route to the east from the Baltic Power DA. Such a corridor could be limited by its western border, based on the extreme eastern point of the Baltic Power DA and the south-eastern point of the breaking of the Baltic Power DA border. This corridor would be an optimal area in terms of width and direction for passages of migratory birds. The creation of this corridor, in connection with the corridor between the Baltica 2 OWF and the Baltica 3 OWF and the corridor between the Baltica 3 OWF and the Baltic Power OWF of secondary importance for birds, will create in this area a system of area free from any developments, enabling movement of birds in a manner minimizing potential disturbances of their migration.

At present, without full knowledge in terms of possible behavior of birds in the context of such an extensive space disturbance used by them during migration periods and taking into account the precautionary principle, the above proposed system of migration corridors to the west and east of the Baltic Power DA can be considered as a solution beneficial from the point of view of birds using this area both in migration and in local movements.

On the basis of the conducted research and using the solution consisting in leaving the proposed areas (corridors) free from any development between the OWF, the significance of the cumulative impact in the form of a physical barrier was assessed at most as of little importance.

7.4.3.2 Landscape disturbances

Landscape disturbances in case of cumulative impact related to simultaneous operation of the Baltic Power, Baltica, Bałtyk II, Bałtyk III, FEW Baltic II and BC-Wind OWFs, as it was described in the sub-chapter 6.1.2.9, depend, to the greatest extent, on the weather conditions – visibility and the Earth curvature.

Figure (Figure 7.2) shows the number of hours per year for a given visibility (how often it happens that visibility is greater than a specific value) based on data from the atmospheric model UMPL (Unified Model for Poland) (calculated by the University of Warsaw Interdisciplinary Center for Mathematical and Computational Modeling – data from approx. 5 years). These values are shown for 4 locations – Łeba, Lubiatowo, Dębki and Jastrzębia Góra. The charts clearly show that in the case of Jastrzębia Góra there will be no situation in which the Baltic Power, Baltica, Bałtyk II and Bałtyk III OWFs will be visible from this place. In the case of Łeba, single wind turbines may be visible even for approx. 5,000 hours per year, but 50% of wind turbines installed in these OWFs may be visible for a very short period of time (several dozen hours per year). In the case of Lubiatowo, single wind turbines may be visible for more than 5,000 hours per year, and 25% of wind turbines installed in the OWFs subject to assessment may be visible for up to 500 hours per year. An observer from Dębki can see individual wind turbines almost 1,000 hours per year, but in practice, they will never see more than 25% of the installed wind turbines.

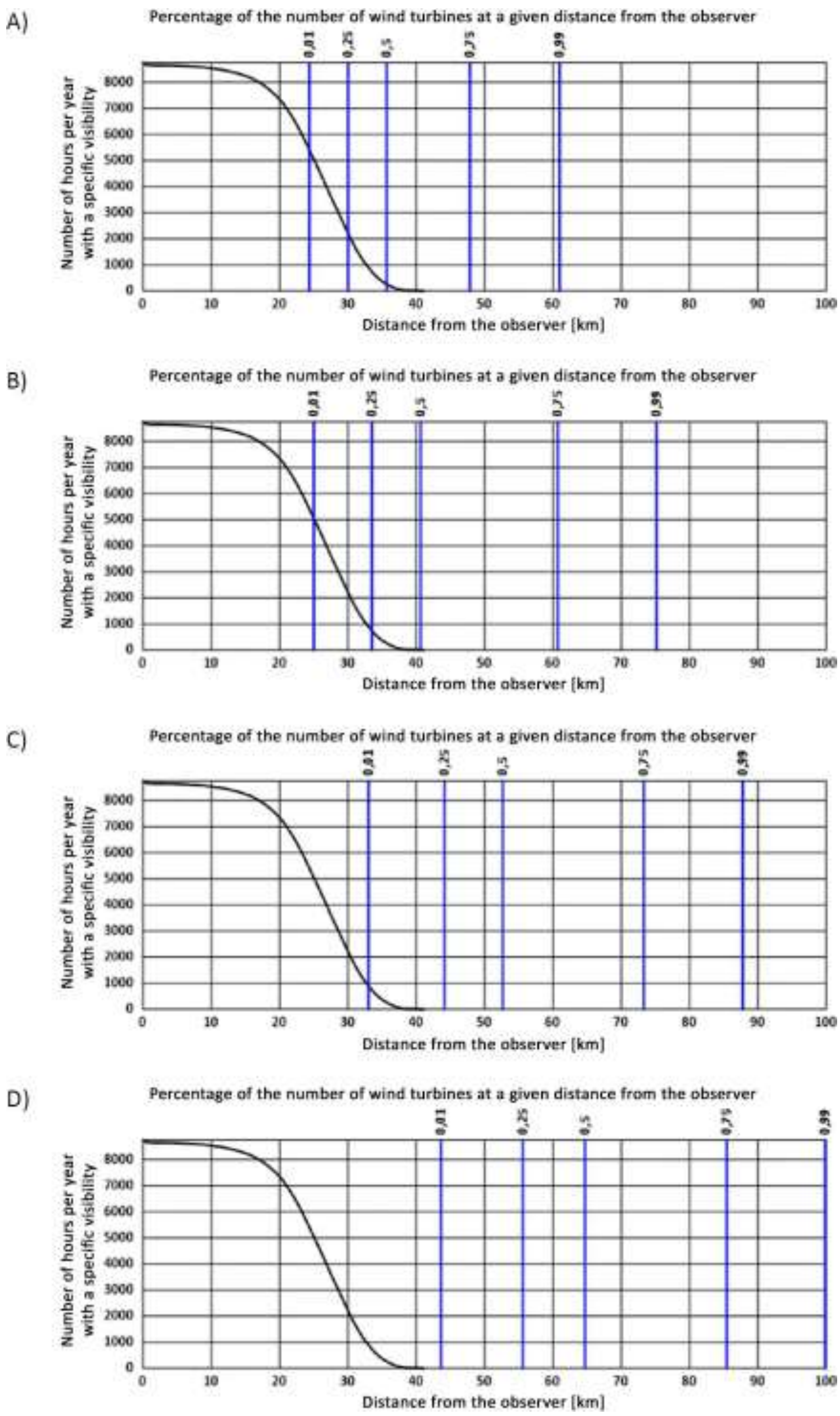


Figure 7.2. Number of hours per year for the preset visibility (distance from the observer) together with marked distances of offshore wind turbines in the option proposed by the Applicant in the cumulative version with the Baltica, BŚ II and BŚ III OWFs (assumed total number of offshore wind turbines and other large-size structures – 611); Chart A – Łeba, B – Lubiatowo, C – Dębki, D – Jastrzębia Góra [Source: own study]

Additionally, the limitation related to the visibility of wind turbines from the mainland is the Earths' curvature and the related limitation of the height of facilities that can be seen from a large distance. In practical terms, this limitation manifests itself by the phenomenon that the further the OWFs are located from the observer, the fewer of them can be seen. Photographs (Photography 7.1, Photography 7.2) show visualizations of views on the Baltic Power OWF together with Baltica, Bałtyk II and Bałtyk III from Lubiatowo and Dębki.

Photo 7.1. Visualization of the view on the Baltic Power OWF together with Baltica, Bałtyk II and Bałtyk III from Lubiatowo [Source: Baltic Power Sp. z o.o. data]

Photo 7.2. Visualization of the view on the Baltic Power OWF together with Baltica, Bałtyk II and Bałtyk III from Dębki [Source: Baltic Power Sp. z o.o. data]

As in the non-cumulative case, the impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF. In the open sea, the landscape is not disturbance-resistant, but its value is not high, as very few people and over a short period will be exposed to the landscape change and some of them (e.g. tourists) may perceive it as beneficial or interesting. The impact will have a large spatial range but the further the distance from the OWF the smaller it will be. It will be a long-term but reversible change. On the mainland, the upper parts of the OWF may be visible occasionally (Photograph 7.1, Photograph 7.2).

Visualization of the view of the Baltic Power OWF together with the Baltica, Bałtyk II and Bałtyk III OWFs is additionally included in Appendix No. 5 to the EIA Report.

7.4.3.3 Disturbances in the operation of systems that use EMF

The space above OWF areas is used for the operation of systems using electromagnetic field, such as: vessel navigation radars, shore radar systems, radio communication equipment and systems for transmission of radio and terrestrial television signals. The construction of a single wind farm as well as a larger number of wind farms may cause disturbances in the proper functioning of these systems. The size of disturbances would be directly proportional to the number of structures built in maritime areas and could cover a proportionally larger maritime area.

Taking into account the possible negative effects resulting from disturbances in the systems using electromagnetic field, in the issued Permits for erection and use of artificial islands, structures and equipment for all wind farms, the minister for Maritime Economy obliged the investors to perform a number of specific actions. These activities will aim to ensure the defense and state security and the safety of navigation.

The necessity to perform these compensatory actions indicates that the impact of the Baltic Power OWF and other OWFs on the systems using electromagnetic field should be considered only as hypothetical and that in fact they will not occur.

7.4.3.4 Fishery

Taking into account the significance of the potential cumulative impact on the aspects related to the conducting sea fishing in connection with the construction and operation of the OWF, the OWFs for which the decision on environmental conditions have been issued (Bałtyk II, Baltica 2, Bałtyk III, Baltica 3, FEW Baltic II, B-Wind and C-

Wind) were taken into account for the assessment of these impacts. Therefore, there is a reasonable likelihood that upon the construction of the last of the indicated OWFs, there will be a maximum space disturbance caused by the presence of the above-water structures.

When treating the space used in fishing activities more than just as the space above the water surface, the cumulative impact assessment also took into account the OWF connection infrastructure. At the moment, the decision on environmental conditions has been issued for the Offshore Grid Connection Infrastructure connecting Bałtyk II and Bałtyk III, Baltica B-2 and B-3 OWFs and Baltic Power OWF with the land (Figure 7.3).

All the above-mentioned projects will have an impact on activities related to sea fishery, whereas the presence of above-water structures will cause two possible types of impacts resulting from space limitations, i.e.: lack of possibility to fish within the OWF and the necessity to avoid the OWF on the way to and from the fishing grounds located north of the OWF. In the case of transmission infrastructure in its immediate vicinity, fishing, in particular with bottom trawl nets, will not be possible either.

The planned projects related to the implementation of the OWF and transmission infrastructure, located within 13 fishing squares (K8, L8, M8, N8, O8, P8, L7, M7, N7, O7, L6, O6 and L5), will occupy a total area of 1013.01 km^2. However, applying the envelope principle, i.e. the impact assessment for the largest values describing a given project, the entire surface of this area was taken into further analyses.

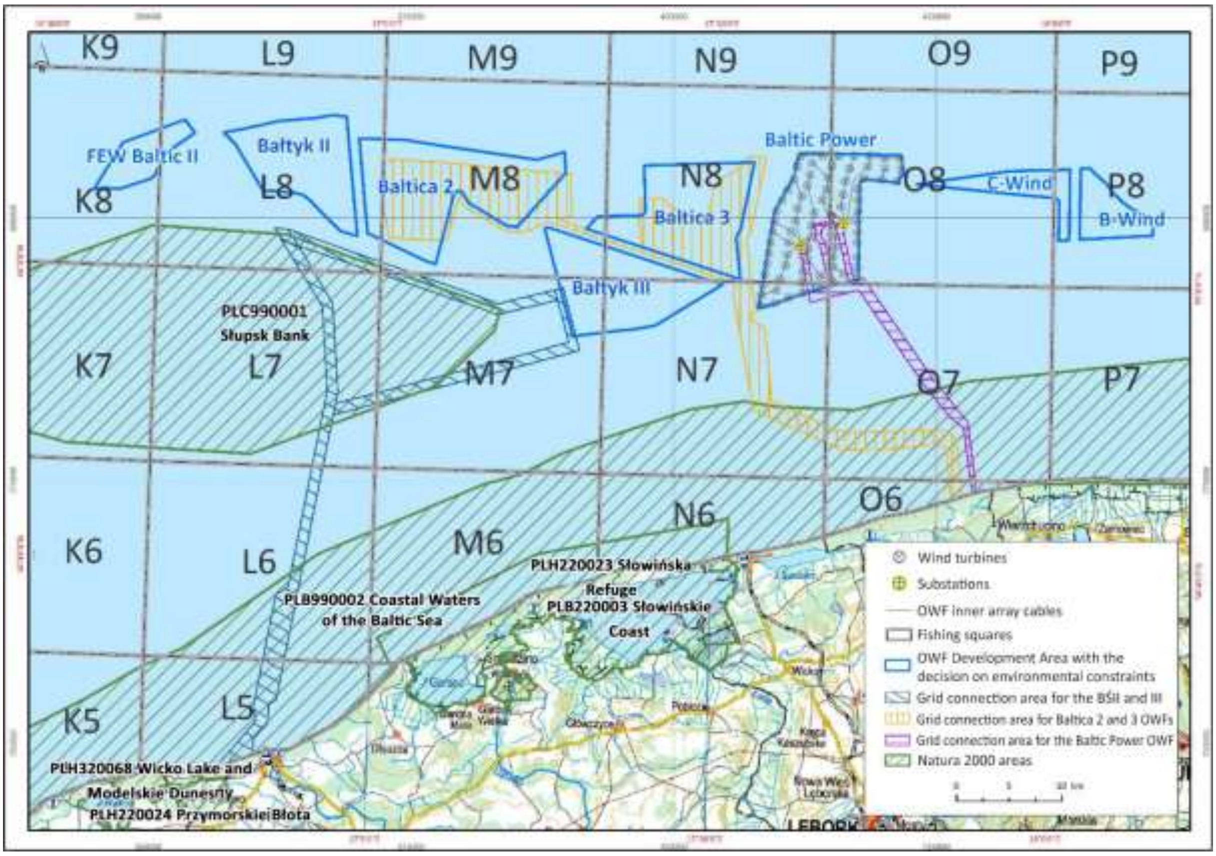


Figure 7.3. Location of the OWF and areas planned for the connection infrastructure against the background of fishing squares [Source: own study]

In the indicated fishing squares in 2014-2018, from 121 to 170 fishing vessels fished to a smaller or larger extent, which accounted for 15 to 20% of all registered fishing vessels in Poland (Table 7.2) fishing in the Baltic Sea.

Table 7.2. Number of vessels fishing in squares occupied by the OWF and connection infrastructure and total registered vessels in 2014–2018

Year	Number of fishing vessels		Share of vessels fishing in the fishing squares occupied by the OWF and the connection infrastructure in relation to the number of vessels fishing in the Baltic Sea and registered in Poland [%]
	In fishing squares occupied by the OWF and connection infrastructure	In the Baltic Sea and registered in Poland	
2014	170	870	20
2015	166	872	19
2016	142	839	17
2017	121	831	15
2018	150	825	18

The value of catches in the fishing squares in the area where the OWF and the connection infrastructure will be located, in the period 2014-2018 ranged from PLN 4.7 to 7.1 million, with an average value for this period of PLN 5.8 million (Table 7.3). This represented between 2 and 3 % of the Polish Baltic fishing. The volume of catches obtained in the individual fishing squares was significantly diversified. The largest average catches values in 2014-2018 were obtained in the P8 and L8 squares, respectively PLN 863 thousand and PLN 657 thousand. The areas of these fishing squares are to be occupied by the OWF and the connection infrastructure in 14.5% and 44% respectively. The value of the completed catches estimated on the basis of the share of the areas occupied by the OWF together with the connection infrastructure in relation to their total area amounted on average to PLN 1.5 million in 2014–2018 and ranged from PLN 1.1 million in 2018 to PLN 1.9 million in 2014. This represented between 0.5 and 1% of the Polish Baltic fishing.

Table 7.3. Value of fishing made in the fishing squares in the area where the OWF is planned to be located

Fishing square	The value of catches [thousand PLN]					Average annual value of catches in 2014-2018 [thousand PLN]
	2014	2015	2016	2017	2018	
K8	173	189	221	55	512	230
L8	871	640	759	549	469	657
M8	436	339	622	527	314	448
N8	146	209	152	250	57	163
O8	240	383	119	374	160	255
P8	766	1119	362	1278	789	863
L7	316	460	363	246	449	367
M7	456	403	510	313	370	410
N7	290	308	241	271	226	267
O7	297	363	201	145	144	230
P7	640	768	559	235	94	459
L6	524	711	674	240	568	543
O6	545	462	223	151	217	320
L5	674	773	842	410	287	597
Total	**6372**	**7126**	**5847**	**5046**	**4656**	**5809**

Since in most cases fishing vessels operating in the area of the analyzed 14 fishing squares, which are to be occupied in different parts by the OWF and the connection infrastructure, also conduct fishing in many other fishing squares, changing the place of conducting fishing activities should not entail additional costs resulting from the need to identify fishing conditions in new fishing grounds. In 2014, in the area of 14 analyzed squares, the bottom-set gears and pelagic trawls were dominant in the fishing grounds. In the following years, the share of fishing with bottom-set gears has gradually decreased, while the use of pelagic trawls has changed, due to the high impact on the overall performance of individual fishing vessels. In 2018, only 25% of fish were caught in the area of the analyzed fishing squares with bottom-set gears, which was mainly a consequence of the deteriorating condition of cod stocks (caught in this area mainly with bottom-set gears) (Table 7.4).

Table 7.4. Fishing volumes in 2014–2018 in the area of 14 fishing squares where OWFs and connection infrastructure will be located

	Volume of catches in years [t]

Species / species group	2014	2015	2016	2017	2018
Cod *Gadus morhua*	922	1 018	868	447	439
European flounder *Platichthys flesus*	475	360	283	168	474
Herring *Clupea harengus*	425	986	274	985	370
Sprat *Sprattus sprattus*	70	170	176	103	483
Other	42	35	48	45	56
Total	**1934**	**2570**	**1649**	**1748**	**1822**

Movement of fishing vessels using bottom-set gears may cause conflicts with existing users of fishing grounds where the number of used gears will increase. However, due to a significant reduction in the fishing capacity of the Polish fleet after accession to the European Union and a significant deterioration in the status of cod stocks in the southern Baltic Sea, which resulted in the suspension of targeted catches of these fish in the Eastern Baltic Sea area in 2020 [Council Regulation (EU) 2019/1838 of October 30, 2019 fixing for 2020 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulation (EU) 2019/124 as regards certain fishing opportunities in other waters (OJ EU L of 2019, No. 281, p. 1, as amended)], it is not expected that there will be an excessive concentration (above recorded to date) of bottom-set gears after the transfer of their volume from the area occupied by wind farms. In view of this, the cumulative negative impact of the relocation of the fishing fleet can be considered insignificant.

Extension of the route and time to the fishing grounds

The creation of a barrier for free passage of fishing vessels shall constitute a negative impact of the presence of many OWFs in neighboring locations. The location of other wind farms, Narodowy Program Zbierania Danych Rybackich (the national fisheries data collection program) from the east and west in relation to the Baltic Power OWF, without leaving space allowing for vessel movement, will extend the route of fishing vessels to productive fishing grounds located north of the OWF in the Słupsk Furrow (Rynna Słupsk) area. This may result in additional costs, mainly for fishing vessels stationed in the ports of Ustka (59 vessels) and Łeba (30 vessels), due to the increase in the amount of fuel and extended time of arrival to the fishing ground.

Figure (Figure 7.4) shows the OWF location in relation to the shortest routes to the fishing grounds in the area of the Słupsk Furrow and potentially changed routes to these fishing grounds as a result of the presence of the OWF.

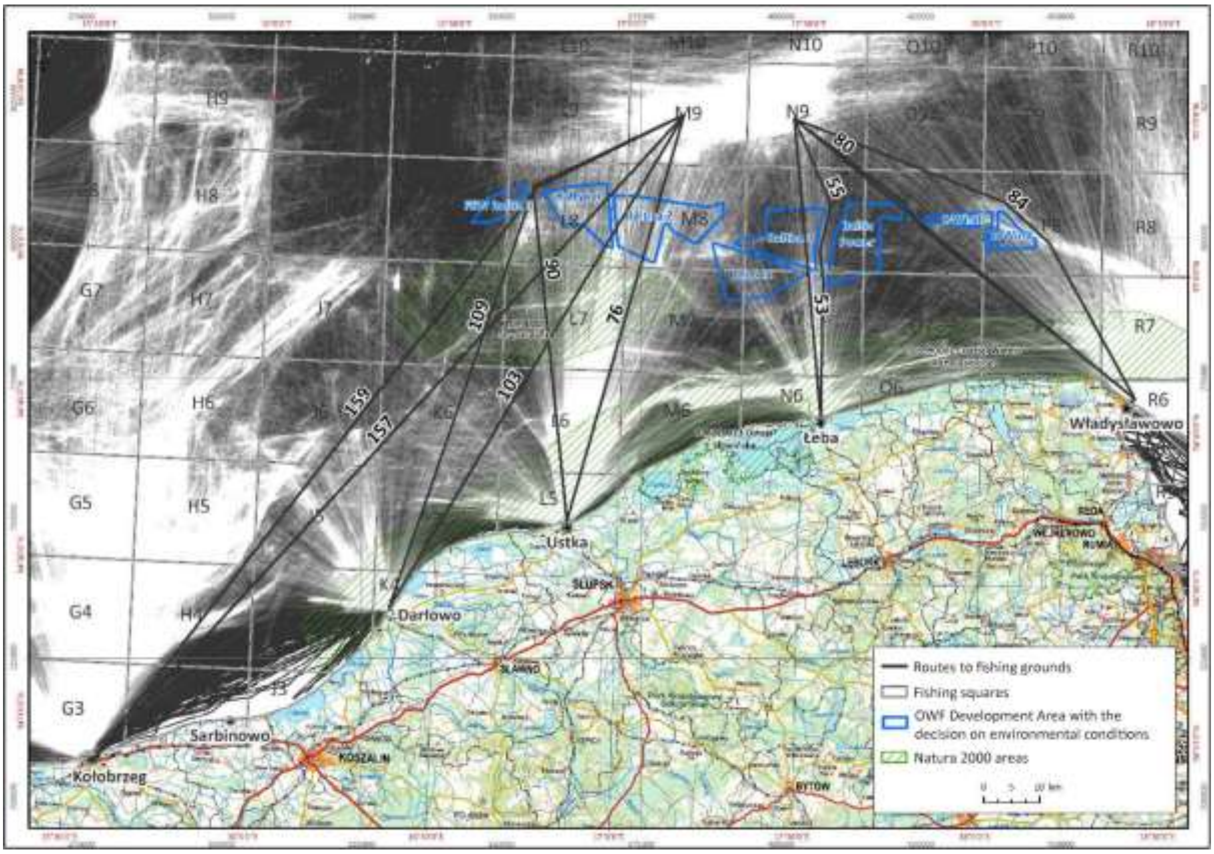


Figure 7.4. Existing and potentially extended routes to fishing grounds in the Słupsk Furrow area as a result of the presence of the OWF [Source: own study]

In order to calculate the estimated increase in the costs of conducting sea fishing, resulting from the necessity to bypass the OWF, the activity of fishing vessels departing from and returning to the ports in Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo was analyzed. The calculations take into account the number of cruises every year to the fishing grounds located north of the OWF. For the calculations, the central locations of fishing squares M9 and N9 were assumed as the target point for the fishing grounds. The number of fishing vessels operating in fishing squares was determined on the basis of data from the logbooks and the register of fishing vessels: M9 for ports in Kołobrzeg, Darłowo and Ustka and N9 for ports in Łeba and Władysławowo. Only cruises beginning and ending at the same port have been taken into account. Considering the above, the analysis takes into account the fishing activities of vessels routinely sailing through OWF areas in order to fish on the Słupsk Furrow. Based on RRW-19 questionnaire – Report on economic performance of the fishing vessel, the number of fishermen employed on board of vessels was analyzed. The average consumption of diesel oil at the level of 15 l/h was assumed for calculations (approximate data, information from the owner of the fishing boat K-15 KS type with a length of 17 m and motor power of 121 kW). The average fuel cost per kW engine power was calculated using the shipping fuel prices in June 2022 (PLN 4,900 per m^3). The cost of the additional working time of fishermen was calculated on the basis of the average monthly salary in the enterprise sector from August 2022 (PLN 6,583). The additional time that fishing vessels will need to bypass the OWF was calculated assuming an average vessel speed of 6 knots (11 km/h). Table (Table 7.5) presents the time and length of routes by which access to fishing grounds in the Słupsk Furrow area will be extended and return to the ports of parent fishing vessels as a result of bypassing the OWF.

Table 7.5. Additional times and lengths of routes necessary to bypass the OWF on the way from and to the fishing grounds in the Słupsk Furrow area by fishing vessels fishing from the ports of Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo

Port	Time [h]	Length [km]
Kołobrzeg	0.36	4
Darłowo	1.08	12
Ustka	2.52	28
Łeba	0.36	4
Władysławowo	0.72	8

The performed calculations based on the data from 2017–2019 indicate that the necessity of bypassing the OWF by fishing vessels departing from and returning to the ports in Kołobrzeg, Darłowo, Ustka, Łeba and Władysławowo and fishing in the fishing grounds in the Słupsk Furrow area will result in the increase in fuel costs by approx. PLN 100,000 per year (Table 7.6). An extended time of arrival and return from the fishing ground may generate additional labor costs of approx. PLN 150,000 per year. Due to the high significance of the fishing grounds in the Słupsk Furrow area for fishermen with a home port in Ustka, as well as the largest extension of the route (by 28 km in both directions), fishermen from this port will bear the highest increase in costs resulting from the necessity to bypass the OWF area. The estimated total increase in fuel costs and wages for this port will amount to approx. PLN 220,000, which constitutes approx. 90% of the total costs for all analyzed ports (Table 7.6).

If the fishing vessels are allowed to use the passage between the Baltic Power OWF and C-Wind, the way to the fishing ground for fishing vessels sailing from Władysławowo will not be extended (Figure 7.4). In this case, the total fuel costs resulting from the necessity to bypass the wind farms will amount to PLN 90,000 and the costs of extended working time will amount to PLN 140,000 (Table 7.7).

Table 7.6. Calculations of additional costs for fishing resulting from bypassing the OWF to the Słupsk Furrow fishing ground

Year	Port	Number of vessels	Average number of crew	Number of cruises	kW cruises	Additional sailing time [h]	Additional working time [h]	Cost of 1 kWh [PLN]	Cost per man hour [PLN]	Additional cost of fuel [PLN]	Additional cost of labor [PLN]	Total [PLN]
2017	Darłowo	2	4.0	4	974	4	17	**0,61***	**39***	642	674	1316
	Kołobrzeg	8	4.0	17	2616	6	24			575	955	1529
	Łeba	12	4.0	192	24,590	69	276			5,400	10,757	16 157
	Ustka	30	4.3	316	53,789	796	3454			82,685	134,722	217 407
	Władysławowo	30	4.9	68	19,324	49	248			8,487	9660	18 147
Total in 2017		**82**	**4.4**	**597**	**101,294**	**925**	**4020**			**97,788**	**156,768**	**254,556**
2018	Darłowo	1	3.4	5	350	5	18			231	716	947
	Kołobrzeg	9	4.0	10	1696	4	14			372	562	934
	Łeba	14	3.8	113	14,514	41	160			3,187	6253	9441
	Ustka	29	4.3	283	53,609	713	3119			82,408	121631	204 039
	Władysławowo	15	4.8	44	12,244	32	154			5,378	6020	11 398
Total in 2018		**68**	**4.3**	**455**	**82,413**	**795**	**3466**			**91,576**	**135183**	**226,759**
2019	Darłowo	1	4.0	1	121	1	4			80	168	248
	Kołobrzeg	6	4.8	8	1993	3	13			438	517	954
	Łeba	11	3.8	99	10,730	36	139			2,356	5417	7773
	Ustka	26	4.3	339	61,850	854	3736			95,076	145,710	240 785
	Władysławowo	7	5.0	33	9616	24	118			4,223	4583	8806
Total in 2019		**51**	**4.4**	**480**	**84,310**	**918**	**4010**			**102,172**	**156,394**	**258,567**
Average		**67**		**511**	**89,339**	**879**	**3832**			**97,179**	**149,448**	**246,627**

** the cost of 1 kWh calculated on the basis of the shipping fuel price of June 2022 (PLN 4,900 per m^3), the cost of man-hour calculated on the basis of the average monthly gross wages and salaries in the enterprise sector of August 2022 (PLN 6,583)*

Table 7.7. Calculations of additional costs for fishing resulting from the extension of the road to the Słupsk Furrow fishing ground (taking into account the corridor between the Baltic Power OWF and the C-Wind OWF)

Year	Port	Number of vessels	Average crew	Number of cruises	kW cruises	Additional sailing time (h)	Additional working time (h)	Cost of 1 kWh (PLN)	Cost of labor (PLN/h)	Additional cost of fuel (PLN)	Additional cost of labor (PLN)	Total
2017	Darłowo	2	4.0	4	974	4	17	**0.61***	**39***	642	674	1316
	Kołobrzeg	8	4.0	17	2616	6	24			575	955	1529
	Łeba	12	4.0	192	24,590	69	276			5400	10,757	16 157
	Ustka	30	4.3	316	53,789	796	3454			82,685	134,722	217 407
Total in 2017		**52**	**4.2**	**597**	**81,970**	**876**	**3772**			**89,301**	**147,108**	**236,410**
2018	Darłowo	1	3.4	5	350	5	18			231	716	947
	Kołobrzeg	9	4.0	10	1696	4	14			372	562	934
	Łeba	14	3.8	113	14,514	41	160			3187	6253	9441
	Ustka	29	4.3	283	53,609	713	3119			82,408	121,631	204 039
Total in 2018		**52**	**4.1**	**597**	**69,819**	**757**	**3293**			**86,198**	**129,162**	**214,414**
2019	Darłowo	1	4.0	1	121	1	4			80	168	248
	Kołobrzeg	6	4.8	8	1993	3	13			438	517	954
	Łeba	11	3.8	99	10,730	36	139			2356	5417	7773
	Ustka	26	4.3	339	61,850	854	3736			95,076	145,710	240 785
Total in 2019		**43**	**4.3**	**597**	**74,573**	**893**	**3888**			**97,949**	**151,812**	**249,513**
Average		**49**		**597**	**75,454**	**842**	**3651**			**91,150**	**142,694**	**233,844**

** the cost of 1 kWh calculated on the basis of the shipping fuel price of June 2022 (PLN 4,900 per m^3), the cost of man-hour calculated on the basis of the average monthly gross wages and salaries in the enterprise sector of August 2022 (PLN 6,583)*

Considering the above, the significance of the cumulative negative impact related to the necessity to extend the routes of fishing vessels to the fishing grounds should be considered as moderate. To limit the negative impact on fishing in this respect, an area of width necessary to maintain the safety of navigation should be left between the OWFs. In such a case, the significance of the cumulative impact of the project on fishing grounds may be considered as low. Another solution may be to allow the transit of fishing vessels through the Baltic Power OWF Area. Designating navigation corridors or allowing navigation through the Baltic Power OWF Area remains the sole responsibility of the competent Director of the Maritime Office.

7.5 Assessment of cumulative impacts for the RAO

7.5.1 Underwater noise

In the case of underwater noise, the results of various possible scenarios regarding simultaneous piling indicated the range of impact, including possible accumulation of impacts. At the same time, these results show that these impacts will be significant in no case if only two simultaneous piling operations are carried out in all OWF areas.

7.5.2 Increase in the concentration and sedimentation of suspended matter

The modeling results of suspended matter impact on the marine environment also indicate that works involving disturbance of the seabed carried out simultaneously in two locations of installation of foundations of support structures, located 3 km apart, do not affect each other in terms of mutual impact of suspended matter when performing works in non-cohesive soils, and feature minimum impact in the case of cohesive soils.

7.5.3 Space disturbances

7.5.3.1 Physical barrier creation

Within the Baltic Power OWF in the RAO and in other OWFs, there will be a partial, long-term reduction in the use of airspace. The nature of the development, with significant distances between individual OWF structures and leaving undeveloped areas between the OWFs, will result in the disturbance of space not being continuous and uniform. This unevenness will also occur within the structures themselves. The greatest space disturbance will occur within the operating range of the rotor, i.e. above 20 m above the water surface.

Taking into account the significance of the potential cumulative impact of the OWF on migratory birds, those OWFs for which the decision on environmental conditions was issued were taken into account for the assessment of these impacts.

The results of the assessment of the cumulative impact on migratory bird species indicate that, in most cases, the significance of this impact will be negligible, and only will be insignificant in the case of long-tailed duck and common scoter.

7.5.3.2 Landscape disturbances

Landscape disturbances in the case of cumulative impact related to simultaneous operation of the OWFs depend, to the greatest extent, on the weather conditions – visibility and the Earth curvature. As in the non-cumulative case, the impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF.

7.5.3.3 Disturbances in the operation of systems that use EMF

The necessity to perform actions aimed at compensation of disturbances in the operation of systems using electromagnetic field indicates that the impact of the Baltic Power OWF and other OWFs on these systems should be considered only as hypothetical and that will not occur in reality.

7.5.3.4 Fishery

The development of wind energy in Polish maritime areas will result in a change in the use of the maritime space by their existing users, including in particular in the context of fishing.

The presence of above-water structures will cause two possible types of impacts resulting from space limitations, i.e.: lack of possibility to fish within the OWF and the necessity to avoid the OWF on the way to and from the fishing grounds located north of the OWF. In the case of transmission infrastructure in its immediate vicinity, fishing, in particular with bottom trawl nets, will not be possible either.

Movement of fishing vessels using bottom-set gears may cause conflicts with existing users of fishing grounds where the number of used gears will increase. Excessive concentration of gillnets should not be expected after shifting the effort from the area occupied by the OWF. In view of this, the cumulative negative impact of the relocation of the fishing fleet can be considered insignificant. The creation of a barrier for free passage of fishing vessels shall constitute a negative impact of the presence of OWFs in neighboring locations. The location of other wind farms, from the east and west in relation to the Baltic Power OWF in the RAO, without setting out the navigation corridor for vessel, will extend the route of fishing vessels to productive fishing grounds located north of the OWF in the Słupsk Furrow area. This may result in additional costs, mainly for fishing vessels stationed in the ports of Ustka and Łeba, due to the increase in the amount of fuel and extended time of arrival to the fishing grounds.

The significance of the cumulative negative impact related to the necessity to extend the route of fishing vessels to fishing grounds should be considered as moderate. To limit the negative impact on fishing in this respect, navigation corridors with the width necessary to maintain the safety of navigation should be left between the OWFs. In such a case, the significance of the cumulative impact of the project on fishing grounds may be considered as low. Another solution may be to allow the transit of fishing vessels through the Baltic Power OWF Area. However, each of these solutions remains the responsibility of the competent director of the maritime office.

8 Transboundary impact

The Baltic Power OWF Area is located in the Polish EEZ. The distances of this area from the boundaries of the EEZ of other countries are as follows:

- over 58 km from the Swedish Exclusive Economic Zone (EEZ);
- 100 km from the Danish EEZ;
- over 85 km from the Russian EEZ;
- over 189 km from the German EEZ.

The conducted impact assessment regarding individual elements of the environment indicates that their scope will be local. Only in three cases, the identified impact of the Baltic Power OWF is regional in scale. This refers to the impact of:

- underwater noise during the construction phase on adult fish;
- underwater noise during the construction phase on marine mammals;
- the barrier effect on birds in the operation phase.

The underwater noise analysis carried out for the purposes of the EIA Report both for fish and marine mammals showed that the ranges of significant impact, determined using TTS values, do not exceed the boundary of the Polish Exclusive Economic Zone.

With reference to the Convention on Environmental Impact Assessment in a Transboundary context, signed at Espoo on 25 February 1991 and the Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 *on the assessment of the effects of certain public and private projects on the environment* (consolidated text) (EU OJ L. of 2012 No. 26, page 1, as amended), the transboundary impacts cannot be excluded for the Baltic Power OWF. Almost all species passing through this area are birds covering long distances between nesting areas and overwintering areas or birds moving locally. This means that the barrier effect and risk of collision affect birds that spend at least part of their lives in north-west Russia and Scandinavia. Additionally, some of the species exposed to the impact are included in Annex I to the Birds Directive or included in the Natura 2000 protected areas program in the neighboring countries, and therefore the impacts of the Baltic Power OWF may affect the abundance of birds which are subject to protection in these areas.

Studies carried out as part of the inventory of migratory birds for this project indicate that the impacts of the barrier effect and the risk of collision for the vast majority of species were considered negligible and insignificant. The significance of the barrier effect at the level of a single OWF was assessed to be negligible for all species. The cross-border impact was considered to be the same (in several cases it was considered to be of little importance). The cross-border bird mortality increased as a result of collisions with the OWF will be an undetectable part of the total mortality (natural and related to human activity) for most species. The moderate significance of the risk of collision in the case of the crane will not affect the population of nesting and wintering cranes in other Baltic countries (the mortality threshold of cranes with which the biogeographical population can cope and remain in good condition is 1887 specimens per year [109]) and will be negligible or insignificant when using mitigation actions (periodic shutdown of individual turbines during intensive flight activity of cranes). The predicted mortality resulting from collisions will not pose a threat to the population, which will be able to compensate for the lost specimens as a result of the project impact. In the case of a larger number of neighboring OWFs in this area of the Baltic Sea, the accumulated mortality may theoretically exceed the above-mentioned mortality threshold allowing to maintain the population in good condition, but this will depend to a large extent on the mitigation actions applied in other projects in the vicinity of the Baltic Power OWF. An important element in the context of all OWFs in this area, which reduces the risk of collision, is the creation of a system of corridors (areas free of development) enabling free movement of birds between individual OWFs. Such a solution has been proposed for the Baltic Power OWF. Corridors were indicated both on the western and eastern side of the Baltic Power development area, which in connection with the corridor between Baltica 2 and Baltica 3 create a free space for bird movement. The application of the system for shutting down the elements of the Baltic Power OWF will additionally allow to minimize the impact of this project on the migration of cranes.

The OWF Area is a place of periodic (winter season) concentration of the long-tailed duck, the velvet scoter, the razorbill and the European herring gull, and also the common guillemot in the summer period. Supplementary studies carried out in 2020 showed that birds wintering in this part of the Baltic Sea move locally in all directions without a clear pattern during short feeding flights. This is confirmed by the rule that seabirds show strong attachment to the wintering site [207, 228, 324]. In a transboundary context, the results of modeling the abundance of avifauna on the Baltic Power OWF during the wintering period and literature data on the size of their Baltic Sea population were compared and presented in the table (Table 8.1).

Table 8.1. Comparison of the abundance of birds wintering in the Baltic Power OWF Area and the Baltic Sea area [Source: data of Baltic Power Sp. z o.o.]

Species	Baltic Power OWF	Baltic population
Long-tailed duck *Clangula hyemalis*	857	1,500,000[1)]
Velvet scoter *Melanitta fusca*	83	373,000[1)]
Razorbill *Alca torda*	75	155,000[2)]
European herring gull *Larus argentatus*	117	N/A
Total	1238	-

[1)] *source: HELCOM 2013 [184]*
[2)] *source: Chylarecki et al., 2018 [81]*

Compared to the Baltic Sea population, the size of the population of the long-tailed duck in the Baltic Power OWF Area is 0.06%, the velvet scoter is 0.02%, and the razorbill is 0.04%. There is no data on the size of the population of the Baltic European herring gull. However, since these birds accompany fishing boats in fishing grounds, their occurrence in the open sea is strongly dependent on human activity. Therefore, no significant transboundary impacts will occur. Therefore, no transboundary impacts are expected from a single project consisting in the construction of the Baltic Power OWF.

9 Analysis and comparison of the considered options and the most environmentally beneficial option

Issues related to project options, including descriptions and comparison of technical parameters of the two analyzed options, i.e. the option proposed by the Applicant (OPA) and the reasonable alternative option (RAO), are included in the sub-chapter 2.3. Taking into account the specificity of the planned project, including in particular the issued location decision (Permit for the erection and use of artificial islands, structures and devices No. MFW/6/12, as amended), it would be unjustified to include another place of execution of the Baltic Power OWF in the RAO. Therefore, both the OPA and the RAO were considered in the same area.

The main differences between the OPA and the RAO were based on the existing and feasible technological solutions in the coming years, resulting from the intensive development of offshore wind energy. The maximum installed power of the Baltic Power OWF, i.e. 1200 MW, indicated in the Permit for the erection and use of artificial islands, structures and devices No. MFW/6/12, as amended, was adopted as the limit parameter in both considered options. Therefore, with the use of higher power turbines, it becomes possible to build a smaller number of wind turbines.

The RAO assumes 5 MW turbines for the analyses. Taking into account the maximum installed power of the Baltic Power OWF, in this option it would be necessary to construct 240 wind turbines. With the turbine power output of 15 MW assumed in the OPA, the comparable installed power will be achieved already after the construction of 76 wind turbines.

Construction and operation of a smaller number of wind turbines as part of the OPA in relation to the RAO, consequently, means less interference with the environment as a result of:

- shorter duration of the construction and decommissioning phase;
- lower number of risky lifting and marine operations;
- lower consumption of construction materials and consumables;
- a smaller area swept by the rotors; and
- smaller area of the seabed occupied or covered by underwater works.

Also in the Baltic Power OWF operation phase, a smaller number of wind turbines under the OPA will require a smaller number of maintenance and operation activities in relation to the RAO, and consequently it will contribute to a smaller environmental impact.

In both cases, i.e. as regards the size of monopiles and the size of rotors, it was assumed that in the case of wind turbines with a higher power output they will be larger in the OPA. Such an assumption results from a prudential approach.

A significant difference indicating that the OPA compared to the RAO will have a smaller impact on the environment is the issue of the risk of collision of migrating birds with the wind turbine structures. The results of collision modeling indicate that in most cases this risk is higher for RAV and in no case lower. Given the long-term nature of this impact (several decades of operation are assumed), these differences are an important reason to indicate that the OPA is a more environmentally advantageous option than the RAO.

To sum up the above considerations, it should be stated that the main parameters differentiating the two analyzed options are the number of wind turbines and the rotor diameter. In consequence, they determine the size of the impact on individual elements of the environment.

When comparing both options (Table 9.1), including in particular the resulting possible environmental impacts, it should be indicated that according to the arguments cited above, the OPA is the most advantageous option for the environment.

Table 9.1. Assessment results of the impact that the planned project will have in the Option proposed by the Applicant (OPA) and the Reasonable Alternative Option (RAO) on elements of the environment in individual phases of its implementation [Source: own study]

Receiver	**Significance of the Baltic Power OWF impact**					
	OPA			**RAO**		
	Construction phase	**Operation phase**	**Decommissioning phase**	**Construction phase**	**Operation phase**	**Decommissioning phase**
Seabed	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Undulation and sea currents	None	Negligible	None	None	Negligible	None
Sea water	Low importance	Moderate	Moderate	Low importance	Low importance	Low importance
Bottom sediments	Low importance	Moderate	Moderate	Low importance	Negligible	Low importance
Climate	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Systems using EM field	None	Negligible	Negligible	None	Negligible	Negligible
Phytobenthos	None	Negligible	Negligible	None	Negligible	Negligible
Macrozoobenthos	Low importance	Moderate	Moderate	Low importance	Moderate	Moderate
Ichthyofauna	Moderate	Negligible	Low importance	Moderate	Negligible	Low importance
Marine mammals	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Migratory birds	Low importance	Moderate	Low importance	Low importance	Moderate	Low importance
Seabirds	Significant	Significant	Significant	Significant	Significant	Significant
Bats	Negligible	Low importance	Negligible	Negligible	Low importance	Negligible
Protected areas other than Natura 2000 sites	Low importance	Low importance	Low importance	Low importance	Low importance	Low importance
Natura 2000 areas	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Wildlife corridors	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Biodiversity	Low importance	Significant	Low importance	Low importance	Significant	Low importance
Cultural values, monuments and archaeological sites and objects;	None	None	Negligible	None	None	Negligible
Use and management of the water area and tangible property	Low importance	Low importance	Negligible	Low importance	Low importance	Negligible
Landscape	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Population	Moderate	Negligible	Negligible	Moderate	Negligible	Negligible

10 Comparison of the proposed technology with the technology meeting the requirements referred to in Article 143 of the Environmental Protection Law

Pursuant to Article 143 of the Act of April 27, 2001 – Environmental Protection Law (consolidated text: Journal of Laws of 2001, item 1973, as amended), the technologies used in newly commissioned systems should meet the requirements which consider in particular:

- the use of substances with a low hazard potential;
- the effective generation and use of energy;
- ensuring rational consumption of water and other raw materials as well as materials and fuel;
- the use of waste-free and low-waste technologies and possibility of waste recovery;
- indication of the type, range and size of emissions;
- the use of comparable processes and methods which have been effectively applied on industrial scale;
- scientific and technical progress.

This catalog of requirements refers to newly commissioned industrial systems and equipment which are a source of environmental hazards. Due to the process specificity of the construction, operation and decommissioning phases and special conditions of operation in the marine environment, offshore wind farms require verification of these requirements at an early stage of project planning.

The structural elements of the Baltic Power OWF shall be made of materials neutral to sea water and soil subbase (seabed). Resistance to erosion, corrosion or chemical compounds that may appear in water is the basic condition for failure-free operation of the Baltic Power OWF.

Efficiency of energy generation will be one of the basic criteria for the selection of OWFs and their distribution, as well as the method of transmission of generated energy from the OWF to the National Power System with reduced transmission losses. The primary criterion of energy efficiency is its generation, with obvious limitations related to the wind speed of the water region, without the use of energy raw materials – in a fully renewable manner.

In the case of this type of renewable energy sector, the actual efficiency of energy use involves non-returnable energy consumption for the production of OWF components (wind turbines and other facilities) and their installation at sea.

The consumption of water, materials, raw materials and fuels will take place during the construction process (installation of subsequent wind turbines and laying submarine cables) and during decommissioning of Baltic Power OWF elements after their loss of technical usefulness. During 20–30 years of operation, the wind turbines will require the use of consumables and fuels during service activities.

Emissions and their range will mainly relate to acoustic impacts accompanying the operation of wind turbines. They will not have a significant impact on marine organisms or cause noticeable electromagnetic impacts.

Experience with the use of wind turbines in the Baltic Sea enables the installation of the most efficient and proven solutions meeting the requirements of the most advanced technologies, resistant to the conditions of operation in the marine environment with a highly variable wind speed.

11 Description of planned actions aimed at avoiding, preventing and limiting negative environmental impacts

The conducted environmental impact assessment of the Baltic Power OWF indicates that no significant negative impacts will occur as a result of this project. However, the occurrence of impacts of minor importance is unavoidable. Therefore, reasonable measures aimed at avoiding, preventing and limiting negative environmental impacts as a result of the Baltic Power OWF project are indicated below, broken down into individual stages.

11.1 Construction phase

The proposed mitigation measures during the construction phase include:

- commencement of piling with soft-start procedure in order to enable fish, birds and marine mammals to leave and move away from the area of works being performed;
- piling in the period from August to March under the ornithological monitoring. If the ornithological monitoring does not confirm the presence of common guillemots and razorbills in a total number of more than 20 individuals, as well as long-tailed ducks in a number of more than 50 individuals in the area with a radius of 2 km from the piling site, works preceded each time by the soft-start procedure may be commenced [265, 362, 254];
- construction of subsequent wind turbines starting from one place, so that the water region intended for the project is filled with structures gradually, extending the OWF area with subsequent wind turbines (assuming that, at certain implementation stages, the entire OWF or its specific parts may be built sequentially, i.e. a specific category of works will be carried out on more than one wind turbine and other types of works will be undertaken only after its completion);
- intensifying the progress of construction works in the period from March to September, when the number of birds in this water region is the lowest;
- limitation of sources of strong light at night directed upwards; this applies mainly to bird migration periods. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards.

11.1.1 Mitigation methods for marine mammals

For marine mammals, a literature analysis was carried out to investigate the mitigation methods that are used before piling starts to deter animals from the impact area. Due to the high impact of noise during piling on porpoises and seals, no animal should be within the impact range during the commencement of construction works. Therefore, one of the mitigation measures required in the wind farm construction process is the observations of sea mammals carried out by observers just before piling. Construction works should not be commenced as long as animals are detected in the impact area (of a size depending on a given project). To increase the efficiency of this process and shorten its duration, it is recommended to use acoustic deterrent devices (ADD) – devices generating sounds of frequency and intensity that may deter sea mammals from a specific area. Depending on technical properties, two ADD categories are distinguished – pingers and seal scarers. Pingers are smaller and less powerful devices. They are primarily used to keep cetaceans away from fishing gear. Seal scarers generate much louder sounds. This ADD type is increasingly used to deter marine mammals (including porpoises and seals) from approaching areas where pulse sounds are used, as during piling or drilling, in particular in situations where a soft start solution is not possible or effective. The devices generate loud, deterrent sound, which is aimed at causing a strong behavioral response and, consequently, the movement of animals away from the high-risk area. Seal scarers are most often used 15 minutes before the impulse sound is generated, so that mammals can leave the impact zone.

There are many ADD-type devices with which various studies have been carried out for effects on porpoise behavior. One of the most frequently studied instruments is the Lofitech ADD instrument [e.g. 60, 61, 95, 223, 303, 432]). A recent study by Thompson et al. [432] during the initial construction phase of Beatrice wind farm (UK) showed that the playing of 15 minutes of Lofitech ADD recordings resulted in a strong behavioral response in porpoises over a long distance. The minimum time of the first detection of porpoises after recording was more than 2 hours. The study showed that appropriate application of ADD could be an effective way to mitigate the effects of piling on porpoises. However, it was stressed that there is a need to optimize the methodology for using seal scarers as a mitigation measure, given the strong sounds they generate. Furthermore, pingers that deter porpoises simultaneously attract seals, which are accustomed that pingers are used on fishing nets. Therefore, the use of ADD should be project specific and adapted to local conditions as well as the possibility to apply noise abatement techniques (e.g. air curtains). In view of the above, it is assumed to activate the above-mentioned scarer at least 2 hours prior to the commencement of piling works.

11.1.2 Ornithological monitoring

The area intended for the Baltic Power OWF is located in the Polish Exclusive Economic Zone, north of municipalities of Łeba and Choczewo at a distance of about 22.5 km from the coastline. In the construction phase, during the installation of wind turbine foundations (monopiles) on the seabed with the use of the piling method, significant noise will be emitted which may have a negative impact on seabirds staying in the area of these works. Therefore, in order to minimize the negative impact of the Baltic Power OWF, the Applicant will carry out ornithological monitoring each time prior to the commencement of piling, in the period from August to March, i.e. during the observed presence of long-tailed ducks *Clangula hyemalis,* common guillemots *Uria aalge* and razorbills *Alca torda.* Supervision will be carried out in an area within a radius of up to 2 km from the pile driving location. It is allowed to drive up to two piles at the same time. Among the species found in the Baltic Power OWF Area during monitoring carried out from October 2018 to November 2019, the most numerous were the long-tailed duck *Clangula hyemalis*, the common guillemot *Uria aalge* and the razorbill *Alca torda*. Outside the summer period, those three species accounted in total for between 80% and 96% of all birds observed in this water region and their presence will be taken into account when making decisions on the commencement of pile driving. Additionally, velvet scoter *Melanitta fusca* will be taken into account since this species is the subject of protection in the nearby Natura 2000 site Coastal Waters of the Baltic Sea and used to appear in the water region intended for the construction of the Baltic Power OWF.

The Baltic Power OWF Area is of minor importance for the three above-mentioned species. In the case of the long-tailed duck, the average densities only in the southern (shallowest) part of the Baltic Power OWF Area exceed 50 individuals per km^2 in the fall, and in other phenological periods they are significantly smaller. The velvet scoter appears here much less frequently and in a smaller number and was also recorded mainly in the southern part of this water region. In the Polish Baltic Sea zone, the common guillemot and the razorbill rarely form larger clusters and most often occur in great dispersion. In the case of the Baltic Power OWF Area, the razorbill, on an annual basis, was observed in larger numbers than the common guillemot, and its average densities reached 1 individual per km^2, only locally, slightly exceeding this value in the winter period.

Ornithological monitoring during pile driving will be carried out by way of observing birds from a vessel which ensures a constant speed during the cruise, between 8 and 11 knots, and a deck height above the sea surface at the observer's location not lower than 2 m (up to 5 m). The vessel should be equipped with two strong floodlights with mobility ensuring the illumination of the sea surface within a radius of at least 300 m from the bow of the vessel and both sides of the vessel with a maximum angle not smaller than 90˚, so as to detect the presence of birds at sea at night. The cruise route will always start at a distance of 300 m from the pile driving location and will be spiral. The distance between the adjacent coils of the spiral must not exceed 600 m [Figure 11.1]. During the cruise, all species present along the cruise route will be recorded, although when making a decision on the commencement of piling, only the presence of the long-tailed duck, velvet scoter, razorbill and common guillemot will be taken into account.

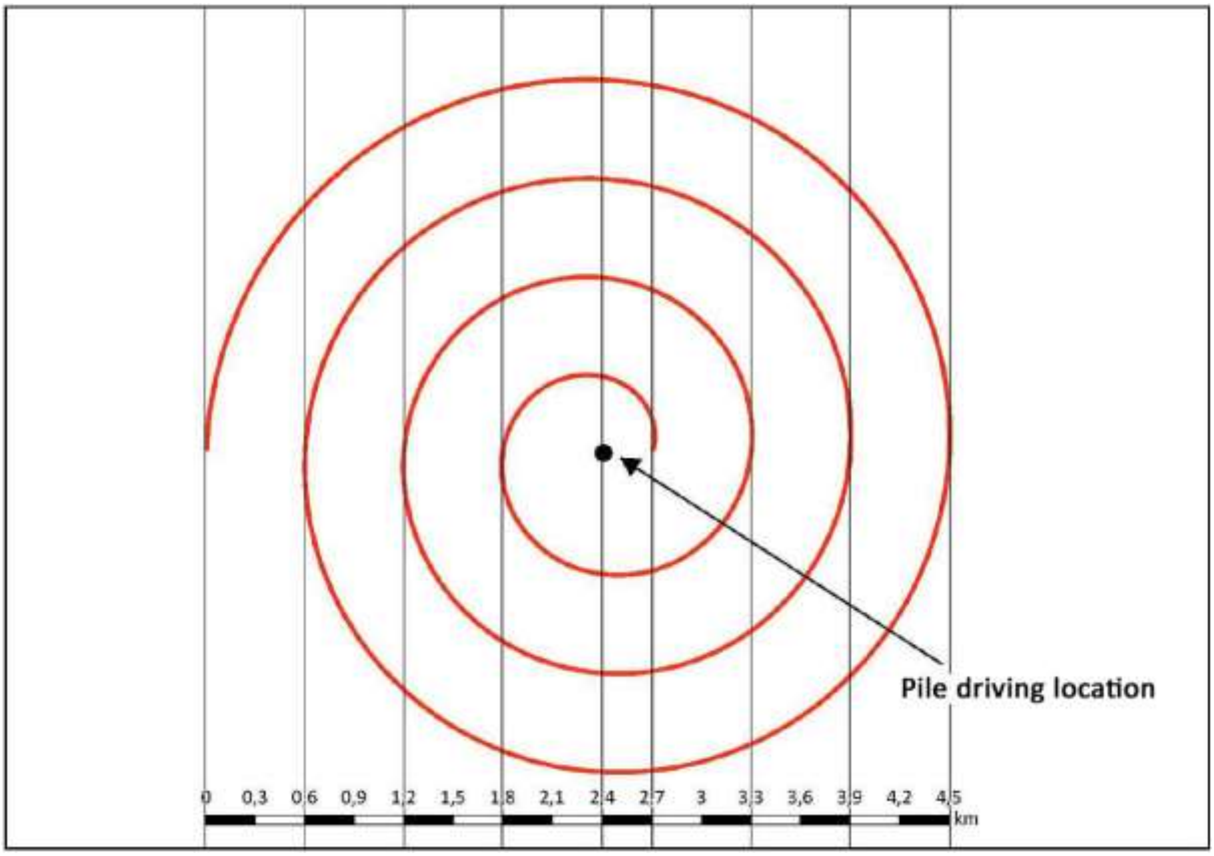


Figure 11.1. Diagram of the cruise route prior to the commencement of monopile driving

Prior to the commencement of the cruise, the surroundings of the vessel should be inspected within a radius of 300 m in search of birds. After the start of the cruise, two observers carry out observations, one per each side of the vessel. The observer must be in possession of forms so as to record bird observations, a head flashlight (at night), binoculars and a GPS device to indicate and record the positions of birds observed. At night, the floodlights must provide constant light and during the cruise they must be directed at an angle of approx. 20–30° laterally from the transect line. The observer must be able to control the beam of light freely. Observation results are recorded on a form (Appendix No. 6 to the EIA Report), but only the results from one cruise may be included on one form.

The long-tailed duck and velvet scoter belong to the group of diving benthophagi and show similar habitat requirements, therefore, they often stay together in sea basins. The same applies to the razorbill and common guillemot, which are diving ichthyophagi and whose food are mainly pelagic fish, and in locations where they are more numerous, usually both these species are encountered. Therefore, when considering together the long-tailed duck and velvet scoter, as well as the razorbill and common guillemot, two thresholds of abundance were adopted, above which it will not be possible to commence piling:

a) long-tailed duck and velvet scoter – 50 individuals of both species observed during the whole cruise. Both species belong to the most numerous seabirds wintering in the Baltic Sea and often form large groups. They are numerous in nearby shallow areas of the Natura 2000 network, where they find appropriate resources of benthic organisms they feed on. Thus, birds that were scared away will easily find alternative locations;
b) razorbill and common guillemot – 20 individuals of both species observed during the whole cruise. These species are definitely much less numerous than the long-tailed duck and velvet scoter. They are usually present in dispersion in the Polish Baltic Sea zone, although they may periodically form slightly higher concentrations near breeding colonies at the boundary of the territorial waters of Sweden. Their distribution in sea basins is most probably variable and depends on the presence of pelagic fish followed by these birds. In conducting offshore observations, in 30–40% of cases, it is not possible to distinguish the razorbill from the common guillemot. Considering both these species together will allow to take account of individuals not identified as to their species when making a decision on piling.

It was assumed that the numbers exceeding the threshold values indicate that birds make use of an abundant (also locally) source of food and scaring them away may have a negative, although probably short-term, impact on their condition.

If individuals of any species of seabirds are observed, the observer shall determine the number of individuals and their behavior from the moment in which they are observed until the vessel passes by their location: staying on the surface of water, diving, flying away outside the 2 km observation zone and moving at a shorter distance when the birds remain in this zone. The location where the birds of the species taken into account in making a decision on piling remained should be marked on the GPS device so that it was possible to return there to confirm their presence. The cruise is continued until the end of the designated route. If the birds observed stay in the surveyed water region and their number exceeds the established thresholds, the vessel returns to each location where the birds were present. Confirmation or non-confirmation of their presence in a total number above the adopted threshold affects the decision on the commencement of piling using the soft-start procedure [Figure 11.2].

Should the birds be found again in the number exceeding one of the determined thresholds, piling is stopped for 2 hours, after which the cruise is repeated.

Should the birds that were scared away move at a short distance, when they sit behind the stern of the vessel, their position should be roughly marked in the area through which the vessel has already passed, so that it is possible to see them during the return cruise. If birds that were scared away sit in front of the vessel, in the area through which the vessel will be passing, they should be counted again by entering in the form the same observation number that has been assigned to them when they were found for the first time.

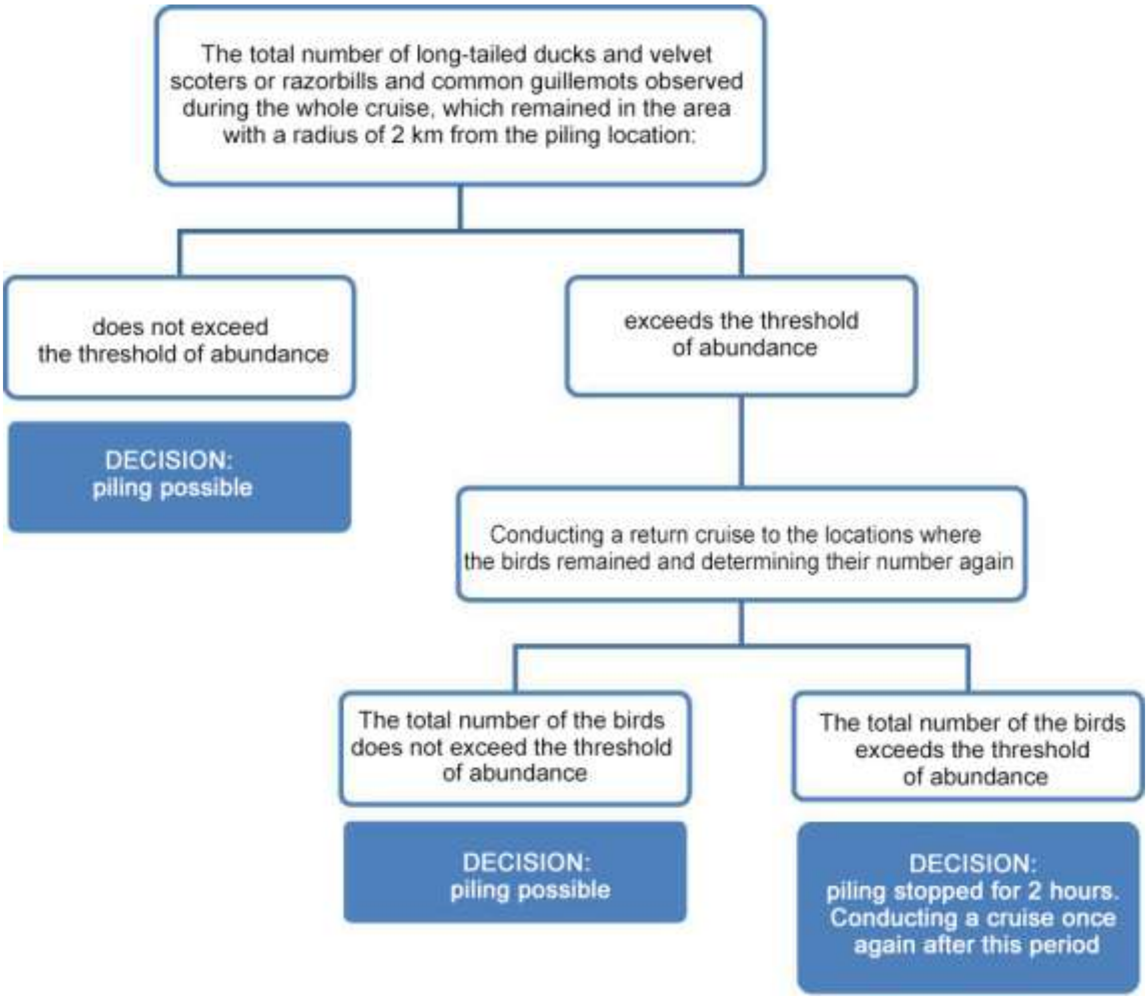


Figure 11.2. Diagram of making a decision on piling based on bird observation results [Source: own study]

Information about the possible commencement of piling works is immediately transmitted by radio after the end of the cruise, when the birds are not found in the number exceeding the adopted threshold or when their number does not exceed this threshold during the return cruise.

Information about the lack of possibility to proceed with piling is immediately transmitted by radio after the end of the cruise, when the birds of the four above-mentioned species during the return cruise are present in the surveyed area in the number exceeding the adopted threshold of abundance.

If piling is interrupted for more than 2 hours, a re-inspection should be carried out according to the described diagram. These inspections are to confirm that the birds did not return to the vicinity of the pile driving location. The inspection should also be carried out after 5 hours of piling, when one-off interruptions in noise emission do not exceed 2 hours. The commencement of driving of another pile must be preceded by the procedure of checking the presence of the birds within a radius of 2 km from its location. All activities and observations should be documented and presented in the form of an interim report, which should be accompanied by the completed observation forms (Appendix No. 6 to the EIA Report).

Ornithological monitoring of piling has not been conducted so far. Knowledge of the reactions of seabirds to a source of pulsating noise is also insufficient. Therefore, the above diagram of observation of the birds at sea may be modified as a result of the occurrence of unexpected bird behavior. Revisions in the ornithological monitoring method are introduced immediately after approval by the investor. The description of the introduced revisions in the supervision methodology is presented to the competent Regional Directorate for Environmental Protection in the interim report on the works performed.

11.2 Operation phase

The proposed mitigation measures during the operation phase include:

- painting the blade tips with bright colors, which should increase the probability of seeing a working turbine by flying birds. The Applicant declares that painting of blade tips will be in accordance with industry standards, technical conditions specified by the wind turbine supplier and will be agreed with competent authorities;
- lighting the turbines at night by installing small, weak and pulsing light sources. Permanently lit bright lights and flashing white lights increase the risk of collision. It is also proposed that lighting should be changed from continuous to pulsing with a long interval when visibility is limited. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards.
- from dusk to dawn, no positioning of lighting upwards;
- equipping the OWF with a system enabling short-term stopping of selected turbines of the wind turbines during bird migration periods, if the results of operational monitoring indicate that intensive migration of cranes at a collision height takes place over the Baltic Power OWF Area. In order to implement a system of temporary shutdowns during the crane migration period, it is planned to use radars and cameras installed on the main wind farm components (i.e. the Baltic Power OWF substation or the external working platform of the transition piece of the wind turbine foundation). The equipment will be installed in such locations so as to allow for observation of the Baltic Power OWF from the direction from which birds fly at a given migration stage (in spring from the south-western direction and in autumn from the north-eastern direction);
- renouncing from the use of steel jacket structures of wind turbine towers (not applicable to monopiles) due to a greater probability of bird collision with wind turbines having such a structure (less visible for birds from a greater distance).

11.3 Decommissioning phase

The proposed mitigation measures during the decommissioning phase include:

- removal of subsequent wind turbines starting from one place, so that the water region occupied by the OWF is gradually released from the structure (assuming that at certain decommissioning phases, the entire OWF or its specific parts may be dismantled sequentially, i.e. a specific category of works will be carried out on more than one wind turbine and other types of works will be undertaken only after its completion);
- maximizing the progress of dismantling works in the period from March to September, when the number of birds in this water region is the lowest.

12 Proposal for monitoring of the impact of the planned project and information on the available results of another monitoring, which may be important for determining the obligations in this regard

Pursuant to Article 66 of the EIA Act, this chapter presents a proposal for monitoring the impact of the planned project at the stages of its construction and operation or use, in particular on the forms of nature conservation referred to in Article 6 section 1 of the Act of April 16, 2004 on *nature conservation,* including on the objectives and subject of protection of the Natura 2000 site, and the continuity of ecological corridors connecting them, as well as information on the available results of other monitoring, which may be relevant for the determination of obligations in this respect.

12.1 Proposal for monitoring the impact of the planned project

Due to the length of the construction process (approx. 3 years) and the possibility of gradual commissioning of individual OWF parts, the schedules of individual monitoring were described in a continuous manner, indicating three clear times of project implementation:

- commencement of construction – understood as the first activities in the Baltic Power OWF Area related to its construction;
- commencement of operation – understood as the start-up of the first stage of the Baltic Power OWF, after which the energy generated in the Baltic Power OWF will be transferred to the NPS;
- construction completion – understood as the completion of all construction works in the Baltic Power OWF Area and the time when the project consisting in the construction of wind turbines with full installed capacity starts supplying with energy generated in all wind turbines to the NPS.

The methodologies of monitoring surveys will be presented to the Regional Director for Environmental Protection for approval prior to the commencement of surveys.

12.1.1 Underwater noise monitoring

Underwater noise monitoring will be carried out during the construction phase. Underwater noise caused mainly by piling of monopiles of wind turbines in the EIA Report was identified as a factor that may have a negative impact on the assessed marine organisms: birds, fish and mammals.

The place of underwater noise monitoring shall be the boundary of the Słowińska Refuge Natura 2000 site (PLH220023), where due to fish and marine mammals being the subject of protection on this area, the level of permitted underwater noise must not exceed for fish 186 dB re 1 μPa^2s SEL_{cum}, for porpoises 140 dB re 1 μPa^2s SEL_{cum} and HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency noise [318]), for seals 170 dB re 1 μPa^2s SEL_{cum} and PW-weighted (PW-weighting function for pinniped marine mammals [318]). The location of the noise measurement station shall be determined so that it is possible to assess the underwater noise level at the boundary of the Natura 2000 site: Ostoja Słowińska (PLH220023) for the works performed in the Baltic Power OWF Area. Noise measurements shall be performed using calibrated hydrophones in the frequency range from 10 Hz to 20 kHz.

Additionally, for 8 selected circumferential wind turbines, underwater noise monitoring during piling shall be carried out at 4 measurement points 11 km away from the piling site, located in 4 main directions (W, S, E, N). For other piling works, monitoring shall be carried out at one point at a distance of 11 km towards the main direction of noise propagation. The results of this monitoring will be subject to the same noise emission limits as the monitoring at the boundary of the Natura 2000 site – Ostoja Słowińska (PLH220023).

In at least 10 locations in the OWF area and the 5 km buffer, continuous underwater noise surveys shall be carried out during the entire piling process.
The tests shall be performed using the test methods and interpretation proposed in the BSH guidelines (StUK 4).
The results of underwater noise monitoring shall be submitted to the Regional Director for Environmental Protection in the form of periodic reports. If exceeding of the indicated noise levels is demonstrated, impact preventive or mitigation measures shall be proposed together with indication of the methods of their implementation and results control.

12.1.2 Monitoring of ichthyofauna

The purpose of the monitoring will be to determine the characteristics of the ichthyofauna complex that will be present in the Baltic Power OWF Area, in particular:

- examining the species composition and abundance of ichthyoplankton;
- determination of the occurrence and productivity of demersal fish on the basis of fishing with sets of survey nets;
- determination of the structure and characteristics of fish species present in exploratory fishing, with particular emphasis on species being the target of fishing, through a set of biological data (length, age, sex, weight, sexual maturity).

Surveys will be performed in spring and summer – after one year and 5 years from the completion of the construction and one year after the decommissioning phase.
During operation, the long-term effect of artificial reef on the number and taxonomic composition of fish will be assessed, including the occurrence of early development stages – larvae and fry, and potential settling of invasive species.
In the case of decommissioning of the Baltic Power OWF, the degree of changes that will occur after destruction of the artificial reef, potentially constituting the place of living, feeding, shelter and reproduction of many fish species, will be assessed.

12.1.2.1.1 Ichthyoplankton

Samples will be taken using a Bongo mesh with an inlet diameter of 60 cm and a mesh size of 300 µm. The haul will be carried out at the vessel speed of approx. 3 nodes, from the depth of 5 m above the bottom to the surface. The volume of water filtered during the water haul will be measured using an electronic flow meter.
The collected biological material will be preserved with a 4% formaldehyde solution. Ichthyoplankton are organisms floating in the water column and as such require area rather than point interpretation of data. The planned arrangement of stations will allow to assess the occurrence of ichthyoplankton in the Baltic Power OWF Area.
In the Baltic Power OWF Area, ichthyoplankton samples will be collected at 10 measurement and survey stations [Figure 12.1, Table 12.1]. The indicated location is only a navigational reference, so that the survey does not take place exactly in the assumed geographical position, but in its nearest position.

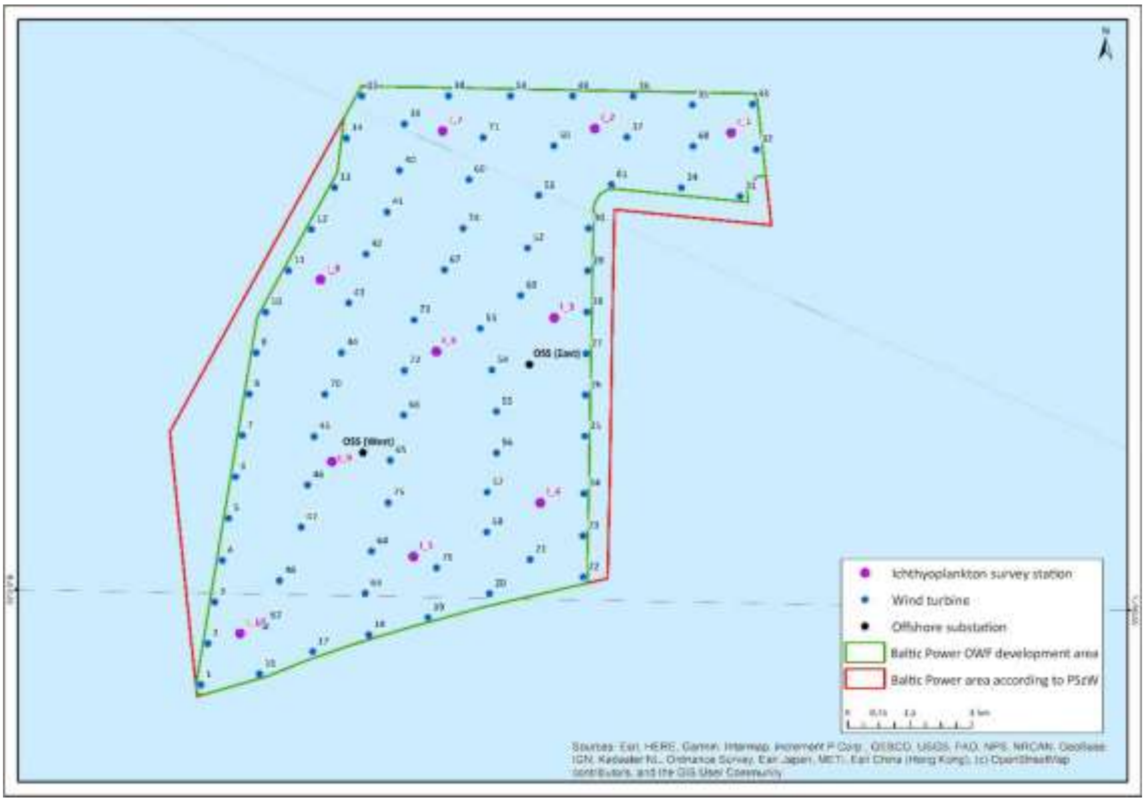


Figure 12.1. Location of ichthyoplankton survey stations [Source: own study]

Table 12.1. Coordinates of ichthyoplankton survey stations [Source: own study]

Station	PUWG 1992 [m]	
	Y	X
I_1	421027,18	805035,91
I_2	417729,79	805134,90
I_3	416753,11	800560,40
I_4	416420,42	796095,52
I_5	413351,41	794796,73
I_6	413904,43	799748,69
I_7	414058,78	805076,25
I_8	411107,86	801487,71
I_9	411382,93	797090,47
I_10	409163,45	792937,89

Collected ichthyoplankton samples will be analyzed under a stereoscopic microscope. A quantitative and qualitative analysis of all components of ichthyoplankton will be carried out. In case of a very large abundance of ichthyoplankton (roe or larvae/fry), a subsample will be subject to taxonomic analysis. Determinations shall be made to the lowest taxonomic unit possible (in most cases to the species).

Larvae/fry length measurements (of all individuals or a sub-sample of 50 individuals of a given species, if the number of larvae in the sample exceeds this value) will be performed using a digital image analysis system. Larval lengths will be expressed as *standard length* (SL), i.e. the distance from the beginning of the head (with closed snout) to the end of the dorsal strand/urostyle in the larvae or to the root of the tail fin in the fry.

The collected material will be used to determine the species composition and abundance of ichthyoplankton (converted to 10 m^2 of water surface) in the surveyed area.

12.1.2.1.2 Adult stages of fish (demersal fish complex)

Fishing will be carried out using bottom-set sets of survey nets constructed for survey purposes. The net design takes into account the necessity of non-selective fishing of all demersal fish present in the Baltic Power OWF Area and the need to assess the biological characteristics of fish.

Each test set [Figure 12.2] will consist of the following:

- 4 standard Nordic Coastal multi-mesh gillnets [355] with a length of 45 m each and a height of 1.80 m, with different mesh sizes in each panel;
- 3 standard fishing nets targeting cod with a total length of 165 m, a height of 3.5 m and a mesh side of 55 mm;
- 2 standard (turbot) gillnets targeting flat fish (European flounder, plaice, turbot) with a total length of 260 m, height of 1 m and mesh side of 130 mm.

The total length of each set is 605 m. A detailed diagram of the survey multi-mesh gillnet is presented in Figure [Figure 12.3].

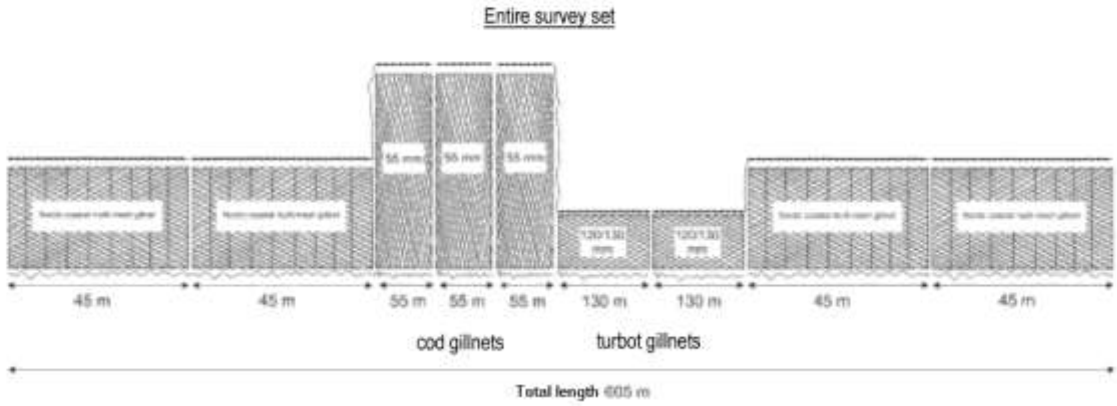


Figure 12.2. Diagram of the set of survey bottom fishing nets

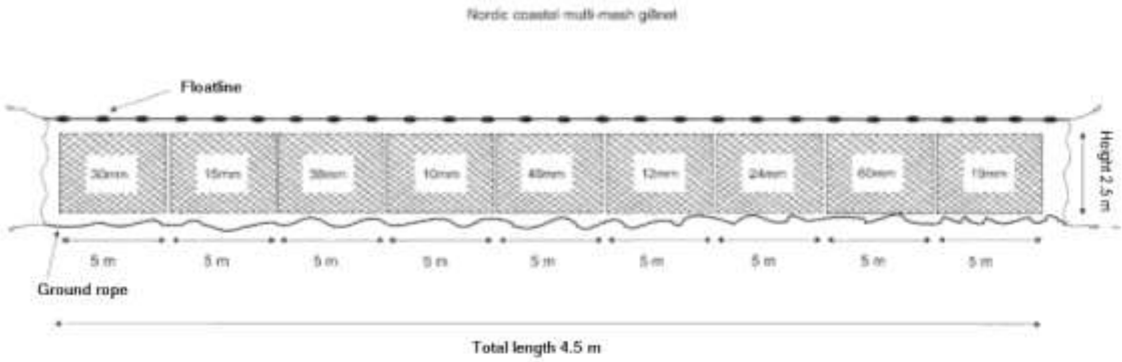


Figure 12.3. Survey multi-mesh gillnet

In the Baltic Power OWF Area, 8 sets of survey gillnets will be set [Figure 12.4, Table 12.2], with a total length of 4,840 m, and in the reference area 4 sets of gillnets with a total length of 2,420 m will be set.

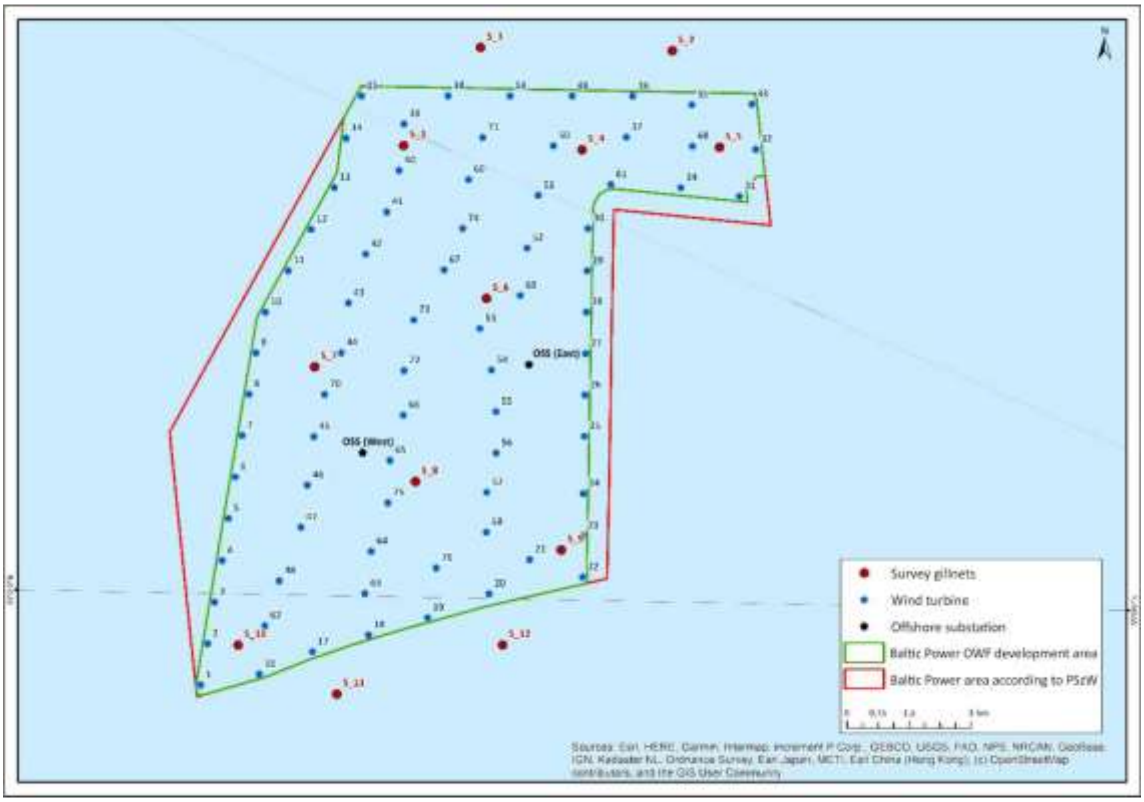


Figure 12.4. Distribution of gillnets [Source: own study]

Table 12.2. Coordinates of the gillnet distribution station [Source: own study]

Station	**PUWG 1992 [m]**	
	Y	**X**
S_1	414988.13	807096.35
S_2	419615.83	807015.38
S_3	413123.63	804727.73
S_4	417435.18	804625.48
S_5	420761.83	804686.15
S_6	415131.73	801032.35
S_7	410974.51	799381.50
S_8	413410.24	796611.91
S_9	416934.75	794960.80
S_10	409123.89	792664.29
S_11	411511.53	791484.84
S_12	415520.45	792668.09

The exposure time of a single set will be at least 12 hours, covering dusk and dawn times particularly important for daily migrations of demersal fishes. Productivity (number and weight of fish caught in each survey set) will be converted to 24-hour catch. Such standardization ensures the possibility of comparing the obtained results with the observations as part of the pre-implementation surveys. All nets at 12 stations will be cast on the same day and hauled in on the next day.

The following data will be recorded for each fishing site:

- date and time when the set was cast and hauled in;
- the geographical position of set casting (latitude and longitude in the GPS format);

- depth of fishing at the beginning and end of the set;
- temperature and salinity profile at the fishing location;
- fishing conditions.

The catch handling procedure will include:

- picking up of fishes from multi-panel survey nets;
- sorting of fishes by species;
- determination of catch mass of each fish species (for each type of net separately);
- measurements of length of each fish species (for each type of net separately). In the case of large catches, the measurement is carried out on a sub-sample of 200-300 fish specimens of smaller sizes – herring, gobies, sandeel and approx. 30–50 kg of fish of other species;
- ichthyological analysis of commercially used species (cod, European flounder). One analysis typically includes 5 specimens in each of the identified length classes.

Fish length measurements will be performed with an accuracy of up to 1.0 cm (rounded down), except for herring and sandeel, for which the length measurement accuracy will be up to 0.5 cm.

The ichthyological analysis will apply to commercially exploited species (cod, European flounder).

The procedure for the ichthyological analysis will include:

- measurement of length and mass of specimens;
- determination of the sex and stage of sexual maturity of the gonads (Maier's scale);
- assessment of the degree of stomach filling (on a scale from 0 – empty stomach to 4 – maximum stomach filling); if fishes are found in the stomach, their species will be determined, if possible;
- collection of otoliths to determine the age of a fish.

The age of demersal fishes will be determined in the laboratory. In the case of cod, the readings will be made with a broken otolith and, in the case of flat fishes, with dyed thin sections of the otolith center. In both cases, age determination will be based on counting the annual rings in two directions on the otolith, using stereoscopic microscopes with appropriate magnification.

According to survey methodologies for ichthyofauna surveys, precise positioning of vessels is not required. The characteristics of the ichthyofauna complex will be determined for the area of the Baltic Power OWF area, not at a specific point. Moreover, during net casting, vessels drift and the planned points of survey stations are only a navigational reference. The GPS system used allows the current position to be determined every 1 s with an accuracy better than 10 m, which is completely sufficient for the needs of ichthyofauna surveying.

12.1.3 Monitoring of migratory birds

Post-project monitoring should take into account radar monitoring as well as visual observations during the day. Radar surveys should target the trajectory of birds flying towards the Baltic Power OWF and their response to the barrier in the form of structural components of the OWF they encounter, as well as to determine the intensity of migration in the Baltic Power OWF Area and in its immediate vicinity in order to enable comparative analysis with other surveys that are available in this respect, as well as providing new data for analyzing the barrier effect and the frequency of avoidance (birds turning back). Radar surveys should be carried out during the migration period, in the months from March to May and from the end of July to mid-November. Optimum post-project monitoring should consist of simultaneous visual and radar and acoustic observations (at night, in order to identify species), allowing identification not only of the flight direction and response, but also of species. The survey station should be located on a permanent platform (e.g. OWF substation) or an anchored vessel and should allow for observation of the Baltic Power OWF from the direction from which birds arrive at a given migration stage, i.e.: on the south-western side of the Baltic Power OWF in spring and on the north-eastern side of the Baltic Power OWF in fall.

In order to monitor migratory birds, it is planned to use the equipment included in the system of temporary shutdown of turbines (radars and cameras) and microphones installed on the main components of the wind farm (i.e. substation or external working platform of the transition piece of the wind turbine foundation). The equipment will be installed in such locations so as to allow for observation of the Baltic Power OWF from the direction from which birds fly at a given migration stage (in spring from the south-western direction and in autumn from the north-eastern direction).

In each migration season, observations should be carried out for not less than 20 days in 2–5-day sessions, distributed evenly throughout the migration season. Taking into account the experience from similar projects in the Baltic Sea and the North Sea [i.a. 27, 211, 221], the authors of this EIA Report suggest that the monitoring of migratory birds should take place in two cycles per year, resulting from two bird migration periods, i.e. from March to May and from July to November, in 4 monitoring blocks of 2 test cycles in each migration period, in the first and third year after the commencement of operation.

12.1.4 Monitoring of seabirds

12.1.4.1 Pre-project monitoring (prior to the commencement of construction)

The surveys will focus on obtaining data on the number and distribution of birds related to the marine environment in the area designated for the construction of the Baltic Power OWF, together with a 5-kilometer zone around the boundaries of the Baltic Power OWF and in the reference area located near Darłowo. The reference area covers a water region similar in depth range to the Baltic Power OWF Area, which will allow the results of the surveys obtained in both areas to be directly related to each other. During the observation, all birds flying over the surveyed water region during counting will also be recorded, together with an estimate of the height at which they move. These observations will supplement the data on the bird flight height collected during the surveys carried out in 2018–2019 and will be a reference to the flight height recorded during the construction and after the construction of the Baltic Power OWF.

Birds will be counted from the vessel, following the methodology described in the methodological manual published by the Chief Inspectorate for Environmental Protection [294]. During the cruise along the designated transects, all floating and flying birds will be counted, and birds within in a 600 m wide strip (300 m on one side) will be recorded separately. The counting shall be done simultaneously by 2 people standing close to each other, each counting birds on one side of the vessel. A third person from the counting team will control the position and speed of the vessel using a GPS device and will record the depth of the water region based on echo sounder readings and will record weather conditions.

In connection with modeling of bird densities in the surveyed water region, the observation methodology described in the methodology manual of the Chief Inspectorate of Environmental Protection [294] was modified. This correction consists in dividing the transect strip into 4 zones on each side of the vessel:

- up to 50 meters from the side;
- 50–100 meters from side;

- 100–200 meters from the side;
- 200–300 meters from the side.

The aim is to allow the final analysis to take into account corrections related to the decreasing detection rate of birds with increasing distance from the vessel side. This is a standard procedure for counting the number of birds in water regions [374].

In addition, the number of flying birds using the "snap-shot" technique (recording flying birds which at a given moment are in the transect strip) will be counted. According to the current methodology [236, 294], birds accompanying the vessel will not be taken into account as this would overestimate their number by counting the same specimens multiple times. The number of snap-shot counts depends on the speed of the vessel. It can be calculated using the following formula:

$$N - \frac{0{,}309V}{D}$$

where:

N –- number of "snap-shot" counts in 10 minutes

V –- vessel speed in knots

D – maximum distance from which bird species flying in front of the vessel are identified (in kilometers). This is usually 0.8 km, but this distance decreases with a worse visibility.

The distance from the vessel side will assessed according to the procedure presented by Heinemann [177] and described in the methodological manual of the Chief Inspectorate of Environmental Protection [294], which is based on the relation describing the distance from the horizon in relation to the height at which the observer's eye is located. To determine the width of the transect strip, a transparent ruler with a properly marked scale (markers) is used, kept at a constant distance from the observer's eye [Figure 12.5].

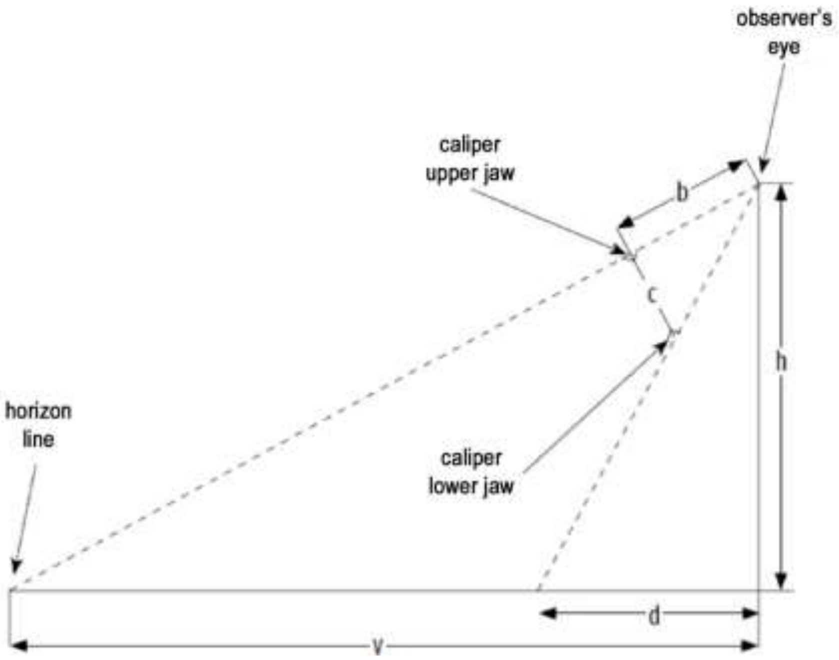


Figure 12.5. Diagram presenting the method of determining the distance from the horizon. C – distance on the ruler between two markers [cm], D – width of the transect on one side of the vessel side [m], h – height of the observer's eye above the water surface [m], V – distance of the observer from the horizon, which is calculated according to the following formula: v = 3838 ($h^{0.5}$)

The observations will be carried out from a height of approximately 2.5–5.5 m (the height of the observer's eye above the water surface) above the sea surface at all times when the vessel is moving along the transect strip. During counting, a constant speed of not less than 8 and not more than 11 knots will be maintained, depending on the vessel and weather conditions.

In both areas covered by the surveys, the transects were demarcated in a way allowing the obtained results to be representative of ever-changing conditions resulting from changes in depth. The length of each transect will be divided into smaller sections with a length of 500 m. Within each section, birds will be counted separately. The position, speed and course of the vessel will be controlled using a GPS device. The depth of the water region provided by the echo sounder being part of vessel equipment will be recorded at the beginning of each section and at the end of the transect. In order to minimize the probability of counting the same specimens twice, a gap between the adjacent transects of approx. 2 to approx. 4 km was planned. The length of four transects designated in the Baltic Power OWF Area will amount to 93.5 km in total, and the area within them will amount to 24.59 km^2 [Figure 12.6, Table 12.4], which constitutes 12.3% of the surface area of the Baltic Power OWF Area surveyed. The route of the cruise was planned in such a way that the modeling of bird density would cover the area intended for the project as well as a five-kilometer zone around the boundaries of the wind farm. This will allow assessing the distribution of birds staying at different distances from the future wind turbine.

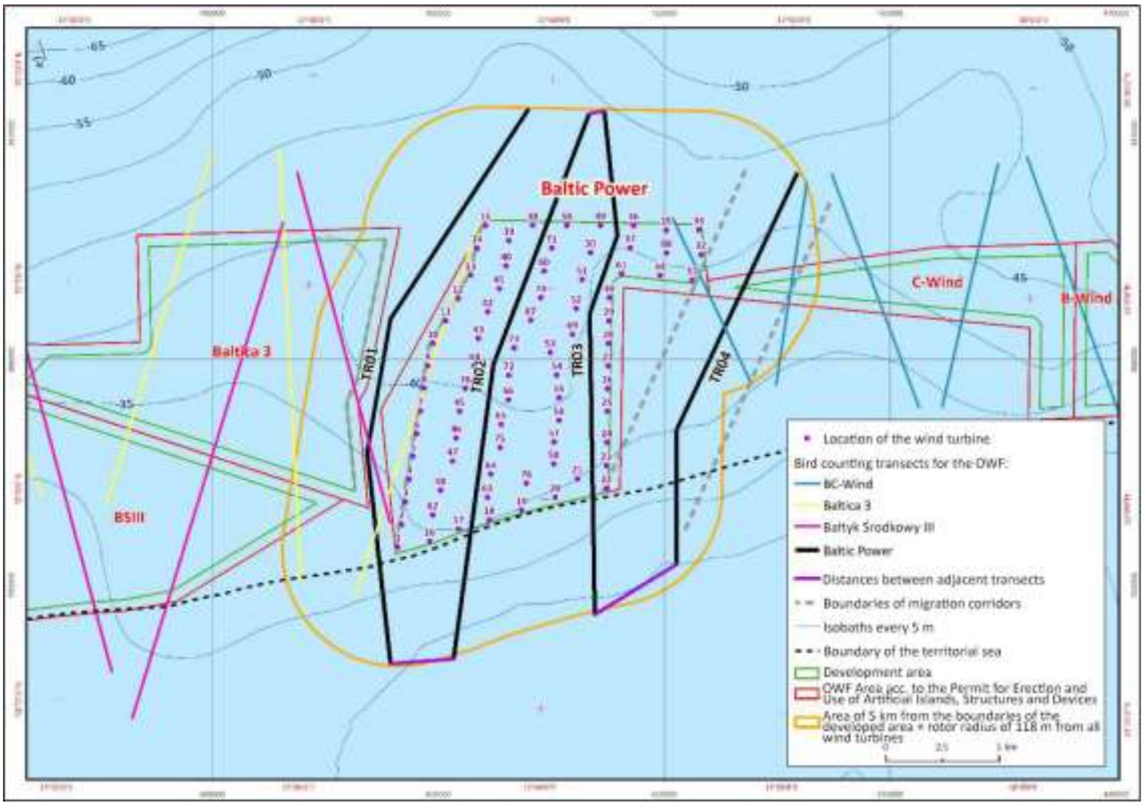


Figure 12.6. Layout of transects in the Baltic Power OWF Area as part of the pre-project monitoring [Source: own study]

Table 12.3. Coordinates of transects in the Baltic Power OWF Area as part of the pre-project monitoring [Source: own study]

Transect	Coordinate system				Length [km]
	PUWG 1992 [m]		Geocentric geodetic coordinates system GRS80h [DD°MM'SS,SSS"]		
	Y	X	Length	Width	
TR01	414005,79	811085,39	17°39'00,033" E	55°09'19,564" N	27

	407891,75	801801,16	17°33'25,453" E	55°04'15,258" N	
	406860,49	795927,30	17°32'34,219" E	55°01'04,546" N	
	407898,00	786564,89	17°33'43,468" E	54°56'02,361" N	
TR02	416684,17	810865,57	17°41'31,589" E	55°09'14,102" N	26
	412449,37	799803,90	17°37'44,610" E	55°03'13,614" N	
	410754,75	787262,45	17°36'23,196" E	54°56'26,797" N	
	410687,80	786766,95	17°36'19,988" E	54°56'10,724" N	
TR03	416933,39	788734,62	17°42'08,883" E	54°57'18,268" N	23
	416702,67	802000,66	17°41'41,993" E	55°04'27,318" N	
	416702,13	802031,95	17°41'41,930" E	55°04'28,330" N	
	417925,95	805481,47	17°42'47,352" E	55°06'20,663" N	
	417354,19	810992,36	17°42'09,310" E	55°09'18,609" N	
TR04	425894,32	808266,59	17°50'14,399" E	55°07'55,291" N	18
	420556,89	796901,55	17°45'24,429" E	55°01'44,622" N	
	420552,62	790957,52	17°45'30,132" E	54°58'32,311" N	

The layout of transects in the Baltic Power OWF Area was aligned with the planned wind turbine setting scheme. The setting of wind turbines makes it impossible to carry out straight transects that are used in surveys of birds in sea areas, including surveys in the Baltic Power OWF Area, which took place in 2018–2019. Deviation from straight transects is allowed and transects which are not a straight line, but the sequence of sections connecting at an open angle, are commonly used in onshore bird surveys, including in the National Monitoring of Common Breeding Birds.

The reference area is located near Darłowo and partially within the Coastal Waters of the Baltic Sea – Natura 2000 site (PLB990002). The cruise route in the reference area consists of five transects with a total length of 88 km. They cover an area of 51.8 km^2 [Figure 12.7, Table 12.4], which constitutes 12.1% of the reference area. The selected area is the only one in the Polish maritime areas which corresponds to depths occurring in the Baltic Power OWF and not being taken into account in spatial planning for the construction of offshore wind farms.

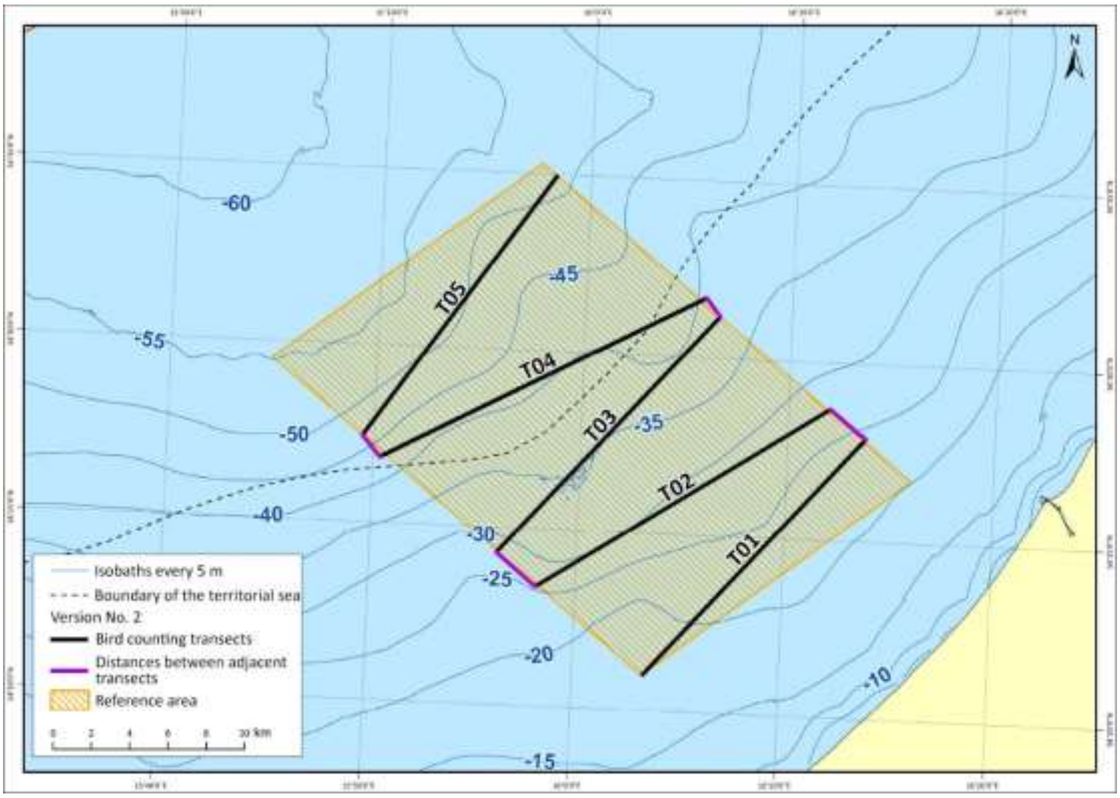


Figure 12.7. Layout of transects in the reference area as part of the pre-project monitoring [Source: own study]

Table 12.4. Coordinates of transects in the reference area as part of the pre-project monitoring [Source: own study]

Transect	PUWG 1992 [m]				Length [km]
	Start		End		
	Y	X	Y	X	
TR01	294208,99	737281,44	304420,20	750873,02	17
TR02	312218,09	744440,01	295119,73	736154,72	19
TR03	312929,24	743467,14	301200,34	731161,33	17
TR04	303228,82	729369,60	318684,05	738596,51	18
TR05	320490,57	737028,83	308784,21	724701,58	17

As part of the pre-project monitoring, it is planned to carry out two cruises (campaigns) each month in the period from October to May, when the number of birds in the southern Baltic Sea is high. In accordance with the commonly used methodology of counting birds at sea, recommended by the Chief Inspectorate of Environmental Protection [294], it is allowed to carry out one survey campaign in a month when long-lasting weather conditions make it impossible to carry out another cruise. During the period of lower number of birds, one survey campaign will be carried out in August and September. The interval between two consecutive cruises in a given area in a given month will not be shorter than 7 days. All cruises will take place in favorable weather conditions, with good visibility, without continuous precipitation, and with a wave motion not exceeding 3°B. Each time (during each survey campaign), the counting of birds will be carried out along all transects in the Baltic Power OWF Area and in the reference area. Counting in both areas must take place within one and the same day. The timing during cruises in both water regions will allow to minimize the risk of omission of possible movements of a higher number of birds between the Baltic Power OWF and the reference area.

Additionally, all flying birds will be recorded (also those found outside the moment when the snap-shot technique is used), indicating the zone of their flight height:

- A – up to 30 m (below the range of rotors of future wind turbines);
- B – from 30 to 150 m (potential lower range of rotors of future wind turbines);
- C – from 150 to 265 m (potential upper range of rotors of future wind turbines);
- D – above 265 m (above the range of rotors of future wind turbines).

These observations will supplement the data on the flight height of birds collected during the surveys carried out in 2018-–2019 in the Baltic Power OWF Area and will constitute a reference to the flight height recorded in the pre-project monitoring and after the construction of the Baltic Power OWF.

The results obtained will be presented by four phenological periods, in the form of tables with the numbers of all taxa found by three groups of species: seabirds, which during the non-breeding season are mostly present in sea waters, reaching their highest population size in the high sea zone, located more than 1 km from the shore.

1) Seagulls, which accompany fishing vessels in fishing grounds, are an exception to this rule, and their occurrence in the open sea is strongly dependent on human activity. Among seagulls, the black-headed gull, common gull and Mediterranean gull, which are very rarely present in the open sea, were excluded from the group of seabirds;
2) waterbirds, which are mainly associated with inland reservoirs and at sea occur in large numbers only near the shores, mainly in estuaries of rivers and on coastal bays and lagoons;
3) birds associated only with terrestrial environments that only fly over the surveyed area and are not able to stay on the water.

A chart of changes in the number of birds during the survey period will be prepared for the entire group of birds and separately for the most numerous species.

When calculating bird densities, only individuals found within the transect strip and during the counting by means of the "snap-shot" technique will be considered. The results obtained will be adjusted to include the decrease in the bird detection rate with the increasing distance from the vessel side. Such an operation is currently a standard in surveys concerning the abundance and distribution of birds in sea areas [152, 374, 194, 405]. The correction will be made using Distance 6.0 software [431], which is a standard tool in analyses of bird distribution based on calculations along transects. The selection of the best model describing the decrease in the bird detection rate will be based on the Akaike criterion [67]. The software also computes the function of the decrease in the detection rate with the increasing distance from the vessel and determines the so-called effective strip width (ESW). This is the distance from one side of the vessel that divides a 300 m wide transect into two parts in such a way that the number of birds spotted in the farther zone is equal to the number of birds not spotted in the closer zone [429]. The population sizes obtained during the counting in the transect strip will be adjusted based on the ESW value.

The distribution of birds in the surveyed water region will be shown by means of the maps where the areas with similar densities are marked with one color. The population size of the most important species in the group and of the entire group of birds will be estimated based on the mean density maps.

For each specifies found, its protection status in Poland will be provided, specifying whether it is included in Annex I of EU Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) and the risk category according to the International Union for Conservation of Nature – IUCN (IUCN *Red List of Threatened Species).*

12.1.4.2 Post-project monitoring

The surveys will focus on obtaining data on changes in the number and distribution of birds related to the marine environment in the area where the Baltic Power OWF will be constructed, together with a 5-kilometer zone around the Baltic Power OWF area, and in the reference area located near Darłowo. The reference area covers a water region similar in depth range to the Baltic Power OWF Area, which will allow the results of the surveys obtained in both areas to be directly related to each other. During the observation, all birds flying over the surveyed water region during counting will also be recorded, together with an estimate of the height at which they move. These observations will supplement the data on the bird flight height collected during the surveys carried out in 2018–2019 and will be a reference to the flight height recorded during pre-project surveys in the same area.

The surveys will be carried out using the same transects and the same methodology as for the pre-project monitoring.

As part of the pre-project monitoring, it is planned to carry out two cruises (campaigns) each month in the period from October to May, when the number of birds in the southern Baltic Sea is high. In accordance with the commonly used methodology of counting birds at sea, recommended by the Chief Inspectorate of Environmental Protection [294], it is allowed to carry out one survey campaign in a month when long-lasting weather conditions make it impossible to carry out another cruise. During the period of lower number of birds, one survey campaign will be carried out in August and September. The interval between two consecutive cruises in a given area in a given month will not be shorter than 7 days. All cruises will take place in favorable weather conditions, with good visibility, without continuous precipitation, and with a wave motion not exceeding 3°B. Each time (during each campaign), the counting of birds will be carried out along all transects in the Baltic Power OWF Area and in the reference area. Counting in both areas must take place within one and the same day. The timing during cruises in both water regions will allow to minimize the risk of omission of possible movements of a higher number of birds between the Baltic Power OWF and the reference area.

Additionally, all flying birds will be recorded (also those found outside the moment when the snap-shot technique is used), indicating the zone of their flight height:

- A – up to 30 m (below the range of rotors of future wind turbines);
- B – from 30 to 150 m (lower range of rotors of future wind turbines);
- C – from 150 to 265 m (upper range of rotors of future wind turbines);
- D – above 265 m (above the range of rotors of future wind turbines).

These observations will supplement the data on the flight height of birds collected during the surveys carried out in 2018-–2019 in the Baltic Power OWF Area and will constitute a reference to the flight height recorded in the pre-project monitoring and after the construction of the Baltic Power OWF.

The reference point for the post-project surveys will be the results obtained as part of the pre-project surveys. An identical layout of transects and the same methodology will enable direct comparison of results from both monitoring activities.

The results obtained will be presented by four phenological periods, in the form of tables with the numbers of all taxa found by three groups of species.

1) seabirds, which during the non-breeding season are mostly present in sea waters, reaching their highest population size in the high sea zone, located more than 1 km from the shore. Seagulls, which accompany

fishing boats in fishing grounds, are an exception to this rule, and their occurrence in the open sea is strongly dependent on human activity. Among seagulls, the black-headed gull, common gull and Mediterranean gull, which are very rarely present in the open sea, were excluded from the group of seabirds;

2) waterbirds, which are mainly associated with inland reservoirs and at sea occur in large numbers only near the shores, mainly in estuaries of rivers and on coastal bays and lagoons;
3) birds associated only with terrestrial environments that only fly over the surveyed area and are not able to stay on the water.

A chart of changes in the number of birds during the survey period will be prepared for the entire group of birds and separately for the most numerous species.

When calculating bird densities, only individuals found within the transect strip and during the counting by means of the “snap-shot” technique will be considered. The results obtained will be adjusted to include the decrease in the bird detection rate with the increasing distance from the vessel side. Such an operation is currently a standard in surveys concerning the abundance and distribution of birds in sea areas [152, 374, 194, 405]. The correction will be made using Distance 6.0 software [431], which is a standard tool in analyses of bird distribution based on calculations along transects. The selection of the best model describing the decrease in the bird detection rate will be based on the Akaike criterion [67]. The software also computes the function of the decrease in the detection rate with the increasing distance from the vessel and determines the so-called effective strip width (ESW). This is the distance from one side of the vessel that divides a 300 m wide transect into two parts in such a way that the number of birds spotted in the farther zone is equal to the number of birds not spotted in the closer zone [429]. The population sizes obtained during the counting in the transect strip will be adjusted based on the ESW value.

The distribution of birds in the surveyed water region will be shown by means of the maps where the areas with similar densities are marked with one color. The population size of the most important species in the group and of the entire group of birds will be estimated based on the mean density maps.

For each specifies found, its protection status in Poland will be provided, specifying whether it is included in Annex I of EU Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) and the risk category according to the International Union for Conservation of Nature – IUCN (IUCN *Red List of Threatened Species).*

12.1.5 Monitoring of marine mammals

Due to the very low number of porpoises detection, each monitoring to investigate the impact of the OWF construction phase is difficult. The monitoring must be carried out with the use of C-POD devices.

At least 5 C-POD devices should be placed in the area of the designed OWF, preferably at the same stations as during the pre-project monitoring. Additionally, 5 C-POD devices should be placed in a gradient system covering an area of not less than 20 km outside the impact zone (cumulative TTS zone related to piling) – see the example provided in Brandt et al. [63].

The gradient system requires the classification of samples depending on the distance and eliminates the problem with selecting the control site [22]. It is also more effective than random selection of control points to detect changes caused by disturbances. It has been shown to be more effective in surveying the movement of porpoises due to piling and in surveying the differences in momentary impacts depending on distance [93].

Monitoring of porpoises should commence no later than 6 months before the planned construction works, be carried out during the entire construction phase and at least 2 years in total after its completion, i.e. in the first and third year of operation.

12.1.6 Monitoring of benthic organisms

Due to the occurrence of negative impacts in the OWF construction and operation phases on benthic communities, monitoring of these organisms should be carried out. The issue of colonization of artificial hard substrates by animal and plant periphyton communities is presented in sub-chapters 6.1.2.6.1.1 and 6.1.2.6.1.2. An important strategy for monitoring surveys is the possibility of comparing the results of these surveys with the results of surveying, and therefore they should be planned in similar seasons. Due to the lack of standard commonly used guidelines for performance of such surveys in the Polish maritime areas, it was proposed to apply a monitoring methodology of an expert nature, based primarily on the life cycle of benthic organisms in the southern Baltic Sea. The proposal of benthic monitoring in the scope of dates and frequency of surveying tasks was prepared also on the basis of the literature of the subject [250, 407], whereas in the scope of the methodology of analyses of benthic organisms samples on the basis of a methodological guide [250].

The program of monitoring surveys of benthos in the Baltic Power OWF Area in the scope of surveys of flora and periphyton will be carried out on 5 underwater structural elements of wind turbines and the accompanying infrastructure.

On each investigated facility, a film and photographic documentation will be prepared for the entire vertical structure overgrown with macroalgae and epiphytic fauna (please note that the depth of occurrence of epiphytic flora may differ from the range of occurrence of epiphytic fauna). Starting from the water surface to the depth of the maximum identified range of epiphytic organisms, at individual depths, at maximum 2 m intervals samples will be collected by a diver or a ROV vehicle from a specific surface for surveying the taxonomic composition and biomass of flora and periphyton. The surveys will be carried out once a year, in June. First surveys should be carried out after at least 3 months have passed since the completion of the construction of the wind turbine selected for monitoring. Subsequent surveys should be performed 2 and 4 years after the first survey. The last surveys should be performed one year before the planned disassembly of the wind farm.

As part of the benthic monitoring surveys, macrozoobenthic surveys will also be performed within 5 monopiles of wind turbines selected so that they represent possible staging of the construction (structures constructed at different stages) and that they are located in different parts of the Baltic Power OWF area. In the vicinity of a single monopile, 6 stations are to be designated, including 3 stations on the transect of the main profile (in the near-bed current axis) at a distance of 20, 50 and 100 m from the monopile, and 3 stations on the transect perpendicular to the main profile (reference profile) at the same distances. The surveys will be performed after completion of the construction of the structures selected for monitoring, once in a period similar to the survey (from May to June). The first surveys should be performed within the indicated period after completion of the construction, and the following surveys after 2 and 4 years since the first survey. The last surveys should be performed one year before the planned disassembly of the wind farm.

12.1.7 Bat monitoring

The aim of the post-project monitoring is to verify the assessment assumptions in the scope of changes in the use of the Baltic Power OWF Area by bats. Monitoring as part of post-project surveys should include surveys of the activity of bats – determination of the species composition and population size. The equipment used should allow automatic recording and meet the minimum requirements for equipment used in the pre-project monitoring. The equipment can be mounted e.g. at a substation or at wind turbines [345].

post-project monitoring should cover a period of 3 years – the first year after the wind turbine is handed over for operation as well as the third year of the Baltic Power OWF operation. Monitoring should cover the period of spring migration (from April to May) and autumn migration (from August to October).

Due to the lack of technological solutions enabling reliable bat mortality and collision surveys on offshore wind farms, the requirement for mortality and collision surveys indicated by the designed guidelines should be refrained from [224].

12.2 Information on the available results of another monitoring which may be important for determining the obligations in this regard

As part of the State Environmental Monitoring, environmental monitoring of the Polish part of the Baltic Sea is carried out. This monitoring includes surveys of the following parameters:

- physical and chemical: temperature, salinity, oxygen concentration, Secchi disk visibility, content of biogenic substances, heavy metals and persistent organic compounds;
- biological: phytoplankton, zooplankton, phytobenthos and macrozoobenthos.

The level of harmful substances in water and marine organisms as well as the content of radionuclides in water and sediments are also monitored. Moreover, surveys of ichthyofauna and optionally microbiology, surveys of hydrographic conditions, waste in the marine environment and underwater noise are carried out (State Environmental Monitoring Program, 2015). The results of this monitoring are collected and stored in the oceanographic database in the Maritime Division in Gdynia IMGW-PIB and in the “ICHTHYOFAUNA” database at the Chief Inspectorate of Environmental Protection in Warsaw (State Environmental Monitoring Program, 2015).

Moreover, since 2015, Monitoring of Marine Species and Habitats (MMSH) has been carried out in the scope of 8 species of fishes and lampreys (sea lamprey, European river lamprey, twait shad, asp, European weatherfish, spined loach, sichel and bitterling), 4 species of marine mammals (porpoise, gray seal, harbor seal and ringed seal) and 5 natural habitats related to maritime areas [Submarine sandbanks (1110); Estuaries (1130); Lagoons and coastal lakes (1150); Large shallow bays (1160) and Rocky and stony seabed, reefs (1170)]. The MMSH results are collected and made available to the Chief Inspectorate of Environmental Protection.

In the State Environmental Monitoring as part of the task entitled “Monitoring of birds taking into account the areas of special protection of birds – Natura 2000”, a number of bird monitoring activities are carried out, which may be important for determining the obligations of monitoring the impact of the planned project, including (State Environmental Monitoring, 2015):

- Monitoring of Flag Bird Species, including monitoring of twelve bird species with characteristics of the so-called flag species, including: mute swan, red-necked grebe, black-necked grebe, bittern, gray heron, white stork, western marsh-harrier, common crane, black-headed gull, common tern, black tern and rook;
- Monitoring of Wintering Seabirds (MWS), including monitoring of averagely numerous and numerous species of anseriformes wintering in the Polish Baltic Sea zone, including basic species (red-throated diver black-throated diver, horned grebe, red-throated grebe, long-tailed duck, velvet scoter, common

scoter, black guillemot, razorbill and common guillemot) and additional species (great crested grebe, European herring gull, great black-backed gull, common gull and black-headed gull).

The results of these monitoring activities are also collected and made available to the Chief Inspectorate of Environmental Protection in Warsaw.

The ministry competent for maritime economy collects data on the volume of fishing catches carried out in the Polish maritime areas. An analysis of these data will enable the assessment in the future of the impact of the planned project on fishing.

In the perspective of several dozen years for which the Baltic Power OWF is planned to be constructed, the obtained results of surveys as part of performed monitoring and information on other activities performed in maritime areas may be used to monitor the environmental impact of the project. This is due to the fact that the scope of these monitoring activities and information covers those elements of the marine environment which may be directly and indirectly affected by the planned project. In addition, long-time series of data will allow short-term changes in the environment to be eliminated from the assessment, i.e. those resulting from the specificity of the complex marine ecosystem and not being a consequence of the impact of the planned project.

13 Limited use area

The issue of establishing a limited use area (LUA) is governed by the provisions of Article 135 section 1 of the *Environmental Protection Act* of April 27, 2001: "*If the environmental review or the environmental impact assessment required under the provisions of the Act of October 3, 2008 on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments or the post-project analysis show that, despite the application of available technical, process and organizational solutions, the environmental quality standards outside the premises of the plant or other facility cannot be met, then a limited use area is created for a wastewater treatment plant, municipal waste landfill, composting plant, communication route, airport, power line and substation as well as a radiocommunication, radionavigation and radiolocation systems.*"

Two out of the above-mentioned tasks, to be performed as part of the planned project, i.e. substations as well as radiocommunication, radionavigation and radiolocation systems, may require an establishment of a LUA.

The validity of establishing a LUA with respect to the planned OWF should be examined by analyzing whether the environmental quality standards cannot be met outside the area of the planned OWF in the meaning of a plant as defined in Article 3 section 48 of the *Environmental Protection Act* of April 27, 2001: "*a plant shall mean one or more systems together with the land to which the plant operator holds a legal title, and with the equipment located thereon.*"

This EIA Report indicates that at the current stage of project preparation, there are no grounds to determine the possibility of exceeding the environmental quality standards either in relation to air, noise, wastewater or the EM field – the intensity of the magnetic field and the electric field will not exceed the permissible values outside the area to which the Applicant holds a legal title. The nearest areas for which environmental quality standards were specified in the aforementioned scope are located onshore, at a distance of over 23 km from the planned project.

14 Analysis of possible social conflicts related to the planned project, including the analysis of impacts on the local community

It should be assumed that the period of informing about the planned Baltic Power OWF is 2011 and the following years, when:

- the Applicant submitted a request for issuing the Permit for the erection and use of artificial islands, structures and devices and obtained Decision of the Minister of Transport, Construction and Maritime Economy No. MFW/6/12 of May 9, 2012 on the permit for the erection and use of artificial islands, structures and devices in the Polish maritime areas for the project named "Offshore Wind Farms Complex with a maximum total power output of 1,200 MW together with technical, measurement, research and service infrastructure related to the preparatory, execution and operation stages";
- the basic documents defining the spatial policy of the country and region have been adopted:
  - "Polityka energetyczna Polski do 2040 roku " (the Polish Energy Policy until 2040) adopted by Resolution of the Council of Ministers of February 2, 2021;
  - "Polityka Morska Rzeczypospolitej Polskiej do roku 2020 (z perspektywą do 2030 roku)" (the Maritime Policy of the Republic of Poland until 2020 (with a perspective until 2030)) (Ministry of Infrastructure, Warsaw 2015) prepared by the Interministerial Team for the Maritime Policy of the Republic of Poland on the basis of the document "Założenia polityki morskiej Rzeczypospolitej Polskiej do roku 2020" (Assumptions of the Maritime Policy of the Republic of Poland until 2020) of September 14, 2009;
  - "Koncepcja Przestrzennego Zagospodarowania Kraju 2030" (the National Spatial Development Concept 2030) adopted by Resolution No. 239 of the Council of Ministers of December 13, 2011;
  - The Spatial Development Plan for the Polish Maritime Areas [PZPPOM – Plan Zagospodarowania Przestrzennego Polskich Obszarów Morskich] adopted by the Regulation of the Council of Ministers of April 14, 2021 on the *adoption of the spatial development plan for internal sea waters, the territorial sea and the exclusive economic zone at a scale of 1:200,000*;
  - "Strategia Rozwoju Województwa Pomorskiego 2030" (Pomorskie Voivodship Development Strategy 2020) adopted by Resolution No. 376/XXXI/21 of the Pomorskie Voivodship Parliament of April 12, 2021;
  - "Regionalny Program Strategiczny w zakresie energetyki i środowiska. Ekoefektywne Pomorze" (Regional Strategic Program for the Energy and the Environment. Eco-Efficient Pomerania) adopted by Resolution No. 415/324/18 of the Government of the Pomorskie Voivodship of April 24, 2018;
  - "Plan zagospodarowania przestrzennego województwa pomorskiego 2030" (Pomorskie Voivodship Spatial Development Plan 2030) adopted by Resolution of the Pomorskie Voivodship Parliament No. 318/XXX/16 of December 29, 2016 on the adoption of a new Pomorskie Voivodship spatial development plan along with a spatial development plan for the Tricity metropolitan area constituting a part of the former.

According to the aforementioned permit and the provisions of planning documents, offshore wind energy constitutes an element of the National Power System.

Draft strategic documents together with strategic environmental assessments were subject to the public participation procedure together with public consultation conducted by competent administration authorities prior to their adoption in accordance with the provisions of the Act on spatial planning and development and the Act of October 3, 2008 *on access to information on the environment and its protection, public participation in* *environmental protection and on environmental impact assessments.*

The starting point for the public consultations on the planned OWF were national and EU legal requirements, which indicate that planned projects that may have a significant impact on the environment – and the construction of offshore wind farms can be considered as such – should be consulted with the public at the earliest possible stage, getting to know the opinions of the interested persons and local communities, in order to identify potential problems and determine the methods of solving them as well as to provide information to interested groups or persons.

The planned OWF is located in the Baltic Sea within the Polish Exclusive Economic Zone (EEZ), north of the seashore, at the height of Rowy-Łeba towns, at a distance of approx. 23 to 36 km from the shore. The nearest seaports are Łeba and Władysławowo in the Pomorskie Voivodship. The regional, on- and offshore nature of the project means a wide range of potential stakeholders and interested entities from the northern part of the Pomorskie Voivodship and other interested parties.

The target groups for conducting information meetings were selected taking into account a number of criteria: the nature of the project, location, potential impacts of the planned project, and the degree and type of interest of various social groups identified during other investments at sea.

The planned OWF will be located in a water region operated and used by people, therefore, it can be expected that the execution and operation of the project, and above all the exclusion or limitation of the existing use and difficulties resulting from the establishment of transport corridors, will potentially cause social conflicts. The possibility of using the water region and safety zone as well as other restrictions will be determined in the future by the Director of the Maritime Office in Gdynia. Considering the nature of the OWF, it was considered probable that this may apply to fisheries and shipping within the OWF region.

The following aspects related to the planned OWF were identified, which may cause social conflicts:

- construction and transport of large-size marine structures;
- concern about the environmental conditions in the Baltic Sea, issues of broadly understood nature and bird protection;
- concern of the current and potential users of the OWF Area about the possibility of access to this water region, concern about workplaces, e.g., related to fisheries, ensuring proper functioning of communication systems;
- concern about navigation restrictions and their nature in the OWF Area;
- landscape aspects, visibility of the OWF;
- concerns for the impact on tourism in coastal municipalities;
- concerns for the impact on the economy in coastal municipalities.

Potential positive changes that may be caused by the planned OWF were also identified:

- workplaces for residents of coastal municipalities at the stage of construction and long-term operation of the OWF;
- impact on tourism and perception of the OWF as a tourist attraction.

The potential conflict concerning the planned OWF is underpinned by the following issues:

- depending on the decisions of the maritime administration, one can expect difficulties for the fisheries in the water area occupied by the OWF, resulting in a limitation of access to it and thus hindering free fishing and transit through the OWF area;

- incompatibility of the objectives and interests of the parties – the objective indicated by the fishermen community is fishing and transit through the OWF Area to further fishing grounds, as well as ensuring the presence of fish in the Baltic Sea;
- disturbance in the environment that may result from the planned OWF;
- negative perception of the OWF by some people as an element that degrades the landscape and the natural environment.

The potential stakeholders (target groups) are:

- administration and state institutions;
- self-government units and institutions;
- trade organizations, including fishing organizations;
- national, regional and local social associations and organizations;
- non-governmental environmental organizations;
- potential suppliers, partners, other investors at sea;
- scientific, research and design units.

Due to the location and scope of the tasks of the planned OWF and the direct users of the sea in this area at the early stage of the project preparation, the Applicant decided to hold information meetings with representatives of fishermen organizations. Information meetings were held with the representatives of fishermen organizations in March 2020. During the procedure concerning the issue of the decision on environmental conditions – the decision was issued by the General Director for Environmental Protection on June 29, 2022 (ref. No.: DOOŚ-WDŚZOO.420.59.2021.SP.10) – the possibility of public participation was also ensured, which included, among others, making public the information on the pending procedure and requesting all the parties concerned to submit comments and motions regarding the project. Once again, formal consultation will be held during the environmental impact assessment procedure conducted by the General Director for Environmental Protection as part of the procedure for amending the said decision on environmental conditions for the Baltic Power OWF.

The participants of the said consultation meetings pointed out a wide variety of issues, including environmental issues. The results of the consultations were used in the preparation of this EIA Report for the Baltic Power OWF. The main conclusions of the information meetings held in 2020 were as follows:

- the participants raised the issue of occupying the fishing grounds by the OWF Area, transit through the OWF Area and the method of co-use of the OWF Area for fishing and transit of fishing vessels to fishing grounds located north of the OWF Area and an extension of the route to these fishing grounds;
- the fishermen showed interest in the methods of conducted research and the obtained data, and the results of research and environmental surveys related to the environment, mainly in the scope of ichthyofauna and birds, and the condition of the ecosystem, in the context fish return after the construction stage to the OWF Area and disappearance of mussels in the OWF Area;
- the potential benefits for the municipalities of Łeba and Władysławowo were indicated, which include the development of the port towards providing services for the OWF and the use of the potential of pleasure craft related to the OWF Area;
- the issue of using local resources of entrepreneurs in the municipalities of Łeba and Władysławowo for the construction and operation process was raised.

The comments and requests of the stakeholders made during the information meetings were recorded on electronic carriers and in writing. At the same time, they create preconditions for a broad public participation in the environmental impact assessment procedure.

15 Description of difficulties resulting from technological deficiencies or gaps in current knowledge which have been encountered during elaboration of the report

Phytobenthos

Overgrowth of macroalgae on structures located in the POM (Polish maritime areas) has not been investigated so far. Therefore, the analysis of impacts on phytobenthos resulting from the project in question is of predictive nature, which is based on foreign experience gained during the implementation of such projects. It will be possible to verify the effects, force and pace of the identified impacts on phytobenthos only after analyzing the post-implementation monitoring results.

Macrozoobenthos

During the operation of the Baltic Power OWF, impacts related to the installation of cables between wind turbines may potentially occur, i.e.: heat emission affecting the change of water and bottom sediment temperature and emission of electromagnetic field and radiation. In current literature, the issue of potential impact of these cable parameters on the benthic fauna is poorly documented and ambiguous [287, 498]. In the case of heat emission, this factor is unlikely to affect the survival of macrozoobenthos as, in principle, it naturally adapts to considerable seasonal temperature changes [36]. On the other hand, the effects of electromagnetic field on individual species of benthic fauna, including clams, crustaceans or polychaetes, are examined only on the basis of laboratory experiments [47, 353, 328, 408], and their results vary depending on the output data and the examined organisms. It is known that electromagnetic field may have an impact on benthic species at the level of biochemical and physiological changes [328], but it is still difficult to determine whether the volume of the electric field emitted by cables will cause any undesirable changes in the structure and functioning of macrozoobenthos in the OWF Area.

Ichthyofauna

Literature on the subject of impacts related to the construction and operation of the OWF is relatively extensive, but it refers to areas other than the southern Baltic Sea. Therefore, when preparing the report, it was necessary to assume that the nature of the impacts in the project area would be similar to the one found in other cases. Data collected in the future as part of monitoring surveys carried out during the construction and operation of projects located in the Polish maritime areas should fill this knowledge gap.

No data was found on potential impacts related to the decommissioning of the project. So far, there has been no documented ichthyofauna monitoring during wind farm structure dismantling, therefore we do not possess knowledge about its course and environmental disturbances caused by such works. It is also difficult to predict what technologies will be available in several dozen years at the time of decommissioning the project. During the impact assessment, it was assumed that the impact would be similar to the one occurring at the time of construction.

In the Baltic Power OWF Area, no ichthyoplankton surveys have been conducted so far. The only source of information to which the results obtained can be referred is the data collected during the annual monitoring of ichthyofauna in the areas adjacent to the planned wind farms. The small amount of data for shallower areas of the southern Baltic Sea results from the fact that this area lies beyond the network of research stations where MIR-PIB usually performs plankton surveys. It is arranged so as to cover the spawning grounds of most fish species caught industrially, excluding shallower water regions. In the case of non-commercial species with early development stages present in both deep water and coastal areas, the available information is scarce and often distant in time and does not relate strictly to the area being surveyed.

There is little information on the spatial distribution of ichthyoplankton in the Baltic coastal zone up to 40 m deep. However, due to random performance of these surveys, often only once, at stations in different areas, the data obtained are limited. Some of them refer to single stations along the Polish coast, while some are concentrated in Gdańsk Bay or in the area of the Pomeranian Bay. Moreover, data on seasonal and perennial variability are missing.

Despite the above-presented problems, the applied research methodology proved to be adequate for the environmental conditions of the Baltic Power OWF Area (among others, the nature of the seabed, hydrometeorological conditions and fishing exploitation). In addition, the use of standard methods for catch and biological analyses ensures comparability of the data collected and analyzed.

Marine mammals

A major limitation in the collection of data on marine mammals is its high cost, which causes gaps in knowledge about seasonal distribution of marine mammals in the Baltic Sea area over longer periods of time covering several seasons.

As a result of the conducted monitoring, it was found that the Baltic Power OWF Area is characterized by low acoustic activity of porpoises. In this respect, the results are consistent with the results of the SAMBAH project, but it should be borne in mind that the confidence limits of SAMBAH are very high. The estimates of the abundance of marine mammals are characterized by high statistical variability [438]. Depending on the confidence limit (lower or upper) used in the SAMBAH project, the PTS for the planned project using SRH may occur in 0 to 2 porpoises. Therefore, the impact assessment is difficult. Moreover, the surveys carried out for the purposes of the OWF will not provide precise information on the abundance of marine mammals in the surveyed area due to the small spatial scope of the surveys and the resulting differences in the abundance and low density of marine mammals in the southern Baltic Sea.

Noise exposure criteria are also a source of uncertainty. The criteria published by NMFS 2016 and subsequently updated by NMFS 2018 [318] are a step forward as they include frequency-dependent audibility of marine mammals in a more comprehensive manner than it was previously possible. However, the weighing thresholds and functions come from few surveys and are also based on noise sources with slightly different spectral and time properties than those examined in the Baltic Power OWF project, to which animals may respond differently. However, at present these are the most recent criteria, which is why they have been used in this assessment. The knowledge about the impact of noise on marine mammals is constantly being expanded. Therefore, the calculated impact ranges should be treated with caution.

Additionally, the C-POD devices widely used in porpoise monitoring, which reflect well the presence of these marine mammals [386, 94], have a limited detection range (like other hydrophones), which may condition the detection of porpoises swimming through the area surveyed [154, 436]. This is particularly important in areas with a low density of these animals.

Migratory birds

So far, there is no technology allowing to identify all migratory species (moving at different heights) at night. The only data collected for night migrants in the central part of the Baltic Sea concerned the areas of the Bałtyk II and Bałtyk III OWFs, Baltica 2 and Baltica 3 OWFs [7, 16, 170, 171]. Despite the lack of reports in this respect, the data collected for Baltic Power are sufficient to formulate conclusions for the needs of the environmental impact assessment for the Baltic Power OWF in terms of birds migrating at night.

In the case of Polish coastal waters, apart from environmental surveys for the purposes of Bałtyk II and Bałtyk III OWFs as well as Baltica 2 and Baltica 3 OWFs, the surveys carried out in the Baltic Power OWF Area are the only complete study concerning birds migrating in the examined location in terms of spring and autumn migrations. Results obtained for the area of the Dębki-Białogóra OWF are available; however, these surveys were limited only to visual observation and were not carried out considering both migration seasons (autumn observation started in October), and the surveys focused only on water birds [68]. However, the monitoring carried out for the purposes of the project related to the construction of the Baltic Power OWF covers all types of surveys considered as the best practice for the purpose of preparing the environmental impact assessment.

European herring gulls, lesser black-backed gulls and great black-backed gulls were often present in the Baltic Power OWF Area and in its vicinity. These species feed mainly in the vicinity of fishing boats and their distribution is reflected in the results of seabird surveys. Although the vast majority of migrations in this area may be related to the presence of fishing boats, migration of these species over long distances cannot be excluded. Due to the fact that it is hardly possible to distinguish between feeding and migrating large seagull species during the surveys of migratory birds, it is practically impossible to obtain information about the size of the seagull migration stream during long-distance migration. Consequently, the risk of collision of large seagulls may have been underestimated.

Seabirds

Modern knowledge about the presence of seabirds in the Baltic Sea is mainly based on studies carried out in the winter season [116, 398]. In the Polish Baltic zone, the surveys in other phenological periods were carried out as part of pre-project monitoring (planned Dębki-Białogóra OWF, Bałtyk Północny OWF, Bałtyk II and Bałtyk III OWF, Baltica OWF) or surveys carried out as part of the development of protection plans for Natura 2000 marine sites (Pomeranian Bay and Coastal Waters of the Baltic Sea). The lack of data on birds staying at sea in the Polish EEZ outside the aforementioned places constitutes a serious obstacle to full interpretation of the results obtained. The example of detecting large, previously unknown concentrations of the common guillemot in the OWF Area demonstrates that our knowledge of birds staying outside the 12-mile strip of territorial waters is still incomplete.

It is also unknown whether seabirds stay all winter in one water region or move to different parts of the Baltic Sea. Short-distance movements resulting from changes in the abundance of the feeding base are very likely [295]. However, there are still no reliable data on the migration of seabirds (including the most numerous species of sea ducks) within the Baltic Sea from certain sites to other remote overwintering sites.

At the current stage of knowledge about seabirds congregating in the Baltic Sea away from the coasts, it is not possible to fully assess the links between the different Natura 2000 sites.

As far as collision estimation is concerned, there is a serious lack of knowledge about the behavioral response of birds consisting in the avoidance of wind turbines, which basically applies to all species. Due to this knowledge deficit, the risk of collision is often assessed considering the precautionary principle, and therefore the number of potential collisions may be overestimated on the one hand, but also, on the other hand, underestimated.

It is currently not known whether the bird species considered sensitive to the presence of a wind farm (e.g. Gaviiformes, long-tailed duck, velvet scoter) will adapt (and if so, to what extent) to the OWF and will start using its area again.

The period under examination was divided into four phenological periods. This division is largely conventional, as various species migrate in slightly different periods and, e.g. in August the autumn migration of common scoters can already be observed, whereas long-tailed ducks start their autumn passage at the end of September [294]. As demonstrated by the results obtained in these surveys, the spring migration period of sea ducks ends in April and for these species, May should rather be included in the summer period. Nevertheless, the adopted division into four phenological periods allows to group observations into periods when most species of the waterfowl whose presence may affect project decisions migrate, overwinter or stay mainly in the coastal zone.

It should be emphasized that the results of visual observation of migrating birds carried out during research cruises may only constitute support material for the analysis of data obtained during research with the use of radars, aimed at birds flying over the Baltic Power OWF Area. The majority of passerines cross the Baltic Sea at night, and therefore in order to examine the directions, altitudes and intensity of these movements, it is necessary to record passages using radars. Daytime observations relate, to a large extent, to specimens that did not fit into a typical behavioral pattern, so their passage over the sea does not have to take place in the same way as at night. Moreover, visual assessment of the passage height is certainly vitiated by a large error resulting, among other things, from the observer's position in relation to the passing bird, ship deck movements due to undulation and distance to the bird being observed, as well as from the individual ability to assess the distance. In addition, birds, especially the small-sized species, are difficult to notice when they pass at significant heights. Therefore, their number may be seriously underestimated. Therefore, the methodology used does not provide a complete picture of bird flights, but only supports the results collected using radars.

In this Report, the European herring gull is treated as a *sensu lato* species, i.e. a taxon covering three currently distinguished, very similar species: the European herring gull (*Larus argentatus – sensu stricto*), the Caspian gull (*Larus cachinnans*) and the yellow-legged gull (*Larus michahellis*). Research carried out in northern Poland demonstrates that the predominant of these three species is the European herring gull, whereas the other two species rarely appear here [288, 296].

Bats

Assessment of the significance of the examined OWF Area on the basis of the conducted monitoring was based on the reference scale included in the project "Guidelines for the assessment of the impact of wind turbines on bats" prepared by Polish specialists and practitioners at the commission of the General Directorate for Environmental Protection in 2011 [224]. The scale presenting the boundaries of bat activity was prepared on the basis of data obtained during research conducted on onshore wind farms. Currently, there are no studies that would confirm that the presented limits also characterize the activity of bats in maritime areas.

16 Project information summary

The planned project consisting in the construction, operation and decommissioning of the Baltic Power OWF is located in the Polish Baltic Sea EEZ, north of Łeba, at a distance of over 22.5 km north of the coastline.

The planned project covers the Baltic Power OWF within the area specified in Decision No. MFW/6/12 on the permit for the erection and use of artificial islands, structures and devices, as amended, obtained by the Applicant. The total area of the water region intended for the Baltic Power OWF facilities and systems is 131.08 km^2.

Offshore wind turbines, offshore substations, power and data communication networks together with infrastructure conditioning the correct operation of the Baltic Power OWF will be installed on the seabed at different depths – within the range from 34 to 45 m.

A project covered by a separate decision on environmental conditions (decision No.: RDOŚ- Gd-WOO.420.16.2021.AJ.36 of September 6, 2022) is the connection used for transmission of electricity generated by the Baltic Power OWF from offshore substations to the customer substation located in the Choczewo commune (plot No. 17/134, Kierzkowo cadastral district). The most important parameters of the Baltic Power OWF are presented in the table (Table 16.1).

Table 16.1. The most important parameters of the Baltic Power OWF for the option proposed by the Applicant [Source:

own study]

Parameter	Option proposed by the Applicant
Installed power [MW] (maximum)	1,200
Number of wind turbines [pcs] (maximum)	76
Wind turbine power output [MW] (minimum)	15
Rotor diameter [m] (maximum)	236
Clearance between the rotor operation area and water surface [m] (minimum)	22.3
Wind turbine height [m a.s.l.] (maximum)	258.3
Number of MV/HV offshore substations [pcs]	2
Maximum length of cable routes of the systems inside the OWF (maximum) [km]	120

As part of the planned project, the following will be located within the sea area:

- Wind turbines installed on monopiles embedded in the seabed;
- cable systems of inter-array power and communication networks;
- substations.

The Baltic Power OWF operation cycle covers the following phases:

- construction and manufacturing works at onshore back-up facilities;
- construction of a wind farm in the offshore area;
- Baltic Power OWF operation period;
- gradual decommissioning of the Baltic Power OWF components.

To avoid, prevent and reduce negative impacts and taking into account the environmental conditions of the planned project, the Applicant left the area without any wind turbine installation on the western side of the Baltic Power OWF, thus enabling access to the Coastal Waters of the Baltic Sea (PLB990002) Natura 2000 site for birds migrating from the north and north-east direction.

The indicated limitations apply to: location of the wind turbine structures and offshore substations.

During construction works related to foundation piling, the SRH system will be implemented. Its use will significantly reduce underwater noise and its impact on marine mammals, fish and birds. In order to monitor the effectiveness of this solution, hydrophones recording the noise level will be installed in the area of planned project. It has been assumed that the underwater noise level at the boundary of the Natura 2000 site – Słowińska Refuge (PLH220032) and at a distance of 11 km from piling works may not exceed the following values: for fish – 186 dB re 1 μPa^2s SEL_{cum}, for porpoises – 140 dB re 1 μPa^2s SEL_{cum} weighted with HF function [318] and for seals – 170 dB re 1 μPa^2s SEL_{cum} weighted with PW function [318].

Table (Table 16.2) presents assessment results of the impact that the planned project will have on elements of the environment in individual phases of its implementation. When conducting the environmental impact assessment, the applied restrictions in the OWF development area were taken into account, both in the OPA and in the RAO.

Table 16.2. Assessment results of the impact that the planned project will have in the OPA on elements of the environment in subsequent phases of its implementation [Source: own study]

Receiver	Significance of the Baltic Power OWF impact		
	Construction phase	Operation phase	Decommissioning phase
Seabed	Negligible	Negligible	Negligible
Undulation and sea currents	None	Negligible	None
Sea water	Low importance	Moderate	Moderate
Bottom sediments	Low importance	Moderate	Moderate
Climate	Negligible	Negligible	Negligible
Systems using EM field	None	Negligible	Negligible
Phytobenthos	None	Negligible	Negligible
Macrozoobenthos	Low importance	Moderate	Moderate
Ichthyofauna	Moderate	Negligible	Low importance
Marine mammals	Moderate	Moderate	Moderate
Migratory birds	Low importance	Moderate	Low importance
Seabirds	Significant	Significant	Significant
Bats	Negligible	Low importance	Negligible

Protected areas other than Natura 2000 sites	Low importance	Low importance	Low importance
Natura 2000 areas	Moderate	Moderate	Moderate
Wildlife corridors	Negligible	Negligible	Negligible
Biodiversity	Low importance	Significant	Low importance
Cultural values, monuments and archaeological sites and objects;	None	None	None
Use and management of the water area and tangible property	Low importance	Low importance	Negligible
Landscape	Negligible	Negligible	Negligible
Population	Moderate	Negligible	Negligible

Taking into account the nature and scale of the planned project, its location and restrictions in the development area taken into account by the Applicant and the use of the SRH system in order to avoid, prevent and reduce negative impacts of the Baltic Power OWF, the following is planned:

- during the construction phase:
  - commencement of piling with "soft-start" procedure in order to enable fish, birds and marine mammals to leave and move away from the area of works being performed.
  - piling in the period from August to March under the ornithological monitoring. If during the ornithological monitoring no presence of guillemots and razorbills (up to 20 individuals in total), long-tailed ducks (up to 50 individuals in total) is observed in an area with a radius of 2 km from the piling site, works preceded each time with the soft-start procedure may be commenced [261, 364, 250];
  - construction of subsequent wind turbines starting from one place, so that the water region intended for the project is filled with structures gradually, extending the OWF area with adjacent wind turbines (assuming that, at certain implementation stages, the entire OWF or its specific parts may be built sequentially, i.e. a specific category of works will be carried out on more than one wind turbine and other types of works will be undertaken only after its completion);
  - simultaneous piling in a maximum of two locations (in order to reduce noise), regardless of whether the two sources are located in the Baltic Power OWF area or whether one of them is located in the area of another neighboring OWF.
  - intensifying the progress of construction works in the period from March to September, when the number of birds in this water region is the lowest;
  - limitation of sources of strong light at night directed upwards; this applies mainly to bird migration periods. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards.
- in the operation phase:
  - painting the blade tips with bright colors, which should increase the probability of seeing a working turbine by flying birds. The Applicant declares that painting of blade tips will be in accordance with industry standards, technical conditions specified by the wind turbine supplier and will be agreed with competent authorities;
  - lighting the turbines at night by installing small, weak and pulsing light sources. Permanently lit bright lights and flashing white lights increase the risk of collision. It is also proposed that lighting should be changed from continuous to pulsing with a long interval when visibility is limited. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards.
  - equipping the OWF with a system enabling short-term stopping of selected turbines of the wind turbines during bird migration periods, if the results of operational monitoring indicate that intensive migration of cranes at a collision height takes place over the OWF Area.
  - abandoning the use of steel jacket structures of wind turbine towers (not applicable to monopiles) due to a greater probability of bird collision with wind turbines having such a structure (less visible for birds from a greater distance).
- In the decommissioning phase:
  - removal of subsequent wind turbines starting from one place, so that the water region occupied by the OWF is gradually released from the structure (assuming that at certain decommissioning phases, the entire OWF or its specific parts may be dismantled sequentially, i.e. a specific category of works will be carried out on more than one wind turbine and other types of works will be undertaken only after its

completion);

- maximizing the progress of dismantling works in the period from March to September, when the number of birds in this water region is the lowest.

This EIA Report describes the impact of the project on the environment in a comprehensive and exhaustive manner, indicating that it does not cause significant negative environmental impacts – neither separately nor in conjunction with other projects for which decisions on environmental constraints were issued, regardless of the technology used – e.g., the type of foundation, size of wind turbines – within the scope described in the OPA and RAO. This also applies to the impact on Natura 2000 Ecological Network sites.

The project impact on the environment was limited by leaving a development-free space on the eastern and western side of the Baltic Power OWF in order to enable bird flights.

In particular, this report shows that there are no significant impacts related to the exact location of wind turbines inside the development area of the Baltic Power DA with respect to all environment components in all phases of the project. Therefore, it can be concluded that there is no need to carry out a repeated environmental impact assessment as part of the procedure for issuing the building permit decision.

Both the OPA and the analyzed RAO are characterized by negligible to moderate impacts in all phases of the project. The intensity of some impacts in the RAO is higher than for the OPA. These include, for example, an increased vessel traffic or a larger expected amount of generated waste. A relatively higher intensity of these impacts would result from a larger number of wind turbines for construction, and consequently, many impacts may last longer and be repeated more times during individual phases of the project. Therefore, it should be stated that the project in the OPA is the most beneficial option for the environment.

17 Justification of the requested changes

The following tables present the justifications for changes to the decision issued by the General Director for Environmental Protection on June 29, 2022 (ref. No.: DOOŚ-WDŚZOO.420.59.2021.SP.10) requested by letter submitted on August 2, 2022. The requested changes were divided into tables presented below (Table 17.1, Table 17.2) containing, respectively, proposals for deletion of the provisions and proposals for changing the provisions together with justification of the conclusions based on the findings of this EIA Report.

Table 17.1. List of proposed deletions of the provisions of the decision on environmental conditions issued for the Baltic Power OWF together with justification

<table>
<tr><th>Item No.</th><th>Wording of the decision on environmental conditions issued for the Baltic Power OWF</th><th>Justification</th></tr>
<tr><td>1.1</td><td colspan="2">The specific conditions of using the environment at the stage of construction and operation or usage of the project, with particular focus on the necessity of protecting outstanding natural values, natural resources and monuments, as well as on reducing nuisance to neighboring areas:</td></tr>
<tr><td>1.1.a</td><td>Land-based site back-up facilities are to be organized within the existing seaport area. Within the site back-up facilities the following shall be located: storage areas for construction materials. Construction materials as well as substances and preparations used at the stage of implementation of the project, from the data sheets of which it is clear that they may pose a threat to water or soil, shall be stored in the area of the site back-up facilities on a hardened and sealed ground, in places sheltered from the weather and protected from unauthorized access. These sites shall be equipped with devices or means to collect or neutralize them in case of their accidental escape from the packages. The types and quantities of devices or means shall be adjusted according to the types and quantities of stored materials, substances and preparations. The above materials, substances and preparations shall be stored and moved in the manufacturer's packaging; if they escape from the packaging, they shall be removed or neutralized immediately.</td><td rowspan="4">In the case of an offshore wind farm, due to its specific work conditions, there are no equivalent site back-up facilities similar to onshore projects. The function of site back-up facilities is performed by seaports, which fulfill this role within the framework of their operating permits as separate ventures, functionally and spatially distinct from offshore wind farms. Therefore, it is requested to clarify the wording of the decision by removing a condition that in fact refers to a project different from the project in question (in accordance with the assumptions indicated in chapter 2.4.1 of this EIA Report).</td></tr>
<tr><td>1.1.b</td><td>Land-based site back-up facilities are to be organized within the existing seaport area. Within the site back-up facilities the following shall be located: storage areas for oils, lubricants and other materials that can be a source of oil derivative substances. These materials shall be stored in the area of the site back-up facilities on a hardened and sealed ground, in lockable and leak-proof containers, resistant to the substances stored in them, in places sheltered from the weather and protected from unauthorized access. These sites shall be equipped with technical and chemical means of containment, removal or neutralization of oil derivative pollutants; in case of leakage of oil derivative substances, they shall be removed or neutralized immediately.</td></tr>
<tr><td>1.1.c</td><td>Land-based site back-up facilities are to be organized within the existing seaport area. Within the site back-up facilities the following shall be located: waste storage sites. Hazardous waste shall be stored in the area of the site back-up facilities on a hardened and sealed ground. Places designated for the storage of hazardous waste shall be equipped with devices or means to collect or neutralize waste, in case of its accidental escape from the containers. The types and quantities of these devices or means shall be adjusted to the types and quantities of the waste stored. If waste escapes from the containers, it shall be removed or neutralized immediately.</td></tr>
<tr><td>1.2</td><td>The ground referred to in point 1.1 shall be made using waterproof and frost-resistant concrete slabs with a minimum strength class of C35/45, sealed with flexible joints resistant to weather (temperature, UV radiation, rain and air) and chemicals, or using</td></tr>
</table>

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Justification
	geomembranes.	
3.5	Offshore wind turbines shall be divided into three groups, located in the eastern, western and central parts of the OWF area, whose rotor tips shall be painted in bright colors, assigning a different painting method (color or pattern) for each group; fluorescent paints shall be used with colors that reflect or absorb UV radiation; in one group, one of the blades shall be painted black.	The issue of painting one of the wind turbine blades in black was analyzed in the publication titled: "Paint it black: Efficacy of increased wind turbine rotor blade visibility to reduce avian fatalities" [283]. The studies were conducted on Smøla island in central Norway over ten years. The results show that collision mortality drops by an average of 70% for painted wind turbines. These are the first studies to confirm the effectiveness of that mitigation measure type. The EIA Report for the Baltic Power OWF proposed mitigation measures in the form of painting the blade tips in bright colors (see Chapters 11.2 and 16 of the EIA Report). The laboratory study "Minimization of Motion Smear: Reducing Avian Collisions with Wind Turbines" [193] tested the degree of motion smear of blades using different patterns and colors on one of the blades (the experiment was based on kestrels' behavior). Of all the patterns, the blade painted uniformly black best reduced the motion smear of the shape perceived by a kestrel. At the same time, the experiment with different blade colors gave inconclusive results. The degree of motion smear depended heavily on the background image (e.g., forest, blue sky, etc.). None of the above studies were conducted in a marine setting with a specific, homogeneous landscape devoid of features typical for land topography, so it is debatable what color would work best in an OWF to reduce the risk of avian collisions. In addition, the studies indicated in the inquiry were conducted for one species only. In conclusion, painting one blade (at least half of it) seems to be the best mitigation measure on land. According to the study from Smøla island: "(...) a dark (black) paint color gives optimal results. For wind farms located in offshore areas, there is no reliable information that indicates what pattern or color of rotor blades would be the optimal measure mitigating the risk of collision with birds. (...)". Therefore, the research results cited above cannot be directly shifted to the offshore wind farms work conditions, including Baltic Power OWF in particular. The afore-mentioned paper does not cite information on how many birds of each species flew over the wind farm, and thus it is not possible to relate the results of the mortality study to the numbers of birds and their species. In order to make such a reference, information on the stream of birds flights through the wind farm would be needed to compare it with the information concerning the Baltic Power OWF. During the Baltic Power OWF surveys (Appendix No. 1 to the EIA Report, Chapters 7.5.1 – Migratory Birds and 7.5.2 – Seabirds), several species observed over the Smøla wind farm were found to be flying over. This includes the flights of kestrels, greylag geese, northern shovelers, common teals, common snipes, European golden plovers, European greenfinches, meadow pipits, and common blackbirds. These birds mostly flew at altitudes below the collision height, and the assessment of impact significance of Baltic Power OWF in terms of avian collisions and barrier effects for these species did not

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Justification
		indicate the need for implementing mitigation measures. At the moment, scientific research is being carried out on the study of the impact of rotor blade color on bird mortality, but the known cases of projects in Spain (https://www.iberdrola.com/press-room/news/detail/iberdrola-painting-wind-turbine- Blades-protect-BirdLife) and the Netherlands (https://group.vattenfall.com/press-and- media/newsroom/2022/black-turbine-blades-reduce-bird-collisions) still concern only onshore wind farms and are at the research stage and, therefore, at the moment there is no reliable data confirming that a change in blade painting will effectively reduce bird mortality in the case of offshore wind farms. Under these circumstances, the imposition of the subject obligation on the Applicant has the appearance of an experiment. It should also be emphasized that, according to current regulations, black is not an authorized color for air obstacle marking, and the use of such a color requires a permit. Obtaining such a permit significantly delays the implementation of the entire project, contradicting both the Applicant's and the public interest. The Applicant's legitimate interest results from the fact that it has to conduct an experiment based on unrepresentative data while increasing the risk of losing the warranty provided by the turbine manufacturer due to interference not provided for in their specifications and the actual consequences in the form of, among other things, uneven wear of turbine blades threatening serious damage to the turbine. In this regard, the obligation imposed on the Applicant is disproportionate to the objective.
3.10	Before starting the removal of elements of the Baltic Power OWF, an environmental inventory of the objects founded in the seabed or on the seabed shall be conducted under the supervision of an ichthyologist and benthologist. The inventory results shall be submitted to the Regional Director for Environmental Protection in Gdansk in Gdańsk and the General Director for Environmental Protection in Gdansk."	In the event of changing point 3.9 (cf. Table 17.2) there is no need to delete this point.
3.11	During the decommissioning stage of the Baltic Power OWF, the adjacent wind turbines and other structures shall be removed one by one.	In light of the currently drafted decommissioning works plan, the indicated requirement for decommissioning individual offshore wind turbines results in significant changes in the organization of decommissioning works, which will involve prolonging operations and stretching the environmental impacts over time during the decommissioning stage. As a result, we request the deletion of that provision. In accordance with the assumptions adopted for the Baltic Power OWF, decommissioning works may be carried out in a sequential manner (*see* Chapter 11.3 of the EIA Report).
4.1	**Monitoring of water and bottom sediment quality and sediment dispersion:**	
4.1.2	**Monitoring during the construction stage of the Baltic Power OWF:**	
4.1.2.a	Immediately before the commencement of the works interfering with the seabed that cause agitation of sediments, monitoring of sediment dispersion shall be carried out by measuring: turbidity of water, determining the extent and concentration of total	The reduced number of wind turbines, the selection of monopiles as foundations and the shortening of the length of cables installed in relation to those assumed in the original EIA Report, on the basis of which the DEC was issued for the Baltic Power OWF, to which this application for change refers, allow

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Justification
	suspended solids and determining the thickness of deposited bottom material.	to conclude that the impacts related to the disturbance of sediments will be many times smaller than those originally predicted and indicated (as part of the envelope concept). That allows to waive the monitoring of suspended solids during construction stage. Detailed analyses and calculations in this respect are presented in Appendix No. 2 to the EIA Report. Therefore, in this regard, there is no need to specify these conditions in the DEC for the Baltic Power OWF and it is reasonable to delete these provisions.
4.1.2.b	The monitoring shall be carried out for a minimum of 4 offshore wind turbines, implemented in the OWF area, in locations that have different abiotic conditions.	
4.1.2.c	The monitoring of total suspended solids shall be carried out throughout the period of the works interfering with the seabed and shall be continued for 1 week after their completion.	
4.1.2.d	The measurement of total suspended solids shall be described in the form of profiles with a radius of 1,000 m from the site of disturbance in the W, S, N, E directions.	
4.2	**Underwater noise monitoring:**	
4.2.1	**Pre-project monitoring – before the commencement of the Baltic Power OWF construction:**	
4.2.1.a	Conduct background noise measurements in the middle of the area occupied by the OWF.	Annual background noise monitoring was performed during the survey stage. The conducted survey is sufficient as a description of the environmental status in this aspect before commencing the Baltic Power OWF construction works. Since the acquisition of the afore-mentioned data, there have been no significant changes in the environmental conditions affecting the underwater noise propagation (temperature, pH, salinity) and vessel traffic in the vicinity of the Baltic Power OWF, which would justify the necessity to repeat the survey. The PZPPOM also determined the manner of using the Baltic Power DA and adjacent water regions, without giving reasons to predict such changes in the scope of background noise. Therefore, in this regard, there is no need to specify these conditions in the DEC for the Baltic Power OWF and it is reasonable to delete these provisions.
4.2.1.b	Conduct background noise measurements separately for three sea states: at about 2, 4 and 6 Bft. For each sea state, conduct 4 round-the-clock measurements, one per each successive quarter.	
4.2.3	**Post-development monitoring – during the Baltic Power OWF operation stage:**	
4.2.3.a	Carry out control measurements of underwater noise at the operation stage no later than 12 months after commissioning of the entire OWF. Measurements shall be carried out in the middle of the area occupied by the OWF and at a distance of 100 meters from 5 randomly selected offshore wind turbines.	The environmental impact assessment report suggested noise monitoring at the construction stage, as vessel traffic and the extent of adjacent offshore wind farms development will continue to change for many years after the Baltic Power OWF is completed. Obtaining new environmental decisions (e.g. for FEW Baltic II and B-Wind and C-Wind) indicates that in the period immediately after the commencement of the Baltic Power OWF operation, the construction works (including piling works) will be carried out on other wind farms, which will prevent reliable performance of such monitoring. The proposed monitoring will not be suitable for the assessment of the acoustic impact of the Baltic Power OWF alone. The authors of the EIA Report indicate that the environmental impact significance for fish and marine mammals was assessed without any doubts to be insignificant at the most. A more reliable and relevant way to monitor noise in that area would be to rely on the State Environmental Monitoring. Under these circumstances, the requirement indicated here is not justified, and hence it is requested to delete it from the DEC envelope for the Baltic Power OWF.
4.2.3.b	Carry out control measurements separately for three nominal power output ranges of the OWF: “low” (at about 2 Bft), “medium” (at about 4 Bft) and “maximum” (at about 6 Bft). For each power output range, conduct 4 round-the-clock measurements, one per each successive quarters.	

<table>
<tr><th>Item No.</th><th>Wording of the decision on environmental conditions issued for the Baltic Power OWF</th><th>Justification</th></tr>
<tr><td>4.5</td><td colspan="2">Monitoring of migratory birds mortality:</td></tr>
<tr><td>4.5.1</td><td>Conduct for a period of 5 years after the completion of construction of the entire OWF, during seasonal spring migrations (from early March to late May) and autumn migrations (from mid-July to late November).</td><td rowspan="3">To the Applicant's current knowledge, there are no recognized industry standards for monitoring the mortality of birds migrating through offshore wind farms – which is confirmed by the Applicant's initial market reconnaissance. Under marine conditions, it is not possible to conduct mortality monitoring by collecting individuals that have collided with the rotor. Systems based on video monitoring (in the visible and infrared bands) are in the development stage, being deficient enough that both the determination of the collision itself and the identification of the species of birds involved in the collision are subject to a very high error margin. Also, the effectiveness of these systems, measured as the ratio of detected to actually flying birds, leaves a lot of room for improvement. There are no scientific publications in this field to realistically assess the effectiveness and quality of such systems.
The mortality forecast carried out in relation to the target number of wind turbines and their final parameters indicate that the risk of common crane collision was determined at a moderate level. The maximum mortality of common cranes was estimated for the proposed option at the level of 47 individuals in autumn (for RAO this value is 116 individuals). Taking into account the size of the biogeographical population (240,000 individuals), in the most unfavorable scenario with the highest number of collisions, the number of individuals colliding will not exceed 0.09% of the biogeographical population (see Appendix No. 4 to the EIA Report).
Additionally, the EIA Report for the Baltic Power OWF assumed the implementation of monitoring of migratory birds for the purposes of a system of wind turbines temporary shutdown during common crane migration (see Chapter 11.2 of the EIA Report). The system will have the ability to track all migrating birds and will be able to provide a basis for modeling bird collisions under Baltic Power OWF conditions. The temporary shutdowns system will be in place throughout the operational period of the Baltic Power OWF. Thus, the mortality risk – which is included in the protected species report – should be significantly reduced.
Therefore, the analyses carried out for the Baltic Power OWF do not support the installation of the afore-mentioned additional collision monitoring systems because, regardless of their unavailability, they will not constitute the added value.</td></tr>
<tr><td>4.5.2</td><td>Monitoring of mortality of birds should be conducted using the automatic system for recording bird collisions with offshore wind turbines / victims of collisions, with the possibility of conducting measurements at both nighttime and daytime.</td></tr>
<tr><td>4.5.3</td><td>As part of monitoring of mortality of birds, use 3 units of automatic bird collision detection systems, one for each group of offshore wind turbines referred to in point III.3.5, mounted on 3 offshore wind turbines in the OWF area.</td></tr>
</table>

Table 17.2 List of justifications for requests to change the provisions

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
1.1	**The specific conditions of using the environment at the stage of construction and operation or usage of the project, with particular focus on the necessity of protecting outstanding natural values, natural resources and monuments, as well as on reducing nuisance to neighboring areas:**		
1.3	Inner array power cables in the OWF area shall be laid at a depth of 1 m to 3 m below the seabed surface.	"If it is necessary to bury inner array power cables in the OWF area, they shall be laid at a depth up to 3 m below the seabed surface."	As the technical aspects of the cable installation have been clarified, including their arrangement and the necessary information regarding the sediments' geotechnical parameters, it is already known that the cables shall not be exclusively buried in the seabed. In part of the sections, they are planned to be laid directly on the seabed (see Chapters 2.2.2.3 and 2.4.3 of the EIA Report). Accordingly, there is a need to amend the afore-mentioned provision of the DEC for the Baltic Power OWF that it will stipulate the conditions for laying cables only to the scope of cables that will be actually buried in a given section.
1.4	Inner array cables shall be laid below the seabed surface using jet trenching.	"The selected cable laying method must not cause greater environmental impact than jet trenching."	As the technical aspects of cable installation have been clarified, including their arrangement and the necessary information regarding the sediments' geotechnical parameters, it is already known that the cables – in sections where they will be buried in the seabed – shall be buried using various methods, including jet trenching (see Chapter 2.4.2 of the EIA Report). In the proceedings pending the issuance of the amended DEC for the Baltic Power OWF, jet trenching was indicated as the benchmark for the Environmental Impact Assessment, as it is the one most unfavorable for the environment. Under these circumstances, it is advisable to amend the provision in question to make it worded in a way that does not limit the project's cable laying methods to jet trenching only, and allows the Investor to use a method that is more favorable for the environment.
1.5	During the construction stage, strong upward-positioned light shall not be used from dusk to dawn.	"During the construction stage, strong upward-positioned light shall not be used from dusk to dawn, save for the lighting required by the OH&S regulations and standards."	As the method of lighting offshore wind farm facilities may also be governed by the OH&S and related regulations, it is requested to clarify the provision in question by including a

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
			reference to OH&S standards in its contents.
1.6	Construction work shall be started from a single site, gradually expanding the offshore wind farm to include additional single adjacent offshore wind turbines and other structures.	"Construction work shall be started from a single site, gradually expanding the offshore wind farm to include additional offshore wind turbines and other structures."	In light of the currently drafted work organization plan related to the construction of individual offshore wind farm facilities, the implementation of the provision in question ordering the one-at-a-time construction of successive offshore wind turbines will involve a significant change in the organization of construction works, which in turn will involve prolonging construction and stretching the environmental impacts of the project over time during the construction stage. Therefore, in accordance with the current assumptions, sequential organization of the construction process is assumed i.e. individual phases of works shall be carried out in the entire Baltic Power OWF area or in a specific area, i.e. in several (or all) locations of wind turbines, works related to seabed preparation shall be carried out, after which piling shall only commence and only after its completion shall the area around individual locations be cleaned after completion of the works (see Chapter 2.4.2 of the EIA Report).
1.7	During the construction and operation stages, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials); in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.	"During the construction and operation stages, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials) in accordance with the regulations applicable in this respect; in case of a spill of oil derivative substances, they shall be removed or neutralized immediately."	The detailed equipment of vessels and offshore wind farm facilities is the subject of relevant international and national regulations. It is, therefore, reasonable to change the original wording of this provision in the DEC for the Baltic Power OWF in accordance with the indicated proposal, which will clarify it in this regard.
1.8	After the completion of the construction work of a single offshore wind turbine or accompanying infrastructure, all construction debris and possible pollution shall be removed	"After the completion of the construction work, all construction debris and possible pollution shall be removed from the seabed."	In light of the currently drafted work organization plan related to the construction of individual Baltic Power OWF facilities, the implementation of the provision in question ordering the one-at-a-time construction of successive

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
	from the seabed.		offshore wind turbines will involve a significant change in the organization of construction works, which in turn will involve prolonging construction and stretching the environmental impacts of the project over time during the construction stage. In accordance with the current assumptions, the driven piles after cutting or burning at an appropriate depth shall be left in the seabed because they do not cause any environmental impact and their removal may cause environmental impact – e.g. when using explosive removal methods. Moreover, underwater components of the OWF may constitute a habitat of valuable communities of marine organisms (*see* Chapters 2.4.4 and 6.1.3.5.1.4 of the EIA Report).
1.9	During the operation stage, small, pulsating light sources of low intensity shall be used to illuminate wind turbines; from dusk to dawn, the light shall not be directed upward.	"During the operation stage, small, pulsating light sources of low intensity shall be used to illuminate wind turbines; from dusk to dawn, the light shall not be directed upward, save for the lighting required by the OH&S and navigation markings' regulations and standards."	Since the issue of marking structures, such as wind turbines, is subject to regulations on navigational markings, we request to clarify the provision with regard to compliance with OH&S and IALA regulations (requirements for navigational markings).
1.10	During the operation stage, light emissions from accommodation and service platforms shall be reduced by using window covers or using blue light.	"During the operation stage, light emission should be limited, subject to lighting required by OH&S and navigation marking regulations and standards".	Since the issue of marking structures, such as above-water components of the OWF infrastructure, is subject to regulations on navigation markings, we request to clarify the provision with regard to compliance with OH&S and IALA regulations (requirements for navigation markings).
1.13	At least 24 hours before the commencement of sonar works, acoustic deterrent devices, such as pingers, shall be used.	"At least two hours before the commencement of sonar works, acoustic deterrent devices, such as pingers, shall be used."	In light of the Investor's findings, prolonged use of pingers may be counterproductive. The pingers that deter porpoises simultaneously attract seals, which are accustomed that pingers used on fishing nets signal the possibility of easier feeding. Therefore, we request to amend the indicated requirement, as its application in its original wording may be counterproductive. The use of pingers at least two hours before the commencement of works will allow to minimize the impact on seals (*see* Chapter 11.1.1 of the EIA Report).
3.2	Acoustic deterrent devices, such as pingers, shall be used at least 24 hours before piling of foundations or support	"Acoustic deterrent devices, such as pingers, shall be used at least two hours before piling".	In light of the Investor's findings, prolonged use of pingers may be counterproductive. The pingers that deter porpoises simultaneously attract seals, which are accustomed that

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
	structures;		pingers used on fishing nets signal the possibility of easier feeding. Therefore, we request to amend the indicated requirement, as its application in its original wording may be counterproductive. The use of pingers at least two hours before the commencement of works will allow to minimize the impact on seals (*see* Chapter 11.1.1 of the EIA Report).
3.3	Piling of foundations or support structures shall be performed under ornithological monitoring. In the period from the beginning of August to the end of March, soft-start piling can be started after the ornithological monitoring determines that there are no common guillemots, razorbills, long-tailed ducks and velvet scoters in an area with a radius of 2 km from the piling site. If the above-mentioned species are observed, piling shall be stopped until the individuals move away;	"Piling in the period from August to March should be performed under the ornithological monitoring. If the ornithological monitoring does not confirm the presence of common guillemots and razorbills in a total number of more than 20 individuals, as well as long-tailed ducks in a number of more than 50 individuals in the area with a radius of 2 km from the piling site, works preceded each time by the soft-start procedure may be commenced."	Having taken into account the current state of knowledge about the project (mainly in the scope of the arrangement of OWF facilities subject to the process of piling of wind turbines and substations), the list of species was revised on the basis of a comparison of densities and a reasonable approach was adopted to the permissible number of individuals in connection with the proposal to apply the softstart procedure, i.e. to enable birds to leave the area of direct impact of underwater noise (*see* chapter 11.1.2 of the EIA Report).
3.4	While piling of foundations or support structures, noise mitigation systems, such as air curtains, acoustic screens, cofferdam systems or other technology shall be used, ensuring that the following maximum underwater noise levels are not exceeded at a distance of 9 km from the piling site: – 140 dB re 1 Pa2s SEL_{cum} and HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency noise – porpoise), – 170 dB re 1 uPa2s SEL_{cum} and PW-weighted (PW-weighting function for pinniped marine mammals – seals), – 186 dB re 1 pPa2s SEL_{cum} unweighted for fish.	"While piling, noise mitigation systems, such as air curtains, acoustic screens, cofferdam systems or other technology shall be used, ensuring that the following maximum underwater noise levels are not exceeded at a distance of 11 km from the piling site: – 140 dB re 1 Pa2s SEL_{cum} and HF-weighted (HF-weighting function for marine mammals with high sensitivity to high frequency noise – porpoise), – 170 dB re 1 uPa2s SEL_{cum} and PW-weighted (PW-weighting function for pinniped marine mammals – seals), – 186 dB re 1 pPa2s SEL_{cum} unweighted for fish".	According to the conclusions of the analyses presented in Chapter 6.1.1.4.1.4, it was demonstrated in the scope of the assessment of the impact on marine mammals that the circle surface area with a radius of more than 11 km corresponds to the surface area on which the presence of porpoises can be potentially expected not exceeding 0.33% of the biogeographical population according to the SAMBAH project. The range for porpoises was assumed as the most vulnerable receiver. It was proposed to change from 9 km (resulting from outdated process assumptions) to 11 km (resulting from the environmental conditions established in the SAMBAH project studies described in Chapter 6.1.1.4.1.4).
3.7	During the decommissioning stage, strong upward-positioned light shall not be used from dusk to dawn.	"During the decommissioning stage, strong upward-positioned light shall not be used from dusk to dawn, save for the lighting required by the OH&S and navigation markings' regulations and standards."	Since the issue of marking structures, such as wind turbines, is subject to regulations on navigational markings, we request to clarify the provision with regard to compliance with OH&S and IALA regulations (requirements for navigational markings).

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
3.8	During the decommissioning stage, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials); in case of a spill of oil derivative substances, they shall be removed or neutralized immediately.	"During the decommissioning stage, the project site (including vessels and substations) shall be equipped with technical and chemical means for containment, removal or neutralization of oil derivative pollutants (including anti-pollution floating dams and sorbent materials) in accordance with the regulations applicable in this respect; in case of a spill of oil derivative substances, they shall be removed or neutralized immediately."	The equipment of vessels and offshore wind farm facilities is the subject of detailed international and national regulations. It is, therefore, reasonable to change the original wording of this provision in the DEC for the Baltic Power OWF in accordance with the indicated proposal, which will clarify it in this regard.
3.9	During the decommissioning stage, all above-water elements of the Baltic Power OWF shall be removed.	"After completion of operation of the farm in question, it is recommended to remove all its components. It is permitted to leave some of the facilities founded in the seabed/on the seabed if they constitute a habitat of valuable communities of marine organisms."	According to the Applicant, leaving the structural components in the water column (after removing only the above-water components) means that the water region after the wind farm's operation stage will not be restored to its condition before the wind farm's construction. The monopiles left as a whole in the water column will additionally pose a major navigational hazard, providing a valid ground for excluding that water region from use, including navigation and fishing (in terms of freedom of navigation). Therefore, it will be reasonable to remove the monopiles to such an extent that the water region could be used as indicated above (for instance, by cutting off the monopiles just above the seabed or a few meters above the seabed) (see Chapters: 2.4.4 and 6.1.3.5.1.4 of the EIA Report).
4.1	**Monitoring of water and bottom sediment quality and sediment dispersion:**		
4.1.1	Pre-project monitoring – before the commencement of the construction of the Baltic Power OWF: during winter, before the commencement of construction works, single water quality tests, including the following hydrochemical parameters shall be carried out: oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH) and concentration of biogenic substances (ammonium nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), turbidity of water, total suspended solids as well as concentration of harmful substances in water and bottom sediments, such as: mercury, heavy metals, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated	"If any extraordinary hazards, which may result in contamination of water and sediments in the Baltic Power OWF area, occur after the conducted surveys of water quality performed for submitting the application for the decision on environmental conditions, the pre-project monitoring of water quality shall be performed i.e. during winter, before the commencement of construction works, single water quality tests, including the following hydrochemical parameters shall be performed: oxygen conditions (dissolved oxygen), total organic carbon (TOC), acidification (pH) and concentration of biogenic substances (ammonium nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), water turbidity, total suspended solids as well	Due to the fact that the pollution of water and sediments is small in the Baltic Power OWF Area and that no events have been recorded that could affect the change of water quality since the water quality surveys were performed for the purpose of preparing the original environmental impact assessment report for the Baltic Power OWF, on the basis of which the DEC for the Baltic Power OWF was issued, which is the subject of the application for change, it is suggested to perform the pre-project monitoring in this respect only in the case of events indicating the possibility of contamination of water or sediments. Otherwise, it is proposed to consider the study performed for the survey as base information on water

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
	biphenyls (PCB).	as the concentration of harmful substances in water and bottom sediments, such as: mercury, heavy metals, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB)."	and sediment quality, as it remains reliable for the assessment of the initial water quality status (i.e. the status before the commencement of the Baltic Power OWF construction). Thus, in order to reduce the project environmental impact during the construction phase, it is necessary to change the requirement originally specified in the DEC for the Baltic Power OWF.
4.1.3	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.1.3.a	Once per year, hydrochemical parameters of water shall be tested, such as: dissolved oxygen, total organic carbon (TOC), acidification (pH) and biogenic substances (ammonia nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), turbidity of water, total suspended matter.	"In the fifth year after the completion of the construction, hydrochemical parameters of water shall be tested, such as: dissolved oxygen, total organic carbon (TOC), acidification (pH) and biogenic substances (ammonia nitrogen, nitrate nitrogen, total nitrogen, mineral nitrogen, phosphates, total phosphorus), water turbidity, total suspended matter."	The results of the Environmental Impact Assessment showed that the Baltic Power OWF and neighboring OWFs are not a source of pollution. The design solutions chosen by the Investor shall not increase the risk of pollutant emissions to marine waters. Therefore, it is proposed to change the provisions from annual monitoring to one-time monitoring in the 5^{th} year after the completion of the OWF.
4.1.3.b	Once per year, the concentration of harmful substances in water and bottom sediments shall be measured, such as: mercury, nickel, lead, cadmium, arsenic, total chromium, chromium (VI), zinc, aluminum, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), TBT.	"In the fifth year after the completion of the OWF construction, the concentration of harmful substances in water and bottom sediments shall be measured, such as: mercury, nickel, lead, cadmium, arsenic, total chromium, chromium (VI), zinc, aluminum, phenols, mineral oils, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), TBT."	The results of the Environmental Impact Assessment showed that the Baltic Power OWF and neighboring OWFs are not a source of pollution. The design solutions chosen by the Investor shall not increase the risk of pollutant emissions to marine waters. Therefore, it is proposed to change the provisions from annual monitoring to one-time monitoring in the 5^{th} year after the completion of the OWF.
4.2	**Underwater noise monitoring:**		
4.2.2	**Monitoring during the construction stage of the Baltic Power OWF:**		
4.2.2.a	Monitor underwater noise levels throughout the entire period of work related to piling of foundations or support structures into the seabed. Noise measurement points to be determined at a distance of 9 km from the piling site in the W, S, N, E directions (a total of 4 measurement points) and on the border of the Natura 2000 site – Ostoja Słowińska PLH220023.	"For 8 selected circumferential wind turbines, underwater noise monitoring during piling to be performed at 4 measurement points 11 km away from the piling site, located in 4 main directions (W, S, E, N). For other piling works, monitoring to be performed at one point at a distance of 11 km towards the main direction of noise propagation. The results of this monitoring will be subject to the same noise emission limits as the monitoring at the boundary of the Natura 2000 site – Ostoja Słowińska	According to the provisions of Chapter 6, it was demonstrated in the scope of the assessment of the impact on marine mammals that the circle surface area with a radius of more than 11 km corresponds to the surface area on which the presence of porpoises can be potentially expected not exceeding 0.33% of the biogeographical population. The condition was determined on the basis of the density of the biogeographical population of a porpoise as the most

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
		(PLH220023)."	vulnerable species. The determination of the measuring point at the boundary of the Ostoja Słowińska PLH220023 Natura 2000 site remains valid due to the fact that a porpoise is the subject of protection in this area.
4.2.2.b	For every 10th offshore wind turbine under construction, monitor underwater noise levels throughout the entire period of work related to piling of foundations or support structures into the seabed, additionally at a distance of 750 m and 1.5 km from the piling site in the W, S, N, E directions (a total of 8 measurement points).	"In at least 10 locations in the Area and the 5 km buffer, continuous underwater noise surveys shall be carried out during the entire piling process."	Continuous monitoring was proposed, which will allow to assess the actual parameters of underwater noise propagation for different distances from noise sources, which will allow to obtain valuable information to assess the scale of this phenomenon. The Baltic Power OWF area with a buffer of 5 km was proposed as the survey area, because the assumed TTS impact accumulated for a porpoise using NRS should not exceed this distance (see Appendix No. 3).
4.2.5	Carry out underwater noise monitoring taking into account the current guidelines of the Bundesamt für Seeschifffahrt und Hydrographie.	"When monitoring underwater noise, apply the measurement methods in terms of equipment, its use, and processing of measurement results, as indicated in the current guidelines of the Bundesamt für Seeschifffahrt und Hydrographie."	The BSH guidelines are adjusted to monitor underwater noise levels in accordance with Germany's permissible underwater noise levels. Accordingly, the use of the methodology set forth in the BSH guidelines is reasonable for underwater noise monitoring, with the exception of standards for the location of measurement stations and permissible noise levels, which are specific to the German legal framework.
4.3	**Monitoring of seabirds**		
4.3.1	**Pre-investment monitoring – before the commencement of the Baltic Power OWF construction:**		
4.3.1.a	On an annual basis, prior to the start of construction works, during the day from early October to the end of May, conduct bird counts at a frequency of no less than two cruises per month. In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September.	"On an annual basis, prior to the start of construction works, during the day from early October to the end of May, conduct bird counts at a frequency of two cruises per month (in cases justified by weather conditions, it is permissible to carry out one cruise per month). In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September."	The generally accepted methodology for surveying seabirds [294] requires making two cruises per month, but allows for making fewer cruises in the event of unfavorable weather conditions. The target parameters of the Baltic Power OWF and their analysis in the context of the data collected so far from the avifauna survey do not justify the extension of the scope of pre-investment monitoring specified in the decision - in particular the necessity to organize two cruises per month regardless of weather conditions. Therefore, in order to limit the environmental impact of the project at the

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
			construction stage and to avoid additional threats to human life and health, it is justified to change the condition indicated here, originally specified in the decision on environmental conditions for the Baltic Power OWF.
4.3.1.b	The monitoring shall cover the OWF area and the 5-kilometer zone around the OWF borders.	"The monitoring shall cover the OWF area, the 5-kilometer zone around the OWF borders, and the reference area."	In order to assess the impact of the OWF, it is necessary to perform surveys also in the control (reference) area (*see* Chapter 12.1.4.1 of the EIA Report). Therefore, in this respect, it is necessary to change the originally specified condition in the decision on environmental conditions for the Baltic Power OWF in order to unify it with the monitoring methodology adopted by the Applicant.
4.3.2	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.3.2.a	In the period from the beginning of October to the end of May, during the day, conduct bird counts with a frequency of not less than two cruises per month. In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September. In order to compare survey results, the route of the survey cruise should be the same or very similar to that conducted during the pre-investment monitoring.	"During the day, from early October to the end of May, conduct bird counts at a frequency of two cruises per month (in cases justified by weather conditions, it is permissible to carry out one cruise per month). In the other months, due to lower bird numbers, survey cruises are to be performed twice – one in August and one in September. In order to compare survey results, the route of the survey cruise should be the same or very similar to that conducted during the pre-investment monitoring."	The generally accepted methodology for surveying seabirds [294] requires making two cruises per month, but allows for making fewer cruises in the event of unfavorable weather conditions. The target parameters of the Baltic Power OWF and their analysis in the context of the data collected so far from the avifauna survey do not justify the extension of the scope of pre-investment monitoring specified in the decision - in particular the necessity to organize two cruises per month regardless of weather conditions. Therefore, in order to limit the environmental impact of the project at the operation stage and to avoid additional threats to human life and health, it is justified to change the condition indicated here in the decision on environmental conditions for the Baltic Power OWF.
4.3.2.b	The monitoring shall cover the OWF area and the 5-kilometer zone around the OWF borders.	"The monitoring shall cover the OWF area, the 5-kilometer zone around the OWF borders, and the reference area."	In order to assess the impact of the OWF, it is necessary to perform surveys also in the control (reference) area (*see* Chapter 12.1.4.1 of the EIA Report). Therefore, in this respect, it is necessary to change the originally specified condition in the GDEP Decision in order to unify it with the monitoring methodology adopted by the Applicant.

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
4.3.2.c	Surveys should be carried out for 3 first years of the entire OWF operation stage, if the construction is not divided into stages. Otherwise, perform surveys one year after the completion of each consecutive phase of construction and for 3 consecutive years after the completion of the entire OWF.	"The surveys shall be performed in the 1st and 3rd year of operation of the entire OWF."	Due to the reduction in the number of wind turbines, it is proposed to reduce the survey effort for seabird monitoring while maintaining the monitoring interval. The proposed survey effort is sufficient to determine how the Baltic Power OWF affects seabirds (see chapter 12.1.4.2 of the EIA Report).
4.4	**Monitoring of migratory birds**		
4.4.1	**Post-development monitoring – during the Baltic Power OWF operation stage:**		
4.4.1.d	Conduct monitoring of migratory birds in two cycles in a year, resulting from two migration periods of birds, i.e. from the beginning of March to the end of May, and from the beginning of July to the end of November, in the first 3 years after the completion of the entire OWF.	"Conduct monitoring of migratory birds in two cycles in a year, resulting from two migration periods of birds, i.e. from the beginning of March to the end of May, and from the beginning of July to the end of November, in the 1st and 3rd year after the completion of the entire OWF."	Due to the reduction in the number of wind turbines, the increase in the distance between them and the decrease in the area swept by the rotors of individual wind turbines, it is proposed to reduce the survey effort for monitoring of the migratory birds while maintaining the monitoring interval. The proposed survey effort is sufficient to determine how the Baltic Power OWF affects migratory birds (as regards the current analysis of the Baltic Power OWF impact on migratory birds, see Appendix No. 4 to the EIA Report).
4.6	**Bat monitoring:**		
4.6.1	Carry out bat monitoring for a period of 3 years after the completion of the entire OWF; the monitoring should be carried out during the periods of spring migration (early April – late May) and autumn migration (early August – late October).	"Carry out bat monitoring in the 1st and 3rd year after completion of the entire OWF. The monitoring shall be carried out during the periods of spring migration (early April – late May) and autumn migration (early August – late October)."	Due to the reduction in the number of wind turbines, it is proposed to reduce the survey effort for bats monitoring while maintaining the monitoring interval. The proposed survey effort is sufficient to determine how the Baltic Power OWF affects bats (see chapter 12.1.7 of the EIA Report).
4.7	**Monitoring of porpoises and seals:**		
4.7.2	**Post-development monitoring – during the Baltic Power OWF operation stage:**		

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
4.7.2.a	Survey monitoring of the presence of porpoises should be carried out for at least the first 3 years after the completion of the OWF using the same methods as during the wildlife survey.	"Survey monitoring of porpoises' presence shall be carried out in the 1st and 3rd year after completion of the entire OWF using the same methods as for the wildlife survey."	Due to the reduction of the number of wind turbines and the reduction of the time and scale of the underwater noise impact by proposing an appropriate NRS, it is proposed to reduce the survey effort on the monitoring of a porpoise while maintaining the monitoring interval. The proposed survey effort is sufficient to determine how the Baltic Power OWF affects a porpoise during the operation phase (*see* Chapter 12.1.5 of the EIA Report).
4.7.2.b	Conduct surveys monitoring of the presence of seals for at least the first 3 years after completion of the entire OWF. Conduct visual surveys during survey cruises with the frequency of one cruise per month.	"Seal surveys should be performed during seabird surveys carried out as part of the post-development analysis."	In order to optimize costs and the environmental pressure associated with the vessels performing cruises, it is proposed to conduct seal monitoring while conducting seabird surveys carried out at the stage of post-development analysis.
4.8	**Monitoring of ichthyofauna:**		
4.8.3	Ichthyofauna survey stations should be located both in the OWF area and at a distance of 1000 m from the OWF area, on the water region not intended for offshore wind energy generation and characterized by similar parameters of the marine environment (depth, distance from the shore, etc.).	"Ichthyofauna survey stations shall be located both in the OWF area and on the water region not intended for offshore wind energy generation that is characterized by similar parameters of the marine environment (depth, distance from the shore)".	The location parameter of the reference area (1000 m from the Baltic Power OWF area) should be removed because, in the light of the Investor's data, such a condition may prevent indication of a water region characterized by similar parameters of the marine environment as the Baltic Power DA, and thus the condition may be objectively unfeasible (*see* Chapter 12.1.2.1.2 of the EIA Report).
IV.	I state the obligation to carry out an assessment of the project environmental impact as part of the procedure on the issuance of decisions referred to in Article 72 section 1 point 1, to the extent consistent with Article 66 of the EIA Act, with particular regard to: 1. cumulation of impacts of the planned project with other offshore wind farms under construction and planned for construction in the Polish Exclusive Economic Zone, for which decisions on environmental conditions have been issued;	"There is no obligation to carry out the project environmental impact assessment as part of the procedure for issuing the decisions referred to in Article 72 section 1 point 1 of the EIA Act."	In view of the application in question, which aims to update the environmental conditions for the implementation of the project planned by the Applicant based on its target parameters which will be reflected in the building permit design, it should be also considered reasonable to revoke the obligation imposed on the Applicant to conduct a reassessment of the project's environmental impact at the stage of the procedure for obtaining a building permit. The precondition for imposing the obligation to perform a reassessment of the environmental impact was the application of the envelope concept of the environmental impact assessment procedure. In the light of the clarification

Item No.	Wording of the decision on environmental conditions issued for the Baltic Power OWF	Proposed new wording of the provision	Justification
	2. the impact of the project in terms of underwater noise emissions.		of the investment assumptions and their re-analysis in the context of the impact on all significant elements of the natural environment, subjecting the project to the reassessment of the environmental impact will be pointless, as the afore-mentioned target solutions shall be assessed as part of this procedure for amending the decision on environmental conditions for the Baltic Power OWF.

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19 List of figures

20 List of tables

21 List of photographs

22 List of appendices

1. OBP_REP_ROOS_PL_A_ZAL_001: Report on the survey of abiotic and biotic resources of the Baltic Power OWF survey area
2. OBP_REP_ROOS_PL_A_ZAL_001.1: List of works performed as part of geophysical measurements
3. OBP_REP_ROOS_PL_A_ZAL_001.2: Bathymetric map
4. OBP_REP_ROOS_PL_A_ZAL_001.3: Sonar image
5. OBP_REP_ROOS_PL_A_ZAL_001.4: Cross-sections
6. OBP_REP_ROOS_PL_A_ZAL_001.5: Map of magnetic anomalies
7. OBP_REP_ROOS_PL_A_ZAL_001.6: List of anomalies
8. OBP_REP_ROOS_PL_A_ZAL_001.7: List of anthropogenic objects
9. OBP_REP_ROOS_PL_A_ZAL_002: Results of model calculations of suspended matter propagation in the Baltic Power OWF Area
10. OBP_REP_ROOS_PL_A_ZAL_003: Results of model calculations of underwater noise propagation during piling
11. OBP_REP_ROOS_PL_A_ZAL_004: Assessment of the impact of the Baltic Power OWF on migratory birds with respect to the barrier effect and collision risk based on model calculations
12. OBP_REP_ROOS_PL_A_ZAL_005: Visualization of the view on the Baltic Power OWF
13. OBP_REP_ROOS_PL_A_ZAL_006: Bird observation form as part of ornithological monitoring of the piling process within the Baltic Power OWF
14. Map

23 Non-specialist summary

23.1 Introduction

23.1.1 Introduction

This document constitutes a summary of the Environmental Impact Report for the Baltic Power Offshore Wind Farm (hereinafter referred to as: Baltic Power OWF) The applicant planning the implementation of the Baltic Power OWF is Baltic Power Sp. z o.o., which is a special purpose vehicle whose shareholders are PKN ORLEN S.A. and Northland Power Baltic Wind B.V.

The planned project is the Baltic Power OWF with a total maximum power output of 1200 MW, located in the maritime areas of the Republic of Poland in the Exclusive Economic Zone, which includes the construction, operation and decommissioning of the Baltic Power OWF. It will consist of 76 wind turbines, up to 120 km of cable routes and 2 offshore substations.

On May 9, 2012, Baltic Power Sp. z o.o. obtained a permit No. MFW/6/12 from the Minister of Transport, Construction and Maritime Economy to erect and use artificial islands, structures and devices in the Polish maritime areas for the project entitled: "Offshore wind farm with a maximum total power output of 1200 MW, including technical, measurement, research and service infrastructure related to development, construction and operation stage", amended in 2013, 2020 and 2021.

The purpose of the planned project is to generate electricity using a renewable energy source – wind.

The present Environmental Impact Assessment Report comprises Appendix to the application for the amendment to the decision on environmental constraints based on the act of October 3, 2008 *on providing access to information about the environment and its protection, participation of the public in the environment protection and assessment of the environmental impact*. The decision on environmental conditions in question was issued by the General Director for Environmental Protection on June 29, 2022. Therefore, the authority competent to issue the amendment decision on environmental conditions for the planned project is the General Director for Environmental Protection. Pursuant to Article 87 of the Act of October 3, 2008 *on providing access to information about the environment and its protection, participation of the public in environmental protection and environmental impact assessment*, the provisions indicating the issue of the decision on environmental conditions shall apply accordingly to any amendments in the decision on environmental conditions.

The area of the planned project is covered by the development plan resulting from the Regulation of the Council of Ministers of April 14, 2021 *on the adoption of a spatial development plan for internal sea waters, territorial sea and exclusive economic zone at a scale of 1:200,000.*

The "Environmental Impact Report for the Baltic Power Offshore Wind Farm" was prepared by the Consortium of MEWO S.A. and the Maritime Institute of the Maritime University in Gdynia (formerly: Maritime Institute in Gdańsk) in cooperation with subcontractors: MIR-PIB, IFAO, Marea Sp. z o.o., DHI Polska Sp. z o.o.

23.1.2 Project classification

Pursuant to §2 section 1 point 5b of the Regulation of the Council of Ministers of September 10, 2019 o*n projects that may have a significant impact on the environment*, the planned project is classified as a project that may always have a significant impact on the environment (i.e. plants using wind energy for electricity generation located in maritime areas of the Republic of Poland).

Classification as projects that may always have a significant impact on the environment means the obligation to obtain a decision on environmental conditions (DEC) after obligatory conducting of the procedure on the environmental impact assessment of the project.

23.1.3 Premises for the implementation of the project

Construction of an offshore wind farm (OWF) is one of the strategic objectives of PKN Orlen. It is in line with the assumptions of the updated Energy Policy of Poland, assuming the construction, in the Polish Exclusive Economic Zone (EEZ) of offshore wind farms with a total power output of 5.9 GW by 2030 and ca. 11 GW in 2040. These actions will allow the transformation of the Polish energy industry towards the use of zero-emission energy sources, which is a response to the current climate challenges facing Poland, Europe and the world.

An important premise for the implementation of the project is the necessity to develop the offshore wind energy as one of the pillars to achieve climate neutrality, which is the assumption of the EU and national policies.

23.1.4 Scope of changes in the decision on environmental conditions

Chapter 1.4 indicates in detail the requested amendments to the decision on environmental conditions issued for the Baltic Power OWF, being the subject of this procedure.

23.1.5 Objective and scope of the report

The environmental impact assessment report was prepared for the purpose of the environmental impact assessment of the planned project in the context of the amendment to the decision on environmental conditions issued for the Baltic Power OWF.

The purpose of the report is to determine or specify in detail:

- characteristics and scale of the project;
- Possible variants of the project;
- Environmental conditions, resources and values of abiotic, natural, cultural and landscape environment;
- Existing and planned use and development of sea water areas;
- Other conditions resulting, among others, from special regulations, e.g. concerning the prevention of failures or construction disasters;
- Nature, range and significance of the expected environmental, spatial and social impacts related to the construction and operation of the Baltic Power OWF;
- The possibility of avoiding, preventing, limiting and possibly compensating the identified adverse effects of the project or hazards, taking into account potential emergency situations;
- The need to formulate recommendations to be applied at the stage of designing and preparation of the investment project, its implementation and operation, as well as decommissioning;
- The need to protect people, health and living conditions of the population against negative impacts;
- Proposal of environmental monitoring carried out at all stages of the project.

The subject of the document is the analysis of the impact of the planned Baltic Power OWF on the environment, comparison of the analyzed variants of the planned project in terms of environmental protection and indication of the variant most favorable for the environment.

23.1.6 Report background

The basis for the preparation of this report was:

- Applicant's Documentation:
  - Permit for erection and use of artificial islands, structures and devices,
  - Plan for prevention of hazards and oil pollution,
  - Navigation risk assessment,
  - Expert opinion on the impact on the safety related to surveys on exploration and exploitation of mineral resources of the seabed,
  - Documentation containing the results of environmental surveys and environmental inventory carried out in the period from October 2018 to March 2020 for the purpose of the original Environmental Impact Assessment Report (EIA);
  - Decision on environmental conditions for the project named: “Baltic Power Offshore Wind Farm” of the Regional Director for Environmental Protection in Gdańsk of September 17, 2021;
  - Decision of the General Director for Environmental Protection of June 29, 2022 repealing the decision of the RDEP in Gdańsk of September 17, 2021 in its entirety and specifying the environmental conditions for the implementation of the project named: Baltic Power Offshore Wind Farm;
  - Opinion of March 31, 2022 of the Director of the National Maritime Museum in Gdańsk in the scope of handling monuments located within the area of the project “Offshore Wind Farm complex with a maximum total power output of 1200 MW and technical, measurement, research and service infrastructure related to the preparation, execution and operation stages (“Baltic Power OWF”);
- strategic documentation, programming and planning documents at international, national, regional and local level;
- applicable laws.

Moreover, when preparing this EIA Report, sources of information were used, in particular environmental impact reports and other documentation for projects completed, implemented or planned, located closest to the planned project.

23.1.7 Findings of strategic and planning documents

The main premises for implementation of the project include: increasing the share of renewable energy and reducing greenhouse gas emissions to the atmosphere. These premises result from strategic and planning documents.

The planned project remains in line with the expectations of many policies and strategies, in particular concerning environmental protection (reduction of pollutant emissions), sustainable development (use of renewable energy sources) and energy security (independence from external energy sources) and remains in line with the environmental objectives of the analyzed applicable strategic and planning documents.

23.1.8 Information on the connection of the Baltic Power OWF with other projects

In the Baltic Power OWF Area, it is planned to launch OWFs of other investors. At the moment none of these projects has been implemented. These projects are at different stages of development. Seven of them have decisions on environmental conditions, i.e. Bałtyk II OWF, Bałtyk III OWF, Baltica 2 and Baltica 3 – as Baltica OWF, FEW Baltic II, B-Wind and C-Wind.

23.1.9 Methodology of assessment of impacts of the planned project

When preparing this EIA Report, the results of environmental surveys and wildlife surveys carried out in 2018-2020 were used. The work also takes into account the results of the information meetings, which were used to clarify the issues of public interest and to develop the part of the report dedicated to the analysis of possible social conflicts.

The works were carried out in accordance with the diagram of the EIA Report preparation. When preparing the EIA Report, the guidelines, manuals and other materials concerning the preparation of the EIA Report as well as the experience of the design team and commonly applicable good practices were primarily used.

The EIA Report includes three phases of the planned project: construction, operation and decommissioning.

The purpose of the EIA Report is to determine potential impacts of the planned project on the environment. The assessment is an analytical and study work. When preparing the EIA Report, analyses of descriptive and cartographic materials were carried out, the impact assessment methodology was applied, as well as interpretation of the results of the conducted surveys and inventories.

The EIA Report contains an analysis of the planned project in terms of applied techniques and technologies and operating conditions. Among others, the information contained in the documentation of the planned project was used and the potential impact of similar projects, which may accumulate, was analyzed.

On the basis of available data, environmental surveys and environmental inventories, significant environmental, spatial and social conditions were determined. On this basis, potential impacts and risks related to the planned project were identified. The scope and reach of the expected environmental impact were determined. Comparisons were made with analogous cases in terms of environmental conditions and the size and nature of impacts.

The approach used to assess the scale and significance of impacts results from the experience gained during the environmental impact assessments of projects planned to be implemented in offshore areas, including OWF.

The adopted approach allowed to identify comprehensive actions aimed at avoiding, preventing and limiting negative impacts related to the planned project.

Specific impacts are assigned characteristics in four categories: nature, type, range and time range of impacts.

At the same time, the resistance of receivers (environment elements) to impacts in cases of possible interaction between the impact and receiver was determined. Taking into account the assigned characteristics of impacts and the determined resistance of receivers to them, the scale (size) of impacts, specific for individual relations between the impact and receiver, was determined.

The size (scale) of the impact is described in a five-step scale: insignificant, small, moderate, large and very large.

Taking into account the prevalence of presence of the receiver, its significance and role in the environment, and in particular its protection status, the receiver, treated as an environmental resource, was assigned a value (significance) on a five-stage scale: insignificant, small, moderate, large and very large.

At the next stage of the assessment, taking into account the assigned size (scale) of the impact and sensitivity of the receiver, the significance of the impact was determined on a five-stage scale: negligible, insignificant, moderate, significant and substantial.

In accordance with the described methodology of the environmental impact assessment, a significant impact may occur if a “very large” scale of impact is determined and at the same time at least a “high” sensitivity of the receiver and a “high” scale of impact with a “very high” sensitivity of the receiver.

23.2 Description of the planned project

23.2.1 General characteristics of the planned project

23.2.1.1 Subject and scope of the project

The project in question is the construction and operation of the Baltic Power OWF with a total maximum installed capacity of 1200 MW, together with technical, measurement, research and service infrastructure related to the preparatory, execution and operation stages, located in the Polish EEZ.

The scope of the project covers its implementation consisting of three basic stages: construction, operation and decommissioning. The entire project will be composed of the following components:

- wind turbines consisting of nacelles with rotors, a tower, transition pieces and monopiles embedded in the seabed;
- two offshore substations;
- internal power and communication lines.

23.2.1.2 Location of the project and area of the occupied water region

The Baltic Power OWF Area is located in the Polish EEZ, north of communes of Łeba and Choczewo at a distance of 22.5 km from the coastline. The Baltic Power OWF will be implemented entirely in the area indicated in the permit for erection and use of artificial islands, structures and devices.

The Baltic Power development area from the north and south will reach the boundary of the area under the permit for erection and use of artificial islands, structures and devices. The western boundary of the Baltic Power development area in the northern route will reach the boundary of the area under the permit for erection and use of artificial islands, structures and devices, and then will run at a distance of 500 m from the boundary of the permit for erection and use of artificial islands, structures and devices to the turn point. Further on, the western boundary of the Baltic Power development area will move away from the boundary of the area under the permit for erection and use of artificial islands, structures and devices to the south-western point of the area under the permit for erection and use of artificial islands, structures and devices. The eastern boundary of the Baltic Power development area in its northeastern section will run at the boundary of the area under the permit for erection and use of artificial islands, structures and devices, and then at a distance of 500 m from the boundary under the permit for erection and use of artificial islands, structures and devices.

The area of the Baltic Power OWF Area is 131.08 km ^{2}, while the area of the Baltic Power DA is 113.72 km ^{2}.

23.2.1.3 Distribution of individual components of the project

Chapter 2.1.3 presents the detailed location of individual components of the planned project, i.e. wind turbines, substations and inner array cable routes. In accordance with the practice, the applicant assumes that, as part of further project development and acquisition of further information, the final locations of wind turbines or substations and inner array cables may change up to 100 m for foundations and 200 m for cables. Such location changes will not cause changes in the environmental impact of the Baltic Power OWF.

23.2.2 Description of the technology

The planned technological solutions of the electricity generation process in the OWE are presented below.

23.2.2.1 Description of the production process

Wind turbines are plants for the conversion of the kinetic wind energy into electricity by driving the power generator with the rotor driven by the wind force. Mechanical energy of the rotating rotor is converted in the generator to alternating current with low voltage, which is most often transformed to medium voltage and then to high voltage for its further transmission.

Due to the location conditions, wind farms located in offshore areas are constructed as groups of single wind turbines together with accompanying infrastructure, the purpose of which is to supply the generated electricity to an onshore substation or to supervise the availability of the OWF.

Wind turbines for electricity generation do not require the supply of other fuels and raw materials. Their proper operation does not cause pollution of the natural environment. A small amount of electricity demand occurs only in the case of windless weather. The demand for raw materials and energy, as in the case of other power systems, is associated with the process of construction and installation of structural elements of individual components of the wind farm, operation of service vessels and decommissioning.

23.2.2.2 Description of the technology of individual elements of the project

The Baltic Power OWF consists of four main components connected together functionally and structurally: i) wind turbines, ii) monopiles, iii) inner array power cables and iv) substations.

23.2.2.2.1 Wind turbine

A wind turbine is an essential component of a wind farm. A Vestas wind turbine, model V236-15.0 MW ™, will be used in the Baltic Power OWF.

Within the OFW, three main structural elements can be identified that perform a specific function: tower, nacelle and rotor.

The **tower** is a structural element connecting the nacelle with the monopile. In addition to its basic load-bearing function, the tower provides the basis for routing the wind turbine control cables, power cables and other systems and devices necessary for the proper operation of the entire plant. The tower may be equipped with internal and external platforms, thanks to which the service teams have access to both the nacelle and the elements of the tower itself.

The **nacelle** is a key component of a wind turbine. It consists of the drive train devices and the enclosure protecting against weather conditions. The drive train ensures the conversion of rotational energy from the rotor into three-phase alternating current. The main components of the drive train are the turbine, the rotating shaft with a gearbox and the generator. The generator generates electricity as a result of electrical induction by placing moving elements in the magnetic field. The nacelle is assembled onshore and fully transported and installed on the wind turbine tower.

The **rotor** is composed of the blades and a hub. As a result of the wind impact, it moves rotationally, capturing and transferring its energy to other elements of the nacelle. The blades are made of composite materials. They are equipped with electric discharge protection systems. The power output of the wind turbine depends to a large extent on the rotor size. In the planned Baltic Power OWF, V236-15.0 MW turbine models with the blade length of 115.5 m and hub diameter of 5 m will be used.

23.2.2.2.2 Monopiles

The wind turbine tower will be mounted on a monopile which is permanently affixed to the seabed. The monopile's main tasks are to ensure:

- appropriate rigidity and strength of the wind turbine;
- support for cable systems;
- connection of the wind turbine with the seabed;
- efficient installation of the wind turbine.

The selection of an appropriate monopile depends on the size and weight of the wind turbine on the one hand, and on the environmental conditions prevailing in the OWF location: depth of the water region and geological conditions of the seabed on the other hand. Other environmental conditions (wave motion, currents, icing, biotic values) and the economic aspect are also important factors when selecting the monopile.

As part of the Baltic Power OWF, monopiles (with a diameter of 9.5 m and weight of up to 2000 t) are planned to be used for foundation of both wind turbines and substations.

23.2.2.2.3 Connection infrastructure

The OWF connection infrastructure includes: power grid (inner array cables) and substations.

Inner array cables of the farm connect the wind turbines with substations located within the wind farm. **Substations** are used to transform energy generated by wind turbines and transfer it to the shore.

The task of **substations** is to increase the voltage of the current from the wind turbines to the transmission level, which, in consequence, is to reduce losses, increase the transmission power and/or enable a reduction of conductor cross-section in the cables.

23.2.3 Considered project options

23.2.3.1 Approach to determination of project options

The planned project was described using the same parameters for two options analyzed further in the EIA Report, i.e.: the option proposed by the Applicant (OPA) and the reasonable alternative option (RAO). With respect to these parameters, in the case of the OPA, these are values corresponding to the target parameters of the Baltic Power OWF, and in the case of the RAO, the maximum possible values were adopted. Such an assumption allows to perform an environmental impact assessment taking into account the highest expected level of project environmental impact.

The project was characterized by determination of the following parameters for each of the options:

- maximum total installed capacity of the OWF;
- maximum total number of wind turbines;
- maximum rotor diameter of the wind turbine;
- minimum clearance between the rotor operating area and water surface;
- maximum height of the wind turbine structure, including the rotor;
- maximum length of cable routes of the internal OWF system.

23.2.3.2 Considered project options together with justification of their selection

In accordance with the requirements for preparation of EIA Reports, both options adopted for assessment are reasonable, i.e. possible to be implemented in the current legal status (including as part of the issued permit for erection and use of artificial islands, structures and devices), technical and process conditions and in the current state of knowledge on environmental conditions.

23.2.3.2.1 Option proposed by the Applicant (OPA)

The option proposed by the Applicant is an option assuming use, to the greatest extent possible, of the latest technological solutions available on the market. It also assumes that the Baltic Power OWF will reach the total maximum nominal power output defined in the permit for erection and use of artificial islands, structures and devices. This option assumes possible use of 15 MW wind turbines. It is planned to use monopiles. Implementation of the Baltic Power OWF project with the total maximum power output specified in the permit for erection and use of artificial islands, structures and devices (up to 1200 MW) assumes installation of 76 wind turbines.

According to further analyses of the environmental impact, the OPA is an option more favorable for the environment compared to the RAO.

23.2.3.2.2 Reasonable alternative option (RAO)

The reasonable alternative option was based in assumptions on the existing technologies currently applied and available on the market. In this option, it was assumed that the wind turbine will have the power output of 5 MW. The assumed wind turbine power output, with the maximum total nominal power output of the OWF complex, indicated in the permit for erection and use of artificial islands, structures and devices, determines the number of wind turbines, which in this option is 240.

In the RAO, it is assumed that it will be possible to use wind turbines of different types and on different types of foundations or support structures.

23.2.3.2.3 List of technical parameters of the considered project options

The table (Table 23.1) summarizes the most important parameters of the project for both options analyzed in this EIA Report.

Table 23.1. List of key parameters of the Baltic Power OWF for the option proposed by the Applicant (OPA) and the reasonable alternative option (RAO) [Source: own study]

Parameter	Unit	VpA	RWA
Maximum installed capacity	MW	1,200	1,200
Maximum number of wind turbines	-	76	240

Parameter	Unit	VpA	RWA
Rotor diameter	m	236	180
Minimum clearance between the area of the rotor operation and water surface	m	22.3	20
Maximum height of the wind turbine	m a.s.l.	258.3	250
Maximum number of additional structures	-	2	12
Maximum length of cable routes inside the OWF	km	120	600

23.2.4 Description of individual phases of the project

23.2.4.1 General information concerning all phases of the project

Due to the location of the planned project executed in the offshore area, all related activities in all phases of its course shall be conducted in the mode of maritime operations, taking into account their special conditions and specificity. Deliveries to and from the OWF area will be performed using various types of vessels.

Activities related to the transport of large-size structural elements of the OWF will be carried out from ports that meet specific requirements:

- sufficient length and load-bearing capacity of the quayside, allowing for installation, storage and loading of structural elements of the OWF;
- appropriate depth of port basins, enabling operation of large construction vessels therein.

At the current stage of development of the Baltic Power OWF project, the ports in Świnoujście and Rønne are considered as installation ports.

During the operation phase of the Baltic Power OWF, it will be possible to use a smaller port located closer to the area of the planned project than the ports indicated above, i.e. the port in Łeba.

Information on activities during the OWF construction phase, establishment of safety zones around the OWF structural components, as well as complete or partial decommissioning of the OWF will be made public in official publications of the Hydrographic Office of the Polish Navy.

At each stage of implementation of the Baltic Power OWF, the applicable legal requirements and good practices regarding waste and wastewater handling shall be applied.

All vessels involved in the entire project shall comply with the requirements and comply with the provisions of the International Convention for the Prevention of Pollution from Ships, including in particular the procedures contained in the "Oil pollution prevention plans".

The same shall apply to other waste, including other hazardous waste; such waste shall be sorted, collected in specially marked and secured containers, transported onshore and handed over for disposal to specialized companies.

23.2.4.2 Construction phase

The construction phase of the OWF is the phase of the project that requires mobilization and involvement of the largest number of vessels, equipment and human resources. It is necessary to create a complex supply chain process for both goods and specialized services in various areas: manufacturing, transport, construction, erection and installation.

Depending on the adopted project implementation strategy, the activities can be carried out sequentially or in parallel.

It is assumed that the construction phase will be completed as soon as possible and that it will take place in 2024-2026. Prior to the commencement of the Baltic Power OWF construction phase, the Investor will use the onshore site equipped with appropriate infrastructure (site back-up facilities and storage yards) where the preliminary erection of the wind turbine components will be performed and structural components of the OWF will be stored. This area will be located in the port or shipbuilding infrastructure existing for the duration of the project, with direct or very good access to the quayside dedicated to loading and unloading operations of vessels participating in the construction process and subsequent maintenance of the OWF. Individual elements of the OWF shall be transported from this area by vessels to the area of their foundation or installation.

Depending on the depth and geological conditions in the Baltic Power OWF Area, the activities shall be carried out to prepare the seabed for substations and before laying inner array cables.

It is planned to use two cable laying organizations: i) laying and burying the cable at the same time, and ii) burying the cable after it has been laid on the seabed.

It is assumed that the disturbed sediment will be entirely managed within the Baltic Power OWF Area. The sediment will be transported only in the immediate vicinity of the work site. The monopiles will be driven into the seabed by means of special equipment (pile drivers with weight and impact energy appropriate to the size of driven piles) from the deck of vessels adapted to these works (jacking platforms or vessels or other solutions available during construction). During the construction phase, the contractor of installation works will apply the noise reduction system (NRS) during driving of monopiles.

Maritime transport will be crucial and the impact of land transport should be minimal. Land transport will be carried out as part of the existing communication solutions.

23.2.4.3 Operation phase

Unlike the construction phase, this phase will be characterized by smaller movement of vessels. In general terms, the traffic of vessels for this phase will include an increased share of traffic of small and medium-sized vessels related to the operation and maintenance of the Baltic Power OWF.

The number of specialist offshore operations related to the operation phase of the Baltic Power OWF is proportional to the number of facilities installed and constructed in the OWF area, including also the length of the installed power grids. Therefore, the number of operations and their effects (e.g. fuel consumption, transport-related emissions) for the OPA will be lower than in the case of the RAO.

The OWF operation process will be a multi-annual project. Offshore wind farms will be connected with the offshore substations by means of power grids and communication networks. Cables buried in the seabed are optimized for emitting residual electric field. The electric current flowing through a power cable causes the cable heating. Inner array cables laid at a depth of 3 m as part of the Baltic Power OWF are compliant with the conditions specified in the Best environmental practice guide for laying and using submarine cable.

Waste is expected to be generated in connection with normal operation of the OWF. The main factors that cause arising of waste and wastewater in the Baltic Power OWF operation phase will include using of vessels and performing repairs. The amounts of waste and wastewater will be much higher in the case of the RAO than in the case of the OPA.

23.2.4.4 Decommissioning phase

In technical terms, the decommissioning phase is the reversal of the Baltic Power OWF construction phase. In the reverse sequence to the construction phase, individual elements of the OWF will be removed and transported to the disposal sites.

The number of specialist offshore operations related to the decommissioning phase of the Baltic Power OWF will be proportional to the number of facilities installed and constructed in the OWF Area, including also to the length of the installed power grids. Therefore, the number of operations and their impact for the OPA will be lower than for the RAO.

In the decommissioning phase, waste will be generated. When comparing its amounts for the OPA and RAO, it can be assumed that the amounts of waste and wastewater will be much higher for the RAO than for the OPA.

It is expected that the decommissioning of structures in the Baltic Power OWF Area will take place to the seabed level. In the case of decommissioning of the Baltic Power OWF, the generation of waste is related mainly to the physical removal of worn-out elements of the Baltic Power OWF, and to operations of vessels used during decommissioning.

23.2.4.5 Information on the energy demand and consumption

The most important factor determining the demand for energy and its consumption is the selected type of structures constructed in the Baltic Power OWF Area, and organization of the construction process, as well as the selection of the OWF operation method. The energy needed and consumed for construction of the OWF is, in nearly 100%, fuel used for transport, reloading and installation of the wind turbines and other OWF facilities. The number of specialist offshore operations related to the construction, operation and decommissioning phase of the Baltic Power OWF will be proportional to the number of facilities installed and constructed in the OWF Area, including also the length of the installed power cables. Therefore, the quantities of fuel and emission values related to transport for the OPA will be lower than for the RAO.

23.2.5 Risk of serious failures or natural and construction disasters

23.2.5.1 Types of failures resulting in contamination of the environment

The project being a subject of this EIA Report is not a place of storage of substances decisive for classification of the project as a plant with an increased or high risk of a serious industrial failure.

The main hazards that may occur during the construction and decommissioning of the Baltic Power OWF are spills of oil derivative substances. To a lesser extent, the marine environment may be incidentally endangered by materials containing hazardous substances, if used. At the operation stage, oil spills may be the main cause of pollution of sea waters. Both within open sea waters and close to the shore, they may pose a problem with long-term effects on fauna, flora, fishing and beaches subject to contamination. In order to counteract this hazard, the Baltic Power OWF systems will be equipped with measures protecting against the spill of hazardous substances.

During normal operation of vessels, minor spills of oil derivative substances may occur. It should be assumed that these will be small spills.

Areas particularly sensitive to potential pollution are protected areas. The number of potential leakages is proportional to the number of vessels used to implement, operate or decommission the project.

During the construction, operation or decommissioning of the Baltic Power OWF, in emergency situation there may be spills of oil derivative substances which will pollute the water and bottom sediments. Spills may occur due to a failure or collision of vessels, their collision with the OWF facilities, sinking or grounding of the vessels, as well as during spills and operational leaks from the vessels, spill from the oil system of the wind turbine, spill from the transformer at the substation or spill of oil related to inspections and overhauls of the Baltic Power OWF components. In the worst case scenario, at the construction or decommissioning stage, there will be medium-sized spills.

During the construction of a wind farm, on vessels, at onshore site back-up facilities and in the place where the projects are to be implemented, waste related to the construction process will be generated. The possibility of releasing waste or chemical substances into water is proportional to the activity related to the use of chemical agents.

Other types of releases include: i) release of municipal waste or domestic sewage, ii) pollution of water and bottom sediments with anti-fouling agents and iii) release of pollutants from anthropogenic objects at the bottom.

23.2.5.2 Environmental hazards

Potential events during the **construction phase**, which may become a source of negative environmental impacts of the OWF, include: I) spill of oil derivative substances as a result of ship collisions, failures or construction disaster, ii) accidental release of municipal waste or domestic sewage, iii) accidental release of construction materials or chemicals and iv) pollution of water and bottom sediments with anti-fouling agents.

As a result of emergency situations and events, the abiotic environment may be directly polluted: sea waters and bottom sediments. Indirectly, these events may affect living organisms. The pollution of water or bottom sediments with municipal waste or domestic sewage is a negative impact, direct, temporary or short-term, reversible, of local range. The impact significance is negligible.

The collision of vessels resulting in the release of hazardous substances into the environment is a factor that may cause increased mortality and diseases of marine organisms. The probability of such events can be considered as low.

The basic threat to Natura 2000 sites during the construction phase is the release of hazardous substances into the environment as a result of the collision of vessels. It can be assumed that this factor will not have a significant impact on protected areas.

During the **operation phase** of the Baltic Power OWF, environmental hazards may also occur, in particular pollution of water and bottom sediments: i) with oil derivative substances, ii) with anti-fouling agents, iii) with accidentally released municipal waste or domestic sewage, and iv) with accidentally released chemicals and waste from the operation of the Baltic Power OWF.

Waste and sewage will be generated by persons on the vessels and will be generated during operation, maintenance of towers and transmission infrastructure.

The collision of vessels resulting in the release of hazardous substances into the environment is a factor that may cause increased mortality and diseases of marine organisms. The probability of such events can be considered as low. The implementation of a proper procedure to be followed in the event of collisions and leakages aims at minimizing the impact of such incidents on marine organisms.

The basic threat to Natura 2000 sites during the operation phase is the release of hazardous substances into the environment as a result of the collision of vessels. This factor may cause increased mortality and diseases of marine organisms, including the subjects of protection. The probability of such events can be considered as low.

During the **decommissioning phase** of the Baltic Power OWF, there may occur impacts resulting from the occurrence of emergency situations and other environmental hazards, in particular pollution of water and bottom sediments: i) with accidentally released municipal waste or domestic sewage, ii) with oil derivative substances and iii) with anti-fouling agents.

There is a risk that the wastewater from the vessel enters the water at the time of collection of wastewater from the vessels by another entity and in case of failure. This may result in local increase in the concentration of biogens and deterioration of water quality. However, the contaminants should be quickly dispersed, and thus they will not contribute to a permanent deterioration of the environment in the project area.

The impacts related to the environmental hazards during the decommissioning phase are identical to the impacts described above for the OWF construction phase.

23.2.5.3 Prevention of failures

The prevention of failures is a set of activities related to the protection of human health and life, natural environment and property, as well as reputation of all participants of the processes related to the construction, operation and decommissioning of the Baltic Power OWF. These activities shall include, but not be limited to:

- the preparation of plans for safe construction, operation and decommissioning of the OWF;
- preparation of rescue plans and training of crews and personnel;
- preparation of a plan for the prevention of hazards and pollution;
- the selection of suppliers and certified components and components of the OWF;
- the designation of protection zones;
- marking of the OWF area, its facilities and vessels;
- the planning of maritime operations;
- application of standards and guidelines;
- provision of navigation surveillance;
- continuous monitoring of vessel traffic within the OWF;
- establishment of a coordination center supervising the implementation of the OWF;
- maintaining permanent communication lines between the OWF coordination center and the coordinator of works at sea, and other coordination centers.

23.2.5.4 Design, process and organizational protections planned to be used by the Applicant

Design, process and organizational protections consist in carrying out navigation risk assessments and developing plans to prevent:

- hazards to human life – evacuation plans, search and rescue plans;
- fire hazards;
- hazards of pollution of the natural environment – plan for prevention of hazards and oil pollution;
- hazards of construction disasters.

23.2.5.5 Potential causes of the failure taking into account extreme situations and the risk of occurrence of natural and construction disasters

OWF structures are designed and built to withstand extreme weather conditions. All components, although subjected to extremely heavy loads, are adapted to long-term operation. All devices are continuously monitored. The rotor is stopped automatically at wind speed exceeding safe operation of the wind turbine. The service plan shall ensure failure-free operation.

Potentially the greatest hazards occur in the construction phase; any risk of a disaster is minimal due to the fact that weather conditions and the possibility of their change are always taken into account when planning offshore operations. Each offshore operation has its limitations in terms of visibility, wind speed, sea state or ambient temperature. The occurrence of negative effects of climate changes in the form of too strong wind or too high wave may only result in the extension of the construction cycle and increased energy demand

23.2.5.6 The risk of occurrence of major accidents or natural disasters and structural collapses, taking into account the substances and technologies used, including the risk of climate change.

The risk of a serious failure resulting in the emission of hazardous substances is minimal. The probability of events such as vessel collisions is included in the category of very rare events, as is the vessel's contact with the OWF structure. Taking into account the effects in the form of 200 m^3 of diesel oil, the level of risk is acceptable. Emission of 200 m^3 of diesel fuel will cause insignificant damage to the natural environment.

23.2.6 Relations between the project parameters and impacts

The table (Table 23.2) presents a matrix of relations between the parameters of the planned project and the impacts.

Table 23.2. Matrix of relations between the project parameters and the impacts [Source: own study]

Parameter	Type of emission or disturbance																
	Topside structures	**Substructures**	**Heat**	**EMR**	**Above-water noise**	**Underwater noise**	**Waste**	**Light effects**	**Seabed disturbances**	**Suspended matter**	**Resuspension of impurities**	**Resedimentation**	**Creation of artificial reef**	**Water pollution**	**Air pollution**	**Increased traffic and collision risk**	**Barrier effect \ displacement or habitat loss**
The number of wind turbines	X	X			X		X	X								X	X
Number of monopiles		X				X	X		X	X	X	X	X	X			X
Width of scour protection						X			X	X	X	X	X	X			X
Monopile diameter		X				X			X	X	X	X	X				X
Piling parameters						X											
Total height of wind turbines	X				X			X								X	X
Rotor diameter	X																X
Length and type of cables		X	X	X						X	X	X				X	X
Depth and method of cable laying/burying			X	X		X			X	X	X						
Number and size of substations	X	X		X	X			X									X
Process organization (number of vessels, time)					X	X	X	X						X	X	X	

23.3 Environmental constraints

23.3.1 Location, topography of the water region's bottom

The Baltic Power OWF area (1 NM) is located to the east of the Słupsk Bank and covers a fragment of the seabed with a depth ranging from 28.1 to 45.4 m. The depth increases northwards.

Based on the analysis of bathymetric and sonar data, the topography and specificity of the seabed surface were fully recognized. On this basis, using the interpretation of seismic and seismoacoustic data as well as data from analyses of surface samples and samples collected with a vibroprobe, and also taking into account the general knowledge about the area, a map of seabed surface types was prepared.

Within the analyzed area, three types of seabed were distinguished, different in terms of their structure and specificity, including as follows: abrasion-accumulation plain, kame terraces and accumulation platform.

23.3.2 Geological structure, bottom sediments, raw materials and deposits

23.3.2.1 Geological structure, geotechnical conditions

According to literature data, Quaternary sediments laying on Paleogene and Neogene sediments were identified in the seabed structure of this area. Below the sediments from Paleogene and Neogene periods, Mesozoic sediments (Trias and Cretaceous period) were identified. They occur only in the southern part of the surveyed area. Under the Mesozoic sediments, in the northern part of the surveyed area, directly under the sediments from Paleogene and Neogene periods, there are sediments from the Silurian period.

23.3.2.2 Bottom sediments and their quality

The seabed, nearly on the entire surface of the analyzed area is covered by a discontinuous layer of fine and medium-grained sands. Partly, on the surface there is accumulation of mixed-grained sediments, clusters of boulders and outcrops of fluvisol.

In the Baltic Power OWF Area (1 NM) two types of sediments that build the bottom surface have been identified: fine- and medium-grained sands and clays with a stone and gravel abrasive boulder bed and sand cover.

The content of biogenic substances (total phosphorus) in the surveyed area did not exceed the values typical of sediments of the southern Baltic Sea.

Concentrations of persistent organic pollutants and harmful substances, such as metals or mineral oils, were low in the surveyed area and did not exceed the values typical for sandy sediments of the southern Baltic Sea. The surveyed sediments were also characterized by low activity of radioactive caesium isotope, typical of sandy sediments.

23.3.2.3 Raw materials and deposits

In the structure of the seabed of the analyzed area, no appropriate parameters of accumulation of fine- and medium-grained sands, which may constitute a mineral deposit, were identified. The identified sands form a layer with a thickness ranging from 0.5 to 2 m, only locally up to several meters. Sands are deposited on silty and loamy substrate, locally on clayey substrate.

23.3.3 Quality of sea waters

The concentrations of the surveyed chemical parameters of water in the Baltic Power OWF Area (1 NM) did not differ significantly from the contents typical of the southern Baltic waters.

These waters are characterized by alkaline reaction and a relatively good oxygenation, with seasonal variations characteristic of southern Baltic waters. The assessment of the water quality indicator in the Baltic Power OWF Area (1 NM) based on the oxygen content in the demersal layer in the summer period indicates a good condition. The suspended matter content in the individual measurement periods occurred at the level typical of the southern Baltic waters.

The content of biogenic substances was characterized by seasonal variations characteristic of southern Baltic waters. Waters of the surveyed area were characterized by low (at the trace level) content values of particularly harmful substances.

The surveyed waters were also characterized by low values of activity of radioactive elements typical of southern Baltic waters. In the Baltic Power OWF Area (1 NM), slightly higher concentrations of aromatic hydrocarbons than indicated in the literature were recorded.

Considering the distance of the Baltic Power OWF development area from the nearest homogeneous surface water body, i.e. Jastrzębia Góra – Rowy CWIIIWB5, and the range of impacts of the project, it should be assumed that the implementation of the Baltic Power OWF will not affect the achievement of environmental objectives for this surface water body.

23.3.4 Climate conditions and air purity conditions

23.3.4.1 Climate and risk of climate change

Based on the available data and analysis, it is possible to indicate the most important forecasts of changes in particular elements of the atmosphere and water in the Baltic Sea region:

- the air temperature rise is faster than the average global rise, and this trend will continue;
- the water surface temperature rise is greater than its deeper layers, which may result in greater thermal

stratification and stabilization of the thermocline during the year;

- forecast changes in salinity are not clearly defined and depend, on the one hand, on changes in air circulation conditions and the volume of water exchange with the North Sea, and, on the other hand, on the volume of fluvial water inflow; a decrease in salinity is forecast;
- precipitation is forecast to increase throughout the Baltic Sea basin during the winter season, while only in the northern part during the summer; the frequency of extreme precipitation will increase;
- in terms of forecast of sea level changes, the effects of its global growth will not be significantly felt;
- forecasts of wind climate change are subject to considerable uncertainty, it is assumed that with an increase in average surface water temperature there will be an increase in average wind speed over sea areas;
- wave climate changes are mainly related to an increase in the frequency and intensity of storms;
- model calculations indicate that there will be an increase in the surface area of areas with low oxygen content in water and anaerobic areas at the seabed.

Due to the increase in the average water temperature and the increased inflow of biogenic pollutants to the sea, the negative phenomenon will be the progressive eutrophication, especially on the water surface.

23.3.4.2 Meteorological conditions

Meteorological conditions of sea areas covering the Baltic Power OWF Area were determined on the basis of measurements of the surface layer parameters. The average wind speed for the entire measurement period was approx. 7.3 $m \cdot s^{-1}$, and the maximum speed reached almost 20 $m \cdot s^{-1}$. The prevailing winds here were from the west and southwest sector. Air temperature ranged from approx. -3.1 °C to approx. 28.3 °C. Atmospheric pressure varied from 975.7 to 1046.4 hPa. Relative humidity was highly variable, oscillating between approximately 40% and 100%.

23.3.4.3 Air quality

The assessment of air quality of the near-water layer was referred to the information obtained as part of the measurements carried out for the nearest onshore substation (Łeba). Due to the lack of significant sources of pollution emission above the sea area, the air purity parameters should not be worse than those measured on the shore. The area of the coastal zone in the Łeba area has air purity class A.

23.3.4.4 Underwater background noise

The results of the background noise monitoring in the Baltic Power OWF Area indicate that underwater noise levels (and their variability ranges) show characteristic values for the southern Baltic Sea area.

23.3.5 Electromagnetic field

In the marine environment, the values of the electric field and geomagnetic field are similar. There are no artificial sources of electromagnetic field (EMR) in the Baltic Power OWF Area. The existing DC transmission system between Poland and Sweden (SwePol Link) is located at a distance of several dozen kilometers from the planned OWF location.

Changes in natural electric fields have no direct impact on living organisms. Natural magnetic fields vary according to geographical location. They have a significant impact on some living organisms.

Electromagnetic fields generated as a result of electric current flow may change natural migratory behavior of sea mammals and fishes, and may also be a source of thermal energy introduced into the marine environment.

23.3.6 Description of natural components and protected areas

The surveys performed in the Baltic Power OWF Area (1 NM) showed lack of underwater vegetation, both established in the seabed sediments and attached to boulders and stones deposited on the seabed.

Macrozoobenthos is a group of invertebrate organisms inhabiting the surface layer of bottom sediments (epifauna), also of the hard substrate (boulders, stones) or living inside the sediment (infauna). For the purpose of this report, separate macrozoobenthos surveys were performed on the soft seabed (sandy deposits) and on the hard seabed (boulders, stones). In the OWF Area (1 NM), 25 taxons were found on the soft seabed, among which the *Marenzelleria sp*. and *Pygospio elegans* polychaetes were found in the group of absolutely stable species. On the hard seabed, 16 taxons belonging to 6 classes and one subclass were recorded. The *Mytilus sp.* mussel dominated in the structure of numbers and biomass.

In the Baltic Power OWF Area (1 NM), **fishes** belonging to 22 taxons were caught. Permanent fish communities of the area include cod, flounder, plaice, turbot, herring, sprats, and the sparse shorthorn sculpin, lumpfish, great sand eel and vivaparous eelpout. The observed presence of larvae of species such as gobies, fourbeard rockling, rock gunnel, longspined bullhead, or common seasnail does not indicate permanent inhabitation of the area by adult fish. The area is poor in terms of species diversity, with a clear predominance of cod and flounder in bottom fishing, and herring and sprat in pelagic fishing. The Baltic Power OWF Area (1 NM) is not a significant breeding area; a breeding area of sprat of minor importance was found only in the summer period.

The results of acoustic monitoring of porpoises, visual observations from the air and additional observations of **sea mammals** from vessels carried out as part of seabird surveys indicate a low number of porpoises and seals in the surveyed Baltic Power OWF Area (2 NM).

In total, 95 species were recorded over the OWF Area (2 NM) during the surveys of **migratory birds**; flight paths were prepared for 67 species and 28 species were identified on acoustic recordings. During the entire survey period, geese (including mostly unidentified species), common scoters and long-tailed ducks were most frequently recorded. The following species were less numerous, but still frequently observed: common wood pigeon, common guillemot, razorbill, Eurasian wigeon, little gull, greater scaup and common gull.

Most of the flight paths were recorded for the common scoter, long-tailed duck, common wood pigeon, skylark, leaf warbler and velvet scoter. The analysis of the echo recorded by the vertical radar indicates the most intensive migration in March at a height of 0–100 m a.s.l., both during the day and at night, but the peak of migration activity was in April. In all months in which the surveys were carried out, the highest number of echoes was recorded at heights of 0–250 m a.s.l.

Seabird surveys were carried out in the Baltic Power OWF Area (2 NM) and in three additional areas of significant importance for birds: Słupsk Bank, a fragment of the Coastal Waters of the Baltic Sea area and the Polish part of the South Central Bank area.

In the Baltic Power OWF Area (2 NM), a total of 19 species of birds staying on water were recorded, including 13 species related to the marine environment and 6 species of aquatic birds rarely encountered at sea away from the coast. Long-tailed duck was by far the most numerous species recorded. A tenfold lower occurrence of European herring gull and common guillemot was found.

In the additional areas, a total of 23 species of birds staying on water were recorded, including 15 species related to the marine environment and 8 species of aquatic birds rarely encountered at sea away from the coast. In these areas the long-tailed duck also definitely prevailed, with half as many velvet scoters and many times less European herring gulls found. The results of observation of seabirds showed that the Baltic Power OWF Area (2 NM) is not a place of very high concentration of birds sitting on water in the period of their most numerous presence in the Baltic Sea.

During spring and autumn migration, the presence of **bats** over the Baltic Power OWF Area was found (2 NM). The recorded signals were assigned to three bat species as follows: Nathusius' pipistrelle, soprano pipistrelle and common noctule. Additionally, some signals, due to the fact that they cannot be assigned to any species, were classified into the Nyctaloid group. The most numerous bat species was Nathusius' Pipistrelle. The total number of recordings indicates low activity of bats during the migration period over the OWF Area (2 NM).

The Baltic Power OWF Area is located outside the boundaries of **protected areas**, including the areas of the European ecological network Natura 2000. Two Natura 2000 Marine Protected Areas are located closest: at a distance of approx. 9 km – Coastal waters of the Baltic Sea (PLB990002), and, at a distance of at least 25 km – Słupsk Bank (PLC990001). There is the onshore and offshore Słowińska Refuge Natura 2000 site (PLH220023) and the onshore Słowińskie Coast area (PLB220003) located at a distance of approx. 21 km from the Baltic Power OWF Area. In the area of Ostoja Słowińska (PLH220023), there is the main complex of the Słowiński National Park, including its section located in the maritime areas.

Ecological corridors do not pass through the Baltic Power OWF Area. They are not identified within the entire Baltic Sea area.

The biodiversity the Baltic Power OWF Area does not differ from the typical biodiversity of the southern Baltic Sea. No species not present at the same time in other parts of the southern Baltic Sea were found in the Baltic Power OWF Area.

The results of environmental surveys indicate that the Baltic Power OWF Area is in most cases homogeneous in terms of abiotic conditions. Therefore, fragments of areas of different **natural values** cannot be indicated, except for the issue related to the depth of the water region. The southern shallower part of the water region is characterized by higher densities of seabirds (long-tailed duck and velvet scoter).

There are no elements of underwater **cultural heritage** in the Baltic Power OWF Area. During the surveys in the Baltic Power OWF Area, five wrecks were found, including three as yet unidentified wrecks.

The Baltic Power OWF Area is characterized by a low degree of use in terms of **navigation** and is used to a small extent by pleasure craft.

In the Baltic Power OWF Area, **fishing** activities are carried out, mainly by fishing vessels from ports in Łeba and Ustka. The area of the planned project is characterized by low fishing productivity. The basic fish species caught in this area were cod and European flounder.

In the Baltic Power OWF Area, there are no structures permanently connected to the seabed. Nor are licenses issued for prospecting, exploration and extraction of hydrocarbons from submarine deposits.

The potential zone of the Baltic Power OWF impact on the landscape includes an area of land from Ustka in the west to Jastrzębia Góra in the east. Due to the shape of the coastal zone, structural components of the Baltic Power OWF may be visible from beaches at this part of the coast.

23.4 Modelling performed for the purpose of project impact assessment

For the purposes of this EIA Report, model studies were carried with the objective to:

- obtain information about the range of suspended matter propagation and concentration in water as a result of works that disturb bottom sediments;
- obtain information about the range and intensity of underwater noise generated during installation and construction works;
- obtain information on the potential number of collisions of flying seabirds with wind turbines.

Based on the results of the seabirds survey, their density in the studied areas was modeled.

The calculation performed for the spreading range and suspended matter content, taking into account the various forcing conditions (wind, currents), made it possible to analyze the influence of these conditions on specific parameters of suspended matter impact. The method of calculations allowed for identifying the least environmentally beneficial, i.e. the most interfering impacts of suspended matter on the marine environment, caused by works related to the construction of the wind farm. The results of the performed simulations indicate, among others, that: I) higher suspended matter content is local in relation to the place of works that disturb the seabed and does not exceed 15 $mg \cdot l^{-1}$ at the distance of 2000 m; II) the thickness of newly formed sediments at a distance of 100 m from the place of works does not exceed 2 mm, III) the concentration above 4 $mg \cdot l^{-1}$ does not last longer than 13 hours.

Underwater noise will be emitted to the environment at every stage of the Baltic Power OWF construction. However, its greatest impact is expected during construction due to the high noise levels generated during monopile driving. The analysis was performed for the worst-case scenario (piling of a 9.5 m diameter monopiles) using numerical modeling of underwater noise. Sound levels were also estimated taking into account the use of SRH in the form of a double big bubble curtain (DBBC) located around the place of pile driving into the seabed and the HSD type shield.

Calculations of noise propagation resulting from piling in several locations showed that the ranges and areas of impact of all analyzed effects of noise exposure (behavioral response, TTS and PTS) increased with the increase in the number of piling sources. Such a trend occurred for all animals and all analyzed turbines, and the largest ranges and areas of impact were identified in the scenario with three sources. Taking into account calculations without NRS, the largest areas of impact were found for the behavioral response. Moreover, in most cases, the impact areas were larger for deep than shallow locations.

The analyses performed for simultaneous piling in several locations indicated that the use of HSD-type shields may be insufficient for the porpoise. Results showed a significant effect related to behavioral response. However, as indicated by modeling results, this impact can be reduced by using HSD and DBBC-type shields, as found for each of the three turbine locations.

Wind turbines may cause **collisions** with flying birds. Among all species considered in this analysis, the significance of the collision risk was determined at a moderate level for the common crane, for which the maximum mortality was estimated at 116 individuals in autumn in the alternative option, while the models for the option proposed by the Applicant indicate a lower mortality by approx. 60% in both spring and autumn for all tested clearance ranges. The impact significance in the form of collision risk for the long-tailed duck, common scoter and velvet scoter was assessed to be of low importance. For these species, the estimated number of collisions concerned a few individuals. For geese, the estimated number of collisions in the worst case scenario involved more than 70 individuals due to the very large populations of the species included in this category (estimated at more than 3.5 million individuals). For the remaining species, the impact significance was considered negligible.

23.5 Description of the expected environmental effects in the case of a decision not to implement the project, taking into account the available environmental information and scientific knowledge

Failure to implement the project consisting in the construction and operation of the Baltic Power OWF may result in the necessity to compensate the assumed amount of energy obtained from conventional sources with similar power output, with emissions of gaseous and dust pollutants from fuel combustion, generation of approx. 20% of waste from combustion in relation to the amount of combusted fuel, as well as indirectly the effects of environmental changes in the areas of fossil fuel extraction.

On the other hand, if the project is not implemented, there will be local benefits related to abandoning the development of offshore areas. Lack of investment in the OWF will mean in practice that complex impacts related to the construction, operation and decommissioning of OWF components will not occur within several dozen years. This also means an absence of restrictions on the availability of these areas to existing and potentially new users. There will be no predicted impacts of varying scale and extent on the abiotic and biotic elements. These elements will be subject to the existing impacts resulting from the existing pressures in the marine environment.

23.6 Identification and assessment of project impacts

The analysis of impacts was carried out separately for the construction, operation and decommissioning phases of the OWF.

23.6.1 Option proposed by the Applicant (OPA)

23.6.1.1 Construction phase

23.6.1.1.1 Impact on geological structure and bottom sediments

Activities related to the construction of the project can cause impacts on the geological structure of the seabed and bottom sediments, including: changes in the structure, shape and level of the seabed, disturbances in the geological structure and changes resulting from the disturbance and sedimentation of suspended matter.

The general impact of the project during the construction phase on the geological structure of the seabed was assessed as negligible for the general nature of the seabed and its structure. The changes will be small, on a relatively small surface area of the seabed.

In geological terms, taking into account the nature of deposits forming the seabed surface of the Baltic Power OWF Area (1 NM), no significant changes in the nature of deposits are expected. In the places of individual locations of the wind turbine, the nature of surface sediments and locally in points where monopiles are to be driven into the seabed will change. The impact on surface sediments will be negligible.

23.6.1.1.2 Impact on the quality of sea waters and bottom sediments

The Baltic Power OWF during the construction phase may have an impact on the water and bottom sediments through:

- release of pollutants and biogenic compounds from sediment into water;
- pollution of water and sediments with oil derivative substances;
- pollution of water and sediments with anti-fouling agents;
- pollution of water and sediments with accidentally released municipal waste or domestic sewage;
- pollution of water and sediments with accidentally released chemicals and waste generated during construction.

The release of pollutants and biogenic substances from bottom sediments in the construction phase is an impact which is direct, negative, local, short-term, reversible or irreversible, repeatable during the construction period, of low intensity. The significance of this impact during the construction phase within the OPA was determined as insignificant for sea waters and as negligible for bottom sediments.

Pollution of sea waters or seabed sediments with oil derivative substances released during normal operation of vessels form a direct negative impact of local range, momentary or short-term, reversible, repeatable, of low intensity. The significance of this impact during the construction phase in the OPA was assessed as negligible for sea waters and bottom sediments.

The pollution of water or seabed sediments with oil derivatives released during an emergency forms a direct negative impact of regional range, short-term, reversible, repeatable, of high intensity. The significance of this impact during the construction phase in the OPA due to the random and sporadic nature of failures and collisions was assessed to have low significance for sea waters and bottom sediments.

Contamination of water or seabed sediments with antifouling substances covering ship hulls forms during the construction phase a direct, negative impact of a local or regional range, short-term, reversible, repeatable during the construction period, of low intensity. The impact significance in the construction phase within the OPA was determined as negligible.

The pollution of water or seabed sediments with municipal waste or domestic sewage is a direct negative impact of a local range, short-term or momentary, reversible, repeatable during the construction period, of low intensity. The significance of this impact during the construction phase in the OPA was assessed as negligible for sea waters and bottom sediments.

The pollution of water or bottom sediments connected with the OWF construction process is a direct, negative impact of a local range, short-term or momentary, irreversible, repeatable during the construction period, of medium intensity. The significance of this impact at the construction phase in OPA was assessed as negligible for sea waters and as of low significance for bottom sediments.

23.6.1.1.3 Impact on the climate, including emission of greenhouse gases and impact significant in terms of adaptation to climate changes, impact on the air (atmospheric purity)

During the construction phase of the Baltic Power OWF, an increased emission of pollutants into the atmosphere can be expected, due to the increased traffic of vessels involved in project construction. During that phase, the significance of the impact of the planned investment project on climate and greenhouse gases will be negligible, as there will be no factors that could have a noticeable impact on their change.

The impact during the construction phase of the planned project on the air quality will be temporary and will disappear after the works have ceased. In addition, due to an open space without obstacles, the concentration of pollutants will decrease rapidly. Therefore, the significance of the impact will be negligible.

23.6.1.1.4 Impact on nature and protected areas

23.6.1.1.4.1 Impact on biotic components in offshore area

During the construction phase of the Baltic Power OWF, there will be no impact on **phytobenthos**.

During the construction phase of the Baltic Power OWF, the works carried out on the seabed will cause the following impacts affecting the condition of **macrozoobenthos** inhabiting this area by: (i) disturbance of the structure of seabed sediments, (ii) increase in the concentration of suspended matter in water, (iii) sedimentation of suspended matter on the seabed, and (iv) redistribution of pollutants from sediments to water.

The analysis of impact during the construction stage of the Baltic Power OWF has shown that the impacts are assessed as negligible or of low significance, whereas the most adverse impact will be the disturbance of the structure of bottom sediments in places where the hard seabed macrozoobenthos currently occurs (especially in the southern and north-eastern part of the examined water region).

The main impacts on **ichthyofauna** will be as follows: (i) noise and vibration emission, (ii) increase in suspended matter concentration, (iii) release of pollutants and biogens from sediment to water, (iv) change of habitat, and (v) construction of a barrier.

The impact of noise and vibration on adult fish will be as follows: negative, direct, short-term and reaching beyond the Baltic Power OWF Area. The significance of the impact was assessed as moderate for all investigated fish species.

it will be a negative, direct, local, short-term impact. The significance of the impact is assessed to be negligible for all investigated fish species.

The impact related to releasing pollutants and biogenic substances from the sediments to the body of water will be negative, direct, temporary and local. The significance of the impact is assessed to be negligible for all investigated fish species.

The impact related to the change of habitat will be negative, direct, temporary and local. The significance of the impact is assessed to be negligible for all investigated fish species.

The impact related to the creation of the barrier will be negative, direct, local and temporary for cod and European flounder, long-term and permanent for other fish species. The significance of the impact is assessed to be negligible for all investigated fish species.

Marine mammals at the construction stage of the Baltic Power OWF may be subject to impacts resulting from: (i) underwater noise from piling works, (ii) noise generated by the traffic of vessels, (iii) increased content of suspended matter in water, (iv) habitat changes, and (v) spillage of oil derivative substances into the environment as a result of vessel failures.

The most important impact on marine mammals during the construction phase will be the emission of underwater noise generated as a result of foundation works. The use of NRS significantly reduces this impact. The significance of this impact was assessed as moderate at most.

During the construction phase of the OWF, the space above the sea area where erection and construction works will carried out is gradually disturbed. Both the vessels participating in these works and the erected OWF structures create obstacles for **migratory birds**. Impacts on them resulting from the barrier effect and collision with the structures of the Baltic Power OWF were assessed for the operation phase, when they are the greatest. The significance of the impact of the Baltic Power OWF, i.e. the barrier effect and risk of collision on migratory birds during the construction phase was assessed to be of low importance at the most.

The most important impacts on **seabirds** during the construction phase include as follows: (i) vessel traffic, (ii) emission of noise and vibration, (iii) lighting, (iv) creation of a barrier, (v) collisions with vessels, (vi) destruction of benthic habitats and (vii) increase in suspended matter content in water and sedimentation of disturbed sediments. The impact assessment was carried out for the five most numerous birds: long-tailed duck, velvet scoter, razorbill, common guillemot and European herring gull. The significance of the above-mentioned impacts for the European herring gull was assessed as negligible, for the razorbill and common guillemot as moderate at most, and for the sea ducks (velvet scoter and long-tailed duck) as significant.

During the construction phase of the Baltic Power OWF, there can be impacts on **bats** resulting from the presence of vessels and gradual spatial development. Therefore there can be a risk of collision with vessels and structural members in the construction area. Moreover, the presence of vessels will result in an increase in noise levels and disturbances resulting from their use of lighting.

The impact on bats during the construction phase will be negative, direct, local, short-term, whereas the significance of this impact was assessed as negligible.

23.6.1.1.4.2 Impact on protected areas

Given the location of the Baltic Power OWF at a significant distance from the protected area of the Słowiński National Park, there will be no significant impact on this area, including any element for which it was established, i.e. biodiversity, resources, objects and elements of inanimate nature and the landscape of the Park.

The identification and assessment of impact on areas protected under the European Natura 2000 ecological network were presented in sub-chapter 23.6.3.

23.6.1.1.4.3 Impact on wildlife corridors

Given the lack of information on the occurrence, functioning and significance of wildlife corridors in maritime areas, it was conservatively assumed that the value of this resource is medium. Taking into account the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea, including the increasing effect of spatial development, it was assessed that the impact of the Baltic Power OWF during the construction phase on the potential migration routes of migratory species will be negligible.

23.6.1.1.4.4 Impact on biodiversity

Taking into account the nature of impacts during the construction phase of the Baltic Power OWF and animal species present in the area, including the role played by this area for them, it can be assumed that at this stage of the project there may be a short-term change in the number of species present in the development area. Individual species may be temporarily scared off to the adjacent areas where they will not be exposed to disturbances. However, such a movement of individuals does not mean a change of biodiversity at the species level. The works carried out will also not lead to changes in the level of ecosystem and genetic diversity. Therefore, the impact of the project on biodiversity was considered insignificant.

23.6.1.1.5 Impact on cultural values, monuments and archaeological sites and facilities

The Baltic Power OWF at the construction stage will not have a negative impact on potential objects of high importance for the protection of cultural heritage from the Stone Age. The surveys carried out in the area in question did not show any archaeological objects or strata related to the settlement in the Stone Age.

23.6.1.1.6 Impact on the use and development of the water region and on tangible property

Limitations resulting from the gradual exclusion from of the Baltic Power OWF Area previous use will have the greatest impact on fishing, including as the area of fishing, as well as the necessity to extend the routes to other fishing grounds, this impact will be negative and direct. Moreover, due to the assumed duration of the construction phase, this impact will be long-term and local.

Taking into account the fact that the previous use of the Baltic Power OWF Area for fishing activities was small and that this activity can be carried out in neighboring water regions, it should be assumed that the significance of the Baltic Power OWF impact on fishing will be of low importance.

23.6.1.1.7 Impact on landscape, including the cultural landscape

During the construction phase of the Baltic Power OWF, potential impacts of the project on the landscape, including the cultural landscape, were identified, resulting from: (i) vessel traffic, (ii) transport of structural elements of the OWF and (iii) gradual development of the area.

23.6.1.1.8 Impact on population, health and living conditions of people.

During the Baltic Power OWF construction, there will be impact on the population at different intensity levels in onshore and offshore areas. This impact will directly affect the persons involved in the construction process. The entire process will be subject to regulations resulting from occupational health and safety regulations. During the construction period, fishermen will have to abandon fishing in the area of works and carry them out in other water regions. An increase in vessel traffic related to construction can also affect the navigational safety.

The scale of impact on people's population, health and living conditions during the construction phase will be “small”, and when assessing the significance of the receiver as “very large”, it can be assumed that the significance of impact will be moderate.

23.6.1.2 Operation phase

23.6.1.2.1 Impact on the geological structure, bottom sediments, access to raw materials and deposits

Changes within the seabed associated with the impact of the project will be local and within the entire area occupied by the project – insignificant for the overall character of the seabed and its structure. It is not expected that there will be any changes in the seabed structure during the project operation phase. The overall impact of the project in the operation phase can be assessed as negligible.

23.6.1.2.2 Impact on the dynamics of sea waters

As a result of the presence of structural elements of the Baltic Power OWF, water flow rates and directions as well as water pressure in the immediate vicinity of each structure can change, which will manifest itself in a local increase in water flow velocity due to narrowing of the flow stream and formation of whirlpools around the structure. This means that overlapping of these impacts should not be expected and disturbances will be only local. The resulting modifications of the wave motion can be noticed only in the close vicinity of individual offshore wind turbines. However, they are of local nature and should not be present outside the Baltic Power OWF Area. The impact of wind turbines on the wave field and sea current field will not have a key impact on these elements.

Significance of the impact of the Baltic Power OWF on the dynamics of sea waters in the OPA during the operation phase was assessed as negligible.

23.6.1.2.3 Impact on the quality of sea waters and bottom sediments

During the Baltic Power OWF operation, works affecting the quality of water and bottom sediments will be carried out in its area. This will be mainly maintenance and intervention works in the event of an emergency situation. The impacts will be similar as in the case of the construction phase, however, their scale, due to the size of resources used in both phases of the project, will be many times smaller than in the construction phase.

New impacts not occurring during the construction phase will result from: (i) contamination of water and the bottom sediments with compounds from anti-corrosion agents and (ii) change of bottom sediments and water through the reception of heat from transmission cables.

Contamination of the environment with aluminum or zinc released during operation with the use of galvanic cathodic protection is a direct, negative impact of local range, being long-term, irreversible, permanent, and of medium intensity. The significance of this impact during the operation phase in the OPA was assessed as negligible for sea waters and bottom sediments.

Increasing the temperature of sediments in which the cable is buried and waters filling the spaces between sand grains in the sediment can cause: (i) increased bacteria activity, (ii) reduction of oxygen content in water, (iii) release of harmful substances, including metals, from sediment into water, and (iv) adverse effects on benthic organisms. The most important parameters influencing the impact size are the depth of cable burial and the seabed type.

The heat emission around the Baltic Power OWF cables in the sediment will be local and the effect will be imperceptible, which is compliant with the technical assumptions of the project for inner array power cables to be buried at a depth of up to 3 m.

Heat emission by the cables is a direct, negative impact of local range which are long-term, irreversible, permanent over the operation period, and of medium intensity. The impact significance in the construction phase for sea waters and bottom sediments was determined as negligible.

23.6.1.2.4 Impact on the climate, including emission of greenhouse gases and impact significant in terms of adaptation to climate changes, impact on the air (atmospheric purity)

The wind turbines will locally reduce wind energy and disturb atmospheric pressure directly in the area of the rotor operation. The wind turbine towers may locally disturb the velocities and directions of water flows and reduce the energy of sea waves locally, which is reflected in their height drop. During the operation phase of the Baltic Power OWF, direct and local impact of the planned project (related to the use of vessels and fuel consumption by them) will not have a significant impact on the change of climatic conditions. Despite long-term impact, its range will be local. However, indirectly the operation of the wind farm will result in reduction of greenhouse gas emissions to the atmosphere by other sources, e.g. coal-fired power plants located in other areas of the country. Therefore, despite the significant importance of the climate and air quality and the small scale of impact of the Baltic Power OWF in the OPA during the operation phase, it may be concluded that the impact in terms of greenhouse gas emissions from vessels to the atmosphere will be negligible.

23.6.1.2.5 Impact on systems using EM field

It follows from the operation of the OWF so far that the operation of wind turbines and certain types of tower structures may adversely affect the operation of marine and onshore navigation support equipment or other applications. This applies in particular to radars, communication systems and radar equipment.

In accordance with the conditions included in the permit for erection and use of artificial islands, structures and devices, the Applicant will be obliged to make arrangements with users using EMF systems to implement remedial measures that will allow to accept the impact of the Baltic Power OWF on communication and radiolocation systems for these users. Therefore, it should be assumed that the significance of the impact of the Baltic Power OWF on these systems will be negligible.

23.6.1.2.6 Impact on nature and protected areas

23.6.1.2.6.1 Impact on biotic components in offshore area

During the operation phase, support structures of wind turbines and accompanying infrastructure located under the water surface in the euphotic zone can be overgrown by macroalgae. Despite the fact that **phytobenthos** does not occur in the area of the planned OWF, macroalgae spores may appear in this area due to various natural and anthropogenic factors.

Macroalgae and animal organisms (e.g. mussels) overgrowing components of the OWF will create the "artificial reef", a factor causing local increase in biodiversity of plant and animal species per se and indirectly affecting the increase in the species richness and quantitative resources of the marine fauna – mainly fish and nekton crustaceans, which will search for food and places convenient for refuge and reproduction within it. Therefore, the effect of overgrowing submerged structures of the OWF by macroalgae should be considered as positive, however it should also be noted that the natural character of the maritime area will be disturbed. Locally and in the long term, the functioning of the marine ecosystem will be changed, for which the anthropogenic factor will be responsible. The significance of the impact was considered positive and negligible.

The operation of the Baltic Power OWF will cause the following impacts on **macrozoobenthos**: (i) loss of a fragment of the habitat, and (ii) artificial reef effect.

The main impact in this phase of project implementation will be the loss of a fragment of macrozoobenthos habitat. The seabed development will eliminate biological life from the seabed surface, in the worst case scenario it will be occupied by the GBS with the largest base diameter from among the proposed types of support structures (in the RAO), including a scour-protection layer.

The loss of a part of the habitat is a negative impact occurring during the operation phase.

Given the moderate scale of the impact on the soft seabed macrozoobenthos, the importance of this impact will be insignificant.

Taking into account the high capacity of recovery of the hard seabed macrozoobenthos resources, this impact was assessed as insignificant.

Once the support structures are introduced into the environment, taking into account the high reproductive potential of zoobenthos, the colonization of artificial hard substrates by animal periphyton communities, as well as mobile epifauna – the so-called artificial reef effect, should be expected here. This artificial reef will partially compensate for the destroyed macrozoobenthos complex occurring there before human interference with the environment. The artificial reef effect is a long-term and permanent phenomenon, but due to its local range, the impact significance was considered moderate.

During the Baltic Power OWF operation phase, the impacts on **ichthyofauna** will result from: (i) noise and vibration emission, (ii) habitat change, (iii) creation of a barrier, and (iv) EMF emission.

The impact of noise at the operation phase of the Baltic Power OWF should be much lower than observed during construction and decommissioning. It will depend on the environmental conditions (depth, type of sediment, seabed morphology) and the type and size of the wind turbine and wind speed.

Emission of noise and vibrations generated during the OWF operation may directly affect the ichthyofauna. The above impacts will be of negative, direct, local, long-term and permanent nature. The significance of the impact is assessed to be negligible for all investigated fish species.

The presence of structural elements of wind turbines involves the creation of additional hard substrates forming a new habitat. Such artificial structures constitute the so-called artificial reef – a new habitat. As early as after several months, numerous populations of fishes will appear in the reef area, both those returning after the end of disturbances related to construction and those not present in this area so far, affecting the increase in biodiversity. The development of a stable artificial reef system usually takes 1–5 years.

Moreover, the introduction of possible restrictions for fishing and navigation in the Baltic Power OWF Area will reduce anthropogenic pressure, and the areas of artificial reefs can constitute a specific refuge for fishes, both adults and early stages of development. However, it is possible that artificial reefs can create an environment that also favors foreign fish species.

The impact related to the change of habitat will be positive, direct, local, permanent and long-term. The significance of the impact is assessed to be negligible for all investigated fish species.

The construction of underwater structures may constitute a migration barrier for economically important fish whose routes run in this place. The impact related to the creation of a barrier will be negative, direct, local, long-term and permanent. The significance of the impact is assessed to be negligible for all investigated fish species.

The sensitivity of ichthyofauna to EMF impact depends on: (i) a species-specific detection threshold, (ii) a type of fish sensory (magnetic or electrical) and (iii) a species lifestyle (demersal or pelagic).

The impact related to the EMF emission will be negative, direct, local, long-term and permanent. The significance of the impact is assessed to be negligible for all investigated fish species.

During the operation phase of the Baltic Power OWF, the impacts on **sea mammals** will result from: (i) emission of noise generated by wind turbines, (ii) emission of noise generated by vessels, (iii) changes in the habitat, (iv) collisions of vessels, and (v) collisions with vessels.

The most significant impact on marine mammals during the operation phase of the Baltic Power OWF will result from a potential collision of vessels and, consequently, from the risk of a significant spill of fuel. In this case, the significance of the impact was assessed as moderate. In other cases, the significance of the impact was assessed as insignificant.

During the operation phase of the Baltic Power OWF, the impacts on **migratory birds** will result from two elements, i.e. the barrier effect and risk of collision with the OWF structures. Due to the largest assumed occupation of space above the Baltic Power OWF Area, the size of these impacts will be higher than in the construction phase.

The significance of the impact of the barrier effect was assessed for all migratory bird species as negligible. However, the significance of the impact in the form of collision risk was considered moderate in the case common cranes, insignificant in the case of geese, long-tailed duck, common scoter and velvet scoter and negligible for other species.

The most important impacts on **seabirds** during the operation phase include: (i) vessel traffic, (ii) scaring away and displacement from the habitat, (iii) creation of a barrier, (iv) collisions with wind turbines, (v) creation of an artificial reef and (vi) creation of a closed water region. The impact assessment was carried out for the five most numerous birds: long-tailed duck, velvet scoter, razorbill, common guillemot and European herring gull.

The significance of the above-mentioned impacts for the European herring gull was assessed as negligible, for the razorbill and common guillemot as moderate at most, and for the sea ducks (velvet scoter and long-tailed duck) as significant at most.The impact of the Baltic Power OWF on **bats** during the operation phase will be caused by: (i) collisions with wind turbines, (ii) noise and light emissions, (iii) barrier effect, and (iv) habitat changes. The significance of the impact of the Baltic Power OWF during the operation phase was assessed as insignificant.

23.6.1.2.6.2 Impact on protected areas

Given the location of the Baltic Power OWF at a significant distance from the Słowiński National Park, no significant impact on this area will occur during the operation phase, including any element for which it was established, i.e. biodiversity, resources, objects and components of inanimate nature and landscape values of the Park.

As a result of the conducted specific assessment of the impact of the Baltic Power OWF, it can be concluded that the planned project will not cause significant impacts on the analyzed Natura 2000 sites.

23.6.1.2.6.3 Impact on wildlife corridors

Due to the same pre-conditions in terms of knowledge about wildlife corridors in maritime areas and the spatial scale of the Baltic Power OWF Area in relation to the size of the Baltic Sea, including the constant effect of space development, it was assessed that the impact of the Baltic Power OWF in the operation phase, similarly as in the construction phase, on migration routes of migratory species will be negligible.

23.6.1.2.6.4 Impact on biodiversity

During the Baltic Power OWF operation phase, structures permanently submerged in water will be founded in the environment, creating favorable conditions for the development of animal and plant periphyton organisms. On a local scale, within the range of structural members, there will be an increase in species diversity, although the character of natural value of this habitat may be ambiguous. This results from the fact that, on the one hand, periphyton communities will be a new biocenosis component of this area, additionally increasing the food base for fish, birds and, incidentally, for marine mammals. On the other hand, this location may favor the spread of foreign species, which lowers the ecological quality of this micro-habitat.

An artificial reef will create favorable conditions for living and reproduction of many fish species. A positive impact on biodiversity can have a long-term reduction or cessation of fishing in the Baltic Power OWF Area. Probably, the artificial reef effect will have only a local impact, without increasing diversity in a larger area.

In the case of seabirds, as a result of scaring away and displacement from habitats, there can be changes in the distribution of birds in the Baltic Power OWF Area. After the disturbance period, birds will gradually become accustomed to the new situation. In the case of species sensitive to the presence of wind turbine structures, the OWF Area can be clearly avoided and thus the biodiversity of this area could be reduced.

23.6.1.2.7 Impact on cultural values, monuments and archaeological sites and facilities

In the Baltic Power OWF Area, no risk of impact on the objects of great importance for the protection of cultural heritage was found. One cannot exclude that the wrecks reported to the Pomeranian Voivodeship Heritage Conservation Officer will be covered by conservation care and will require determination of protection zones in which the possibility of development will be limited.

The Applicant assumes preventive limitation of activities that involve disturbance of the seabed at a distance of up to 100 m from the discovered wrecks.

23.6.1.2.8 Impact on the use and development of the water region and on tangible property

During its operation, the Baltic Power OWF Area will be excluded from navigation due to safety reasons. Decisions on permits for vessels other than vessels handling the OWF in the Baltic Power OWF Area will be made by relevant maritime administration authorities.

As a result of the Baltic Power OWF occupying the maritime area, this area may be excluded from the possibility of fishing. The Baltic Power OWF Area is located within four fishing squares. This area is characterized by low fishing productivity, therefore the significance of the impact was assessed to be of low importance.

23.6.1.2.9 Impact on landscape, including the cultural landscape

During the operation phase of the OWF, potential impacts of the project on the landscape, including the cultural landscape, resulting from the presence of marine structures and vessels were identified.

Objectively the landscape within the OWF will be industrial, but its impact will be subjective and will depend on individual characteristics of the receiver and may be perceived negatively and positively.

The significance of impacts was assessed as negligible.

23.6.1.2.10 Impact on population, health and living conditions of people.

The operation of the Baltic Power OWF will require regular maintenance services. All related works will be performed by specialized teams of employees and will be subject to high occupational health and safety requirements.

The access to the Baltic Power OWF Area may be limited for fishing vessels and may mean, for instance, limitation of availability to the currently exploited fishing grounds and extension of routes for fishing vessels from certain ports to the fishing grounds located north of the Baltic Power OWF Area. During most meteorological situations, the Baltic Power OWF will not be noticeable from the shore. Only from higher viewing points and under suitable visibility conditions will, it be possible to observe a larger number of wind turbines.

Other types of events that may affect health and living conditions may involve different types of collisions of vessels at sea. Such events are random, and the presence of the OWF may hinder rescue operations at sea.

Although the human population resources, and both the health and living conditions of people, is of great value, due to the fact that the distance of the Baltic Power OWF from permanent places of residence and work of people is large, the impact of the Baltic Power OWF was considered negligible.

23.6.1.3 Decommissioning phase

During the decommissioning phase, most of the OWF facilities will most likely be removed from the seabed, in accordance with international regulations. These regulations define the conditions for removal of components and installations of wind farms. Decommissioning works should be carried out in such a manner that they do not hinder navigation and do not adversely affect the marine environment. These standards also define exceptional situations in which there is no obligation to completely remove infrastructure components of the OWF. It is possible to leave such structures, among others, when:

- the weight of the foundation in the air exceeds 4000 tons or it is located at a depth of more than 100 m, provided that it does not hinder the use of maritime areas by other sectors of the economy;
- removal of the components is technically impossible or too expensive;
- there is a threat to the life of the OWF decommissioning personnel;
- decommissioning involves an unacceptable risk of polluting the marine environment.

If some components are left on the seabed, relevant tests and analyses should be carried out to determine whether the remnants of the OWF will not interfere with vessel traffic and will not have a negative impact on biotic and abiotic elements of the environment. It should be ensured that the left behind parts of the structure do not start to move under the influence of waves, tides, currents or storm surges, causing a hazard to maritime navigation.

The decommissioning process of the Baltic Power OWF will start in several dozen years. During this time, there will be experiences resulting from the decommissioning of other OWFs. This will allow for the development of a detailed plan for the decommissioning of the OWF, taking into account all environmental aspects, including the determination of the part of structural elements removed from the environment. There is no doubt that all above-water components will be removed, transported onshore and disposed of there. To a large extent, the underwater parts will also be removed. Most probably, parts of monopiles in the seabed will remain in the environment, as their total extraction will involve too much effort and resources, and at the same time their removal could cause significant environmental impact.

When assessing the impact of the planned activities during the decommissioning phase of the Baltic Power OWF, no higher significance of these impacts on individual assessed elements of the environment than during the construction or operation phase was found.

As a result of the decommissioning process of the Baltic Power OWF, the condition of biocenotic balance created during the several decades of operation will be disturbed. Removal of structural components from water will lead to removal of the substrate for the development of periphyton fauna and flora. Periphyton communities living on these structures will be destroyed. This applies in particular to plant organisms which, without the OWF structure, did not occur in the Baltic Power OWF Area. As a last resort, depending on the scale of decommissioning, a new state of biocenotic equilibrium, closer to the current one, will be established. This balance will also be affected by natural processes taking place in the southern Baltic Sea.

The release of the marine space from the structural components of the Baltic Power OWF will enable its re-use by the existing users, in particular in navigation. The possibility of using this area in terms of fishing will depend on the degree of removal of structural components in water.

23.6.2 Reasonable alternative option (RAO)

The Option Proposed by the Applicant (OPA) and the Reasonable Alternative Option (RAO) differ in two key parameters, i.e. the maximum number of wind turbines and the maximum rotor diameter. These two main parameters of the Baltic Power OWF may generate different environmental impacts.

When assessing the impact on individual elements of the environment in all phases of the project implementation no differences were found in the significance of the impact between the two options under consideration. There were only differences in modeling results between the OPA and the RAO in the assessment of collision on migratory birds during the operation phase. The results of collision modeling showed the same or higher risk of collision of migratory birds for the RAO.

23.6.3 Impact assessment for Natura 2000 sites

23.6.3.1 Preliminary assessment

The primary objective of protection of Natura 2000 areas is to maintain or restore the proper conservation status of species and natural habitats which are being protected and for the protection of which these areas have been designated.

The Baltic Power OWF project is not directly related to or necessary for the management of Natura 2000 sites. It follows from these premises that it is necessary to carry out an assessment of the impact on these areas.

An essential element of the preliminary assessment of the Baltic Power OWF impact on the Natura 2000 areas is to determine whether a given Natura 2000 site is within the range of potential impacts of the Baltic Power OWF.

The main reasons for concluding whether the planned project may have impacts on the Natura 2000 protected area are the distance between this area and the project execution area and the range of the impacts. Due to the specific nature of the functioning of the Natura 2000 areas and possible functional connections between these areas, it is also important to locate the investment project area in relation to the Natura 2000 sites.

The Baltic Power OWF area is located outside the areas of the European Natura 2000 network. Therefore, when determining the impact of the planned project on Natura 2000 sites, impacts that go beyond the Baltic Power OWF Area were assumed, i.e.: (i) increased concentration of suspended matter in water and its sedimentation, (ii) underwater noise, and (iii) space disturbance.

Taking into account that from the nearest structures of the Baltic Power OWF, the source of suspended matter generation, to the boundaries of protected habitats, the distance is many times larger than the maximum range of suspended matter sedimentation, there will be no impacts on these habitats, both in the context of changing their boundaries, fragmentation or on their structure and function.

The noise reduction system, which is an integral part of the Baltic Power OWF in the construction phase, is aimed at limiting underwater noise generated during piling works to such an extent that it does not exceed the TTS values within Natura 2000 sites where these organisms are subject to protection. It is assumed that in order to avoid significant impacts on Natura 2000 sites for other OWFs, the prerequisite for implementation of these projects will be to meet the underwater noise levels safe for organisms subject to protection in these areas.

As a result of the preliminary assessment of the impact of the planned project on Natura 2000 sites, given the ranges and nature of impacts, both of the Baltic Power OWF and of the impact cumulative with impacts from other projects, it was indicated that none of the Natura 2000 sites is within the range of the impacts: (i) increased concentration of suspended matter in water and its sedimentation, and (ii) underwater noise. The absence of these impacts applies in particular to the subjects of protection (species and habitats) within the areas for which protection was established.

The actual impact assessment of the Baltic Power OWF on Natura 2000 sites covered the aspect related to the probable impact caused by the disturbance of the airspace over the Baltic Power OWF development area in the context of integrity of the Coastal waters of the Baltic Sea ("Przybrzeżne wody Bałtyku") area (PLB990002) and coherence of the Natura 2000 network.

23.6.3.2 Actual assessment

The Baltic Power OWF operation stage was included in the actual assessment due to the nature of the impact. During this phase, the airspace above the maritime area will be occupied as much as possible by the structures of both wind turbines and substations, so the impact will be the greatest in relation to the remaining phases of the project.

In the context of the protection of seabird populations within the Natura 2000 network, the following are important features of the Słupsk Bank (PLC990001) and Coastal Waters of the Baltic Sea (PLB990002) areas: (i) the location of these areas along the migration route of birds, (ii) appropriate habitat conditions, and (iii) the availability of these areas for the populations of wintering birds and birds resting during migration.

In the context of maintaining the coherence as part of the Natura 2000 network, it is important above all to maintain the possibility of dislocation of bird populations between the areas without the risk of significant depletion of the population or significant energy inputs that could affect the ecology and biology of these populations.

Although the availability of the Baltic Power OWF area for the populations of birds wintering and resting during migration and subject to protection in the neighboring Natura 2000 sites will be limited, this impact was assessed as negligible for the long-tailed duck and the European herring gull, and there will be no impact for the black guillemot and the common scoter. Moreover, the existence of corridors (areas free from development) to the west and east of the OWF development area and between the Baltica 2 OWF and the Baltica 3 OWF will significantly increase the possibility of migrating birds flying within offshore wind farms in this area.

Due to the location of the Baltic Power OWF, the issue of the impact of the planned project on the integrity of the Natura 2000 site could be considered in the context of the nearest Natura 2000 site, i.e. the Coastal Waters of the Baltic Sea area (PLB990002). The Baltic Power OWF is not expected to cause significant negative impacts consisting in the displacement of bird species subject to protection from the habitats within the Coastal Waters of the Baltic Sea area (PLB990002).

As a result of the actual assessment of the impact of the Baltic Power OWF on the bird species subject to protection in the Słupsk Bank (PLC990001) and Coastal waters of the Baltic Sea (PLB990002) areas, the integrity of the Coastal waters of the Baltic Sea area (PLB990002) and coherence of the Natura 2000 network, it can be concluded that the planned project, both in the OPA and in the RAO, will not cause any significant impacts on the analyzed Natura 2000 sites.

23.7 Cumulative impacts of the planned project (taking into account the existing, implemented and planned projects and activities)

In the assessment of the cumulative impact of the implementation of the Baltic Power OWF in connection with other projects, the projects were included that were implemented, are being implemented or planned. In the case of projects at the planning stage, the ones for which decisions on environmental constraints were issued were taken into account.

At present, no other projects that may cause cumulative impacts are being implemented and will not be implemented in the Baltic Power OWF Area. Implementation of the OWF in all its phases, due to the correct and safe functioning of this project, prevents carrying out other activities in the same area. Therefore, the impacts that possibly may accumulate with the impacts of the Baltic Power OWF will have their source outside its area.

23.7.1 Existing, implemented and planned projects with the decision on environmental conditions

In the Polish maritime areas, projects related to the extraction of hydrocarbons and gas from underneath the seabed are being implemented or planned. Their distance from the Baltic Power OWF and the different specificity of these projects cause that no cumulative impacts will occur during their implementation.

At the moment, nine projects related to the construction of the OWF and connection infrastructure in the Polish maritime areas have received decisions on environmental conditions, which indicates that the construction phase may commence within several years. These projects are at different stages of progress, therefore, among others, the dates of construction works commencement and their detailed schedules are unknown. The possibility of cumulative impact occurrence at the construction phase, due to the temporary limitation of the impacts themselves, may take place only in the case of carrying simultaneous or short time interval works of the same nature.

After completion of the construction phases, the operation phases of individual OWFs will start. As a last resort, the beginning of the operation phase at the last of the Investors will cause the highest possible cumulative impact resulting from the cumulation of individual impacts indicated for this project phase.

In the case of the OWF decommissioning phases, both the time and the scale of their implementation are currently unknown. With the assumed OWF lifetime, the decommissioning phases will start in several dozen years. The environmental impacts associated with this phase will be of a different nature and will be significantly smaller than in the case of the construction and operation phases. As a result of commencing the removal of the above-water structures, the space will be gradually released until the original condition is restored.

23.7.2 Types of impacts that may cause cumulative impacts

Cumulative impacts of the Baltic Power OWF with other projects implemented in the Polish maritime areas may occur, if the activities generating similar impacts are carried out simultaneously. In the case of impacts that have been classified as temporary, simultaneous implementation of the same activities by different Investors should be considered as rare. The impacts that have been identified as local will not cause cumulative impacts, as in most cases their range will not exceed the Baltic Power OWF Area.

The impacts of the Baltic Power OWF that may cause cumulative impacts with other projects (other OWFs: Bałtyk III, Bałtyk II, Baltica 2 and Baltica 3) include those resulting from: (i) underwater noise, (ii) the increase of suspended matter concentration and sedimentation and (iii) space disturbances, including those in terms of a barrier to free movement of birds, disruption of the landscape and disturbances in the operation of radars and restrictions in fishing. The first two indicated impacts will occur during the construction phase, while the third one will occur during the operation phase.

23.7.3 Assessment of cumulative impacts

23.7.3.1 Underwater noise

In the case of underwater noise, the results of various possible scenarios regarding simultaneous piling indicated the range of impacts, including possible accumulation of impacts. At the same time, these results show that these impacts will not be significant in any case provided that only two simultaneous piling operations are carried out within all OWF areas.

23.7.3.2 Increase in the concentration and sedimentation of the suspended matter

The results of modeling of suspended matter impact on the marine environment also indicate that dredging works carried out simultaneously in two locations of installation of foundations located 3 km apart do not affect each other in terms of mutual impact of suspended matter when performing works in non-cohesive soils, and feature minimum impact in the case of cohesive soils.

23.7.3.3 Space disturbances

23.7.3.3.1 Physical barrier creation

Within the Baltic Power OWF and on other OWFs, there will be a partial, long-term reduction in the use of airspace. The nature of the development, with significant distances between individual OWF structures and leaving undeveloped areas between the OWFs, will result in the disturbance of space not being continuous and uniform. This unevenness will also occur within the wind turbine structures. The greatest space disturbance will occur within the operating range of the rotor, i.e. more than 20 m above the water surface.

The results of the assessment of the cumulative impact on migratory bird species indicate that, in most cases, the significance of this impact will be negligible, and will be insignificant only in the case of long-tailed duck and common scoter.

23.7.3.3.2 Landscape disturbances

Landscape disturbances in the case of cumulative impact related to simultaneous operation of the OWFs depend, to the greatest extent, on the weather conditions – visibility and the Earth curvature. As in the non-cumulative case, the impact was assessed as negligible, although it varies depending on the distance of the observer from the OWF.

23.7.3.3.3 Disturbances in the operation of systems that use EMF

The necessity to perform actions aimed at compensation of disturbances in the operation of systems using electromagnetic field indicates that the impact of the Baltic Power OWF and other OWFs on these systems should be considered only as hypothetical and which in fact will not occur.

23.7.3.3.4 Fishing

The development of wind energy in Polish maritime areas will result in a change in the use of the maritime space by their existing users, including in particular in the context of fishing.

The presence of above-water structures will cause two possible types of impacts resulting from space limitations, i.e.: lack of possibility to fish within the OWF and the necessity to bypass the OWF on the way to and from the fishing grounds located north of the OWF. In the case of transmission infrastructure in its immediate vicinity, fishing, in particular with bottom trawl nets, will not be possible either.

Movement of fishing vessels using bottom-set gears may cause conflicts with existing users of fishing grounds where the number of used fishing gears will increase. Excessive concentration of gillnets should not be expected after shifting the effort from the area occupied by the OWF. In view of this, the cumulative negative impact of the relocation of the fishing fleet can be considered insignificant.

The creation of a barrier for free passage of fishing vessels shall constitute a negative impact of the presence of OWFs in neighboring locations. The location of other wind farms, from the east and west side in relation to the Baltic Power OWF, without setting out the navigation corridor for vessel, will extend the route of fishing vessels to productive fishing grounds located north of the OWF in the Słupsk Furrow area. This may result in additional costs, mainly for fishing vessels stationed in the ports of Ustka and Łeba, due to the increase in the amount of fuel and extended time of arrival to the fishing ground.

The significance of the cumulative negative impact related to the necessity to extend the route of fishing vessels to fishing grounds should be considered as moderate. In order to limit the negative impact on fishing in this respect, navigation corridors with the width necessary to maintain the safety of navigation should be left between the OWFs. In such a case, the significance of the cumulative impact of the project on fisheries may be considered insignificant. Another solution may be to allow the transit of fishing vessels through the Baltic Power OWF Area. However, each of these solutions remains the responsibility of the competent director of the maritime office.

23.8 Cross-border impact

The Baltic Power OWF Area is located in the Polish EEZ. The distances of this area to the EEZ borders of other countries are as follows: (i) more than 58 km from the Swedish EEZ, (ii) 100 km from the Danish EEZ, (iii) more than 85 km from the Russian EEZ and more than 189 km from the German EEZ.

The conducted impact assessment regarding individual elements of the environment indicates that their scope will be local. Only in three cases, the identified impact of the Baltic Power OWF is regional in scale. This applies to the impact of: (i) underwater noise during the construction phase on adult fish, (ii) underwater noise during the construction phase on marine mammals, and (iii) barrier effect during the operation phase on birds.

The underwater noise analysis carried out for the purposes of the EIA Report both for fish and marine mammals showed that the ranges of significant impact, determined using TTS values, do not exceed the boundary of the Polish EEZ.

Almost all species passing through this Baltic Power OWF Area are birds covering long distances between nesting areas and wintering areas or birds moving locally. This means that the barrier effect and risk of collision affect birds that spend at least part of their lives in north-west Russia and Scandinavia. Additionally, some of the species exposed to the impact are included in Annex I to the Birds Directive or included in the Natura 2000 protected areas program in the neighboring countries, and therefore the impacts of the Baltic Power OWF may affect the abundance of birds in these protected areas.

Studies carried out as part of the survey of migratory birds indicate that the impacts of the barrier effect and collision for the vast majority of species were considered negligible and insignificant. The significance of the barrier effect at the level of a single OWF was assessed to be negligible for all species. The cross-border impact was considered to be of little importance at the most.

The significance of the collision impact on the common crane was assessed as moderate. It will not affect the population of nesting and overwintering common cranes in other Baltic States. During periodic shutdowns of individual wind turbines in the course of intensive flight of common cranes, the significance of the impact of the collision risk on this species was assessed to be insignificant at the most.

The predicted mortality resulting from collisions will not pose a threat to the population, which will be able to compensate for the lost specimens as a result of the project impact. In the case of a larger number of OWFs in this area of the Baltic Sea, the accumulated mortality may theoretically exceed the mortality threshold (1887 specimens per year) allowing to maintain the population in good condition, but this will depend to a large extent on the mitigation measures applied in other projects in the vicinity of the Baltic Power OWF. The application of the system for shutting down the elements of the Baltic Power OWF will allow the minimization of the impact of this project on the migration of cranes.

The OWF Area is a place of periodic (winter season) concentration of the long-tailed duck, the velvet scoter, the razorbill and the European herring gull, and also the common guillemot in the summer period. The nearest Coastal waters of the Baltic Sea Natura 2000 site is an important overwintering area for the long-tailed duck and velvet scoter. It can be assumed that birds appearing in the area of the planned project come from this site. Compared to the Baltic populations, the size of the population of the long-tailed duck, velvet scoter and razorbill in the Baltic Power OWF Area is small. There is no data on the size of the population of the Baltic European herring gull. However, the presence of this species is strongly dependent on the fishing activity. No cross-border impacts of the Baltic Power OWF are expected.

It is necessary to apply mitigation measures in the form of leaving undeveloped space between OWF areas. This will allow the continuity of migration routes to be maintained between overwintering areas and will minimize the cross-border impact in the context of cumulative assessment concerning seabirds.

23.9 Analysis and comparison of the considered options and the most environmentally beneficial option

Taking into account the issued permit for erection and use of artificial islands, structures and devices for the Baltic Power OWF, it would be unreasonable to analyze another location option of the planned project. Therefore, both the OPA and the RAO were considered for the same area.

The differences between the OPA and the RAO were based on the existing and feasible technological solutions in the coming years, resulting from the intensive development of OWE. The maximum installed capacity of the Baltic Power OWF, i.e. 1200 MW, was assumed as the limit parameter in both options considered. Therefore, with the use of higher power wind turbines, it becomes possible to build a smaller number of wind turbines.

The RAO assumes 5 MW wind turbines for the analyses. Taking into account the maximum installed power of the Baltic Power OWF, in this option it would be necessary to construct 240 wind turbines. With the wind turbine power output of 15 MW assumed in the OPA, the maximum installed power will be achieved already after the construction of 76 wind turbines.

Construction and operation of a smaller number of wind turbines under the OPA in relation to the RAO, consequently, means less interference with the environment as a result of: (i) shorter duration of the construction and decommissioning phase, (ii) fewer risky lifting and offshore operations and (iii) less consumption of construction materials and consumables. Also in the OWF operation phase, a smaller number of wind turbines under the OPA will require a smaller number of maintenance and operation activities in relation to the RAO, and consequently it will contribute to a smaller environmental impact.

A significant difference indicating that the OPA compared to the RAO will have a smaller impact on the environment is the issue of the risk of collision of birds migrating with the wind turbine structures. The results of collision modeling indicate that in most cases this risk is higher for RAO and in no case lower. Given the long-term nature of this impact (several decades of operation are assumed), these differences are an important reason to indicate that the OPA is a more environmentally advantageous option than the RAO.

When comparing both options, including in particular the resulting possible environmental impacts, it should be indicated that the OPA is the most advantageous option for the environment.

23.10 Comparison of the proposed technology with the technology meeting the requirements referred to in Article 143 of the Environmental Protection Law

Pursuant to Article 143 of the Environmental Protection Law, technologies used in newly commissioned plants should meet specific requirements beneficial from the environmental point of view.

Due to the process specificity and special conditions of operation in the marine environment, offshore wind farms require verification of these requirements at the planning and design stages.

Structural components of the Baltic Power OWF will be made of materials neutral to sea water and seabed, including those that are resistant to erosion, corrosion or activity of chemical compounds that may occur in water. The efficiency of electricity generation and transmission will be one of the basic criteria determining the most important parameters of the Baltic Power OWF, including, among others, the selection of turbines, the arrangement of wind turbines within the area and the arrangement of cable routes. The primary criterion of energy efficiency is its generation, with obvious limitations related to the wind speed in the area, without the use of energy raw materials – in a fully renewable manner. In the case of the renewable energy sector, the actual efficiency of energy use involves non-returnable energy consumption for the production of OWF components and their installation at sea.

Consumption of water, materials, raw materials and fuels will take place at the construction and decommissioning phase of the Baltic Power OWF components. During its operation period, the wind turbines will require the use of consumables and fuels during service activities.

Emissions and their range will mainly relate to acoustic impacts accompanying the operation of wind turbines. They will not have a significant impact on marine organisms or cause noticeable electromagnetic impacts.

The experience in the use of offshore wind turbines will enable the installation of the most efficient and proven solutions meeting the requirements of the most advanced technologies.

23.11 Description of the planned actions aimed at avoiding, preventing and limiting negative environmental impacts

The conducted environmental impact assessment of the Baltic Power OWF indicates that no significant negative impacts will occur as a result of this project. However, the occurrence of impacts of minor importance is unavoidable. Therefore, reasonable measures aimed at avoiding, preventing and limiting negative environmental impacts as a result of the Baltic Power OWF project are indicated below, broken down into individual stages.

The proposed mitigation measures during the construction phase include:

- commencement of piling with soft-start procedure in order to enable fish, birds and marine mammals to leave and move away from the area of works being performed;
- piling in the period from August to March under ornithological monitoring;
- observations of marine mammals carried out by observers just before piling – construction works should not be commenced as long as animals are detected in the impact area;
- use of acoustic deterrent devices – devices generating sounds with frequency and intensity that may deter sea mammals from a specific area;
- construction of subsequent wind turbines starting from one place, so that the water region intended for the project is filled with structures gradually, extending the OWF area with subsequent wind turbines (assuming that, at certain implementation stages, the entire OWF or its specific parts may be built sequentially, i.e. a specific category of works will be carried out on more than one wind turbine and other types of works will be undertaken only after its completion);
- simultaneous piling in a maximum of two locations (in order to reduce noise), regardless of whether the two sources are located in the Baltic Power OWF Area or whether one of them is located in the area of a neighboring OWF;
- intensifying the progress of construction works in the period from March to September, when the number of birds in this water region is the lowest;
- limitation of sources of strong light at night directed upwards; this applies mainly to bird migration periods. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards.

The proposed mitigation measures during the operation phase include:

- painting the blade tips with bright colors, which should increase the probability of seeing a working turbine by flying birds. The Applicant declares that the painting of blade tips will be in accordance with industry standards, technical conditions specified by the wind turbine supplier and will be agreed with competent authorities;
- lighting the turbines at night by installing small, weak and pulsing light sources. Permanently lit bright lights and flashing white lights increase the risk of collision. It is also proposed that lighting should be changed from continuous to pulsing with a long interval when visibility is limited. The Applicant declares that it will limit light emission to the necessary level resulting from applicable occupational safety regulations and standards;
- from dusk to dawn, no positioning of lighting upwards;
- provision of equipment for the OWF in the form of a system enabling short-term stopping of selected turbines of the wind turbines during bird migration periods, if the results of operational monitoring indicate that intensive

migration of cranes at a collision height takes place over the Baltic Power OWF Area;

- renouncing from the use of steel jacket structures of wind turbine towers (not applicable to monopiles) due to a greater probability of bird collision with wind turbines having such a structure (less visible for birds from a greater distance).

The proposed mitigation measures during the decommissioning phase include:

- removing subsequent wind turbines starting from one place, so that the structures are gradually removed from the water region occupied by the OWF.
- maximizing the progress of dismantling works in the period from March to September, when the number of birds in this water region is the lowest.

23.12 Proposal for monitoring of the impact of the planned project and information on the available results of another monitoring, which may be important for determining the obligations in this regard

23.12.1 Proposal for monitoring the impact of the planned project

Due to the length of the construction process, the schedules of individual monitoring were described in a continuous manner, indicating three clear moments of the project implementation, i.e.: (i) commencement of construction, (ii) commencement of operation and (iii) completion of construction.

During the implementation of the Baltic Power OWF, the following monitoring activities will be carried out: (i) underwater noise, (ii) ichthyofauna, (iii) migratory birds, (iv) seabirds, (v) marine mammals, (vi) benthic organisms and (vii) bats.

Detailed methodologies of monitoring surveys will be presented to the Regional Director for Environmental Protection in Gdańsk for approval prior to the commencement of surveys.

23.12.2 Information on the available results of another monitoring which may be important for determining the obligations in this regard

As part of the State Environmental Monitoring, a number of environmental monitoring activities are carried out in the Polish maritime areas. These monitoring activities include surveys of physical-chemical parameters in water and sediments as well as biological parameters. The results of these monitoring activities are collected and made available to the Chief Inspectorate of Environmental Protection.

The Ministry of Maritime Economy and Inland Navigation collects data on the volume of fishing carried out in the Polish maritime areas. An analysis of these data will enable the assessment of the impact of the planned project on fishing in the future.

In the perspective of several dozen years for which the Baltic Power OWF is planned to be implemented, the obtained results of surveys as part of monitoring and information on other activities performed in maritime areas may be used to monitor the environmental impact of the project. This is due to the fact that the scope of these monitoring activities and information covers those elements of the marine environment which may be directly and indirectly affected by the planned project. Long time series of data will allow short-term changes in the environment, i.e. those resulting from the specificity of the complex marine ecosystem and not being a consequence of the impact of the planned project, to be eliminated from the assessment.

23.13 Area with restricted use

This EIA Report indicates that at the current stage of project preparation, there are no grounds to determine the possibility of exceeding the environmental quality standards either in relation to air, noise, wastewater and the intensity of the magnetic field, which will not exceed the permissible values outside the area to which the Applicant holds a legal title.

23.14 The analysis of the possible social conflicts related to the planned project, including the analysis of impacts on the local community

The beginning of the period of informing about the planned Baltic Power OWF should be the year 2011 and subsequent years when: (i) the Applicant submitted an application for the permit for erection and use of artificial islands, structures and devices in the Polish maritime areas and obtained a decision of the Minister of Maritime Economy on the permit for erection and use of artificial islands, structures and devices, and (ii) basic documents defining the spatial policy of the country and region were adopted. This decision and the arrangements of the planning documents provide for the construction of the OWE as an element of the National Power System.

Draft strategy documents together with environmental impact forecasts were subject to a public participation procedure, together with social consultations conducted by competent administrative authorities prior to their adoption in accordance with the provisions of the Act on spatial planning and management.

The target groups for conducting information meetings were selected taking into account a number of criteria: the nature of the project, location, potential impacts of the planned project, and the degree and type of interest of various social groups identified during other investments at sea.

The aspects related to the Baltic Power OWF that may cause social conflicts and potential positive changes that may be caused by the planned OWF were identified. The background to the potential conflict is as follows:

- depending on the decisions of the maritime administration, one can expect difficulties for fishing activities in the water region occupied by the OWF, resulting in a limitation of access to it and thus hindering free fishing and transit through the OWF area;
- non-compliance of the objectives and interests of the parties – the objective indicated by the fishermen community is fishing and transit through the OWF area to further located fishing grounds, as well as ensuring the presence of fish in the Baltic Sea;
- disturbance in the environment that may result from the planned OWF.

Potential stakeholders are as follows:

- administration and state institutions;
- self-government units and institutions;
- trade organizations, including fishing organizations;
- national, regional and local social associations and organizations;
- non-governmental environmental organizations;
- potential suppliers, partners, other investors at sea;
- scientific, research and design units.

Due to the location and scope of the tasks of the planned OWF and the direct users of the sea in this area at the current early stage of the project preparation, the Applicant decided to hold information meetings with representatives of fishermen organizations. Information meetings were held with the representatives of fishermen organizations in March 2020. During the procedure concerning the issue of the decision on environmental conditions – the decision was issued by the General Director for Environmental Protection on June 29, 2022 – the possibility of public participation was also ensured, which included, among others, making public the information on the pending procedure and requesting all the parties concerned to submit comments and conclusions regarding the project. Once again, formal consultation will be held during the environmental impact assessment procedure conducted by the General Director for Environmental Protection as part of the procedure for amending the said decision on environmental conditions for the Baltic Power OWF.

The participants of the said consultation meetings pointed out a wide variety of issues, including environmental ones. The results of the consultations were used in the preparation of this EIA Report for the Baltic Power OWF.

23.15 Indication of difficulties resulting from shortages in engineering or gaps in contemporary knowledge which have been encountered during preparation of the report

The identification of the elements of the environment that may be affected by the wind farm in the Polish maritime areas is inconsistent. The identification of some aspects, especially biotic ones, is more extensive, e.g. the presence of zoobenthos, and for some aspects, the information is scarce, e.g. the presence of bats over maritime areas. The surveys carried out for the benefit of the EIA Report allowed more detailed information to be obtained on the environment in the area of the planned project. This allowed a comprehensive wildlife survey to be developed, both in terms of abiotic and biotic elements.

There is no information on potential impacts of the OWF, especially during the operation phase, e.g. in the scope of the phenomenon of overgrowing of underwater structures, environmental effects of an artificial reef or behavior of birds encountering above-water structures during flights. So far, no wind turbines have been built in the Polish maritime areas. Therefore, there is no experience and detailed knowledge based on the results of surveys in the scope of the impact of such projects in the Polish maritime areas.