BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

Environmental report for the suitability assessment of site N-7.2*

Hamburg, February 2022

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Content

List of figures

List of tables

List of abbreviations

TFEU	Treaty on the Functioning of the European Union
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
EEZ	Exclusive Economic Zone
BBergG	Federal Mining Act
BfN	Federal Agency for Nature Conservation
BFO	Federal Offshore Grid Plan
BFO-N	Federal Offshore Grid Plan North Sea
BFO-O	Federal Offshore Grid Plan Baltic Sea
BGBl	Federal Law Gazette
BMU	Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (Federal Ministry for Environment, Nature Conservation and Nuclear Safety)
BNatSchG	Act on Nature Conservation and Landscape Management (Federal Nature Conservation Act)
FNA	Bundesnetzagentur (Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway)
BSH	Federal Maritime and Hydrographic Agency
CMS	Convention on the Conservation of Migratory Species of Wild Animals
EMSON	Survey of marine mammals and seabirds in the German EEZ of the North Sea and Baltic Sea
EnWG	Act concerning electricity and gas supply (German Energy Act)
EUNIS	European Nature Information System
EUROBATS	Agreement on the Conservation of Populations of European Bats
R&D	Research and development
SDP	Site development plan
FFH	Flora Fauna Habitat
Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
FFH-VP	Impact assessment in accordance with Article 6, paragraph 3 FFH Directive and Section 34 BNatSchG
FPN	North Sea Research Platform
FVU	Preliminary investigation
HELCOM	Helsinki Convention
IBA	Important bird area
ICES	International Council for the Exploration of the Sea
IfAÖ	Institute for Applied Ecosystem Research
IOW	Leibniz Institute for Baltic Sea Research, Warnemünde
IUCN	International Union for Conservation of Nature and Natural Resources (World Conservation Union)
K	Kelvin
LRT	Habitat type according to FFH Directive
MARPOL	International Convention for the Prevention of Pollution from Ships

MINOS	Marine warm-blooded animals in the North Sea and Baltic Sea: Basic principles for the assessment of wind turbines in the offshore area
MRO	Maritime spatial planning
MSFD	Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in marine environment policy (Marine Strategy Framework Directive)
NAO	North Atlantic Oscillation
NSG	Nature conservation area
NN	Normal Null [Sea level]
OSPAR	Oslo-Paris Agreement
OWF	Offshore wind farm
PAH	Polycyclic aromatic hydrocarbons
POD	Porpoise Click Detector
PSU	Practical Salinity Units
SCANS	Small Cetacean Abundance in the North Sea and Adjacent Waters
SeeAnlV	Ordinance on Installations on the seaward side of the German territorial waters (Offshore Installations Ordinance)
SEL	Sound event level
SPA	Special Protected Area
SPEC	Species of European Conservation Concern
StUK4	Standard "Investigation of impacts of offshore wind turbines".
StUKplus	"Accompanying ecological research on the alpha ventus offshore test site project"
SEA	strategic environmental assessment
SEA DIRECTIVE	Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the environmental impacts of certain plans and programmes on the environment (SEA Directive)
UBA	Umweltbundesamt (Federal Environment Agency)
UVPG	Environmental Impact Assessment Act
EIA	Environmental impact assessment
EIS	Environmental impact study
UVU	Environmental impact assessment
VO-KVR	Regulation on the International Regulations for Preventing Collisions at Sea, 1972
V-RL	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Birds Directive)
WTG	Wind turbine
WindSeeG	Offshore Wind Energy Act (WindSeeG)

1 Introduction

1.1 Legal basis and tasks of environmental assessment

According to Section 12, paragraph 4 in conjunction with Section 10, paragraph 2 of the Offshore Wind Energy Act of 13 October 2016 (BGBl. I p. 2258, 2310) as last amended by Article 21 of the Act of 13 May 2019 (BGBl. I p. 706) (Wind Energy at Sea Act WindSeeG), the BSH shall assess the suitability of a site for the construction and operation of wind turbines at sea as a basis for the separate determination of suitability. In accordance with Section 12, paragraph 5 WindSeeG, the result of the suitability assessment and the capacity to be installed shall be determined by legal ordinance if the suitability assessment shows that the site is suitable for tendering according to Part 3 Section 2. As part of the suitability assessment, an environmental assessment is carried out within the meaning of the Environmental Impact Assessment Act in the version of the announcement from 24 February 2010 (BGBl. I p. 94) as last amended by Article 22 of the Act of 13 May 2019 (BGBl. I p. 706) (Environmental Impact Assessment Act – UVPG), Strategic Environmental Assessment (SEA).

The obligation to implement a strategic environmental assessment with the preparation of an environmental report results from Section 35, paragraph 1, no. 1 UVPG in conjunction with no. 1.18 of Annex 5, according to which determinations of the suitability of a site and the installable capacity on the site according to Section 12, paragraph 5 WindSeeG constitute plans or programmes within the meaning of the UVPG and are subject to the SEA obligation. In accordance with Section 33 UVPG, the SEA is a "dependent part of official procedures for the preparation or amendment of plans and programmes". The official procedure for drawing up the plan, in this case for determining suitability, is the suitability assessment because any threat to the marine environment must be investigated within this framework.

The suitability and performance determination itself is the "plan" within the meaning of the UVPG (i.e. the formally confirming file based on the result of the suitability assessment).

According to Article 1 of the SEA Directive 2001/42/EC, the objective of strategic environmental assessment is to ensure a high level of environmental protection in order to promote sustainable development, and thereby to contribute to ensuring that environmental considerations are taken into consideration in an appropriate manner well in advance of concrete project planning, when the plans are compiled and adopted. The Strategic Environmental Assessment has the task of identifying, describing, and assessing the likely major environmental impacts of the implementation of the plan. It serves as an effective environmental precaution according to the applicable laws and is implemented according to consistent principles, and with public participation. All protected assets in accordance with Section 2, paragraph 1 UVPG must be considered:

- Human beings, in particular human health,
- fauna, flora, and biodiversity,
- site, soil, water, air, climate and landscape,
- cultural heritage and other material assets as well as
- the interrelationships between the aforementioned protected assets.

The Strategic Environmental Assessment was completed in December 2021. The main content document of the Strategic Environmental Assessment for Site N-7.2 is this environmental report. This identifies, describes, and assesses the likely major environmental impacts of implementing the plan for this site as well as possible planning alternatives, taking into consideration the main purposes of the plan.

1.2 Brief description of the content and the most important objectives of the suitability and performance determination

With the introduction of the central model, the support system for offshore wind energy was changed to a tendering model. The subject of the tenders for offshore wind energy are sites in the German North Sea and Baltic Sea on which wind turbines are to be erected. The site development plan (SDP), which precedes this determination of suitability, defines areas and sites in these areas and determines the chronological order in which the sites are tendered by the FNA. The designation of the sites is based on the current expansion targets of the federal government. The tendering of a site by the Federal Network Agency requires that this specific site is suitable for the erection of offshore wind turbines.

To this end, the suitability of the site and the respective capacity to be installed shall be determined by means of a legal ordinance in accordance with Section 12, paragraph 5 WindSeeG. The suitability is established if the preceding suitability assessment shows that the site is fundamentally suitable for the construction of a wind farm.

The determination of suitability additionally serves as a classification for the subsequent planning approval procedure. This preliminary assessment of the concerns and criteria of the planning approval procedure (as far as possible without knowledge of the concrete design of the project) is intended to prevent a negative decision in the planning approval procedure as far as possible because such a late rejection and thus the loss of the site would threaten the primary objective of the WindSeeG, which is to steadily increase the installed capacity of offshore wind turbines to the target value in 2030.

Through this early assessment, questions relevant to approval can be sifted, and subsequent planning approval procedures can thus be accelerated. This primarily serves to simplify administration and indirectly benefits the subsequent executing agency of the project.

The main contents of the legal ordinance on the determination of suitability will be:

- the determination of the suitability of the specific sites at the time they are put out to tender according to Part 3 Section 2 Wind Energy at Sea Act as well as
- the designation of the capacity to be installed in each case

According to Section 10, paragraph 2 WindSeeG, a site is suitable for the erection of wind turbines if

- the requirements of spatial planning are observed,
- there is no threat to the marine environment,
- in particular no concern of pollution of the marine environment within the meaning of Article 1, paragraph 1, No. 4 of the United Nations Convention on the Law of the Sea (UNCLOS) and
- no threat to bird migration,
- the safety and ease of shipping and air traffic as well as
- the certainty of national and allied defence is guaranteed,
- other overriding public or private interests do not conflict,
- any development would be compatible with existing and planned cable, offshore connection, pipeline and other subsea cables and pipelines
- and with existing and planned sites of converter platforms or substations and
- other requirements according to the WindSeeG and other public law provisions are complied with.

A strategic environmental assessment is carried out on the question of whether there is a threat to the marine environment.

The legal ordinance on the determination of suitability may stipulate requirements for subsequent projects if there are otherwise concerns that the construction and operation of offshore wind turbines on the site will have adverse effects on the aforementioned criteria and concerns. The planned requirements can be found in the determination of suitability and are summarised for the marine environment under Chap. 9 (Planned measures to avoid, reduce, and compensate for environmental impacts) and Chapter 11 (Planned measures to monitor impacts).

1.3 Staged planning procedures – relationship to other relevant plans, programmes, and projects

1.3.1 Introduction

The determination of suitability is part of a staged planning process for offshore wind energy, which serves to stratify and begins with spatial planning as strategic spatial planning for the entire exclusive economic zone (EEZ). A strategic environmental assessment must be carried out when the spatial plan is drafted. This is followed by site development planning as a controlling planning instrument. The aim is to plan the use of offshore wind energy in a targeted manner and as optimally as possible under the given framework conditions by designating areas and sites as well as routes and route corridors for grid connections or for cross-border submarine cable systems. A Strategic Environmental Assessment is being carried out to accompany the preparation of the SDP.

This is followed by the determination of suitability. This, in turn, forms the basis for the subsequent planning approval. If the suitability of a site for the use of offshore wind energy is established, the site is put out to tender and the winning bidder can submit an application for approval (planning approval or planning permission) for the construction and operation of wind turbines on the site. As part of the planning approval procedure, an environmental impact assessment is carried out if the prerequisites are met.

In the case of multi-stage planning and approval procedures, for environmental assessments, it follows from the relevant legislation (e.g. Spatial Planning Act, WindSeeG and Federal Mining Act (BBergG)) or, more generally, from Section 39, paragraph 3 UVPG that, in the case of plans, when defining the scope of the investigation, it should be designated at which of the stages of the process certain environmental impacts are to be assessed in focus. This serves to prevent the conducting of multiple assessments. The nature and extent of the environmental impacts, technical requirements, and the content and subject matter of the plan must be taken into consideration.

In the case of subsequent plans and subsequent approvals of projects for which the plan sets a framework, the environmental assessment according to Section 39, paragraph 3, sentence 3 UVPG shall be limited to additional or other major environmental impacts as well as to necessary updates and more detailed investigations.

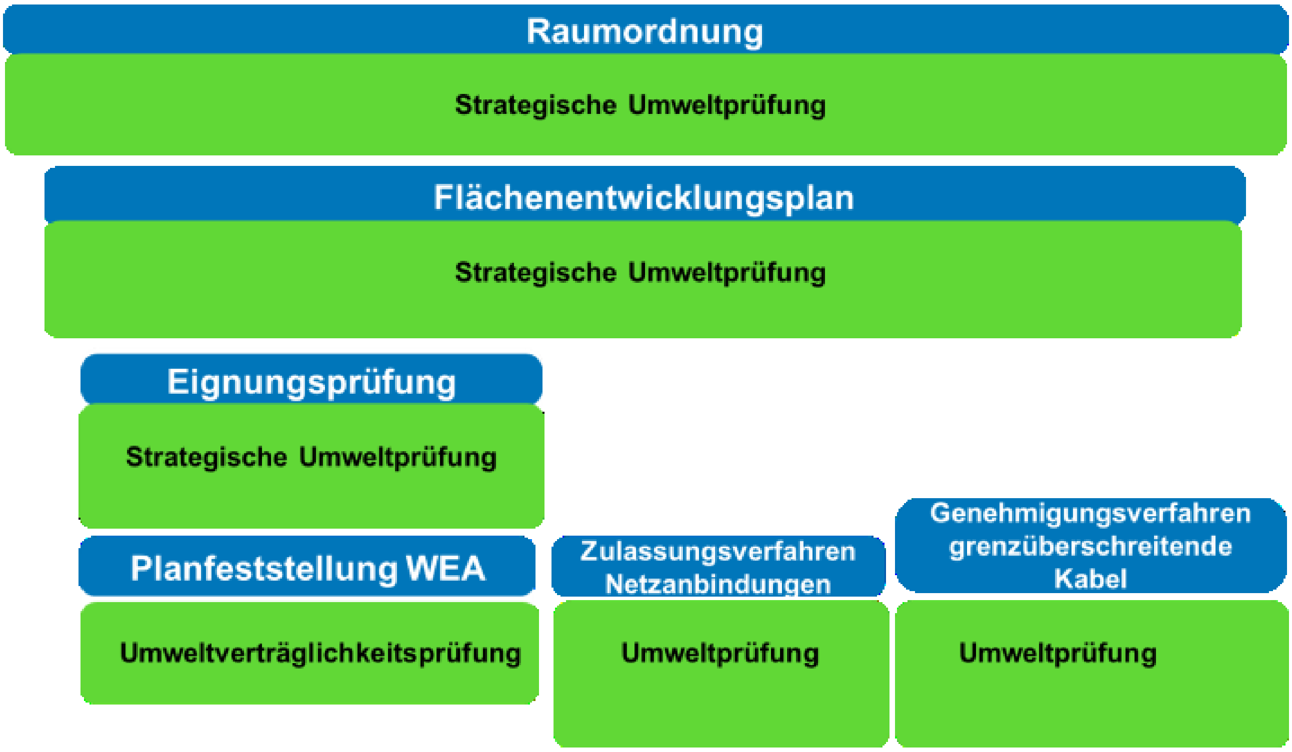

Figure 1: Overview of the environmental assessments to be carried out at each stage of the procedure.

Within the framework of the staged planning and approval procedure, all assessments have in common that environmental impacts on the protected assets listed in Section 2, paragraph 1 UVPG are considered, including their interrelationships.

According to the definition of Section 2, paragraph 2 UVPG, environmental impacts within the meaning of the UVPG are direct or indirect effects of a project or the implementation of a plan or programme on the protected assets.

According to Section 3 UVPG, environmental assessments comprise the identification, description, and assessment of the major impacts of a project or a plan or programme on the protected assets. They serve to ensure effective environmental precaution according to the applicable laws and are carried out according to uniform principles and with public participation.

In the offshore area, the special protected assets have been established as subcategories of the legally specified protected assets animals, plants, and biological diversity:

- Avifauna: Seabirds/resting birds and migratory birds
- Benthos
- Plankton
- Marine mammals
- Fish
- Bats

In detail, the staged planning process is as follows:

1.3.2 Maritime spatial planning (EEZ)

At the highest and superordinate level is the instrument of maritime spatial planning. For sustainable spatial development in the EEZ, the BSH prepares spatial plans on behalf of the responsible Federal Ministry; these comes into force in the form of legal ordinances. The Ordinance of the (then) Federal Ministry of Transport, Building and Urban Development (BMVBS) on

Spatial Planning in the German EEZ in the North Sea dated

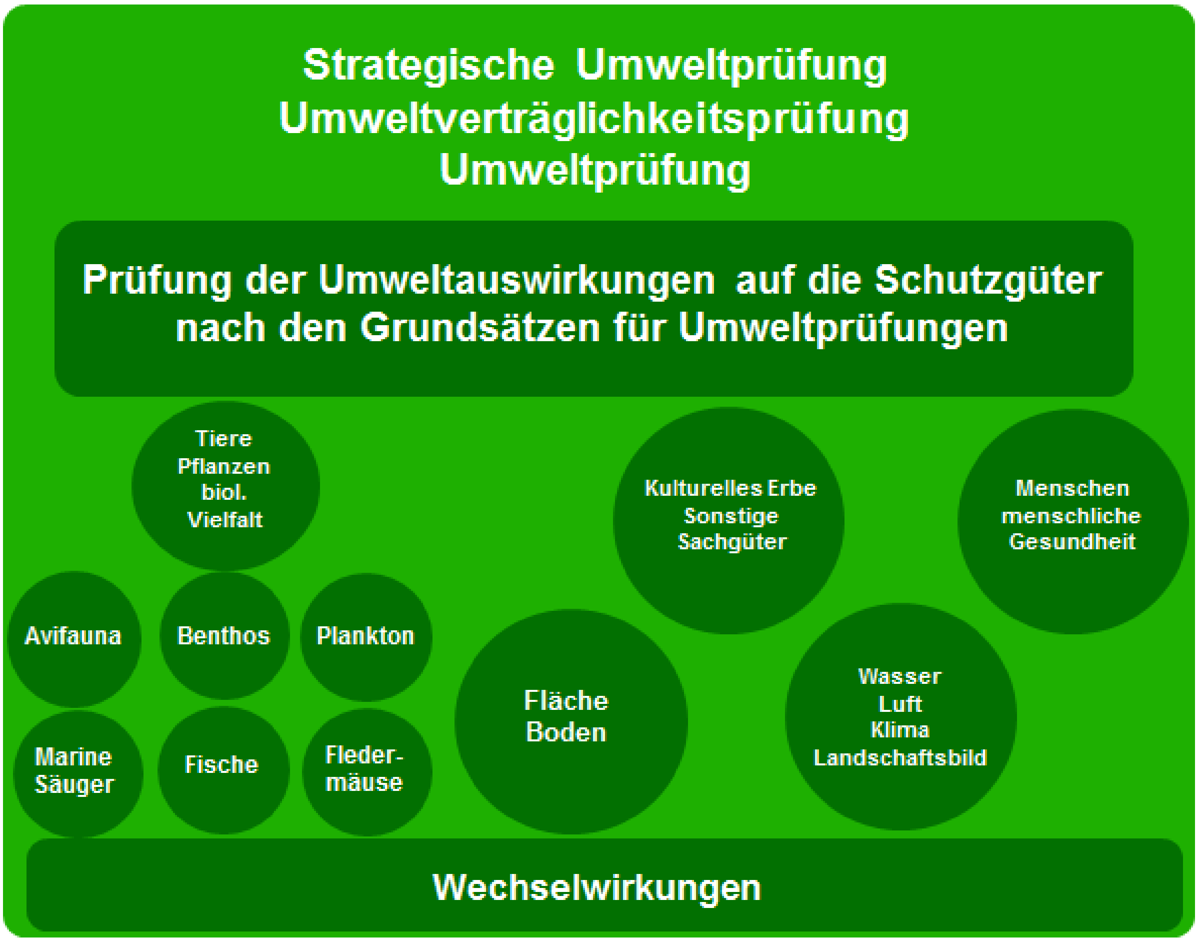

Figure 2: Overview of the protected assets in the environmental assessments.

21 September 2009 BGBl. I p. 3107 entered into force on 26 September 2009, and the Ordinance for the Area of the German EEZ in the Baltic Sea dated 10 December 2009 BGBl. I p. 3861 entered into force on 19 December 2009. The spatial plans are currently being updated. The drafts of the spatial plan and the environmental reports for the German EEZ of the North Sea and Baltic Sea were consulted both nationally and internationally. The current status is available on the website of the BSH.[1] The updated plan is expected to come into force as an ordinance in September 2021. Conditional or temporary spatial designations are also made in this.

The spatial plans shall define designations, taking into consideration any interrelationships between land and sea as well as safety aspects

- to ensure the safety and ease of shipping traffic,
- for further economic uses,

[1] https://www.bsh.de/DE/THEMEN/Offshore/Meeresraumplanung/Fortschreibung/fortschreibung-raumplanung_node.html.

- for scientific uses and
- to protect and improve the marine environment.

Within the framework of spatial planning, designations are mainly made in the form of priority and reservation areas as well as objectives and principles. According to Section 8, paragraph 1 ROG, when drafting spatial plans, the body responsible for the spatial plan must carry out a strategic environmental assessment in which the expected major impacts of the respective spatial plan on the protected assets, including the interrelationships, must be identified, described, and evaluated.

The objective of the instrument of spatial planning is to optimise overall planning solutions. A wider range of uses is considered. Fundamental strategic questions should be clarified at the beginning of a planning process.

The instrument thus functions primarily as a steering planning tool for the planning authorities in order to create a spatially and environmentally compatible framework for all uses.

In principle, the depth of assessment of the SEA in the spatial planning is characterised by a greater breadth of investigation (i.e. a fundamentally greater number of alternatives) and a lesser depth of investigation in the sense of detailed analyses. Above all, regional, national and global impacts as well as secondary, cumulative and synergetic impacts are taken into consideration.

The focus of the strategic environmental assessment is therefore on possible cumulative effects, strategic and large-scale alternatives, and possible transboundary impacts.

1.3.3 Site development plan

The next level is the SDP. The designations to be made by the SDP and examined within the framework of the SEA are derived from Section 5, paragraph 1 WindSeeG. The plan mainly designates areas and sites for wind turbines as well as the expected capacity to be installed on these sites. In addition, the SDP also designates routes, route corridors and sites. Planning and technical principles are also laid down. Although these also serve, among other things, to mitigate environmental impacts, they may in turn lead to impacts so that an assessment is required as part of the SEA.

With regard to the objectives of the SDP, this deals with the fundamental questions of the use of offshore wind energy and grid connections based on the legal requirements, especially with regard to the need, purpose, technology, and identification of sites and routes or route corridors. The plan therefore primarily has the function of a management planning instrument in order to create a spatially and, environmentally compatible framework for the implementation of individual projects (i.e. the construction and operation of offshore wind turbines, their grid connections, cross-border submarine cable systems, and connections between them).

The depth of the examination of expected major environmental impacts is characterised by a greater breadth of investigation (i.e. a greater number of alternatives) and, in principle, a lesser depth of investigation. At the level of sectoral planning, detailed analyses are generally not yet performed. Above all, local, national and global impacts as well as secondary, cumulative, and synergistic impacts in the sense of an overall view are taken into consideration.

As with the instrument of maritime spatial planning, the focus of the examination is on possible cumulative effects as well as possible cross-border impacts. In addition, the SDP focuses on strategic, technical and spatial alternatives, especially for the use of wind energy and power cables.

1.3.4 Preliminary investigation including suitability assessment

The next step in the staged planning process is the suitability assessment of sites for offshore wind turbines. In addition, the capacity to be installed is determined on the site in question.

According to Section 10, paragraph 2 WindSeeG, the suitability assessment assesses whether the construction and operation of offshore wind turbines on the site conflicts with the criteria for the inadmissibility of designating a site in the site development plan according to Section 5, paragraph 3 WindSeeG or, insofar as they can be assessed independently of the later design of the project, with the interests relevant for the planning approval according to Section 48, paragraph 4, sentence 1, WindSeeG.

Both the criteria of Section 5, paragraph 3 WindSeeG and the matters of Section 48, paragraph 4, sentence 1 WindSeeG require an assessment of whether the marine environment is endangered. With regard to the latter concerns, there must be an assessment of whether pollution of the marine environment within the meaning of Section 1, paragraph 1, number 4 of the United Nations Convention on the Law of the Sea is at risk and whether bird migration is of least concern.

The suitability assessment is thus the instrument interposed between the SDP and the planning approval procedure for offshore wind turbines. It refers to a specific site designated in the SDP and is thus much more small-scale than the SDP. It is distinguished from the planning approval procedure by the fact that an inspection approach which is independent of the later specific type of plant and layout is to be applied. The impact forecasting is thus based on model parameters in two scenarios corresponding to the range of SDP 2020. These are intended to depict possible realistic developments.

Compared with the SDP, the SEA of the suitability assessment is thus characterised by a smaller area of investigation and a greater depth of investigation. In principle, fewer and more spatially limited alternatives can be seriously considered. The two primary alternatives are the determination of the suitability of a site on one hand and the determination of its (possibly also partial) unsuitability (see Section 12, paragraph 6 WindSeeG) on the other. On the other hand, restrictions on the type and extent of development that are included as specifications in the determination of suitability are not alternatives in this sense (see Chapter **10**).

The focus of the environmental assessment in the context of the suitability assessment is on the consideration of the local impacts caused by a development with wind turbines in relation to the site and the location of the development on the site.

1.3.5 Approval procedure for offshore wind turbines

The next stage after the suitability assessment is the approval procedure for the construction and operation of offshore wind turbines. After the suitability of the site has been determined and the site has been tendered by the FNA, the winning bidder can submit an application for planning approval or – if the prerequisites are met – for planning approval for the construction and operation of offshore wind turbines, including the necessary ancillary installations on the pre-investigated site with the award of the contract to the FNA in accordance with Section 46, paragraph 1 WindSeeG.

In addition to the legal requirements of Section 73, paragraph 1, sentence 2 VwVfG, the plan must include the information contained in Section 47, paragraph 1 WindSeeG. The plan may be adopted only under certain conditions listed in Section 48, paragraph 4 WindSeeG and, among other things, only if the marine environment is not threatened, in particular if there is no concern of pollution of the marine environment within the meaning of Article 1, paragraph 1, Number 4 of the Convention on the Law of the Sea and bird migration is not threatened.

According to Section 24 UVPG, the competent authority shall prepare a summary presentation

- of the environmental impacts of the project,
- the characteristics of the project and the location that are intended to exclude, mitigate, or compensate for major negative environmental impacts,
- measures to prevent, mitigate, or offset major negative environmental impacts, and
- the compensatory measures in the case of interventions in nature and landscape.

According to Section 16, paragraph 1 UVPG, the project developer must submit a report to the competent authority on the likely environmental impacts of the project (EIA report), which must contain at least the following information:

- a description of the project, including the location, nature, scope, design, size, and other essential characteristics of the project,

- a description of the environment and its components within the sphere of influence of the project,
- a description of the characteristics of the project and of the location of the project to exclude, mitigate, or offset the occurrence of major adverse environmental impacts of the project,
- a description of the measures planned to prevent, mitigate, or offset any major adverse environmental impacts of the project on the environment and a description of planned compensatory measures,
- a description of the expected major environmental impacts of the project,
- a description of the reasonable alternatives, relevant to the project and its specific characteristics, that have been considered by the developer and the main reasons for the choice made, taking into consideration the specific environmental impacts of the project as well as
- a generally understandable, non-technical summary of the EIA report.

Pilot wind turbines are dealt with exclusively within the framework of the environmental assessment in the approval procedure and not at upstream stages.

1.3.6 Summary overviews of environmental assessments

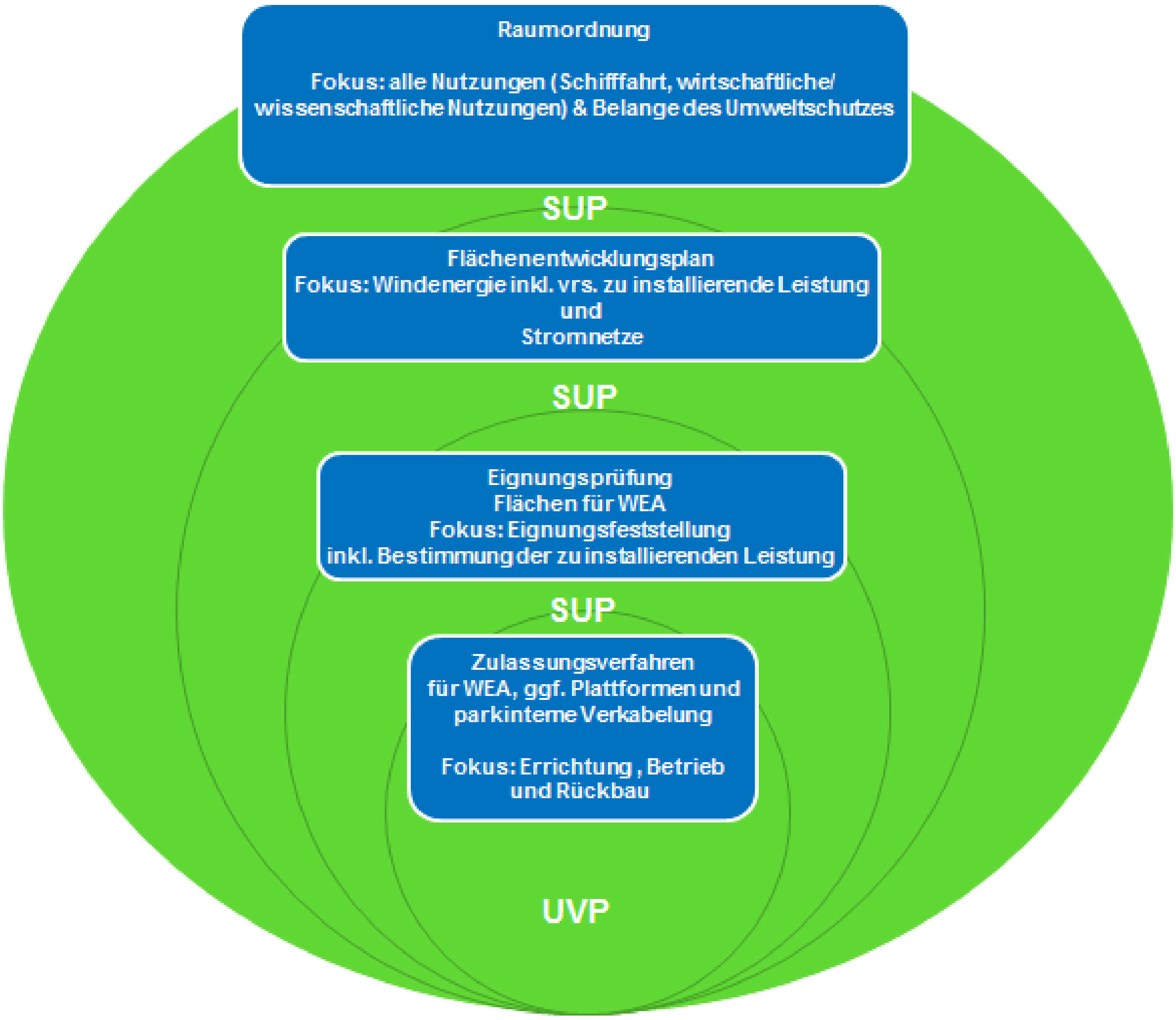

Figure 3: Object of the planning and approval procedures with emphasis on environmental assessment.

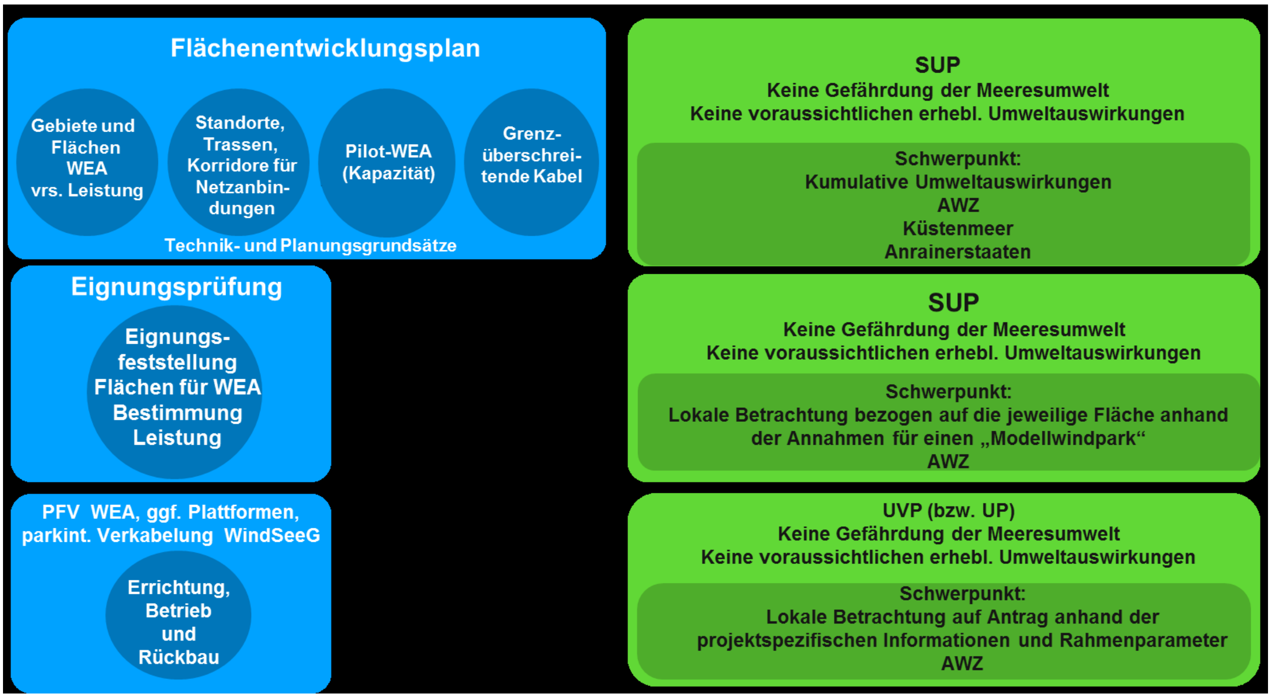

Figure 4: Subject of the planning and approval procedures with a focus on environmental assessment for site development plan, suitability assessment, and EIA.

Table 1: Overview of the priorities of environmental assessments in the planning and approval procedure.

Spatial planning	**SDP**	**Suitability assessment**
SEA		
Strategic planning for the designations		**Strategic environmental assessment for sites with wind turbines**
Designations and subject of assessment		
-Priority and reservation areas • to ensure the safety and ease of shipping traffic, • To further economic uses. especially offshore wind energy and pipelines • for scientific uses and • to protect and enhance the marine environment -Objectives and principles -Application of the ecosystem approach	• Areas for offshore wind turbines • Sites for offshore wind turbines, including the expected capacity to be installed • Platform locations • Routing and route corridors for submarine cable systems • Technical and planning principles	• Examination/determination of the suitability of the site for the erection and operation of wind turbines, including the capacity to be installed • Based on the data handed over and collected (StUK) as well as other information that can be determined with reasonable effort • Specifications, in particular on the type, extent, and location of the development
Analysis of environmental impacts		

Analyses (identifies, describes and assesses) the expected major impacts of the plan on the marine environment	Analyses (identifies, describes and assesses) the expected major impacts of the plan on the marine environment	Analyses (identifies, describes, and assesses) expected major environmental impacts from the construction and operation of WT that can be assessed independently of the subsequent design of the project using model assumptions
Objective		
Aims to optimise overall planning solutions (i.e. comprehensive bundles of measures). Consideration of a wider range of uses. Starts at the beginning of the planning process to clarify basic strategic issues (i.e. at an early stage when there is still more room for manoeuvre).	For the use of offshore wind energy, addresses the fundamental questions of • Needs or legal objectives • Purpose • Technology • Capacities • Finding sites for platforms and routes Searches for bundles of measures without making an absolute assessment of the environmental impact of the planning.	Deals with the fundamental issues for the use of offshore wind energy according to • Capacity • Suitability of the specific site Assesses the suitability of the site in particular with regard to • Type of development • Size of the development • Location of the development on the site
Essentially functions as a steering planning instrument for the planning authorities in order to create a spatially and environmentally compatible framework for all uses.	Functions primarily as a steering planning instrument for a spatially and environmentally compatible framework for the realisation of individual projects (wind turbines and grid connections, cross-border submarine cables).	Acts as an instrument between the SDP and the approval procedure for wind turbines on a specific site.
Assessment depth		
Characterised by greater breadth of investigation (i.e. a larger number of alternatives and less depth of investigation (no detailed analyses)). Spatial, national, and global impacts as well as secondary, cumulative, and synergetic impacts are taken into consideration in the sense of an overall view.	Characterised by greater breadth of investigation (i.e. larger number of alternatives and less depth of investigation (no detailed analyses)). Local, national, and global impacts as well as secondary, cumulative, and synergetic impacts are taken into consideration in the sense of an overall view.	Characterised by a small-scale area of investigation, greater depth of investigation (detailed analyses). Considers primarily local or national impacts on neighbouring countries as well as additional/new secondary, cumulative, and synergistic impacts as appropriate.
Focus of the assessment		
Cumulative effects • Overall perspective • Strategic and large-scale alternatives • Possible transboundary impacts	**Cumulative effects** • Overall perspective • Strategic, technical and spatial alternatives • Possible transboundary impacts	**Local impacts of any development** • Consideration of the specific site • Technical and small-scale alternatives
Approval procedure (planning approval or permit) for WT (EIA)		

Subject of the assessment
Environmental impact assessment on request for • the erection and operation of wind turbines • on the site identified and pre-screened for suitability in the SDP • according to the designations of the SDP and specifications of the determination of suitability.
Environmental impact assessment
Analyses (determines, describes, and assesses) the environmental impacts of the specific project (wind turbines and possibly platforms and in-farm cabling) According to Section 24 UVPG, the competent authority shall prepare a summary presentation • of the environmental impacts of the project, • the characteristics of the project and the location that are intended to exclude, mitigate, or compensate for major negative environmental impacts, • measures to prevent, mitigate, or offset major negative environmental impacts, and • the compensatory measures in the case of interventions in nature and landscape (Note: Exception according to Section 56, paragraph 3 BNatSchG
Objective
Deals with the questions of the concrete design (“how”) of a project (technical equipment, construction) at the request of the tender winner/project developer
Assessment depth
Characterised by narrower area of investigation (i.e. a limited number of alternatives) and greater depth of investigation (detailed analyses). Assesses the environmental impact of the project on the site under study and formulates conditions for this. Considers mainly local impacts in the vicinity of the project.
Focus of the assessment
The main focus of the assessment is formed by: • Construction-related and operational environmental impacts • Testing in relation to the specific installation design • Dismantling of the installation

1.4 Presentation and consideration of the objective of environmental protection

The assessment and determination of suitability and capacity to be installed shall take into consideration the environmental protection objectives relevant to the plan. These provide information on the environmental status to be aimed for with regard to the relevant protected assets (environmental quality objectives). The objectives of environmental protection can be derived from the following international, community, and national conventions or regulations, administrative provisions, and strategies that deal with marine environment protection and based on which the Federal Republic of Germany has committed itself to certain principles and set objectives.

1.4.1 International conventions on marine environment protection

The Federal Republic of Germany is party to all relevant international conventions on marine environment protection.

1.4.1.1 Globally applicable conventions that are wholly or partly aimed at marine environment protection

the 1973 Convention for the Prevention of Pollution from Ships, as amended by the 1978 Protocol (MARPOL 73/78)

The Convention for the Prevention of Pollution from Ships, 1973, developed under the auspices of the International Maritime Organization (International Convention for the Prevention of Pollution from Ships, 1973, promulgated by the Act relating to the International Convention for the Prevention of Pollution from Ships, 1973, and to the 1978 protocol relating thereto of 23 December 1981, BGBl. 1982 II p. 2.) provides the legal basis for environmental protection in maritime shipping. It primarily addresses ship owners to refrain from operational discharges into the sea; however, according to Article 2, paragraph 4 MARPOL, it also applies to offshore platforms. Relevant for the suitability assessment are, above all, the objectives of the regulations of Annexes IV and V on the prevention and reduction of the discharge of waste water and ship-generated waste. In the specifications of the determination of suitability for the avoidance and reduction of material emissions, these objectives are implemented with regard to the permissibility of sewage treatment plants and ship-generated waste.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London, 29 December 1972) and its 1996 Protocol

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter of 29 December 1972 (announcement of the entry into force of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter of 21 December 1977, BGBl. II 1977, p. 1492) covers the dumping of wastes and other matter from ships, aircraft, and offshore platforms. While the 1972 London Convention provides for bans on the discharge of only certain substances (Black List), the 1996 protocol (announcement on the entry into force of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 9 December 2010, BGBl. II No. 35) establishes a general ban on discharges. Exceptions to this prohibition are permitted only for certain categories of waste such as dredged material and inert, inorganic, geological substances. These regulations are implemented through the requirements of the determination of suitability.

1982 United Nations Convention on the Law of the Sea

Article 208 of the United Nations Convention on the Law of the Sea of 10 December 1982 (UNCLOS) shall be taken into consideration for the construction of installations for the generation of energy at sea. This requires coastal states to enact and enforce legislation to prevent and reduce pollution resulting from activities on the seabed or from artificial islands, installations, and structures. Otherwise, the contracting states have a general obligation to protect the marine environment according to their capabilities (cf Article 194, paragraph 1 UNCLOS). No harm must be done to other states and their environment through pollution. For the use of technologies, it is regulated that all necessary measures are taken to prevent and reduce resulting marine pollution (Art. 196 UNCLOS). The Strategic Environmental Assessment serves to identify, describe, and assess the expected major environmental impacts. The suitability of a site for the construction of a wind farm is assessed with regard to threat to the marine environment and conflicts of use. Measures to avoid and mitigate impacts are elaborated and specifications are proposed; these also serve to protect against pollution, among other things.

1.4.1.2 Regional conventions on marine environment protection

Trilateral Wadden Sea Cooperation (1978) and Trilateral Monitoring and Assessment Programme of 1997 (TMAP)

The objective of the Trilateral Wadden Sea Cooperation and the 1997 Trilateral Monitoring and Assessment Programme between Denmark, the Netherlands, and Germany is to preserve the diversity of biotopes in the Wadden Sea ecosystem. The principle is to achieve, as far as possible, a natural and self-sustaining ecosystem in which natural processes can take place undisturbed. For this purpose, a Wadden Sea plan with common cornerstones was adopted (COMMON WADDEN SEA SECRETARIAT 2010). The objectives of the Wadden Sea Plan, which relate, inter alia, to the protected assets landscape, water, sediment, birds, marine mammals, and fish and overlap in essential points with those of the Habitats and Birds Directive, the Water Framework Directive, and the Marine Strategy Framework Directive, are taken into consideration through the requirements on sediment warming and cable crossings included in the determination of suitability. The impacts on nature conservation areas is also examined and included in the assessment and consideration of the plan.

Convention for the Protection of the Marine Environment of the North-East Atlantic of 1992 (OSPAR Convention)

The objective of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) is to protect the marine environment of the North-East Atlantic against risks from anthropogenic pollution from all sources. This requires the application of the best emission reduction technology available (Article 2, paragraph 2 and 3 OSPAR Convention). With the specifications included in the determinations of suitability, requirements are set for the reduction of emissions from the operation of the wind farms, platforms, and cables.

UNECE Convention on the Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo Convention) and UNECE Protocol on Strategic Environmental Assessment (SEA Protocol)

The Convention of the United Nations Economic Commission for Europe (Convention of 25 February 1991 on Environmental Impact Assessment in a Transboundary Context, implemented by the Espoo Treaty Act of 7 June 2002, BGBl. 2002 II, p. 1406 et seq. and the Second Espoo Treaty Act of 17 March 2006, BGBl. 2006 II, p. 224 f – UNECE) obliges parties to carry out an EIA for planned projects that may have major adverse environmental impacts and to notify the affected parties. The notification shall include details of the proposed project, including information on its transboundary environmental impacts, and shall indicate the nature of the possible decision. The party in whose jurisdiction a project is planned shall ensure that EIA documentation is prepared as part of the EIA process and shall provide it to the Party concerned. The EIA documentation is the basis for the consultations to be held with the party concerned on, among other things, the possible transboundary environmental impacts of the project as well as the mitigation and avoidance of these. The contracting parties shall ensure that the public concerned in the affected state is informed of the project and given the opportunity to submit comments.

The SEA protocol is an additional protocol to the Espoo Convention. The UNECE Protocol on Strategic Environmental Assessment – SEA Protocol – requires the contractual parties to take full consideration of environmental considerations when preparing plans and programmes.

The objectives of the protocol include integrating environmental (including health-related) aspects into the preparation of plans and programmes, voluntarily integrating environmental (including health-related) aspects into policies and legislation, creating clear framework conditions for an SEA process, and ensuring public participation in SEA processes. In the course of the determination of suitability, the neighbouring countries are informed and given the opportunity to comment.

1.4.1.3 Agreements specific to protected asset

1979 Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

The Convention on the Conservation of European Wildlife and Natural Habitats (see Act on the Convention of 19 September 1779 on the Conservation of European Wildlife and Natural Habitats of 17 July 1984, BGBl. II 1984 p. 618, last amended by Article 416 of the Ordinance of 31 August 2015 (BGBl. I p. 1474) – Bern Convention) of 1979 regulates the protection of species through restrictions on removal and use and the obligation to protect their habitats. Annex II of the strictly protected animal species also protects, for example, harbour porpoises, divers, little gulls, and others. The contents are also included in the assessment of environmental impacts via species protection law.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) of 1979

The 1979 Convention on the Conservation of Migratory Species of Wild Animals (see Act on the Convention of 23 June 1979 on the Conservation of Migratory Species of Wild Animals of 29 June 1984 (BGBl. 1984 II p. 569), last amended by Article 417 of the Ordinance of 31 August 2015 (BGBl. I p. 1474)) obliges the contracting parties to take measures for the protection of transboundary wild migratory species and for their sustainable use. The range states in which the threatened species are distributed must conserve their habitats if they are of importance to protect the species from the risk of extinction (Article 3, paragraph 4 a Bonn Convention). They must also eliminate, compensate for, or minimise the adverse effects of activities or obstacles that seriously impede the migration of the species (Article 3, paragraph 4b Bonn Convention) and prevent or reduce, as far as practicable, impacts that threaten the species. The conditions are examined via species protection and territorial protection law and presented within the framework of the environmental report.

Within the framework of the Bonn Convention, regional agreements for the conservation of the species listed in Appendix II were concluded according to Article 4, No. 3 Bonn Convention.

African-Eurasian Migratory Waterbird Agreement, 1995 (AEWA)

The 1995 African-Eurasian Migratory Waterbird Agreement (see Act on the Agreement of 16 June 1995 on the Conservation of African-Eurasian Migratory Waterbirds of 18 September 1998 (BGBl. 1998 II p. 2498), last amended by Article 29 of the Ordinance of 31 August 2015 (BGBl. I p. 1474)) also surveys bird species migrating over the North Sea. Migratory birds should be left in a favourable conservation status on their migration routes, or this status should be restored. The environmental report examines the impacts of the determination of suitability with regard to migratory bird movements in the EEZ.

Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas of 1991 (ASCOBANS)

The 1991 Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea (see Act on the Agreement of 31 March 1992 on the Conservation of Small Cetaceans of the Baltic and North Sea of 21 July 1993 (BGBl. 1993 II p. 1113), last amended by Article 419 of the Ordinance of 31 August 2015 (BGBl. I p. 1474)) stipulates the protection of toothed whales – with the exception of the sperm whale – specifically for the area of the North Sea and the Baltic Sea. Most importantly, a conservation plan was developed to reduce the by-catch rate. The environmental report will assess the impacts of the designations on mammals and, as a result of the suitability assessment, noise mitigation and noise prevention measures, and coordination of pile driving, may be prescribed to protect small cetaceans.

Agreement on the Conservation of Seals in the Wadden Sea of 1991

The 1991 Agreement on the Conservation of Seals in the Wadden Sea (see announcement of the Agreement on the Conservation of Seals in the Wadden Sea, 19 November 1991, BGBl. II No. 32 pp. 1307) aims to establish and maintain the favourable conservation situation for the seal population in the Wadden Sea. It contains regulations on monitoring, removal, and protection of habitats. In the environmental report, the expected major impacts on marine mammals and thus also on harbour seals are examined and included in the assessment and subsequent consideration.

Agreement on the Conservation of Populations of European Bats of 1991 (EUROBATS)

The 1991 Agreement on the Conservation of Populations of European Bats (EUROBATS, see act on the Agreement of 4 December 1991 on the Conservation of Bats in Europe, BGBl. II 1993 p. 1106) is intended to ensure the protection of all 53 European bat species through appropriate measures. The agreement is open not only to European states but also to all range states that belong to the distribution area of at least one European bat population. The most important instruments of the agreement are regulations on the removal of animals, the designation of important protected areas, and the promotion of research, monitoring, and public relations. As a specially and strictly protected species, bats are the subject of the species protection assessment according to Section 7, paragraph 2, Nos. 13 and 14 BNatSchG and are also protected under territorial protection law; this is reflected in the impact assessment.

Convention on Biological Diversity 1993

The Convention on Biological Diversity (see Act on the Convention on Biological Diversity of 5 June 1992 of 30 August 1993, BGBl. II No. 72, p. 1741) aims at the conservation of biological diversity and the fair and equitable sharing of the benefits arising from the use of genetic resources. Furthermore, the sustainable use of natural resources is also enshrined as an objective for conservation for future generations. According to Article 4b, the Convention also applies to procedures and activities outside coastal waters in the EEZ. Biodiversity is a protected asset within the scope of the Strategic Environmental Assessment. Major environmental impacts are thus also likely to be identified and assessed in relation to this protected asset.

1.4.2 Environmental and nature conservation requirements at the EU level

The material scope of application of the TFEU (Treaty on the Functioning of the European Union, OJ EC No. C 115, 9.5.2008, p. 47) and thus in principle also that of secondary law extends to the extent that the member states experience an increase in rights in an area outside their territory, which they have transferred to the EU (EuGH, Kommission./.Vereinigtes Königreich, 2005). For the area of marine environmental protection, nature conservation, or water protection, the applicability of the EU legal requirements therefore also applies in the EEZ area.

The relevant EU legislation to be taken into consideration is:

Council Directive 337/85/EEC of 27 June 1985 on the environmental impact assessment for certain public and private projects (Environmental Impact Assessment Directive, EIA Directive) and Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the environmental impacts of certain plans and programmes (Strategic Environmental Assessment Directive, SEA Directive)

Council Directive 337/85/EEC of 27 June 1985 on the environmental impact assessment of certain public and private projects on the environment ((OJ 175 p. 40) (codified by Directive

2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the environmental impact assessment of certain public and private projects on the environment; Directive 2011/92/EU of 28 November 2011, OJ 26/11) was transposed into national law by the Environmental Impact Assessment Act. Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the environmental impacts of certain plans and programmes (Strategic Environmental Assessment Directive, SEA Directive OJ L 197, 21 July 2001) has also been transposed into national law in the Environmental Impact Assessment Act. The objectives in accordance with the UVPG are therefore to be given priority here.

Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora of 21 May 1992 (Habitats Directive, ABl. L 206 dated 22 July 1992)

In designated FFH areas and for projects in their vicinity, an FFH impact assessment according to Article 6, paragraph 3 Habitats Directive must be carried out within the framework of approval procedures for projects if installations are to be built. If there are compelling reasons of public interest, erection may be justified even if there is incompatibility. The FFH areas in the North Sea have now been designated as nature conservation areas according to the national protected area categories. The impact assessment is thus based on the protective purposes in the nature conservation areas. The directive was implemented in Germany by the Federal Nature Conservation Act – there, the regulation on Natura 2000 areas and on species protection.

Directive 2000/60/EC of the European Parliament and the Council dated 23 October 2000 for the establishment of a Framework for Community Action in Water Policy (Water Framework Directive (WFD))

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 for establishing a framework for Community action in water policy (WFD, OJ L 327, 22 December 2000) aims to achieve good ecological status of surface waters. This is linked to the monitoring, assessment, target setting, and implementation of the measures as steps. It also applies to transitional and coastal waters but not to the EEZ. Accordingly, the regulations of the Marine Strategy Framework Directive are primarily relevant in the preparation of the environmental report.

Directive 2008/56/EC of the European Parliament and the Council dated 17 June 2008 for the establishment of a Framework for Community Action in Marine Environment (Marine Strategy Framework Directive (MSFD))

Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a Framework for Community Action in Marine Environmental Policy (MSFD, OJ L 164, 25 June 2008) as the environmental pillar of an integrated European maritime policy has the objective of "achieving or maintaining good environmental status in the marine environment by 2020 at the latest" (Article 1, paragraph 1 MSFD). The focus is on preserving biodiversity and the conservation or creation of diverse and dynamic oceans and seas that are clean, healthy, and productive (cf recital 3 to the MSFD). The result is to achieve a balance between anthropogenic uses and ecological equilibrium.

The environmental targets defined in the MSFD were developed applying an ecosystemic approach for controlling human activity and according to the precautionary principle and polluter pays principle:

- Marine environments free of adverse effects by human-induced eutrophication
- Marine environments free of pollution from contaminants
- Marine environments free of adverse effects to the marine species and habitats induced by the impacts of human activity
- Marine environments containing sustainably used and conserved resources

- Oceans free of waste pollution
- Marine environments free of adverse effects from anthropogenic introduction of energy
- Seas with natural hydromorphological characteristics (cf BMU 2012).

The environmental report serves to systematically identify, describe, and assess the impacts of the designations on the marine environment.

In particular, impacts on marine species and habitats will be assessed and, in order to reduce environmental impacts, the determination of suitability will include requirements for waste treatment and resource use as well as with regard to pollutants.

Council Directive 2009/147/EC on the conservation of wild birds (Birds Directive)

Council Directive 2009/147/EC on the conservation of wild birds of 30 November 2009 (Birds Directive OJ L 20/7 of 26 January 2010) aims to permanently conserve the populations of all species of birds naturally occurring in the areas of the EU Member States, including the population of migratory bird species, and to regulate not only the protection but also the management and use of birds. All European bird species as defined in Article 1 of Directive 2009/147/EC are protected according to Section 7, paragraph 2, No. 13 b) bb) of the Nature Conservation and Landscape Management Act. The requirements of the Directive are investigated in the context of the species protection assessment.

Rules on sustainable fishing under the Common Fisheries Policy

In the area of fisheries policy, the EU has exclusive jurisdiction (cf Article 3, paragraph 1d Treaty on the Functioning of the European Union). The regulations include, for example, catch quotas based on maximum sustainable yield (MSY), multi-annual management plans, a landing obligation for by-catch, and the promotion of aquaculture facilities. The use of the EEZ for fishing is to be considered as a concern in the determination of suitability.

1.4.3 Environmental and nature conservation requirements at national level

There are various legal provisions at a national level, too, and their specifications must be taken into consideration in the environmental report.

Act on Managing Water Resources (WHG)

The Act on Managing Water Resources of 31 July 2009 (BGBl. I p. 2585), last amended by Article 1 of the Act of 18 July 2017 (Federal Water Act, WHG, BGBl. I p. 2771) transposes the MSFD into national law in Sections 45a to 45l. Section 45a WHG implements the objective of ensuring good status of marine waters by 2020. Deterioration of the status is to be prevented, and human inputs avoided or reduced. However, regulations on uses such as reservations of permission are not linked to this. Rather, Sections 45a et seq. are to be interpreted as mandating the state to develop strategies for implementation, whereby Section 45a WHG provides the benchmark for the environmental status to be aimed at with regard to the relevant protected assets (environmental quality objectives). In turn, the standard is used in the interpretation of the provisions of the sectoral legislation. Sections 45a et seq. WHG implement the requirements of the MSFD.

The environmental report serves to systematically identify, describe, and assess the impacts of the designations on the marine environment.

Act concerning nature conservation and landscape management (Federal Nature Conservation Act - BNatSchG)

The act on nature conservation and landscape management (Federal Nature Conservation Act – BnatSchG, last amended by Article 8 of the Act of 13 May 2019 (BGBl. I p. 706)) is also applicable in the EEZ according to Section 56, paragraph 1 BNatSchG except for the landscape planning requirements. According to Section 1

BNatSchG, the objectives of the BNatSchG include safeguarding biological diversity and the performance and functionality of the natural balance as well as the diversity, uniqueness, beauty, and recreational value of nature and the landscape. Sections 56 et seq. BNatSchG contain specifications for marine nature conservation that require certain assessments; these are depicted in the environmental report. This concerns the protection of legally protected biotopes according to Section 30 BNatSchG; the destruction of or other adverse effects on these biotopes is prohibited. Furthermore, an impact assessment according to Section 34, paragraph 2 BNatSchG must be carried out for plans in nature conservation areas or in the case of impacts on the protective purpose of nature conservation areas. In terms of species protection, according to Section 44, paragraph 1 BNatSchG, it is prohibited to injure or kill wild animals of specially protected species or to considerably disturb wild animals of strictly protected species and European bird species during the breeding, rearing, moulting, hibernation, and migration periods.

In order to assess the suitability of the site, it is checked in particular whether there is a threat to the marine environment. As a result of the suitability assessment, specifications can be made for the subsequent project in order to prevent adverse effects on the marine environment.

Environmental Impact Assessment Act (UVPG)

The Environmental Impact Assessment Act (UVPG) requires a Strategic Environmental Assessment to be carried out for certain plans or programmes. Annex 5.1 of the UVPG lists the determination of suitability so that there is a general obligation to carry out an SEA according to Section 35, paragraph 1, No. 1 UVPG. Within this framework, the present environmental report is being prepared according to the requirements of the UVPG, and the national and transboundary public participation is being carried out.

Offshore Wind Energy Act (WindSeeG)

The objective of the Offshore Wind Energy Act (WindSeeG) is, in accordance with Section 1, paragraph 1 WindSeeG, to expand the use of wind energy at sea in the interest of climate and environmental protection, whereby, in accordance with Section paragraph 2, this is to be achieved by steadily and cost-effectively expanding the installed capacity of wind turbines at sea from 2021 to 15 Gigawatts by 2030 (see supplementary resolutions of the Climate Cabinet of 20 September 2019 and of the Federal Cabinet of 9 October 2019). Essential elements to ensure a steady expansion are the site development plan, which identifies potential sites for the erection of wind turbines, and the assessment of the suitability of these sites prior to the planning approval procedure. However, this expansion, which is to be driven forward in the interest of climate and environmental protection, should in turn take into consideration environmental protection concerns: Section 10, paragraph 2 WindSeeG stipulates that, in order to determine whether a site is suitable, it must be examined whether the criteria for the inadmissibility of designations in the SDP or the criteria relevant for a subsequent planning approval do not conflict. In accordance with Section 5, paragraph 3 WindSeeG, designations are inadmissible if there are overriding opposing public or private interests. In the following list of impermissible designations, the threat to the marine environment is listed as a standard example (cf Section 5, paragraph 3, sentence 1, No. 2 WindSeeG). Furthermore, in accordance with Section 48, paragraph 4, No. 1 WindSeeG, a plan for the construction and operation of a wind farm may be approved only if the marine environment is not threatened. Efficient expansion can take place only if the performance potential of a site is optimally utilised. At the same time, this expansion must not threaten the marine environment; this is why the determination of suitability includes requirements that serve to protect it. These two essential objectives of environmental protection from the WindSeeG are guidelines for the preparation of the plan and the consideration in planning.

Regulations and ordinances governing protected areas

With legal ordinances of 22 September 2017, the already existing nature conservation or FFH areas in the German EEZ were included in the national area categories and declared nature conservation areas according to Section 57 BNatSchG. Within this framework, they were partially regrouped. For example, the Ordinance on the Establishment of the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area (NSGSylV of 22 September 2017, BGBl. I p. 3423), the Ordinance on the Establishment of the “Borkum Riffgrund” nature conservation area (NSGBRgV of 22 September 2017, BGBl. I p. 3395) and the Ordinance on the Establishment of the “Doggerbank” nature conservation area (NSGDgbV of 22 September 2017, BGBl. I p. 3400) now include the nature conservation areas “Sylter Außenriff – Östliche Deutsche Bucht”, “Borkum Riffgrund”, and “Doggerbank”. This does not result in any differences with regard to the spatial expansion. As a result, some species (skua and pomarine skua) were given protected status for the first time. In the context of the SEA, any impacts on the protected areas or the compatibility of sites with wind turbines for the protected areas are examined in order to check whether these areas can be severely adversely affected in the components relevant to their protective purposes. In the impact assessment according to Section 34, paragraph 2 BNatSchG, reference shall be made to the protective purposes set out in the ordinances. The requirements included in the suitability assessment regarding the deconstruction of the installations, noise mitigation, emission reduction, and gentle cable laying procedures also serve to prevent adverse effects on the protected areas.

1.4.4 The energy and climate protection objectives of the federal government

Offshore wind energy was already of particular importance after the strategy of the German government for the expansion of offshore wind energy use in 2002. The proportion of wind energy in electricity consumption should grow to at least 25% within the next three decades. According to the resolutions of the Climate Cabinet of 20 September 2019 and the Federal Cabinet of 9 October 2019, the proportion of
renewable energies in electricity consumption is now set to rise to 65% by 2030. Accordingly, the target for the expansion of offshore wind energy is to be increased to 20 Gigawatts in 2030.
The climate policy objectives of the federal government form the planning horizon for the designation of the plan.

1.5 Methodology of the Strategic Environmental Assessment

1.5.1 Introduction

The strategic environmental assessment shall determine the nature and extent of the environmental impacts of the plan, taking into consideration the content and subject of decision of the plan. The central content document of the Strategic Environmental Assessment is the environmental report to be prepared in accordance with Section 40 UVPG: “The environmental report identifies, describes and assesses the expected major environmental impacts and reasonable alternatives.

The environmental report is prepared in advance of the public and authority participation and incorporated into these procedural steps. The additional information that emerges in the course of the procedure is used in accordance with Section 43 UVPG in order to update the information in the environmental report. In accordance with Section 40, paragraph 3 UVPG, a preliminary assessment of the environmental impacts is already made in the environmental report. As with the EIA, this is to be carried out in a precautionary manner according to legal requirements”.

(PETERS/BALLA/HESSELBARTH, UVPG-Kommentar Section 40, marginal number 1.)

The environmental impacts of the determination of suitability for Site N-7.2 are examined here. The environmental impacts of constructing an offshore wind farm on the site, including all necessary installations, are investigated. The environmental impacts are assessed with regard to effective environmental precaution within the meaning of Section 3 in conjunction with Section 2, paragraph 1 and 2 UVPG. In accordance with Section 10, paragraph 2 in conjunction with Section 5, paragraph 3 and Section 48, paragraph 4, sentence 1 WindSeeG, it must be ensured that the marine environment is not threatened by the plan.

1.5.2 Area of investigation

According to Section 2, paragraph 11 UVPG, the area of investigation is the geographical area in which environmental impacts relevant to the adoption of the plan are likely to occur. Among other things, the designated depends on the respective protected asset and is partly limited to Site N-7.2 but goes beyond its boundaries (e.g. when considering mobile species).

1.5.3 Implementation of the environmental assessment

The expected major environmental impacts of the plan shall be identified and described in accordance with Section 40, paragraph 1 UVPG, and their materiality shall be assessed.

The description and assessment of the environmental status (taking into consideration the function and importance of the site for the individual protected assets) as well as the development of the status if the plan is not implemented form the reference status based on which the changes caused by the plan or programme can be assessed (see Chapter 2).

The description and assessment of the expected major impacts of the implementation of the plan on the marine environment also relate to the protected assets presented (cf Chapter 4).

The following protected assets are considered:

- Site
- Seabed
- Water
- Biotopes
- Benthos
- Fish
- Marine mammals
- Avifauna
- Bats
- Biological diversity
- Air
- Climate
- Landscape
- Cultural heritage and other material assets
- Humans, especially human health

A forecast of the project-related impacts is made depending on the criteria of intensity, range, and duration of the effects (cf Figure 5). All plan contents that could have considerable environmental impacts are investigated.

The impacts of construction, deconstruction, installation, and operation, including those related to maintenance and repair, are considered. The likely environmental impacts to be identified are both direct and indirect effects of the implementation of the plan (KMENT UVPG, Section 40, marginal number 51); these including secondary, cumulative, synergistic, short-, medium-, and long-term, permanent and temporary, and positive and negative effects. Secondary or indirect impacts are those that do not take effect immediately and thus possibly only after some time and/or at other locations (WOLFGANG & APPOLD 2007; SCHOMERUS ET AL.2006).

This is followed by a presentation of possible interrelationships as well as a consideration of possible cumulative effects and potential transboundary impacts.

In general, the following methodological approaches find their way into the environmental assessment:

- Qualitative descriptions and assessments
- Quantitative descriptions and assessments
- Evaluations of the results of the preliminary investigation
- Evaluation of studies and specialist literature
- Visualisations
- Worst-case assumptions
- Statistical evaluations, modelling, and trend assessments (e.g. on the state of the art of installations)
- Assessments by experts/the professional public

Subsequently, according to Section 40, paragraph 3 UVPG, the materiality of the environmental impacts of the plan shall be provisionally assessed in accordance with Section 3, sentence 2 UVPG with regard to effective environmental precaution according to the applicable laws.

A uniform definition of the term "significance" does not exist because it is an "individually determined significance" that cannot be considered independently of the "specific characteristics of plans or programmes" (SOMMER, 2005, 25 f.). In this context, the question of materiality is closely linked to the question of the subsequent influence on the decision on the adoption of the plan or programme according to Section 44 UVPG (Kment in Hoppe/Beckmann/Kment, UVPG – Environmental Impact Assessment Act, Environmental Appeals Act, Comment, 5.A, Section 40, marginal no. 54.). For the suitability assessment and the applicable Section 10, paragraph 2 in conjunction with Section 5, paragraphs 3, Section 48, paragraph 4, No. 1 WindSeeG, a threat to the marine environment from the designations of the plan must be ruled out or, in the case of a threat to the marine environment, would be considerable. In general, major impacts can be defined as effects that are serious and considerable in the context being considered.

In accordance with the criteria set out in accordance with Annex 6 of the UVPG for the assessment of whether major environmental impacts are likely to occur, the following characteristics are to be used for the assessment:

- the likelihood, duration, frequency, and irreversibility of the impacts;
- the cumulation with other environmental impacts;
- the transboundary nature of the impacts;
- the risks to human health or the environment (e.g. in the case of accidents);
- the magnitude and spatial extent of the impacts;
- the value and vulnerability of the area likely to be affected because of special natural characteristics or cultural heritage, the intensity of land use, and the exceeding of environmental quality standards or limit values;
- the impacts on areas or landscapes of which the protected status is recognised at national, community or international level.

Furthermore, the characteristics of the plan are relevant, in particular with regard to

- the extent to which the plan sets a framework for projects and other activities in terms of location, type, size, and operating conditions or through the use of resources;
- the extent to which the plan influences other plans and programmes, including those in a planning hierarchy;
- the importance of the plan in integrating environmental considerations, particularly with a view to promoting sustainable development;
- the environmental issues relevant to the plan;
- the relevance of the plan for the implementation of community environmental legislation

(e.g. plans and programmes concerning waste management or water protection).

The technical legislation provides specification on when an impact reaches the materiality threshold. Also sub-legislatively, threshold values have been developed in order to be able to make a delimitation.

With regard to the consideration of the environmental objectives in the context of the assessment of the expected major environmental impacts of the implementation of the Plan, reference is made to Chapter 4.

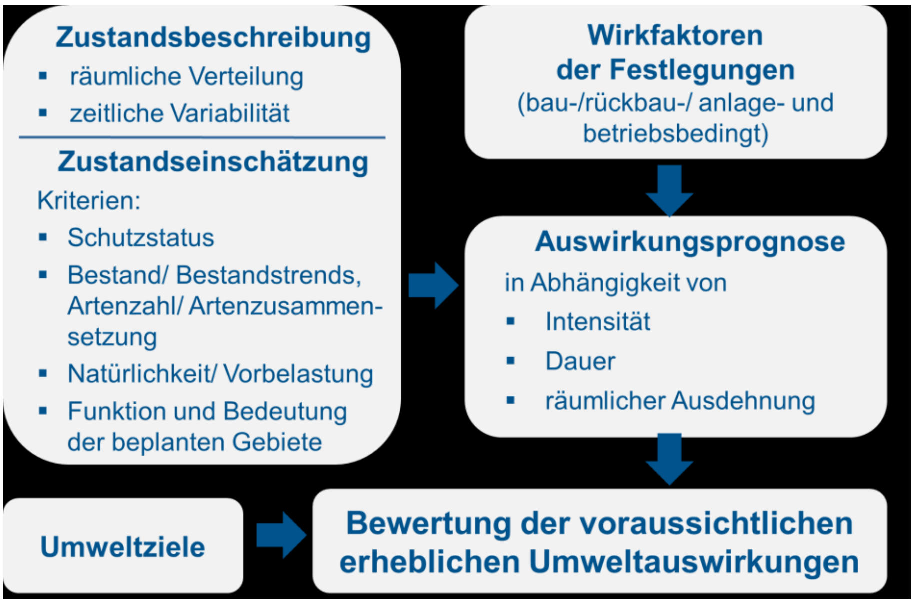

Figure 5: General methodology for assessing the expected major environmental impacts.

1.5.4 Criteria for condition description and status assessment

The status assessment of the individual protected assets in Chapter 2 is carried out based on various criteria. The assessment of the protected assets goods area/soil, benthos and fish is based on the aspects of rarity and threat, diversity and uniqueness, and legacy impact. The description and assessment of the protected assets marine mammals, seabirds and resting birds, and migratory birds is based on aspects for the status assessment of the protected assets land/seabed, benthos, and fish. Because these are highly mobile species, an approach analogous to these protected assets is not expedient. For seabirds and resting birds and marine mammals, the criteria of protection status, assessment of occurrence, assessment of spatial units, and legacy impacts are therefore used as a basis. For the protected asset migratory birds, the aspects of rarity and threat as well as the assessment of occurrence and the large-scale importance of the area for bird migration are considered.

The following is a list of the criteria used for the status assessment of the respective protected asset. This overview addresses the protected assets that are considered in the focus in the environmental assessment.

Water

Aspect: Naturalness
Criterion: Hydrographic conditions and water quality
Aspect: Legacy impact
Criterion: Extent of anthropogenic legacy impact of the water body

Area/soil

Aspect: Rarity and threat
Criterion: Areal proportion of sediments on the seabed and distribution of the morphological form inventory.
Aspect: Diversity and uniqueness
Criterion: Heterogeneity of the sediments on the seabed and development of the morphological inventory of forms.
Aspect: Legacy impact
Criterion: Extent of the anthropogenic legacy impact of seabed sediments and morphological form inventory.

Benthos

Aspect: Rarity and threat
Criterion: Number of rare or endangered species based on the Red List species identified (Red List by RACHOR et al. 2013).
Aspect: Diversity and uniqueness
Criterion: Number of species and composition of the species communities. The extent to which species or communities characteristic of the habitat occur and how regularly they occur is assessed.
Aspect: Legacy impact
For this criterion, the intensity of fishing exploitation, which is the most effective disturbance variable, will be used as a benchmark. Benthic communities can also be adversely affected through eutrophication. For other disturbance variables (e.g. shipping traffic, pollutants), there is currently a lack of suitable measurement and detection methods to be able to include them in the assessment.

Biotopes

Aspect: Rarity and threat
Criterion: National protection status and threat of biotopes according to the Red List of Threatened Biotope Types in Germany (FINCK et al., 2017).
Aspect: Legacy impact
Criterion: Threat as a result of anthropogenic influences.

Fish

Aspect: Rarity and threat
Criterion: Proportion of species considered to be threatened according to the current Red List of Marine Fishes (THIEL et al. 2013) and for the diadromous species on the Red List freshwater fish (FREYHOF 2009) and assigned to Red List categories.

Aspect: Diversity and uniqueness
Criterion: The diversity of a fish community can be described by the number of species (α-diversity, 'species richness'). The species composition can be used to assess the uniqueness of a fish community (i.e. how regularly habitat-typical species occur). Diversity and uniqueness are compared and assessed between the German EEZ of the North Sea and the individual site.
Aspect: Legacy impact
Criterion: The legacy impact of a fish community is defined by anthropogenic influences. Because of the removal of indicator species and by-catch as well as the adverse effect on the seabed in the case of bottom-disturbing fishing methods, fishing is considered to be the most effective disturbance to the fish community and therefore serves as a measure of the legacy impact on fish communities in the North Sea and Baltic Sea. There is no assessment of populations at a smaller spatial scale (e.g. the German Bight). The input of nutrients into natural waters is another pathway through which human activities can affect fish communities (e.g. through algal blooms and oxygen depletion resulting from the microbial degradation of organic matter). Eutrophication is therefore used for the assessment of the legacy impact.

Marine mammals

Aspect: Protection status
Criterion: Status in accordance with Annex II and Annex IV of the Habitats Directive and the following international conservation agreements: Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, CMS), ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas), Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)
Aspect: Assessment of the occurrence
Criteria: Population, population changes/trends based on large-scale surveys, distribution patterns, and density distributions
Aspect: Assessment of spatial units
Criteria: Function and importance of the German EEZ as well as the specific site and its immediate surroundings for marine mammals as a migration area or feeding or breeding ground
Aspect: Legacy impact
Criterion: Threats as a result of anthropogenic influences and climate change.

Seabirds and resting birds

Aspect: Protection status
Criterion: Status in accordance with Appendix I of the V-RL, European Red List of BirdLife International
Aspect: Assessment of the occurrence
Criteria: Distribution patterns, abundances, variability
Aspect: Assessment of spatial units
Criteria: Function of the specific site and its surroundings for breeding birds and migrants and as resting areas; distances to protected areas
Aspect: Legacy impact
Criterion: Legacy impact/threats as a result of anthropogenic influences and climate change.

Migratory birds

Aspect: The importance of bird migration over a large area
Criterion: Guidelines and areas of concentration
Aspect: Assessment of the occurrence
Criterion: Migration activity and its intensity
Aspect: Rarity and threat
Criterion: Number of species and endangerment status of the species involved in accordance with Annex I of the Birds Directive, AEWA (African-Eurasian Waterbird Agreement), and SPEC (Species of European Conservation Concern).
Aspect: Legacy impact
Criterion: Legacy impact/threats as a result of anthropogenic influences and climate change.

1.5.5 Specific assumptions for the assessment of expected major environmental impacts

The description and assessment of the expected major impacts of the implementation of the plan on the marine environment is carried out in relation to the protected assets, incorporating the status assessment described above.

1.5.5.1 Impact factors and potential impacts

The following table sets out the potential environmental impacts based on essential factors that form the basis for the assessment of the expected major environmental impacts. The effects are differentiated according to whether they are due to construction, deconstruction, or operation or are caused by the installation itself.

Table 2: Project-related impacts if the plan is implemented.

Protected asset	Effect	Potential impact	Con-struc-	Installa-	Commis-
Wind turbines					
Water	Resuspension of sediment	Change of habitats	X		
	Change in currents and sea state	Change of habitats		X	
	Material emissions	Change of habitats			X
Seabed	Introduction of hard substrate (foundations)	Change of habitats		X	
	Permanent area use	Change of habitats		X	
Protected asset	Effect	Potential impact	Construc-tion/decon-	Installation	Commis-

	Scouring/sediment rear-rangement	Change of habitats		X	
Benthos	Formation of turbidity plumes	Adverse effect on benthic species	X		
	Resuspension of sediment and sedimentation	Adverse effect on or damage to ben-thic species or communities	X		
	Introduction of hard substrate	Habitat changes, habitat loss		X	
Fish	Sediment turbulence and tur-bidity plumes	Physiological effects and deterrent effects	X		
	Noise emissions during pile driving	Averting	X		
	Area use	Local habitat loss for demersal fish species		X	
	Introduction of hard substrate	Attraction effects, increase in spe-cies diversity, change in species composition		X	
Seabirds and rest-ing birds	Visual unrest as a result of construction activity	Local deterrent and barrier effects	X		
	Obstacle in airspace	Deterrent effects ⇨ Habitat loss Collisions		X	
	Light emissions	Attraction effects	X		X
Migratory birds	Obstacle in airspace	Collisions, barrier effect		X	
	Light emissions	Attraction effects ⇨ collisions	X		X
Marine mammals	Noise emission during pile driving	Threat if no preventative and mitiga-tion measures are taken	X		
		In-farm cabling			
Water	Resuspension of sediment	Change of habitats	X		
Seabed	Introduction of hard substrate (stone packing)	Change of habitats		X	
Benthos	Heat emissions	Adverse effect on/displacement of cold-water loving species			X
	Magnetic fields	Adverse effect on benthic species			X
	Turbidity plumes	Adverse effect on benthic species	X		
	Introduction of hard substrate (stone packing)	Habitat change, local habitat loss		X	
Protected asset	Effect	Potential impact	Construc-tion/decon-	Installation	Commis-

Fish	Turbidity plumes	Physiological effects and deterrent effects	X		
	Magnetic fields	Adverse effect on the orientation behaviour of individual migratory species			X

Cumulative impacts and interrelationships between protected assets are also assessed in addition to the effects on the individual protected assets.

1.5.5.2 Cumulative assessment

According to Article 5, paragraph 1 SEA Directive, the environmental report also includes the testing of cumulative and secondary impacts. Cumulative impacts arise from the interaction of various independent individual effects which either add up as a result of their interaction (cumulative effects) or reinforce each other and thus generate more than the sum of their individual effects (synergetic effects) (e.g. SCHOMERUS ET AL., 2006). Cumulative as well as synergetic impacts can be caused by both the temporal and spatial coincidence of impacts of the same or different projects. The individual impacts are the construction-related impacts as well as the installation-related and operational impacts, whereby the impacts of the construction phase are predominantly short-term and temporary in nature, while installation-related and operational impacts can occur permanently.

The assessment of cumulative impacts derives from a number of legal obligations:

- WindSeeG, Part 2, Section 1: Section 5, paragraph. 3, No. 2 WindSeeG:

"designations according to paragraph 1, numbers 1 and 2 and numbers 6 to 11 are not permissible if they conflict with overriding public or private interests. These designations are particularly inadmissible if … 2. they threaten the marine environment […]"

- WindSeeG, Part 4, Section 1: Section 48, paragraph 4, No.1 WindSeeG:

"The plan may be established only if the marine environment is not threatened".

- UVPG: Section 2, paragraph 2 UVPG:

"Environmental impacts within the meaning of this Act are direct and indirect impacts of a project or the implementation of a plan or programme on the protected assets and from Section 3 UVPG Environmental assessments […] serve effective environmental precaution in accordance with the applicable laws, […]"

- BNatSchG and ordinances for the designation of nature conservation areas in the German EEZ, including Section 34, paragraph 1 BNatSchG (impact assessment):

"Projects shall be assessed for their compatibility with the conservation objectives of a Natura 2000 area prior to their approval or implementation if, individually or in combination with other projects or plans, they are likely to have a major effect on the area and do not directly serve the management of the area"

- Section 44, paragraph 1, No. 2 BNatSchG: (prohibition of interference)

"[…] a considerable disturbance exists if the disturbance worsens the conservation status of the local population of a species".

In part, concrete concepts such as the position paper on the cumulative assessment of diver habitat loss in the German North Sea (BMU 2009) and the noise abatement concept of the BMUB (2013) can be used for the cumulative assessment.

The cumulative effects in relation to the protected assets are assessed in Chapter 4.12.

1.5.5.3 Interrelationships

In general, impacts on any one protected asset lead to various consequences and interrelationships between the protected assets. The essential interconnection of the biotic protected assets exists via the food webs. Because of the variability of the habitat and the complexity of the food web and material cycles, interrelationships can be described only imprecisely overall.

Information on interrelationships can be found in Chapter 4.13.

1.5.5.4 Assumptions on wind turbines, including the capacity to be installed:

According to Section 12, paragraph 5 WindSeeG, the capacity of offshore wind turbines to be installed shall be determined for the site. The suitability assessment describes how the capacity to be installed per site is determined and specified. It will essentially be reviewed whether the expected capacity to be installed, which was determined during the preparation of the SDP, needs to be adjusted. For the calculations of the SDP, the sites within the areas are assigned to two categories based on criteria such as area geometry, wind accessibility, state of the art of offshore wind turbines, and grid connection capacity within the framework of the legal requirements. On the basis of these parameters and assumptions, the power density to be applied is determined in megawatt/km² per site. For details, please refer to the explanations in the context of the suitability assessment.

For the consideration of protected assets in this SEA, the model parameters already used in the environmental assessments for the SDP are assumed with, among other things, any wind turbines that may become available. In order to reflect the range of possible developments, the assessment is essentially based on two scenarios. In the first scenario, many small installations are assumed, while in the second scenario. a few large installations are assumed. Scenarios 1 and 2 correspond to the range used as a basis in SDP 2020. Because of the range covered, a description and assessment of the current state of planning that is as comprehensive as possible is enabled. The assessment of the two scenarios thus covers all possible parameters within the range of SDP 2020.

The Strategic Environmental Assessment takes particular consideration of these factors:

- Installations already in operation (as reference and legacy impact)
- Forecasting of certain technical developments.

Table 3 provides an overview of the parameters used. It should be noted that these are only estimate-based assumptions because project-specific parameters are not known at the level of the SEA for the suitability assessment.

Table 3: Model parameters for the consideration of the site.

Parameters	Scenario 1	Scenario 2
Capacity per installation [MW]	10	20
Hub height [m]	approx. 125	approx. 200
Height lower rotor tip [m]	approx. 25	approx. 50

Rotor diameter [m]	approx. 200	approx. 300
Total height [m]	approx. 225	approx. 350
Diameter foundation [m]*	approx. 10	approx. 15
Area foundation, excluding scour protection [m²]	approx. 79	approx. 177
Diameter of scour protection [m]	approx. 50	approx. 75
Area of foundation, including scour protection [m²]	approx. 1,963*	approx. 4,418*

* The calculation of the land use is based on the assumption of a monopile foundation. However, it is assumed that the monopile and jacket each occupy approximately the same area on the seabed.

With regard to the information on hub height, it should be taken into consideration that the objective Item 3.5.1 (8) of the spatial plan of the North Sea provides for a height limit of 125 m for wind turbines within sight of the coast and islands. Accordingly, this target was used as a basis in Scenario 1.

Because Sections 19 and 6 ROG generally provide for the possibility of a deviation procedure to deviate from the objectives of the MRO and the height limitation is not relevant for non-visible installations, a hub height of 200 m was used as a basis for Scenario 2.

1.5.5.5 Assumptions on other development

The following model assumptions are made with regard to the other installations (Table 4).

Table 4: Parameters for the consideration of other development of Site N-7.2.

Parameters	Value
Capacity to be installed (MW)	980*
Length of in-farm cabling (= 0.12 km/MW*) [m²]	117.6
Voltage level of in-farm cabling	66 kV
Number of wind turbines – Scenario 1	98
Number of wind turbines – Scenario 2	49
Number of transformer platforms	0
Number of accommodation platforms	1
Surface sealing of foundation, including scour protection [m²] – Scenario 1	192374**
Surface sealing of foundation, including scour protection [m²] – Scenario 2	216482**
Surface sealing of the accommodation platform, including scour protection	1,963

* The initially planned capacity of 930 MW on Site N-7.2 was increased to 980 MW after recalculation.

** The calculation of the length of the cabling within the park is made in correlation to the expected capacity to be installed in the respective site (here 980 MW). The applied value of 0.12 km/MW was determined by calculating the average value of already erected wind farms and existing plans.

** The calculation of the land use is based on the assumption of a monopile foundation. It is assumed that the monopile and jacket each occupy approximately the same area on the seabed.

1.5.5.6 Principles of the examination of reasonable alternatives

In accordance with Article 5, paragraph 1, sentence 1 SEA Directive in conjunction with the criteria in Appendix I SEA Directive and Section 40, paragraph 2, No. 8 UVPG, the environmental report contains a brief description of the reasons for the choice of the reasonable alternatives examined.

The examination of reasonable alternatives does not explicitly require particularly environmentally-friendly alternatives to be developed and examined. Rather, the “reasonable” alternatives in the above sense should be presented in a comparative manner with regard to their environmental impacts so that consideration of environmental concerns becomes transparent when deciding on the alternative to be pursued (BALLA ET AL. 2009). At the same time, the effort required to identify and assess the alternatives under consideration must be reasonable. The following applies: The greater the expected environmental impacts and thus the need for conflict management in planning, the more likely it is that extensive or detailed investigations will be required.

Alternatives are already being examined as part of the upstream SEA for SDP 2020 (BSH 2020a). At this planning level, these are primarily the conceptual/strategic design, the spatial location, and technical alternatives. Therefore, in the context of the suitability assessment, only alternatives that relate to the specific site to be assessed according to the designations of the SDP – in this case N-7.2 – are to be considered in the sense of stratification between the instruments. These can mainly be process alternatives (i.e. the (technical) design of the installations in detail) (BALLA ET AL. 2009). At the same time, the exact design of the installations to be constructed on the site has not yet been determined at the time of the suitability assessment. Therefore, within the framework of the SEA for the suitability assessment, only alternatives that relate to the respective site and can already be undertaken without detailed knowledge of the specific construction project are to be examined.

1.6 Data sources and indications of difficulties in compiling the documents

The basis for the SEA is a description and assessment of the environmental status in the area of investigation. All protected assets must be included. The data source is the basis for the assessment of the expected major environmental impacts, the area and species protection assessment, and the examination of reasonable alternatives.

According to Section 39, paragraph 2, sentence 2 UVPG, the environmental report contains the information that can be obtained with reasonable effort, taking into consideration the current state of knowledge and public statements known to the authority, generally accepted assessment methods, content and level of detail of the plan and its position in the decision-making process.

This environmental report builds on the environmental assessment carried out as part of the preparation of the SDP for the EEZ of the North Sea.

According to the requirements of Section 10, paragraph 2, sentence 2 WindSeeG, the study results and documents from the preliminary investigation as well as the data acquired in this context form the essential basis of this SEA.

According to Section 40, paragraph 4 UVPG, information available to the competent authority from other procedures or activities may be included in the environmental report if it is suitable for the intended purpose and is sufficiently up-to-date.

Based on this, relevant data from the planning approval and enforcement procedures conducted at the BSH are used as a supplement. The data and knowledge situation has improved considerably in recent years, particularly as a result of the extensive data collection within the framework of environmental compatibility studies and the construction and operational monitoring for the offshore wind farm projects and the accompanying ecological research.

In summary, the following data sources are used as a basis for the environmental report:

- Data from the preliminary investigation for Site N-7.2

- Data from construction and operational monitoring of existing offshore wind farms on the site and in the vicinity of Site N-7.2
- Data from approval procedures for offshore wind farms on the site and in the vicinity of Site N-7.2
- Scientific studies
- Findings and results from research projects and supporting ecological research
- Results from projects
- Comments from the specialist authorities
- Comments from the (specialist) public
- Literature

Because the data sources can vary depending on the protected asset, the data availability of each is discussed at the beginning of Chapter 2.

Indications of difficulties arising when compiling the data (e.g. as technical gaps or lack of knowledge) are to be presented according to Section 40, paragraph 2, number 7 UVPG. The description and assessment of the individual protected assets (Chapter 2) make it clear that in certain places there are still gaps in knowledge. Information gaps exist in particular with regard to the following points:

- Long-term effects from the operation of offshore wind farms and associated installations such as converter platforms
- Data for assessing the environmental status of the various protected assets for the area of the outer EEZ.

In principle, forecasts on the development of the living marine environment after implementation of the plan remain subject to uncertainties. There is often a lack of long-term data series or analytical methods (e.g. for the intersection of extensive information on biotic and abiotic factors) in order to better understand complex interactions of the marine ecosystem.

In particular, there is a lack of detailed area-wide sediment and biotope mapping outside the nature conservation areas of the EEZ. As a result, there is a lack of a scientific basis on which to assess the impacts of the possible use of strictly protected biotope structures.

Furthermore, there are no scientific assessment criteria for some protected assets, both with regard to the assessment of their status and with regard to the impacts of anthropogenic activities on the development of the living marine environment, to allow cumulative effects to be considered in both temporal and spatial terms.

This is dealt with separately for each protected asset in Chapter 2 .

2 Description and assessment of the environmental status

2.1 Introduction

According to Section 40, paragraph 2, number 3 UVPG, the environmental report includes a description of the characteristics of the environment and the current environmental status in the area of investigation of the SEA. The description of the current state of the environment is required in order to be able to forecast its change upon implementation of the plan. The subject of the inventory are the protected assets listed in Section 2, paragraph 1, Nos. 1 to 4 UVPG as well as interrelationships between them. The information is presented in a problem-oriented fashion. The focus is thus on possible legacy impacts, environmental elements requiring special protection and on the protected assets that will be most affected by the implementation of the plan. In spatial terms, the description of the environment is based on the respective environmental impacts of the plan. These vary in extent depending on the type of impact and the protected asset affected and can extend beyond the boundaries of the plan (LANDMANN & ROHMER 2018). Please refer to the comments under 1.5.2.

The following description and assessment of the environmental status also characterises and assesses the existing situation and presents the existing legacy impact based on the aforementioned information within the meaning of Section 10, paragraph 1, No. 1 WindSeeG.

2.2 Seabed/sites

The protected asset seabed comprises the upper layer of the seabed, which is described below in terms of its morphology, the surface sediments, and the near-surface subsoil. With regard to land as a protected asset, the focus is on land consumption. The objective of sparing land use is already being pursued through the designations made in the SDP (BSH 2020b) on the spatially ordered and land-sparing expansion of offshore wind turbines and the offshore connecting cables required for this.

In the following, the protected assets land and soil are considered together. Where it makes sense or is necessary, more detailed information is provided on the land as a protected asset.

2.2.1 Availability of data

The basis for the description of the surface sediments and the near-surface subsoil of Site N-7.2 are the preliminary investigation carried out in this area. These include grab samples and video recordings as well as hydrographic investigations using a multibeam echo sounder, side-scan sonar, and sediment echo sounder from 2019(VBW WEIGT GMBH, 2020).

The map of sediment distribution in the German North Sea (LAURER ET. AL, 2014; project GPDN – Geopotential German North Sea) is available as a further data source.

The data and information used to describe the distribution of pollutants in the sediment are collected during the annual monitoring tours of the BSH.

2.2.2 Status description

2.2.2.1 Geomorphology

Site N-7.2 under consideration is located in the western part of the German EEZ of the North Sea, an area with a largely flat seabed relief.

The entire site was investigated using a multibeam echo sounder. The seabed rises from west to east. The seabed is uniformly flat and not characterised by any abrupt changes in depth.

The water depths in relation to Lowest Astronomical Tide (LAT) are between 36.5 and 38.6 m. Figure 6 shows the bathymetry of the site.

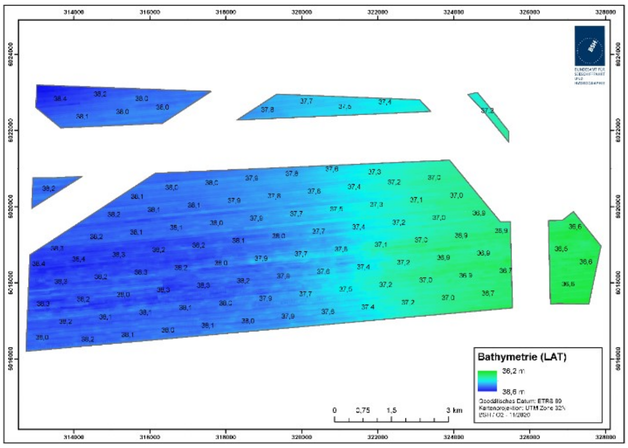

Figure 6: Bathymetry of Site N-7.2 related to Lowest Astronomical Tide (LAT).

2.2.2.2 Sediment distribution on the seabed

On Site N-7.2, area-wide investigations were carried out using side-scan sonar, and soil samples were taken. The sediment samples were classified according to DIN17892-4 as well as Figge 1981 and Folk 1954/1974. The determination of the grain indices from the grain size distributions of the soil samples taken on Site N-7.2 show fine sands with different contents of medium sands. All samples from the 2019 geological survey have a silt content of 5–10%. Fine grain fractions of 5–15% on average were recorded during benthos sampling in 2019/ 2020(IFAÖ 2021). The content of organic material is almost without exception below 2% (IFAÖ 2021). In the backscatter mosaic, no changes in backscatter intensities that indicate a change in sediment are visible.

The sediment mapping was carried out according to the seabed mapping guide (BSH, 2016) and shows only fine sand (Figure 7) on Site N-7.2.

In addition to this homogeneous sediment composition, one object was verified in the area of Site N-7.2; this was identified as an anthropogenic object. After comparison with the wreck database of the BSH, there is a known wreck on this position.

The occurrence of marine boulders as defined in the reef mapping guide of the BfN can be excluded. Residual or relict sediments or coarse sands and gravels are not expected in the area.

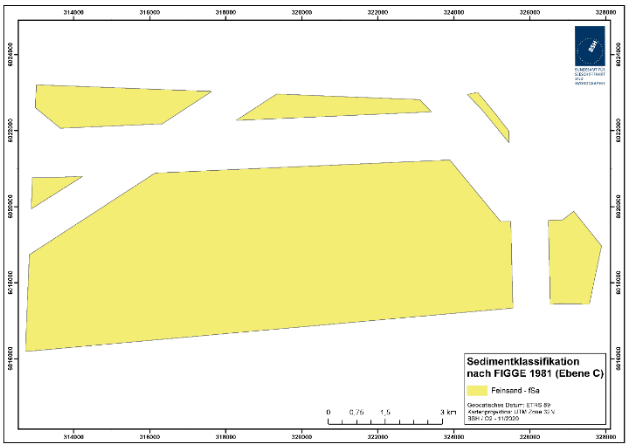

Figure 7: Sediment classification according to the seabed mapping guide (BSH) for Site N-7.2.

2.2.2.3 Geological structure of the near-surface subsoil

Sediment echosounder surveys were carried out as part of the preliminary investigation with an average profile spacing of approx. 75 m.

On Site N-7.2, further sands lie beneath an approx. 0.2 to > 2.2 m thick upper sand layer (marine surface layer, fine to medium sand), which were only partially sonicated. A base is nowhere recognisable in the measurements. At the base of the marine surface layer, there are isolated channel structures and trough-like, uneven depressions filled with sediment. Occasionally, rather soft sediments also occur as channel fill. Where this was recognisable, it was recorded as a separate layer. Occasionally and quite irregularly, strong, internally often parallel reflectors appear at the base of the marine surface layer. The may be peats or cohesive soft sediments. They were also recorded as an independent layer. If possible, further distinctions such as conspicuously parallel-laminated sands or channel sediments were digitised. The base of the marine surface layer is often only indistinctly recognisable. Figure 8 shows the thickness of the marine surface layer.

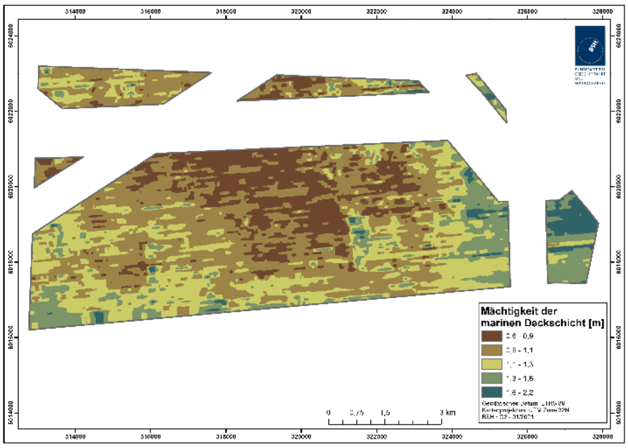

Figure 8: Thickness of the marine surface layer of Site N-7.2.

2.2.2.4 Pollutant distribution in the sediment

Metals

The seabed is the most important sink for trace metals in the marine ecosystem. However, it can also act as a regional source of pollution by re-suspension of historically deposited, more highly contaminated material. The absolute metal content in the sediment is strongly dominated by the regional grain size distribution. Higher contents are observed in regions with high silt content than in sandy regions. The reason is the higher affinity of the fine sediment content for the adsorption of metals. Metals accumulate mainly in the fine grain fraction.

Especially the elements copper (Cu), cadmium (Cd), and nickel (Ni) are at low levels or in the range of background concentrations in most regions of the German EEZ. All heavy metals show elevated levels near the coast, and less pronounced levels along the East Frisian islands than along the North Frisian coast. These distinct gradients with increased contents near the coast and low contents in the central North Sea indicate a dominant role of freshwater inflows as a source of metal pollution. In contrast, especially lead in the central North Sea is found in considerably increased levels in the fine-grain fraction. These are even higher than the values measured at stations near the coast. In contrast, the spatial distribution of the nickel contents in the fine grain fraction of the surface sediment is characterised only by weakly pronounced gradients. The spatial structure does not allow any conclusions to be drawn about the main areas of stress. Heavy metal contamination in the surface sediment of the EEZ has tended to decline overall over the past 30 years (Cd, Cu, Hg) or to show no clear trend (Ni, Pb, Zn).

Organic substances

Most of the organic pollutants are of anthropogenic origin. About 2,000 mainly industrially produced substances are currently considered environmentally relevant (pollutants) because they are toxic or persistent in the environment and/or can accumulate in the food web (bioaccumulative). Because their properties can vary greatly, their distribution in the marine environment depends on a wide range of factors. In addition to input sources, input quantities, and input pathways (directly via rivers, diffusely via the atmosphere), the physical and chemical properties of the pollutants and the dynamic-thermodynamic state of the sea are relevant for dispersion, mixing, and distribution processes. For these reasons, the various organic pollutants in the sea show an uneven and varying distribution and occur in quite different concentrations.

During its monitoring tours, the BSH determines up to 120 different pollutants in the seawater, suspended solids and sediments. For most pollutants in the German Bight, the Elbe is the main source of input. For this reason, the highest pollutant concentrations are generally found in the Elbe plume off the North Frisian coast, which generally decreases from the coast to the open sea. The gradients are particularly strong for non-polar substances because these substances are predominantly adsorbed on suspended matter and are removed from the water phase by sedimentation. Outside the coastal regions rich in suspended matter, the concentrations of non-polar pollutants are therefore usually quite low. However, many of these substances are also discharged into the sea by atmospheric deposition or have direct sources in the sea (e.g. PAHs (polycyclic aromatic hydrocarbons), discharges from the oil and gas industry and shipping); land-based sources must therefore also be considered in the distribution of these substances.

According to the current state of knowledge, the observed concentrations of most pollutants in seawater do not pose any immediate threat to the marine ecosystem. An exception is the contamination by tributyltin hydride (TBT), formerly used in marine paints, the concentration of which sometimes reaches the biological impact threshold near the coast. Furthermore, acute oil spills (shipping, offshore oil production) can cause massive damage to seabirds and harbour seals.

Radioactive substances (radionuclides)

For decades, the radioactive contamination of the North Sea was determined by discharges from nuclear fuel reprocessing plants. Because these discharges are currently quite low, the radioactive contamination of the North Sea does not pose any danger to people or nature according to the current state of knowledge.

Inherited waste

Possible contaminated sites in the EEZ of the North Sea include munitions residues. In 2011, a federal-state working group published a basic report on munitions contamination in German marine waters. This is updated annually. According to official estimates, the seabed of the North Sea and Baltic Sea holds 1.6 million tonnes of old ammunition and explosive ordnance of various types. A considerable proportion of these ammunition dumps are from the Second World War. Even after the end of the war, large quantities of ammunition were sunk in the North Sea and Baltic Sea to disarm Germany. According to the current state of knowledge, the explosive ordnance load in the German North Sea is estimated at up to 1.3 million tonnes. The overall availability of data is insufficient. It can thus be assumed that explosive ordnance deposits are also to be expected in the area of the German EEZ (e.g. remnants of mine barriers and combat operations). The location of the known ammunition dump sites can be found on the official nautical charts and in the 2011 report (which also includes suspected areas for ammunition contaminated areas).

The reports of the Federal-State Working Group are available at www.munition-im-meer.de.

2.2.3 Status assessment

The status assessment of the seabed in terms of sedimentology and geomorphology is limited to the area of Site N-7.2 considered in the suitability assessment.

2.2.3.1 Rarity and threat

The aspect “rarity and threat” takes into consideration the portion of the sediments on the seabed and the distribution of the morphological form inventory throughout the North Sea. The fine sands predominant at Site N-7.2 are widespread throughout the North Sea. The seabed is uniformly flat. The aspect “rarity and threat” is thus rated as “low”.

2.2.3.2 Diversity and uniqueness

The aspect “diversity and uniqueness” considers the heterogeneity of the described surface sediments and the expression of the morphological form inventory.

The sediment composition of the surface sediments on Site N-7.2 is quite homogeneous. Special morphological forms in this fine sand area are not known. The aspect “diversity and uniqueness” is therefore rated “low”.

2.2.3.3 Legacy impact

2.2.3.3.1 Natural factors

Climate change and sea level rise: The North Sea region has experienced dramatic climate change over the last 11,800 years; this has been associated with a profound change in the land/sea distribution because of the global sea level rise of 130 m. For about 2,000 years the sea level of the North Sea has reached its present level. Off the German North Sea coast, the sea level rose by 10 to 20 cm in the 20th century. Storms cause changes to the seabed. All sedimentary-dynamic processes can be traced back to meteorological and climatic processes, which are largely controlled by the weather patterns in the North Atlantic.

2.2.3.3.2 Anthropogenic factors

Fishing: In the North Sea, bottom trawling uses otter trawls and beam trawls. Shearboards are used mainly in the northern North Sea and are pulled diagonally across the seabed. Beam trawls, on the other hand, have been used in the southern North Sea, especially since the 1930s. Since the 1960s, there has been a sharp increase in beam trawl fishing. This has declined slightly over the last decade because of catch regulations and the decline in fish populations. The skids of the beam trawls leave tracks of 30 to 50 cm in width. In particular, their skids or chain nets have a greater impact on the seabed than otter trawls. In the sediment, the bottom trawls create specific furrows that can be a few millimetres to 8 cm deep on boulder clay and sandy soils and up to 30 cm deep in soft silt. The results from the EU project TRAPESE show that at most the upper 10 cm of the seabed are regularly scoured and stirred up (PASCHEN et al. 2000). According to the report by IFAÖ (2021a), fishing tracks from the current fishing, which predominantly takes place there, are to be expected on Site N-7.2.

Submarine cables (telecommunications, energy transmission): Submarine cables already laid on Site N-7.2 (out of service) should also be mentioned as a legacy impact and are associated with potential impacts. On one hand, the seabed in these areas has already been disturbed and influenced locally. As a rule, however, sediment dynamic processes lead to a complete levelling of the laying tracks. On the other hand, old submarine cables might have to be removed during the construction of a wind farm (sediment turbulence) or make crossing constructions necessary (local introduction of hard substrate).

Anthropogenic factors affect the seabed through erosion, mixing, resuspension, and material sorting. In this way, the natural sediment dynamics (sedimentation/erosion) and the mass transfer between sediment and soil water are influenced.

The extent of anthropogenic legacy impact of the sediments and the morphological form inventory is decisive for the assessment of the aspect “legacy impact”. With regard to the pollutant load, it can basically be stated that the sediment in the site under consideration is only slightly contaminated by metals and organic pollutants. Because of the current fishing, the protected asset seabed/land is assigned a medium importance with regard to the criterion “legacy impact” in Site N-7.2. This is thus marked as an anthropogenically influenced site on which the aforementioned legacy impacts are present but do not cause a loss of ecological function.

2.3 Water

The North Sea is a relatively shallow shelf sea with a wide opening to the North Atlantic Ocean in the north. The oceanic climate of the North Sea - characterised by salinity and temperature - is largely determined by this northern opening to the Atlantic. In the south west, the Atlantic has less influence on the North Sea because the shallow English Channel and the narrow Dover Strait. The Baltic Sea is connected to the Kattegat/Skagerrak and the North Sea by the Great Belt, the Little Belt, and the sound.

2.3.1 Availability of data

In addition to data and information from the literature, the description and assessment of the status of the protected asset water is based primarily on the evaluation of various long-term measurement series by the BSH (some of which span several decades) as well as monitoring tours by the BSH.

2.3.2 Status description

2.3.2.1 Nutrients

Nutrients such as phosphate and inorganic nitrogen compounds (nitrate, nitrite, ammonium) as well as silicate are essential for marine life. An excess of these nutrients, which occurred in the 1970s and 1980s because of extremely high nutrient inputs caused by industry, transport, and agriculture, leads to a high accumulation of nutrients in seawater and thus to eutrophication. The eutrophication problem continues (BMEL and BMU 2020). As a result, there may be an increased occurrence of algal blooms (phytoplankton and green algae), reduced visibility depths, a decline in seagrass meadows, shifts in the species spectrum, and oxygen deficiencies near the seabed (BMU 2018A).

Nutrient concentrations in the German Bight show a typical annual cycle with high concentrations in winter and low concentrations in the summer months. All nutrients show similar distribution structures with a gradual decrease in concentration from the estuary area via the coastal area to the open sea (BMU 2018a).

2.3.2.2 Pollutants

Organic pollutants and metals reach North Sea waters via direct discharges, rivers, and the air as well as via direct sources in the sea such as offshore activities, resource extraction, and the introduction of dredged material. Pollutants can also accumulate in sediments and in marine organisms.

In the Elbe plume off the North Frisian coast, the highest concentrations of organic pollutants are commonly measured; in principle, these decrease towards the open sea. The gradients are particularly strong for non-polar substances because these substances are predominantly adsorbed on suspended matter and are removed from the water phase by sedimentation. Outside the coastal regions rich in suspended matter, the concentrations of non-polar pollutants are therefore usually quite low. The pollution of the water by petroleum hydrocarbons is low; however, in isolated cases, acute oil pollution from shipping can be detected by visible oil films. In recent years, new analytical methods have detected many “new” pollutants (contaminants of emerging concern) with polar properties in the environment (BMU 2018a). Many of these substances (e.g. the per- and polyfluorinated alkyl compounds as well as some pesticides) occur in much higher concentrations than the classic pollutants.

Metals occur naturally in the marine environment. The detection of metals in the marine environment is therefore not necessarily pollution. Metals are dissolved and suspended in the water body. Suspended sediment levels in the water column decrease with increasing distance from the coast. Thus, the proportion of surfaces available for adsorption processes decreases and a proportionally increasing part of the metal content remains in solution. The levels of mercury, cadmium, copper, and zinc generally decrease from the coast to the open sea. Because of the natural background concentration of lead in sediments of the open North Sea, similar high concentrations can be found for lead in the water phase in the open sea as on the coast (BMU 2018a). Similar to nutrients, some metals (e.g. zinc, cadmium) also show seasonal periodic concentration fluctuations in the dissolved fraction. This seasonal profile roughly corresponds to the biological growth and remineralisation cycle.

2.3.2.3 Currents

The currents in the North Sea consist of a superposition of the half-day tidal currents with the wind- and density-driven currents. In general, the North Sea is characterised by large-scale cyclonic (i.e. anti-clockwise) circulation with a strong inflow of Atlantic water at the north-western edge and an outflow into the Atlantic Ocean via the Norwegian Gully. The strength of the North Sea circulation depends on the prevailing air pressure distribution over the North Atlantic, which is parametrised by the North Atlantic Oscillation Index (NAO), the standardised air pressure difference between Iceland and the Azores.

Based on an analysis of all current measurements carried out between 1957 and 2001 by the BSH and the German Hydrographic Institute (DHI) (KLEIN 2002), the mean amounts of current velocity (scalar mean including tidal current) and the residual current velocities (vector mean) near the surface (3–12 m water depth) and near the bottom (0–5 m distance from the bottom) were determined for various areas in the Deutsche Bucht. All time series with a length of at least 10 days and a water depth of more than 10 m were taken into consideration in this analysis. The objective of the analysis was to estimate the conditions in the open sea. The mean values are shown in Table 5. The tidal currents were determined by connecting to the Helgoland tide gauge (i.e. the measured currents are related to the tidal ranges and high tide times observed there (KLEIN & MITTELSTAEDT 2001).

Table 5: Mean current velocities, residual and tidal currents in the German Bight

	Surface proximity (3–12 m)	**Ground level (0–5 m ground clearance)**
Mean amount	25 - 56 cm/s	16 - 42 cm/s
Vector means (residual current)	1 - 6 cm/s	1 - 3 cm/s
Tidal current	36 - 86 cm/s	26 - 73 cm/s

Figure 9 shows the flow conditions in the near-surface layer (3–12 m measurement depth) for various areas in the Deutsche Bucht. In the illustration, the values in Area GB3 correspond to the (geological) sub-area “Borkum und Norderneyer Riffgrund”, GB2 corresponds to the sub-area “Nördlich Helgoland”, and GB1 corresponds to the sub-area “Elbe Glacial Valley and western plains”.

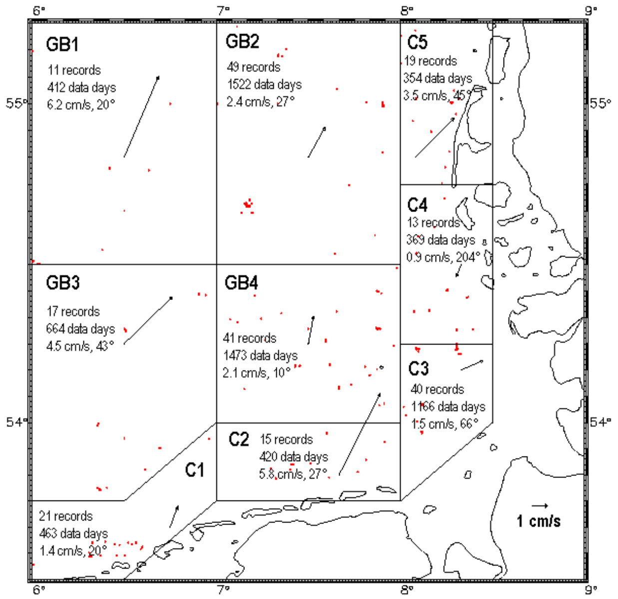

Figure 9: Vector mean of the flow in the near-surface layer (measuring depth 3 to 12 m). The measurement positions are marked with a red dot (BSH 2002)

2.3.2.4 Sea state

In the case of sea state, a distinction is made between the waves generated by the local wind (the wind sea) and the swell. Swells are waves that have left their area of origin and enter the maritime area under consideration. The swell entering the southern North Sea is generated by storms in the North Atlantic or the northern North Sea. The swell has a longer period than the wind sea. The height of the wind sea depends on the wind speed and the time over which the wind acts on the water surface (duration of action) and on the length of the swell (fetch) (i.e. the distance over which the wind acts). For example, the strike length in the German Bight is considerably smaller for easterly and southerly winds than for northerly and westerly winds. The significant or characteristic wave height (i.e. the mean wave height of the upper third of the wave height distribution) is given as a measure of the wind sea.

In the climatological annual cycle (1950–1986), the highest wind speeds (about 9 m/s) in the inner German Bight occur in November and then drop to 7 m/s by February. In March, the speed reaches a local maximum of 8 m/s, after which it drops rapidly and remains at a flat level of around 6 m/s between May and August, before rising just as rapidly from mid-August to the maximum in late autumn (BSH, 1994). This annual trend, based on monthly averages, is transferable to the height of the sea state. For the inner German Bight, the directional distribution of the swell for the unmanned lightship UFS German Bight (formerly UFS Deutsche Bucht) shows – analogous to the distribution of the wind direction – a distribution with a maximum for sea state from the west/south west and a second maximum from the east/south east (LOEWE et al. 2003).

2.3.2.5 Temperature, salinity and seasonal stratification

Water temperature and salinity in the German EEZ are determined by large-scale atmospheric and oceanographic circulation patterns, freshwater inputs from the Weser and Elbe rivers and energy exchange with the atmosphere. The latter applies in particular to sea surface temperature (LOEWE ET AL., 2003). The seasonal minimum temperature in the German Bight usually occurs at the end of February/beginning of March, seasonal warming begins between the end of March and the beginning of May, and the temperature maximum is reached in August. Based on spatial mean temperatures for the Deutsche Bucht, SCHMELZER ET AL. (2015) find extreme values of 3.5°C in February and 17.8°C in August for the period 1968–2015. This corresponds to a mean amplitude of 14.3 K with the annual difference between maximum and minimum varying between 10 and 20 K. With the onset of seasonal warming and increased irradiation, thermal stratification sets in between the end of March and the beginning of May in the north-western German Bight at water depths of over 25–30 m. With pronounced stratification, vertical gradients of up to 3 K/m are measured in the temperature jump layer (thermocline) between the warm surface layer and the colder soil layer; the temperature difference between the layers can be up to 10 K (LOEWE et al., 2013). Flatter areas are generally mixed, even in summer, as a result of turbulent tidal currents and wind-induced turbulence. With the beginning of the first autumn storms, the German Bight is again thermally vertically mixed.

The time series of the annual mean spatial temperatures of the entire North Sea based on the temperature maps published weekly by the BSH since 1968 show that the course of the sea surface temperature (SST) is not characterised by a linear trend, but by regime changes between warmer and colder phases (see also Fig. 3-28 in BSH 2005). The extreme warm regime of the first decade of the new millennium – in which the annual mean North Sea SST fluctuated around a mean level of 10.8°C – ended with the cold winter of 2010 (Figure 10). After four considerably cooler years, the North Sea SST reached its highest annual mean of 11.4°C in 2014.

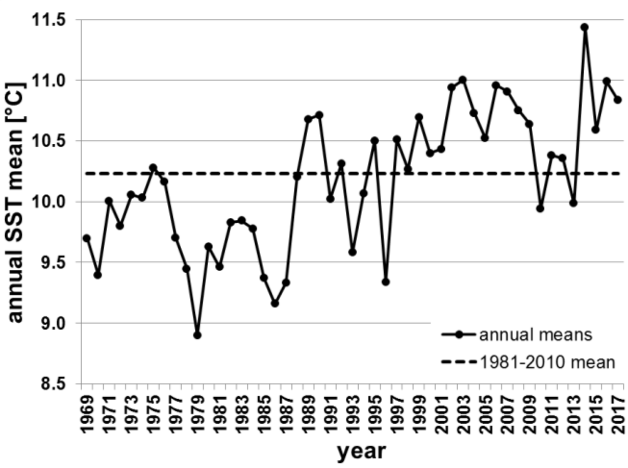

Figure 10: Annual mean North Sea surface temperature for the years 1969–2017.

With regard to climate-related changes, QUANTE ET AL. (2016) expect an increase in SST of 1–3 K by the end of the century. Despite considerable differences in the model simulations with regard to set-up, forcing from the global climate model, and bias corrections, the different projections arrive at consistent results (KLEIN ET AL. 2018).

In contrast to the temperature, the salt content does not have a clearly pronounced annual cycle. Stable salinity stratifications occur in the North Sea in the estuaries of the major rivers and in the area of the Baltic outflow. Because of tidal turbulence, the fresh water discharge of the major rivers within the estuaries mixes with the coastal water at shallow depths, but at greater depths it stratifies over the North Sea water in the German Bight. The intensity of stratification varies depending on the annual course of river discharges, which in turn exhibit considerable inter-annual variability (e.g. as a result of high meltwater run-off in spring after heavy snow winters). For example, the salinity at Helgoland Reede is negatively correlated with the discharge volumes of the Elbe. This shows that freshwater inputs cause a considerably reduced salinity near the surface near the coast (LOEWE et al. 2013), whereby the Elbe – with a discharge of 21.9 km³/year – has the strongest influence on salinity in the German Bight.

Since 1873 the salinity measurements of Helgoland Reede have been available, since about 1980 also the data at the positions of the former lightships, which were at least partly replaced by automated measuring systems later. The relocation of lightship positions and methodological problems, also in the measurements at Helgoland, led to breaks and uncertainties in the long time series and made reliable trend estimates difficult (HEYEN & DIPPNER 1998). For the annual mean surface salinity at Helgoland, no long-term trend is apparent for the years 1950-2014. This also applies to the annual discharge rates of the Elbe. Projections of the future development of salinity in the German EEZ currently differ widely in terms of temporal development and spatial patterns. Recent projections indicate a decrease in salinity of between 0.2 and 0.7 PSU by the end of the century (KLEIN et al., 2018).

2.3.2.6 Ice conditions

In the open German Bight, the heat reserve of the relatively salty North Sea water in early winter is often so large that ice can form only rarely. The open maritime area off the North and East Frisian islands is ice-free in two thirds of all winters. On average over many years, the ice edge extends right behind the islands and into the outer estuaries of the Elbe and Weser. In normal winters, ice occurs on 17 to 23 days in the protected inner fairways in the North Frisian Wadden area, and only on 2 to 5 days in the open fairways - similar to the East Frisian Wadden area.

In ice-rich and ice-rich winters, on the other hand, ice occurs on average on 54 to 64 days in the protected inner fairways in the North Frisian Wadden area, and on 31 to 42 days in the open fairways similar to the East Frisian Wadden area. In the inner tidal flats, mainly solid ice forms. In the outer tidal flats, mainly floe ice and ice slurry form; these are kept in motion by wind and tidal effects. Further information can be found in the Climatological Ice Atlas 1991–2010 for the Deutsche Bucht (SCHMELZER et al. 2015).

2.3.2.7 Fronts

Fronts in the sea are high-energy mesoscale structures (of the order of a few tens of kilometres to a few hundred kilometres) which have major impacts on the local movement dynamics of the water, biology, ecology, and – because of their ability to bring CO_2 to greater depths – the climate. In the coastal areas of the North Sea, especially off the German, Dutch and English coasts, the river plume fronts with strong horizontal salinity and suspended matter gradients are located between the freshwater input area of the major continental rivers and the continental coastal waters of the North Sea. These fronts are not static formations but consist of a system of smaller fronts and eddies with typical spatial scales between 5 and 20 km. This system is subject to great temporal variability with time scales from 1 to about 10 days. Depending on the meteorological conditions, the discharge rates of the Elbe and Weser rivers and the circulation conditions in the German Bight, frontal structures continuously dissolve and form. Only under extremely calm weather conditions can discrete frontal structures be observed over longer periods of time. During the period of seasonal stratification (approx. from the end of March to September), the tidal mixing fronts, which mark the transition area between the thermally stratified deep water of the open North Sea and the shallower, vertically mixed area as a result of wind and tidal friction, are located approximately in the area of the 30 m depth line. Because of the dependence on topography, these fronts are relatively stationary (OTTO ET AL., 1990). KIRCHES et al. (2013a–c) analysed satellite-based remote sensing data from 1990 to 2011 and constructed a climatology for SST, chlorophyll, yellow, and suspended sediment fronts in the North Sea. This shows that fronts occur year-round in the North Sea. The strength of the spatial gradient generally increases towards the coast.

Fronts are characterised by considerably increased biological activity; adjacent areas play a key role in the marine ecosystem. They influence ecosystem components at all stages – either directly or as a cascading process through the food web (ICES 2006). Vertical transport on fronts brings nutrients into the euphotic zone, thereby increasing biological productivity. The increased biological activity on fronts resulting from the high availability and effective use of nutrients, results in increased atmospheric CO_2 binding and transport to deeper layers. The outflow of these CO_2-enriched water masses into the open ocean is referred to as "shelf sea pumping" and is an essential process for the uptake of atmospheric CO_2 by the world ocean. The North Sea is a CO_2 sink in large parts all year round except or the southern areas in the summer months. Over 90% of the CO_2 absorbed from the atmosphere is exported to the North Sea.

2.3.2.8 Suspended solids and turbidity

The term “suspended matter” refers to all particles with a diameter >0.4 µm suspended in seawater. Suspended matter consists of mineral and/or organic material. The proportion of organic suspended matter is strongly dependent on the season. The highest values occur during plankton blooms in early summer. During stormy weather conditions and the resulting high sea state, the suspended matter content in the entire water column increases strongly because of the swirling up of silty-sandy bottom sediments. This is where the swell has the greatest effect. When hurricane lows pass through the German Bight, increases in the suspended matter content of up to ten times the normal values are easily possible. As water samples cannot be taken during extreme storm conditions, corresponding estimates are derived from the records of anchored turbidimeters. If one considers the temporal variability of the suspended sediment content at a fixed position, there is always a distinct half-day tidal signal. Ebb and flood currents transport the water in the German Bight on average about 10 nautical miles from or towards the coast. Accordingly, the high suspended matter content near the coast (SPM = Suspended Particular Matter) is also transported back and forth and causes the strong local fluctuations. Further variability in SPM is caused by material transport (advection) from rivers such as the Elbe and Weser and from the south-east coast of England. In Figure 11, a mean suspended sediment distribution for the Deutsche Bucht is shown. The basis for the presentation are all SPM values stored in the Marine Environmental Database (MUDAB) as of 15 October 2005.

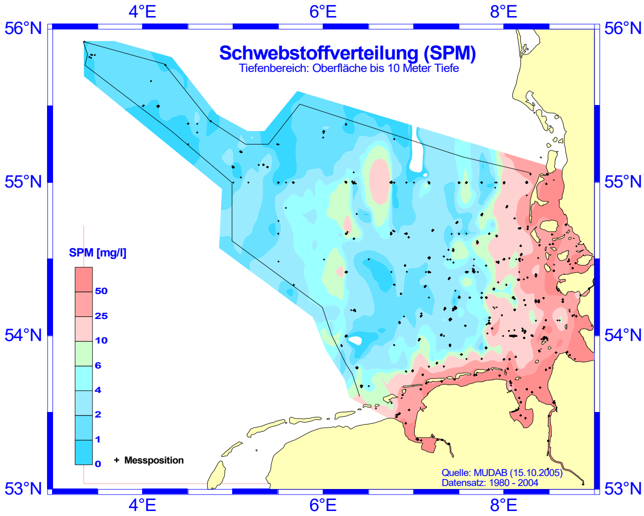

Figure 11: Suspended particulate matter (SPM) for the German North Sea.

The data set was reduced to the range “surface to 10 metres depth” and to values ≤ 150 mg/l. The underlying measured values were only obtained in weather conditions in which research vessels are still operational. Difficult weather conditions are therefore not reflected in the mean values shown here. In Figure 11, mean values of around 50 mg/l and extreme values of > 150 mg/l are measured in the mudflat areas landward of the East and North Frisian Islands and in the large estuaries. Further seawards, the values quickly decrease to a range between 1 and 4 mg/l. Slightly east of 6° E, there is an area of increased suspended sediment. The lowest SPM mean values around 1.5 mg/l are found in the north-western fringe of the EEZ and over the sandy areas between Borkum Riffgrund and the Elbe-Urstromtal.

2.3.3 Status assessment

The following parameters are used to assess water as a protected asset:

- Thermohaline layering
- Salinity
- Water depth and geomorphology,
- Turbidity,
- Tide,

- Circulation, currents,
- Water temperature,
- Water quality, nutrient and oxygen content,
- Sea state, and
- Ice conditions.

2.3.3.1 Hydrography

The hydrographic conditions result from the complex interplay of the individual parameters. These, in turn, are largely influenced and controlled by the large-scale processes in the North Atlantic.

2.3.3.2 Nutrients

Because of measures such as advanced waste water treatment technologies and the introduction of phosphate-free detergents, nutrient inputs into the North Sea have been reduced by around 50% since 1983 – and phosphorus inputs by as much as around 65% (BMEL and BMU 2020). Nevertheless, according to the 2018 MSFD Assessment (BMU 2018), 55% of German North Sea waters are still considered eutrophic. Eutrophication thus continues to be one of the greatest ecological problems for the marine environment of the German North Sea waters. The enrichment with nutrients and organic material via direct discharges, the rivers, and the air leads to undesirable biological effects such as algal mass developments or an altered species spectrum as well as other impacts such as oxygen deficits (OSPAR 2017).

2.3.3.3 Pollutants

Organic pollutants continue to be detected in elevated concentrations in the North Sea (BMU 2018a). Many of the persistent, bioaccumulative, and toxic substances will still be found in high concentrations in the marine environment decades after they have been banned. However, according to the current state of knowledge, the observed concentrations of most pollutants in seawater do not pose any immediate danger to the marine ecosystem. For most pollutants, a decreasing trend can be observed (OSPAR 2017). The exception is the contamination by perfluorooctane sulphonic acid PFOS, the concentration of which in some cases exceeds the toxicological limits near the coast (BMU 2018a). Furthermore, seabirds and harbour seals can be damaged by oil films floating on the water surface as a result of acute oil spills. According to the current state of knowledge, the aforementioned metal contamination of seawater does not pose a direct threat to the marine ecosystem.

The input of pollutants has a negative impact on the performance of the marine ecosystem of the North Sea and can seriously deteriorate it. As a result of the constant renewal of water, a dilution of pollutant concentrations occurs, thereby resulting in a corresponding medium sensitivity to the aforementioned effects. However, prolonged and excessive pollution can severely damage the North Sea ecosystem.

2.3.4 Conclusion

Because of the complex natural interaction structure and the unknown interrelationships of the many pollutants – even if they are largely present in low concentrations – the assessment of water also plays a role in the population assessment of fish, macrozoobenthos, and seabed.

Water as a protected asset is characterised by medium naturalness as a result of the existing pollution caused by eutrophication.

The legacy impact on water as a protected asset is rated as “high”.

2.4 Biotopes

According to von Nordheim & Merck (1995), a marine biotope is a characteristic, typified marine habitat. With its ecological conditions, a marine biotope offers largely uniform conditions for biotic communities in the sea that differ from other types. Typification includes abiotic (e.g. moisture, nutrient content) and biotic features (occurrence of certain vegetation types and structures, plant communities, animal species).

The current biotope classification of the North Sea and Baltic Sea has been published by the Federal Agency for Nature Conservation (BfN) in the Red List of Threatened Biotope Types in Germany (FINCK et al. 2017).

2.4.1 Availability of data

The data sources for the status description and assessment of biotopes in the EEZ of the North Sea are described in the Environmental Report on SDP 2020 (BSH 2020a).

An up-to-date description of the biotopes in Site N-7.2 was initially based on data from the autumn 2019 and spring 2020 campaign (interim report). After the completion of the 2020 autumn campaign, these data were also included in the analyses and evaluations; this confirmed the results of the first two investigations (IFAÖ, 2021a).

So far, there is no detailed mapping of biotopes, including legally protected biotopes according to Section 30 BNatSchG, in the EEZ outside the nature conservation areas. A detailed and area-wide mapping of marine biotopes in the EEZ is currently being developed within the framework of ongoing R&D projects of the BfN with a spatial focus on nature conservation areas.

2.4.2 Status assessment

The population assessment of the biotopes occurring in the German marine area is based on the national protection status as well as the endangerment of these biotopes according to the Red List of Threatened Biotope Types in Germany FINCK et al. 2017).

In the area of Site N-7.2, primarily the two biotopes “Sublittoral, flat sandy bottom of the North Sea with *Nucula nitidosa* community – open North Sea only” (code 02.02.10.05) and “Sublittoral, flat sandy bottom of the North Sea with *Amphiura filiformis* community – open North Sea only” (code 02.02.10.02.01) are encountered.

For the biotopes type “Sublittoral, flat sandy bottom of the North Sea with *Nucula nitidosa* community – open North Sea only, the character species *Abra alba, Abra nitida, Amphictene auricoma, Amphiura filiformis, Nephtys hombergii, Phaxas pellucidus, Scalibregma inflatum*, and *Tellimya ferruginosa* as well as the secondary species *Eudorella truncatula, Magelona alleni, Notomastus latericeus*, and *Thyasira flexuosa* are indicated by FINCK et al. (2017). All of these species were detected in Site N-7.2, although some occurred in low or highly variable presences and densities of individuals. The by definition characteristic species *Scalibregma inflatum* was detected only in autumn 2019 and, in fact, functioned only as a companion species in the faunal community.

The character species indicated by FINCK et al. (2017) for the biotopes “Sublittoral, flat sandy bottom of the North Sea with *Amphiura filiformis* community – open North Sea only” are *Amphiura filiformis, Kurtiella bidentata, Harpinia antennaria,* and *Pholoe baltica*. All four species were detected in Site N-7.2 with presences of at least 80% in both survey campaigns. The eponymous character species of the biotope, *Amphiura filiformis,* was the main species with the highest individual densities and a presence of 100% during the infauna analysis.

The two biotopes that occur are classified as “conditionally regenerable” (Category B) with a regeneration time of up to 15 years and are not listed as protected biotopes in accordance with Section 30 BNatSchG.

No indications of legally protected biotopes were found in the SEA for the SDP (BSH 2020a). This assessment is supported by the results of the preliminary investigation to date. No biotopes protected according to Section 30 BNatSchG were found in the investigation area.

2.5 Benthos

Benthos is the term used to describe all biological communities bound to substrate surfaces or living in soft substrates at the seabed of water bodies. Benthic organisms are an important component of the North Sea ecosystem. They are the main food source for many fish species and play a crucial role in the conversion and remineralisation of sedimented organic material (KRÖNCKE 1995). The zoobenthos of the North Sea is composed of many systematic groups and shows a wide variety of behaviours. Overall, this fauna is quite well investigated and therefore allows comparisons with conditions a few decades ago.

2.5.1 Availability of data

The data for the status description and assessment of the macrobenthos in the EEZ of the North Sea is described in the Environmental Report on SDP 2020 (BSH 2020a).

An up-to-date description of the macrobenthos in Site N-7.2 was initially based on data from the autumn 2019 and spring 2020 campaign (interim report). After the completion of the 2020 autumn campaign, these data were also included in the analyses and evaluations; this confirmed the results of the first two investigations (IFAÖ, 2021a).

It is currently not possible to reliably predict the anticipated effects of the introduction of hard substrate on the development of benthic communities.

2.5.2 Status description

As part of the preliminary investigation of N-7.2, investigations of the benthic communities (infauna and epifauna) were carried out in accordance with the requirements of the scope of the preliminary investigation and StUK4 (BSH, 2013). In total, 20 infauna stations were sampled with a van Veen grab and 10 epifauna stations with a 2 m beam trawl in autumn 2019 and spring 2020, respectively.

2.5.2.1 Infauna

In Site N-7.2, a 182 taxa of the infauna were recorded during the 1st year of investigation; of these 132 were identified to species. In total, 133 of the taxa were recorded in autumn 2019, while 143 taxa were recorded in spring 2020. The mean number of taxa per station did not differ significantly between the autumn 2019 (48 taxa) and spring 2020 (50 taxa) investigations.

In autumn 2019, the following species were steadily occurring at all stations: *Callianassa subterranea*, *Amphiura filiformis*, *Abra alba*, *Chamelea striatula*, *Corbula gibba*, *Nucula nitidosa*, *Turritellinella tricarinata*, *Nephtys hombergii*, and *Spiophanes bombyx*. In spring 2020, the following species were detected at each station: *Callianassa subterranea*, *Amphiura filiformis*, *Abra alba*, *Corbula gibba*, *Cylichna cylindracea*, *Kurtiella bidentata*, *Nucula nitidosa*, *Turritellinella tricarinata*, *Nephtys hombergii*, *Pholoe baltica*, and *Spiophanes bombyx*.

Mean total abundance did not differ significantly between the autumn 2019 (1,381 ind./m²) and spring 2020 (1,129 ind./m²) surveys. The highest proportion of abundance was accounted for by the secondary species (28.0%) followed by *Amphiura filiformis* (25.7%). Subdominant species were the polychaeta *Spiophanes bombyx* (8.9%) and *Pholoe baltica (3.3%), the bivalves Kurtiella bidentata* (6.5%), *Nucula nitidosa* (6.1%), *Corbula gibba* (4.8%), and *Abra alba* (4.4%), the decapod *Callianassa subterranea* (5.9%), and representatives of Phoronidae. (6.4%).

In spring 2020, there was also no eudominant main species. Dominant main species were *Amphiura filiformis* (18.2%), *Nucula nitidosa* (11.9%), and individuals of the genus *Abra* sp. (11.4%). *Corbula gibba* (6.1%), *Kurtiella bidentata* (5.1%), *Abra alba* (5.1%), *Turritellinella tricarinata* (4.3%), and *Callianassa subterranea* (5.2%) were classified as sub-dominant species. The remaining 120 taxa occurred only as companion species (34.3%) with a relative abundance of < 3.2%.

Mean diversity was not significantly different between the autumn 2019 (4.14) and spring 2020 (4.21) investigations. For the mean evenness, no significant difference was found between autumn (0.75) and spring (0.76).

The mean total biomass was significantly higher in spring 2020 (189 g/m²) than in autumn 2019 (107 g/m²).

In both seasons, the common heart urchin *Echinocardium cordatum* was the only major eudominant species in terms of biomass (52.5% in autumn, 77.0% in spring). In autumn 2019, *Amphiura filiformis* (11.6%) and *Turritellinella tricarinata* (10.4%) were dominant species in terms of biomass, whilst *Gari fervensis* and *Nephtys hombergii* were sub-dominant with 4.3% each. In spring 2020, *Turritellinella tricarinata* (4.7%) and *Amphiura filiformis* (3.3%) were classified as sub-dominant.

The macrozoobenthos in the area of Site N-7.2 is a transitional community of the *Nucula nitidosa* community and the Amphiura filiformis community according to RACHOR & NEHMER (2003) and PEHLKE (2005). The silt area of the inner German Bight, which are largely bounded by the 30 m depth contour, are colonised by the *Nucula nitidosa* community (RACHOR & NEHMER 2003). Accordingly, *Nucula nitidosa* and *Abra alba* were detected as character species with a presence of 100% in both investigations. In contrast, the third character species for this community, *Scalibregma inflatum*, was detected only in autumn 2019 as a companion species with a presence of only 20% and was not detected at all in spring 2020.

In addition to species of the *Nucula nitidosa community*, typical faunal elements of the *Amphiura filiformis* community were also detected. The character species for this community of mudflats in the outer EEZ, *Amphiura filiformis*, was the main infauna species with the highest number of individuals in Site N-7.2. In addition, the character species *Kurtiella bidentata* (formerly *Mysella bidentata*) and the characteristic species *Corbula gibba* were found to be major sub-dominant major in Site N-7.2. The third of the three character species, *Harpinia antennaria*, was detected only as a companion species in terms of abundance but quite frequently (at least 80% presence) in both campaigns. With the exception of the characteristic species *Ennucula tenuis* (formerly *Nuculoma tenuis*) and *Galathowenia oculata* , all character species and characteristic and secondary species of the *Amphiura filiformis* community were thus detected in Site N-7.2.

The community values obtained in Site N-7.2 for abundance, biomass, diversity, evenness, and taxa count of the infauna fit well with the results described by DANNHEIM et al. (2014) for the *Nucula nitidosa* community and the geo-cluster “NW DB I”.

2.5.2.2 Epifauna

In total, 86 taxa of the epifauna were recorded in Site N-7.2 in autumn 2019 and spring 2020; of these 68, were identified at the species level. During both survey campaigns, the common hermit crab *Pagurus bernhardus*, the echinoderms *Asterias rubens, Astropecten irregularis*, *Echinocardium cordatum*, and *Ophiura ophiura*, and the snail *Turritellinella tricarinata* were recorded at each station. The mean number of taxa per station did not differ significantly between the autumn 2019 (22 taxa) and spring 2020 (21 taxa) investigations.

Mean total abundance did not differ significantly between the autumn 2019 (0.19 ind./m²) and spring 2020 (0.12 ind./m²) investigations. In autumn 2019, *Pagurus bernhardus* (28.9%), *Ophiura ophiura* (24.1%), and *Asterias rubens* (17.8%) were ranked as dominant species. Subdominant species were *Pisidia longicornis* (9.7%), *Liocarcinus holsatus* (5.4%), *Ophiura albida* (7.8%), and *Astropecten irregularis* (4.1%). In spring 2020, *Ophiura ophiura* was the main eudominant species in Site N-7.2 and accounted for 33.4% of the total abundance. The species

Astropecten irregularis (25.6%) and *Corystes cassivelaunus* (11.8%) were classified as dominant. Sub-dominant species were *Pagurus bernhardus* (8.4%), *Asterias rubens* (7.5%), *Ophiura albida* (5.8%), and *Aphrodita aculeata* (4.7%).

The mean diversity of the epifauna did not differ significantly between the sampling in autumn 2019 (2.24) and spring 2020 (2.41). Also for the mean evenness, no statistically significant difference was found between autumn (0.74) and spring (0.77).

Similarly, no statistically significant difference was detected for mean biomass between they autumn 2019 (1.29 g/m²) and spring 2020 (1.07 g/m²) surveys. In autumn 2019, the starfish *Asterias rubens* (61.7%) was the main eudominant species. *Pagurus bernhardus* (10.9%) was recorded as dominant. Sub-dominant species were *Liocarcinus holsatus (8.9%)*, *Ophiura ophiura* (7.4%), and *Astropecten irregularis* (3.4%). In spring 2020, six species accounted for ≥ 10% of the total biomass: *Aphrodita aculeata* (23.1%), *Asterias rubens* (18.3%), *Astropecten irregularis* (14.9%), *Ophiura ophiura* (10.7%), *Cancer pagurus* (12.4%), and *Corystes cassivelaunus* (12.4%). The only subdominant species was *Pagurus bernhardus* (3.2%).

The values determined in Site N-7.2 for abundance, biomass, diversity, evenness, and taxa count of the epifauna fit well into the results described by DANNHEIM et al. (2014) for the community “Transition I” as well as for the geo-cluster “NW DB I”.

2.5.2.3 Red List species

Of the total 225 taxa of infauna and epifauna recorded in autumn 2019 and spring 2020 in Site N-7.2, 162 taxa were identified at the species level. Twenty-three of these species are listed as vulnerable or rare in the Red List for Germany (RACHOR et al. 2013) because of their population situation or development. This corresponds to a proportion of Red List species in the total number of species of 14.2%.

No species considered lost (RL category 0) or critically endangered (RL category 1) were recorded. The only species considered endangered (RL category 2) was the polychaeta species *Sabellaria spinulosa*, which was detected in spring 2020 with a presence of 10–20%.

Three of the species detected in Site N-7.2 are considered vulnerable (category 3): the dead man’s fingers *Alcyonium digitatum*, the sea anemone *Sagartiogeton undatus*, and the polychaeta species *Sigalion mathildae*. The three species were all detected in autumn 2019; during both campaigns, only *Sigalion mathildae* was detected.

Fourteen of the species found are listed as indeterminate (RL category G). Five other species are considered extremely rare (RL category R). In addition, *Photis longicaudata* is near-threatened species; however, it is neither vulnerable nor rare.

Overall, none of the macrozoobenthos species detected in Site N-7.2 have a protection status according to BArtSchV or are listed in Annexes II and IV of the Habitats Directive.

2.5.3 Status assessment of the protected asset benthos

The benthos of the EEZ of the North Sea is subject to changes because of both natural and anthropogenic influences. In addition to natural and weather-related variability (severe winters), the main influencing factors are demersal fishing, sand and gravel extraction, the introduction of non-indigenous species, eutrophication of the water body, and climate change.

2.5.3.1 Rarity and threat

The number of rare or vulnerable species is taken into consideration. The rarity of/threat to the population can be assessed based on the confirmed species on the Red List.

In Site N-7.2, 23 species on the Red List of RACHOR et al. (2013) that are considered vulnerable or rare were recorded. No species considered lost (Rl category 0) or critically endangered (RL category 1) were detected. The endangered (RL category 2) species *Sabellaria spinulosa* was found in relatively low presence and abundance in Site N-7.2. Of the three species classified as vulnerable (category 3)*(Sagartiogeton undatus, Alcyonium digitatum*, and *Sigalion mathildae*), only one species, *Sigalion mathildae*, occurred during both periods of investigation.

Based on the Red List species found and their abundances, the benthic communities of Site N-7.2 are assigned medium importance with regard to the criterion of rarity and threat. This confirms the assessment of the environmental report on SDP 2020 (BSH 2020a), according to which the benthic communities detected in Area N-7 are neither considered rare nor threatened.

2.5.3.2 Diversity and uniqueness

This criterion refers to the number of species and the composition of the species communities. The extent to which species or communities characteristic of the habitat occur and how regularly they occur is assessed.

The benthic community found in Site N-7.2 can be described as a transitional community of the *Nucula nitidosa* community according to RACHOR & NEHMER (2003) with typical elements of the *Amphiura filiformis* community. Typical representatives of this community were detected in the first year of the preliminary investigations. Of the total of about 750 known species in the German EEZ, 225 taxa of the epifauna and infauna (162 taxa determined to species level) were recorded in Site N-7.2. Three non-native species were detected: *Austrominius modestus, Loimia ramzega*, and *Tricellaria inopinata* .

Based on these results, the benthic community of Site N-7.2 is assigned medium importance with regard to the criterion of diversity and uniqueness. This confirms the assessments of the environmental report on SDP 2020 (BSH 2020a), according to which a benthic community with average species diversity occurs in the vicinity of Site N-7.2.

2.5.3.3 Legacy impact

For this criterion, the intensity of fishing exploitation, which is the most effective direct disturbance variable for the benthos (e.g. HIDDINK et al., 2019, EIGAARD et al., 2016, BUHL-MORTENSEN et al., 2015, and literature cited therein), is used as the assessment benchmark. Benthic communities can also be adversely affected through eutrophication. For other disturbance variables (e.g. shipping traffic, pollutants), there is currently a lack of suitable measurement and detection methods to be able to include them in the assessment.

Because of the bottom-disturbing trawling that takes place in Site N-7.2, it can be assumed that the dominance structures found, especially within the epibenthic community, result from anthropogenic influence. According to PEDERSEN et al. (2009), fishing with small and large beam trawl in particular takes place in the investigation area. Although fishing has decreased in the North Sea since the early 2000s because of EU regulations (ICES, 2018a), it continues to strongly influence benthic communities in this area of the North Sea. Since the 1980s, nutrient inputs to the North Sea have been reduced by 50% (BSH, 2019a). Large parts of the German EEZ in the North Sea were classified as eutrophic in the period from 2006 to 2014(BROCKMANN et al. 2017). However, despite this information, suitable measurement and detection methods for quantifying the effects of eutrophication are still lacking.

Long-lived mussel species such as *Mya arenaria* and *Arctica islandica* were not found in Site N-7.2 during the investigations in autumn 2019 and spring 2020. On the other hand, the faunal community consisted partly of numerous short-lived, opportunistic groups such as Amphipoda and Polychaeta.

With regard to the criterion “legacy impact”, the benthic ecosystem in Site N-7.2 is assigned medium importance.

2.5.3.4 Importance of Site N-7.2 for benthos

The individual criteria, each rated “medium”, result in an overall medium rating for the benthic ecosystem of site N-7.2. This assessment confirms the average overall assessment of the Environmental Report on SDP 2020 (BSH 2020a) for sites in the area of Area N-7.

2.6 Fish

As the most species-rich of all vertebrate groups living today, fish are equally important in marine ecosystems as predators and prey. The most important influences on fish populations, fishing, and climate change (HOLLOWED et al. 2013, HEESSEN et al. 2015) interact and can hardly be distinguished with respect to their relative impact (DAAN et al. 1990, VAN BEUSEKOM et al. 2018).

2.6.1 Availability of data

Because data are available almost exclusively from bottom trawling and not from pelagic sampling, the following assessment can be made for demersal fish only. For pelagic fish, there are no data that represent the species spectrum or which were collected in connection with offshore wind farms. A reliable assessment of the pelagic fish community is therefore not possible. An up-to-date description of the (bottom-dwelling) fish at Site N-7.2 was initially based on data from the autumn 2019 and spring 2020 campaign (interim report). After the completion of the 2020 autumn campaign, these data were also included in the analyses and evaluations; this confirmed the results of the first two investigations (IFAÖ, 2021a). In addition, the Environmental Report on Site Development Plan 2020 for the German North Sea (BSH 2020a) and the Database of Trawl Surveys (DATRAS) of the International Council for the Exploration of the Sea (FROESE & PAULY 2019, accessed November 2020) were consulted. In order ensure spatial and temporal comparability with the catch data from the preliminary investigation of sites, DATRAS data from plan square 37F6 from the 1st and 3rd quarters of 2019 and 2020 were used as a reference. It should be taken into consideration that the DATRAS data were carried out with different fishing gear as well as deviating haul numbers and towing times compared with the investigations of the environmental impact studies. These results are therefore used only for the representation of the species spectrum and the presences of the fish.

In the following, Area N-7.2 is depicted in area. Furthermore, Area 37F6 is considered; this includes the project and reference area N-7.2 and the DATRAS data mentioned above.

2.6.2 Status description

In order to be able to narrow down possible influences of OWF on fish in Chapter 4.5, it is useful to first differentiate the species according to their mode of life and their life cycle. Furthermore, knowledge of feeding patterns, reproduction and habitat use, can provide important clues as to the importance of an area or site for fish.

2.6.2.1 Mode of life

At almost 60%, predominantly bottom-dwelling (demersal) species make up the largest proportion of the North Sea fish community followed by open-water (pelagic; 20%) and benthopelagic (15%) species, which are found mainly just above the seabed. Only about 5% cannot be assigned to any of the three modes of life because of a close habitat connection (FROESE & PAULY 2019). This categorisation applies to the adult stages of the fish. However, the individual developmental stages of the species often differ more from each other in form and behaviour than the same stages of different species. Most of the fish species found in the North Sea complete their entire life cycle there – from egg to spawning adult – and are therefore described as permanent residents. These include herring, plaice, and whiting (LOZAN 1990). Other marine species such as red and grey gurnard occur regularly in the North Sea as "summer visitors" mainly in summer but without clear signs of reproduction, whilst the "stray visitors", including bream mackerel or halibut, occur irregularly and usually only as single specimens in the North Sea regardless of the season.

The life cycle of diadromous species includes marine and freshwater – either with marine spawning grounds and limnetic nursery grounds (catadromous (e.g. eel)) or vice versa (anadromous (e.g. smelt, twaite shad, or salmon)).

Finally, fish can be assigned to functional guilds based on their feeding, reproduction, or habitat use. Unlike taxonomic classification, these make it easier to describe the functions of fish in the ecosystem (ELLIOTT et al. 2007).

2.6.2.2 Spatial and temporal distribution

The spatial and temporal distribution of fish is determined first and foremost by their life cycle and associated migrations of the various developmental stages (HARDEN-JONES 1968, WOOTTON 2012, KING 2013). The framework for this is set by many different factors that take effect on different spatial and temporal scales. Hydrographic and climatic factors such as sea state, tides, and wind-induced currents as well as the large-scale circulation of the North Sea have a large-scale effect. On medium (regional) to small (local) space-time scales, water temperature and other hydrophysical and hydrochemical parameters as well as food availability, intra- and interspecific competition, and predation, which includes fishing, have an impact. Another crucial factor for the distribution of fish in time and space is habitat. In a broader sense, this means not only physical structures but also hydrographic phenomena such as fronts (MUNK et al. 2009) and upwelling areas (GUTIERREZ et al. 2007), where prey can aggregate and thus initiate and maintain entire trophic cascades.

The diverse human activities and influences are further factors that can influence fish distribution. They range from nutrient and pollutant discharges to the obstruction of migratory routes of migratory species and fishing to structures in the sea that some fish species use as spawning substrates (sheet piling for herring spawn) or food sources (fouling of artificial structures) (EEA 2015). In addition, fish species could aggregate on newly introduced structures. Further information can be found in Chapter 4.5 .

2.6.2.3 Characterisation of the fish community

KLOPPMANN et al. (2003) detected a total of 39 fish species during a one-off investigation to record fish species of Appendix II Habitats Directive in the German EEZ in the areas of Borkum-Riffgrund, Amrum-Außengrund, Osthang Elbe-Urstromtal, and Doggerbank in May 2002. This study revealed a gradual change in the species composition of the fish communities from the inshore to the offshore areas because of hydrographic conditions. These changes were confirmed by DANNHEIM et al. (2014a), who were able to geographically deliniate four fish communities in the German EEZ using effort-corrected catch figures: The largest formed the central community (ZG), which were demarcated in the north by the two communities of the Duck's bill (ES I and ES II) and along the coast by a coastal community (KG). These four fish communities basically had a similar species composition but with different, species-specific abundances. Dab generally dominated and occurred quite regularly with plaice and dab predominating in the offshore community ES II. Plaices were also regularly found in the central transitional community. Dragonets, yellow sole, and hooknose were characteristic of the coastal community of demersal fish. Yellow sole and dragonets were also regularly found in the central transitional community. The species composition and distribution of demersal fish showed gradual changes from the offshore community to the central community to the nearshore areas.

According to this classification (Dannheim et al. 2014a), Site N-7.2 lies at the transition between the central and coastal communities.

RAMBO et al. (2017) identified diversity hotspots of the demersal fish community in the Northern silt bottoms and Borkum Riffgrund. Less diverse areas are found on Doggerbank and the southern Duck's Bill (RAMBO et al. 2017). Site N-7.2 lies outside the hotspot areas.

2.6.3 Status assessment

The status assessment of the demersal fish community is carried out based on

- the rarity and threat,
- the diversity and uniqueness as well as
- the legacy impact.

These three criteria are defined below and applied to Site N-7.2. The importance of the area is then considered with reference to the life cycle of the fish community.

2.6.3.1 Rarity and threat

The rarity of and threat to the fish community is assessed based on the proportion of species in the respective surveys (see 2.6.1) that have been assigned to one of the standardised Red List categories according to the current Red List and Total Species List of Marine Fishes (THIEL et al. 2013) and for the diadromous species of the Red List of Freshwater Fishes (FREYHOF 2009):
0: Extinct or lost,
1: critically endangered
2: endangered,
3: vulnerable
G: Indeterminate
R: extremely rare
V: Near-threatened
D: Data insufficient
*: unthreatened
The relative proportions of Red List species in these assessment classes are related to the relative proportions of species from data sources mentioned in 2.6.1. An overview can be found in Table 6. Special attention is paid also to the endangerment situation of species listed in Appendix II of the Habitats Directive. They are the focus of Europe-wide conservation efforts and require special conservation measures.

In total, 34 species from 21 families were recorded on Site N-7.2 during the preliminary investigation in autumn 2019 and spring 2020. Of these, according to THIEL et al. (2013), no species is considered extinct or lost (0). With the thornback ray, two individuals of critically endangered species were detected (1). The haddock caught in autumn 2019 is considered endangered (2). None of the species detected on Site N-7.2 are classified as vulnerable (3) or indeterminate (G). With the spotted ray, an extremely rare species (R) was recorded. With sole, turbot, cod, and Atlantic mackerel, four species were registered as near-threatened (V). For another three species, the availability of data for an assessment is considered insufficient (D) (reticulated dragonet, sand goby, and Lozano's goby). Of the 34 species recorded during the preliminary investigation of sites on Site N-7.2, 24 are considered to be unthreatened (*).

In the surrounding maritime area 37F6, 50 fish species were recorded during fish biology investigations (see 2.6.1). In addition to the species identified, other species adapted to the local geological and hydrographical conditions may occur on Site N-7.2. In this section, the species that have not yet been detected in the project site N-7.2 but which have been detected in the reference area or during the further trawl surveys (DATRAS, see 2.6.1) are presented as well.

According to THIEL et al. (2013), the female spiny dogfish recorded in the area is critically endangered (1). Additional endangered (2), vulnerable (3) or extremely rare (R) species have not been detected in the maritime area so far. The threat level (G) for the ocean pipefish is assumed to be indeterminate. With the twaite shad, a further near-threatened species (V) was recorded. The twaite shad is also listed in Annex II of the Habitats Directive (THIEL & WINKLER 2007). For four other species, the availability of data for an assessment is considered insufficient (D) (spotted dragonet, greater spotted sand eel, lesser sand eel, and Tobias fish).

In the Red List of Marine Fishes, 27.1% of the species assessed are assigned to an endangerment category (0, 1, 2, 3, G, or R), 6.5% are near-threatened, and 22.4% cannot be assessed because of a lack of data. Overall, 43.9% of the species are considered to be unthreatened (THIEL et al. 2013, Table 6).

Of the fish species detected during the preliminary investigation at Site investigation N-7.2, 8.7% have an endangerment status of categories 0–3, G, and R (1, 2: 5.8%; R: 2.9%). 11.8% of the species are near-threatened. For a further 8.8% of the species detected, no threat can be determined because there was insufficient availability of data (D). The largest proportion (70.6%) is made up of unthreatened species (Table 6).

When considering the entire area 37F6, the number of species with an endangerment status of 0–3, G, and R increases (1, 2: 6%, G, R: 4%). 10% of the fish species recorded so far in maritime area 37F6 are classified as being near-threatened; for 14%, there is insufficient availability of data for an assessment. Overall, as in Site N-7.2, more than half of all species recorded are classified as unthreatened (66%; Table 6).

Extinct or lost species (0) were not detected on Site N-7.2 nor in the surrounding maritime area 37F6. The relative proportion of critically endangered (1), endangered (2), and vulnerable (3) species is considerably lower than in the North Sea as a whole. Thus, Site N-7.2 tends to be of below-average importance for species in the endangerment categories 0–3. The proportion of fish species with an unknown threat level (G) is also lower than in the North Sea. For extremely rare species (R), N-7.2 has a below-average to average importance, while the relative proportion of category V species is clearly above that of the North Sea (Table 6).

Species of endangerment categories 1, 2, and R were recorded as individual specimens in Area N-7.2. The critically endangered thornback ray prefers sandy, muddy soils (ZIDOWITZ et al. 2017). Since 2018, single individuals have been increasingly recorded during several environmental impact assessments in the maritime area of the German EEZ. The presence of the thornback ray on Site N-7.2 can therefore not be ruled out. The spiny dogfish is a cosmopolitan (ZIDOWITZ et al. 2017) and occurs as a bottom-dwelling species up to water depths of over 900 m (HEESSEN et al. 2015). In the North Sea, however, this species prefers areas with water depths of 60–200 m (HEESSEN et al. 2015). In the shallower areas of the German Bight, this species is atypical (CAMPHYSEN & HENDERSON 2017). The Habitats Directive species twaite shad was recorded as a single pelagic migratory species. Its main distribution is in the estuaries of rivers; a regular occurrence in Site N-7.2 is thus not to be expected.

In the overall assessment, the fish fauna in Site N-7.2 is therefore rated as average with regard to the criterion of rarity and threat.

Table 6: Absolute number of species and relative proportion of Red List categories of fish detected during the preliminary investigation of sites (FVU) on Site N-7.2, during environmental impact assessments (EIA) in the maritime area “Nördlich Borkum” and in the entire German North Sea (Red List and total species list, THIEL et al. 2013).

Red List Category	FVU N-7.2		Maritime area 37F6		German North Sea (Thiel et al. 2013)	
	Absolute number of species	Relative proportion [%]	Absolute number of species	Relative proportion [%]	Absolute number of species	Relative proportion [%]
0: Extinct or lost	0	0.0	0	0.0	3	2.8
1: Critically endangered	1	2.9	2	4.0	8	7.5
2: Endangered	1	2.9	1	2.0	7	6.5
3: Vulnerable	0	0.0	0	0.0	2	1.9
G: Indeterminate	0	0.0	1	2.0	5	4.7
R: Extremely rare	1	2.9	1	2.0	4	3.7
V: Near-threatened	4	11.8	5	10.0	7	6.5
D: Data insufficient	3	8.8	7	14.0	24	22.4
***:** Unthreatened	24	70.6	33	66.0	47	43.9
Total number of species	34		50		107	

2.6.3.2 Diversity and uniqueness

The diversity of a fish community can be described by the number of species (α-diversity, 'species richness'). The species composition can be used to assess the uniqueness of a fish community (i.e. how regularly habitat-typical species occur). Below, diversity and uniqueness are compared and assessed between the entire North Sea and N-7.2 as well as maritime area N37F6.

Over 200 species of fish have been recorded in the North Sea to date (YANG 1982, DAAN 1990: 224, LOZAN 1990: > 200, FRICKE et al. 1994, 1995, 1996: 216, WWW.FISHBASE.ORG: 209; last revised: 24 February 2017), whereby most of the species are rare individual records. Less than half of them reproduce regularly in the German Exclusive Economic Zone (EEZ) or are encountered as larvae, juveniles, or adults. According to these criteria, only 107 species are considered established in the North Sea (THIEL et al. 2013). The International Bottom Trawl Survey (IBTS) detected 99 fish species throughout the North Sea between 2014 and 2018. The fish community of sandy seabeds in the southern North Sea is characterised by the species dab, plaice, yellow sole, scaldfish, whiting, sand goby, common dragonet, hooknose, and lesser sand eel (DAAN et al. 1990, REISS et al. 2009).

In total, 34 species, including all typical flatfish and roundfish species, were recorded on Site N-7.2. The species dab, scaldfish, plaice, and yellow sole dominated the catches during the preliminary investigation of sites campaigns in autumn and spring and together represented more than 90% of the total individual density. In addition, character species included whiting in autumn 2019 and grey gurnard in spring 2020. In addition, the species common dragonet, red gurnard, sand goby, sole, turbot, striped red mullet and fourbeard rockling were typical representatives of the fish fauna in Site N-7.2. Also during the investigations on wind farm clusters 6-8, the demersal fish fauna was mainly dominated by the four flatfish species dab, scaldfish, plaice, and yellow sole (BSH 2020a).

The diversity and uniqueness of the fish community in maritime area 37F6 largely correspond to those in Site N-7.2. The species composition differs with regard to individual, rare species; this is due to the larger sample size. With regard to the occurrence of habitat-typical species, biodiversity, and dominance ratios, the results for Site N-7.2 and the maritime area "Nördlich Borkum" are consistent. In total, 50 fish species were detected in maritime area 37F6 during the trawl surveys (see 2.6.1).

Species of the central fish community (Dannheim et al. 2014a) represent the largest proportion in terms of biodiversity. Individual rare species of the coastal community diversify the fish fauna in N-7.2. Consequently, the diversity and uniqueness in Area N-7.2 is characterised by a typical species and dominance structure of fish fauna. Because of the diversity of species in the maritime area "Nördlich Borkum", the diversity and uniqueness in area N-7.2 is assessed as average.

Table 7: Total species list of the fish species detected in project site N-7.2 and in maritime area 37F6 (DATRAS, N-7.2 project and reference sites) with their Red List Status of the North Sea region (RLS) according to Thiel et al. 2013 as well as their mode of life (p = pelagic, d = demersal).

Fish species	Common name	Mode of life	RLS	N-7.2	37F6
Scomber scombrus	Atlantic mackerel	p	V	x	x
Pholis gunnellus	Butterfish	d	*		x
Hippoglossoides platessoides	American plaice	d	*		x
Squalus acanthias	Spiny dogfish	d	1		x
Gasterosteus aculeatus	Three-spined stickleback	d	*	x	x
Engraulis encrasicolus	European anchovy	p	*		x
Alosa fallax	Twaite shad	p	V		x
Raja montagui	Spotted ray	d	R	x	x
Platichthys flesus	Flounder	d	*		x
Ciliata mustela	Fivebeard rockling	d	*	x	x
Callionymus maculatus	Spotted dragonet	d	D		x
Callionymus lyra	Common dragonet	d	*	x	x
Aphia minuta	Transparent goby	d	*		x
Scophthalmus rhombus	Brill	d	*	x	x
Eutrigla gurnardus	Grey gurnard	d	*	x	x
Entelurus aequoreus	Ocean pipefish	d	G		x
Hyperoplus lanceolatus	Greater sand eel	d	D		x
Clupea harengus	Herring	p	*	x	x
Trachurus trachurus	Horse mackerel	p	*	x	x
Belone belone	Garpike	p	*	x	x

Fish species	Common name	Mode of life	RLS	N-7.2	37F6
Gadus morhua	Cod	d	V	x	x
Syngnathus rostellatus	Lesser pipefish	d	*	x	x
Ammodytes marinus	Lesser sand eel	d	D		x
Scyliorhinus canicula	Small-spotted catshark	d	*	x	x
Limanda limanda	Common dab	d	*	x	x
Arnoglossus laterna	Scaldfish	d	*	x	x
Pomatoschistus lozanoi	Lozano's goby	d	D	x	x
Raja clavata	Thornback ray	d	1	x	x
Callionymus reticulatus	Reticulated dragonet	d	D	x	x
Chelidonichthys lucerna	Tub gurnard	d	*	x	x
Microstomus kitt	Lemon sole	d	*	x	x
Pomatoschistus minutus	Sand goby	d	D	x	x
Engraulis encrasicolus	European anchovy	p	*		x
Sardina pilchardus	European sardine	p	*		x
Melanogrammus aeglefinus	Haddock	d	2	x	x
Pleuronectes platessa	Plaice	d	*	x	x
Gobius niger	Black goby	d	*	x	x
Cyclopterus lumpus	Lumpfish	d	*	x	x
Myoxocephalus scorpius	Bullhead	d	*	x	x
Solea solea	Sole	d	V	x	x
Sprattus sprattus	Sprat	p	*	x	x
Scophthalmus maximus	Turbot	d	V	x	x
Agonus cataphractus	Hooknose	d	*	x	x
Mullus surmuletus	Striped red mullet	d	*	x	x
Ammodytes tobianus	Lesser sand eel	d	D		x
Enchelyopus cimbrius	Fourbeard rockling	d	*	x	x
Echiichthys vipera	Lesser weever	d	*		x
Mustelus asterias	Starry smooth-hound	d	*		x
Merlangius merlangus	Whiting	d	*	x	x
Buglossidium luteum	Yellow sole	d	*	x	x
Total number of species				34	50

2.6.3.3 Legacy impact

The southern North Sea has been intensively used for centuries. In the process, fishing and nutrient pollution affect the natural habitat and the fish community. In addition, the fish fauna is under other direct or indirect human influences such as shipping traffic, pollutants, and sand and gravel extraction. However, these indirect influences and their impacts on the fish fauna are difficult to prove. In principle, it is not possible to reliably separate the relative impacts of individual anthropogenic factors on the fish community and their interactions with natural biotic (predators, prey, competitors, reproduction) and abiotic (hydrography, meteorology, sediment dynamics)

parameters of the German EEZ.
However, as a result of the removal of indicator species and by-catch as well as the adversely affect on the seabed in the case of bottom-disturbing fishing methods, fishing is considered the most effective disturbance to the fish community. There is no assessment of populations on a smaller spatial scale such as the German Bight. Consequently, the assessment of this criterion cannot be carried out for N-7.2 in terms of site rather only for the entire North Sea.

Of the 107 species considered established in the North Sea, 21 are fished commercially (Thiel et al. 2013). The fishing impact assessment is based on the "Fisheries overview - Greater North Sea Ecoregion" of the International Council for the Exploration of the Sea (ICES 2018a). Fishing has two main effects on the ecosystem: the disturbance or destruction of benthic habitats by bottom-disturbing nets and the removal of indicator species and by-catch species. The latter often include protected, endangered or threatened species, including not only fish but also birds and mammals (ICES 2018c). About 6,600 fishing vessels from nine nations fish in the North Sea. The largest quantities were landed in the early 1970s and catches have been declining since then. However, a reduction in fishing effort has only been observed since 2003.

The intensity of bottom-disturbing fishing is concentrated in the southern North Sea and is also by far the predominant form of fishing in the German EEZ (ICES 2018a). Flatfish trawling in the German EEZ targets plaice and sole; it uses not only heavy bottom gears but also relatively small meshes. As a result of this, the by-catch rates of small fish and other marine organisms can be quite high.

Commercial fishing and spawning population sizes are assessed against maximum sustainable yield (MSY), taking into consideration the precautionary approach. In total, 119 populations were considered in terms of fishing intensity; of these, 43 are subject to scientific population assessment (Figure 12 Fishing intensity and reproductive capacity of 119 fish populations throughout the North Sea. Number of populations (top) and biomass proportion of catch (bottom). Reference level of fishing intensity: sustainable yield (FMSY; red: above FMSY, green: below FMSY, grey: not defined); reference level of reproductive capacity: Spawning biomass (MSY Btrigger; red: below MSY, green: above MSY, grey: not defined). Modified according to ICES (2018a).; ICES 2018a). Of the 43 populations assessed, 25 are managed sustainably. 38 of the 119 populations were assessed for their reproductive capacity (spawning biomass); 29 populations are able to use their full reproductive capacity.

The biomass proportion of the total catch (5,350,000 t in 2017) managed at too high a fishing intensity outweighs the proportions of sustainably caught and unassessed fish populations in the North Sea (Figure 1). Fish from populations for which the reproductive capacity is above the reference level account for most biomass in the catch (3,709,000 t).

Overall, the fishing mortality of demersal and pelagic fish has decreased considerably since the late 1990s. For most of these populations, spawning biomass has been increasing since 2000 and is now above or close to individually set reference points. Nevertheless, fishing mortality for many populations is also above the established reference measures (e.g. for cod, whiting, or mackerel). Moreover, for the vast majority of the populations exploited, no reference levels are defined, which makes it impossible to carry out scientific population assessments.

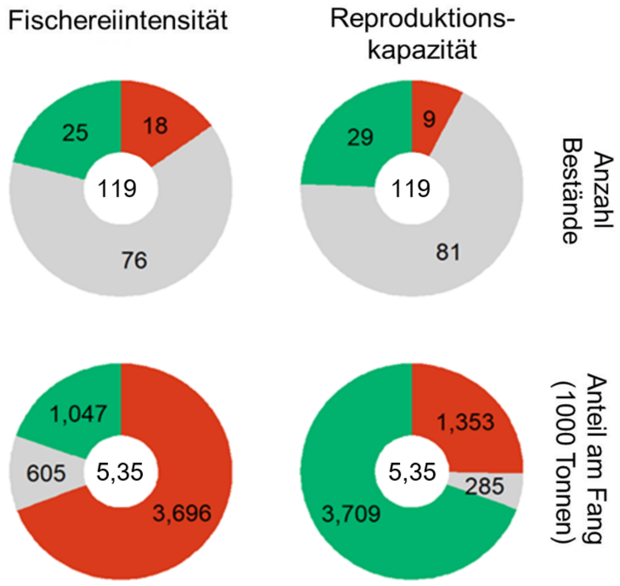

Figure 12 Fishing intensity and reproductive capacity of 119 fish populations throughout the North Sea. Number of populations (top) and biomass proportion of catch (bottom). Reference level of fishing intensity: sustainable yield (FMSY; red: above FMSY, green: below FMSY, grey: not defined); reference level of reproductive capacity: Spawning biomass (MSY Btrigger; red: below MSY, green: above MSY, grey: not defined). Modified according to ICES (2018a).

In addition to fishing, eutrophication is one of the greatest ecological problems for the marine environment in the North Sea (BMU 2018). Despite reduced nutrient inputs and lower nutrient concentrations, the southern North Sea is subject to a high eutrophication load in the period 2006 - 2014. Nitrates and phosphates are predominantly carried in via rivers; this leads to a pronounced gradient in nutrient concentration from the coast to the open sea (BROCKMANN ET AL. 2017). Major direct effects of eutrophication are increased chlorophyll-a concentrations, reduced depths of visibility, local decline in seagrass areas, and density with associated mass proliferation of green algae as well as increased cell numbers of nuisance phytoplankton species (especially Phaeocystis). Above all, the seagrass meadows of the Wadden Sea have an important protective function for the fish spawn and offer numerous juvenile fish such as the common goby *Pomatoschistus microps* a protected feeding area between the stalks (POLTE ET AL. 2005, POLTE & ASMUS 2006). As seagrass meadows decline as a result of eutrophication, there are fewer retreat areas and potentially higher predation rates. The indirect effects of nutrient enrichment (e.g. oxygen deficiency and a changed species composition of macrozoobenthos) may also have impacts on the fish fauna. In many species, the survival and development of fish eggs and larvae depends on oxygen concentration (DAVENPORT & LÖNNING 1987). Depending on how much oxygen is needed, lack of oxygen can lead to the death of the fish spawn and larvae. Furthermore, the altered species composition of the benthos can also influence the biodiversity of the fish community, especially that of the specialists.

Based on the fact that despite these anthropogenic factors according to ICES, fish species richness in the North Sea has not declined for 40 years (number of species per 300 hauls; catch data from the International Bottom Trawl Survey, IBTS), and that commercially exploited populations are also subject to strong natural fluctuations, the fish fauna was assessed as average in terms of legacy impact in the German EEZ. This assessment is supported by the summary of fishing metrics and the ecosystem effects of bottom-disturbing fishing (WATLING & NORSE 1998, HIDDINK et al. 2006).

2.6.3.4 Importance of Site N-7.2 for fish

The overarching criterion for the importance of Site N-7.2 for fish is its relation to the life cycle within which different stations with stage-specific habitat requirements are linked by more or less long migrations in between.

During the current preliminary investigation of sites of N-7.2, mainly juvenile individuals of the character species dab, plaice, whiting, and grey gurnard were detected in the catches. Accordingly, the area of N-7.2 could serve as a nursery and foraging habitat for the juvenile stages. So far, however, no specific spawning sites of these species have been detected; instead, the spawning grounds coincide with the distribution of the adult stages (HEESSEN et al. 2015). The affected character species occur throughout the German Bight. They are food generalists and r-strategists with high reproductive output. For endangered species (see chapter 542.6.3.1), there are currently no indications of a special importance of Site N-7.2. Accordingly, the localised area N-7.2 is considered to be of average importance as a habitat.

2.7 Marine mammals

Three species of marine mammals regularly occur in the German EEZ of the North Sea: Harbour porpoises (*Phocoena phocoena*), grey seals (*Halichoerus grypus*), and harbour seals (*Phoca vitulina*). All three species are characterised by high mobility. Migrations (especially in search of food) are not limited to the EEZ but also include the territorial waters and large areas of the North Sea across borders.

The two seal species have their resting and littering sites on islands and sandbanks in the area of the territorial waters. To search for food, they undertake extensive migrations in the open sea from their moorings. Because of the high mobility of the marine mammals and the use of extensive areas, it is necessary to consider the occurrence not only in the German EEZ, but in the entire area of the southern North Sea.

Occasionally, other marine mammals are also observed in the German EEZ of the North Sea. These include white-sided dolphins (*Lagenorhynchus acutus*), white-beaked dolphins (*Lagenorhynchus albirostris*), bottlenose dolphins (*Tursiops truncatus*) and minke whales (*Balaenoptera acutorostrata*).

Marine mammals are among the top predators of marine food webs. This makes them dependent on the lower components of the marine ecosystem: On one hand, from their direct food organisms (predominantly fish and zooplankton). On the other hand, indirectly from phytoplankton. As consumers at the top of the food web, marine mammals simultaneously influence the abundance of food organisms.

2.7.1 Availability of data

The current availability of data on the occurrence of marine mammals is quite good. The data are collected using standardised survey methods according to the Standard for the Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment (StUK4, BSH 2013), systematically quality-assured and used for studies so that the current state of knowledge on the occurrence of marine mammals in German waters can be classified as good. The good availability of data thus allows a reliable description and evaluation of the occurrence as well as an assessment of the status. It should be noted that for the description and assessment of the occurrence of highly mobile species such as the harbour porpoise, data on large-scale occurrence as well as data that provide insights into the temporal and spatial use of selected habitats are important.

Harbour porpoises occur year-round in the German EEZ of the North Sea but show seasonal variability in their occurrence and spatial distribution.

The large-scale investigations include the three SCANS surveys (Small Cetacean Abundance in the North Sea and adjacent waters), which cover the entire area of the North Sea, Skagerrak, Kattegat, the western Baltic Sea/Belt Sea, the Celtic Sea, and other parts of the north-eastern Atlantic.

The German waters currently belong to the areas of the North Sea which have been systematically and intensively investigated for the presence of marine mammals since 2000. Most of the data are provided by the investigations according to StUK4 (BSH, 2013), which are carried out as part of environmental impact studies and construction and operational monitoring for offshore wind farms. From 2009 to 2019, a monitoring network consisting of more than 20 stations was operated in the German EEZ of the North Sea for the acoustic recording of harbour porpoise habitat use in the German EEZ of the North Sea using C-PODs on behalf of wind farm operators. The station network provided the most comprehensive and valuable data to date on harbour porpoise habitat use in the areas of the German EEZ of the North Sea. The acoustic data are additionally collected by means of C-PODs within the scope of the preliminary investigation of sites as well as the construction and operational monitoring of individual projects.

Since the switch from observer-based recording from aircraft to digital recording using video technology or photography with the StUK4 in 2013 (BSH, 2013), large clusters have been investigated as part of the monitoring of offshore wind farms. These cluster studies cover a large part of the German EEZ, in particular also valuable habitats of the harbour porpoise and all areas with offshore wind energy use.

In addition, regular investigations for the monitoring of Natura2000 areas have been carried out on behalf of BfN since 2008 (monitoring reports on behalf of BfN in 2008, 2009, 2011, 2012, 2013, and 2016). Data are also collected as part of research projects that investigate specific issues.

The current findings relate to different spatial levels:

- entire North Sea and adjacent waters: large-scale investigations in the framework of SCANS I, II, and III from 1994, 2005, and 2016,
- Natura2000 areas in the German EEZ: Monitoring on behalf of BfN since 2008 and ongoing,
- Parts of the German EEZ and the territorial waters: Research projects with different focal points (e.g. MINOS, MINOSplus (2002–2006), StUKplus (2008–2012), Underwater Cluster (commissioned by the BfN).
- Investigations to fulfil the requirements of the UVPG and the WindSeeG within the framework of preliminary investigation of sites, and approval and planning approval procedures of the BSH as well as within the framework of monitoring the construction and operating phase of offshore wind farms since 2001 and ongoing. During the baseline surveys from 2001 to 2013, most specific areas with planned offshore wind farms were investigated at high temporal resolution. Since 2014, these areas have been enlarged and adjusted so that data with high temporal resolution are currently available for large areas of the German EEZ. Since 2018, large areas have been surveyed as part of the preliminary investigation to determine the suitability of sites on behalf of the BSH.

The BSH has current findings from the preliminary investigation for the period August 2018 to July 2020 on the occurrence of marine mammals from the vicinity of the opposing Site N-7.2. The final report of the preliminary investigation on the occurrence of marine mammals in Site N-7.2 includes data from the digital survey from the aircraft for area of investigation area FN6_7 (which encloses Site N-7.2) as well as data from the immediately adjacent investigation area FN10_11 to the north (IfAÖ et al., 2020a). In addition, there are data from the continuous acoustic recording using special underwater hydrophones for the detection of harbour porpoise clicks, the C-PODs, at four long-term monitoring stations. Additional information on the occurrence of harbour porpoise in Site N-7.2 and its immediate surroundings is also provided by sightings during the ship-based survey of resting birds and seabirds.

In order to determine the suitability of Site N-7.2 with regard to marine mammals, the BSH also has access to extensive current data from the monitoring of offshore wind farms already constructed and in operation in the German EEZ of the North Sea for the purpose of taking cumulative effects into consideration and classifying the importance of the site for the respective local population. Specifically, data are available from the investigations of cluster 6 of the wind farms “Bard Offshore 1”, “Veja Mate”, “Deutsche Bucht”, the cluster “Östlich Austerngrund” with the wind farms “Global tech 1”, “EnBWHoheSee”, “Albatros”, the cluster “Nördlich Borkum” with the wind farms “alpha ventus”, “Borkum Riffgrund 1”, “Borkum Riffgrund 2”, “Gode Wind 1”, “Gode Wind 2”, “Trianel Windpark Borkum Phase 1 und 2”, “Merkur Offshore”, “NordseeOne”, the cluster “Nördlich Helgoland” with the wind farms “MeerwindSüdOst”, “NordseeOst”, “AmrumbankWest”, the wind farm “Butendiek”, and the cluster “Westlich Sylt” with the wind farms “DanTysk” and “Sandbank”.

All data from the preliminary investigation commissioned by the BSH as well as the data from the monitoring of the wind farms, which were used to determine the suitability of the site, are highly resolved in terms of time and space, quality-assured, and comparable because of the standardised methods used.

There are currently still gaps in knowledge in connection with research into the biological relevance of the effects of offshore wind farms on marine mammals in the German EEZ and in particular on the key species harbour porpoise. There is also a continuing need for monitoring and knowledge generation with regard to the assessment of interrelationships as well as possible cumulative effects.

2.7.2 Spatial distribution and temporal variability

The high mobility of marine mammals depending on specific conditions of the marine environment leads to a high spatial and temporal variability of their occurrence. In addition to natural variability, climate-related changes in the marine ecosystem and anthropogenic uses also influence the occurrence of marine mammals. Both the distribution and abundance of the animals vary over the course of the seasons. In order to be able to draw conclusions about seasonal distribution patterns and the use of areas and sites, the effects of seasonal and interannual variability, and the influences of anthropogenic uses, large-scale long-term studies in the German EEZ are necessary.

2.7.2.1 Harbour porpoise

The harbour porpoise (*Phocoena phocoena*) is the most common and widespread whale species in the temperate waters of the North Atlantic and North Pacific as well as in some secondary seas such as the North Sea (Evans, 2020). The distribution of harbour porpoises is restricted to continental shelf seas with water depths predominantly between 20 m and 200 m because of their hunting and diving behaviour (Read 1999, Evans, 2020). The animals are extremely mobile and can cover long distances in a short time. Satellite telemetry has shown that harbour porpoises can travel up to 58 km in one day. The marked animals have behaved individually in their migration. Between the individually chosen places of inhabitation, there were migrations of a few hours to a few days (Read & Westgate 1997).

In the North Sea, the harbour porpoise is the most widespread species of cetacean. In general, harbour porpoises occurring in German and neighbouring waters of the southern North Sea are assigned to a single population (ASCOBANS 2005, Fontaine et al., 2007, 2010).

The best overview of the occurrence of harbour porpoises throughout the North Sea is provided by the large-scale surveys of small cetaceans in northern European waters conducted in 1994, 2005, and 2016 as part of the SCANS surveys (Hammond et al. 2002, Hammond & Macleod 2006, Hammond et al. 2017). The large-scale SCANS surveys allow the estimation of population size and population trends in the entire area of the North Sea that belongs to the habitat of highly mobile animals without claiming to map marine mammals in detail in sub-areas (seasonal, regional, small-scale). The abundance of harbour porpoises in the North Sea in 1994 was estimated at 341,366 animals based on the SCANS-I survey. In 2005, a larger area was covered by the SCANS II survey and, as a result, a larger number of 385,617 animals was estimated. However, the abundance calculated on an area of the same size as in 1994 was approximately 335,000 animals. The latest survey in 2016 showed a mean abundance of 345,373 (minimum abundance: 246,526; maximum abundance: 495,752) animals in the North Sea. As part of the statistical evaluation of the data from SCANS-III, the data from SCANS I and II were recalculated. Results from SCANS I, II, and III indicate no decreasing trend in harbour porpoise abundance between 1994, 2005, and 2016(Hammond et al., 2017). However, the regional distribution in 2005 and 2016 differs from the distribution in 1994 in that more individuals were counted in the south-west than the north-west in 2005 (LIFE04NAT/GB/000245, Final Report, 2006) and high abundance was recorded across the English Channel in 2016. The results of the latest SCANS survey (SCANS III) can be summarised as follows: The calculated abundance of harbour porpoise in the North Sea in 2016 is 345,000 (coefficient of variance CV = 0.18) animals, which is comparable to the abundance in 2005 with 355,000 (CV = 0.22) and in 1994 with 289,000 (CV = 0.14) animals. However, a further shift of populations towards the south-eastern coast of the UK and the English Channel was noted in 2016. This shift is causing populations to decline in German waters of the North Sea (Hammond et al. 2017). Statistical modelling of the results from SCANS-III is still pending.

The abundance calculated in SCANS I, II, and III is also comparable to the statistical value of 361,000 (CV 0.20) from modelling data from study conducted from 2005 to 2013 (Gilles et al. 2016). The study by Gilles et al. (2016) provides a good overview of the seasonal distribution patterns of harbour porpoise in the North Sea. Data from the UK, Belgium, the Netherlands, Germany and Denmark for the years 2005 to 2013 inclusive were considered together in the study. Data from large-scale and transboundary visual surveys such as those collected in the SCANS-II and Doggerbank projects as well as extensive data from smaller-scale national surveys (monitoring, EIS) were validated, and seasonal habitat distribution patterns were predicted (Gilles et al. 2016). During the investigation, the results of the habitat modelling were verified and confirmed using data from acoustic surveys. This study is one of the first to take into consideration dynamic hydrographic variables such as surface temperature, salinity and chlorophyll as well as food availability, especially of sand eels. The food availability was modelled by the distance of the animals to known sand eel habitats in the North Sea. The habitat modelling showed significantly high densities in the area west of Doggerbank, especially in spring and summer. The study concludes that the distribution patterns of harbour porpoise in the North Sea indicate the high spatial and temporal variability of hydrographic conditions, the formation of fronts, and the associated food availability.

In the large-scale survey conducted in 2016, the SCANS III showed a further shift of the stock from the south-eastern area of the North Sea more towards the south-western area towards the English Channel (Hammond et al., 2017). An initial analysis of research data as well as data from the national monitoring of nature conservation areas suggests a shift in the population; the authors considered several factors as possible reasons for the observed change (GILLES et al., 2019).

2.7.2.1.1 Occurrence of the harbour porpoise in the German North Sea

Site N-7.2 in Area N-7 (SDP, 2020) is located north of the traffic separation areas in the German EEZ and is part of the harbour porpoise habitat in the North Sea. Especially in the summer months, the area of the coastal sea and the German EEZ off the North Frisian Islands, especially north of Amrum and near the Danish border, are intensively used by harbour porpoises (SIEBERT et al. 2006). In addition, the presence of calves is always confirmed there during the summer months.

The large-scale investigations on the distribution and abundance of harbour porpoises and other marine mammals carried out in the framework of the MINOS and MINOSplus projects from 2002 to 2006 (SCHEIDAT et al. 2004, GILLES et al. 2006) have provided an initial overview for the German waters of the North Sea. Based on the results of the MINOS surveys (SCHEIDAT et al. 2004), the abundance of harbour porpoises in German North Sea waters was estimated at 34,381 individuals in 2002 and 39,115 individuals in 2003. In addition to the pronounced temporal variability, a strong spatial variability was also observed. The seasonal analysis of the data has shown that temporarily (e.g. in May/June 2006) up to 51,551 animals may have been present in the German EEZ of the North Sea (GILLES et al. 2006). Since 2008, the abundance of harbour porpoises has been determined as part of the monitoring of Natura 2000 areas. Although the abundance varies from year to year, it remains at high levels, especially in the summer and spring months. In May 2012, 68,739 individuals were recorded – the highest abundance ever recorded in the German North Sea (GILLES et al. 2012).

A recent evaluation of data from the monitoring of Natura2000 areas and from research projects has confirmed the indications from the SCANS-III study and shown that the population of harbour porpoise in the German EEZ of the North Sea has changed in recent years. The changes in the population are more pronounced in the area of the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area than in the southern part of the German EEZ (GILLES et al., 2019).

2.7.2.1.2 Occurrence in nature conservation areas

Based on the results of the MINOS and EMSON investigations (survey of marine mammals and seabirds in the German EEZ of the North Sea and Baltic Sea), three areas that are of particular importance for harbour porpoises were defined in the German EEZ. These were notified to the EU as offshore protected areas in accordance with the Habitats Directive and recognised by the EU as Sites of Community Importance (SCI) in November 2007: Doggerbank (DE 1003-301), Borkum Riffgrund (DE 2104-301), and especially the Sylter Außenriff (DE 1209-301). Since 2017, the three FFH areas in the German EEZ of the North Sea have been given the status of nature conservation areas:

- Ordinance on the Establishment of the “Doggerbank” nature conservation area (NSGDgbV), Federal Law Gazette I, I p. 3395 dated 22 September 2017,
- Ordinance on the Establishment of the “Doggerbank” nature conservation area (NSGDgbV), Federal Law Gazette I, I p. 3400 dated 22 September 2017,
- Ordinance on the Establishment of the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area (NSGSylV), Federal Law Gazette I, I p. 3423 dated 22 September 2017.

The “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area is the main distribution area for harbour porpoises in the EEZ. The highest densities are often found here in the summer months. The nature conservation area "Sylter Außenriff – Östliche Deutsche Bucht" has the function of a breeding area. In the period from 1 May and until the end of August, high calf percentages are surveyed in the protected area "Sylter Außenriff – Östliche Deutsche Bucht".

The "Borkum Riffgrund" nature conservation area highly important for harbour porpoises in spring and partially in the early summer months.

Results from the monitoring of Natura2000 areas as well as from the monitoring of offshore wind farms have shown a high occurrence of harbour porpoise in protected areas until 2013, especially in the area of the Sylter Außenriff (GILLES et al., 2013). However, current findings from the monitoring of Natura2000 areas show a change in populations in the German EEZ, which also particularly affects the nature conservation area "Sylter Außenriff – Östliche Deutsche Bucht" (NACHTSHEIM et al. 2021, GILLES et al. 2019).

The BMU has highlighted the importance of the area of the "Sylter Außenriff – Östliche Deutsche Bucht" nature conservation area in the noise abatement concept for harbour porpoises based on findings and defined a main concentration area for harbour porpoises in the summer months (BMU 2013).

2.7.2.1.3 Occurrence in Site N-7.2

Current data n on the occurrence of marine mammals in Site N-7.2 and its surroundings are available from the preliminary investigation for 2018 to 2020 commissioned by the BSH.

Two large survey areas, each with an average area of 2,330 km^2 and a total transect distance of 9,000 km, were covered from the aircraft using digital video recording. Eight aerial surveys per investigation area were conducted annually. Thus, data from 32 aerial surveys are available to describe the distribution and abundance of marine mammals in Site N-7.2 and its surroundings. The investigation areas cover built-up areas such as N-7, N-9, N-10, N-11, N12, and partly N-13 as well as offshore wind farms such as "Deutsche Bucht", "Veja Mate", "BARD Offshore 1", "EnBWHoheSee", "Albatros", and "Global Tech 1" from the indirect vicinity of Site N-7.2.

From the acoustic survey of harbour porpoise to determine gradients and seasonal patterns in habitat use, data from four long-term CPOD monitoring stations, S02, S03, S04 and S13 at distances ranging from 13 km to 110 km were added.

Finally, evidence from the ship-based survey of resting birds with simultaneous recording of marine mammal sightings was also taken into consideration.

The final report on the occurrence of marine mammals during the preliminary investigation of Site N-7.2 contains a detailed description of the investigations conducted (IFAÖ et al. 2020a).

In the southern investigation area, where Site N-7.2 is also located, 183 harbour porpoises, including four calves in August, were recorded by video-based survey in the first year of investigation. In the second year of investigation, 287 harbour porpoises were recorded, of which were 10 calves mostly in June. The phenology of occurrence varied between the two years of investigation. Higher occurrences were recorded in February 2018 and in the summer months of 2019. The density varied from 0.07 ind./km^2 to 0.57 ind./km^2. Most sightings were always to the West–Northwest of Site N-7.2.

In the northern investigation area, 260 harbour porpoises, including 22 calves, were recorded in the first year of investigation, and 395 harbour porpoises, including 13 calves, were recorded in the second year of investigation. Most mother-calf pairs were recorded in June in both years. The density varied from 0.03 ind./km^2 to 1.24 ind./km^2. The density increased along a gradient from the South and towards the North (IFAÖ et al. 2020a).

The acoustic survey at stations S02, S03, and S04, which are all located in the same natural unit as Site N-7.2, has shown that the detection rates (% DPM10M/day or proportion of detection-positive 10-minute intervals per day) are highest in the winter months and lowest in autumn. However, compared with station S13, which is located in the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area, the detection rates in the three stations to the west are always lower and without major seasonal differences. The detection rates at station S13, on the other hand, remain high throughout the year and increase slightly in the summer months and autumn (IFAÖ et al. 2020a).

The evaluation of the CPOD data from the large-scale station network within the framework of the GESCHA II study showed that in the central area of the German Bight (in which Site N-7.2 is also located), the lowest detection rates were found overall compared with other areas and sites in the course of all seasons. In winter, however, this was not particularly pronounced, and the values were partly at a level similar to that in other areas within the German EEZ. The highest values were detected here in winter (with maximum values in February and early March) before there was a sharp drop in detection rates in the course of spring. In the summer, the values rose again. The seasonality (but not the intensity) is thus quite similar to that in the south-western part of the EEZ “Nördlich Borkum”, where the highest winter values in the German Bight were recorded (ROSE et al. 2019).

Information on the occurrence of harbour porpoises in the part of the German EEZ in which Site N-7.2 is located is also provided by the operational monitoring for the projects “BARD Offshore I”, “Veja Mate”, and “Deutsche Bucht” as well as “EnBW HoheSee” and “Albatros”. Higher densities occur mainly in spring and late summer, low densities mainly in autumn and early winter. The annual mean absolute abundances from the years of investigation 2008 to 2013 ranged from 0.34 individuals/km² to 0.98 individuals/km²; this was slightly to considerably above the values recorded in 2004–2006. In the course of the year, average densities of 0.5 harbour porpoises/km² can be expected in this area of the German EEZ with daily values generally varying between 0 and 2 individuals/km² depending on the season. The results of the acoustic monitoring carried out since 2008 and to date confirm the occurrence. In addition, the results from acoustic monitoring indicate that high harbour porpoise activity can also take place in the winter months. While the abundance of harbour porpoises was relatively stable in the years 2005 to 2012, it decreased in the following years. It is only from the end of 2016 onwards that a steady increase in the occurrence of harbour porpoises in the central part of the German EEZ in the North Sea is becoming apparent again (final report on the construction phase of the OWF “BARD Offshore 1”, PGU 2014, Cluster Monitoring Cluster 6, Report Phase I (01/15–03/16) for the OWF “BARD Offshore I”, “Veja Mate”, and “German Bight”, PGU 2017, environmental monitoring in the cluster “East of Austerngrund” Annual Report 2016 - April 2015 - March 2016).

The proportion of calves recorded in 2008–2020 in this area of the German EEZ, which includes Site N-7.2, still does not suggest that the area is of particular importance for the reproduction of the species.

2.7.2.2 Harbour seals and grey seals

The harbour seal (*Phoca vitulina*) is the most widespread seal species in the North Atlantic and is found along coastal regions throughout the North Sea. Throughout the Wadden Sea, regular aerial surveys are carried out at the height of the change of coat in August. In 2005, 14,275 harbour seals were counted throughout the Wadden Sea (ABT et al. 2005). Because there is always a part of the animals in the water and not counted, this is the minimum population.

Suitable undisturbed moorings are crucial for the occurrence of harbour seals. In the German North Sea, sandbanks in particular are used as resting places (SCHWARZ & HEIDEMANN 1994). Telemetric investigations show that adult harbour seals in particular rarely move more than 50 km from their original resting sites (TOLLIT et al. 1998). On foraging trips, the action radius is usually about 50 to 70 km from the resting places to the hunting grounds (z. B. THOMPSON & MILLER 1990), although in the Wadden Sea area, it can be as much as 100 km (ORTHMANN 2000).

Censuses of grey seals *(Halichoerus grypus)* at the time of the hair change have been carried out only occasionally in the German North Sea. These figures are only a snapshot. Strong seasonal fluctuations were always reported (ABT et al. 2002, ABT 2004). The numbers observed in German waters must be seen in a broader geographical context because grey seals can sometimes undertake long migrations between different resting sites throughout the North Sea region (MCCONNELL et al. 1999). The grey seals observed resting in the territorial waters probably have their foraging grounds at least partly in the EEZ.

Site N-7.2 is used by seals in small numbers and irregularly. During the digital survey for the preliminary investigation, seven harbour seals, two grey seals, and 19 undetermined seals were recorded in the southern investigation area, which includes Site N-7.2. During the same period, six harbour seals, two grey seals, and 17 undetermined seals were recorded in the northern investigation area.

2.7.2.3 Other marine mammals

Other marine mammal species occur only sporadically in Site N-7.2 and its surroundings. During the preliminary investigation, four white-beaked dolphins *(Lagenorhynchus albirostris)*, one undetermined small cetacean, and three other marine mammals that it was not possible to clearly classify into one of these categories were recorded in the southern investigation area. In the northern investigation area, an additional 12 marine mammals that were not clearly taxonomically determined were recorded.

2.7.3 Status assessment of the protected asset marine mammals

The good availability of data, which has already been built up since 2002 until today, allows a good assessment of the importance and condition of the surroundings of Site N-7.2 as a habitat for marine mammals.

2.7.3.1 Protection status

Harbour porpoises are protected under several international conservation agreements. They fall under the conservation mandate of the European Habitats Directive (Directive 92/43/EEC) on the conservation of natural habitats and of wild fauna and flora, under which special areas are designated to protect the species. The harbour porpoise is listed in both Appendix II and Appendix IV of the Habitats Directive. As a species listed in Annex IV, it enjoys strict general protection in accordance with Articles 12 and 16 of the Habitats Directive.

The harbour porpoise is also listed in Appendix II to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, CMS). The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) was also adopted under the auspices of CMS. In addition, the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), in Annex II of which the harbour porpoise is listed, should also be mentioned.

In Germany, the harbour porpoise is listed in the Red List of Threatened Animals (MEINIG et al., 2020). Here it is classified in endangerment category 2 (endangered). The authors point out that the endangerment classification for Germany results from the joint consideration of threats in the

North Sea and Baltic Sea. The occurrence in the North Sea is surveyed by ship- and aircraft-based investigations and is described as stable. In the Borkum-Riffgrund nature conservation area, there is a slight increase in abundance (PESCHKO et al. 2016, zitiert in MEINIG et al. 2020). However, because of ongoing threat from by-catch in gillnets, environmental toxins, and noise, the authors have concluded to classify the status as “Threatened” despite the overall stable short-term population trend (MEINIG et al., 2020). Investigations in the Danish Baltic Sea and adjacent areas also indicate stable population sizes around 30,000 individuals (SVEEGAARD et al. 2013, Viquerat et al. 2014 zitiert in MEINIG et al. 2020). In contrast, the results from the EU research project SAMBAH have shown that the population of the separate sub-population of harbour porpoise in the central Baltic Sea is only approx. 500 animals (SAMBAH 2016). For this reason, this sub-population is classified as “critically endangered”.

Grey seal and harbour seal are also listed in Appendix II of the Habitats Directive. In the current Red List of Mammals of Germany, the grey seal is classified from endangerment category 2 (endangered) to category 3 (vulnerable) (MEINIG et al. 2020). The harbour seal is classified in category G (indeterminate). The authors confirm that there are two separate populations in the German North Sea and Baltic Sea. The population of the German North Sea has seen an increase in juveniles since 2013. After the two distemper virus epidemics, it would be classified as unthreatened – unlike the population of the German Baltic Sea (MEINIG ET AL., 2020).

Based on the results of the research projects MINOS and EMSON, three areas that are of particular importance for harbour porpoises were defined in the German EEZ. These were notified to the EU as offshore protected areas in accordance with the Habitats Directive and recognised by the EU as Sites of Community Importance (SCI) in November 2007: Doggerbank (DE 1003-301), Borkum Riffgrund (DE 2104-301), and especially Sylter Außenriff (DE 1209-301). Since 2017, the three FFH areas in the German EEZ of the North Sea have been given the status of nature conservation areas:

- Ordinance on the Establishment of the “Doggerbank” nature conservation area (NSGDgbV), Federal Law Gazette I, I p. 3395 dated 22 September 2017,
- Ordinance on the Establishment of the “Doggerbank” nature conservation area (NSGDgbV), Federal Law Gazette I, I p. 3400 dated 22 September 2017,
- Ordinance on the Establishment of the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area (NSGSylV), Federal Law Gazette I, I p. 3423 dated 22 September 2017.

The protective purposes of the nature conservation areas in the German EEZ of the North Sea include maintaining and restoring a favourable conservation status of the species from Annex II of the Habitats Directive, in particular the harbour porpoise, grey seal, and harbour seal as well as the conservation of their habitats (NSGBRgV, 2017. Federal Law Gazette, Part I, No. 63, 3395).

2.7.3.2 Assessment of the occurrence

The harbour porpoise is the key species in the German waters of the North Sea that is used in the noise abatement concept of the BSH (2013) to assess the potential impacts of impulsive noise inputs. Furthermore, within the framework of the implementation of the MSFD, the harbour porpoise is the indicator species for assessing cumulative impacts of uses and, finally, for assessing good environmental status in the OSPAR area.

The population of harbour porpoises in the North Sea has decreased over the last centuries. The general situation of the harbour porpoise has already deteriorated in earlier times. In the North Sea, the population has declined mainly because of by-catch, pollution, noise, over-fishing and food restrictions (ASCOBANS 2005, EVANS, 2020). However, there is a lack of concrete data to calculate or forecast trends. The best overview of the distribution of harbour porpoises in the North Sea is provided by the compilation from the "Atlas of the Cetacean Distribution in North-West European Waters"(REID et al. 2003). However, when making abundance or population calculations based on aerial surveys or even field trips, the authors caution that the occasional sighting of a large aggregation (group) of animals within an area recorded in a short period of time can lead to the assumption of unrealistically high relative densities (REID et al. 2003). The recognition of distribution patterns or the calculation of populations is made more difficult in particular by the high mobility of the animals.

The population of harbour porpoises throughout the North Sea has not changed significantly since 1994, or no significant differences were found between data from SCANS I, II, and III (HAMMOND & MACLEOD 2006, HAMMOND et al. 2017, Evans, 2020).

The statistical evaluation of data from the large-scale surveys carried out as part of research projects and, since 2008, as part of the monitoring of Natura 2000 areas on behalf of the Federal Agency for Nature Conservation (BfN) indicates a significant increase in harbour porpoise densities in the southern German North Sea between 2002 and 2012. In the area of Sylter Außenriff, the trend analysis also indicates stable populations in summer over the years 2002 to 2012 (GILLES et al. 2013). The western area in particular shows a positive trend for spring and summer, while no clear trend can be detected in autumn. Harbour porpoise densities in the eastern area have remained largely constant over the years and significant differences between the hotspots in the west and lower density in the south-eastern German Bight have been found.

Current findings from the large-scale cluster studies of offshore wind farms do not provide any indication of a decreasing trend in the abundance of harbour porpoise or of changes in seasonal distribution patterns in the German EEZ of the North Sea from 2001 to the present. The multi-year data from the CPOD station network confirm continuous habitat use by harbour porpoises (ROSE et al. 2019).

In general, there is still a north-south density gradient of harbour porpoise occurrence from the North Frisian to the East Frisian area.

A current assessment of the population trend in the German waters of the North Sea based on data from the monitoring of nature conservation areas and from research projects from 2012 to 2018 has shown a population shift. Declining trends were observed in the "Sylter Außenriff – Östliche Deutsche Bucht" and "Doggerbank" nature conservation areas as well as in the central area of the German Bight. A positive trend has developed in the area of the "Borkum Riffgrund" nature conservation area as well as in areas N-1, N-2, and N-3. The causes of the population shift are not yet known and could be related to both the impacts of human activities and shifts in the fish populations (NACHTSHEIM et al., 2021, GILLES et al., 2019).

2.7.3.3 Importance of Site N-7.2 for marine mammals

According to the current state of knowledge, it can be assumed that the German EEZ is used by harbour porpoises for traversing, inhabitation, and as a food and area-specific breeding area. Based on the knowledge available, it can be concluded that the EEZ is of medium to high importance for harbour porpoises in certain areas. Habitat use varies in different areas of the EEZ. Marine mammals and, of course, harbour porpoises are highly mobile species that use large areas variably in search of food, depending on hydrographic conditions and food supply.

The investigations carried out as part of the preliminary investigation, the monitoring of Natura2000 areas, and the cluster studies for the monitoring of offshore wind farms always confirm a medium occurrence with interannual fluctuations and only weak seasonality for the area of the German EEZ in which site N-7.2 is also located.

Site N-7.2 is regularly used by harbour porpoises for crossing and inhabitation or – depending on the seasonal food supply – as a foraging ground.

Because of the relatively few sightings of mother-calf pairs, the use of the area as a breeding area can almost certainly be ruled out.

According to the current state of knowledge, Site N-7.2 is of medium importance for harbour porpoises:

- The site is used year-round by harbour porpoises for passage, inhabitation, and probably as a foraging ground,
- The seasonal use of the site varies between years. Usage is higher in the winter months,
- The occurrence of harbour porpoises in Site N-7.2 and its surroundings is average compared with the high occurrence in the waters west of Sylt or also north of Borkum.
- The irregular sighting of single mother-calf pairs rules out the use of this site as a breeding ground,
- There is no evidence of any ongoing special function of the site and its surroundings for harbour porpoises.

For the two seal species, Site N-7.2 and its surroundings are of no particular importance because of the distance to the nearest resting and littering sites.

2.7.3.4 Legacy impacts

Legacy impact for population of the harbour porpoise in the North Sea is affected by a wide range of anthropogenic activities, changes in the marine ecosystem, diseases, and climate change.

Legacy impacts on marine mammals result from fishing, attacks by dolphin-like creatures, physiological effects on reproduction, diseases possibly related to high levels of pollution and underwater noise. The greatest threat to harbour porpoise populations in the North Sea comes from fishing – through by-catch in set and bottom trawls, depletion of prey fish stocks through overfishing, and the associated reduction in food availability (Evans 2020). An analysis of dead and stranded fish from the British Isles between 1991 and 2010 has identified the causes as follows: 23% infectious diseases, 19% attacks by dolphins, 17% by-catch, 15% starvation, and 4% stranded alive (Evans 2020).

Current anthropogenic uses in the vicinity of the areas with noise pollution include shipping traffic, seismic exploration, military use and the detonation of non-transportable ammunition. Threats to marine mammals can be caused during the construction of wind turbines and converter platforms with deep foundations, in particular by noise emissions during the installation of the foundations by means of pile driving, if no mitigation or preventive measures are taken.

In addition to pressures from discharges of organic and inorganic pollutants or oil spills, threats to the population also come from disease (bacterial or viral) and climate change (especially impact on the marine food web).

Current anthropogenic uses in the vicinity of Site N-7.2 with high sound impacts are, in addition to shipping traffic, also seismic explorations as well as military uses or blasting of non-transportable munitions. Threats to marine mammals may be caused during the construction of wind farms and converter platforms with deep foundations, especially because of noise emissions during the installation of the foundations if no mitigation or avoidance measures are taken.

2.8 Seabirds and resting birds

According to the “Qualitätsstandards für den Gebrauch vogelkundlicher Daten in raumbedeutsamen Planungen” (DEUTSCHE ORNITHOLOGEN-GESELLSCHAFT 1995), resting birds are “birds that stay in an area outside their breeding territory, usually for a longer period of time (e.g. for moulting, feeding, resting, and wintering)”. Feeding birds are defined as birds “that regularly seek food in the investigated area and do not breed there but which breed or might breed in the wider region”.

Seabirds are species of birds that are mainly bound to the sea with their mode of life and only come ashore for breeding for a short time. These include, for example, Northern fulmar, Northern gannet, and auks (guillemot, razorbill). Terns and gulls, on the other hand, have a distribution that is mostly closer to the coast than seabirds.

2.8.1 Availability of data

The BSH has good data sources for the suitability assessment of Site N-7.2 with regard to the protected asset “seabirds and resting birds”. This is primarily the result of the preliminary investigation of sites for Site N-7.2 commissioned by the BSH as part of which large-scale flight and ship transect surveys were carried out between August 2018 and July 2020. This final report of the preliminary investigation for N-7.2 contains results from the ship-based and digital aircraft-based surveys in investigation areas SN7 and FN6_7, respectively, each of which encompasses Site N-7.2 as well as an additional adjacent flight survey area FN10_11 to the north, which is used comparatively for some species (BIOCONSULT SH ET AL. 2020). Thiscan be supplemented by long-term surveys in the surrounding wind farm areas (IBL UMWELTPLANUNG et al. 2018a, IBL UMWELT planung et al. 2019a, IBL UMWELTPLANUNG et al. 2020a).

Important information on large-scale seabird abundance in the German EEZ of the North Sea is provided by the investigations of NATURA2000 areas carried out on behalf of the Federal Agency for Nature Conservation in recent years (e.g. MARKONES et al. 2015). In addition, extensive scientific literature and evaluations on various specific issues, including behavioural responses to offshore wind turbines, will be used.

The data sources available can therefore be assessed as quite good overall. However, the following points must be taken into consideration:

- The species-specific risk of seabirds colliding with offshore wind turbines can be only partially predicted and is currently being recorded with the investigations according to StUK4 in the operating phase as well as in ongoing research projects.
- Behavioural changes and habituation effects among disturbance-sensitive species in the German EEZ have only been investigated since the commissioning of the first large, commercial wind farms, including the converter platforms. Operational monitoring is still ongoing.
- There is still insufficient knowledge of the impacts of disturbances or habitat loss at species population level; these will be investigated only based on data currently being collected.

2.8.2 Spatial distribution, temporal variability, and abundance of seabirds and resting birds in the German North Sea

Seabirds are highly mobile and therefore able to cross large areas during their search for food or to track species-specific prey organisms such as fish over long distances. This high mobility - depending on the specific conditions of the marine environment - leads to a high degree of spatial and temporal variability in the occurrence of seabirds. The distribution and abundance of birds vary over the course of the seasons.

The distribution of seabirds in the German Bight is determined in particular by the distance from the coast or breeding grounds, hydrographic conditions, water depth, the composition of the bottom and the food supply. In addition, the occurrence of seabirds is influenced by strong natural events (e.g. storms) and anthropogenic factors such as nutrient and pollutant inputs, shipping, and fishing. Seabirds, as consumers in the upper part of the food webs, feed on species-specific fish, macrozooplankton, and benthic organisms. They are thus directly dependent on the occurrence and quality of benthos, zooplankton and fish.

Some areas of the German territorial waters and parts of the EEZ of the North Sea are highly important for seabirds and waterbirds (not only nationally as well as internationally as a number of studies have shown) and were identified as areas of special importance for seabirds, "Important Bird Areas – IBA" early on (SKOV et al. 1995, HEATH & EVANS 2000). Particular mention should be made here of sub-area II of the "Sylter Außenriff – Östliche Deutsche Bucht" nature conservation area established by ordinance of 22 September 2017, which was already designated as a Special Protected Area (SPA) by ordinance of 15 September 2005: Special Protected Area (SPA)) in accordance with V-RL (79/409/EEC).

With regard to the diver species group, a main concentration area was identified in spring in the German Bight, west of Sylt, within the framework of an overarching evaluation and assessment of existing data sets. The delimitation of the main concentration area was chosen to include all important and known regular occurrences (BMU 2009).

There are 19 species of seabirds in the German EEZ of the North Sea; these are regularly recorded as resting birds in larger populations. Table 8 contains population estimates for the most important seabird species in the EEZ and the entire German North Sea in the seasons with the highest occurrence. Detailed descriptions of the seasonal and spatial occurrence of the most common seabird and resting bird species as well as species of special importance for the "Sylter Außenriff – Östliche Deutsche Bucht" nature conservation area in the EEZ of the North Sea can be found in the corresponding chapters of the Environmental Report on Site Development Plan 2020 for the German North Sea (BSH 2020A).

2.8.3 Occurrence of seabirds and resting birds in the vicinity of Site N-7.2

The investigations on seabirds conducted as part of the preliminary investigation of sites for Site N-7.2 show that a seabird community can be found here as would be expected for the prevailing water depths and hydrographic conditions, the distance from the coast, and for the site-specific influences.

The seabird population is dominated by gulls, which occur year-round in the vicinity of Site N-7.2. The most common species were the lesser black-backed gull *(Larus fuscus)* and the kittiwake *(Rissa tridactyla)*.

Lesser black-backed gulls occur widely in the vicinity of Site N-7.2; however, the magnitude of their occurrence varies seasonally. In winter, lesser black-backed gulls were observed only sporadically in the investigations on Site N-7.2; the highest densities were recorded in summer and autumn. At 1.53 ind./km^2, the highest mean seasonal density was recorded in autumn 2019 following aerial transect surveys; in summer 2019, the density was highest (4.66 ind./km^2) according to ship transect surveys (BIOCONSULT SH ET AL. 2020). The spatial distribution of the lesser black-backed gull, a prominent ship-follower, is often influenced by fishing activity and therefore does not reveal a specific distribution pattern. No distribution foci were identified on or in the vicinity of Site N-7.2 in the investigations as part of the previous preliminary investigation of sites (BIOCONSULT SH ET AL. 2020).

Kittiwakes are the second most common gull species in the vicinity of Site N-7.2 according to ship and aerial transect surveys. Kittiwakes were recorded throughout the year in years of investigation 2018–2020. According to aerial surveys, the highest monthly densities were 1.25 ind./km^2 in March 2019 and 0.60 ind./km^2 in February 2020; according to ship surveys, the highest monthly densities were 2.11 ind./km^2 and 3.36 ind./km^2 in December 2018 and February 2020, respectively. Thus, except for spring 2019 because of another survey flight with lower densities than in March 2019, the highest mean seasonal densities were in spring and winter according to both

Table 8: Populations of the most important resting bird species in the German North Sea and EEZ in the seasons with the highest occurrence according to MENDEL et al. (2008). Spring populations of red-throated divers according to SCHWEMMER et al. (2019); spring populations of black-throated divers according to GARTHE et al. (2015).

Common name (*scientific Name*)	**Season**	**Population German North Sea**	**Population German EEZ**
Red-throated diver (*Gavia stella*)	Winter	3,600	1,900
	Spring	22,000	16,500
Black-throated diver (*Gavia arctica*)	Winter	300	170
	Spring	1,600	1,200
Northern gannet (*Morus bassanus*)	Summer	1,400	1,200
Greater black-backed gull (*Larus marinus*)	Winter	15,500	9,000
	Autumn	16,500	9,500
Lesser black-backed gull (*Larus fuscus*)	Summer	76,000	29,000
	Autumn	33,000	14,500
Common gull (*Larus canus*)	Winter	50,000	10,000
Little gull (*Hydrocoloeus minutus*)	Winter	1,100	450
Kittiwake (*Rissa tridactyla)*	Winter	14,000	11,000
	Summer	20,000	8,500
Sandwich tern (*Thalasseus sandvicensis*)	Summer	21,000	130
	Autumn	3,500	110
Common tern (*Sterna hirundo*)	Summer	19,500	0
	Autumn	5,800	800
Arctic tern	Summer	15,500	210

(*Sterna paradisaea*)	Autumn	3,100	1,700
Razorbill (*Alca torda*)	Winter	7,500	4,500
	Spring	850	800
Guillemot (*Uria aalge*)	Winter	33,000	27,000
	Spring	18,500	15,500

survey methods (BioConsult SH et al. 2020). The spatial occurrence of kittiwakes in years of investigation 2018 to 2020 did not show any spatial focal points in the investigation areas, but was characterised by a large-scale, albeit seasonally patchy, distribution (BioConsult SH et al. 2020).

Common gulls *(Larus canus*), herring gull *(Larus argentatus*), and greater black-backed gulls *(Larus marinus*) occur regularly in the vicinity of Site N-7.2 but mainly in low densities of < 0.1 individuals/km^2. Densities in the neighbouring investigation area FN10_11 were comparable over the same period with the exception of September 2019 for which, according to flight surveys, a density of 1.16 ind./km^2 was recorded for greater black-backed gulls in Area FN6_7. According to ship transect surveys, the densities determined for the three species did not exceed a value of 0.65 ind./km^2 in any month and were thus slightly higher than according to the densities of the digital flight transect survey (BioConsult SH et al. 2020). Spatial distribution centres of the three gull species were not identified – not least because of the low densities (BioConsult SH et al. 2020).

Little gulls *(Hydrocoloeus minutus*) are found mainly in the German Bight as migrants during their migration to the breeding grounds in eastern Europe from the end of March as well as their way to the wintering grounds in western Europe from the end of September. In addition, there is a constant winter population (Mendel et al. 2008). According to the findings on increased occurrence during migration periods, the highest monthly densities were recorded during the surveys for the preliminary investigation of sites for N-7.2 according to both survey methods in the spring months of March and April. The highest monthly density according to aerial transect surveys was recorded in April 2019 (0.72 ind./km^2) and after ship transect surveys in April 2019 (1.95 ind./km^2). In the spring of 2019, when the species was abundant, according to both recording methods, higher numbers of individuals were observed in the immediate vicinity or on Site N-7.2. According to the experts, these observations, including the higher densities, are to be expected when the survey days coincide with a migration wave of little gulls (BioConsult SH et al. 2020)

Divers can be found in the German Bight from autumn to spring. In summer, they are mostly completely absent. Because of the similarity of the red-throated diver *(Gavia stellata*) and the black-throated diver *(Gavia arctica)* , the two species are often grouped together as divers in further considerations. However, the proportion of individuals actually identified at the species level shows a dominant abundance of the red-throated diver – often over 90% compared with the black-throated diver (Mendel et al. 2008).
In the investigations on Site N-7.2, according to ship and aerial transect surveys, the highest mean seasonal densities of 0.06–0.09 individuals/km^2 occurred in investigation areas FN6_7 and SN7 in spring and in investigation area FN10_11 in winter (BioConsult SH et al. 2020).

According to digital aerial transect surveys, the highest monthly densities were recorded in April 2019 and March 2020 (n = 2) with 0.11 ind./km^2 and 0.13 ind./km^2, respectively. According to ship transect surveys, the highest densities were 0.10 ind./km^2 in December 2018 and 0.13 ind./km^2 in May 2020 (BioConsult SH et al. 2020). Regular distribution centres within the investigation areas and especially on or in the immediate vicinity of Site N-7.2 were not evident (BioConsult SH et al. 2020). The immediate vicinity of Site N-7.2 does not appear to be of particular importance as a resting area for divers because of its low occurrence and patchy distribution.

Terns occur in the vicinity of Site N-7.2 (as in the entire German Bight) mainly during the migration periods in spring and autumn. In summer, their occurrence is concentrated in coastal areas near the breeding colonies in the Wadden Sea. In winter, they are mostly not found at all in the entire German North Sea (MENDEL et al. 2008).

The highest monthly densities of Sandwich terns (*Thalasseus sandvicensis*) were recorded in the investigations of Site N-7.2 in spring during the migration to the breeding areas. In years of investigation 2018 to 2020, the highest monthly density was 0.23 ind./km^2 according to aerial transect surveys in Area FN6_7 in April 2019. In the same month, the highest monthly density of 0.43 individuals/km^2 was also recorded in the neighbouring investigation area FN10_11. During the ship transect surveys, Sandwich terns were recorded exclusively in September 2018 at a density of 0.05 ind./km^2 (BIOCONSULT SH et al. 2020).

For the common and Arctic tern *(Sterna hirundo, Sterna paradisaea*), which are often difficult to distinguish and therefore often recorded together, the highest monthly densities were 1.03 ind./km^2 in April 2019 (aerial transect survey) and 0.94 ind./km^2 in May 2020 (ship transect survey). Clear distribution centres, especially in the immediate vicinity of Site N-7.2, were not found in the surveys (BIOCONSULT SH et al. 2020).

According to the seabird and resting bird surveys in the vicinity of Site N-7.2, the species group <u>auks</u> is the second most common seabird group in this area of the German Bight. The common guillemot *(Uria algae*) and razorbill *(Alca torda*) are particularly prominent. Because of the relative similarity of the two aforementioned species from increasing distance as well as their strongly overlapping habitat requirements and feeding areas, an often relatively large proportion of auks is not determined to species level. Data evaluation is therefore often carried out for both species together. As a rule, based on the individuals actually determined to species level, a dominance of the guillemot in this group becomes clear.
In the investigations on Site N-7.2, guillemots were among the most common species along with lesser black-backed gulls and kittiwakes. During the aerial transect surveys in the vicinity of Site N-7.2, the highest monthly densities were recorded at 1.03 ind./km^2 and 1.37 ind./km^2 in April 2019 and 2020, respectively. The same was found in the neighbouring investigation area FN10_11, although the densities there were considerably higher at 3.35 individuals/km^2 and 1.83 individuals/km^2. According to ship transect surveys, extreme density maxima were recorded in December 2018 (6.95 ind./km^2) and July 2020 (8.10 ind./km^2) (BIOCONSULT SH et al. 2020).

Extremely high densities were also determined for razorbills based on the ship transect surveys. In the aerial transect surveys, the calculated values were also comparable to those for the guillemots. Based on the ship transect survey, the maximum monthly densities for razorbills were 3.54 ind./km^2 in April 2019 and 9.58 ind./km^2 in April 2020. During the flight surveys, maximum monthly densities of 0.81 ind./km^2 (February 2019) to 1.07 ind./km^2 (April 2020) were recorded in area FN6_7. These were also comparable to the values in the neighbouring area of investigation FN10_11(BIOCONSULT SH et al. 2020). Auks were observed in large numbers, especially in spring; this corresponds to the expected phenology as described by MENDEL et al. (2008). However, density maxima were also found in autumn and winter.
With the exception of the autumn seasons, a consideration of the spatial distribution for auks shows large-scale and regularly area-covering occurrences in the investigation areas considered. Focal points were variably located in the East and West and occasionally in the central area of Site N-7.2 and its immediate surroundings (BIOCONSULT SH et al. 2020).

Like large parts of the EEZ, the area surrounding Site N-7.2 is part of the large-scale habitat of the guillemot in the North Sea because of its nature. The investigations as part of environmental impact studies and monitoring indicate the occasional occurrence of juvenile guillemots in the wider vicinity of Site N-7.2 during the post-breeding season (Markones & Garthe 2011, Markones et al. 2014, Planungsgemeinschaft Umweltplanung Offshore Windpark 2015). However, guillemots are not bound to specific habitats outside the breeding season (Camphuysen 2002, Davoren et al. 2002, Vliestra 2005, Crespin et al., 2006, Frederiksen et al. 2006). This is supported by the fact that extensive resting and foraging habitats are used throughout the North Sea; guillemots also show high mobility during the feeding of young birds, and the occurrence shows high spatial and temporal variability.

Gannets *(Sula bassana)* occur in the investigation area as well as in the entire German Bight throughout the year although the highest populations are reached in summer (Mendel et al. 2008). As expected, the highest monthly densities according to digital aerial transect surveys in area FN6_7 were recorded in summer in June 2019 (0.20 ind./km^2) and in July 2020 (0.72 ind./km^2). In the neighbouring investigation area FN10_11, the highest densities were 0.39 ind./km^2 in June 2019 (n = 2) and 0.37 ind./km^2 in May 2020. From the ship transect surveys, densities were much higher at 2.56 ind./km^2 in August 2018 and 1.18 ind./km^2 in July 2020. The highest seasonal densities were thus also determined for the summer periods. This also applied to the additional aerial survey area FN10_11(BioConsult SH et al. 2020). The aerial transect surveys in area FN6_7 did not indicate a focal distribution in 2018 to 2020. During the ship transect surveys, larger occurrences of gannets were observed south of Site N-7.2 as well as to a lesser extent in the central area of Area N-7 during the high occurrence summer of 2018. According to the experts, larger aggregations of gannets are not unusual because they usually hunt in larger groups (BioConsult SH et al. 2020). An overriding importance of Site N-7.2 cannot be derived from this.

Northern fulmars *(Fulmarus glacialis)* are a typical deep-sea bird species and occur mainly offshore in the EEZ beyond the 30 m depth contour. However, their distribution centres strongly depend on the hydrographic properties of the food availability in the North Sea water and are therefore correspondingly variable (Camphuysen & Garthe 1997, Mendel et al. 2008, Markones et al. 2015). Only low densities of a maximum of 0.03 individuals/km^2 (February 2019) were recorded in the area of investigation FN6_7 in the investigations for Site N-7.2. Comparatively higher densities were recorded in the neighbouring investigation area FN10_11 (0.16 ind./km^2 and 0.44 ind./km^2 in February 2020 and September 2018, respectively). According to the experts, the higher densities in investigation area FN10_11 may be related to the greater water depths compared with area FN6_7. According to the ship transect surveys in area SN7, the highest monthly densities were 0.10 ind./km^2 and 0.11 ind./km^2 in July 2020 and October 2018, respectively. The occurrence in the immediate vicinity of Site N-7.2 was rather low and did not indicate any focal points (BioConsult SH et al. 2020).

Because of the water depths of 30–40 m, feeding diving sea ducks, for example black scoter *(Melantta nigra)*, occur only sporadically as resting birds in this area of the German Bight. Their distribution is concentrated in coastal or shallower areas of the German North Sea (Mendel et al. 2008). The highest monthly density of 0.07 ind./km^2 in March 2019 (ship transect surveys) determined during the investigations for Site N-7.2 therefore corresponds to the expected abundance (BioConsult SH et al. 2020). For diving sea ducks, the surroundings of Site N-7.2 are therefore of no importance.

Skuas, which include the species pomarine skua *(Stercorarius pomarinus)*, skua (*Stercorarius skua*), and parasiti cskua (*Stercorarius parasiticus*), were not sighted at all or only sporadically with single individuals in the investigations of

Site N-7.2 (BioConsult SH et al. 2020). The surroundings of Site N-7.2 do not seem to be part of their preferred habitat and thus have no special importance for these species

Black-headed Gulls *(Chroicocephalus ridibundus*) do not belong to the typical offshore species and were mostly found in correspondingly low densities of < 0.06 individuals/km^2. An exception was the ship survey in August 2019 for which a density of 0.17 individuals/km^2 was determined. Spatial focal points were not identified (BioConsult SH et al. 2020). Sightings of great crested grebes *(Podiceps cristatus*) are a rare exception in the vicinity of Site N-7.2 (BioConsult SH et al. 2020).

2.8.4 Status assessment of the protected asset seabirds and resting birds

The investigation effort of previous years allows a good assessment of the importance and condition of the area surrounding Site N-7.2 as a habitat for seabirds.

2.8.4.1 Protection status

Of the seabird species regularly observed in the vicinity of Site N-7.2, albeit sometimes in low densities, the red-throated diver, black-throated diver, and little gull as well as the three tern species sandwich, common, and Arctic tern are listed in Annex I of the EU Birds Directive as already mentioned. The red-throated diver, black-throated diver, and little gull are also classified as SPEC category 3 (not restricted to Europe but with negative population trends and unfavourable protection status). Common gull and Sandwich tern are considered “concentrated in Europe with negative population trends and unfavourable protection status” (SPEC category 2). Northern fulmars are considered “endangered” according to the pan-European endangerment status (EUR-Gef.). Kittiwakes are classified as “vulnerable” (VU) according to the current pan-European endangerment status, while little gull, herring gull, guillemot, and razorbill are classified as “near-threatened” (NT) (BirdLife International 2015). The endangerment status in the 27 EU states (EU27-Gef.) is considered “endangered” (EN) for kittiwakes and “vulnerable” (VU) for Northern fulmar and herring gull (BirdLife International 2015). For the assessment aspect of protection status, the seabird community found in the vicinity of Site N-7.2 is therefore of medium to high importance.

2.8.4.2 Assessment of the occurrence of resting birds and seabirds

In the wider surroundings of Site N-7.2, seagulls dominate the seabird population (Chapter 2.8.3). Lesser black-backed gulls and kittiwakes are the most frequently observed species. Species of Annex I of the V-RL such as divers, terns and little gulls use the surroundings of Site N-7.2 as a foraging ground only to a moderate extent and mainly during migration periods. For them, this area is not one of the valuable resting habitats or preferred inhabitation sites in the German Bight. The main resting area for divers in the German Bight is west of Sylt.

Because of a water depth of 30–40 m, feeding sea ducks such as black scoters occur only sporadically in the vicinity of Site N.7-2. The occurrence of Northern fulmars is quite variable; as expected, gannets showed an increased occurrence in the summer months. For auks such as guillemots and razorbills, the area surrounding Site N-7.2 is part of the large-scale habitat in the German Bight. Specific distribution foci were not identified.

According to the current state of knowledge, the occurrence of seabirds and resting birds in Site N-7.2 and its surroundings can be assessed as average.

2.8.4.3 Assessment of spatial units

Typical seabird species of the EEZ of the North Sea have been recorded in the vicinity of site N-7.2 (BSH 2020a). Occurrence and distribution were based on the species-specific habitat requirements and phenologies. For breeding birds, the surroundings of site N-7.2 are of no particular importance because of the distance to the breeding colonies on the coasts or on Helgoland. Occasionally, fledgling guillemots from the British colonies are observed in the wider vicinity of Site N-7.2. However, a special function of the wider surroundings of Site N-7.2 as a feeding or breeding area cannot be determined based on the findings to date, particularly with regard to the large-scale and individual-strong occurrence in the German North Sea.

Site N-7.2 is also located at a distance of more than 80 km from the “Östliche Deutsche Bucht” bird conservation area (sub-area II of the “Sylter Außenriff – Östliche Deutsche Bucht” nature conservation area). Overall, the function of Site N-7.2 and its surroundings is assessed as medium.

2.8.4.4 Legacy impacts

Site N-7.2 is located to the north of the German Bight Western Approach traffic separation route. Because of its proximity to the busy shipping route, the surroundings of Site N-7.2 are influenced by traffic volume in terms of legacy impact. In addition, fishing in the North Sea affects the availability of food resources and the abundance of seabird species known to be ship-followers, adversely affects the seabed through bottom trawling and can pose a direct threat through the setting of gillnets in which seabird species diving for food can become entangled and die. The pressures from shipping and fishing in the vicinity of Site N-7.2 are of medium to species-specific high intensity for seabirds. Several wind farm projects have already been realised in thewider vicinity of Site N-7.2. In addition, changes in the ecosystem may be associated with threats to seabird populations. The following factors can cause changes in the marine ecosystem and thus also in seabirds:

- Climate change: Changes in water temperature are accompanied by changes in water circulation, plankton distribution and the composition of the fish fauna. Plankton and fish fauna serve as a food source for seabirds. However, because of the uncertainty regarding the effects of climate change on the individual ecosystem components, it is hardly possible to predict the impacts of climate change on seabirds.
- Fishing: It can be assumed that fishing has a considerable influence on the composition of the seabird community in the EEZ and thus also in the vicinity of Site N-7.2. Fishing can lead to a reduction in the food supply and even to food limitation. Selective fishing of fish species or fish sizes may lead to changes in the food supply for seabirds. Fishing discards provide additional food sources for some seabird species. The resulting trend towards more birds (lesser black-backed gull, herring gull, and common gull) has been established by targeted investigations (GARTHE et al. 2006).
- Shipping: Shipping traffic has a scaring effect on species sensitive to disturbance such as divers (MENDEL et al. 2019, FLIESSBACH et al. 2019, BURGER et al. 2019) and includes the risk of oil spills.
- Technical structures (offshore wind turbines, platforms): Technical structures can have similar impacts on disturbance-sensitive species as shipping traffic. In addition, there is an increase in the volume of shipping because of supply trips. There is also a risk of collision with such structures.

In addition, threats to seabirds can come from eutrophication, pollutant accumulation in marine food webs, and rubbish floating in the water (e.g. parts of fishing nets and plastic debris). Epidemics of viral or bacterial origin also pose a threat to resting and seabird populations.

The existing impacts on Site N-7.2 and its surroundings are to be assessed as "medium" because of the influences described.

2.8.4.5 Conclusion

According to the current state of knowledge, the surroundings of Site N-7.2 have an overall medium importance for resting and foraging seabirds.

2.9 Migratory birds

Bird migration is usually defined as periodic migrations between the breeding area and a separate non-breeding area, which in the case of birds at higher latitudes normally contains the wintering grounds. Because bird migration takes place annually, it is also called annual migration – and is spread throughout the world. In this context, one also speaks of two-way migratory birds, which make a return journey, or annual migratory birds, which migrate every year. Often, in addition to a resting place, one or more stopovers are made, be it for moulting, to find favourable feeding grounds or for other reasons. A distinction is made between long-distance and short-distance migrants according to the distance covered and physiological criteria (ALERSTAM 1990, BERTHOLD 2000, NEWTON 2008, NEWTON 2010).

2.9.1 Availability of data

The BSH has good data sources for the suitability assessment of Site N-7.2 with regard to the protected asset "migratory birds". This is primarily the result of the preliminary investigation of sites for Site N-7.2 commissioned by the BSH. In the context of this, bird migration during the main migration periods autumn 2018 to spring 2020 was investigatedby means of radar surveys, visual observations, and nocturnal migratory call survey in accordance with the standard investigation concept (StUK 4) (BIOCONSULT SH et al. 2020b). In addition, long-term surveys in the surrounding wind farm areas can be used (IBL UMWELTPLANUNG et al. 2019b, IBL UMWELTPLANUNG et al. 2020b).

In general, it should be noted that the methods required in the StUK can capture only parts of a complex migration event. Visual observations provide information on the type, number, and migration direction of the birds during the day; however, the migration altitude can be difficult to determine. Nocturnal migration call surveys provide information on calling species, although the number of individuals remains undetermined. Although radar surveys can provide reliable indications of migratory activity, they do not allow species-specific recording, do not determine the number of animals, and record migratory activity up to an altitude of only 1,000–1,500 m.

In order to classify the bird migration in the area of Site N-7.2 in relation to the overall bird migration, long-term data series from various offshore and coastal sites are also available (MÜLLER 1981, DIERSCHKE 2001, HÜPPOP & HÜPPOP 2002, HÜPPOP & HÜPPOP 2004, HÜPPOP et al. 2004, HÜPPOP et al. 2005).

Overall, the data forms a good basis for the suitability assessment of N-7.2, the site in question. Because of the aforementioned methodological limitations and the general difficulties in recording a dynamic phenomenon such as bird migration, there are still gaps in knowledge regarding the following points:

- There is currently a lack of sufficient knowledge of the impacts of offshore construction in some areas. Knowledge from the territorial waters and on land is transferable only to a limited extent because of the different conditions.
- The species-specific risk of collision with offshore wind turbines for migratory birds is largely unknown.

- Possible barrier impacts of offshore wind turbines on species-specific sea migration routes are largely unexplored.

2.9.2 Bird migration over the German Bight – Spatial distribution and temporal variability of migratory birds

According to previous estimates, tens to hundreds of million birds migrate across the German Bight every year (EXO et al. 2003, HÜPPOP et al. 2005). The largest proportion is made up of songbirds, most of which cross the North Sea at night (HÜPPOP et al. 2005, HÜPPOP et al. 2006). Most birds come from Norway, Sweden, and Denmark. For waterfowl and waders, however, breeding grounds extend far north-east into the Palaearctic and in the north and north-west to Spitsbergen, Iceland and Greenland.

The German Bight is on the migration route of numerous bird species. For example, between 226 and 257 (on average 242) species per year were recorded on Helgoland from 1990 to 2003 (according to DIERSCHKE et al. 1991–2004, cited in OREJAS et al. 2005). Other species that migrate at night but do not or rarely call, (such as the pied flycatcher) (HÜPPOP et al. 2005) should also be included. If rarities are included, a more than 425 migratory bird species were recorded on Helgoland over the course of several years (HÜPPOP et al. 2006). At greater distances from the coast, the average migration intensity and possibly the number of migrating species seems to decrease (DIERSCHKE 2001).

According to current knowledge, migratory bird events can be roughly divided into two phenomena: broad-front migration and migration along migratory routes. It is known that most migratory bird species fly over at least large parts of their migration areas in a broad front.

According to KNUST et al. (2003), this applies also to the North Sea and Baltic Sea. Species migrating at night in particular, which cannot be guided by geographical structures because of the darkness, move across the sea in broad-front migration.

Broad-front migration is typical for night migration as well as for the diurnal migration of songbirds. A current cross-project evaluation of all data from large-scale bird migration monitoring for offshore wind farm projects showed a clear gradient of decreasing migration intensities with greater distance from the coast for nocturnal bird migration over the North Sea; this is dominated by songbirds (WELCKER 2019). For several songbirds primarily migrating during the day, a lower migration intensity can be observed on Helgoland than on Sylt or Wangerooge (HÜPPOP et al. 2009). Radar surveys confirm a decreasing intensity of the limni migration towards the offshore area (DAVIDSE et al. 2000; LEOPOLD et al. 2004; HÜPPOP et al. 2006). Also the comparative investigations of the visible diurnal migration of waders and waterbirds between Helgoland and the (former) Research Platform North Sea (FPN), 72 km west of Sylt of DIERSCHKE (2001) indicate a gradient between the coast and the open North Sea. This assumption is confirmed in the BeoFINO final report because the results of the visual observations presented show a clear concentration of waterbirds near the coast. Only a few bird species are found in the offshore area in equal or larger numbers of individuals (e.g. red-throated diver, pink-footed goose).

Figure 13 shows a detailed section of the broad front over the south-eastern North Sea. It should be emphasised that the distances between the lines of individual migration flows merely indicate the direction of a gradient. Therefore, conclusions about the magnitude of spatial trends must not be drawn from the figure under any circumstances. The thickness of the lines also only qualitatively illustrates intensity differences between the migration streams.

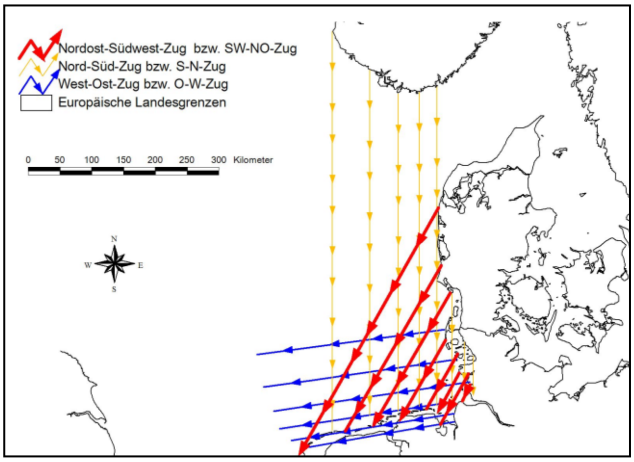

Figure 13: Schematic of main migration routes over the south-eastern North Sea (shown for autumn from HÜPPOP et al. 2005a).

The seasonal north-east-south-west or south-west-north-east migration dominates over a wide area according to the current state of knowledge (see Figure 13), although there may be some differences in the direction of migration and the degree of coastal orientation. HÜPPOP et al. (2009) and AVITEC RESEARCH GBR (2015b) also found a clear main direction of migration to the south-southwest in autumn (departure) during their investigations using radar on the FINO1 research platform. In spring, a clear direction (north-east) was also discernible, but only at night when no foraging birds were active.

Seasonal migration intensity is closely linked to species- or population-specific life cycles (e.g. BERTHOLD 2000). In addition to these largely endogenously controlled annual rhythms in migratory activity, the actual course of migration is determined mainly by weather conditions. Weather factors also influence at what altitude and at what speed the animals migrate. In general, birds wait for favourable weather conditions (e.g. tailwind, no precipitation, good visibility) for their migration in order to optimise it in terms of energy. As a result, bird migration is concentrated on individual days or nights in autumn and spring. According to the results of an R&D project, half of all birds migrate in only 5–10% of all days (KNUST et al. 2003).

More detailed descriptions of large-scale bird migration over the German Bight can be found in the Environmental Report on Site Development Plan 2020 for the German North Sea (BSH 2020a).

2.9.3 Bird migration in the vicinity of Site N-7.2

2.9.3.1 Species spectrum

During the investigations of Site N-7.2, 98 species (79 taxa determined to species level in year of investigation 2018/2019 and 73 taxa determined to species level in 2019/2020) were detected by means of visual observations in the light phase during the entire period of investigation (2018 to 2020). During the same period, 36 bird species (34 in year of investigation 2018/2019 and 21 in 2019/2020) were recorded during the nocturnal migration call surveys. In total, 29 species were detected both during the day by means of visual observations and at night by means of migratory call surveys (BIOCONSULT SH et al. 2020b).

In the investigations on Site N-7.2, gulls dominated the migratory activity in the light phase and formed relative proportions of 32% and 39% of all recorded individuals in spring 2019 (gulls: n = 1,673 individuals, total: n = 5,151 individuals) and 2020 (gulls: n = 1,393 individuals, total: n = 3,567), respectively and 46% and 53% of all recorded individuals in autumn 2018 (gulls: n = 2,466 individuals, total: n = 5,403 individuals) and autumn 2019 (gulls: n = 1,713 individuals, total: n = 3,232 individuals), respectively. Among the gulls, lesser black-backed gulls and kittiwakes were the most common species followed by common gulls, little gulls, greater black-backed gulls, herring gull, and black-headed gull in varying frequencies (BIOCONSULT SH et al. 2020b).

Other species or species groups observed regularly and in larger numbers included gannets (2,479 individuals), terns (2,501 individuals) and auks (1,707 individuals), the relative proportions (in the respective total number of species) of which varied seasonally and annually (BIOCONSULT SH et al. 2020b).

In addition, songbirds, ducks, waders, Northern fulmars, and geese reached frequencies of > 2% of the total number of individuals. Species or species groups such as skuas, cormorants, swans, and birds of prey each accounted for less than 1% of the total number of individuals (BIOCONSULT SH et al. 2020b).

According to the results of the migratory call survey, songbirds dominated the migratory activity during the dark phase. Their relative proportions of the respective total calls in the autumn migration periods were 98% in autumn 2018 (songbirds: n = 11,835 calls, total: n = 12,043 calls) and 96% in autumn 2019 (songbirds: n = 3.254 calls, total n = 3,383 calls); these were considerably higher than in spring 2019 (79%, songbirds: n = 190 calls, total: n = 239 calls) and spring 2020 (70%, songbirds: n = 64 calls, total: n = 91 calls). The most common species included red-winged thrush, blackbird, song thrush, and fieldfare. Among the non-singing birds, calls of waders and gulls were detected most frequently. In total, 208 wader calls and 115 gull calls were recorded in the investigations of Site N-7.2 (BIOCONSULT SH et al. 2020b).

2.9.3.2 Migration intensities, migration altitudes, migration direction

The bird migration surveys carried out as part of the preliminary investigation of sites for Site N-7.2 show that migratory activity was regularly detected both during the day and at night on the respective survey days for the survey period autumn 2018 to spring 2020. In the autumn 2018 and autumn 2019 migration periods, diurnal and nocturnal migration intensities were highest in the second half of August. However, it was not possible to limit the migratory activities for the autumn period to the month of August only because of the regular migratory activities in the other months. Seasonal and interannual differences can be seen when comparing the individual years of investigation. Bird migration events of varying intensity occurred during the period of investigation (BIOCONSULT SH et al. 2020b).

2.9.3.2.1 Migration intensities

Based on the vertical radar surveys for Site N-7.2, the mean migration intensity during the dark phase was 167 echoes/h*km in autumn 2018 and 252 echoes/h*km in autumn 2019. A mean nocturnal migration intensity of 252 echoes/h*km was determined for the spring migration of 2019; in spring 2020, the mean nocturnal migration intensity was 194 echoes/h*km (BIOCONSULT SH et al. 2020b). There were no significant differences between spring and autumn migration rates in either survey year. When comparing the two years with each other, it is noticeable that the mean migration intensity in spring 2019 was higher than in autumn 2018. However, in the 2nd year of investigation, the mean migration intensity in autumn was higher than in spring (BIOCONSULT SH et al. 2020b). In autumn 2018 and 2019, there were individual nights with high mean migration rates; however this was not reflected in the migration call surveys. In this context, the highest mean migration rate of 1,620 echoes/h*km on the night of 24-25 August 2019 was almost twice as high as on the night with the highest migration intensity in the 1st year of investigation, the night of 21– 22 August for which a mean migration intensity of 890 echoes/h*km was determined. No mean nocturnal migration rates above 1,000 echoes/h*km were detected during the 2019 and 2020 spring periods (BIOCONSULT SH et al. 2020b).

For diurnal migration, the mean migration intensity was 177 echoes/h*km in autumn 2018 and 167 echoes/h*km in autumn 2019. For the early season migration of 2019, the mean migration intensity in the light phase was 112 echoes/h*km; for the spring migration of 2020, this was only 68 echoes/h*km (BIOCONSULT SH et al.

2020b). In both survey years, the mean migration intensities were higher in autumn than in spring. However, this difference was significant only in the 2nd year of investigation (autumn 2019/spring 2020). For diurnal migration, too, the highest mean migration intensities were recorded in the second half of August. The mean migration intensity on 22 Aug 2018 (912 echoes/h*km) was comparable to the mean migration intensity on 24 Aug 2019 (1,009 echoes/h*km) (BioConsult SH et al. 2020b).

There were no significant differences between spring and autumn migration rates in either survey year. When comparing the two years with each other, it is noticeable that the mean migration intensity in spring 2019 was higher than in autumn 2018. However, in the 2nd year of investigation, the mean migration intensity in autumn was higher than in spring (BioConsult SH et al. 2020b). In autumn 2018 and 2019, there were individual nights with high mean migration rates; however this was not reflected in the migration call surveys. In this context, the highest mean migration rate of 1,620 echoes/h*km on the night of 24-25 August 2019 was almost twice as high as on the night with the highest migration intensity in the 1st year of investigation, the night of 21– 22 August for which a mean migration intensity of 890 echoes/h*km was determined. No mean nocturnal migration rates above 1,000 echoes/h*km were detected during the 2019 and 2020 spring periods (BioConsult SH et al. 2020b).

An examination of the diurnal occurrence of bird migration in the vicinity of Site N-7.2 shows that bird migration was recorded at all times of day in both spring and autumn. The intensity of bird migration at the respective times of day and night was partially varied between the months and years of investigation (BioConsult SH et al. 2020b).

2.9.3.2.2 Migration altitudes

An examination of the distribution of nocturnal bird migration altitudes on Site N-7.2 shows monthly fluctuations in the most frequently used flight altitudes for both years of investigation. A clear pattern thus does not emerge for either the nocturnal autumn migration or for the spring nocturnal migration.

Monthly nocturnal migration rates below 300 m ranged from 18% (September 2018) to 55% (July 2018) in the first year of investigation (Autumn 2018/ Spring 2019). In terms of seasonal migration intensities, 32% (autumn 2018) and 39% of echoes were recorded in the altitudinal range below 300 m (BioConsult SH et al. 2020b).

The second year of investigation (Autumn 2019/Spring 2020) showed comparable monthly fluctuations with regard to the use of the altitude range up to 300. In both autumn 2019 and spring 2020, about 30% of echoes were in the altitude range up to 300 m (BioConsult SH et al. 2020b).

In relation to the turbine scenarios used for the evaluation forecast (cf Table 3, Chapter 1.5.5.4), the echoes in the rotor range of Scenario 1 (25–225 m) varied between 21% (Autumn 2018, Spring 2019) and 27% (Spring 2019). For the rotor range of Scenario 2 (50–350 m), the percentages were higher: 24% in Spring 2020 to 47% in Spring 2019 (BioConsult SH I et al. 2020b).

The differences between the years described in Chapter 2.9.3.2.1 with regard to higher or lower migration intensities in spring or autumn were also evident in the flight altitudes. The higher migration rates recorded in spring 2019 and autumn 2019 compared with autumn 2018 and spring 2020, respectively, are expressed in the higher migration rates at all altitude layers (BioConsult SH I et al. 2020b).

As with the nocturnal migration, monthly differences in preferred flight altitudes were also evident in the diurnal migration. In some months, a preference for flight altitudes up to 100 m became apparent (July, August, and November

2018; March, July, and November 2019; May 2020). This also had a corresponding effect on the percentage flight altitude distribution in relation to the turbine scenarios, especially Scenario 1.

In both the first and second year of investigation, 30% of the echoes were detected in the lower 300 m in spring and autumn. In terms of turbine band widths, between 16% (Spring 2019) and 23% (Spring 2020) of the respective echoes were recorded at 25–225 m and between 25% (Autumn 2018, Spring 2019) and 33% (Spring 2020) at the height of the rotor range of Scenario 2 (50–350 m)(BIOCONSULT SH et al. 2020b).

For diurnal migration, the higher migration intensities of the autumn migration periods compared with the spring periods were evident in all altitude layers.

On migratory days or nights with stronger migratory events, no clear pattern in the distribution of migratory altitudes was observed as was also the case in the overall observation for diurnal and nocturnal migration. During the individual stronger migration events, different altitude ranges were flown variably. The lower altitudinal range up to 200 m was among the most frequented altitudinal ranges only on the night of migration from 23 to 24 August (BIOCONSULT SH I et al. 2020b).

In addition to the radar recordings and usually with reference to the species, visual observations provide information on the distribution of migration heights in the lower 200 m during the light phase. In the four migration periods studied from 2018 to 2020, the proportion of birds flying below 20 m ranged from 77% in autumn 2019 (n = 3,232 sightings) to 89% (n = 5,151 sightings) in spring 2019 (BIOCONSULT SH Iet al. 2020b).

2.9.3.2.3 Direction of migration

The migration directions according to visual observations revealed clear north-east to east components for the respective spring periods in 2018 to 2020. As expected, south-westerly to westerly migration directions dominated during the migration periods. Slight differences were observed between the individual recording months. However, these fit into the context of seasonal migration directions (BIOCONSULT SH et al. 2020b).

2.9.4 Status assessment and importance of Site N-7.2 and its surroundings for bird migration

The status assessment of the protected asset migratory birds and the importance of Site N-7.2 and its surroundings for bird migration is based on the following evaluation criteria:

- The importance of bird migration over a large area
- Assessment of the occurrence
- Rarity and threat
- Legacy impact

Unless otherwise stated, the following comments refer to bird migration as a whole.

2.9.4.1 The importance of bird migration over a large area

No specific migration corridors can be identified for any migratory bird species in the EEZ of the North Sea. Bird migration takes place in an unspecified broad-fronted migration across the North Sea with a tendency towards coastal orientation. Site N-7.2 is located in an area of the EEZ far from the coast. Site N-7.2 and its surroundings are therefore of medium importance at most.

2.9.4.2 Assessment of the occurrence

During migration periods, bird migration regularly occurs in the vicinity of Site N-7.2. There are occasionally stronger migratory events during the day and at night on a site-specific scale. The migration rates determined are part of the overall bird migration over the German Bight (see detailed information in BSH 2020a). The migratory activity and its intensity in the vicinity of Site N-

7.2 is therefore considered to be of medium importance.

2.9.4.3 Rarity and threat

In the investigations of Site N-7.2, 98 species were recorded in the visual observations, and 36 species in the migration call surveys. Of these, 29 species were recorded both during the day and at night. Across all migration periods investigated, 14 species of Annex I of the European Birds Directive were recorded; among these were red-throated and black-throated divers, Sandwich terns, common and Arctic terns, and little gulls were the most common species of Annex I. Barnacle goose and Eurasian golden plover were recorded in comparatively higher numbers. Short-eared owl, black tern, Leach's storm petrel, merlin, and bar-tailed godwit were recorded only sporadically. In view of the number of species recorded in the vicinity of Site N-7.2 in relation to the species spectrum of bird migration over the entire German Bight (see Chapter 2.9.2), the number of species is assessed as average and the endangerment status as above average.

2.9.4.4 Legacy impact

Anthropogenic factors contribute to the mortality of migratory birds in various ways and, in a complex interaction, can influence population size and determine current migration patterns.

Major anthropogenic factors that increase mortality of migratory birds are active hunting, collisions with anthropogenic structures and, for waterbirds and seabirds, pollution by oil or chemicals (CAMPHUYSEN et al. 1999). The various factors have a cumulative effect; the detached significance is therefore usually difficult to determine. Especially in Mediterranean countries, a statistically insufficient amount of hunting still takes place (HÜPPOP & HÜPPOP 2002). TUCKER & HEATH (1994) conclude that more than 30% of European species marked by population declines are also threatened by hunting.

The proportion of birds ringed on Helgoland and indirectly killed by humans has increased in the past in all species groups and finding regions; building and vehicle approaches were the main causes (HÜPPOP & HÜPPOP 2002). Surveys of collision victims at four lighthouses in the German Bight show that songbirds are strongly dominant. Starlings, thrushes (song thrush, red thrush, fieldfare) and blackbirds are particularly prominent among the birds being found dead. Similar findings are available for FINO1 (HÜPPOP et al. 2009), the FPN (MÜLLER 1981) or former lighthouses on the Danish west coast (HANSEN 1954). During 36 of 159 visits to the research platform FINO1 with bird monitoring between October 2003 and December 2007, 770 dead birds (35 species) were found. Thrushes and starlings were the most common, accounting for 85% of the total. The species concerned are characterised by nocturnal migration and relatively large populations. It is striking that almost 50% of the collisions registered on FINO1 occurred in only two nights. On both nights, there were south-easterly winds (which may have encouraged migration over sea) and poor visibility (which may have led to a reduction in flight altitude and increased attraction by the illuminated platform) (HÜPPOP et al. 2009). The wider surroundings (Areas N-6 and N-8) of Site N-7.2 are partly developed with wind farms. A wind farm is currently being planned in the immediate vicinity in Area N-7.2.

Global warming and climate change also have measurable impacts on bird migration (e.g. through changes in phenology or altered arrival and departure times) However, these are species-specific and vary from region to region (cf BAIRLEIN & HÜPPOP 2004, CRICK 2004, BAIRLEIN & WINKEL 2001). Clear relationships between large-scale climatic cycles such as the North Atlantic Oscillation (NAO) and the condition of songbirds caught during spring migration have also been demonstrated (HÜPPOP & HÜPPOP 2003). Climate change can influence conditions in breeding, resting and wintering areas or the resources of these sub-habitats.

Overall, the legacy impacts are rated as medium.

2.9.4.5 Conclusion

Overall, based on the above criteria and their respective assessment, Site N-7.2 and its surroundings are of medium importance for bird migration.

2.10 Bats and bat migration

Bats are characterised by a high mobility. While bats can travel up to 60 km per day in search of food, nesting or summer resting places and wintering areas are several hundred kilometres apart. Migration movements of bats in search of extensive food sources and suitable resting places are often observed on land but predominantly aperiodically. However, migratory movements of bats over the North Sea are still poorly documented and largely unexplored.

2.10.1 Availability of data

The data availability on bat migration over the North Sea is insufficient for a detailed description of the occurrence and intensity of bat migration in the offshore area in general and in the offshore vicinity of Site N-7.2 in particular. In the following, reference is made to general literature on bats and findings from systematic surveys on Helgoland as well as acoustic surveys from the FINO1 research platform and other sources of knowledge in order to reflect the current state of knowledge. In view of the need for further knowledge on bat migration over the North Sea, the following can be stated:

- There is a lack of knowledge about the quality and quantity of migratory bat populations in the North Sea area.
- There is currently a lack of sufficient knowledge of the impacts of offshore construction. Knowledge from the territorial waters and on land is transferable only to a limited extent because of the different conditions.
- The species-specific risk of bats colliding with offshore wind turbines is largely unknown.

2.10.2 Spatial distribution and status assessment

Bats are characterised by a high mobility. Migratory movements of bats in search of extensive food sources and suitable resting places are often observed on land but predominantly aperiodically. In contrast to irregular migratory movements, migratory movements occur periodically or seasonally. Both the sedentary and migratory behaviour of bats is highly variable. On the one hand, differences can occur depending on species and sex. On the other hand, sedentary or migratory movements can vary greatly even within the populations of a species. Based on their sedentary behaviour, bats are divided into short-distance, medium-distance and long-distance migratory species.

Bats go on short- and medium-distance migrations in search of nesting, feeding, and resting places. Corridors along flowing waters, around lakes and Bodden waters are known for medium distances (BACH & MEYER-CORDS 2005). However, long-distance migrations are still largely unexplored. Bats migratory routes are scarcely described. This particularly applies to migratory movements across the open sea. In contrast to bird migration, which has been confirmed by extensive studies, the migration of bats remains largely unexplored because of the lack of suitable methods or large-scale special monitoring programmes.

The long-distance migratory species include the mountain noctule bat (*Nyctalus noctula*), Nathusius's pipistrelle (*Pipistrellus nathusii*), parti-coloured bat (*Verspertilia murinus*), and Leisler's bat (*Nyctalus leisleri*). For these four species, migrations over a distance of 1,500 to 2,000 km are regularly recorded (Tress et al. 2004, Hutterer et al. 2005).

Long-distance migratory movements are also suspected for the species soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*) (Bach & Meyer-Cords 2005). Some long-distance migratory species occur in Germany and littoral states of the North Sea and have occasionally been encountered on islands, ships, and platforms in the North Sea.

However, based on observations of bats on Helgoland, the number of bats migrating from the Danish coast across the German North Sea in autumn is estimated at about 1,200 individuals (Skiba 2007). An evaluation of observations of bats migrating from south-west Jutland to the North Sea leads to the same conclusion (Skiba 2011).

Visual observations such as on the coast or on ships and offshore platforms provide initial indications but are hardly suitable for fully recording the migration behaviour of nocturnal and nocturnally migrating bats over the sea. The recording of ultrasonic calls of bats by suitable detectors (bat detectors) provides good results on land about the occurrence and migration movements of bats (Skiba 2003). However, the results obtained so far from the use of bat detectors in the North Sea only provide initial indications. Acoustic surveys of bat migration over the North Sea on the FINO1 research platform resulted in detections of only at least 28 individuals between August 2004 and December 2015 (Hüppop & Hill 2016).

When recording bat migration over the open sea, in addition to general occurrence, species composition, and migration routes, the question also arises as to the heights at which bats migrate in order to be able to assess a possible risk of collision with offshore wind farms. Depending on location and method, the individuals surveyed by Hüppop & Hill (2016) were surveyed between 15 and 26 m at mean sea level, which includes the area between the lower rotor blade tip and the water surface of most wind farms. Brabant et al. (2018) investigated bat occurrence at Thornton Bank wind farm using bat detectors at 17 m and 94 m above ground. Only 10% of the 98 bat recordings – and thus significantly fewer than at 17 m – were taken at a greater height.

Some species such as Nathusius's pipistrelle and the mountain noctule bat are listed in Annex II of the 1979 Convention on Migratory Species (CMS), "Bonn Convention". Twenty-five bat species are native to Germany. Of these, the current Red List of Mammals (Meinig et al. 2008) assigns two species to the category "indeterminate", four species to the category "endangered", and three species to the category "critically endangered". The common bent-wing bat (*Miniopterus schreibersii)* is considered "extinct or lost". Of the species that have so far been recorded more frequently in marine or coastal areas of Germany, the mountain noctule bat is near-threatened, while the common pipistrelle and Nathusius's pipistrelle are considered "unthreatened". For an assessment of the endangerment status of the availability of data of the common swift is considered insufficient.

The data available for the EEZ of the North Sea and the area of Site N-7.2 are fragmentary and insufficient to be able to draw meaningful conclusions about the migratory movements of bats. It is not possible to draw specific insights into migratory species, migration directions, migration altitudes, migration corridors, and possible concentration ranges based on the data available. Previous knowledge only confirms that bats, especially long-distance migratory species, fly over the North Sea. Against this background, there is currently no scientific basis for describing and assessing the occurrence of bats in the vicinity of Site N-7.2 and, accordingly, the status of the protected asset bats.

2.11 Biological diversity

Biological diversity (or in short: Biodiversity comprises the diversity of habitats and biotic communities, the diversity of species, and the genetic diversity within species (Article 2 Convention on Biological Diversity, 1992). Biodiversity is in the public eye. Species diversity is the result of an evolutionary process that has been going on for over 3.5 billion years, a dynamic process of extinction and species formation. Of the approximately 1.7 million species described by science to date, some 250,000 occur in the sea, and although there are considerably more species on land than in the sea, the sea is more comprehensive and phylogenetically more highly developed than the land in terms of its tribal biodiversity. Of the 33 known animal phyla, 32 are found in the sea; 15 of these are exclusively marine. (VON WESTERNHAGEN & DETHLEFSEN 2003).

Marine diversity cannot be directly observed and is therefore difficult to assess. For their assessment, tools such as nets, weirs, grabs, traps or optical registration methods must be used. However, the use of such devices can only ever provide a section of the actual species spectrum – precisely that which is specific to the device question. Because the North Sea, as a relatively shallow marginal sea, is more easily accessible than, for example, the deep sea, intensive marine and fishery research has been carried out for about 150 years. This has led to an increase in knowledge about its flora and fauna. This makes it possible to refer to inventory lists and species catalogues in order to document possible changes (VON WESTERNHAGEN & DETHLEFSEN 2003). According to the results of the Continuous Plankton Recorder (CPR), about 450 different plankton taxa (phyto- and zooplankton) have been identified in the North Sea. About 1,500 marine species of macrozoobenthos are known. Of these, an estimated 800 are found in the German North Sea area (RACHOR et al. 1995). According to YANG (1982), the fish fauna of the North Sea is composed of 224 species of fish and lamprey. For the German North Sea, 189 species are reported (FRICKE et al. 1995). In the EEZ of the North Sea, 19 seabirds and resting birds occur regularly in larger populations. Three of these species are listed in Annex I of the V-RL.

With regard to the current state of biodiversity in the North Sea, it should be noted that there is countless evidence of changes in biodiversity and species assemblages at all systematic and trophic levels in the North Sea. The changes in biodiversity are due mainly to human activities (e.g. fishing and marine pollution) and climate change.

Red lists of endangered animal and plant species fulfil an important monitoring and warning function in this context because they show the status of the populations of species and biotopes in a region. Based on the Red Lists, 32.2% of all currently assessed macrozoobenthos species in the North Sea and Baltic Sea (RACHOR et al. 2013) and 27.1% of the fish and lampreys established in the North Sea (THIEL et al. 2013, FREYHOF 2009) are assigned to a Red List category. The marine mammals form a species group in which all representatives are currently vulnerable, whereby the bottlenose dolphin has even disappeared from the area of the German North Sea (VON NORDHEIM et al. 2003). Of the 19 regularly occurring seabirds and resting birds, three species are listed in Annex I of the V-RL. In general, in accordance with the Birds Directive, all wild native bird species are to be conserved and thus protected.

2.12 Air

Shipping traffic causes emissions of nitrogen oxides, sulphur dioxides, carbon dioxide, and soot particles. These can negatively affect air quality and to a large extent are carried into the sea as atmospheric deposition. Since 1 January 2015, shipping in the North Sea has been subject to stricter rules as an emission control area, the "Sulphur Emission Control Area" (SECA). In accordance with Annex VI, Regulation 14 of the MARPOL convention, ships may only use heavy fuel oil with a maximum sulphur content of 0.10%. Worldwide, a limit of 3.50% is currently still in force. According to a resolution by the International Maritime Organization (IMO), in 2016, this limit is to be reduced to 0.50% worldwide from 2020.

Emissions of nitrogen oxides are particularly relevant for the North Sea as an additional nutrient load. To this end, the IMO decided in 2017 that the North Sea will be declared a "Nitrogen Emission Control Area" (NECA) from 2021. The total reduction of the discharge of nitrogen oxides into the Baltic Sea region through the North Sea and Baltic Sea ECA measure is estimated at 22,000 t (European Monitoring and Evaluation Programme (EMEP 2016)).

2.13 Climate

The German North Sea is located in the temperate climate zone. An important influencing factor is warm Atlantic water from the North Atlantic Current. Icing can occur in coastal areas, but is rare and only occurs at intervals of several years. There is broad agreement among climate researchers that the global climate system is being noticeably affected by the increasing release of greenhouse gases and pollutants, and that the first effects are already being felt.

According to reports by the Intergovernmental Panel on Climate Change (IPCC 2001, 2007), the large-scale impacts of climate change on the oceans are expected to be increases in sea surface temperature and average global sea level. Many marine ecosystems are sensitive to climate change. Global warming is also expected to have a considerable impact on the North Sea – both through rising sea levels and changes in the ecosystem. In recent years, for example, species that were previously only found further south have increasingly spread, and the habits of long-established species have changed, sometimes considerably.

2.14 Landscape

The marine landscape is characterised by large-scale open space structures surrounded by offshore wind turbines. For example, a number of wind turbines in the German Bight are visible on the horizon when viewed from the coast.

Structures are platforms as well as measuring masts for research purposes, which are located within or in the immediate vicinity of the wind farms. The landscape will continue to change as a result of the expansion of offshore wind energy, and the necessary lighting can also have adverse effects on the appearance of the landscape.

The extent to which the landscape is adversely affected by vertical structures depends strongly on the visibility conditions. The space in which a building becomes visible in the landscape is the visual impact space. It is defined by the visual relationship between the structure and its surroundings, whereby the intensity of an effect decreases with increasing distance (GASSNER et al. 2005).

For platforms and offshore wind farms or sites planned at a distance of at least 30 km from the coastline, the adverse effect on the landscape as perceived from land is not particularly high. At such a distance, the platforms and wind farms will not be noticeable even in good visibility conditions (HASLØV & KJÆRSGAARD 2000). This also applies with regard to night-time safety lighting. The as yet undeveloped Site N-7.2 is located behind and between wind farms that are already in trial operation at a distance of more than 70 km from the coast.

2.15 Cultural heritage and other material assets

Indications of possible material assets or cultural heritage are available insofar as the spatial location of wrecks is known in the BSH wreck database and recorded in the BSH nautical charts. For Site N-7.2 there is an entry for an underwater obstacle (wreck) in the BSH wreck database. Another underwater obstacle is known to exist south of Site N-7.2.

Furthermore, the side-scan sonar images carried out as part of the preliminary investigation of sites were evaluated with regard to the known underwater obstacles as well as other possible objects and ground structures. This involved mapping recognisable objects and ground structures in the data (either directly in the 'waterfall mode' of the recording software or from side-scan sonar mosaics with a max. resolution of 25 × 25 cm). The positions identified were additionally compared with the simultaneously recorded multibeam echo sounder data and identified using visual methods (video). On Site N-7.2, the already known wreck was confirmed in the site. No separate examination of the site for cultural assets was carried out as part of the preliminary investigation.

The investigation results of the identified positions of the shipwrecks were sent to the State Office for Culture and Monument Preservation Mecklenburg-Western Pomerania, the State Office for Monument Preservation of Lower Saxony and the Schleswig-Holstein State Archaeological Office. According to information provided by the aforementioned heritage authorities on 11 February 2021, the shipwreck immediately south of Site N-7.2, centred on 54°16.2354′N; 006°18.5607′E; WGS84 could date from the mid-19th century to 1945. According to the previously named Ladesämter, this is an archaeological ground monument.

In the largest part of Site N-7.2 lies the shipwreck with centre 54°16.9768′N; 006°15.8848′E; WGS84. According to the announcement of 11 February 2021, the shipwreck can probably be placed in the period from the mid-19th century to 1945. However, no characteristic features that would allow a clear classification of the wreck was identified.

The BSH also has information about another object under water that is located between two of the sub-sites. According to current findings, this is not a wreck but rather a patent anchor and a steel pipe.

2.16 Protected asset human beings, including human health

Site N-7.2 has a low significance for the protected asset human beings. In a broader sense, the maritime space represents the working environment for people employed on ships. Exact numbers of people regularly present in the area are not available. However, the numerous existing and planned wind farm projects are increasing the activities in the vicinity of Site N-7.2.

For active recreational use, the EEZ of the North Sea as a whole is of only minor importance. Direct use for recreation and leisure at a distance of more than 70 km from the coast by recreational boats and tourist watercraft is sporadic to non-existent. No special importance of the planning areas for human health and well-being can be derived.

2.17 Interrelationships between the protected assets

The components of the marine ecosystem – from bacteria and plankton to marine mammals and birds – influence each other through complex processes. The plankton described conclusively in the North Sea Environmental Report on the SDP (BSH, 2020a) and the protected biological resources plankton, benthos, fish, marine mammals, and birds described individually in Chapter 2 are interdependent within the marine food webs.

The phytoplankton serves as a food source for the organisms that specialise in filtering the water for food. The main primary consumers of phytoplankton include zooplanktonic organisms such as copepods and water fleas. Zooplankton have a central role in the marine ecosystem as primary consumers of phytoplankton on one hand and as the lowest secondary producer within the marine food webs on the other. Zooplankton serve as food for secondary consumers of marine food webs – from carnivorous zooplankton species to benthos, fish, marine mammals, and seabirds. Among the top components of marine food webs are the predators. The upper predators within the marine food webs include water and seabirds and marine mammals. In food webs, producers and consumers are interdependent and influence each other in many ways.

In general, food availability regulates the growth and distribution of species. Exhaustion of the producer results in the decline of the consumer. Consumers in turn control the growth of producers by eating away. Food limitation affects the individual level by adversely affecting the physical condition of each individual. At the population level, food restriction leads to changes in the abundance and distribution of species. Food competition within a species or between species has similar impacts.

The time-adjusted succession or sequencing of growth between the different components of marine food webs is critical. For example, the growth of fish larvae is directly dependent on the available biomass of plankton. For seabirds, breeding success is also directly related to the availability of suitable fish (species, length, biomass, energy value). Temporally or spatially staggered occurrence of succession and abundance of species from different trophic levels leads to the disruption of food webs. Temporal offset, or trophic "mismatch", causes early developmental stages of organisms in particular to become undernourished or even starve to death. Disruptions to marine food webs can affect not only individuals but also populations. Predator-prey relationships or trophic relationships between size or age groups of a species or between species also regulate the balance of the marine ecosystem. For example, the decline of cod populations in the Baltic Sea had a positive effect on the development of sprat populations (Österblom et al. 2006).

Trophic relationships and interrelationships between plankton, benthos, fish, marine mammals, and seabirds are controlled by multiple mechanisms. Such mechanisms operate from the bottom of the food webs starting with nutrient, oxygen, or light availability upwards to the upper predators. Such bottom-up control mechanisms can act by increasing or decreasing primary production. Effects emanating from the upper predators downwards, via "top-down" mechanisms, can also control food availability.

The interrelationships within the components of marine food webs are influenced by both abiotic and biotic factors. For example, dynamic hydrographic structures, frontal formation, water stratification and currents play a decisive role in food availability (increase in primary production) and use by upper predators. Exceptional events such as storms and ice winters also influence trophic relationships within marine food webs. Biotic factors such as toxic algal blooms, parasite infestations, and epidemics also affect the entire food chain.

Anthropogenic activities also have a decisive influence on the interrelationships within the components of the marine ecosystem. Humans affect the marine food web both directly through the capture of marine animals and indirectly through activities that can influence components of the food web.

Overfishing of fish populations, for example, confronts upper predators such as seabirds and marine mammals with food limitations or forces them to develop new food resources. Overfishing can also cause changes at the bottom of food webs. This can lead to the extreme spread of jellyfish when their fish predators are fished away. Furthermore, shipping and mariculture are an additional factor that can lead to positive or negative changes in marine food webs via the introduction of non-native species. Discharges of nutrients and pollutants via rivers and the atmosphere also affect marine organisms and can lead to changes in trophic conditions.

Natural or anthropogenic effects on one of the components of marine food webs (e.g. the species spectrum or the biomass of plankton) can influence the entire food web and shift and possibly threaten the balance of the marine ecosystem. Examples of the complex interrelationships and control mechanisms within marine food webs have been presented in detail in the description of the individual protected assets.

The complex interrelationships of the various components to each other ultimately lead to changes in the entire marine ecosystem of the North Sea. The changes in the marine ecosystem of the North Sea described in Chapter 2 can be summarised:

- Since the early 1980s, there have been slow changes in the living marine environment.
- Since 1987/88, rapid changes in the living marine environment have been observed.

The following aspects or changes can influence the interrelationships between the different components of the living marine environment: Changes in species composition (phyto- and zooplankton, benthos, fish), introduction and partial establishment of non-native species (phyto- and zooplankton, benthos, fish), changes in abundance and dominance ratios (phyto- and zooplankton), changes in available biomass (phytoplankton), extension of the growth phase (phytoplankton, copepods), Delay in the growth phase after a warm winter (spring diatom bloom), food organisms of fish larvae have brought forward the start of growth (copepods), decline of many species typical of the area (plankton, benthos, fish), decline in the food base for upper predators (seabirds), shift of populations from southern to northern latitudes (cod), shift of populations from northern to southern latitudes (harbour porpoises).

3 Expected development in the event of non-implementation of the plan

In accordance with Section 40, paragraph 2, No. 3, UVPG, in addition to the presentation of the current environmental status, its development in the event of non-implementation of the plan must be predicted. This representation "forms […] a reference state against which the changes brought about by the plan or programme can be measured" (WULFHORST 2011). The development of the environmental status during the forecast period must be investigated if the plan is not realised or implemented (KMENT in UVPG, Section 40, marginal no. 46) (i.e. if no offshore wind turbines are erected and operated on the site). In this context, possible environmental impacts that are already present in the area and that could become even more widespread if planning is not carried out must also be taken into account (KMENT in UVPG, Section 40, marginal no. 46).

3.1 Seabed/sites

The protected assets soil and land would be affected by various uses regardless of whether construction projects were carried out in the area of Site N-7.2. Anthropogenic factors affect the seabed through erosion, mixing, resuspension, material sorting, displacement, and compaction. In this way, the natural sediment dynamics (sedimentation/erosion) and the mass transfer between sediment and soil water are influenced. If the plan were not implemented, the protected asset seabed would continue to be affected by the impacts of fishing. This is associated with direct disturbance of near-surface sediments, resuspension of sediment, and sediment redistribution as well as potential pollutant input. These impacts on the seabed also occur during the construction phase of wind turbines, platforms, and submarine cable systems and would be eliminated by not implementing the plan as would permanent, localised seabed sealing.

3.2 Water

If no construction project were to be carried out on Site N-7.2, the protected asset water would continue to be slightly affected, in particular by general land-based nutrient and pollutant inputs into German North Sea waters.

Construction, installation, and operational impacts (see Chapter 4) would not occur if the plan were not implemented. However, because these would occur with low intensity and would not cause any structural and functional impairments of the protected asset water, the development of the protected asset water will not differ considerably regardless of whether the construction project is carried out on Site N-7.2.

3.3 Biotopes

If the plan were not implemented, the protected asset biotopes would be affected, in particular, by the unrestricted impacts of fishing, including disturbance of the seabed and increased turbidity development. If the plan is implemented, fishing intensity on the site is expected to decrease based on the legal framework and past practice. The form and extent of fishing use will depend on the future navigation regulations of the GDWS according to Section 53 WindSeeG in conjunction with Section 7, paragraph 2 and 3 VO-KVR, which will be issued for the safety zone regularly established around offshore wind farms.

Up to now, fishing or the use of certain fishing gear (such as angling, bottom, trawl and drift nets, or similar gear) as well as anchoring within the safety zone has been regularly prohibited after weighing up the major concerns. In part, passive fishing with baskets and fish traps in the safety zone outside the built-up wind farm areas is exempt from this as long as the passive fishing gear is on the seabed.

In order to ensure the safety of installations and shipping and to fulfil the conditions of the suitability of the sites for shipping purposes, a similar prohibition of shipping can also be expected in similar circumstances. It is conceivable that passive fishing with fish traps and baskets will be allowed outside the area of the safety zone where the installations themselves are located. Recovery of the biotopes because of the likely considerable restriction of fishing would no longer occur to the same extent if the plan were not implemented.

3.4 Benthos

If the plan were not implemented, the protected asset benthos would be affected, in particular, by the unrestricted impacts of fishing, including disturbance of the seabed and increased turbidity development. The function of the wind farm area as a refuge for benthic communities, which is to be expected for the implementation of the plan based on the legal framework and past practice of fishing restrictions (see 3.3), would no longer exist if the plan were not implemented. On the other hand, the locally limited impacts of the introduction of hard substrate through the foundations would be eliminated.

3.5 Fish

If the plan were not implemented, the protected asset fish would be partially affected by other uses, in particular by the unrestricted impacts of fishing (analogous to the protected asset benthos).

The potential function of the wind farm area as a retreat for fish, which is to be expected for the implementation of the plan based on the legal framework and past practice of fishing restrictions (see 3.3), would no longer exist if the plan were not implemented.

Overall, similar impacts on fish fauna as on benthic fauna are to be expected regardless of whether the plan is implemented. The staged planning procedure and the standardised engineering and planning principles allow potential environmental impacts to be identified at an early stage. This can ensure better protection of the fish fauna.

3.6 Marine mammals

The protected asset marine mammals would continue to be affected by the impacts of various uses such as shipping and fishing – even if offshore wind turbines were not installed in Site N-7.2.

Marine mammals, in particular the sound-sensitive harbour porpoises, could be adversely affected by the sound input during the realisation of offshore wind turbines through the installation of driven foundations for offshore wind turbines, transformer stations, accommodation platforms, and converter platforms if no noise abatement measures are taken. Alternative foundation methods (e.g. the jacket suction buckets in locations suitable for this) are currently being developed or have even been partially realised. The installation of ‘Suction Bucket’ monopiles is currently being tested.

The power transmission from Site N-7.2 towards the land will be realised by means of DC cables. The operation of direct current cables is state of the art for the distances that will be required to connect the offshore wind farms in Site N-7.2.

The determination of suitability also includes a number of requirements that relate to the most compatible design possible of offshore wind energy production, in particular requirements for noise mitigation and the coordination of noise-intensive work in order to prevent and mitigate considerable disturbance of the harbour porpoise and to exclude major adverse effects on the protective purposes and conservation objectives of the nature conservation areas. Overall, however, the impacts of the realisation of offshore wind turbines in Site N-7.2 on marine mammals will be comparable to the effects of the zero alternative because project- and site-specific noise mitigation measures are generally ordered in the specific planning approval. In addition, a trend is emerging with regard to the capacity and the associated reduction in the number of installations. If offshore wind turbines were not realised, Site N-7.2 might not be used for renewable energy generation in an economic and yet environmentally sound way.

The impacts of natural variability resulting from climate change on marine mammals are complex and difficult to predict. All species will be indirectly affected by possible impacts of climate change on the marine food web. The possible shift in harbour porpoise populations already mentioned could also be related to climate change. Overall, however, this development is independent of the construction and operation of offshore wind turbines in Site N-7.2.

3.7 Seabirds and resting birds

Even if the plan were not implemented, the protected asset seabirds and resting birds would partly be affected by the impacts of various uses (e.g. shipping and fishing) as shown. The impacts of climate change on affected species are complex and difficult to predict. All species, especially fish, will be indirectly affected by possible climate change impacts on their food organisms. Overall, however, this development is independent of whether the plan is implemented.

If the plan were not implemented, the suitability of Site N-7.2 would not be determined and, as a consequence, would not be developed. As a result, potential project-related impacts on seabirds and resting birds from a wind farm on Site N-7.2 would not occur. However, legacy impacts from already implemented projects and other uses in the vicinity of Site N-7.2 would continue to exist. In view of this, the impacts on the protected asset seabirds and resting birds would not differ considerably regardless of whether the plan is implemented. However, if the plan were not implemented, Site N-7.2 would not be available in order to achieve the expansion targets for offshore wind energy.

3.8 Migratory birds

Even if the plan were not implemented, the protected asset migratory bird species would still be partially affected by the impacts of various uses (e.g. shipping and fishing) as described in Chapter 2.9.4.4. The impacts of climate change on affected species are complex and difficult to predict. All species, especially fish, will be indirectly affected by possible climate change impacts on their food organisms. Overall, however, this development is independent of whether the plan is implemented.

If the plan were not implemented, the suitability of Site N-7.2 would not be determined and, as a consequence, would not be developed. As a result, potential project related impacts on migratory birds from a wind farm on Site N-7.2 would not occur. However, legacy impacts from already implemented projects and other uses in the vicinity of Site N-7.2 would continue to exist.

3.9 Bats and bat migration

Migratory movements of bats across the North Sea are still poorly documented and largely unexplored. There is a lack of concrete information on migrating species, migration corridors, migration altitudes, and migration concentrations. Previous knowledge merely confirms that bats, especially long-distance migratory species, fly over the North Sea. However, based on previous findings, including on the distribution and habitat preferences of bats, some effects of climate change can be predicted. Among other things, the loss of resting places along migration routes, the decimation of breeding habitats, and changes in the food supply are to be expected. Time-delayed food occurrence can have consequences for the reproductive success of bats in particular (AHLEN 2002, RICHARDSON 2004). The observed insect die-off will have an increasingly negative impact on bats.

Regardless of whether the plan is implemented, the protected asset bats will probably develop in the same way. It can also be assumed that any negative impacts on bats can be avoided by the same preventative and mitigation measures used to protect bird migration.

3.10 Biological diversity

Large-scale consequences of climate change are also to be expected in the oceans. Because many marine ecosystems are sensitive to climate change, this has impacts on biodiversity. There may be a shift in the species spectrum. For example, a strong influence on the population density and dynamics of fish would be conceivable. This, in turn, would have major consequences for food webs. Overall, however, this development is independent of whether the plan is implemented.

Local impacts on habitat diversity and biodiversity (e.g. from the introduction of hard substrate through the foundations and scour protection of wind turbines) would not occur if the plan were not implemented. On the other hand, however, recovery of the benthos and fish communities with corresponding impacts on biodiversity would no longer be possible because of the suspension of fishing if the plan were not implemented. Large-scale impacts on biodiversity are not expected even if the plan is not implemented.

3.11 Air

With increasing intensity of use, shipping traffic in the North Sea also increases; this can have a negative impact on air quality. However, this development is largely independent of the construction of a wind farm on Site N-7.2 because the construction and operation of the installations and the in-farm cabling would not result in any measurable impacts on air quality in this area. The protected asset air will therefore develop in the same way regardless of whether the building development is implemented.

3.12 Climate

No impacts on the climate are expected from the construction and operation of the wind turbine and the in-farm cabling because no measurable climate-relevant emissions occur either during construction or operation. On the contrary, the CO_2 savings associated with the expansion of offshore wind energy can be expected to have positive impacts on the climate in the long term. The development of the protected asset climate is thus independent of implementation of a construction project on Site N-7.2.

3.13 Landscape

The realisation of offshore wind farms has impacts on the landscape because it is altered by the construction of vertical structures and security lights. The extent of these adverse effects on the landscape caused by the planned offshore installations will depend to a large extent on the respective visibility conditions. Area N-7 is more than 70 km from the North Sea coast. This means that the existing and planned installations are/will no longer be perceptible from land (see Chapter 2.14). The development of the landscape in the absence of the construction project on Site N-7.2 is not expected to differ considerably from the development in the event of the implementation of the construction project because this area of the German EEZ is already characterised by the wind farms already constructed in areas N-6, N-7, and N-8.

3.14 Cultural heritage and other material assets

Immediately south of Site N-7.2 is the shipwreck centred at 54°16.2354′N; 006°18.5607′E; WGS84. The shipwreck could date from the middle of the 19th century to 1945, according to information of the State Office for Culture and Monument Preservation Mecklenburg-Western Pomerania, the Lower Saxony State Office for Monument Preservation, and the Schleswig-Holstein State Archaeological Office dated 11 February 2021. According to the previously named state authorities, this is an archaeological monument. The determination of suitability provides for a corresponding connection zone (Section 39, paragraph 1).

In the area largest sub-site of Site N-7.2 lies the shipwreck with the centre 54°16.9768′N; 006°15.8848′E; WGS84. According to the information of the State Office for Culture and Monument Preservation Mecklenburg-Western Pomerania, the Lower Saxony State Office for Monument Preservation and the Schleswig-Holstein State Archaeological Office dated 11 February 2021, the shipwreck can probably be dated to the period from the mid-19th century to 1945. However, no characteristic features that would allow a clear classification of the wreck was identified. Based on a corresponding recommendation by the State Office for Culture and Monument Preservation Mecklenburg-Western Pomerania, the Lower Saxony State Office for Monument Preservation, and the Schleswig-Holstein State Archaeological Office, the site is to be protected by exclusion zones as a precautionary measure until the wreck is more closely classified. The determination of suitability contains corresponding specifications (Section 39, paragraph 2).

In addition, the BSH has information on another object under water that is located between two of the sub-sites. According to current findings, this is not a wreck but rather a patent anchor and a steel pipe.

According to the current state of knowledge and based on the preliminary investigations, no other material or cultural assets are known to exist in the area of Site N-7.2. Nevertheless, the occurrence of further cultural or material assets cannot be completely ruled out at this point in time. In the determination of suitability, a requirement that cultural assets on the site must be identified, reported, and any resulting protective measures taken is included (Section 38, paragraph 1). In addition, according to Section 38, paragraph 3, an evaluation of the data obtained in the preliminary investigation on suspected cases of cultural assets in the respective area shall be submitted to the planning approval authority upon request. Furthermore, with regard to the known shipwrecks in and adjacent to Site N-7.2, special requirements have been included (Section 39).

Under these conditions, no major impacts on the protected asset “Cultural heritage and other material assets” are to be expected either in the case of implementation or non-implementation of the construction project on Site N-7.2.

3.15 Protected asset human beings, including human health

The site has a low significance for human health and well-being. People are not directly affected by the plan but rather, at most, indirectly through their perception of the landscape as protected asset and possible influences on the recreational function of the landscape for water sports enthusiasts and tourists (cf Chapter 2.16). If the building project were not carried out, the site would theoretically be available for these uses. However, because of the considerable distance to the coast (more than 70 km), the site is actually only rarely (if at all) used for these purposes. In addition, the undeveloped site would be surrounded by other offshore wind farms and their safety zones with navigation regulations as well as a traffic separation area. Use by recreational boats would thus be possible only to a limited extent even if the construction project were not carried out. As a working environment, Site N-7.2 is already used by the construction activities of the surrounding wind farms of Areas N-6, N-7, and N-8. This use would remain if the building project were not carried out. Development would increase the importance of Site N-7.2 as a working environment compared with no development.

3.16 Interrelationships between the protected assets

It is assumed that the interrelationships between the protected assets will develop in the same way regardless of whether the plan is implemented. At this point, please refer to Chapter 2.17.

4 Description and assessment of the expected major impacts of the implementation of the plan on the marine environment

According to Section 40, paragraph 1 UVPG, the expected major environmental impacts of implementing the plan must be described and assessed. The general procedure is already described in Chapter 1.5.3.

The protected assets for which a considerable adverse effect was already ruled out in Chapter 2 are not taken into consideration. This applies to the protected assets air, climate, landscape, cultural heritage, and other material assets as well as to the protected asset human beings, including human health. Possible impacts on the protected asset biological diversity are dealt with under the individual protected biological resources. All the protected assets listed in Section 2, paragraph 1 UVPG are investigated before the species protection and site protection assessments are presented. Statements on the general protection of nature and landscape according to Section 13 BNatSchG are also covered in the assessment of the individual protected assets.

4.1 Seabed/sites

4.1.1 Wind turbines and platforms

Wind turbines and platforms are currently installed almost exclusively as deep foundations. In deep foundations, the foundation of a wind turbine or platform is anchored in the seabed using one or more steel piles. The foundation piles are generally driven into the seabed.

To protect against scouring, scour protection in the form of stone packing is primarily installed around the foundation elements, or the foundation piles are installed correspondingly deeper into the seabed.

The wind turbines and platforms have a locally limited environmental impact with regard to the protected asset seabed, which is the subject of the protection. The sediment is permanently affected only in the immediate vicinity by the introduction of the foundation elements (including scour protection, if necessary) and the resulting area use.

4.1.1.1 Construction-related

When the foundations of the wind turbines and platforms are being installed, sediment is briefly churned up and turbidity plumes are formed.

The extent of resuspension depends essentially on the fine grain content in the seabed. The surface sediments in the area of Site N-7.2 are medium sandy fine sands with varying but rather low silt contents of approx. 5–15%. The released sediment will therefore settle directly at the construction site or relatively quickly in its immediate vicinity. As a result of the dilution effect caused by the near-bottom currents, the expected adverse effects caused by increased turbidity remain relatively limited in small areas.

Pollutants and nutrients can be released from the sediment into the groundwater in the short term. The possible pollutant input into the water column through stirred-up sediment is not considered to be considerable because of the relatively low proportion of fines (more silt than clay) and the low pollutant load as well as the relatively rapid resedimentation of the sands. This also applies against the background that the sandy sediments are naturally (e.g. during storms) churned up and moved by sea state touching the ground and appropriate currents.

Impacts in the form of mechanical stress on the seabed as a result of displacement, compaction, and vibrations that are to be expected in the course of the construction phase are assessed as low because of their small-scale nature. As part of the preparatory construction measures for gravity foundations, it may be necessary to excavate building pits. The movement of the excavated soil leads to an adverse effect on additional sites.

4.1.1.2 Installation-related

Because of the installation, the seabed is permanently sealed only locally to a small extent by the introduction of the foundation elements of deep foundations for wind turbines or platforms. The sites that are affected essentially consist of the diameter of the foundation piles plus any scour protection that may be required. By far the most common type of foundation in this case is the monopile. A monopile with a diameter of 8.5 m, including scour protection, requires an area use of around 1400 m².

4.1.1.3 Operational reasons

Because of the interrelationship between the foundation and the hydrodynamics in the immediate vicinity of the installation, the sandy sediments may be permanently stirred up and rearranged. Scouring may also occur in the immediate vicinity of the installations. Based on experience to date, permanent sediment redistribution as a result of currents is to be expected only in the immediate vicinity of the installations and platforms. These will arise locally around the individual foundation piles (local scour) according to the findings from the accompanying geological investigations in the "alpha ventus" offshore test site (LAMBERS-HUESMANN & ZEILER 2011) as well as on the FINO1 and FINO3 research platforms. Because the prevailing seabed conditions within Site N-7.2 and the predicted spatially confined perimeter of the scouring, no noteworthy changes are expected.

Based on the above statements and taking into consideration the status assessment that the seabed in the area of investigation is predominantly poorly structured with a homogeneous sediment distribution of medium sandy fine sands, the SEA comes to the conclusion that no considerable impacts on the protected asset seabed are to be expected as a result of the designation of the installation or platform locations.

4.1.2 In-farm cabling

4.1.2.1 Construction-related

Because of construction, the turbidity of the water column increases as a result of sediment turbulence during cable laying work; because of the influence of tidal currents, this is distributed over a larger area. The extent of the resuspension depends mainly on the cable laying procedure and the consistency of the seabed. Because of the prevailing sediment characteristics within Site N-7.2, most of the released sediment will settle directly at the construction site or the immediate vicinity thereof. In the process, the suspension content decreases again to the natural background values because of dilution effects and sedimentation of the stirred-up sediment particles. The anticipated adverse effects caused by increased turbidity will be limited to a small area. The results of investigations of different methods in the North Sea reveal that the seabed levels off relatively quickly in some cases because of the natural sediment dynamics along the affected routes.

Pollutants and nutrients can be released from the sediment into the groundwater in the short term. A possible release of pollutants from the sandy sediment is not considered likely because of the relatively low fine grain content and the low heavy metal concentrations in the sediment.

Impacts in the form of mechanical stress on the seabed as a result of displacement, compaction, and vibrations that are to be expected in the course of the construction phase are assessed as low because of their small-scale nature.

4.1.2.2 Operational reasons

Because of the operating conditions, the surrounding sediment heats up radially around the cable systems in both direct current and three-phase submarine cable systems. The heat emission results from the thermal losses of the cable system during energy transmission.

With regard to possible negative impacts of heat emission from cable systems, the 2 K criterion represents a precautionary value that, according to the assessment of the BfN based on the current state of knowledge, ensures with sufficient probability that considerable negative impacts of cable heating on nature or the benthic community are avoided. In order to ensure compliance with the "2 K criterion" (i.e. a maximum temperature increase of 2 degrees in 20 cm below the seabed surface), a corresponding principle on sediment warming has been included in the BFO-N and continued in the SDP. The determination of suitability contains the stipulation that the planning principle of the site development plan for sediment warming must be observed when dimensioning and laying the submarine cable systems within in the farm (Section 5).

Energy losses from cable systems depend several factors. The following output parameters have a considerable influence:

- Transmission technology: Basically, greater heat emission as a result of thermal losses can be assumed with three-phase submarine cable systems than with direct current submarine cable systems with the same transmission capacity (OSPAR Commission 2010).
- Ambient temperature in the vicinity of the cable systems: Depending on the water depth and the time of year, fluctuation of the natural sediment temperature can be assumed, which influences heat dissipation.
- Thermal resistance of the sediment: In the EEZ, and thus also on site N-7.2, predominantly water-saturated sands occur. For the specific thermal resistance of these, a size range of 0.4 to 0.7 KmW^{-1} is valid, taking into consideration various sources (SMOLCZYK 2001, BARTNIKAS & SRIVASTAVA 1999, VDI 1991, BARNES 1977). According to this, more efficient heat removal can be assumed for water-saturated coarse sands than for finer-grained sands.

For the temperature development in the sediment layer near the surface, the installation depth of the cable systems is also decisive. According to the current state of knowledge, no major impacts from cable-induced sediment warming are to be expected if sufficient installation depth is maintained and state-of-the-art cable configurations are used. Temperature measurements on a park-internal three-phase cable system in the Danish offshore wind farm "Nysted" showed a sediment warming directly above the cable (transmission capacity of 166 MW) 20 cm below the seabed of max. 1.4 K (MEISSNER et al. 2007). The intensive water movement near the bottom of the North Sea also leads to the rapid removal of local heat.

Table 9: Thermal properties of water-saturated soils (according to SMOLCZYK 2001).

Soil type	**Thermal conductivity minimum**	**Thermal conductivity maximum**	**Specific thermal resistance maximum**	**Specific thermal resistance minimum**
	W/(K*m)	W/(K*m)	K*m/W	K*m/W
Gravel	2.00	3.30	0.50	0.30
Sand	1.50	2.50	0.67	0.40
Clay	0.90	1.80	1.11	0.56

Soil type	Thermal conductivity minimum	Thermal conductivity maximum	Specific thermal resistance maximum	Specific thermal resistance minimum
Till	2.60	3.10	0.38	0.32
Silt	1.40	2.00	0.71	0.50

Taking into consideration the aforementioned results and forecasts, compliance with the “2 K criterion” can be assumed at any rate for an installation depth of at least 1.50 m.

Because the concrete impacts of a cable system also depend on its cross-section as well as other properties, the designation of a uniformly applicable value for the overlap to be produced does not appear to be expedient without knowledge of the specific project parameters. The concrete cover to be constructed shall be designated in the planning approval based on a comprehensive study to be submitted by the project developer. The concerns of marine environment protection must also be explicitly taken into consideration.

If the 2 K criterion in accordance with the planning principle of the SDP and the requirement for sediment warming in Section 5 of the determination of suitability are complied with, it can currently be assumed that no considerable impacts such as structural and functional changes are to be expected on the protected asset seabed as a result of the cable-induced sediment warming. Because of the low proportion of organic material in the sediment, no considerable release of pollutants as a result of sediment warming is expected to occur.

4.2 Water

4.2.1 Wind turbines and platforms

4.2.1.1 Construction-related impacts – resuspension of sediment

The introduction of the foundation elements leads to a stirring up of sediments in the immediate vicinity. Depending on the fine grain content in the sediment, turbidity plumes may form in the lower water column, thereby further reducing the already shallow depths of visibility in these water depths. In this context, the content of organic material in the sediment can lead to higher oxygen depletion as well as the release of nutrients and pollutants in the short term. However, because of the relatively low organic contents in the surface sediments of Site N-7.2, this is not to be assumed.

Overall, small-scale impacts of short duration with low intensity are expected. Structural and functional impairments are minor.

4.2.1.2 Installation-related impacts – change in currents and sea state

The support structures of offshore wind turbines represent obstacles in the water body that lead to a change in the flow conditions on both a small and medium scale. Numerical modelling of flow conditions in offshore wind farms has already been carried out within the GIGAWIND project (Zielke et al. 2001, Mittendorf & Zielke 2002, GIGAWIND / Uni Hannover 2003 and 2004).

From the modelling results, it can be deduced that the flow velocity will increase in the immediate construction areas. The influence of a single structure on the flow extends laterally to a small area. This can lead to a change in the dynamics of the stratification conditions in the water body in the immediate vicinity of the support structures. Because of the mixing within the water column, stratified water bodies may experience an increased oxygen input to greater water depths.

Furthermore, the sea state changes as a result of the support structures because these cause additional friction in the wave field. This leads to a slight decrease in wave height on the side facing away from the swell and to a slight increase in wave height on the side facing the current (HOFFMANNS & VERHEIJ 1997, CHAKRABARI 1987). According to the results of the Gigawind project, the influence of a single structure on the swell, similar to that of the current, is limited to distances of about one to two structure diameters laterally and a few diameters behind. Wave dissipation is expected to result in low attenuation, although the impact of large offshore wind farms on the wake of the wind field and thus on the wave field is currently the subject of research.

The changes in the current regime and the sea state as a result of offshore wind turbines or offshore wind farms are long-term and medium-scale. The intensity of the effects is low. Based on this intensity assessment, the structural and functional changes are minor.

4.2.1.3 Operational impacts

To ensure operation for offshore installations (wind turbines and platforms), techniques that may be associated with material discharges into the marine environment are used. In particular, the protection of structural installations from corrosion is associated with permanent emissions into the marine environment. At the same time, corrosion protection is essential for the structural integrity of the installations. Galvanic anodes (sacrificial anodes) can be used on the foundation structures as a common corrosion protection variant in the underwater area. The gradual dissolution of these anodes releases the components into the marine environment. The anode mass required for a service life of 25 years varies depending on the foundation structure, building type, and local environmental conditions. According to current experience in the offshore industry, emissions from wind turbines, for example, are around 150–700 kg per installation per year. Galvanic anodes used for offshore wind energy typically consist of aluminium-zinc-indium alloys (approx. 95% aluminium, 2.5–5.75% zinc, 0.015–0.04% indium; DNV GL 2010). In principle, the galvanic anodes may also contain small quantities of particularly environmentally critical heavy metals (e.g. cadmium, lead, copper) because of the production process (REESE et al. 2020). These are also released into the marine environment during operation. When assessing this impact, it must also be taken into consideration that inputs from corrosion protection are distributed throughout the North Sea system by distribution and dilution processes and do not necessarily accumulate locally and lead to harmful concentrations.

As an alternative to galvanic anodes, external current anodes have now established themselves on the market and are increasingly being used. These external current anodes are inert and associated with only minimal emissions (e.g. as a result of material removal).

With regard to the impacts of corrosion protection-related emissions in the area of offshore wind farms, the BSH is conducting the research project "OffCHEm" (https://www.bsh.de/DE/THEMEN/Forschung_und_Entwicklung/Aktuelle-Projekte/OffChEm/OffChEm_node.html) in cooperation with the Helmholtz Centre Geesthacht. Initial results indicate that the metal contents in water and sediment samples from the wind farms studied are within the range of North Sea variability. Therefore, according to the current state of knowledge and investigation, the existing environmental quality standards (insofar as they exist for the substances concerned) are not currently exceeded in these areas as a result of corrosion-related inputs.

Nevertheless, according to the precautionary principle, material discharges are to be avoided according to the state of the art for the protection of the marine environment. It should be mentioned here, in particular, that the use of external power systems is to be preferred. Furthermore, the use of galvanic anodes is permitted only in combination with coatings; this significantly reduces emissions from galvanic anodes into the water body. Subsequently, only galvanic anodes for which the production-related content of environmentally critical heavy metals is reduced to a minimum may be used.

For this reason, according to the current state of knowledge, the impacts from corrosion protection are assessed as long-term, small-scale, and of low intensity. Structural and functional changes are minor.

In addition to the material emissions from corrosion protection, there may also be other selective discharges into the water during the regular operation of platforms. Accumulating rainwater and drainage water may contain oil as a result of the operating materials contained in the installations of the platform (e.g. operating materials released through leakages). Light liquid separators (oil separators) are therefore used to reduce the oil content of this waste water. According to the technical availability and current implementation status, the oil content is to be reduced to 5 ppm so that the MARPOL directive for maritime shipping (limit value 15 ppm for bilge water) is undercut. On manned platforms, in exceptional cases, waste water from sanitary facilities, laundry, and canteen operations can be treated by certified waste water treatment plants and reduced in view of the possible environmental impact of the insufficient treatment of waste water. On platforms with a small crew size, this waste water must always be collected and disposed of ashore. For the purpose of installation cooling, closed cooling systems without material discharges have generally been established on the platforms. Only in atypical exceptional cases can “open” state-of-the-art seawater cooling systems be approved. To ensure the permanent operational readiness of these system-relevant cooling systems, biocides (usually sodium hypochlorite) are added in order to protect pipelines and pumps from marine fouling. The sea cooling water is then discharged back into the sea; the components are then subject to the local distribution and dilution processes.

The impacts of the aforementioned platform emissions into the water are also assessed as long-term, small-scale, and of low intensity provided that the state of the art is implemented and the minimisation requirement is complied with according to the current state of knowledge. Structural and functional changes are minor.

For the operation of the wind turbines and platforms, high volumes of operating materials hazardous to water (including hydraulic oils, lubricating greases, transformer oils and diesel for emergency power generators, and extinguishing agents) are inevitably required in some cases. Because of their material properties, these have a fundamental hazard potential for the marine environment. The risks arising from operational substance leaks/accidents can thus be prevented by taking structural and operational precautionary and safety measures (e.g. enclosures, double-walled tanks, catch basins, and management concepts). The same applies to fuel changes and refuelling measures to be carried out. If environmentally compatible and, as far as possible, biodegradable substances are used, the overall impacts on the marine environment resulting from accidental discharges is assessed as low taking into consideration the probability of occurrence.

4.2.2 In-farm cabling

Construction-related impacts– resuspension of sediment

The introduction of in-farm cabling leads to a stirring up of sediments in the immediate vicinity. Depending on the fine grain content in the sediment, turbidity plumes may form in the lower water column, thereby further reducing the already shallow depths of visibility in these water depths. Depending on the organic content, a higher oxygen consumption as well as a release of nutrients and pollutants can be the short-term result.

However, because of the relatively low content of organic material in the surface sediments of Site N-7.2, this cannot be assumed.

Overall, small-scale impacts of short duration with low intensity are expected. Structural and functional impairments are minor.

4.3 Biotopes

4.3.1 Wind turbines and accommodation platform

Possible impacts on the protected asset biotopes may result from the direct use of protected biotopes, possible overlap as a result of the sedimentation of material released during construction, and potential habitat changes.

According to the current state of knowledge, there are no biotopes or FFH habitat types protected according to Section 30 BNatSchG in Site N-7.2. Direct use of protected biotopes by the installations and the accommodation platform can therefore be ruled out. Impacts resulting from sedimentation and habitat change are small-scale and/or short-term. Major construction-related, site-related, and operational impacts of the installations on protected biotopes can thus be excluded.

If, after final evaluation of the preliminary investigations, indications of the presence of legally protected biotopes emerge, these will be taken into consideration accordingly in the suitability assessment.

4.3.2 In-farm cabling

According to the current state of knowledge, there are no biotopes or FFH habitat types protected according to Section 30 BNatSchG in Site N-7.2. Direct use of protected biotopes by the submarine cable systems can therefore be ruled out. Impacts resulting from sedimentation and habitat change resulting from crossing constructions are small-scale and short-term, respectively. Major construction-related, site-related, and operational impacts of the submarine cable systems on protected biotopes can thus be excluded.

If, after final evaluation of the preliminary investigations, indications of the presence of legally protected biotopes emerge, these will be taken into consideration accordingly in the suitability assessment.

4.4 Benthos

The construction of the accommodation platform and the wind turbines as well as the installations themselves may have impacts on the macrozoobenthos.

Site N-7.2 is of average importance with regard to the species inventory of benthic organisms. The i *Nucula nitidosa* coenosis with typical elements of the *Amphiura filiformis* community also does not show any special features because it is typical for the German North Sea because of the predominant sediments. The species inventory found and the number of Red List species indicate an average importance of Site N-7.2 for benthic organisms.

The construction-related, site-related, and operational impacts of the plan are listed in detail in the Environmental Report on SDP 2020 (BSH, 2020a) and are summarised below.

4.4.1 Wind turbines and accommodation platform

4.4.1.1 Construction-related

The deep foundation of the wind turbines and the accommodation platform will cause disturbance of the seabed, sediment turbulence, and the formation of turbidity plumes. This may result in harm or adverse effects to benthic organisms or communities in the immediate vicinity of the installations for the duration of construction activities.

Because of the predominant sedimentary composition, the sediment released will settle quickly. The sand fraction is deposited again after small-scale drifting and can lead to adverse effects on the macrozoobenthos because of overlap.

According to the current state of knowledge, the construction-related impacts resulting from the turbidity plumes and sedimentation are to be classified as short-term and small-scale.

4.4.1.2 Installation-related

Installation-related changes in the benthic community may occur as a result to the sealing of the area, the introduction of hard substrates, and the alteration of the flow conditions around the installations and the platform. In the area of the installations and the associated scour protection, there will be soil sealing/area use to the extent mentioned in 1.5.5.4 for the two scenarios and thus a complete loss of soft bottom macrozoobenthos habitats.

Recruitment of additional species will most likely occur from the natural hard substrate habitats (e.g. superficial boulder clay and stones). This means that the risk of negative impacts on the benthic sandy seabed community by non-native species is low.

In the immediate vicinity of the structures, there is an impact on the benthic communities with a change from formerly sedentary and sessile species to mobile species as a result of sediment erosion and an increase in predators.

Therefore, for scour protection, according to the corresponding specification of the determination of suitability (Section 16), only stone packing made of natural stones or biologically inert and natural materials are to be used so that plant-related emissions of pollutants are not to be expected.

The restriction of fishing on Site N-7.2 (see 3.3), which is to be expected based on the legal framework and past practice, could have a positive effect on the benthos. Associated negative fishing effects such as disturbance of the seabed would be eliminated or would not occur to the same extent. Because of the lack of or reduced fishing pressure, a more natural community structure of benthos could develop within the project area.

Regardless of the design of the future wind farm, fishing would be expected to be prohibited or substantially restricted throughout Site N-7.2 such that fishing disturbance would be eliminated or reduced.

4.4.1.3 Operational reasons

According to the current state of knowledge, operational impacts of the wind turbines and the accommodation platform on the macrozoobenthos are not to be expected.

Waste water is to be collected properly as a matter of priority, transported ashore, and properly disposed of there. Thus, according to the current state of knowledge, taking into consideration the aforementioned requirements of the determination of suitability, no major impacts are to be expected from the discharge of waste water and the use of corrosion protection systems.

Based on the above statements and representations, the result of the SEA is that, according to the current state of knowledge, the construction and operation of the wind turbines and the accommodation platform are not expected to have any major impacts on the protected asset benthos in Site N-7.2. The overall impacts are estimated to be short-term and small-scale. Only small-scale areas outside protected areas are occupied. Because of the mostly rapid regenerative capacity of the populations of benthic organisms with short generation cycles and their widespread distribution in the German Bight, rapid recolonisation is highly likely.

The overall impacts are estimated to be short-term and small-scale. Only small areas outside protected areas are occupied. Because of to the mostly fast regenerative capacity of the populations of benthic organisms with short generation cycles and their widespread distribution in the German Bight, rapid recolonisation is highly likely.

4.4.2 In-farm cabling

4.4.2.1 Construction-related

Possible impacts on benthic organisms depend on the cable laying procedure used. Local sediment turbulence and turbidity plumes are to be expected for the duration of the installation of the in-farm cabling. This may result in a small-scale and short-term habitat loss for benthic species or adverse effects on or damage to benthic organisms or communities during construction activities in the vicinity of the cable systems. The linear character of submarine cable systems favours repopulation from undisturbed peripheral areas.

Benthic organisms can also be adversely affected in the short term and on a small scale by the release of nutrients and pollutants associated with the resuspension of sediment particles. Impacts are generally considered to be low because the flushing in of cable systems is limited in time and space, the pollutant load in the EEZ area is comparatively low, and nutrients or pollutants are quickly diluted.

4.4.2.2 Installation-related

In the area of any cable crossings, the disturbances are permanent but also small-scale. Required cable crossings are secured with stone packing, which is a permanent non-native hard substrate. The non-native hard substrate provides new habitats for benthic organisms.

For the area of cable crossings, according to the specifications of the determination of suitability, only stone packing made of natural stones or biologically inert and natural materials is to be used. The use of cable protection systems containing plastic is permitted only in exceptional cases and must be kept to a minimum. Thus, according to the current state of knowledge, installation-related emissions of pollutants are not to be expected.

4.4.2.3 Operational reasons

Operationally, warming of even the uppermost sediment layer of the seabed can occur directly above the cable system. This can lead to a reduction in winter mortality of the infauna and thus to a change in the species communities in the area of the cable routes. According to the current state of knowledge, if sufficient installation depth is maintained and state of the art cable configurations are used, the 2 K criterion can be met, and no significant impacts on the benthos as a result of cable-induced sediment warming are expected. The draft of the determination of suitability includes a requirement to comply with the relevant planning principle of the SDP on sediment warming when dimensioning and laying the in-farm submarine cable systems.

The same assumptions apply to electric and electromagnetic fields. These are also not expected to have considerable impacts on the macrozoobenthos.

Given a sufficient installation depth and taking into consideration that the effects will be small-scale (i.e. only a few metres on either side of the cable), according to the current state of knowledge, no major impacts on benthic communities are expected from the installation and operation of the submarine cable systems. According to current knowledge, the ecological impacts are small-scale and mostly short-term.

4.5 Fish

The fish fauna in Area N-7.2 shows a typical species composition of the German Bight. The demersal fish community in the maritime area “Nördlich Borkum” is also dominated by flatfish character species. According to the current state of knowledge, the planned locations does not represent a preferred habitat for any of the fish species protected under the Red List and the

Habitats Directive. As a result, the fish population in planning area N-7.2 is not of outstanding ecological importance (cf 2.6.3.4).

4.5.1 Wind turbines and accommodation platform

Two project-specific scenarios are used as a basis for estimating the construction-related impacts as well as the installation- and operation-related effects of a wind farm on the fish community (cf Chapter 1.5.5.4). The parameters relevant for the fish fauna are shown in Table 4.

Possible impacts of the different wind farm phases on the fish fauna are presented below and transferred to the load criteria of the two model wind farms.

4.5.1.1 Construction-related

- Noise emissions from driving the foundations
- Sedimentation and turbidity plumes

Noise emissions

All fish species and their life stages studied so far can perceive sound as particle movement and pressure changes (KNUST et al. 2003, KUNC et al. 2016, WEILGART 2018, POPPER & HAWKINS 2019). Depending on the intensity, frequency, and duration of sound events, sound can have a direct negative impact on fish development, growth, and behaviour or override environmental acoustic signals that are sometimes crucial for fish survival (KUNC et al. 2016, WEILGART 2018). However, most evidence on the impacts of sound on fish comes from laboratory studies (WEILGART 2018). The range of perception and possible species-specific behavioural responses in the marine habitat have been investigated only to a limited extent. The construction- and deconstruction-related impacts of wind farms on fish fauna are limited in space and time. It is likely that during the construction phase, short, intense sound events – especially during the installation of the established foundation types – will cause fish to be scared away. In the Belgian EEZ, DE BACKER et al. (2017) showed that the sound pressure generated during pile driving was sufficient to cause internal bleeding and barotrauma of the swim bladder in cod. This effect was found at a distance of 1,400 m or closer from a pile driving sound source without any noise abatement (DE BACKER et al. 2017). Investigations such as this indicate that considerable disturbances or even the killing of individual fish in the vicinity of the ramming points are possible. The risk to fish posed by the sound input from pile driving is expected to be reduced by prescribed noise mitigation measures. Partial aspects of the deterrence measures for marine mammals are probably also applicable to fish. According to the planning principle for noise mitigation during pile driving, a sound event level of less than 160 dB re 1µPa²s outside a circle with a radius of 750 m around the pile driving or insertion site is to be complied with as a noise protection value.
After temporary displacement, the fish are likely to return after the noise-intensive construction measures have ended.

For the consideration of the wind farm scenarios, the specifications on mitigation measures for sound input included in the suitability assessment are used. These were originally introduced to protect marine mammals so that the emitted sound level is below 160 dB outside a circle with a radius of 750 m around the pile driving site. The duration of construction activities and the associated noise emissions are comparable in both scenarios. In Scenario 1, the pile driving time of the individual wind turbine is shorter than in Scenario 2 because of the smaller foundations. However, the installation of 98 smaller installations (cf Table 4) takes longer in total so that, overall, a similar pile driving time is assumed for both scenarios. The risk of injury to fish in the vicinity of the pile driving sites could be increased in the first scenario because of the greater number of pile driving sites with sudden noise levels. However, the prior deterrence should cause a flight reaction of the animals. The construction of the wind farm is therefore not expected to have a considerable adverse effect on the protected asset fish provided that deterrence and mitigation measures are applied.

Sedimentation and turbidity plumes

The construction activities of the foundations of both wind turbines as well as the accommodation platform and in-farm cabling result in sediment turbulence and turbidity plumes, which can cause adverse physiological effects as well as deterrent effects – albeit for a limited period of time and in different ways depending on the species. Predators that hunt in open water (e.g. mackerel and horse mackerel) avoid areas with high sediment loads and thus avoid the danger of gill adhesion (EHRICH & STRANSKY 1999). A threat to these species as a result of sediment turbulence therefore does not appear likely because of their high mobility. Neither are any adverse effects on bottom-dwelling fish to be expected as a result of their good swimming characteristics and the associated evasion possibilities. Plaices and sole were even found to have increased foraging activity after storm-induced sediment turbulence (EHRICH et al. 1998). In principle, however, fish can avoid disturbances thanks to their distinct sensory abilities (lateral line) and their high mobility; adverse effects are thus unlikely for adult fish. Eggs and larvae, in which reception, processing, and conversion of sensory stimuli are not yet or only slightly developed, are generally more sensitive than adult conspecifics. However, the spawning grounds of most fish species lie outside the wind farm site of N-7.2 to be developed. After fertilisation, fish eggs develop a leather skin that makes them robust to mechanical stimuli (e.g. to swirling sediments). Although the concentration of suspended particles can reach levels that are harmful to certain organisms, the impacts on fish are considered to be relatively low because such concentrations occur only spatially and temporally and are quickly degraded again by dilution and distribution effects (HERRMANN & KRAUSE 2000). This applies also to possible increases in the concentration of nutrients and pollutants resulting from the resuspension of sediment particles (ICES 1992; ICES WGEXT 1998). With sedimentation of the released substrate, the main risk is coverage of fish spawn deposited on the seabed. This can result in a lack of oxygen supply to the eggs and, depending on the efficiency and duration of the sedimentation process, can lead to damage or even death of the spawn. For most fish species present in the EEZ, no damage to the spawning population is expected because they either have pelagic eggs and/or their spawning grounds are in shallow water outside the EEZ. The early life stages may also be adapted to turbulence, which regularly occurs in the North Sea as a result of natural phenomena such as storms or currents.

The more construction activities take place in Site N-7.2, the higher the sedimentation and turbidity plumes. Accordingly, an increased sediment suspension is to be expected in the immediate vicinity of the 98 foundation structures of the first scenario compared with the construction of 49 WT of the second scenario (Table 4). In Scenario 1, more wind turbines must therefore be connected by in-farm cabling so that the sediment turbulence is greater than in Scenario 2, especially when the submarine cables are flushed in. As a result, a possible adverse effect on fish fauna is more likely in Scenario 1 than in Scenario 2. Sediment turbulence is limited in time and space so that adverse effects are only temporary. In addition, fish are adapted to sediment turbulence in the North Sea in various ways. Fish fauna are not expected to be considerably adversely affected by construction activities for either Scenario 1 or Scenario 2.

4.5.1.2 Installation-related

- Area use
- Introduction of hard substrate
- Expected restriction of fishing

Area use

After the foundations of the wind turbines are completed, part of the site will no longer be available for the demersal fish community. There is a habitat loss for benthic fish species and their food base – the macrozoobenthos – because of the local overdevelopment.

With a total area (foundations including scour protection of all wind turbines and one platform) of 194,337 m² in Scenario 1, the habitat loss is lower than the area loss of 218,445 m² in Scenario 2 (Table 4). For the demersal fish fauna and their food base, the benthos, the implementation of the first model wind farm scenario would preserve a larger area of their habitat.

Introduction of hard substrate

The construction of wind farms alters the habitat structure of site N-7.2 by introducing hard substrate (foundations, scour protection). An attraction effect of artificial reefs on fish has been observed in most cases (METHRATTA & DARDICK 2019). GLAROU et al. (2020) reviewed 89 scientific studies on artificial reefs; of these, 94% demonstrated positive or no effects of artificial reefs on fish fauna abundance and biodiversity. In 49% of the studies, a local increase in the abundance of fish was recorded after the construction of artificial reefs. Reasons for increased fish abundance on artificial reefs could be the locally more extensive food availability and protection from currents and predators (GLAROU et al. 2020).

The attractiveness of artificial substrates for fish depends on the size of the hard substrate introduced (OGAWA et al. 1977). The radius of action is assumed to be 200 to 300 m for pelagic fish and up to 100 m for benthic fish. (GROVE et al. 1989). STANLEY & WILSON (1997) found increased fish densities within 16 m of an oil rig in the Gulf of Mexico. Because of the distance between the individual installations, when this is transferred to the foundations of the wind turbines, it can be assumed that each individual foundation, regardless of the type of foundation, acts as a separate, relatively unstructured substrate and that the impact does not cover the entire area of the wind farm.

COUPERUS et al. (2010) found a concentration of pelagic fish that was up to 37 times greater in the vicinity (0-20 m) of wind turbine foundations using hydroacoustic methods in comparison to the areas between the individual wind turbines. REUBENS et al. (2013) found considerably higher concentrations of pout on wind turbine foundations than over the surrounding soft substrate; these feed predominantly on the fouling on the foundations.

OWF could not only provide an aggregation site for different fish species but also increase the productivity of some species in the area. Recent biological investigations have shown that cod reproduce in the wind farms of the “Nördlich Helgoland” cluster (GIMPEL et al. in prep.). This evidence serves as a guide to the impact of OFW on productivity and would need to be investigated further.

As a result of a potentially increased species diversity, biomass, and productivity of the fish community in the OWF, the dominance relationships within the fish community could lead to increased feeding pressure on one or more prey fish species as a result of the increase in large predatory fish.

In terms of the model wind farm scenarios, the presence and abundance of fish species could increase in Scenario 1 because of the higher number of installations, thereby potentially increasing biodiversity on Site N-7.2 more than in Scenario 2. As a result of colonisation by benthic invertebrates, more fish individuals could aggregate in the vicinity of the 98 WT than at the 49 WT. As mentioned above, follow-up effects would then be an improved food base and higher biodiversity as well as an increased feeding pressure or a change in dominance relationships.

Expected restriction of fishing

The restriction of fishing on Site N-7.2 (see 3.3), which is to be expected based on the legal framework and past practice, could have a further positive effect on the fish fauna. Associated negative fishing effects such as disturbance of the seabed as well as catch and by-catch of many species, would be eliminated or would not occur to the same extent. Because of the lack of or reduced fishing pressure, the age structure of the fish fauna within the development area could develop again towards a more natural distribution so that the number of older individuals increases. In particular, resident fish species would benefit from the restricted use. To date, the effects on fish fauna that could result from the restriction or elimination of fishing in the area of offshore wind farms have not been quantitatively investigated. There is therefore currently a need for research to transfer such impacts to the population level of fish.

Regardless of the design of the future wind farm, fishing would be expected to be prohibited or substantially restricted throughout Site N-7.2 such that fishing disturbance would be eliminated or reduced.

4.5.2 In-farm cabling

4.5.2.1 Construction-related

- Noise emissions
- Sedimentation and turbidity plumes

During the construction phase of submarine cable systems, fish fauna can be temporarily scared away by noise and vibrations caused both by the use of ships and cranes as well as by the installation of the cable systems. Furthermore, construction-related turbidity plumes can occur near the seabed, and local sediment redistribution can take place; this can harm fish spawn and larvae in particular. The ecological impacts of turbidity plumes on fish are described in detail in Chapter 4.5.1.1. The impacts on fish in areas with sediment redistribution are short-term and geographically limited.

The more construction activities take place in Site N-7.2, the higher the noise emissions and sedimentation. In Scenario 1, more WT must be connected by in-farm cabling so that the sediment turbulence is greater than in Scenario 2, especially when the submarine cables are flushed in. As a result, a possible adverse effect on fish fauna is more likely in Scenario 1 than in Scenario 2. Sediment turbulence is limited in time and space so that adverse effects are only temporary. In addition, fish are adapted to sediment turbulence in the North Sea in various ways. Fish fauna are not expected to be considerably adversely affected by construction activities for either Scenario 1 or Scenario 2.

4.5.2.2 Installation-related

- Habitat change as a result of cable crossings

A local change in the fish community is to be expected as a result of the stone packing in the area of the planned line crossings. A change in the fish population can lead to a change in dominance ratios and the food web. However, because of the small-scale nature of the cable crossing structures, these effects are to be considered minor.

4.5.2.3 Operational reasons

- Warming of the sediment
- Electric/electromagnetic fields

Warming of the sediment

For sediment warming in the immediate vicinity of the cables, the determination of suitability contains a requirement (Section 5) with which reference is made to the planning principle of the SDP. Experience shows that it will not exceed the precautionary value of 2 K at 20 cm sediment depth. Therefore, no significant impacts on fish fauna are expected.

Electric/electromagnetic fields

When operating submarine cables, the generation of magnetic fields cannot be ruled out. Direct electric fields do not occur in a significantly measurable way in either the direct current or the three-phase submarine cable systems. Magnetic fields of the individual cable systems largely cancel each other out in the planned bipolar (forward and return conductors) or three-wire cable configurations. Modelling for DC submarine cable systems resulted in values of 11 to max. 15 µT at the seabed surface (PGU 2012a, PGU 2012b). In comparison, the Earth's natural magnetic field is 30 to 60 µT depending on location. Because of the lower load current and the three-wire technology, a weaker magnetic field can be assumed for three-phase cable systems than for DC cable systems. Values of less than 10 µT are to be expected for three-phase cable systems. The strongest magnetic fields occur directly above the cable system. The strength of the fields decreases relatively quickly with increasing distance from the cable system. Orientation to the Earth's magnetic field has been documented for a number of fish species, especially migratory species such as salmon and river eel. These species can perceive electric fields; in some cases, this can lead to behavioural changes (MARHOLD & KULLINK 2000). According to KULLINK & MARHOLD (1999), a possible adverse effect on the orientation behaviour of adult specimens of species that use electric or magnetic fields for orientation (e.g. eels, sharks, and salmon) is at most short-term as proven by experiments on Baltic Sea eels. Fish draw on different environmental parameters, which, in interaction, are responsible for orientation performance.

4.6 Marine mammals

According to the current state of knowledge, it can be assumed that the German EEZ is used by harbour porpoises for traversing and inhabitation and as a foraging- and area-specific breeding area. Based on the findings available, in particular from the current investigations for offshore wind farms and the monitoring of Natura2000 areas, a medium importance of Site N-7.2 for harbour porpoises can be derived. Site N-7.2 is of no particular importance for harbour seals and grey seals.

4.6.1 Wind turbines and accommodation platform

4.6.1.1 Construction-related

Threats may be caused to harbour porpoises, grey seals, and harbour seals by noise emissions during the construction of offshore wind turbines and the accommodation platform if no preventative and mitigation measures are taken. Depending on the foundation method, impulse noise or continuous noise can be introduced. The introduction of impulse noise, which is generated when piles are being driven with hydraulic hammers, for example, has been thoroughly investigated. The current state of knowledge about impulse noise makes a major contribution to the development of technical noise mitigation systems. In contrast, the current state of knowledge on the input of continuous noise as a result of the installation of foundation piles using alternative methods is quite limited.

The Federal Environment Agency (UBA) recommends compliance with noise protection values during the construction of foundations for offshore wind turbines. The sound event level (SEL) outside of a circle with a radius of 750 m around the pile-driving or insertion point must not exceed 160 dB (re 1 µPa). The maximum peak sound pressure level must not exceed 190 dB if possible. The UBA recommendation does not include any further substantiation of the SEL noise protection value (http://www.umweltdaten.de/publikationen/fpdf-l/4118.pdf, as of: May 2011).

The noise protection value recommended by the UBA has already been developed through preliminary work by various projects (UNIVERSITY OF HANOVER, ITAP, FTZ 2003). For precautionary reasons,"safety margins" have been taken into consideration (e.g. for the inter-individual distribution of hearing sensitivity that has been documented to date) and particularly because of the problem of repeated exposure to loud sound impulses such as the ones that will occur when foundations are being rammed (ELMER et al., 2007). At present, only a small amount of reliable data is available for evaluating the effect duration of exposure to pile driving sounds. However, pile driving operations, which can last several hours, are much more potentially damaging than a single pile-driving operation. It currently remains unclear what kind of deduction should be applied to the aforementioned limit value should be applied to a series of individual events. A deduction of 3 dB to 5 dB for each tenfold increase in the number of pile-driving impulses is being discussed among experts. Because of the uncertainties shown here in the assessment of the effect duration, the limit value used in the approval practice is less than the limit value proposed by SOUTHALL et al (2007).

As part of the development of a measurement specification for recording and assessing underwater noise from offshore wind farms, the BSH has substantiated the specifications from the UBA recommendation (UBA 2011) and the findings of the research projects with regard to noise protection values and standardised them as much as possible. In the measurement regulations for underwater noise measurements of the BSH, the SEL_5 value is defined as the assessment level (i.e. 95% of the measured individual sound event levels must be below the statistically determined SEL_5 value) (BSH 2011). The extensive measurements within the framework of the efficiency control show that SEL_5 is up to 3 dB higher than SEL_{50}. Therefore, by defining the SEL_5 value as an assessment level, a further tightening of the noise protection value was made in order to take the precautionary principle into consideration.

In its overall assessment of the available expert information, the BSH therefore assumes that the sound event level (SEL_5) outside of a circle with a radius of 750 m around the pile-driving or introduction site must not exceed 160 dB (re 1 µPa) in order to be able to rule out adverse effects on harbour porpoises with the required certainty.

Initial results concerning the acoustic resilience of harbour porpoises have been obtained as part of the MINOSplus project. After sonication with a maximum reception level of 200 pk-pk dB re 1 μPa and an energy flux density of 164 dB re 1 μPa2/Hz, a temporary hearing threshold shift (TTS) was detected for the first time in a captive animal at 4 kHz. It was also shown that the hearing threshold shift lasted for more than 24 hours. Behavioural changes were already registered in the animal from a reception level of 174 pk-pk dB re 1 μPa (LUCKE et al. 2009). However, in addition to the absolute volume, the duration of the signal also determines the impacts on the exposure limit. The exposure limit decreases as the duration of the signal increases (i.e. damage to the hearing of the animals can occur in the event of prolonged exposure), even at lower volumes. Based on these latest findings, it is clear that harbour porpoises suffer a hearing threshold shift above 200 decibels (dB) at the latest, which may also lead to damage to vital sensory organs.

The scientific findings that have led to the recommendation or designation of noise protection values are mainly based on observations of other cetacean species (SOUTHALL et al. 2007) or on experiments on harbour porpoises in captivity using air guns or air pulsers (LUCKE et al. 2009).

Without the use of noise mitigating measures, considerable adverse effects on marine mammals during the pile driving of the foundations cannot be ruled out. The pile driving of the wind turbines and the accommodation platform will therefore be permitted only in the specific approval procedure with the use of effective noise mitigation measures. Principles will be included for this purpose. These principles state that the pile driving work when installing the foundations of offshore wind energy plants and platforms may only be carried out if strict noise mitigation measures are complied with. In the specific approval procedure, extensive noise mitigation measures and monitoring measures will be arranged in order to ensure that the applicable noise protection values (sound event level (SEL) of 160 dB re 1μPa and maximum peak level of 190 dB re 1μPa at a distance of 750 m around the pile-driving or introduction point) are complied with. Suitable measures must be taken to ensure that no marine mammals are present in the vicinity of the pile-driving site.

Current technical developments in reducing underwater noise show that the use of suitable systems can considerably reduce or even completely prevent the impacts of sound input on marine mammals (Bellmann, 2020).

Taking the current state of knowledge into consideration, the approval procedure will contain conditions as part of the specification of the types of foundation to be constructed with the objective of avoiding impacts on harbour porpoises caused by sound input to as great an extent as possible. The extent of the necessary conditions will result from the assessment of the structural design in a location and project-specific way at the approval level based on the species protection law and territorial protection law requirements.

The noise abatement concept of BMU has also been in force since 2013. The approach of the BMU noise abatement concept is habitat-related. In accordance with the noise abatement concept, pile driving work must be temporally coordinated in such a way that sufficiently large areas, especially within the German EEZ in the North Sea and especially within the protected areas and the main concentration area of the harbour porpoise during the summer months are kept free from impacts caused by impact noise.

The approval notices of the BSH contain two arrangements to protect the marine environment from noise pollution caused by pile driving:

a) Reduction of sound input at the source: Mandatory use of low-noise working methods according to the state of the art when installing foundation piles and mandatory restriction of noise emissions during pile driving. The primary purpose of the order is to protect marine species from impulsive noise inputs by avoiding killing and injury.

b) Avoidance of considerable cumulative impacts: The propagation of noise emissions must not exceed defined areas of the German EEZ and nature conservation areas. This ensures that sufficient high-quality habitats are available for the animals to escape at all times. The arrangement primarily serves to protect marine habitats by preventing and minimising disturbances caused by impulsive sound input.

The order under a) specifies the mandatory noise protection values to be complied with, the maximum duration of the impulsive sound input, and the use of technical noise mitigation systems and deterrent measures as well as the extent to which the protective measures are to be monitored.

Under order b), provisions are made, inter alia, for the avoidance and mitigation of considerable cumulative impacts or disturbance to the harbour porpoise population that may be caused by impulsive noise inputs. The provisions are derived from the BMU concept for the protection of harbour porpoises in the German EEZ of the North Sea (BMU, 2013).

- It shall be ensured with the necessary certainty that at any time no more than 10% of the area of the German EEZ of the North Sea and no more than 10% of a neighbouring nature conservation area is affected by noise-inducing pile driving activities.
- During the sensitive period of the harbour porpoise from 1 May to 31 August, it shall be ensured with the necessary certainty that no more than 1% of sub-area I of the nature conservation area “Sylter Außenriff – Östliche Deutsche Bucht” with its special function as a breeding area is affected by sound-intensive pile driving work for the foundation of the piles from disturbance-triggering sound inputs.

In order to ensure that marine habitats are protected, in accordance with the noise abatement concept of the BSU (2013), depending on the location of a project in the German EEZ or its proximity to nature conservation areas, additional measures are required during foundation work. Additional measures will be issued by the BSH within the scope of the third construction approval, taking into consideration the location- and project-specific characteristics.

In general, the considerations mentioned for harbour porpoises regarding noise exposure from construction and operation activities of wind turbines and platforms also apply to all other marine mammals occurring in the indirect vicinity of the structures.

Especially during pile driving, direct disturbance of marine mammals at the individual level can be expected locally around the pile driving site and for a limited time, whereby – as explained above – the duration of the work also has impacts on the exposure limit. In order to prevent a resulting threat to the marine environment, the specific approval procedure must include an order to minimise the effective pile driving time (including the entanglement). The effective pile driving time to be observed in each case (including deterrence) will be specified later in the approval procedure on a location- and installation-specific basis. As part of the enforcement procedure, the coordination of noise-intensive works with other construction projects is also reserved in order to prevent or reduce cumulative effects.

Based on the function-dependent importance of the areas for harbour porpoises and taking the noise abatement concept of the BMU (2013) into consideration for avoiding disturbances and cumulative effects, the provisions made in the site development plan (SDP, 2019), the specifications within the scope of the suitability assessment and the conditions imposed within the scope of planning approval for reducing sound input, the potential impacts of noise-intensive construction work on harbour porpoises are not considered to be considerable. By protecting open space in nature conservation areas, designating the reservation area and implementing the specifications of the noise abatement concept of the BMUB, the adverse effects on important feeding and breeding grounds for harbour porpoises is ruled out.

4.6.1.2 Operational reasons

According to current state of knowledge,operational noise from the wind turbines and the accommodation platform has no impacts on highly mobile animals such as marine mammals. The investigations carried out as part of the operational monitoring for offshore wind farms have so far given no indications of avoidance by wind farm-related shipping traffic. So far, avoidance has been observed only during the installation of the foundations; this may be related to the large number and varying operating conditions of vehicles on the site.

The standardised measurements of the continuous noise input from the operation of the wind farms, including the wind farm-related shipping traffic, have shown that low-frequency noise can be measured at a distance of 100 m from the respective wind turbine. However, with increasing distance from the installation, the noise from the installation is not considerably different from the ambient sound. At a distance of only 1 km from the wind farm, higher sound levels are always measured than in the centre of the wind farm. The investigations have clearly shown that the underwater noise emitted by the installations cannot be clearly identified from other sound sources (e.g. waves or ship noise) even at short distances. The wind farm-related shipping traffic was also hardly differentiated from the general ambient noise, which is introduced by various sound sources such as other shipping traffic, wind and waves, rain, and other uses (MATUSCHEK et al. 2018).

All measurements showed that not only the offshore wind turbines emit sound into the water but also that various natural sound sources such as wind and waves (permanent background sound) can be detected in the water over a broad band and contribute to the broadband permanent background noise.

In the measurement regulation for the recording and evaluation of underwater noise (BSH, 2011), a level difference of at least 10 dB is required between pulsating and background noise for a technically unambiguous calculation of impulse noise during pile driving. On the other hand, for the calculation or assessment of continuous sound measurements there is no minimum requirement in this respect due to a lack of experience and data. Within the airborne sound range, a level difference of at least 6 dB is required between plant and background noise in order to achieve an unambiguous assessment of installation noise and operating noise. If this level difference is not achieved, a technically unambiguous assessment of the installation noise is not possible, or the installation noise is not clearly distinguishable from the background noise level.

The results from the measurements of underwater noise that are available show that a 6 dB criterion such as this based on airborne sound can be fulfilled only in the close proximity to one of the installations at most. However, this criterion is no longer fulfilled even a short distance from the edge of the wind farm. As a result, from an acoustic point of view, the sound emitted by the operation of the installations outside the project areas does not clearly differ from the existing ambient noise.

The biological relevance of continuous sound on marine species, particularly harbour porpoises, has not yet been conclusively clarified. Continuous noise is the result of emissions from various anthropogenic uses as well as from natural sources. Reactions of animals in the immediate vicinity of a source such as a moving ship are to be expected and can occasionally be observed (WISNIEWSKA et al. 2018). Such reactions are even essential for survival in order to avoid collisions, among other things. In contrast, reactions that were not observed in the immediate vicinity of noise sources can no longer be assigned to a specific source.

Most behavioural changes are the result of a wide range of actions. Noise can certainly be a possible cause of behavioural changes. However, behavioural changes are primarily controlled by the survival strategy of the animals, for preying on food, for escaping from predators and for communicating with members of the same species. For this reason, behavioural changes always occur in a situational way and in a different form.

The literature contains references to possible behavioural changes caused by ship noise, but the results are not well-founded enough to draw conclusions about the significance of behavioural changes or even for developing and implementing suitable mitigation measures.

Scientific reviews of the existing literature on possible impacts of ship noise on cetaceans and fish clearly indicate the lack of comparability, transferability, and reproducibility of results (POPPER & HAWKINS, 2019, ERBE et al., 2019).

The now long-standing investigations according to StUK within the framework of operational monitoring of offshore wind farms in the German EEZ of the North Sea have so far not provided any evidence indicating avoidance or behavioural change of harbour porpoises in the wind farms, their surroundings, and along shipping routes (BioConsultSH, 2019, IfAÖ et al., 2018 and 2019, IBL et al., 2018). In the southern part of the German EEZ of the North Sea, of all places, with the two traffic separation areas and now with nine offshore wind farms in operation, the occurrence of harbour porpoise has increased since 2012 (NACHTSHEIM et al., 2021, GILLES et al., 2019).

Previous evaluations of service traffic from some wind farms show that there are, on average, three trips per day for the purpose of supplying, maintaining, or repairing installations. Thus, the average number of wind farm-related shipping movements is within the range of normal shipping traffic in and around the sites of the offshore wind farms that it was before the wind farms were constructed. As a result of the bypassing of the wind farm areas from commercial shipping and the expected exclusion or considerable restriction of the use of fishing vessels (cf 3.3), wind farms are to be described as rather traffic.calm zones.

It is known from oil and gas platforms that the attraction of different fish species leads to an enrichment of the food supply (FABI et al., 2004; LOKKEBORG et al., 2002). The recording of harbour porpoise activity in the immediate vicinity of platforms have also shown an increase in harbour porpoise activity associated with foraging during the night (TODD et al., 2009). It can thus be assumed that the possibly increased food supply in the vicinity of the wind turbines and the accommodation platform is likely to be attractive to marine mammals.

As a result of the SEA, according to the current state of knowledge, no major impacts on the protected asset marine mammals are to be expected from the construction and operation of wind turbines and the accommodation platform within Site N-7.2.

4.6.2 In-farm cabling

4.6.2.1 Construction-related

During the installation phase, which is limited in time and space, short-term deterrent effects may occur as a result of construction-related shipping traffic. However, these effects do not go beyond the disturbances generally associated with slow ship movements. Possible changes in sediment structure and associated temporary benthic changes do not have major impacts on marine mammals because they search for their prey in widely extended areas in the water column.

4.6.2.2 Operational reasons

Operational sediment warming has no direct impacts on highly mobile animals such as marine mammals. The influence of electromagnetic fields from submarine cables on the migration behaviour of marine mammals is largely unknown (GILL et al. 2005). However, because the magnetic fields that occur are significantly below the Earth's natural magnetic field, no major impacts on marine mammals are to be expected.

As a result of the SEA, it can be said that, according to the current state of knowledge, no major impacts on the protected asset marine mammals are to be expected as a result of the laying and operation of the in-farm cabling.

As a result of the SEA, it can be said that, according to the current state of knowledge, no major impacts on the protected asset marine mammals are to be expected as a result of the laying and operation of current-carrying cables.

4.7 Seabirds and resting birds

4.7.1 Wind turbines

If Site N-7.2 is determined to be suitable and an offshore wind farm project is realised on this site, the following general impacts may occur:

4.7.1.1 Construction-related

During the construction of offshore wind turbines, impacts on seabirds and resting birds can be expected; however, the nature and extent of these impacts are limited in time and space.

Species sensitive to disturbance may react to the construction site or construction traffic with avoidance behaviour. Turbidity plumes may occur as a result of the installation process. Attraction effects resulting from the lighting of the construction site and the construction site vehicles can also not be ruled out.

The potential impacts during the construction phase of an OWF on Site N-7.2 are to be assessed as spatially and temporally local. Temporary construction-related shipping traffic will be integrated into regular shipping activity north of the Traffic Separation Areas and will thus not exceed the level of impact on seabirds from regular shipping. Turbidity plumes will also occur only locally and only for a limited time. With regard to possible attraction effects caused by lighting, a requirement to minimise emissions is included in the determination of suitability (Section 6) in order to reduce light emissions to a necessary minimum, among other things, and thus also possible attraction effects. In conclusion, because of the generally high mobility of birds and if the measures to avoid and mitigate intensive disturbance by coordinating construction activity are specified, major impacts on all seabird and resting bird species during the construction phase can be excluded with the necessary certainty.

4.7.1.2 Operational and installation-related

Erected wind turbines can be an obstacle in the airspace and cause collisions with the vertical structures for seabirds and resting birds (GARTHE 2000). It is difficult to estimate the extent of such incidents so far because it is assumed that a large proportion of the collided birds do not touch down on a solid structure (HÜPPOP et al. 2006). The risk of collision of a species is determined by factors such as manoeuvrability, flight altitude, and proportion of time spent flying (GARTHE & HÜPPOP 2004). The risk of collision for seabirds and resting birds must therefore be assessed differently depending on the species.

Species sensitive to disturbance can be expected to avoid the wind farm areas to a species-specific extent during the operating phase of the wind farms. As a result of the restriction of fishing on Site N-7.2 (see Chapter 3.3**Fehler! Verweisquelle konnte nicht gefunden werden.**), which is to be expected based on the legal framework and past practice, it cannot be ruled out that fish populations will recover during the operating phase. In addition to the introduction of hard substrate, this could increase the species range of fish present and thus provide an attractive food supply for foraging seabirds.

For the estimation of a possible risk of collision for seabirds and resting birds with offshore wind turbines, the corresponding height parameters of the installations are an important key figure. Therefore, in the suitability assessment, analogous to Site development plan 2020, two scenarios are checked according to the current technical developments with regard to the dimensions of future wind turbines, which take into consideration possible relevant turbine parameters (cf Chapter 1.5.5.4). In accordance with Scenario 1, wind turbines with a hub height of 125 m and a rotor diameter of 200 m would be used; the turbines would thus reach a total height of 225 m. According to Scenario 2, these would be wind turbines with a hub height of 200 m, a rotor diameter of 300 m, and a total height of 350 m. This means that the lower rotor-free area from the water surface to the lower rotor blade tip would be 25 m in Scenario 1 and 50 m in Scenario 2.

As part of StUKplus, the "TESTBIRD" project used rangefinders to determine the flight altitude distribution of seven species of seabird and resting bird species. The herring gull, lesser black-backed gull, and greater black-backed gull species flew at altitudes of 30–150 m in most the flights recorded. Species such as kittiwake, common gull, little gull, and gannet, on the other hand, were observed mainly at lower altitudes up to 30 m (MENDEL et al. 2015). A study at the Thanet Offshore Wind Farm in England also investigated the flight height distribution of gannets, kittiwakes, and the great black-backed gull species herring gull, greater black-backed gull, and lesser black-backed gull using the rangefinder (SKOV et al. 2018). The flight altitude measurements of the great black-backed gulls and the gannet showed comparable altitudes as determined by MENDEL et al. (2015). Black-legged kittiwakes, on the other hand, were mostly observed at an altitude of about 33 m.

In general, great and lesser black-backed gulls have a high manoeuvrability and can react to wind turbines with appropriate evasive manoeuvres (GARTHE & HÜPPOP 2004). This was also shown in the study by SKOV et al. (2018), which investigated not only the flight altitude but also the immediate, small-scale, and large-scale evasive behaviour of the species considered. Furthermore, the investigations using radar and thermal imaging cameras revealed low nocturnal activity. The risk of collision at night as a result of attraction effects caused by the illumination of the wind turbines can therefore also be assessed as low.

The risk of collision is estimated to be quite low for disturbance-sensitive species such as red-throated and black-throated divers because they do not fly directly into or near the wind farms because of their avoidance behaviour.

The terns, which are listed in Annex I of the V-RL, are also not threatened by collisions with the installations because they prefer low flight altitudes and are extremely agile flyers (GARTHE & HÜPPOP 2004).

Overall, an increased risk of collision for seabird and resting bird species is not to be assumed with the realisation of the wind turbines specified in Scenarios 1 and 2 on Site N-7.2. According to the current state of knowledge, this also applies to species whose flight altitudes are within the range of the rotating rotor blades but whose flight behaviour enables them to avoid the turbines at an early stage.

Species sensitive to disturbance can be expected to avoid the wind farm areas to a species-specific extent during the operating phase of the wind farms.

Red-throated divers and black-throated divers show pronounced avoidance behaviour towards offshore wind farms. A recent study by the FTZ on behalf of the BSH and the BfN, which took into consideration data from wind farm monitoring in the EEZ as well as research data and data from Natura2000 monitoring, found a statistically significant decrease in diver abundance over all built-up areas in the EEZ up to 10 km starting from the periphery of a wind farm (GARTHE et al. 2018). This was also the conclusion of a study commissioned by the BWO, which used a modified data source and different statistical analysis methods compared with the FTZ study (BIOCONSULT SH et al. 2020b). Both studies do not show total avoidance but rather partial avoidance with increasing diver densities up to 10 km from a wind farm.

In order to quantify the habitat loss, early decisions concerning individual planning approval were based on a shooing distance of 2 km (defined as complete avoidance of the wind farm area including a 2 km buffer zone) for divers. The assumption of a habitat loss of 2 km was based on data from the monitoring of the Danish wind farm “Horns Rev” (PETERSEN et al., 2006). The study by GARTHE et al. (2018) shows more than a doubling of the shooing distance to an average of 5.5 km. This shooing distance, which is also known as calculated total habitat loss, is based on the purely statistical assumption that there are no divers within 5.5 km of an offshore wind farm. The study commissioned by the BWO showed a calculated total habitat loss (‘theoretical habitat loss’) of 5 km for wind farm projects in the entire investigation area under consideration and therefore provided a comparable result. In the individual consideration of a northern and a southern sub-area, a calculated total habitat loss of 2 km in the southern sub-area indicated that there were regional differences. For wind farm projects in the northern sub-area, which includes the main concentration area, the overriding value of 5 km was confirmed (BIOCONSULT SH et al. 2020).

No clear findings on the avoidance behaviour of divers towards operating wind farms are available from the neighbouring area N-8, which is being investigated as part of the “Östlich Austerngrund” cluster studies. The experts attribute this to the low numbers of diver sightings in this area of the EEZ, which is not part of the feeding and preferred habitat of divers because of the area and surrounding characteristics (IBL UMWELTPLANUNG et al. 2018a). Also for the investigations accompanying the construction of the OWF projects in the “Östlich Austerngrund” cluster, it has so far not been possible to statistically prove avoidance effects. However, the experts do not completely exclude avoidance effects of the cluster on divers but assume that these are not detectable because of the naturally low diver occurrence and the small scale of the investigation areas (IBL UMWELTPLANUNG et al. 2019a, IBL UMWELTPLANUNG et al. 2020a). It can be assumed that further investigations will provide a clearer picture of the avoidance behaviour of divers in this area of the EEZ. Detailed information on the avoidance behaviour of divers, especially in the area of the main concentration area west of Sylt, can be found in the corresponding chapters of the Environmental Report on Site Development Plan 2020 for the German North Sea (BSH 2020a).

For Site N-7.2, the findings from the “Östlich Austerngrund” cluster studies specifically mean that it cannot be ruled out that an OWF on Site N-7.2 will have avoidance effects on divers. However, because of the low abundance of divers in this area of the EEZ in general and in the vicinity of Site N-7.2 in particular, it can be assumed that potential impacts will not be major. In addition, Site N-7.2 is located more than 50 km from the main concentration area of divers, the most important resting area in the EEZ of the North Sea. Given the low seasonal and spatial occurrence of divers in the vicinity of Site N-7.2, major impacts can be excluded with the necessary certainty. A consideration of cumulative effects is given in Chapter 4.12.4.

For other species such as gannets, little gulls, terns, guillemots, and razorbills, there are findings from some areas of the EEZ on small-scale avoidance behaviour towards wind farms.

For gannets, significant avoidance effects between 2 km (ship surveys) and 3.4 km (aerial transect surveys) were found from the investigations on the "Östlich Austerngrund" cluster from the operational monitoring for the OWF "Global Tech I" (IBL UMWELTPLANUNG et al. 2018a). In the subsequent investigations of the construction phase of the OWFs "Hohe See" and "Albatros", no clear avoidance effects were identified. This was partly due to the high mobility of the animals and the presence of hunting gannet groups as was also observed in the investigations of Site N-7.2(IBL UMWELTPLANUNG et al. 2019a, IBL UMWELTPLANUNG et al. 2020a).

For little gulls, considerably lower densities were found up to 3 km from the OWF compared to outside this area during operational monitoring for the OWF "Global Tech I". Because the occurrence and survey of little gulls is related to the coincidence of interval-like migration events, it was not possible to determine comparable values in the further course of the subsequent construction phase monitoring because of small sample sizes (IBL UMWELTPLANUNG et al. 2018a, IBL UMWELTPLANUNG et al. 2019a, IBL UMWELTPLANUNG et al. 2020a). Overall, the occurrence of little gulls in this area of the EEZ is highly variable.

Although there are findings from other areas of the EEZ, for example north of Borkum, on significant avoidance of the wind farm area by terns (IFAÖ et al. 2017b, IFAÖ et al. 2018b, IFAÖ et al. 2019b, IFAÖ et al. 2020b), no statistically significant avoidance effects were detected in the previous investigations on the "Östlich Austerngrund" cluster. This is mainly due to the low numbers of individuals recorded. This does not allow a reliable statistical detection of significant avoidance effects (IBL UMWELTPLANUNG et al. 2018a, IBL UMWELTPLANUNG et al. 2019a, IBL UMWELTPLANUNG et al. 2020a).

For the Common Guillemot, which is widespread in the German North Sea, previous findings indicate that reactions to offshore wind farms depend on a number of factors. DIERSCHKE et al. (2016) compiled findings on the behaviour of seabirds from 20 European wind farms. From the studies that were taken into consideration, it was found that Common Guillemots appear to react differently depending on the location of an offshore wind farm. In the wind farms considered, complete avoidance of the OWF area, partial avoidance behaviour up to adjacent areas or no avoidance behaviour at all was observed (DIERSCHKE et al. 2016). The authors attribute these differences to food availability at the respective location. MENDEL et al. (2018) add a seasonal aspect to the avoidance behaviour of guillemots. Using digital aerial transect surveys in the area north of Helgoland, the authors found differences in the avoidance behaviour before and during the breeding season. In spring, for example, a significant reduction in density up to 9 km from the wind farm projects north of Helgoland was observed, while no effect radius was found during the breeding season. MENDEL et al. (2018) link these differences to the reduced range and attachment to the breeding colony on Helgoland during the breeding season. In spring, however, guillemots are independent of a specific range and generally show a more westerly distribution (MENDEL et al. 2018). In a recent study, PESCHKO et al. (2020) confirmed the breeding season behaviour found by MENDEL et al. (2018) by using transmittered guillemots in the same area of investigation.

From the operational monitoring of the cluster "Östlich Austerngrund", there are indications of statistically significant, partial avoidance effects up to 6 km. However, these results take into consideration investigations from a complete annual cycle and are not broken down by season. There are currently no scientific findings on the seasonal and site-related avoidance behaviour during the high occurrence seasons of spring, winter, and autumn. Furthermore, the evaluations refer to the species group guillemot/razorbill and are therefore also to be assumed for razorbills as a precautionary measure (IBL UMWELTPLANUNG et al. 2018a). In the EEZ of the North Sea, however, guillemots regularly occur as the more dominant of the two species. For the previous construction phase monitoring of the OWFs “Albatros” and “Hohe See”, the results from the operational monitoring have so far not been confirmed (UMWELTPLANUNG et al. 2019, IBL UMWELTPLANUNG et al. 2020).

In all the above findings on the avoidance effects of gannets, little gulls, terns, and auks, it should be noted that these are partial avoidances and not complete avoidances to the appropriate distances. Because of their low or highly variable occurrence in the vicinity of Site N-7.2, most species are not expected to be considerably impacted by avoidance effects. For guillemots and razorbills, the vicinity of Site N-7.2 is part of the large-scale habitat in the German EEZ of the North Sea. According to the current state of knowledge, major impacts of a project on Site N-7.2 can also be ruled out for these species.

4.7.2 In-farm cabling and accommodation platform

The impacts of platforms and submarine cable systems have already been assessed and evaluated at the level of the Strategic Environmental Assessment for the Site Development Plan (BSH 2020a). As a result, the impacts of platforms and submarine cable systems on seabirds and resting birds were assessed as not considerable. This assessment is still valid.

4.8 Migratory birds

The threat to bird migration is a reason for refusal for offshore wind farm projects in accordance with Section 48, paragraph 4, no. 1b WindSeeG.

4.8.1 Wind turbines

If Site N-7.2 is determined to be suitable and an offshore wind farm project is realised on this site, the following general impacts may occur:

4.8.1.1 Construction-related

In the first instance, adverse effects during the construction phase may be caused by light emissions and visual disturbance. These can cause species-specific, differently pronounced deterrent and barrier effects on migrating birds. However, lighting for construction equipment can also have the effect of attracting migrating birds and increase the risk of collision.

4.8.1.2 Installation- and operation-related

Possible impacts of an offshore wind farm on Site N-7.2 during the operating phase may be that it creates a barrier for migrating birds or a risk of collision. Flying around or otherwise changing the flight behaviour can lead to higher energy consumption, which can affect the fitness of the birds and subsequently their survival rate or breeding success. Collision events can occur on the vertical structures (such as rotors and support structures of the wind turbines). Poor weather conditions – especially at night and in strong winds – increase the risk of collision. In addition, there are possible glare or attraction effects caused by the safety lighting of the installations; this can lead to birds becoming disoriented. Furthermore, birds caught in wake currents and air turbulence at the rotors could be influenced in their manoeuvrability. For the aforementioned impacts, sensitivities and risks are expected to vary by species. For this reason, potential hazards are considered on a species-specific basis when considering the likely considerable impacts at Site N-7.2. A species-specific assessment is not possible in most cases because of methodological limitations in bird migration recording.

Detailed information on the general threat potential of bird migration and the assessment criteria can be found in the corresponding chapters of the Environmental Report on the Site Development Plan for the German North Sea (BSH 2020a).

For the estimation of a possible risk of collision for seabirds and resting birds with offshore wind turbines, the corresponding height parameters of the installations are an important key figure. Therefore, in the suitability assessment, analogous to Site development plan 2020, two scenarios are checked according to the current technical developments with regard to the dimensions of future wind turbines, which take into consideration possible relevant turbine parameters (cf Chapter 1.5.5.4). In accordance with Scenario 1, wind turbines with a hub height of 125 m and a rotor diameter of 200 m would be used; the turbines would thus reach a total height of 225 m. According to Scenario 2, these would be wind turbines with a hub height of 200 m, a rotor diameter of 300 m, and a total height of 350 m. This means that the lower rotor-free area from the water surface to the lower rotor blade tip would be 25 m in Scenario 1 and 50 m in Scenario 2. The larger dimensions also increase the area covered by the rotor. However, this influence is reduced by the decrease in the number of installations. However, the taller installations may increase the risk of collision.

The assessment of the conflict potential for bird migration is differentiated according to species groups because of the different mode of life, navigational ability, and migration behaviour (diurnal/nocturnal migrators). Rarity, endangerment status, and reproductive strategy should also be included in the sensitivity assessment to be carried out. In the following consideration of individual species or groups of species, only those that have been recorded in considerable numbers of individuals in the vicinity of Site N-7.2 are taken into consideration.

Seagulls

In the vicinity of Site N-7.2, gulls dominated the migratory activity during the light phase in the previous survey years (see Chapter 2.9.3.1). The populations of the most common gull species are generally large. Over all recorded migration periods, the lesser black-backed gull was the most common gull species (BioConsult SH et al. 2020b). The size of the biogeographical population of the dominant subspecies *Larus fuscus intermedius* in Germany is currently estimated at 325,000–440,000 individuals (Wetlands International 2020). Among the gulls, the herring gull is the only species with an assignment to SPEC category 2 (Species concentrated in Europe with negative population trends and unfavourable protection status). In the German North Sea, both the subspecies *Larus argentatus argentatus* and *Larus argentatus argenteus* occur. The size of the two populations are estimated to comprise 1,300,000–3,100,000 individuals and 990,000–1,050,000 individuals, respectively (WETLANDS INTERNATIONAL 2020).

Within the framework of research projects, flight altitude measurements using rangefinders for the species herring gull, lesser black-backed gull, and greater black-backed gull showed flights at altitudes of 30–150 m in most cases. Species such as kittiwakes and common Gulls, on the other hand, were observed mainly at altitudes up to 30 m (MENDEL et al. 2015, SKOV et al. 2018).

In general, great and lesser black-backed gulls have a high manoeuvrability and can react to wind turbines with appropriate evasive manoeuvres (GARTHE & HÜPPOP 2004). This was also shown in the study by SKOV et al. (2018), which investigated not only the flight altitude but also the immediate, small-scale, and large-scale evasive behaviour of the species considered. In adverse weather conditions, gulls can also land on the water and wait for better migration conditions. Overall, major impacts on gulls as a result of construction on Site N-7.2 can be ruled out with the necessary certainty – also against the background of the installation scenarios to be considered here.

In accordance with Article 4, paragraph 1 of the Birds Directive, special protective measures (in particular the designation of protected areas) must be applied to the habitats of the species listed in Annex 1 of the Directive.

In addition, in accordance with Article 4, paragraph 2 of the Directive member states are required to take the appropriate measures for the breeding, moulting, wintering, and resting areas of regularly occurring migratory species not listed in Annex 1. However, there is no generally applicable and binding list for these migratory bird species to be protected. However, indications of conservation status are provided by the classification of the species in the European SPEC categories (Species of European Conservation Concern), the pan-European endangerment categories (EUR-Gef.), the EU25 endangerment categories (EU25-Gef.), and the status of the species according to the Action Plan of the "African-Eurasian Migratory Waterbird Agreement" (AEWA).

In the following, the impacts on species in need of special protection according to Annex I and other species in need of protection according to Article 4, paragraph 2 Bird Directive are considered and assessed in a differentiated manner.

With regard to the impacts on the species of Annex I of the Birds Directive, the following applies:

Tern species group

Terns were among the more common species groups in the investigations of Site N-7.2. Common terns *(Sterna hirundo)* and Arctic terns *(Sterna paradisaea)* were observed more frequently than Sandwich terns *(Thalassesus sandvicensis)*; however, it was not possible to clearly distinguish them from each other in most cases.

The size of the biogeographical populations of Arctic tern and common terns are estimated at 1,000,000 and 800,000–1,700,000 individuals, respectively. The population size of the relevant biogeographical population of Sandwich tern is currently estimated at 166,000–171,000 individuals (WETLANDS INTERNATIONAL 2020).

Visual observations during the preliminary investigation for Site N-7.2 revealed 41 Sandwich terns in year of investigation 2018/2019 and 11 individuals in the 2019/2020. This corresponds to a maximum of 0.02% of the biogeographical population. In the first year of investigation, 474 common terns and 166 Arctic terns were also observed. In the 2nd year of investigation, there were 133 common terns and 212 Arctic terns. This corresponds to approx 0.06% of the biogeographical population of common terns and

0.02% of the biogeographical population of Arctic terns (BioConsult SH et al. 2020b).

The investigations accompanying construction and operation in the neighbouring Area N-8, which is being investigated as part of the cluster studies “Östliche Austerngrund”, confirm previous the previous state of knowledge that terns prefer mainly the height range of the lower 20 m and thus below the assumed scenarios for future wind turbines on Site N-7.2 (IBL Umweltplanung et al. 2019b, IBL Umweltplanung et al. 2020b).

Overall, taking into consideration the low population proportions passing through the area of Site N-7.2, it can be concluded that considerable impacts of a project on terns on Site N-7.2 can be excluded with the necessary certainty.

<u>*Species group divers*</u>

The species group divers includes the species red-throated diver (*Gavia stellata*) and black-throated diver (*Gavia arctica*). The respective relevant biogeographical populations are estimated to comprise 150,000–450,000 individuals (red-throated divers) and 250,000–500,000 individuals (black-throated divers) (Wetlands International 2020). Divers are considered to be particularly sensitive to disturbance and show marked avoidance behaviour towards offshore wind farms during resting (see Chapter 4.7.1.2). According to Garthe & Hüppop (2004), red-throated and black-throated divers received the highest wind farm sensitivity indices of 43 and 44, respectively. Because of their avoidance behaviour, the risk of collision can be considered quite low. In addition, divers were observed regularly but only in small numbers of individuals during the bird migration survey of the preliminary investigation of sites for N-7.2 (BioConsult SH et al. 2020b). Furthermore, divers mainly fly close to the water surface and at most at heights of about 10 m (Garthe & Hüppop 2004). Considerable impacts on the divers species group in terms of a threat to bird migration can be excluded with the necessary certainty.

<u>*Little gull (Hydrocoloeus minutus)*</u>

The little gull is also an Annex I species of the Birds Directive and is therefore considered separately from the other gull species observed in the vicinity of Site N-7.2.

The biogeographical population of the little gull is currently estimated to be 72,000–174,000 individuals (Wetlands International 2020). In the vicinity of Site N-7.2, it was regularly surveyed depending on its migratory activity. Most sightings were recorded in the first year of investigation with 761 individuals (BioConsult SH et al. 2020b). This corresponds to almost 1% of the biogeographical population. Rangefinder surveys of flight altitudes showed that little gulls prefer flight altitudes in the lower 30 m (Mendel et al. 2015). The investigations from the investigation cluster confirm that little gulls mainly use the height range up to 20 m and thus below the rotor ranges assumed here (IBL Umweltplanung et al. 2019b, IBL Umweltplanung et al. 2020b). During resting, little gulls show minor avoidance behaviour towards offshore wind farms. Garthe & Hüppop (2004) classified the little gull as relatively insensitive to offshore wind farms partly because of its extreme manoeuvrability (WSI 12.8). Considerable impacts on little gulls can be excluded with the necessary certainty.

With regard to the impacts on the species to be protected according to Article 4, paragraph 2 of the Birds Directive, the following applies:

<u>*Species group geese and ducks*</u>

From the group of geese and ducks that are protected or threatened according to at least one of the aforementioned agreements or threat analyses, black scoter *(Melanitta nig-ra)*, brent goose (*Branta bernicla*), and teal *(Anas crecca)* were observed in notable numbers of individuals in the vicinity of Site N-7.2 during the surveys of the preliminary investigation of sites.

Black scoters have AEWA endangerment status B 2a (populations with numbers of individuals greater than about 100,000 for which special attention appears necessary because of concentration on a small number of sites in each phase of their annual cycle). The biogeographical population of the black scoter is currently estimated at 550,000 individuals (WETLANDS INTERNATIONAL 2020).

According to AEWA, teals are classified in endangerment status C1 (populations with an individual number of more than about 100,000 for which international cooperation could be of considerable benefit and which do not meet the conditions for column A or B). Current estimates for the relevant biogeographical population are 500,000 individuals (WETLANDS INTERNATIONAL 2020).

Brent geese are classified as threat status B 2b under AEWA (populations with numbers of individuals greater than about 100,000 for which special attention appears necessary because of reliance on a habitat type under considerable threat. The size of the relevant biogeographical population is currently estimated at 200,000–280,000 individuals (WETLANDS INTERNATIONAL 2020).

During the visual observations of bird migration in the preliminary investigation of sites of N-7.2, individuals of the aforementioned species were regularly recorded in the survey years (2018–2020). In total, 211 black scoters were observed in the first year of investigation and 186 black scoters in the second year (BIOCONSULT SH et al. 2020b). This corresponds to about 0.04% of the biogeographical population. In the first year of investigation, 227 teals and 155 brent geese were also registered. In the second year of investigation, there were 62 teals and 19 brent geese (BIOCONSULT SH et al. 2020b). This corresponds to 0.05% of the relevant biogeographical population for teals and 0.1% of the biogeographical population for brent geese.

The species mentioned are mainly diurnal migrants. It is therefore to be expected that they will be able to recognise and fly around the vertical obstacles in good time because of their good visual abilities. The visual observations on Site N-7.2 showed that more than 2/3 of the diurnal migration was below 20 m (see Chapter 2.9.3.2.2). Considering the possible scenarios of the turbines, diurnal migration takes place mostly below the lower rotor blade tip.

Because of the low observed population proportions on migration in the vicinity of Site N-7.2 and the flight behaviour of the species considered, considerable impacts on duck and goose species occurring regularly and in considerable numbers can be excluded with the necessary certainty.

Species group waders

In the vicinity of Site N-7.2, only a few species of waders were recorded in small numbers during investigations on bird migration in previous year of investigation – both at night and during the day. It can therefore be assumed that a wind farm on Site N-7.2 will not have considerable impacts on waders.

In summary, diurnal migrants fly mostly in the lower 50 m and thus also below the lower rotor tip in accordance with the underlying scenarios for turbines. It is generally assumed that diurnal migrators orientate themselves visually and, if these species belong to the seabird or waterbird species, can land on the water. As a result, considerable impacts on predominantly diurnal species are not expected.

Songbirds

Songbirds dominate the nocturnal bird migration. Taking into consideration migratory behaviour, there is a particular risk of collision for the nocturnal migration of small birds because of migration in the dark, high migration volume, and the strong attracting effect of artificial light sources.

In general, migrating birds fly higher in good weather than in bad. It is also well known that most birds usually start their migration in good weather and are able to choose their departure conditions so that they are reasonably likely to reach their destination in the best possible weather (BSH 2009). In a recent study, BRUST et al. (2019) found that the migratory behaviour of thrushes is influenced not only by prevailing wind conditions but also by the condition of the individual and individual behaviour. Individuals that stayed longer at stopovers along the coast tended more often to cross the North Sea along an offshore route rather than following the coastline.

Furthermore, in the clear weather conditions preferred by birds for their migration, the probability of a collision with wind turbines is therefore low because the flight altitudes of most birds will be above the range of the rotor blades, and the installations are clearly visible. On the other hand, unexpected fog and rain, which lead to poor visibility and low flight altitudes, represent a potential risk situation. The coincidence of bad weather conditions and mass migration events is particularly problematic. According to information from various environmental impact studies, mass migration events in which birds of different species fly over the North Sea simultaneously occur about 5 to 10 times per year. On average, two to three of them are coupled with bad weather. An analysis of all existing bird migration surveys from the mandatory monitoring of offshore wind farms in the EEZ of the North Sea and Baltic Sea (observation period 2008–2016) confirms that particularly intensive bird migration coincides with extremely poor weather conditions at less than 1% of the migration times (WELCKER & VILELA 2019).

According to migratory call surveys, the most common species on Site N-7.2 are mainly thrush species such as the red-winged thrush, song thrush, fieldfare, and blackbird (see Chapter 2.9.3.1).

The songbird species crossing the area in large numbers originate from highly individual populations. Starting from the main direction of migration SW or NE, the German Bight is mainly overflown by songbirds from the Fennoscandian area. The migratory birds observed are therefore presumably predominantly to be attributed to the breeding populations of northern Europe. There are currently no more up-to-date estimates of population sizes of northern European breeding populations. According to BIRDLIFE INTERNATIONAL (2004), northern European breeding populations for the red-winged thrush are given as 3,250,000 to 5,500,000 and song thrush as 3,300,000 to 5,700,000. According to the investigations on Site N-7.2, the listed songbird species do not occur in considerable proportions (> 1% of the total number of individuals of the breeding populations of Northern Europe) in the investigation area. Given the level of breeding populations in northern Europe, the investigation area is not of particular importance for songbird populations during migration.

However, it cannot be ruled out that the lighting of the installations has an attracting effect, especially on birds migrating at night, and that they fly into the turbines or are at least adversely affected by glare. Investigations at lighthouses in Denmark have shown that light sources are rarely approached by sea and waterbirds but rather increasingly by small birds such as starlings, song thrush, and skylarks when visibility is poor. In a recent study, REBKE et al. (2019) investigated the influence of different coloured and different luminous light sources on nocturnal songbird migration at different cloud cover levels. As a result, birds were more attracted to continuous rather than flashing lighting. In addition, the authors recommended the use of red light in cloudy weather conditions in order to reduce attraction effects in poor visibility conditions

The risk of bird strike as a result of the attraction effects of wind turbine lighting seems to be more likely in the aforementioned individual-rich populations and therefore does not indicate a threat to nocturnal bird migration. In the determination of suitability, as regularly in the planning approval, arrangements are made for the avoidance or minimisation of light emissions, among other things, insofar as these are not required and unavoidable by the safety requirements of shipping and air traffic.

Overall, the individual species- and species-group-specific assessment shows that considerable impacts by a wind farm on Site N-7.2 can be excluded with the necessary certainty for the migratory bird species occurring in the project and their relevant biogeographical populations. However, the possible increased risk of collision as a result of the higher 10–20 MW installations on which the assessment is based must be taken into consideration in the cumulative consideration of several wind farm projects in the vicinity of site N-7.2 and in the concrete planning of the individual project.

4.8.2 Cabling and living accommodation platform within the wind farm

The impacts resulting from platforms and submarine cable systems have already been reviewed and evaluated at the level of the Strategic Environmental Assessment for the Site Development Plan (BSH (Federal Agency for Seafare and Hydrographics) 2020a). The results which were therefore obtained for the impacts of platforms and submarine cable systems on seabirds and resting birds were evaluated as insignificant. This evaluation is still valid.

4.9 Bats and bat migration

Migratory movements of bats across the North Sea are still poorly documented and largely unexplored. There is a lack of concrete information on migrating species, migration corridors, migration heights, and migration concentrations. Previous knowledge merely confirms that bats, especially long-distance migratory species, fly over the North Sea.

There is no reliable data regarding migration corridors and migration behaviour of bats over the North Sea currently available, which would enable a founded evaluation of the potential impacts of a wind farm on Site N-7.2. It can therefore be assumed that any adverse effects on bats can be prevented by the same prevention and mitigation measures which are implemented to protect bird migration.

4.10 Climate

Impacts on the climate from the construction and operation of wind turbines, a platform as well as the submarine cable systems are not expected because no measurable climate-relevant emissions occur either during construction or operation.

4.11 Landscape

The realisation of offshore wind farms has impacts on the landscape because it is altered by the installation of vertical structures and security lights. The extent of these visual impairments to the landscape caused by the planned offshore installations will depend to a large extent on the respective visibility conditions. Area N-7 indicates a distance of more than 70 km from the North Sea coast, which therefore means that the existing and still in planning wind farms are/will no longer be perceivable when viewed from land (refer to Chapter 2.14). The development of the landscape will not be significantly altered by the execution of the construction project on Site N-7.2, as this area of the German EEZ is already characterised by the wind farms which have already been erected on Areas N-6, N-7 and N-8.

4.12 Cumulative effects

The following chapters and sections will examine, in conjunction with the explanations in Chapter **1.5.5.2** , whether significant environmental impacts on the protected objects are to be expected as a result of the cumulative effects.

4.12.1 Soil/ the area, benthos and biotopes

A significant proportion of the environmental impacts caused by the areas and surfaces, platforms and submarine cable systems on the protected assets soil, benthos and biotopes types is expected to occur exclusively during the construction period (formation of turbidity plumes, sediment shifting etc.) and within a spatially narrowly defined area. Possible cumulative impacts on the seabed, which could also have a direct impact on the benthos and specially protected biotopes, will result from the sum of the permanent direct land area use for the foundations of the wind turbines and platforms as well as the cable systems which will be laid. The individual impacts will be generally small-scale and local as described in Chapter 4 .

In order to be able to estimate the direct land area use, a rough calculation is made in the following which is based on the model wind farm scenarios (Chapter 1.5.5.4) and the assumptions regarding other installations (Chapter 1.5.5.5). Calculating the land area use will be executed based on ecological aspects i.e. the calculation will be based on the direct ecological loss of function and/or the possible structural change in the area caused by the installation of foundations and cable systems. In the area of the cable trench, however, the impact on sediment and benthic organisms will be essentially temporary. Permanent impairment would have to be assumed in the case of the crossing over particularly sensitive biotope types such as reefs or species-rich gravel, coarse-sand and shell beds.

When based on the allocated capacity of 980 MW for Site N-7.2 and an assumed capacity per turbine of 10 MW (model wind farm Scenario 1) or 20 MW (model wind farm Scenario 2), the calculated number of turbines for the area results in between 98 turbines (Scenario 1) and 49 turbines (Scenario 2) (Table 4).

On the basis of the model wind farm parameters, this therefore results in a land sealing area of 194,337 m² (Scenario 1) and 218,445 m² (Scenario 2), including an assumed scour protection and an accommodation platform. When compared to the total area of Site N-7.2, which is approx. 58.4 km², the calculated land sealing area for the model wind farm scenarios is between 0.33 % (Scenario 1) and 0.37 % (Scenario 2) (Table 4).

The calculation of the loss of function due to the in-farm cabling was executed in accordance with the reported capacity, assuming a 1 m wide cable trench. If this conservative estimate is utilised as the basis, then a temporary impairment by approx. 117.6 km of intra-farm cabling will result for Site N-7.2, which corresponds to a temporary land use of 0.20 % of the total area of N-7.2.

The total arising from land sealing and temporary land use also therefore results in a conservatively estimated impact of well below 1% of the total area of N-7.2 (0.53% - 0.58%). According to current knowledge, no significant adverse effects are therefore to be expected, even in cumulation, which would lead to a threat to the marine environment with regard to the seabed and the benthos.

4.12.2 Fish

Furthermore, the wind farms of the southern North Sea could have an additive effect and beyond, as their immediate location in that the mass and measurable production of plankton could be dispersed by currents and thereby influence the qualitative and quantitative composition of the zooplankton (FLOETER et al. 2017). This, in turn, could affect planktivorous fish, including pelagic schooling fish such as herring and sprat, which are the target of one of the largest fisheries in the North Sea. Species composition could also change directly; species with habitat preferences that differ from those of the established species (e.g. reef dwellers) could find more favourable living conditions and thereby occur more frequently. In the Danish wind farm Horns Rev, 7 years after its construction, a horizontal gradient in the occurrence of hartsubrate-affected species was found between the surrounding sand areas and near the turbine foundations: Cliff perch *Ctenolabrus rupestris*, Eelpout *Zoarces viviparus* and Lumpfish *Cyclopterus lumpus* were much more common near the wind turbine foundations than on the surrounding sandy areas (LEONHARD et al. 2011). Cumulative effects resulting from a major expansion of offshore wind energy could include

- an increase in the number of older individuals,
- better conditions for fish due to a larger, more diverse food resource,
- further establishment and distribution of fish species adapted to reef structures,
- the recolonisation of previously heavily fished areas and zones,
- better living conditions for territorial species such as cod-like fish.

Besides predation, intraspecific and interspecific competition, also known as density limitation, is the natural mechanism for limiting populations. It is not possible to rule out the onset of local density limitation within individual wind farms before the positive effects of the wind farms are reproduced spatially through the migration of “surplus” individuals, for example. In this case, the effects would be local and not cumulative. The effects which alterations in fish fauna could have on other elements of the food chain, both below and above their trophic level, cannot be predicted at this stage with the level of knowledge which is currently available.

4.12.3 Marine mammals

Cumulative effects on marine mammals, in particular harbour porpoises, may occur mainly due to noise exposure during the installation of foundations using impact pile driving. For example, marine mammals can be significantly affected when pile driving takes place simultaneously at different sites within the EEZ, without equivalent alternative habitats being available.

So far, the implementation of offshore wind farms and platforms has been relatively slow and gradual. In the period from 2009 to 2018 inclusive, pile driving work was carried out on twenty wind farms and eight converter platforms in the German North Sea EEZ. Since 2011, all pile driving work has been carried out using technical noise mitigation measures. Since 2014, the sound protection values have been reliably complied with and even undercut by the successful use of sound reduction systems (Bellmann, 2020).

The majority of the construction sites were located at distances of 40 km to 50 km away from each other, so that there was no overlap of noise-intensive pile driving that could have led to cumulative effects. Only in the case of the two directly adjacent projects Meerwind Süd/Ost and Nordsee Ost in Site N-4 was it required to coordinate the pile driving, including deterrent measures.

The evaluation of the noise results with regard to noise propagation and the possibly resulting accumulation has shown that the propagation of impulsive noise is strongly limited when effective noise-minimising measures are applied (DÄHNE et al., 2017).

Current findings on the possible cumulative effects of pile driving on the occurrence of harbour porpoise in the German EEZ of the North Sea are provided by two studies from 2016 and 2019 commissioned by the German Offshore Wind Energy Association (BWO). Within the framework of the two studies, the extensive data gained from monitoring the construction phases of offshore wind farms by means of acoustic and visual/digital recording for the harbour porpoise were evaluated and assessed across projects (Brandt et al., 2016, Brandt et al., 2018, Diederichs et al., 2019). Novel evaluation approaches were described and elaborate statistical analyses were also executed in a robust manner within the framework of the studies. Already recognised and identified seasonal and area-specific activity patterns were once again confirmed. Intense inter-annual as well as spatial fluctuations in harbour porpoise activity were also thereby identified. The objective of the second study (GESCHA 2) was to evaluate possible effects of the optimised technical noise protection measures from 2014 up to and including 2016, when considering disturbance of the harbour porpoise in the form of displacement.

The study came to the conclusion that the optimised utilisation of technical noise reduction measures since 2014, as well as the resulting reliable compliance with the limit value, has not resulted in a reduction in the displacement effects on harbour porpoises compared to the phase from 2011 to 2013 with not yet optimised noise reduction systems. A reduction of the displacement effects could not be determined from a sound level of 165 dB (SEL_{05} re 1µPa2 s at a distance of 750 m). The displacement effects were evaluated analogously to the GESCHA 1 study from 2016 (period 2011 to 2013 inclusive) on the basis of the range and duration before, during and after pile driving. The authors put forward five hypotheses in order to explain the results (Diederichs et al., 2019):

- The stereotypic response of harbour porpoises can result in the fact that the mammals leave the area above a certain sound level and not return for a period of time, regardless of the progression of sound emissions.
- Displacement effects from utilising the seal scarer are more intense than the effectively attenuated pile driving sound.
- Shipping traffic and other construction site-related noise also result in displacement effects.
- Installations (pile driving), which are executed in very short succession at intervals of less than 24 hours, also result in displacement
- The differences between habitats and the conjunction to the food supply, but also differences in the quality of the data, have an influence on the results of the study.

Having evaluated the current findings, BSH therefore assumes that the determined avoidance effects on harbour porpoises during the installation phase are due to a variety of construction-related factors as well as natural processes. However, it can therefore be assumed that the avoidance effects would be greater in the absence of effective technical noise mitigation and compliance with noise limits. Minimising pile driving noise at the source is all the more important as it has become increasingly apparent since 2014 that offshore construction sites are experiencing increased activity due to the optimisation and acceleration of logistics and construction processes, which could potentially be additional sources of disturbing the porpoises.

The findings gained from the monitoring process were always taken into account in the enforcement process. For example, the BSH and BfN (Federal Office for Nature Conservation) authorities decided to switch from Pinger and SealScarer to the Fauna Guard system for displacing harbour porpoises since 2018. The use of the new Fauna Guard system was intensively monitored in this instance, the data was analysed and the results were evaluated in the context of a study.

Cumulative impacts on harbour porpoise populations from the construction of offshore wind turbines and the accommodation platform within Site N-7.2 and possibly Sites N-3.5 and N-3.6, which are being tendered for at the same time, as well as the "EnBWHedreiht" offshore wind farm which is planned in the immediate vicinity, will be mitigated by the requirements included in the suitability assessment in accordance with the specifications of the BMU's 2013 noise protection concept. In accordance with the noise protection concept of the BMU (2013), this means that all pile driving work will have to be coordinated in such a way that less than 10% of the area of the German EEZ in the North Sea is affected by pile driving noise. The object is therefore to always keep sufficient alternative habitats free in the protected areas, in equivalent habitats and in the entire German EEZ.

4.12.4 Seabirds and resting birds

Vertical structures such as platforms or offshore wind turbines can have differing impacts on resting birds, such as a loss of their habitat, an increased risk of collision or a scaring away and disturbing effect. These effects have already been considered in Chapter 4.7.1 on a site-specific basis, also taking into account the possible technical scenarios with regard to turbine parameters. An additional, repeated project-specific consideration will be executed within the framework of the environmental impact inspection for the individual project and monitored as part of the subsequent mandatory monitoring of the construction and operation phases of offshore wind farm projects. For resting birds, habitat loss due to cumulative effects of several structures or offshore wind farms can be particularly significant.

In order to assess the significance of the cumulative effects on seabirds, any effects must be assessed on a species-specific basis. In particular, species which are listed in Appendix I of the Birds Directive, species in sub-area II of the Sylt Outer Reef - Eastern German Bight Nature Conservation Site and species for which avoidance behaviour towards structures has already been established must be considered with regard to the cumulative effects.

When assessing the cumulative effects of building offshore wind farms, special attention must be paid to the group of loons with the endangered yet disturbance-sensitive species of red-throated and black-throated loons. GARTHE & HÜPPOP (2004) certify that loons are very sensitive to structures. For the consideration of cumulative effects, both neighbouring wind farms and those located in the same coherent functional spatial unit, which are defined by physically and biologically significant characteristics for a species, must be taken into account. In addition to the structures themselves, impacts from shipping traffic (also for the operation and maintenance of platforms and submarine cables) must also be taken into account. Recent knowledge from studies confirm the scare effect on loons caused by ships. Red-throated and black-throated loons are among the bird species in the German North Sea which are most sensitive to shipping traffic (MENDEL et al. 2019, FLIESSBACH et al. 2019, BURGER et al. 2019).

Since 2009, the BSH has implemented the qualitative assessment of cumulative effects on loons within the framework of licensing procedures, using the main concentration area in accordance with the BMU position paper (2009).

The definition of the main concentration area of loons in the German North Sea EEZ, within the context of BMU's position paper (2009), is an important measure to ensure species protection of the disturbance-sensitive species of the red-throated and black-throated loon. The BMU thereby decreed that in future licensing procedures for offshore wind farms, the main concentration area should be utilised as a benchmark for the cumulative assessment of habitat loss for the loon population.

The main concentration area takes into account the spring season, a period of particular importance for the species. The main concentration area was defined in 2009 on the basis of the data available at the time: the main concentration area was home to around 66% of the German North Sea loon population and around 83% of the EEZ population in spring, and is therefore, among other things, of particular importance in terms of population biology (BMU 2009) and an important functional component of the marine environment with regard to seabirds and resting birds. Against the background of current stock assessments, the importance of the main concentration area for loons in the German North Sea and within the EEZ has further increased (SCHWEMMER et al. 2019). The delineation of the main concentration area of loons is based on the data basis, which is considered to be very good, and on expert analyses that find broad scientific acceptance. The area includes all areas of very high and most of the areas of high sea loon density in the “Deutsche Bucht”.

Current findings from the operational monitoring of offshore wind farms and research projects consistently indicate that the avoidance behaviour of loons towards offshore wind farms is far more pronounced than had been previously anticipated in the original approval decisions for the wind farm projects (refer to Chapter 4.7.1). The broad area of the main concentration area (MCA), which is affected by offshore wind farms in the MCA is already greater than originally assumed (compare with BSH 2020a).

The region where Site N-7.2 is located is used by loons to a small extent as a passage area during their migration periods. According to current knowledge, this area and its surroundings is located outside of the main resting areas for loons in the German North Sea.

On the basis of available data from research projects and monitoring of wind farm clusters, the BSH thereby concludes that Site N-7.2 and its surroundings are not of high importance for the common loon resting population in the German North Sea. Site N-7.2 is located at a distance of > 50 km from the main concentration area to the West of Sylt. Implementing an offshore wind farm on Site N-7.2 can therefore exclude cumulative effects with the required certainty for such cases.

4.12.5 Migratory birds

The potential threat to bird migration not only results from the effects of the individual project, in this case a project on Site N-7.2, but also cumulatively in connection with other approved or already erected wind farm projects in the vicinity of Site N-7.2 or in the main migration directions.

The surrounding areas of Site N-7.2 in Area N-7 have not yet been developed. To the North of Site N-7.2, and therefore located outside the main directions of approach to Site N-7-2, a wind farm is being planned, for which the same turbine parameters from Chapter 1.5.5.4 are to be assumed as a precautionary measure as for the area in question. In the neighbouring, but not directly adjacent Area N-6, is Site N-6.6, which lies in the main direction of flight to Site N-7.2 with stronger east components and/or west components of the flight directions, has been defined for a call for tenders in 2024. The turbine scenarios from FEP 2020 will also be utilised as a basis for this area. The wind farm projects, which are already in operation or currently under construction in Areas N-6 and N-8, lie outside the assumed flight paths, taking into account the main directions of approach and commencing from Site N-7.2. So-called "staircase effects", where larger turbines on Site N-7.2 are located in the immediate vicinity of much smaller turbines of already implemented wind farm projects, are therefore not probable. With a wind farm project on site N-6.6, staircase effects can occur insofar as the turbines of Scenario 1 are installed on one of the two sites and turbines of Scenario 2 on the other site. The height difference between the upper rotor blade tips of the two wind farm projects would then be 125 m (25 -225 m compared to 50 - 350 m), the difference in the hub heights would be 75 m (125 m compared to 200 m) (Table 3). Only the rotating rotor blades would be visible from the larger turbines which are located behind during the migration periods, when the birds initially fly towards the smaller turbines according to Scenario 1.

Under normal migratory conditions, which are those preferred by migratory birds, there is no evidence available so far for any species to indicate that the birds do not recognise and avoid obstacles or that they migrate exclusively within the danger zone of the types of installations which are to be utilised.

Surprisingly occurring fog and rain, which can lead to poor visibility and low flight altitudes, represent a potential hazard situation. The coincidence of bad weather conditions with so-called mass migration events is particularly problematic in such cases. According to research results, which were obtained on the FINO1 research platform, this prognosis could however be subsequently put into perspective. The research determined that birds migrate to higher altitudes in very poor visibility (below 2 km) than in medium visibility (3 to 10 km) or good visibility (> 10 km). These results were however only based on three measurement proximities (HÜPPOP et al. 2005).

The risk of collision for birds which are migrating during the day as well as seabirds is generally considered to be low (refer to Chapter 4.8.1.2).

Cumulative effects could also lead to an extension of the migration route for migrating birds. The potential impairment on bird migration in the sense of a barrier effect will depend on many factors and, in particular, the orientation of the wind farms to the main migration directions must be taken into account. Assuming that the main direction of migration is south west to north east and vice versa, then the wind farms of the same or another area which are located adjacent to each other in this orientation thereby create a uniform barrier, so that one single evasive movement is sufficient. It is known that birds avoid wind farms, i.e. they fly around wind farms or over them horizontally. In addition to observations which have been implemented on land, this behaviour has also been verified in offshore areas (e.g. KAHLERT et al. 2004, AVITEC RESEARCH GBR 2015b). Lateral avoidance reactions are apparently the most common reaction (HORCH & KELLER 2005). Evasive reactions occurred in different directions, but a reverse movement direction was not determined (KAHLERT et al. 2004). AVITEC RESEARCH GBR (2015) were able to determine avoidance behaviour in ducks, gannets, miniature gulls, lesser black-backed gulls and kittiwakes during long-term surveys.

Taking into consideration the main migration directions as north-east to south-west for Autumn migration and south-west to north-east for Spring migration, no other wind farm projects are located in the migration direction of Site N-7.2, which means that barrier effects would only arise from a project on Site N-7.2. Also taking into account stronger westerly and easterly components, Site N-6.6 in neighbouring Area N-6 would also be located in the direction of migration. Taking into account the main migration directions as north-east to south-west or vice versa, evasive movements of approx. 16 km will result when barrier effects occur, and evasive movements of approx. 40 km will result when stronger East or West components are taken into account, when the original migration route is resumed after the evasive movement.

The flight distance to cross over the North Sea is sometimes several 100 km. According to BERTHOLD (2000), the non-stop flight performance of the majority of migratory bird species is in the order of magnitude of over 1000 km. This also applies to small birds. It is not therefore to be expected that the possibly required additional energy demand, which is caused by possibly necessary diversions of a few kilometres, would lead to a threat to bird migration.

Consideration of the existing knowledge relating to the migratory behaviour of the various bird species, the usual flight altitudes and the diurnal distribution of bird migration leads to the conclusion that, based on the current state of knowledge, a threat to bird migration from the construction and operation of a wind farm on Site N-7.2 is not likely, especially when cumulatively taking into account the already approved offshore wind farm projects which have been completed to date. At this stage, a possible bypassing of the projects is not expected to have any significant negative effect on the further development of the populations.

In this context, it therefore has to be taken into consideration that, according to the present state of the art in science and technology, that this forecast is made under premises which are not yet suitable in order to ensure the basis for the bird migration in a satisfactory manner. There are still gaps in knowledge present, particularly with regard to species-specific migration behaviour in poor weather conditions (rain, fog).

4.13 Interrelationships

In general, impacts on any one protected asset will lead to various consequences and interrelationships between the protected assets. For example, impacts on the seabed or the water body usually also have consequences for the biotic assets in these habitats. For example, pollutant discharges may reduce water and/or sediment quality and be absorbed by benthic and pelagic organisms from the surrounding medium. The essential interdependence of the biotic protected assets exists via the food chains. These correlations between the various assets to be protected and possible impacts on biological diversity are described in detail for the respective assets to be protected.

Possible interactions during the construction phase result from sediment shifting and turbidity plumes, as well as noise emissions. However, these interactions occur only very briefly and are limited to a few days or weeks.

4.13.1 Sediment shifting and turbidity plumes

Sediment shifting and turbidity plumes often occur during the construction phase for wind farms and platforms and/or the laying of a submarine cable system. Fish are temporarily driven away. The macrozoobenthos is covered locally. As a result, the feeding conditions for benthos-eating fish and for fish-eating seabirds and harbour porpoises also change temporarily and locally (decrease in the supply of available food). However, considerable impairments to the biotic assets which are to be protected, and thereby to the existing interrelationships with one another, can be ruled out with the requisite degree of certainty due to the mobility of species and the temporal and spatial limitation of sediment relocation and turbidity plumes.

4.13.2 Sound impact

The sound-intensive installation of the foundations of the offshore wind turbines and the accommodation platform can lead to temporary flight reactions and a temporary avoidance of the area by marine mammals, some fish species and sea bird species. According to current knowledge levels, no significant noise emissions are to be expected from the operation of offshore wind turbines, current-carrying cables and the accommodation platform. Only the operationally-linked shipping traffic can result in a temporary and local increase in underwater noise. There are no empirical values and data presently available in order to assess possible interrelationships caused by such indirect operational noise emissions.

4.13.3 Land use

Creating foundations will result in a local deprivation of settlement area for the benthic zone, which can lead to a potential deterioration of the food base which would normally be available the fish, birds and marine mammals following on within the food pyramid. However, benthos-eating seabirds in deeper water areas are not affected by the loss of foraging area due to land sealing, as the water is too deep for effective food acquisition.

4.13.4 Creating an artificial hard substrate

The creation of artificial and/or off-site, not original hard substrate (platform foundations, cable crossing structures) leads to a localised alteration in the soil composition and sediment conditions. As a result, the composition of the macrozoobenthos can also alter. According to KNUST et al. (2003), the introduction of artificial hard substrate into sandy seabeds leads to the settlement of additional species. These species will most likely be recruited from natural hard substrate habitats, such as superficial boulder clay and stones.

The risk of negative impacts on benthic sandy seabed communities by non-native species is therefore low. However, settlement areas for sandy soil fauna are lost in these places. By altering the species composition of the macrozoobenthos community, the food base of the fish community at the site can be influenced (bottom-up regulation).

Certain fish species could be attracted, which in turn could increase the feeding pressure on the benthos by predation and thereby shape the dominance relationships by selecting certain species (top-down regulation).

4.13.5 Prohibition of use and driving ban

A ban or significant restriction of fishing is to be expected on Site N-7.2 based on the legal framework and past practices, (refer to 3.3). Any resulting elimination or restriction of fishing can lead to an increase in the stock of both fishery target species and non-utilised fish species. A shift in the length spectrum of these fish species could also be conceivable in such cases. In the event of an increase in fish stocks, an enrichment of the food supply for marine mammals can be expected. Furthermore, it is expected that a macrozoobenthic community, which is undisturbed by fishing activity, will develop. This could mean that the diversity of the community of species will increase, giving sensitive and long-lived species of the current epifauna and infauna better chances of survival and developing stable stocks. The expansion of wind turbines with sessile invertebrates could favour benthophagous species and make a larger and more diverse food source accessible to fish (LINDEBOOM et al. 2011). This could therefore improve the condition of the fish, which in turn would have a positive effect on their fitness. There is currently a need for more research in order to transfer such cumulative effects to the fish population level.

Due to the variability of the existing habitat and the complexity of the food web and material cycles, interrelationships can only be described very imprecisely overall. In principle, the SEA concludes that, based on the current state of knowledge, no significant effects on existing interrelationships will be discernible during implementation of the plan which could result in a threat to the marine environment.

4.14 Cross-border impacts

According to the current status, no significant effects on the areas of neighbouring countries adjacent to the German EEZ of the North Sea are discernible as a result of Site N-7.2.

Cross-border environmental impacts are defined under Article 2(3) UVPG as environmental impacts in another country.

Whether the development of Site N-7.2 can have an impact on the environment in the neighbouring countries, and whether this impact is to be classified as significant, will always depend on the circumstances of the individual case.

According to the assumptions of the agreement on the implementation of cross-border participation between Germany and the Netherlands ("Joint Declaration on Cooperation in the Implementation of Cross-border Environmental Impact Assessments and Cross-border Strategic Environmental Assessments in the Dutch-German Border Site between the Ministry of Infrastructure and the Environment of the Netherlands and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany" 2013), which distinguishes between projects which are located up to 5 km from the border and those which are located beyond this distance, impacts are more probable in the case where spatial proximity occurs.

Site N-7.2 is centrally located in the German EEZ of the North Sea. The distance to the Dutch EEZ is at least 11 km. Denmark (and/or the Danish EEZ) is at least 113 km away. Localised impacts such as turbidity plumes and land sealing on benthos, soil or biotopes in the neighbouring countries, sound, or noise on marine mammals or fish, or impacts on the landscape and thereby on tourism are therefore generally not to be expected.

Large-scale cross-border impacts are also not to be expected.

According to the Guidance Document on the Practical Application of the Espoo Convention, which was prepared by the Netherlands, Sweden and Finland in 2003, projects which can have large-scale impacts in a transboundary context would be those which result in air or water pollution, projects which pose a potential threat to migratory species and projects which are related to climate change.

As represented above, no significant impacts on the protected assets of air and water or climate are to be expected.

Possible significant cross-border impacts could only arise for the highly mobile protected assets of fish, marine mammals, seabirds and resting birds, as well as migratory birds and bats, when the (local) impacts of the project would have significant effects on the respective population/migratory species. However, this is not considered to be the case according to the aforementioned impact predictions for the individual protected assets.

As far as the protected asset of fish is concerned, the SEA concludes that, according to current knowledge, no significant impacts on the protected asset are to be expected from Site N-7.2 since, on the one hand, the site does not have a prominent function for fish fauna and, on the other hand, the recognisable and predictable effects are of a small-scale and temporary nature. Cross-border impacts are therefore also excluded.

For marine mammals, significant (cross-border) impacts can also be ruled out based on current knowledge and taking into account impact-minimising and damage-limiting measures which can be implemented in this case. For example, the installation of the foundations of wind turbines and the accommodation platform will only be permitted with the use of effective noise and sound abatement measures.

For the protected species of seabirds and resting birds, significant cross-border impacts can also be excluded with the necessary certainty due to the distance to the Dutch borders and/or Danish borders.

Bird migration over the North Sea takes place in a broad-front migration which cannot be defined in more detail, although with a tendency towards coastal orientation. Guidelines and fixed migration routes are not yet known. The individual species-specific assessment (Chapter 4.8.1.2) has not revealed any considerable impacts. Consideration of the existing knowledge relating to the migratory behaviour of the various bird species, the usual flight altitudes and the diurnal distribution of bird migration leads to the conclusion that, based on the current state of knowledge, a threat to bird migration from the construction and operation of a wind farm on Site N-7.2 is not very probable, taking into account, as cumulatively, the already approved offshore wind farm projects, although there is still a need for knowledge on the species-specific migratory behaviour. As a result, significant cross-border impacts are also not probable.

Migratory movements of bats across the North Sea are still poorly documented and largely unexplored. There is a lack of concrete information on migrating species, migration corridors, migration heights, and migration concentrations. Previous knowledge merely confirms that bats, especially long-distance migratory species, fly over the North Sea. A technically comprehensible assessment of possible impacts, including cross-border impacts, is therefore not possible at the present time. It can therefore be assumed that any negative effects on bats can also be prevented by the same prevention and mitigation measures which are implemented to protect bird migration. For further information, please refer to the results of the impact predictions for the individual objects of protection in Chapter 4.1 et. sec.

5 Biotope protection review

According to Article 7(2) No. 4 BNatSchG (Federal Nature Conversation Act), a biotope is the habitat of a community of wild animals and plants. A community in this respect is considered to be a community of organisms of different species in a definable habitat (SCHÜTTE/ GERBIG in Schlacke GK-BNatSchG, Article 7, Marginal No. 36) In the case of Germany, 764 biotope types are distinguished (HENDRISCHKE/ KIEß in SCHLACKE GK-BNatSchG, Article 30, Marginal No. 8). Certain parts of nature and landscape, which are of particular importance as biotopes, are protected by law, Article 30(1) BNatSchG

5.1 Legal basis

Article 30 of BNatSchG provides statutory protection for biotopes which require special protection due to their rarity, their endangerment or their special significance as habitats for particular animal or plant species (Hendrischke/Kieß in Schlacke GK-BNatSchG, Article 30, Marginal No. 8). According to Article 56(1) BNatSchG, the standards for the Federal Nature Conservation Act are also valid for the German EEZ.

Article 30(2) No. 6 BNatSchG lists the legally protected coastal biotopes and marine biotopes. Reefs, sublittoral sandbanks, species-rich gravel beds, coarse sand beds and shingle beds as well as alluvial mud beds with drilling bottom megafauna are relevant for the EEZ. The latter have not been detected in the EEZ yet due to the absence of the sea pen species which are characteristic of the biotope.

The statutory protection of these biotopes applies directly, without the need for additional administrative designation of the area. Explanations and definitions regarding the individual biotope types can be found in the explanatory memorandum to the Federal Nature Conservation Act. The BfN has additionally published mapping instructions for various marine biotope types. As a supplement, for biotopes which also represent FHH habitat types (e.g. reefs, sandbanks), the "Interpretation Manual of European Habits - EUR27" can be utilised (HENDRISCHKE/ KIEß in Schlacke GK-BNatSchG, Article 30, Marginal No.).

Within the context of the present biotope protection assessment, it will be examined whether legally protected biotope types according to Article 30 BNatSchG are present on the site and/or in the study area, and whether the prohibition of destruction and impairment will be upheld in this case during implementation of the plan.

In accordance with Article 30(2) Sentence 1 of the Federal Nature Conservation Act (BNatSchG), all actions which can cause the destruction or other significant impairment of the marine biotope types as listed in Article 30(2) Sentence 1 No. 6 of the BNatSchG are hereby prohibited.

The direct and permanent utilisation of a biotope, which is protected under Article 30 of the Federal Nature Conservation Act, is generally considered to be a significant impairment. With reference to the methodology according to LAMBRECHT & TRAUTNER (2007), an impairment can be classified as non-significant in individual cases when various qualitative-functional, quantitative-absolute and relative criteria are fulfilled, thereby taking into account all impact factors and considering them in a cumulative manner. A central component of this evaluation approach is the orientation values for quantitative-absolute area losses of an affected biotope occurrence, which must not be exceeded depending on its overall size. In principle, a maximum value of 1% has been established for the relative area loss in such cases.

5.2 Statutory protected marine biotope types

According to the current state of knowledge, there are no indications for the occurrence of statutory protected biotopes according to Article 30 BNatSchG for Site N-7.2.

The final report of the two-year basis investigation was expected to be available by 15th March 2020 and will then be taken into account in the environmental report and the suitability assessment.

Should, following on from the final evaluation of the preliminary investigations, indications of the presence of statutory protected biotopes emerge, then these will be taken into account accordingly in the suitability assessment.

5.3 Result of the assessment

According to the current state of knowledge, it is thereby assumed that no biotopes protected under Article 30 of the Federal Nature Conservation Act (BNatSchG) occur in Site N-7.2, therefore significant impairments of statutory protected biotopes within the meaning of Article 30(2) BNatSchG can be excluded.

6 Species protection assessment

Implementing the plan in terms of the erection and operation of offshore wind turbines, including the ancillary facilities required for operation, complies with the provisions for species protection law.

6.1 Legal basis

Species protection is defined in Articles 37 et. sec. BNatSchG as a tiered protection regime and is also applicable in the German EEZ due to its extension in accordance with Article 56(1) BNatSchG.

Article 39 BNatSchG contains a general basic protection for all wild species.

In the case of specially protected species, a higher level of protection applies in accordance with Article 44(1) No. 1, 3 and 4 BNatSchG, and for strictly protected species including European bird species, the highest level of protection applies in accordance with Article 44(1) No. 2 BNatSchG.

According to Article 7(2) No. 13 BNatSchG, specially protected species are animal species and plant species listed in Appendix A or B of the Washington Convention on International Trade in Endangered Species (Regulation (EC) No. 338/97), animal species and plant species listed in Appendix IV of the Habitats Directive (Directive 92/43/EEC), European bird species and the species listed in the Ordinance regarding the Protection of Wild Fauna and Flora (Federal Species Protection Ordinance - BArtSchV).

Strictly protected species according to Article (2) No. 14 BNatSchG are those listed in Appendix A or B of the Washington Convention on International Trade in Endangered Species (Regulation (EC) No. 338/97), animal species and plant species listed in Appendix IV of the Habitats Directive (Directive 92/43/EEC) and the strictly protected species listed in the Federal Ordinance on the Protection of Species (BArtSchV).

According to Article 44(1) No. 1 BNatSchG, wild animals of specially protected species must not be injured or killed. The prohibition of access under Article 44(1) No. 1 BNatSchG aims at the protection of individuals and as such is inaccessible to a population-related relativisation (Landmann/Rohmer UmweltR/Gellermann BNatSchG Article 44 Marginal No. 9). According to 44(5)(2)(1) BNatSchG, there is no violation of the prohibition of killing and injury in accordance with Paragraph 1(1), inter alia, for the animal species and European bird species listed in Appendix IV of the Habitats Directive "when the impairment caused by the intervention or the project does not significantly increase the risk of killing and injury to specimens of the species which are concerned and this impairment cannot be prevented by applying the necessary, professionally recognised protective measures".

According to Article 44(1) No. 2 BNatSchG, wild animals living in the area or fauna of strictly protected species and European bird species must not be significantly disturbed during reproduction, rearing, moulting, hibernation, and migration periods. It does not matter in such cases whether a relevant injury or disturbance is due to reasonable grounds, nor do reasons, motives or subjective tendencies play any part in respect of compliance with the prohibitions (LANDMANN/ROHMER UMWELTR GELLERMANN BNATSCHG ARTICLE 44 MARGINAL NO. 10–14).

A significant disturbance does not already exist when it is realised for individual specimens, rather only when the disturbance worsens the conservation status of the local population of a species (BVerwGE 130, 299; BVerwGE 131, 274).

In the explanatory memorandum to the amendment of the BNatSchG 2007, the term local population is defined as follows: "A local population comprises those (partial) habitats and activity areas of the individuals of a species which are in a spatial-functional relationship sufficient for the habitat (space) requirements of the species".

According to the Guidance Document on the Strict System of Protection for Species of Community Interest under the Habitats Directive (para. 39), disturbance within the meaning of Art. 12 of the Habitats Directive occurs if the act in question reduces the chances of survival, reproductive success or the ability to reproduce of a protected species, or if this act leads to a reduction in its range. On the other hand, occasional disturbances which are not likely to have a negative impact on the species concerned are not to be regarded as disturbance within the meaning of Article 12 of the Habitats Directive.

According to the explanatory memorandum to the Act, a deterioration of the conservation status of the local population is also to be assumed when the chances of survival, breeding success or reproductive capacity are reduced (BT-Drs. 16/5100, P. 11), whereby this must be judged on a species-specific basis for each individual case. It is therefore essential whether the disturbance is associated with effects which, in view of the circumstances of the individual case and the conservation situation of the species concerned, thereby make adverse effects on the conservation status of the local population appear likely (similarly in OVG Berlin NuR 2009, 898 (899), e.g. when rare specimens are found in the local population of a species, or when the population of a species is affected by the disturbance). e.g., when specimens of rare or highly endangered species are disturbed, the disturbed individuals belong to small local populations or a disturbance affects all animals of the population in question (LANDMANN/ROHMER UMWELTR GELLERMANN BNATSCHG ARTICLE 44 MARGINAL NO. 13). In contrast, the widespread distribution of a species with possibly large local populations (BVerwG NuR 2008, 633 Marginal No. 258) or the existence of low-disturbance alternative habitats which are usable by the animals (LANDMANN/ROHMER UMWELTR GELLERMANN BNATSCHG ARTICLE 44 MARGINAL NO. 13).

Within the framework of the present species protection assessment, it will be examined whether the implementation of the plans, i.e. the implementation and operation of wind turbines and other facilities , fulfils the provisions of Article 44(1) No. 1 and No. 2 BNatSchG for specially and strictly protected animal species. In particular, it will be examined whether the construction and operation of the facilities violate the prohibitions under species protection law.

The present assessment will be executed at the level of the assessment of the basic suitability of Site N-7.2 for the generation of electricity from wind energy. At this point in time, the technical design of the specific project has not been determined. In this respect, an update of the species protection assessment is necessary within the framework of the subsequent individual approval procedure, taking into account the specific project parameters.

6.2 Marine mammals

As illustrated above, Site N-7.2 is home to the harbour porpoise, a species listed in Appendix IV (animal species and plant species of community interest which require strict protection) from the Habitats Directive, as well as harbour seal and grey seal, two native mammals which are specially protected under the Federal Species Protection Ordinance (Appendix 1 BArtSchV). Harbour porpoises therefore occur in varying numbers throughout the year. Seals and grey seals are encountered in the area in small numbers and irregularly.

Against this background, the suitability of the site must also be ensured with regard to Article 44(1) BNatSchG.

Utilisation by marine mammals varies greatly in the individual areas of the FEP in the German

North Sea EEZ. Area N-7, where Site N-7.2 is located, is of medium importance for harbour porpoises, but of low importance for grey seals and harbour seals.

6.2.1 Harbour porpoise

With an average body length of 1.5 m and a weight of about 60 kg, the harbour porpoise (*Phocoena phocoena*) is a small, rather inconspicuous species of whale which is extremely shy. This widespread species of whale, which is often located in the temperate waters of the North Atlantic and North Pacific, is usually observed singly or as mother-calf pairs and rarely in groups.

The life expectancy of the harbour porpoise is 8 to 12 years. Observations have illustrated that individual animals can however live up to 23 years of age. The harbour porpoise does not reach its reproductive age until it is three to four years old. Harbour porpoises give birth to one calf per year or every two years. The gestation period is 10 to 11 months and the lactation period is 8 to 10 months. The calves can weigh between 4.5 and 10 kg at birth with a length of 70 to 90 cm. Most calves are born in the months of May, June and July.

Harbour porpoises use continental shelf seas of up to 200 m deep due to their hunting behaviour and diving behaviour. Their preferred depths seem to be between 20 and 50 m.

The preferred food organisms for the mammals include fish such as sand eels, gobies, herring, sardines and cod with lengths of up to 30 cm. Among the cetacean species, the harbour porpoise therefore indicates a distinctly selective feeding behaviour with a clear preference for food prey which is rich in fat and energy. The occurrence of the preferred nutrition resources largely determines the distribution patterns of the harbour porpoise.

The harbour porpoise uses the frequency range between 80 kHz and 120 kHz for communication and echolocation and therefore belongs to the group of high-frequency cetaceans.

Being caught is a major threat to the harbour porpoise, as are diseases, attacks by dolphins, enrichment of food organisms with pollutants and microplastics as well as underwater noise.

Erecting and operating facilities in Site N-7.2 will be associated with noise emissions. The impacts of the project, especially with regard to noise emissions, must be evaluated or assessed under the species protection law.

6.2.1.1 Article 44 (1) 1 of the BNatSchG (prohibition of killing and injury)

Under Article 44(1) No. 1 of the Federal Nature Conservation Act, the killing or injuring of wild animals of specially protected species i.e. including animals or mammals which are listed in Appendix IV to the Habitats Directive, such as the harbour porpoise, is prohibited.

In its statements, BfN frequently assumes that, according to current knowledge, injuries for harbour porpoises occur in the form of temporary hearing loss when the mammals are exposed to a single event sound pressure level (SEL) of 164 dB re 1 μPa^2/Hz and/or a peak level of 200 dB relating to 1 μPa.

According to the BfN, it is sufficiently certain that, if the specified limits of 160 dB for the sound event level (SEL_{05}) and 190 dB for the peak level at a distance of 750 m from the emission point are complied with, then killing conditions and injury conditions in accordance with Article 44(1) No. 1 of the BNatSchG cannot therefore occur.

BfN hereby takes into account the current use of monopiles with a diameter of up to 8.2 m and jacket piles with a diameter of up to 4 m. The BfN thereby assumes that suitable means, such as deterrence, soft-start procedures etc. are utilised in order to ensure that no harbour porpoises are present within the 750 m radius around the pile driving site.

This estimation concurs with that of the BSH. In the suitability assessment, specifications are implemented and subsequently, also within the framework of the individual approval procedures and, if necessary, in their enforcement, orders are issued regarding the necessary noise protection measures and other mitigation measures (so-called conflict-preventing or mitigating measures), compare with inter alia *Lau* in: Frenz/Müggenborg, BNatSchG, Commentary, Berlin 2011, Article 44 Marginal No. 3, by means of which the realisation of the prohibition can be excluded or the intensity of possible impairments can be reduced. The measures are to be strictly monitored using the prescribed monitoring system in order to ensure with the necessary certainty that the killing provisions and injury provisions of Article 44(1) No. 1 BNatSchG do not come into effect.

Within the framework of the suitability determination, it will be envisaged that the subsequent owner of the project will be required to utilise the least noisy working method in accordance with the prevailing circumstances for the foundation and installation of the facilities (Article 7). On this basis, the BSH can, within the framework of the individual approval procedure as well as in the context of enforcement, order appropriate specifications with regard to individual work steps, such as deterrence measures and a slow increase in pile-driving energy, by means of so-called "soft-start" procedures. Deterrent/aversive measures and the so-called “soft-starts” can ensure that no harbour porpoises or other marine mammals are present in an adequate area around the pile-driving site, keeping them a minimum distance of 750 m or more from the construction site.

To summarise the aforementioned points, the implementation of the prohibition of killing can be excluded by the above-mentioned mitigation and avoidance measures. The use of appropriate deterrent measures will ensure that the animals are outside the 750-metre radius of the point of emission. Moreover, the degree of noise reduction which is required and specified in the draft suitability determination must be such that it can be assumed that, outside the area in which no harbour porpoises are expected to be present as a result of the deterrent measures to be implemented, there will be no lethal and no long-term adverse effects of the noise.

The measures which are ordered by the BSH within the context of the individual approval procedure will prevent, with sufficient certainty, the fulfilment of the prohibitions of species protection under Article 44(1) No. 1 of the Federal Nature Conservation Act (BNatSchG).

According to the current state of knowledge, neither the operation of the installations nor the laying and operation of the wind farm's internal submarine cabling will have any significant negative impacts on marine mammals that meet the killing and injury criteria under Article 44(1) No. 1 of the Federal Nature Conservation Act.

6.2.1.2 Article 44(1) No. 2 BNatSchG (prohibition of disturbance)

According to Article 44(1) No. 2 BNatSchG, it is also prohibited to cause significant disturbance to wild animals of strictly protected species during the times and periods for reproduction, rearing, moulting, wintering and migration.

The harbour porpoise is a strictly protected species according to Appendix IV of the Habitats Directive, and thereby within the meaning of Article 44(1) No. 2 in conjunction with Article 7(2) No. 14 BNatSchG, so that a species protection assessment must also be executed in this regard.

The species protection assessment under article 44 (1) No. 2 of the BNatSchG relates to population-relevant disturbances of the local population, the occurrence of which varies in the German North Sea EEZ.

In its statements in the context of planning approval and enforcement procedures, the Federal Agency for Nature Conservation (BfN) regularly examines the existence of disturbance under species protection law within the meaning of Article 44 (1) No. (2) of the Federal Nature Conservation Act (BNatSchG). It comes to the conclusion that the occurrence of a significant disturbance caused by construction-related underwater noise in relation to the protected species harbour porpoise can be avoided, provided that the sound event level of 160 dB or the peak level of 190 dB is not exceeded at a distance of 750 m from the point of emission and sufficient alternative areas are available in the German North Sea. BfN demands that compliance with the latter requirement be ensured by coordinating the timing of noise-intensive activities of multiple project participants with the aim of ensuring that no more than 10 % of the area of the German North Sea EEZ is affected by noise (BMU 2013).

Effects and impacts of the construction phase

There will be no disturbance of harbour porpoises within the meaning of Article 44(1) No. 2 BNatSchG when assumed as a result of the temporary pile driving work.

According to the current state of knowledge, it cannot however be assumed that disturbances which could occur due to sound-intensive construction measures would worsen the conservation status of the "local population".

Implementing effective noise abatement management, in particular through the use of suitable noise abatement systems in accordance with the requirements of the suitability determination and subsequent orders in the individual approval procedure of the BSH, and taking into account the requirements of the noise abatement concept of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (2013), will mean that negative impacts of pile driving on harbour porpoises are not to be expected.

In this respect, the suitability determination thereby contains the requirement for the project sponsor to coordinate the pile driving work as required for its project with that of other projects which could potentially be constructed during the same period. The planning approval decrees from the BSH will contain specific directives which will ensure effective noise abatement management by means of suitable measures.

In accordance with the precautionary principle, measures to prevent and reduce the effects of noise during construction are to be specified according to the state of the art in science and technology. The decreed measures in the suitability determination, or subsequently in the planning decree and, in particular, the measures ordered in the planning approval decisions in order to ensure the requirements of species protection are coordinated with the BSH in the course of implementation and adapted, if necessary. The following noise-reducing, sound-reducing and environmental protection measures are ordered regularly within the framework of the plan-approval procedures:

- Preparation of a sound prognosis under consideration of the site- and installation-specific characteristics (basic design) before the start of construction,
- Selection of the erection method for producing the lowest-possible noise level according to the state of the art and the existing conditions,
- Creating a specific noise prevention concept, as adapted to the selected foundation structures and construction processes, for implementation of pile driving, in principle two years before the start of construction, and in any case before the conclusion of contracts concerning components affected by noise,
- Use of noise-reducing accompanying measures, individually or in combination, noise-reducing systems remote from the piles (bubble curtain system) and, if necessary, noise-reducing systems close to the piles in accordance with the state of the art in science and technology,
- Consideration of hammer characteristics and the options for controlling the pile driving process in the noise prevention concept,
- Concept for scaring animals away from the hazard area (within a radius of at least 750 m around the pile driving site),
- Concept for verifying the effectiveness of the deterrent and noise-reducing measures,
- State-of-the-art installation design to reduce operational noise.

As outlined above, deterrent measures and a soft-start procedure must be applied to ensure that animals in the vicinity of the pile-driving operations have the opportunity to move away or to avoid them in good time.

Even a measure ordered to avoid the risk of killing pursuant to Section 44 subsection 1 number 1 of the BNatSchG, such as deterring a species, can in principle comply with the prohibition of disturbance if it takes place during the periods of protection and is significant (BVerwG, judgement of 27 November 2018 - 9 A 8/17, cited in juris).

For deterrence up until 2017, a combination of pingers was used as a pre-warning system, followed by the use of the so-called Seal Scarers as a warning system. All the results of the monitoring by means of acoustic detection of harbour porpoises in the vicinity of offshore construction sites with pile driving have confirmed that the use of deterrence has always been effective. The animals have left the danger zone of the respective construction site. However, scaring deterrence and driving away measures by utilising the Seal Scarer will be accompanied by a large loss of habitat, caused by the animals' flight reactions and therefore constitutes a disturbance (Brandt et al., 2013, Dähne et al., 2017, Diederichs et al., 2019).

To prevent this, a new system for deterring animals from the danger zone of the construction sites, the so-called Fauna Guard System, has been used in construction projects in the German North Sea EEZ since 2018. The development of new deterrence systems, such as the Fauna Guard System, opens up the possibility for the first time to adapt the deterrence of harbour porpoises and seals in such a way that the realisation of the killing and realisation elements within the meaning of Article 44(1) No. 1 of the Federal Nature Conservation Act can be excluded with certainty without leading to a simultaneous realisation of the disturbance elements within the meaning of Section 44 (1) (2) of the Federal Nature Conservation Act (BNatSchG).

The use of the Fauna Guard System is accompanied by monitoring measures. The effects of the Fauna Guard System are being systematically analysed as part of a research project. When required, adjustments in the application of the system will have to be implemented in future construction projects.

On the basis of the aforementioned requirement, this or another type of deterrence can be decreed when it proves to be more suitable on the basis of the state of knowledge and the state of the art at that particular point in time

The selection of noise reduction and/or abatement measures by the subsequent developers of the individual projects must always be based on the state of the art in science and technology and on experience already gained in other offshore projects. Findings based on practical experience in the application of technical noise-reducing systems and from experience with the control of the pile driving process in connection with the characteristics of the impact piling hammer were gained, in particular, during the foundation work in the projects "Butendiek", "Borkum Riffgrund I", "Sandbank", Gode Wind 01/02", "NordseeOne", "Veja Mate", "Arkona Basin Southeast", "Merkur Offshore", "EnBWHoheSee" and others. A current study which was commissioned by BMU (BELLMANN, 2020) provides an overarching-project evaluation and presentation of the results from all technical noise reduction and abatement measures utilised in German projects to date.

The results of the very extensive monitoring of the construction phase of 20 offshore wind farms have confirmed that the measures to avoid and reduce disturbances to harbour porpoise arising from impact noise are effectively implemented and that the requirements of BMU's noise abatement concept (2013) are reliably met. The current state of knowledge takes into account construction sites at water depths ranging from 22 m to 41 m, in seabed soils ranging from homogeneous sandy to heterogeneous and difficult to penetrate profiles, and piles with diameters of up to 8.1 m. It has been shown that the industry has found solutions in the various procedures to effectively harmonise installation processes and noise protection.

According to the current state of knowledge and based on the development of technical noise protection to date, it can be assumed that considerable disturbance to harbour porpoises can be excluded from the foundation work within the areas covered by the Site N-7.2 even assuming the use of piles with a diameter of more than 10 m.

Furthermore, the planning approval decision of the BSH will specify monitoring measures and noise measurements in detail in order to detect a possible hazard potential on site on the basis of the actual project parameters and, if necessary, to initiate optimisation measures.

New findings thereby confirm that the reduction of noise input through the use of technical noise reduction systems clearly reduces disturbance effects which act on harbour porpoises. Minimising the effects therefore not only concerns the spatial but also temporal extent of disturbances (BRANDT et al. 2016).

As a result, and by applying the aforementioned strict noise protection and noise reduction measures in accordance with the principles and objectives of the suitability determination and the orders in the planning approval decisions, there is no reason to fear significant disturbance within the meaning of Section 44 (1) No. 2 of the Federal Nature Conservation Act (BNatSchG) if the limit value of 160 dB SEL_5 at a distance of 750 m is complied with. Furthermore, the BfN's implemented demand to coordinate the timing of noise-intensive construction phases of different project developers in the German North Sea EEZ in accordance with the BMU's Noise Abatement Concept (2013) is mandated.

Impacts during operation

According to the current state of knowledge, the operationof offshore wind turbines cannot be assumed to thereby constitute a disturbance in accordance with Article 44(1) No. 2 of BNatSchG. Based on the current state of knowledge, no negative long-term effects from wind turbine noise emissions for harbour porpoises are to be expected assuming the normal design of the plants. Any effects are limited to the immediate vicinity of the plant and depend on sound propagation in the specific area and, not least, on the presence of other sound sources and background noise, such as shipping traffic (MADSEN et al. 2006). This is confirmed by findings from experimental work on the perception of low-frequency acoustic signals by harbour porpoises using simulated operating noise from offshore wind turbines (LUCKE et al. 2007b): Masking effects were recorded at simulated operating noises of 128 dB re 1 µPa at frequencies of 0.7, 1.0 and 2.0 kHz. In contrast to this, no significant masking effects were found at operating noise levels of 115 dB re 1 µPa. The previous results from the monitoring of underwater sound and/or noise in offshore wind farms as well as in their surroundings confirm that the noise and/or sound emissions from the operation of the turbines do not clearly rise above the background noise and/or sound even after a few hundred metres (Chapter 4.5.1). Monitoring the harbour porpoises during the operational phase of offshore wind farms in the German EEZ of the North Sea has also not revealed any evidence of avoidance or alterations in behaviour. Offshore wind farms which are located in areas of high abundance continue to be frequented by harbour porpoises. This result applies not only to wind farms in the harbour porpoise's main distribution area in the German Bight, such as "Butendiek", but also to wind farms in areas outside this area, such as North of Borkum (BIOCONSULT SH 2018, 2019, IFAÖ et al. 2018, 2019).

Results of a study on habitat use of offshore wind farms by harbour porpoises in operation from the Dutch offshore wind farm "Egmont aan Zee" also confirm this observation. With the help of acoustic recording, the use of the area of the wind farm and/or of two reference areas by harbour porpoises was considered before the construction of the turbines (baseline recording) and in two consecutive years of the operational phase. The results of the study confirm a pronounced and statistically significant increase in acoustic activity in the inner area of the wind farm during the operating phase compared to the activity or use during the baseline survey (SCHEIDAT et al. 2011). The increase in harbour porpoise activity within the wind farm during operation significantly exceeded the increase in activity in both reference areas. The increase in use of the wind farm area was significantly independent of seasonality and interannual variability. The authors of the study see a direct correlation between the presence of the turbines and the increased use by harbour porpoises. They suspect the causes to be factors such as an enrichment of the food supply due to a "reef effect" or calming of the area due to the absence of fishing and shipping or possibly a positive combination of these factors.

The results of the investigations during the operational phase of the "alpha ventus" project also indicate a return to distribution patterns and abundances of harbour porpoise that are comparable - and in some cases higher - than those from the baseline survey of 2008.

The results from the monitoring of the operational phase of offshore wind farms in the EEZ have so far not yielded clear results. The investigations in accordance with StUK4 using aircraft-based survey has so far revealed fewer sightings of harbour porpoises inside the wind farm areas than outside. However acoustic recording of habitat use by means of special underwater measuring devices, the so-called CPODs, shows that harbour porpoises use the wind farm areas (BUTENDIEK 2017, North HELGOLAND, 2019, KRUMPEL et al., 2017, 2018, 2019). Both methods, firstly the visual/digital detection from aircraft and acoustic detection are complementary i.e. the results from both methods should be utilised in order to identify and assess possible effects. The joint evaluation of the data, the development of suitable evaluation criteria and the description of the biological relevance is to be the subject matter of a research programme.

In order to guarantee with sufficient certainty that contravening of the prohibition in accordance with Article 44(1) No. 2 of the BNatSchG will not occur, an operational sound-reducing turbine design in accordance with the state of the art will be used against this background in the sense of the corresponding requirements of the suitability determination (Article 7(4)).

Appropriate monitoring will also be provided for the operational phase of the individual projects in Site N-7.2 as the area which is covered by the suitability determination in order to identify and assess any location-specific and project-specific impacts.

As a result, the protective measures which have been ordered are considered to be sufficient to ensure that, where harbour porpoises are concerned, operation of turbines in Site N-7.2 as covered by the plan and also does not contravene the prohibitions according to Section 44(1) No. 2 BNatSchG.

Other marine mammals

In addition to the harbour porpoise, other animal species listed as such in a statutory instrument in accordance with Article 54(1) are also considered to be specially protected under Article 7(2) No. 13 (c) BNatSchG. The Federal Ordinance on Species of Wild Fauna and Flora (BArtSchV), which was issued on the basis of Article 54(1) No. 1 BNatSchG, states that native mammals are listed as specially protected and thereby also fall under the species protection provisions of Article 44 (1) No.1 BNatSchG. In principle, the considerations which are listed in detail for harbour porpoises regarding noise pollution from the construction and operation of offshore wind turbines apply to marine mammals occurring in Site N-7.2 and its surroundings. However, dependent on the species, hearing thresholds, sensitivity and behavioural responses vary considerably among marine mammals. The differences in the perception and evaluation of sound events among marine mammals are based on two components: On the one hand, the sensory systems are morphoanatomically and functionally species-specific. As a result, marine mammal species therefore hear and react differently to sound. On the other hand, both perception and reaction behaviour depend on the respective habitat (KETTEN 2004).

Also with regard to harbour seals and grey seals, there are no indications from the monitoring of the operational phase that would suggest an avoidance of the areas or alterations in behaviour.

Site N-7.2 and its surroundings are not considered to be of particular importance for harbour seals and grey seals. The nearest frequently frequented breeding and resting sites are located at a distance of more than 80 km towards Helgoland and the East Frisian Islands.

Seals are generally considered tolerant to sonic activity, especially when they have a plentiful supply of food. However, telemetric studies have shown flight reactions during seismic activity (RICHARDSON 2004). According to all current findings, seals can still hear pile-driving sounds at a distance of more than 100 km.

Overall, it can be assumed that the operation of the facilities in Site N-7.2 will not fulfil the prohibition criteria of Article 44(1) No. 2 BNatSchG with regard to harbour seals and grey seals, due to the distances from the breeding and resting areas which are mentioned above and the measures specified.

6.3 Avifauna (seabirds, resting as well as migratory birds)

The suitability of Site N-7.2 for offshore wind energy use is to be assessed on the basis of species protection requirements in accordance with Article 44(1) BNatSchG for avifauna (resting birds and migratory birds).

The surroundings of Site N-7.2 contain protected bird species according to Appendix I of the Birds Directive (in particular red-throated loons, black-throated loons, little gulls, Sandwich, common and Arctic tern) and regularly occurring migratory bird species (in particular storm gulls and herring gulls, fulmar, gannet, kittiwake, guillemot and razorbills) occur in varying densities. Against this background, the compatibility of the plans with Article 44(1) No. 1 of the BNatSchG (prohibition of killing and injury) and Article 44(1) No. 2 of the BNatSchG (prohibition of disturbance) must be examined and ensured.

All previous findings indicate that Site N-7.2 and its surroundings are of medium importance for seabirds, including species which are listed in Appendix I of the Birds Directive. Site N-7.2 lies outside the concentration centres of various bird species which are listed in Appendix I of the Birds Directive, such as loons, lesser black-backed gulls and terns.

In the case of migratory bird species, Site N-7.2 including its surroundings is of medium importance. It is hereby assumed that significant proportions of the songbirds breeding in northern Europe will migrate across the North Sea. However, guidelines and concentration areas for bird migration are not present in the EEZ. There is evidence that the flight intensity will however decrease with as distances away from the coast increase.

6.3.1 Article 44 (1) 1 of the BNatSchG (prohibition of killing and injury)

In accordance with Article 44 (1) No. 1 BNatSchG in conjunction with Article 5 V-RL*, it is prohibited to hunt, capture, injure, or kill wild animals of specially protected species. Species which are considered to be under special protection include European bird species, thereby the species listed in Appendix 1 of the V-RL, species whose habitats and residing areas are protected in the nature reserves, as well as characteristic species and regularly occurring migratory bird species (in particular storm and herring gull, fulmar, gannet, kittiwake, guillemot and razorbills). Accordingly, injuring or killing resting birds as a result of collisions with wind turbines must be ruled out in principle. The risk of collision depends on the behaviour of the individual animals and is directly related to the species concerned and the environmental conditions encountered. For example, a collision of divers is not to be expected because of their pronounced avoidance behaviour towards vertical obstacles.

As already represented and in accordance with Article 44(5) second sentence No. 1 BNatSchG, a violation of the prohibition of killing and injury does not exist "when the impairment caused by the intervention or the project does not significantly increase the risk of killing and injury to specimens of the species concerned, and this impairment cannot be avoided by applying the necessary, professionally recognised protective measures". This exception was included in the BNatSchG on the basic principles from the pertinent Supreme Court decisions, since in the planning and approval of public infrastructure and private construction projects, it must regularly be assumed that unavoidable operational killings or injuries of single individuals (e.g. due to collision of birds with wind turbines) can sometimes occur which, however, as the realisation of socially adequate risks, should not fall however under the scope of the ban (BT-Drs. 16/5100, Page 11 and 16/12274, Page 70 following on.). An attribution can only be executed when the risk of consequences of the project is significantly increased due to special circumstances, such as the design of the turbines, the topographical conditions or the biology of the species. In this context, measures to avoid and reduce risks are to be included in the assessment (compare with LÜTKES/EWER/HEUGEL, ARTICLE 44 BNATSCHG, MARGINAL NO. 8, 2011; BVERWG, JUDGEMENT OF 12 MARCH 2008; FILE REFERENCE 9 A3.06; BVERWG, JUDGEMENT OF 9 July 2008, File Reference 9 A14.07; FRENZ/MÜGGENBORG/LAU, Article 44 BNATSCHG, MARGINAL NO. 14, 2011).

It is not therefore possible to exclude that individual collision-related losses caused by the erection of a fixed installation in previously obstacle-free areas cannot be completely ruled out. However, the measures provided for in the suitability determination, such as minimising light emissions, will ensure that collisions with offshore wind turbines are prevented as far as possible or that this risk is at least minimised. In addition, effects monitoring is to be executed during the operating phase in order to verify the current nature conservation assessment of the actual risk of bird strikes which are posed by the installations and, if necessary, to be able to adjust for this. According to the provisions of the WindSeeG (Wind and Sea Act), additional measures can be ordered within the framework of the planning approval and also later during enforcement. Against this background, the BSH hereby estimates that there is no significant increase in the risk of killing or injuring migratory birds. In its statement of 31.05.2021, the BfN also assumes that a wind farm on Site N-7.2 would not result in a significantly increased risk of killing. The implementation of offshore wind turbines, together with ancillary facilities such as an accommodation platform and cabling within the wind farm on Site N-7.2, therefore does not violate the prohibition of killing and injury pursuant to Article 44(1) No.(1) of the Federal Nature Conservation Act (BNatSchG).

According to the current state of knowledge, a significantly increased risk of collision of individual resting bird species in Site N-7.2 is not discernible as location-related. This conclusion was also reached by the BfN in its statement of 31.05.2021.

The realisation of the prohibition of injury and killing under Article 44(1) No. 1 BNatSchG in the context of offshore wind energy use on Site N-7.2 can therefore be ruled out with the required certainty in this particular case.

6.3.2 Article 44(1) No. 2 BNatSchG (prohibition of disturbance)

Pursuant to Article 44(1) No. 2 BNatSchG, it is prohibited to significantly disturb wild animals of strictly protected species during the breeding, rearing, moulting, hibernation and migration periods, whereby a significant disturbance exists if the disturbance worsens the conservation status of the local population of a species.

The species protection assessment pursuant to Article 44(1)(2) BNatSchG refers to population-relevant disturbances of local populations. For this reason, it is necessary to consider possible disturbances to local populations in German waters, especially in the German EEZ, which will be caused by wind energy use on Site N-7.2. A cross-area and area-wide species protection assessment with regard to the ban on disturbance in the sense of a deterioration in the conservation status of local populations of protected species has been executed as part of the SEA for the Site Development Plan (SDP 2020a). The following contains a brief summary of the results of the species protection assessment with regard to Article 44 (1) No. 2 BNatSchG for the site development plan.

Summary of the species protection assessment under Article 44(1)(2) BNatSchG (prohibition of disturbance) for the FEP

The focal point for the assessment was on the loon species group, which has been shown to be particularly sensitive to wind farms when based on the results of operational monitoring of offshore wind farms in the German EEZ, research projects and published literature.

The assessment resulted in the fact that loons are highly sensitive in terms of population biology, that the main concentration area is of high importance for the conservation of the local population and that the adverse effects due to avoidance behaviour towards offshore wind farms are intense and permanent.

In order to prevent a deterioration of the conservation status of the local population because of the cumulative impacts of the wind farms, it is necessary to retain the area of the main concentration area which is currently available to loons outside the impact zones of already implemented wind farms as free of new wind farm projects.

The BSH came to the conclusion that a significant disturbance within the meaning of Article 44(1) No. 2 BNatSchG as a result of the implementation of the plan (FEP) can be excluded with the necessary certainty when it can therefore be ensured that no additional habitat loss occurs in the main concentration area.

As a result, Site N-5.4 was excluded from additional planning for offshore wind turbines when based on the results of the assessment of cumulative adverse effects on the conservation status of the local population of common loons, and Areas N-4 and N-5 were therefore placed under consideration for subsequent use.

For Areas N-1 to N-3, N-6 to N-13 the assessment pursuant to Article 44(1)(2) BNatSchG came to the conclusion that, based on the current state of knowledge, it cannot be assumed that the disturbance requirement is fulfilled, which also applies to other species listed in Appendix I of the VRL and which also and characteristic species as well as regularly occurring migratory bird species.

Species protection assessment pursuant to Article 44(1)(2) BNatSchG for Site N-7.2

The result of the assessment in the context of the preparation of the FEP (BSH 2020a) can be confirmed for Site N-7.2 on the basis of the available data and information.

As already explained, protected species occur on Site N-7.2 and in its vicinity. These include species listed in Appendix of VRL (Birds Directive), species whose habitats are protected in the nature conservation areas, as well as characteristic species and regularly occurring migratory bird species (in particular storm and herring gull, fulmar, gannet, kittiwake, guillemot and razorbills). Against this background, the compatibility of the Site N-7.2 with Article 44(1) No. 2 BNatSchG in conjunction with Article 5 of the VRL must be ensured.

The region in which Site N-7.2 is located is utilised mainly by loons as a passage area during their migration periods. The site is located outside the identified, main concentration region for loons in the German Bight. On the basis of available data from research projects and monitoring of wind farm clusters, the BSH thereby concludes that Site N-7.2 and its surroundings are not of high importance for the common loon resting population in the German North Sea. Site N-7.2 is located at a distance of more than 50 km from the main concentration for loons. Due to this distance, it can therefore be safely assumed that there will be no significant disturbance for the local loon population in the main concentration area West of Sylt. In its statement regarding the draft environmental report on Site N-7.2 dated 31.05.2021, the Federal Agency for Nature Conservation shares this assessment. As a result, a significant disturbance of the local population according to Article 44(1) No. 2 BNatSchG can be excluded with the necessary certainty. Based on the observed densities of Lesser black-backed gulls in the vicinity of Site N-7.2 as well as the temporally limited coupling to the species-specific main migration periods, a maximum medium importance of the vicinity of N-7.2 for lesser black-backed gulls can be assumed. Maximum densities determined are subject to strong interannual fluctuations. Cumulative effects on the population are not to be expected according to current knowledge. With regard to lesser black-backed gulls and according to the current state of knowledge, a wind farm project on Site N-7.2 can exclude with the necessary certainty when implementing the disturbance requirement according to Article 44(1) No. 2 BNatSchG. This estimation was also reached by the BfN in its statement of 31.05.2021.

Based on the available findings on the occurrence of Terns in the vicinity of Site N-7.2, the BSH does not assume, according to the current state of knowledge, that there will be a significant disturbance due to an offshore wind farm project on Site N-7.2. Terns only use the vicinity of Site N-7.2 as a migration area during migration periods. According to the current state of knowledge, the implementation of the disturbance inventory according to Article 44(1) No. 2 BNatSchG for terns can be excluded with the necessary certainty. This estimation was also reached by the BfN in its statement of 31.05.2021.

According to the current state of knowledge, significant impacts on guillemots and razorbills due to a wind farm project on Site N-7.2 are not to be expected due to the large overall population and the large-scale distribution in the area. In its statement of 31.05.2021, BfN states that, based on the current state of knowledge, it cannot be assumed that the construction of a wind farm on Site N-7.2 will therefore have any significant impact on guillemot and razorbills. Nevertheless, and also with regard to the avoidance behaviour of guillemots and razorbills, BfN refers to initial indications of a higher effect strength, which prompted BfN to initiate a research project on the potential impacts of further wind power development. The findings and knowledge gained from this research project, as well as other related future results, will be taken into account in the future. However, for an offshore wind farm on Site N-7.2 and according to current knowledge, the implementation of the disturbance status measures according to Article 44(1) No. 2 BNatSchG can exclude this issue with the necessary certainty.

So far little is known about the reaction from the fulmar to offshore wind farms under construction or in operation, as generally low sighting rates, as well as insufficient data, do not permit any reliable statements to be made. A low sensitivity to offshore wind farms is assumed for them in expert circles. In its statement of 31.05.2021, the Federal Agency for Nature Conservation (BfN) comes to the conclusion that the disturbance requirement in accordance with Article 44(1) No. 2 BNatSchG will not be fulfilled by a project on Site N-7.2. The BSH concurs with this estimation. Due to the low densities observed in the vicinity of Site N-7.2, significant disturbance pursuant to Article 44(1)(2) BNatSchG can be excluded with the necessary certainty.

Gannets were observed in variable abundance during the surveys on Site N-7.2. A spatial focal occurrence on Site N-7.2 could not be determined. In view of the interannual fluctuations in the occurrence of this highly mobile species, no overriding importance can be assumed for Site N-7.2. In its statement of 31.05.2021, the Federal Agency for Nature Conservation (BfN) comes to the conclusion that the disturbance requirement in accordance with Article 44(1) No. 2 BNatSchG will not be fulfilled by a project on Site N-7.2. The BSH concurs with this estimation. An implementation of the disturbance requirement according to Article 44(1) No. 2 for gannets can be excluded with the necessary certainty.

Seabirds and resting birds in the vicinity of Site N-7.2 are dominated by the gull population. Herring gulls and kittiwakes are the most common species among these. In general, offshore wind turbines seem to attract the majority of gull species. They are also known as prominent ship followers. Significant impacts on gulls from an offshore wind farm on Site N-7.2 are not expected according to current knowledge. In its statement of 31.05.2021, the BfN also states that a project on Site N-7.2 would not cause any significant disturbance within the meaning of Article 44(1) No.2. According to the current state of knowledge, the construction and operation of offshore wind turbines and ancillary facilities (accommodation platform, cabling within the wind farm) on Site N-7.2 can be ruled out with the necessary certainty as a cause of significant disturbance pursuant to Article 44(1) No. 2 BNatSchG.

At the time of determining the suitability of Site N-7.2, the technical construction of the specific project has not been determined. In this respect, it is necessary to update the examination of the implementation for the element of disturbance according to Article 44(1) No. 2 BNatSchG within the framework of the individual approval procedure.

6.4 Bats

Migratory movements of bats across the North Sea are still poorly documented and largely unexplored. There is a lack of concrete information on migrating species, migration corridors, migration heights, and migration concentrations. Previous knowledge merely confirms that bats, especially long-distance migratory species, fly over the North Sea.

6.4.1 Article 44 (1) No. 1 and No. 2 BNatSchG

Bats belong to a very high level for species and fauna of common interest, which have to be protected according to Appendix IV of the FHH (Habitats Directive) Guide, and are therefore highly protected in accordance with Article 7 (2) No. 14 BNatSchG. A total of 25 bat species are currently native to Germany. According to expert knowledge, the risk of isolated collisions with wind turbines cannot be ruled out. In terms of species protection, the same considerations apply in principle as those already mentioned in the assessment of avifauna. Collision with offshore structures does not constitute deliberate killing. In this case, explicit reference can be made to the guidance document on the strict system of protection for animal species of community interest under FHH, which in II.3.6 Margin No. 83 thereby assumes that killing bats through collisions with wind turbines is an incidental killing to be continuously monitored under Article 12(4) FHH.

Experience and findings from research projects and/or gained from wind farms already in operation will also be adequately considered in further processes.

The data available for the EEZ of the North Sea are fragmentary and insufficient to be able to draw conclusions about bat migration. It is not possible to draw concrete conclusions on migratory species, migration directions, migration heights, migration corridors and possible concentration ranges on the basis of the available data. What we have seen so far only confirms that bats, especially long-distance migratory species, fly over the North Sea.

However, it can be assumed that any negative impacts of wind turbines on bats can be countered by the same avoidance and mitigation measures provided for the protection of bird migration. Moreover, Site N-7.2 is located in an area far from the coast.

According to the current state of knowledge, the construction and operation of offshore wind turbines and ancillary facilities (accommodation platform, cabling within the farm) on Site N-7.2 is neither likely to result in either killing or injury under Article 44(1) No. 1 BNatSchG nor of significant disturbance under Article 44(1) No. 2 BNatSchG.

7 Impact assessment/area protection assessment

7.1 Legal basis

In accordance with Article 36 in conjunction with Articles 34 BNatSchG, plans or projects which, individually or in conjunction with other plans or projects for a Natura2000 region, and which can significantly affect the habitats and EU bird protection area and which do not directly serve the management of the area must be assessed for their compatibility with the protection and conservation objectives of a Natura2000 region. This also applies to projects outside the region which, either individually or in combination with other projects or plans, are likely to significantly affect the region's conservation objectives. The Natura2000 network comprises the regions of community importance (FFH regions) according to the FLL (Habitats Directive) as well as the bird sanctuaries. Insofar as these regions have been designated as protected regions, the assessment refers to the compatibility with the protective purpose of these nature conservation areas, Article 34(1) Sentence 2 BNatSchG.

The scope of the impact assessment is therefore narrower than that of the rest of the SEA, because it is limited to reviewing the compatibility with the conservation objectives defined for the protected area, i.e. it has a territorial reference.

Within the framework of the present SEA, the compatibility of the construction and operation of wind turbines on Site N-7.2 with the conservation objectives of the individual nature conservation areas is to be examined separately for each protected property and protected area.

The compatibility assessment which is to be executed here for Site N-7.2 will take place at the higher level of the suitability assessment and does not replace the assessment at the level of the specific project in knowledge of the specific project parameters, which is to be executed within the framework of planning approval procedures. In this respect, further preventative and mitigation measures are to be expected if these are deemed necessary by the impact assessment within the framework of approval procedures in order to exclude any adverse effect on the conservation objectives of the Natura2000 areas and/or conservation purposes of the protected areas by the use within or outside a nature conservation area. The compatibility within the framework of the suitability assessment is therefore to be examined on the basis of the previously executed reviews for the nature conversation area and/or FHH region.

Before being designated as marine areas pursuant to Article 20(2) 57 of the Federal Nature Conservation Act under European law, from 12th December 2007 the nature conservation areas in the EEZ had been included as FFH sites in the first updated list of sites of Community importance in the Atlantic biogeographical region pursuant to Article 4(2) of the Habitats Directive (Official Journal of the EU, 15 January 2008, L 12/1), so an FFH impact assessment had already been performed as part of the Federal Offshore Sectoral Plan for the German North Sea EEZ (BSH 2017). Most recently, a compatibility review was executed according to Article 34(1) BNatSchG in the context of the SEA for the site development plan (BSH, 2019a).

Essentially, construction of artificial installations and structures in nature conservation areas is prohibited. Also, in accordance with Article 5(3) No. 5 lit a), sites must not be located within a protected area designated according to Article 57 BNatSchG, which has to be reviewed again within the framework of the suitability assessment.

Projects and plans located outside protected areas must also be examined for their compatibility with the protective purpose of the respective ordinance as “surrounding projects” (LANDMANN/ROHMER, Article 34 BNatSchG, Marginal No. 10) (compare with Article 5(4) NSGBRgV).

They are therefore considered permissible when, according to Article 34(2) BNatSchG, they cannot lead to significant adverse effects of the components of the nature conservation area which are relevant to the conservation purpose or when they fulfil the requirements according to Article 34(3) to (5) BNatSchG (also compare with Article 5(2) and (4) NSGFmbV). The protection purpose results from the protection area ordinance or other instructions.

The German EEZ of the North Sea contains the nature conservation areas “Sylt Outer Reef – Eastern German Bight” (Ordinance regarding the establishment of the nature conservation area “Sylt Outer Reef – Eastern German Bight” of 22 September 2017), “Borkum Reef Ground” (Ordinance on the establishment of the nature conservation area “Borkum Reef Ground” of 22 September 2017) and “Dogger Bank” (Ordinance on the establishment of the nature conservation area “Dogger Bank” of 22 September 2017).

Within the framework of the impact assessment, the habitat types “reef” (EU code 1170) and “sandbank” (EU code 1110) according to Appendix I of the FHH-RL (Habitats Directive) with their characteristic and endangered biotic communities and species as well as protected species, specifically fish (river lamprey, twaite shad), marine mammals according to Appendix II of FHH-RL (harbour porpoise, grey seal, and harbour seal) as well as protected bird species according to Appendix I of the Birds Directive (in particular red-throated loons, black-throated loons, little gull, Sandwich tern, common tern, and Arctic tern) and regularly occurring migratory bird species (in particular common and lesser black-backed gull, Northern fulmar, Northern gannet, kittiwake, guillemot, and razorbills).

The nature reserve of "Borkum Riffgrund" with an area of 625 km^2 is the closest to Site N-7.2 in the German EEZ. The shortest distance between Site N-7.2 and the nature reserve of "Borkum Riffgrund" is 27.0 km.

In addition, the FFH area of "Lower Saxony Wadden Sea National Park” is also located 57.7 km away from Site N-7.2 (EU code: DE 2306-301, Act on the "Lower Saxony Wadden Sea National Park" of 11 July 2001 (NWattNPG)) in the coastal sea. The FFH region in the territorial sea has already been included in the list of Sites of Community Importance (SCIs) in the Atlantic biogeographical region in accordance with Article 4(2) of the FFH-RL by decision of the EU Commission of 7 December 2004 (Official Journal of the EU, 29 December 2004, L387/1).

The nature conservation area “Sylter Außenriff – Östliche Deutsche Bucht” has an area of 5,603 km^2 and is located in the southern North Sea. The shortest distance to Site N-7.2 is 49.8 km.

The “Doggerbank” nature conservation area has an area of 1,692 km^2 and is located in the so-called “Duck’s bill” of the German EEZ. The shortest distance to Site N-7.2 is 154.3 km.

The framework of the compatibility review will also consider possible long-distance effects on these two protected areas in the German EEZ as well as protected areas in the adjacent waters of neighbouring countries.

7.2 Impact assessment Impact with regard to habitat types

The conservation or, insofar as it is required, the restoration of a favourable conservation status of the habitat types "sandbanks with only slight permanent over topping by seawater" and "reefs" is the conservation objective of the "Borkum Riffgrund" nature reserve in accordance with Article 3(3) No. 1 NSGBRgV (Federal Nature Conservation Act). Sandbanks" are also protected in the "Doggerbank" nature reserve pursuant to Article 3(3) No. 1 NSGBRgV and value-determining habitat types in the "Lower Saxony Wadden Sea National Park" in the coastal sea.

Due to the shortest distance of Site N-7.2 of at least 27.0 km to the nature reserve "Borkum

Riffgrund" in the German EEZ, and respectively of 57.7 km to the FHH regions of "Lower Saxony Wadden Sea National Park" in the territorial sea, impacts on the Habitats Directive habitat types "reef" and "sandbank" in the nature reserve "Borkum Riffgrund" and the FHH habitat types in the "Lower Saxony Wadden Sea National Park" with their characteristic and endangered biotic communities and species due to construction, installation and operation can therefore be excluded. Site N-7.2 lie far outside the drift distances which has been discussed in the literature so that no release of turbidity, nutrients, and pollutants which could adversely affect the nature conservation and FFH areas in their components relevant to the conservation objectives or the conservation purpose is to be expected.

7.3 Impact assessment with regard to protected species

7.3.1 Protected marine mammal species

7.3.1.1 Compatibility review according to Article 36 in conjunction with 34(1) BNatSchG in conjunction with Article 5(6) of the Ordinance on the Establishment of the “Borkum Riffgrund” Nature Conservation Site

In accordance with Article 36 in conjunction with Article 34(1) BNatSchG as well as Article 5(6) NSGBRgV, the requirements of Article 5(4) NSGBRgV must always be observed when determining the suitability of Site N-7.2.

The review for the impacts of the construction of offshore wind turbines and ancillary facilities within Site N-7.2 is hereby based on the conservation purposes of the nearest protected area in the German EEZ, "Borkum Riffgrund". According to Article 3 (1) NSGBRgV, the purpose of protection is to achieve the conservation objectives of the Natura2000 conservation area. According to Article 3(2) No. 3 in conjunction with Paragraph 2 NSGBRgV, the conservation and restoration of the specific ecological values and functions of the area, in particular the populations of harbour porpoise and seals and their habitats, and the natural population dynamics are to be protected.

Finally, under Article 3(5) No. 1 to 5 NSGBRgV, the ordinance sets out objectives in order to ensure the conservation and restoration of the marine mammal species listed in Article 3(2) NSGBRgV (harbour porpoise, harbour seal, and grey seal) as well as to conserve and, where necessary, restore their habitats.

Conservation and restoration:

- No.1: of the natural population densities of these species with the aim of achieving a favourable conservation status, their natural spatial and temporal distribution, health status and reproductive fitness, taking into account natural population dynamics and genetic exchanges with populations outside the area,
- No. 2: of the area as a largely undisturbed habitat, unaffected by local pollution, of the species of marine mammals referred to in paragraph 3, Number 2 and, in particular, as a habitat of supraregional importance for harbour porpoises in the area of the East Frisian Wadden Sea,
- No. 3: of undissected habitats and the possibility of migration of the species of marine mammals referred to in subsection 3 number 2 NSGBRgV within, in particular to neighbouring conservation areas of the Wadden Sea and off Helgoland,
- No. 4: of the essential food sources of the species of marine mammals referred to in subsection 3 number 2 NSGBRgV, in particular the natural population densities, age-group distributions and distribution patterns of the organisms serving as food sources for these marine species of marine mammals, and

- No. 5: a high vitality of individuals and species-typical age structure of fish and cyclostomes populations as well as the spatial and temporal distribution patterns and population densities of their natural food sources.

Site N-7.2 is located within Region N-7 of the Site Development Plan (FEP, 2019, 2020) in the German EEZ. The shortest distance to the nature reserve of "Borkum Riffgrund", (EU code: DE 2104-301) is 27.3 km.

The FEP (2019, 2020) has implemented specified regions, areas and sites for wind turbines and platforms. The potential impacts of the plan have been assessed within the framework of the impact assessment for the site development plan. The assessment has therefore resulted in the conclusion that the construction and operation of offshore wind turbines and platforms in Region N-7 will not hereby have any significant adverse effects on marine mammals.

The assessment considered possible impacts from the construction and operation of offshore wind turbines in the specific Site N-7.2 and in interaction with the existing wind turbines from the offshore wind farms "BARD Offshore 1", "Veja Mate", "Deutsche Bucht", "EnBWHoheSee", "Albatross" and "Global Tech 1" in the indirect vicinity as well as with the planned wind turbines in the Site for "EnBWHedreiht".

The assessment has therefore resulted in the conclusion that the sound input from pile driving during the installation of foundations for offshore wind turbines and platforms can cause significant impacts on marine mammals, in particular harbour porpoises, when no sound protection measures are taken. The exclusion of significant impacts, in particular through disturbance of the local stock levels and the population of the respective species, requires the implementation of strict noise protection measures. The suitability determination contains a number of provisions in this regard. In the context of the species protection assessment, noise protection measures were also described according to the state of the art in science and technology, the application of which, according to current knowledge, excludes any significant disturbance of the population in Site N-7.2, in its vicinity and in the German EEZ of the North Sea. In 2008, the BSH introduced mandatory limiting values for impulse-containing noise introductions which are caused by pile driving in its approval notices. The introduction of the binding limiting values is based on findings on the triggering of temporary hearing threshold shifts in harbour porpoises (LUCKE et al., 2008, 2009). Compliance with the limit values (160 dB individual sound event level (SEL_{05}) re 1μPa2s and 190 dB re 1μPa2s at a distance of 750 m is to be monitored by the BSH by applying standardised measurement and evaluation methods. Additional noise protection measures with regard to the coordination of parallel pile driving work and in order to reduce the impact on nature conservation areas are also to be derived from the noise protection concept of the BMU (2013) and are created as part of the suitability assessment and ordered and strictly monitored in the individual approval procedures by the BSH, adapted to the location-specific and project-specific characteristics. Since 2011, all pile driving work in German waters of the North Sea and Baltic Sea has been executed by utilising noise reduction systems. Monitoring of the noise abatement-related measures has clearly shown that they have been very effective since 2014, so that significant disturbance of the stocks and an associated impairment of the local population in the German EEZ of the North Sea can therefore be excluded.

An impairment of the conservation purposes for the "Borkum Riffgrund" nature conservation area due to the construction and operation of offshore wind turbines and the cabling within the wind farm in Site N-7.2 can therefore be excluded with the necessary degree of certainty, taking into account the requirements of the suitability determination as well as the orders from the planning approval decision.

However, at this point in time, the assessment cannot take into account the constructive design of the installations, plants, systems and the erection process. In this respect, an update of the impact assessment is therefore required within the framework of the subsequent planning approval procedure, in which additional location-specific and project-specific characteristics of the installations are to be examined and suitable protective measures are ordered, if necessary.

7.3.1.2 Requirement for a compatibility assessment pursuant to Article 34(1) BNatSchG in conjunction with Article 6(3) FHH Directive with regard to the FFH regions of "Sylt Outer Reef - Eastern German Bight" and "Dogger Bank"

A compatibility review for the implementation of offshore wind energy use in Site N-7.2 in accordance with Article 34 BNatSchG in connection with the conservation purposes of the nature conservation areas "Sylter Außenriff - Östliche Deutsche Bucht" (Sylt Outer Reef - Eastern German Bight) at a distance of 49.9 km and "Doggerbank" at a distance of 110 km with regard to marine mammals is not required due to the large distance of the site from the nature conservation areas.

7.3.1.3 Result

The result concludes that a significant impairment of the conservation purposes of the nature conservation areas in the German EEZ of "Borkum Riffgrund", "Sylter Außenriff -Östliche Deutsche Bucht", and "Doggerbank" through the construction and operation of offshore wind turbines in Site N-7.2 can be excluded with the necessary certainty, taking into account the requirements for noise protection.

7.3.2 Protected bird species

7.3.2.1 Compatibility assessment based on the conservation objectives of Site II of the nature conservation area of "Sylt Outer Reef - Eastern German Bight" with regard to avifauna - long-distance impacts

According to Article 5(1) No. 1 NSGSylV (Sylt Nature Conservation Site Act), the conservation or, where necessary, the restoration to a favourable conservation status of bird species listed in Appendix I of V-RL (Birds Directive) and regularly occurring migratory bird species occurring in this area are part of the protection purposes of the nature conservation area.

The species mentioned under Article 5(1) No. 1 NSGSylV include the species red-throated loon (*Gavia stellata*, EU code A001) and black-throated loon (*Gavia arctica*, EU code A002).

The ordinance then sets out objectives for Site II under Article 5(2) No. 1 to No. 4 NSGSylV in order to ensure the conservation and restoration of the bird species listed in Article 5(1) NSGSylV and the functions of Site II under Paragraph 1.

Conservation and restoration:

- No.1: Of the qualitative and quantitative populations of bird species with the aim of achieving a favourable conservation status, taking into account natural population dynamics and population trends; special attention must be paid to bird species with negative trends in their biogeographical population,
- No.2: Of the main organisms serving as food for bird species, in particular their natural population densities, age-group distributions and distribution patterns,
- No.3: Of the increased biological productivity at vertical fronts, which is characteristic of

the area, and the geo- and hydro morphological characteristics with their species-specific ecological functions and effects as well as

- No.4: Of the natural quality of habitats with their respective species-specific ecological functions, their fragmentation and spatial interrelationships, and unimpeded access to adjacent and neighbouring marine areas.

According to the current state of knowledge, Site N-7.2 is of no significance with regard to the occurrence of loons in Site II of the nature conservation area of "Sylter Außenriff -Östliche Deutsche Bucht" due to their distance away from the area.

A significant negative impact on the protection purposes and conservation objectives of Site II of the nature conservation area of "Sylter Außenriff -Östliche Deutsche Bucht" through the implementation of offshore wind energy use on Site N-7.2 can be excluded due to the distance involved. Reference is made to the remarks in Chapter 4.7 and 6.3 .

7.3.3 Other species

In accordance with Article 3(3) No. 2 NSGBRgV, the conservation objectives pursued in the nature reserve include the preservation or, insofar as required, the restoration of a favourable conservation status of the common golden eye (*Alosa fallax*, EU-Code 1103) as a species according to Appendix II of the FFH Guideline.

In accordance with Article 2(3) in conjunction with Appendix 5 NWattNPG, the areas of the national park also serve to preserve or restore a favourable conservation status of the common, golden eye, the river lamprey (*Lampetra fluviatilis*) and the sea lamprey (*Petromyzon marinus*).

However, due to the shortest distance from Site N-7.2 of at least 27.0 km to the nature reserve of "Borkum Riffgrund" in the German EEZ and/or of 57.7 km to the FFH region of "Lower Saxony Wadden Sea National Park" in the coastal sea, impacts resulting from construction, installation and operation on these species and/or their conservation status in the nature reserve can be excluded.

7.4 Outcome of the impact assessment

As a result, significant adverse effects on the protective purposes of the nature conservation areas “Borkum Riffgrund”, “Sylter Außenriff – Östliche Deutsche Bucht”, and “Doggerbank” and the protective purposes of the FFH area “Niedersächsisches Wattenmeer” can be excluded with the necessary degree of certainty by the update of the plan, taking into consideration avoidance and mitigation measures for FHH habitat types, marine mammals, avifauna, and other protected animal groups.

It should also be noted that the FFH impact assessment which has been executed here was not able to examine project-specific properties which are only specified and set out by project developers in the course of planning approval procedures. The impact assessment is therefore carried out in the context of planning approval procedures for the respective project, with the aim of deriving and defining the necessary avoidance and mitigation measures at project level.

According to the current state of knowledge, a significant adverse effect on the Habitats Directive habitat types “reefs” and “sandbanks with only slight permanent over topping by seawater” can be ruled out even when cumulatively considering the plan and already existing projects for the nature conservation areas “Borkum Riffgrund”, “Sylter Außenriff – Östliche Deutsche Bucht”, and “Doggerbank” as well as for the “Niedersächsisches Wattenmeer” national park in the territorial waters because of the small-scale impacts as well as the distances to the areas.

8 Evaluation of the overall plan

In summary, no significant impacts on the marine environment are to be expected from the construction and operation of offshore wind turbines including the required necessary facilities. With strict adherence to avoidance, prevention and mitigation measures, in particular for noise reduction during the construction phase, avoidance of light emissions, significant impacts can therefore be avoided by the implementation of the project on the site.

Laying the cabling within the wind farm can be designed to be as environmentally friendly as possible, among other things, by choosing a laying method that is as gentle as possible. The provision, which refers to the FEP's planning principle on sediment heating, is intended to ensure that significant negative impacts of cable heating on benthic communities are prevented. The avoidance of intersections of submarine cable systems, as far as physically possible, additionally serves to prevent negative impacts on the marine environment, in particular on the protected assets of soil and benthos. Based on the aforementioned descriptions and assessments, it can be concluded for the Strategic Environmental Assessment, also with regard to any interrelationships that, according to current knowledge and at the comparatively more abstract level of sectoral planning, no significant impacts on the marine environment within the study area are to be expected from the construction and operation of an offshore wind farm on Site N-7.2. The potential effects are frequently small-scale and mostly short-term, as they are limited to the construction phase. To date, there is a lack of sufficient scientific knowledge and uniform assessment methods for the cumulative assessment of impacts on individual protected assets such as bat migration. Therefore, these impacts cannot be conclusively assessed within the framework of this SEA or are subject to uncertainties and thereby require an extended level of knowledge to be gained, for example through research.

9 Planned measures for preventing, reducing and offsetting any significant negative impacts on the marine environment

In accordance with Article 40(2) of the UVPG, the environmental report includes a description of the planned measures to prevent, mitigate and, as far as possible, compensate for significant adverse environmental effects resulting from implementation of the plan. While some avoidance, prevention, mitigation and compensation measures can already be implemented at the planning level, others can only come into play during the actual implementation phase

With regard to planning avoidance, prevention and mitigation measures, the Site Development Plan defines spatial and textual specifications which, according to the environmental protection objectives set out therein, serve to avoid, prevent and/or mitigate significant negative effects on the marine environment. The specifications from the FEP are taken into account in the suitability assessment. Due to the specific reference to the area, the measures can also be specified here and/or additional measures can be specified. Project-specific or location-specific measures relating to the specifically planned project will be added in the subsequent planning approval procedure.

Within the framework of the suitability assessment, measures in accordance with Article 12(5) Sentence 2 of the WindSeeG can be proposed as specifications for the subsequent project in order to determine the suitability of the site, if the erection and operation of wind turbines on the site might otherwise impair criteria and concerns pursuant to Article 10(2) of the WindSeeG.

The judgement regarding the suitability of the site with regard to a hazard to the marine environment is based, among other things, on data from the baseline survey according to StUK.

In order to prevent hazards to the marine environment from noise emissions, measures are to be implemented in particular during the construction of the turbines. These measures should be effective to ensure that the work is executed as quietly and briefly as possible while complying with limit values for sound pressure (SEL05) and peak sound pressure levels. This principle, in particular the observance of maximum values of 160 dB for the sound event level (SEL_{05}) and 190 dB for the peak sound pressure level at a distance of 750 m from the point of emission, can already be anchored in the suitability determination even without knowledge of the specific types of installations. Later, the planning approval authority, knowing the types of systems, turbines and foundations to be utilised, will order the specifications e.g. on maximum permissible durations.

The owners of the offshore wind farm projects which are to be completed in parallel will coordinate their respective pile driving activities in order to prevent disturbance within the meaning of Article 44(1) No. 2 of the Federal Nature Conservation Act (BNatschG).

Together with the planning documents, the project sponsor shall submit documents on impact assessment pursuant to Article 15 BNatschG and on compensation pursuant to the Federal Compensation Ordinance (BKompV) (compensation concept: Representation of the planned compensation measures and discussion of the content of the compensation measures) in order to provide the planning approval authority with the basis required under Article 15 of BNatschG in order to decide on the permissibility of the planned impact.

The required submarine cable systems will be designed and laid in such a way that the adverse effects on the marine environment which are caused by cable-induced sediment heating are reduced as far as possible. It must always be ensured and demonstrated in the planning approval procedure that the sediment above the cable system is not heated by more than two degrees (Kelvin) at a depth of 20 cm below the seabed surface. The planning approval authority will subsequently assign the minimum cover to be provided, knowing the specific parameters - if necessary differentiated according to subsections. The procedure for laying submarine cable systems will be selected in such a way that the minimum cover assigned is always achieved with the least possible environmental impact.

In order to be able to prevent pollution of the marine environment, measures must be implemented during the planning and implementation of the installations to prevent or reduce material emissions during construction and operation. These measures must always ensure that no emissions of pollutants, noise and light, which are preventable according to the state of the art, can enter into the marine environment. Insofar as such emissions are required and cannot be prevented by the safety requirements for the shipping traffic and air traffic, it must always be ensured that they cause as little nuisance as possible. The least possible impairment must always be ensured, for example, by the selection of operating materials to be utilised, structural safety systems, suitable monitoring measures and organisational and technical precautionary measures. This thereby applies in particular to the areas of fuel exchange, refuelling, corrosion protection, wastewater, drainage water, the diesel generators used and scour and cable protection.

10 Investigated alternatives

In accordance with Article 5 (1) Sentence 1 SEA Directive in conjunction with the criteria in Appendix I SEA Directive and Article 40(2) No. 8 UVPG, the environmental report contains a brief description of the reasons for the choice of the reasonable alternatives examined.

Essentially, different types of alternatives can be considered for an assessment of alternatives; in particular strategic, spatial or technical alternatives. The prerequisite is always that these are reasonable or can be seriously considered. Not all the conceivable alternatives therefore need to be assessed. However, it is no longer sufficient to identify, describe and evaluate only those alternatives that "seriously offer" or "impose" themselves. The obligation to investigate thus extends to all alternatives that “are not obviously (...) are remote” (LANDMANN & ROHMER 2018). Assessment of alternatives does not explicitly require the development and assessment of particularly environmentally-friendly alternatives. Rather more, the "reasonable" alternatives in the above sense should be represented in a comparative manner with regard to their environmental impacts, so that consideration of environmental concerns becomes transparent when deciding on the alternative to be pursued (BALLA et al. 2009).

At the same time, the effort required to identify and assess the alternatives under consideration must be reasonable. The following therefore applies: The greater the expected environmental impacts and thus the need for conflict management in planning, the more likely it is that extensive or detailed investigations will be required.

By way of example, Appendix 4, No. 2 UVPG refers to the assessment of alternatives with regard to the design, technology, location, size and scope of the project, but explicitly refers only to projects. According to (HOPPE 2018), the plan-related and programme-related alternative assessment is likely to be reduced to concept alternatives and location-related alternatives, leaving out facility-specific alternatives except in rare exceptional cases. Attention should be simultaneously paid to whether alternative plan concepts or programme concepts have already been dealt with at a higher planning level in the sense of the synergistic effects of stratification set out in Article 39(3) UVPG.

Alternatives are already being examined within the context of the upstream SEA for the FEP 2020 (BSH 2020A). At this planning level, these are primarily the conceptual/strategic design, the spatial location and technical alternatives.

The focal point of this assessment regarding the FEP is the consideration of alternatives for determining the sites which are required to achieve the statutory expansion target for offshore wind energy: The sites will be compared and determined by utilising nature conservation criteria. The site which has been determined in the FEP represents the planning area for the suitability assessment following the determination in the FEP. The scope of the subsequent construction project is therefore already essentially determined in the FEP, primarily through the definition of the site and the power which is expected to be installed on the site.

This definition for the sites for offshore wind energy also in turn forms the starting point for the additional, future specifications of the FEP with regard to the required grid connection systems. At the present level of the suitability assessment, it is therefore neither required nor reasonable to examine alternative locations to the present planning area, the site which is defined by the FEP. Such an examination would inevitably run counter to the FEP "structure", comprising the wind farm procedures and grid connection systems in operation or in specific planning, as well as the synchronised determinations of the FEP for wind energy sites and grid connection systems which are based on these.

Examining alternative site locations would therefore be unsuitable for achieving the objective of the plan to establish the suitability assessment for the site to be examined in the order specified in the FEP for the invitation to tender (Article 9(1) No. 2 WindSeeG). The waiver of the assessment for spatial alternatives also corresponds to the "synergy effects of stratification" laid down in Article 39(3) UVPG, through which the alternatives examination can be decisively reduced (HOPPE 2018). The alternative assessment within the framework of the SEA for the FEP procedure (published on 28.06.2019) appears sufficiently up-to-date and detailed for this purpose.

Therefore, in the context of the suitability assessment, only alternatives which relate to the specific site to be assessed according to the FEP specifications, in this case N-7.2, are to be taken into account in the sense of stratification between the instruments. These can primarily be process alternatives i.e. the (technical) design of the facilities in detail (BALLA et al.2009).

At the same time, the exact design of the facilities which are to be erected on the site has not yet been determined at the time of the suitability assessment. Examining alternatives with regard to the specific design of the subsequent project can therefore only be executed in the concluding planning approval procedure. At this point, therefore, only alternatives will be examined which relate to the respective site and can already be undertaken without detailed knowledge of the specific construction project in question. This is therefore "not about alternatives for the entire plan, rather about variants for individual planning provisions or the type of implementation in question" (HOPPE 2018).

These are to be deliminated from measures to prevent, avoid, reduce and compensate for significant adverse impacts of the plan on the marine environment. Only "re-planning amendments which lead to a significant alteration in the planning concept and thereby to a new plan variant (...) are subject to the alternatives assessment" (BALLA et al. 2009). The corresponding "re-planning" which does not lead to corresponding new plan variants is represented as prevention, avoidance and mitigation measures in Chapter 9 .

The remaining conceivable alternatives which have not already been conclusively dealt with in the FEP and do not represent mere measures, and are conceivable at the present abstract level without knowledge of the specific project, therefore appear limited. As represented, they are limited to process alternatives i.e. the (technical) design of the plant facilities in detail.

Against this background, one alternative which could be seriously considered appears to be the utilisation of different facility concepts which differ in terms of their physical parameters. Due to the quantity of structures which are expected to be erected on the site, as well as their impact on the marine environment, the variation of the turbine parameters appears to be of particular importance for wind turbines. In order to achieve the capacity of 980 MW on Site N-7.2, which was determined within the framework of the suitability assessment (Article 12(4) WindSeeG) and is to be specified by ordinance (Article 12(5) Sentence 1 WindSeeG), the project developer can utilise various turbines which are available on the market at the time of project planning. The implementation of the project can be assessed by utilising model parameters for opposing concepts in the sense of "comprehensive information gathering" (HOPPE 2018): On the one hand, for an implementation with small wind turbines, a correspondingly relatively low generation capacity and thereby a larger number of wind turbines, or on the other hand, with large, powerful wind turbines and therefore a smaller number of wind turbines; refer to Chapter 1.5.5.4.

It would also seem conceivable, even without knowledge of the specific project, to consider alternatives with regard to the foundation of the high-rise structures (wind turbine and accommodation platform); refer to Chapter 10.2. Due to the fundamental effects created by the selection of foundation type on the design and environmental impacts, the comparison of foundation variants represents an alternative, not just a mere measure to prevent, reduce or avoid impacts on the marine environment. The additional technical designs for the installations, such as the design of scour protection or corrosion protection, on the other hand, are regarded as measures to prevent, avoid, reduce or compensate for environmental impacts and are described accordingly in Chapter 9 .

A zero option is only to be considered in the alternatives assessment when it is "reasonable" i.e. if it takes into account the objectives and the geographical scope. This zero variant would mean that the site is not suitable for a tender in the present case. This presupposes that the impairment of the relevant criteria and concerns are also to be worried about when the suitability determination includes specifications for the subsequent project. This is not deemed to be the case for Site N-7.2, as the relevant impairments can be ruled out by implementing the specifications. The zero alternative therefore does not represent a reasonable alternative and is not to be examined, as it would not be "consistent with the objectives of the planning" (HOPPE 2018).

The anticipated developments in the state of the environment in the absence of implementation of the plan i.e. without offshore wind turbines being erected and operated on the site, are described as a comparative benchmark for the assessment of environmental impacts in Chapter 3.

The consideration of alternatives with regard to the cabling within the wind farm does not appear to be appropriate, as there are no reasonable alternatives with regard to their technical design (largely standardised transmission voltages and cable systems) or installation (laying on the seabed is not possible due to the lack of protection for the cable).

10.1 Wind turbine concept

Wind turbines which are characterised by various parameters can be utilised in the implementation of the project. With regards to the comparison of alternatives and their assessment, it appears useful to evaluate model-like wind farm plans which show the range of wind turbines that are available or will be available in the future.

Corresponding model-like scenarios have already been introduced in (BSH 2020b). Both these scenarios are also implemented into the present assessment, described under Chapter 1.5.5.4 and applied to Site N-7.2.

Both alternative scenarios differ in particular with regard to the number of wind turbines which are to be erected to achieve the capacity to be installed (Scenario 1: 98 wind turbines compared to Scenario 2: 49 wind turbines) as well as hub height and rotor diameter, which result in the total height of the individual wind turbines (about 225 m compared to 350 m).

The evaluation of these alternatives and/or scenarios is executed in relation to the individual protected assets in Chapter 4.

As a result, neither of the two scenarios can be rated as clearly preferable due to their lower environmental impacts. Rather, the evaluation differs depending on the protected asset. Scenario 2, for example, is more advantageous with regard to the protected assets of soil and benthos, since the smaller number of wind turbines and the scour protection associated with each wind turbine means that hard substrate from other, third-party locations is introduced. In the case of avifauna, on the other hand, the lower number of wind turbines in Scenario 1 is expected to have a slightly lower impact.

10.2 Foundations

As represented in Chapter 1.5.5.4 , the foundation of the wind turbines and the accommodation platform is assumed to be based on driven pile foundations (monopile for the offshore wind turbines and jacket pile for the accommodation platform). In principle, utilising other foundation types is also conceivable. Other variants have already been implemented and/or are planned in the German EEZ in individual cases or for test purposes.

Suction bucket, vibration pile or gravity foundation are to be discussed as conceivable alternatives for the foundations for the wind turbines. Bored piles, on the other hand, are out of the question for utilisation in the sandy soils located in the German EEZ in the North Sea, as the required drilling fluid cannot be retained in the borehole in the porous sandy subsoil of this area.

Only very limited information is available for the aforementioned foundation types which are under consideration. In particular, there is insufficient knowledge available from monitoring other comparable offshore installations. Based on the current state of knowledge with regard to the specific parameters, and in particular with regard to the impacts on the various protected assets during construction and operation, the environmental impacts of these foundation types cannot be determined, described and evaluated.

For example, the different foundation types cannot be compared with regard to their noise and/or sound immissions during construction and operation, as there is a lack of knowledge regarding both the effects associated with construction and the continuous noise immission operation. The possible impacts of the foundation alternatives on the marine environment cannot therefore be estimated precisely. This is the case e.g. when utilising vibratory hammers but also with so-called suction buckets. Only gravity foundations, when these can be installed without sheet piling, can possibly be described as low noise. However, additional significant impacts of gravity foundations, such as the sealing over of large areas and the associated alterations in the functions of the seabed, would then have to be examined in terms of environmental compatibility. Once again, there is also insufficient information available.

Consideration of these alternatives in detail is therefore ruled out, as the necessary information or details cannot be obtained with reasonable effort.

Furthermore, the foundation variants which have been mentioned are each suitable for different soil types and water depths, so that the choice of foundation would also have to take into account the respective conditions of the site. The evaluation for the soil in terms of its subsoil properties cannot however be executed within the framework of the suitability assessment, at most, the preliminary exploration can reveal a condition of the soil which is not or less suitable for certain foundation technologies (DEUTSCHER BUNDESTAG 2016).

In order to evaluate whether the stated foundation methods could be considered for the specific site would require an even more intensive examination, which must be specified and evaluated depending on the respective individual case.

11 Measures planned to monitor the effects of the plan on the environmental

The potential significant impacts on the environment resulting from the implementation of the plan are to be monitored in accordance with Section 45 of the UVPG. This is intended to enable unforeseen negative impacts to be evaluated at an early stage and suitable remedial measures to be taken.

Therefore, in accordance with Article 40(2) No. 9 of the UVPG, the environmental report is to specify the measures envisaged for monitoring the significant environmental effects of implementation of the plan. Monitoring is the responsibility of the BSH, which is the authority responsible for the SEA (refer to Article 45(2) UVPG). As intended by Article 45(5) UVPG, existing monitoring mechanisms may be used in order to prevent duplication of monitoring work.

With regard to the planned monitoring activities, it should be noted that the actual monitoring of the potential effects on the marine environment can only begin when the plan is implemented, i.e. when the project on Site N-7.2 is implemented. Nevertheless, the natural development of the marine environment, including climate change, must still not be disregarded when assessing the results of monitoring activities. However, general research cannot be carried out based on the monitoring. Therefore, the project-related monitoring of the impacts of the project on the site and its surroundings is of particular importance.

The essential task of monitoring this plan in conjunction with the FEP as well as the individual planning approval procedures is to bring together and thereby evaluate the results from various phases of monitoring. The assessment will also cover the unforeseen significant effects of the implementation of the plan, the marine environment and the review of the forecasts in the environmental report. The procedure which is envisaged for this here, the planned measures for monitoring the potential impacts of the plans and the data required are described in the Environmental Report on the Site Development Plan 2020 for the German North Sea in Chapter 10 (particularly in Chapter 10.1 for the potential impacts of the areas and sites for offshore wind turbines) (BSH 2020a).

In order to be able to verify the forecasts of the present environmental report and the subsequent EIA within the framework of the plan approval and to enable any required, subsequent adjustments to be made, construction and operation monitoring must be executed with regard to the individual protected assets and any hazards, such as collisions of migratory birds with the wind turbines. This is to be designed in accordance with the requirements of the StUK.

12 Non-technical summary

12.1 Subject and occasion

In accordance with Article 12(4) in conjunction with Article 10(2) of the WindSeeG, the BSH will inspect the suitability of a site for the construction and operation of offshore wind turbines as a basis for the separate determination of suitability by means of an ordinance. Within the framework of the suitability assessment, an environmental assessment will be executed within the meaning of the Environmental Impact Assessment Act in the version promulgated on 24 February 2010 (BGBl. I P. 94), last amended by Article 22 of the Act of 13 May 2019 (BGBl. I P. 706) (Environmental Impact Assessment Act - UVPG), the so-called Strategic Environmental Assessment (SEA)._The main document content of the Strategic Environmental Assessment is the present Environmental Report. This identifies, describes and assesses the likely significant effects that the implementation of the plan i.e. the construction and operation of an offshore wind farm on Site N-7.2, will have on the environment, as well as possible planning alternatives, taking into account the main purposes of the plan.

The determination of suitability is part of a planning cascade. It is preceded by the sectoral planning for the spatial planning as a rough overall plan for all uses in the German EEZ and the FEP as an important steering instrument for the orderly expansion of offshore wind energy. On the basis of the FEP, which thereby defines areas and sites as well as locations as well as route and route corridors for grid connections, the BSH implements a preliminary investigation of the sites and reviews their suitability.

The ordinance, which will be issued on the basis of a positive suitability assessment contains, in addition to the basic determination of suitability and the power to be installed, specifications for the project on the site when if suitability would otherwise have to be denied due to adverse effects on the marine environment or other concerns to be assessed.

The determination of suitability in connection with the underlying suitability assessment has the character of technical planning and as such forms the basis for the subsequent planning approval. If the suitability of a site for the use of offshore wind energy is established, then the site is put out to tender and the winning bidder can submit an application for approval (planning approval or planning permission) for the erection and operation of wind turbines on the site.

The SEA in this case is related to the environmental assessments of the upstream planning levels and downstream planning levels. Whereas, in the upstream strategic environmental assessments of maritime spatial planning and the FEP, the depth of the assessment for likely significant environmental effects was characterised by a broader scope of investigation and, in principle, a lower depth of investigation and the focus of the assessment was on the evaluation of cumulative effects and the examination of spatial alternatives, the SEA for the suitability assessment hereby examines the effects on the marine environment of an offshore wind farm project on the specific site. In addition, the results of the state preliminary investigation are to be utilised for the suitability assessment and the depth of assessment is therefore increased compared to the upstream plans.

The suitability assessment, as well as the implementation of the SEA as the basis for the determination by legal ordinance, will be executed by taking into account the objectives of environmental protection. These provide information about the environmental status which is to be achieved in the future (environmental quality objectives). The objectives of environmental protection can be seen as an overall view of the international, community and national conventions and regulations which deal with marine environmental protection and on the basis of which the

Federal Republic of Germany has committed itself to certain principles and objectives.

12.2 Methodology for the Strategic Environmental Assessment

This environmental report builds on the methodology which has already been utilised for the SEA of the Federal Specialist Offshore Plans (BFO) and the FEP and develops it further with regard to the specifications which were defined the suitability determination.

Within the framework of this SEA, it is primarily determined, described and evaluated whether the construction and operation of an offshore wind farm on the site involved can have significant impacts on the protected assets concerned. Where impacts would be expected, then it will be additionally evaluated for whether these can be offset by measures and whether these would not in themselves constitute a significant impact. Although some measures also serve to reduce environmental impacts, they can in turn also lead to impacts, so that an assessment is required.

The assessment of anticipated, significant environmental effects includes secondary, cumulative, synergetic, short-term, medium-term and long-term, permanent and temporary, positive and negative effects. A detailed description and evaluation of the environmental status hereby serves as the basis for assessing potential impacts. The SEA will be executed on the basis of the results of the SEA FEP North Sea (BSH 2020a) for the following protected assets:

- Site
- Soil
- Water
- Biotope types
- Benthos
- Fish
- Marine mammals
- Avifauna
- Bats
- Biological diversity
- Air
- Climate
- Landscape
- Cultural heritage and other tangible assets
- People, in particular human health
- Interactions between protected assets

The description and assessment of the anticipated, significant environmental impacts will be executed in relation to the protected assets. All the plan contents which can potentially have significant environmental impacts are to be examined.

Not only the impacts from construction and dismantling but also the impacts from the wind energy installation itself and its operating conditions are to be considered. In addition, impacts and/or effects which can arise in the course of maintenance and repair work are also taken into account. This is followed by a description of possible interrelationships, a consideration of possible cumulative effects and potential cross-border impacts.

The impacts are to be evaluated on the basis of the status description and status estimation and the function and significance of the respective site for the individual protected assets. The forecast is based on the criteria of intensity, range and duration of the impacts.

Within the framework of the impact forecast, certain parameters are to be assumed for the consideration of protected assets in the SEA. In order to be able to reflect the range of possible (realistic) developments, executing the assessment is essentially based on two scenarios. Scenario 1 assumes many small wind turbines, while Scenario 2 assumes a few large wind turbines, each with different parameters, such as number of wind turbines, hub height, height of the lower rotor tip, rotor diameter, overall height, diameter of foundation types and scour protection.The range thereby covered enables a description and assessment of the current planning status which is as comprehensive as possible in terms of the protected assets.

Result of the assessment of the individual protected assets

12.2.1 Soil/Areas

The surface sediments of Site N-7.2 indicate a homogeneous sediment composition and a largely structureless seabed. It is considered to be a medium sandy, fine sand area, as is found in almost the entire North Sea.

Wind turbine installations have a locally limited environmental impact with regard to the seabed as a protected asset. The sediment is only permanently affected in the immediate vicinity by the insertion of the foundation elements including scour protection and the thereby resulting land utilisation.

Due to their construction, the foundation of wind turbines and the laying of the cabling within the wind farm will briefly result in the resuspension of sediments and the formation of turbidity plumes. The extent of the resuspension depends mainly on the fine-grain content in the soil, which varies within Site N-7.2 at a low level between approx. 5 and 15 %. In the areas with a very lower proportion of fine grained material, most of the released sediment will settle relatively quickly directly in the area of the intervention or in the immediate vicinity. Because of dilution effects and sedimentation of the stirred-up sediment particles, the suspension content will quickly decrease again to the natural background values. However, the expected slightly increased impairments in areas with slightly higher fine grain contents and the associated slightly increased turbidity will still remain limited on a small scale due to the low flow near the bottom. A substantial alteration in the sediment composition is not expected.

Due to operational conditions, the interaction of foundation and hydrodynamics in the immediate vicinity of the installations may lead to a permanent agitation and rearrangement of sediments. According to previous experience in the EEZ in the North Sea, current-related permanent sediment shifting can only be expected in the immediate vicinity of the wind turbines. Due to the predicted spatially limited extent of scouring, no significant changes in the substrate are to be expected.

In the short term, pollutants and nutrients can be released from the sediment into the soil water. A possible release of pollutants from the predominantly sandy sediment of Site N-7.2 is still not considered likely due to the relatively low fine grain content and low heavy metal concentrations in the sediment.

Impacts in the form of mechanical stress on the soil or seabed sediment due to displacement, compaction and vibrations, which are to be expected during the construction phase, are estimated to be low due to their limited extent.

12.2.2 Water

The water area of the German Bight is characterised by land-based inputs of nutrients and pollutants, although no acute negative effects on the marine ecosystem are to be expected from the concentrations of most pollutants. However, the natural nature of the water as a protected asset is generally classified as medium in the German North Sea waters due to the pre-loads from the nutrient inputs (eutrophication).

The resuspension of sediment during the construction phase can possibly affect the water body through turbidity plumes and - depending on the organic content - create an increased oxygen depletion as well as a release of nutrients and pollutants. In this respect, small-scale impacts of a short duration and low intensity are expected on Site N-7.2, especially due to the low organic content in the sediment. The structural and functional impairments are considered to be minor

The constructed facilities generally alter the flow regime on a long-term and medium-scale basis, although with very low intensity.

Operationally-related, the material emissions from corrosion protection and selective inputs from the regular operation of platforms are of particular importance for the water as a protected asset. According to the current state of knowledge, these impacts and assuming implementation of the state of the art and compliance with the minimisation requirement, are to be assessed as long-term, small-scale and of low intensity. The structural alterations and functional alterations are considered to be minor.

12.2.3 Biotope types

Possible effects and impacts of wind turbines and submarine cables on protected biotopes can result from direct use of these biotopes, their covering by sedimentation of material which is released during construction, or potential habitat alterations.

Owing to the predominant sediment composition, impairments caused by overburdening are likely to be small-scale and temporary, as the released sediment will settle quickly. Permanent habitat changes are limited to the immediate area of foundations and crossing structures for cable crossings. Required cable crossings are secured with stone fill, which permanently represents a hard substrate unfamiliar to the site. This provides new habitats for benthic organisms that love hard substrates and can lead to a change in the species composition. These small-scale habitat changes are not expected to have any significant impact on the protected habitat types. In addition, the risk of a negative impact on the benthic soft soil community caused by species untypical of the area is low, since it is highly likely that the species will be recruited from natural hard substrate habitats.

Permanent habitat alterations will be limited to the immediate vicinity of foundations and rock fills, which are required in the case of cable laying on the seabed and cable crossings. Stone rubble permanently represents a hard substrate, which is foreign to the location. This provides new habitats for benthic organisms and can lead to a change in the species composition. These small-scale areas are not expected to have any significant impact on the protected biotope types. In addition, the risk of a negative impact on the benthic soft soil community caused by species untypical of the area is low, since it is highly likely that the species will be recruited from natural hard substrate habitats.

12.2.4 Benthos

Site N-7.2 is not of major importance in terms of the species inventory of benthic organisms. Nor do the benthic communities identified show any special features, as they are typical of the North Sea EEZ due to the predominant sediments. Investigations of the macrozoobenthos within the scope of the preliminary area investigation revealed communities which are typical for the German North Sea. The species inventory located and the number of Red List species indicate an average importance of Site N-7.2 for benthic organisms.

The deep foundations of the wind turbines and platforms will cause disturbance of the seabed, sediment turbulence and the formation of turbidity plumes. The resuspension of sediment and the subsequent sedimentation can lead to an impairment or damage of the benthos in the immediate vicinity of the foundations for the duration of construction activities. However, due to the prevailing sediment composition, these impairments will only have a small-scale effect and are limited in time. As a rule, the concentration of the suspended material decreases very quickly with removal. Depending on the given installations, changes in species composition may occur as a result of the local land sealing and the introduction of hard substrates in the immediate vicinity of the structures.

Laying of the submarine cable systems is also expected to cause only small-scale and short-term disturbances of the benthos by sediment turbulence and turbidity plumes in the area of the cable route. Possible effects on the benthos depend on the installation methods utilised. With the comparatively gentle installation using the flushing method, only minor disturbances of the benthos in the area of the cable route are to be expected. Local sediment shifts and turbidity plumes are to be expected during the laying of the submarine cable systems. Due to the predominant sediment composition in the North Sea EEZ, most of the sediment released will settle directly at the construction site or in its immediate vicinity.

Benthic habitats will be directly overbuilt in the area of necessary stone fills for cable crossings. The resulting habitat loss is permanent but small-scale. The result is a non-native hard substrate which can cause changes in the species composition on a small scale. In addition, the benthic community could also benefit from the expected reduction in fishing (refer to 3.3) and develop into a more natural community in Site N-7.2.

Due to operational conditions, a warming of the uppermost sediment layer of the seabed can occur directly above the cable system. With sufficient installation depth and taking into consideration the fact that the effects will be small-scale, no significant impacts on benthic communities are expected according to current state of knowledge. According to the current state of knowledge and, if a sufficient installation depth is maintained and state of the art cable configurations are utilised, then the 2K criteria will be complied with and no significant impacts on the benthos due to cable-induced sediment heating are to be expected. The same assumptions apply to electric and/or electromagnetic fields.

The ecological impacts are small-scale and mostly short-term.

12.2.5 Fish

The fish fauna in the region of Site

N-7.2 indicates a typical species composition. In all regions concerned, the demersal fish community is characterised by typical flatfish species and roundfish species. According to current knowledge, the site does not represent a preferred habitat for any of the protected fish species mentioned. As a result, the fish stock in Planning Site N-7.2 is not ecologically significant when compared to neighbouring marine areas. According to the current state of knowledge, the planned construction of a wind farm and the associated accommodation platform and internal wind farm submarine cable routes is not expected to have a significant impact on the protected assets of fish. The impacts on the fish fauna from the construction of the wind farm are limited as spatial and temporal. During the construction phase of the wind turbines, the accommodation platform and the laying the submarine cable systems, the fish fauna could be temporarily affected in small areas by sediment turbulence as well as the formation of turbidity plumes. The turbidity in the water is expected to decrease again quickly due to the prevailing sediment conditions and current conditions. The impacts are therefore considered to be limited as spatial and temporal and not considerable according to current knowledge. Moreover, the fish fauna is adapted to the natural sediment turbulence caused by storms which is typical for this area. Furthermore and during the construction phase, temporary escape reactions of fish can occur due to noise and vibrations. Noise emissions will be minimised by mitigation measures such as the implementation of deterrent devices and a bubble curtain. Additional local impacts on the fish fauna can be assumed from the additional hard substrates introduced as a result of possible altering habitats. The fish community will lose a part of its habitat due to the installation of the wind farm. Benthic invertebrates normally settle on the introduced structures and thereby provide food for the fish. In addition, the fish community in the area could also benefit from the expected reduction in fishing (refer to 3.3) and accumulate more in the retreat area of N-7.2. Regardless of the planned wind farm scenario, the installation of a wind farm will not have a significant impact on fish fauna. In the long term, Scenario 1 could provide an advantage for the fish community due to the lower land use and the numerous wind turbines.

12.2.6 Marine mammals

According to the current state of knowledge, it can be assumed that the German EEZ is used by harbour porpoises for traversing, staying and also as a food-specific area and area-specific breeding ground. Based on the knowledge available, it can be concluded that the EEZ is of medium to high importance for harbour porpoises in certain areas. Use varies in the sub-areas of the EEZ. This also applies to seals and grey seals. Site N-7.2 is of medium importance for harbour porpoises, but of low importance for grey seals and harbour seals.

Hazards to marine mammals can be caused by noise emissions during pile driving for the foundations of offshore wind turbines and the accommodation platform. Without the use of noise abatement measures, significant disturbance to marine mammals during pile driving cannot be excluded. Driving piles for offshore wind turbines and accommodation platforms will only therefore be permitted when effective noise-reduction measures are utilised in the specific approval procedure. To this end, the suitability determination for Site N-7.2 contains requirements for the protection of the living marine environment from impulsive noise inputs.

This states that the installation of the foundations must be executed by utilising effective noise reduction measures to comply with applicable noise protection values. In the specific approval procedure, extensive noise mitigation measures and monitoring measures are ordered to comply with applicable noise protection values (sound event level (SEL) of 160 dB re 1 μPa²s and maximum peak level of 190 dB re 1 μPa at a distance of 750 m around the pile driving or placement site). Suitable measures shall be taken to ensure that no marine mammals are present in the vicinity of the pile driving site.

Current technical developments in the field of reducing underwater noise have indicated that the effects of noise input on marine mammals can be significantly reduced by the application of appropriate measures. The noise abatement concept of BMU has also been in force since 2013. According to the noise abatement concept, pile driving activities must be coordinated in such a way that sufficiently large areas, especially within the protected areas and the main distribution area of harbour porpoise in the summer months, are kept free of impacts caused by impact noise. According to current knowledge, significant effects on marine mammals which are caused by the operation of offshore wind turbines and the accommodation platform can be excluded.

The Site Development Plan's (FEP) exclusion for the erection of offshore wind turbines and accommodation platforms in the Natura2000 regions contributes to reducing the risk to harbour porpoises in important feeding and breeding areas.

Following the implementation of the mitigation measures for compliance with applicable noise protection values, which are defined as a planning principle in the site development plan (BSH 2020b) and are to be ordered as part of the determination of the suitability of Site N-7.2 and in the planning approval procedure, the erection and operation of the planned offshore wind turbines and the accommodation platform are currently not expected to have any significant adverse impacts on marine mammals. No significant impacts on marine mammals are expected from the laying and operation of submarine cable systems.

12.2.7 Seabirds and resting birds

According to current knowledge, Site N-7.2 indicates medium importance for resting and foraging birds. Overall, typical seabird species of the North Sea EEZ were identified (BSH 2020a), often however in low densities. This is mainly due to the fact that the area characteristics do not correspond to the species-specific preferred conditions which are required for some seabird species.

Impacts during the construction phase, which are caused by deterrent effects, are to be expected locally and temporarily at the most. Due to the high mobility of birds, significant effects can be ruled out with the required degree of certainty.

Wind turbines can have a permanent disturbing effect and chasing-away effect on species which are sensitive to disturbance such as red-throated loons and black-throated loons. Current knowledge and findings indicate a more pronounced avoidance behaviour of loons towards existing wind farms than was originally anticipated. There are no findings on habituation effects to date. This means that it cannot be ruled out that an OWF, which is erected on Site N-7.2, will have an avoidance effect on loons in Site N-7.2. However, and also in view of the low seasonal and spatial occurrence of loons in the vicinity of Site N-7.2, significant impacts can be excluded with the required degree of certainty.

In the case of the Common Guillemot, which is widespread in the German North Sea, previous findings indicate that reactions to offshore wind farms depend on a number of factors (refer to Chapter 4.7.1.2).
Operational monitoring of the “Östlich Austerngrund“ (oyster beds to the east) cluster has shown that there are indications of statistically significant, partial avoidance effects up to 6 km. However, these results also take into account studies from a complete annual cycle and are not seasonally broken down. Scientific findings relating to seasonal and site-related avoidance behaviour during the high season of Winter and Autumn are not currently available. The vicinity of Site N-7.2 is part of the large-scale habitat for Common Guillemots in the German EEZ of the North Sea. According to the current state of knowledge, significant impacts of a construction project on Site N-7.2 can also be excluded for this species.

12.2.8 Migratory birds

Overall, Site N-7.2 and its surroundings are of medium importance for bird migration.

Possible impacts could be that the wind turbines will represent a barrier and/or a collision risk. In the clear weather conditions preferred by birds for their migration, the probability of collision with a wind turbine or platform is low. Poor weather conditions increase the risk. Overall, the individual species-specific assessment has indicated that, for the migratory bird species occurring in the project area or their relevant biogeographical populations, significant impacts due to a wind farm on Site N-7.2 can be excluded with the required degree of certainty. The somewhat increased collision risk caused by the higher 10-20 MW wind turbines, which were utilised as a basis for the assessment (refer to Chapter 1.5.5.4) must still be taken into account in the cumulative consideration of several wind farm projects in the vicinity of Site N-7.2 and in the specific planning for the individual project.

12.2.9 Bats

Migratory movements of bats across the North Sea are still poorly documented and largely unexplored. There is a lack of concrete information on migrating species, migration corridors, migration heights, and migration concentrations. Previous knowledge merely confirms that bats, especially long-distance migratory species, fly over the North Sea.

Hazards to individual individuals from collisions with wind turbines and platforms cannot be ruled out. According to the current state of knowledge, there are no findings on possible significant impairments for bat migration over the North Sea EEZ. It can also be assumed that any adverse effects on bats can be avoided by the same prevention and mitigation measures used to protect bird migration.

12.2.10 Biological diversity

Biological diversity comprises the diversity of habitats and biotic communities, the diversity of species, and the genetic diversity within species (Article 2 Convention on Biological Diversity, 1992). Biodiversity is in the public eye.

With regard to the current state of biodiversity in the North Sea, it should be noted that there is countless evidence of changes in biodiversity and species assemblages at all systematic and trophic levels in the North Sea. These are mainly because of human activities (e.g. fishing and marine pollution) or climate change. Red lists of endangered animal and plant species have an important monitoring and warning function in this context because they show the status of the populations of species and biotopes in a region. In the environmental report, possible impacts on biodiversity are dealt with under the individual protected assets. In summary, according to current knowledge, the planned expansion of offshore wind energy and the corresponding grid connections is not expected to have a significant impact on biological diversity.

12.2.11 Air

The construction and operation of the wind turbines and laying internal submarine cable systems in the wind farm will have no measurable impact on air quality.

12.2.12 Climate

Negative impacts on the climate caused by the construction and operation of wind turbines as well as the submarine cable systems on Site N-7.2 are not expected because no measurable climate-relevant emissions occur either during construction or operation.

12.2.13 Landscape

The realisation of offshore wind farms has impacts on the landscape because it is altered by the installation of vertical structures and security lights. The extent of these visual adverse effects of the landscape caused by the planned wind turbines will strongly depend on the respective visibility conditions.

Due to the very large distance to the nearest coast (> 70 km), the development of the landscape will not alter as a result of the implementation of the construction project on Site N-7.2, especially as this area of the German EEZ has already been significantly characterised by the already constructed wind farms in Regions N-6, N-7 and N-8.

12.2.14 Material assets, cultural heritage (archaeology)

The implementation of offshore projects may have an impact on shipwrecks which are located in and adjacent to the site. The cultural heritage asset is affected when the shipwrecks are considered to be cultural monuments.

This has not yet been clarified for the shipwreck, which is located in Site N-7.2. An exclusion zone was specified in the suitability determination for Site N-7.2, , mainly as a precautionary measure in order to protect this shipwreck, until a more detailed classification of the wreck sites is possible (Article 39 2).

The shipwreck which is lying directly to the South of Site N-7.2 is considered to be an archaeological ground-located monument according to the notification of 18 August 2021 by the Mecklenburg-Western Pomerania State Office for Culture and Monument Preservation, the Lower Saxony State Office for Monument Preservation and the Schleswig-Holstein State Archaeological Office. The wreck must therefore be protected.

The provisions for the exclusion zone (Article 39(1) correspond to the recommendation of the State Offices mentioned above.

As the provision of the draft suitability determination for Site N-7.2 makes clear, the planning approval authority can order, in the planning approval procedure, that the developer of the project must ensure, through appropriate measures and with the involvement of monument protection and heritage authorities, that additional, future scientific investigations and documentation of the assets involved can be executed before construction work commences and that objects of an archaeological or historical nature can be preserved and conserved either in situ or by salvage (Article 39(3)).

On the basis of this provision, and the general provisions and guidelines regarding cultural assets in the context of determining the suitability of Site N-7.2, the construction and operation of the planned wind turbines and facilities is not currently expected to have any significant adverse impacts on the cultural heritage asset.

12.2.15 Protected asset human beings, including human health

Site N-7.2 has a low significance for human health and well-being. The site is not directly used for recreation and leisure. Human beings are not directly affected by the plan. Site N-7.2 is already utilised solely as a working environment by the operational activities of the surrounding wind farms in Regions N-6 and N-8. This use will be increased by the development of Site N-7.2.

12.2.16 Interactions/ interrelationships, cumulative impacts

In general, impacts on any one protected asset will lead to various consequences and interrelationships between the protected assets. The essential interdependence of the biotic protected assets exists via the food chains. Possible interactions during the construction phase result from sediment shifting and turbidity plumes, as well as noise emissions. However, these interactions occur only very briefly and are limited to a few days or weeks.

Interrelationships relating to the facilities, due to the introduction of hard substrate, for example, will be permanent, but to be expected only on a local level. This could lead to small-scale change in the food supply.

Due to the variability of the habitat, interrelationships can only be described in very imprecise terms overall. In principle, it can be stated that according to the current state of knowledge, no interactions are discernible that could result in a threat to the marine environment.

Cumulative effects arising from the interrelationship and interaction of various independent individual effects which either add up as a result of their interaction (cumulative effects) or reinforce each other and thus generate more than the sum of their individual effects (synergetic effects). Cumulative as well as synergetic impacts can be not only caused by temporal but also by spatial coincidence of impacts of the same or different projects.

12.2.16.1 Soil, benthos and biotope types

A significant proportion of the environmental impacts caused by the areas and surfaces, platforms and submarine cable systems on the protected assets soil, benthos and biotopes types is expected to occur exclusively during the construction period (formation of turbidity plumes, sediment shifting etc.) and within a spatially narrowly defined area. Possible cumulative impacts on the seabed, which could also have a direct impact on the benthos and specially protected biotopes, will result from the sum of the permanent direct land area use for the foundations of the wind turbines and platforms as well as the cable systems which will be laid. The individual impacts are in principle small-scale and local.

In order to be able to estimate the direct land area use, a rough calculation is made in the following which is based on the model wind farm scenarios (Chapter 1.5.5.4) and the assumptions regarding other installations (Chapter 1.5.5.5). Calculating the land area use will be executed based on ecological aspects i.e. the calculation will be based on the direct ecological loss of function and/or the possible structural change in the site caused by the installation of foundations and cable systems. In the area of the cable trench, however, the impact on sediment and benthic organisms will be essentially temporary. Permanent impairment would have to be assumed in the case of the crossing over particularly sensitive biotope types such as reefs or species-rich gravel, coarse-sand and shell beds.

When based on the allocated capacity of 980 MW for Site N-7.2 and an assumed capacity per turbine of 10 MW (model wind farm Scenario 1) or 20 MW (model wind farm Scenario 2), the calculated number of turbines for the site results in between 98 turbines (Scenario 1) and 49 turbines (Scenario 2) ().

On the basis of the model wind farm parameters, this therefore results in a land sealing area of 194,337 m² (Scenario 1) and 218,445 m² (Scenario 2), including an assumed scour protection and an accommodation platform. When compared to the total area of Site N-7.2, which is approx. 58.4 km², the calculated land sealing area for the model wind farm scenarios is between 0.33 % (Scenario 1) and 0.37 % (Scenario 2) ().

The calculation of the loss of function due to the in-farm cabling was executed in accordance with the reported capacity, assuming a 1 m wide cable trench. If this conservative estimate is utilised as the basis, then a temporary impairment by approx. 117.6 km of intra-farm cabling will result for Site N-7.2, which corresponds to a temporary land use of 0.20 % of the total area of N-7.2.

The total arising from land sealing and temporary land use also therefore results in a conservatively estimated impact of well below 1% of the total area of N-7.2 (0.53% - 0.58%). According to current knowledge, no significant adverse effects are therefore to be expected, even in cumulation, which would lead to a threat to the marine environment with regard to the seabed and the benthos.

12.2.16.2 Fish

Furthermore, the wind farms of the southern North Sea could have an additive effect beyond their immediate location in that the mass and measurable production of plankton could be dispersed by currents and thereby influence the qualitative and quantitative composition of the zooplankton. This, in turn, could affect planktivorous fish, including pelagic schooling fish such as herring and sprat, which are the target of one of the largest fisheries in the North Sea. Species composition could also change directly; species with habitat preferences that differ from those of the established species (e.g. reef dwellers) could find more favourable living conditions and thereby occur more frequently. In the Danish wind farm Horns Rev, 7 years after its construction, a horizontal gradient in the occurrence of hartsubrate-affected species was found between the surrounding sand areas and near the turbine foundations: Cliff fish, eel mother and lumpfish were found much more frequently near the wind turbine foundations than on the surrounding sand areas (LEONHARD et al. 2011). Cumulative effects resulting from a major expansion of offshore wind energy could include

- an increase in the number of older individuals,
- better conditions for fish due to a larger, more diverse food resource,
- further establishment and distribution of fish species adapted to reef structures,

- the recolonisation of previously heavily fished areas and zones,
- better living conditions for territorial species such as cod-like fish.

Besides predation, intraspecific and interspecific competition, also known as density limitation, is the natural mechanism for limiting populations. It is not possible to rule out the onset of local density limitation within individual wind farms before the positive effects of the wind farms are reproduced spatially through the migration of “surplus” individuals, for example. In this case, the effects would be local and not cumulative. The effects which alterations in fish fauna could have on other elements of the food chain, both below and above their trophic level, cannot be predicted at this stage with the level of knowledge which is currently available.

12.2.16.3 Marine mammals

Cumulative effects on marine mammals, in particular harbour porpoises, may occur mainly due to noise exposure during pile driving of the foundations. These protected goods could therefore be significantly impaired by the fact that, when pile driving is executed simultaneously on other sites within the EEZ, there is insufficient space available to avoid the pile driving.

Cumulative impacts of the plan on the population of harbour porpoise are considered in accordance with the requirements of the noise abatement concept of the BMU of 2013. Pile driving activities which have the potential to cause disturbance to harbour porpoises due to sound impacts in the nature conservation areas or in the entire North Sea EEZ will be coordinated in such a way that the proportion of the site affected always remains below 10% and/or below 1% in partial area 1 of the nature conservation area for "Sylt Outer Reef - Eastern German Bight".

12.2.16.4 Seabirds and resting birds

Vertical structures such as platforms or offshore wind turbines can have differing impacts on resting birds, such as a loss of their habitat, an increased risk of collision or a scaring away and disturbing effect. These effects have already been considered in Chapter 4.7.1 on a site-specific basis, also taking into account the possible technical scenarios with regard to turbine parameters. An additional, repeated project-specific consideration will be executed within the framework of the environmental impact inspection for the individual project and monitored as part of the subsequent mandatory monitoring of the construction and operation phases of offshore wind farm projects. For resting birds, habitat loss due to cumulative effects of several structures or offshore wind farms can be particularly significant.

In order to assess the significance of cumulative effects on seabirds, any effects must be assessed on a species-specific basis. In particular, species which are listed in Appendix I of the Birds Directive, species in sub-area II of the Sylt Outer Reef - Eastern German Bight Nature Conservation Site and species for which avoidance behaviour towards structures has already been established must be considered with regard to cumulative effects.

Since 2009, the BSH has implemented the qualitative assessment of cumulative effects on loons within the framework of licensing procedures, using the main concentration area in accordance with the BMU position paper (2009).

The definition of the main concentration area of loons in the German North Sea EEZ, within the context of BMU's position paper (2009), is an important measure to ensure species protection of the disturbance-sensitive species of the red-throated and black-throated loon. The BMU thereby decreed that in future licensing procedures for offshore wind farms, the main concentration area should be utilised as a benchmark for the cumulative assessment of habitat loss for the loon population.

The main concentration area takes into account the spring season, a period of particular importance for the species. The main concentration area was defined in 2009 on the basis of the data available at the time: the main concentration area was home to around 66% of the German North Sea loon population and around 83% of the EEZ population in spring, and is therefore, among other things, of particular importance in terms of population biology (BMU 2009) and an important functional component of the marine environment with regard to seabirds and resting birds. Against the background of current stock assessments, the importance of the main concentration area for loons in the German North Sea and within the EEZ has further increased (SCHWEMMER et al. 2019). The delineation of the main concentration area of loons is based on the data basis, which is considered to be very good, and on expert analyses that find broad scientific acceptance. The area includes all areas of very high and most of the areas of high sea loon density in the “Deutsche Bucht”.

The region where Site N-7.2 is located is used by loons to a small extent as a passage area during their migration periods. According to current knowledge, this site and its surroundings is located outside of the main resting areas for loons in the German North Sea.

On the basis of available data from research projects and monitoring of wind farm clusters, the BSH thereby concludes that Site N-7.2 and its surroundings are not of high importance for the common loon resting population in the German North Sea. Site N-7.2 is located at a distance of > 50 km from the main concentration area to the West of Sylt. Implementing an offshore wind farm on Site N-7.2 can therefore exclude cumulative effects with the required certainty for such cases.

12.2.16.5 Migratory birds

The potential threat to bird migration not only results from the effects of the individual project, in this case a project on Site N-7.2, but also cumulatively in connection with other approved or already erected wind farm projects in the vicinity of Site N-7.2 or in the main migration directions.

The surrounding areas of Site N-7.2 in Area N-7 have not yet been developed. To the North of Site N-7.2, and therefore located outside the main directions of approach to Site N-7-2, a wind farm is being planned, for which the same turbine parameters from Chapter 1.5.5.4 are to be assumed as a precautionary measure as for the area in question. In the neighbouring, but not directly adjacent Area N-6, Site N-6.6, which lies in the main direction of flight to Site N-7.2 with stronger east components and/or west components of the flight directions, has been defined for a call for tenders in 2024. The turbine scenarios from FEP 2020 will also be utilised as a basis for this site. The wind farm projects, which are already in operation or currently under construction in Areas N-6 and N-8, lie outside the assumed flight paths, taking into account the main directions of approach and commencing from Site N-7.2. So-called "staircase effects", where larger turbines on Site N-7.2 are located in the immediate vicinity of much smaller turbines of already implemented wind farm projects, are therefore not probable. With a wind farm project on site N-6.6, staircase effects can occur insofar as the turbines of Scenario 1 are installed on one of the two sites and turbines of Scenario 2 on the other site. The height difference between the upper rotor blade tips of the two wind farm projects would then be 125 m (25 -225 m compared to 50 - 350 m), the difference in the hub heights would be 75 m (125 m compared to 200 m) (). Only the rotating rotor blades would be visible from the larger turbines which are located behind during the migration periods, when the birds initially fly towards the smaller turbines according to Scenario 1.

Under normal migratory conditions, which are those preferred by migratory birds, there is no evidence available so far for any species to indicate that the birds do not recognise and avoid obstacles or that they migrate exclusively within the danger zone of the types of installations which are to be utilised.

Surprisingly occurring fog and rain, which can lead to poor visibility and low flight altitudes, represent a potential hazard situation. The coincidence of bad weather conditions with so-called mass migration events is particularly problematic in such cases. According to research results, which were obtained on the FINO1 research platform, this prognosis could however be subsequently put into perspective. The research determined that birds migrate to higher altitudes in very poor visibility (below 2 km) than in medium visibility (3 to 10 km) or good visibility (> 10 km). These results were however only based on three measurement proximities (HÜPPOP et al. 2005).

The risk of collision for birds which are migrating during the day as well as seabirds is generally considered to be low (refer to Chapter 4.8.1.2).

Cumulative effects could also lead to an extension of the migration route for migrating birds. The potential impairment on bird migration in the sense of a barrier effect will depend on many factors and, in particular, the orientation of the wind farms to the main migration directions must be taken into account. Assuming that the main direction of migration is south west to north east and vice versa, then the wind farms of the same or another area which are located adjacent to each other in this orientation thereby create a uniform barrier, so that one single evasive movement is sufficient. It is known that birds avoid wind farms, i.e. they fly around wind farms or over them horizontally. In addition to observations which have been implemented on land, this behaviour has also been verified in offshore areas (e.g. KAHLERT et al. 2004, AVITEC RESEARCH GBR 2015b). Lateral avoidance reactions are apparently the most common reaction (HORCH & KELLER 2005). Evasive reactions occurred in different directions, but a reverse movement direction was not determined (KAHLERT et al. 2004). AVITEC RESEARCH GBR (2015) were able to determine avoidance behaviour in ducks, gannets, miniature gulls, lesser black-backed gulls and kittiwakes during long-term surveys.

Taking into consideration the main migration directions as north-east to south-west for Autumn migration and south-west to north-east for Spring migration, no other wind farm projects are located in the migration direction of Site N-7.2, which means that barrier effects would only arise from a project on Site N-7.2. Also taking into account stronger westerly and easterly components, Site N-6.6 in neighbouring Area N-6 would also be located in the direction of migration. Taking into account the main migration directions as north-east to south-west or vice versa, evasive movements of approx. 16 km will result when barrier effects occur, and evasive movements of approx. 40 km will result when stronger East or West components are taken into account, when the original migration route is resumed after the evasive movement.

The flight distance to cross over the North Sea is sometimes several 100 km. According to BERTHOLD (2000), the non-stop flight performance of the majority of migratory bird species is in the order of magnitude of over 1000 km. This also applies to small birds. It is not therefore to be expected that the possibly required additional energy demand, which is caused by possibly necessary diversions of a few kilometres, would lead to a threat to bird migration.

Consideration of the existing knowledge relating to the migratory behaviour of the various bird species, the usual flight altitudes and the diurnal distribution of bird migration leads to the conclusion that, based on the current state of knowledge, a threat to bird migration from the construction and operation of a wind farm on Site N-7.2 is not likely, especially when cumulatively taking into account the already approved offshore wind farm projects which have been completed to date. At this stage, a possible bypassing of the projects is not expected to have any significant negative effect on the further development of the populations.

In this context, it therefore has to be taken into consideration that, according to the present state of the art in science and technology, that this forecast is made under premises which are not yet suitable in order to ensure the basis for the bird migration in a satisfactory manner. There are still gaps in knowledge present, particularly with regard to species-specific migration behaviour in poor weather conditions (rain, fog).

12.3 Cross-border impacts

The SEA has come to the conclusion that, as things currently stand, Site N-7.2 will not have a significant impact on the areas or regions of neighbouring countries which are bordering on the German North Sea EEZ. Site N-7.2 is centrally located in the German EEZ of the North Sea. The distance to the Dutch EEZ is at least 11 km. Denmark (and/or the Danish EEZ) is at least 113 km away.

Significant cross-border impacts can generally be ruled out for the following protected assets of soil, water, plankton, benthos, biotope types, landscape, cultural heritage and other material assets, as well as for human being and human health due to these distances. Possible significant cross-border impacts could only arise if all planned wind farm projects in the area of the German North Sea for the highly mobile protected assets, therefore for fish, marine mammals, seabirds and resting birds, migratory birds and bats, are considered cumulatively.

As far as the protected asset of fish is concerned, the SEA concludes that, according to current knowledge, no significant impacts on the protected asset are to be expected from Site N-7.2 since, on the one hand, the site does not have a prominent function for fish fauna and, on the other hand, the recognisable and predictable effects are of a small-scale and temporary nature.

For marine mammals, significant (cross-border) impacts can also be ruled out based on current knowledge and taking into account impact-minimising and damage-limiting measures which can be implemented in this case. For example, the installation of wind turbine foundations and accommodation platforms will only be permitted as part of the suitability determination, subject to the use of effective noise mitigation measures and coordination of noise-intensive construction work with neighbouring projects.

Bird migration over the North Sea takes place in a broad-front migration which cannot be defined in more detail, although with a tendency towards coastal orientation. Guidelines and fixed migration routes are not yet known. The individual species-specific assessment (Chapter 4.8.1.2) has not revealed any considerable impacts. Consideration of the existing knowledge relating to the migratory behaviour of the various bird species, the usual flight altitudes and the diurnal distribution of bird migration leads to the conclusion that, based on the current state of knowledge, a threat to bird migration from the construction and operation of a wind farm on Site N-7.2 is not very probable, taking into account, as cumulatively, the already approved offshore wind farm projects, although there is still a need for knowledge on the species-specific migratory behaviour. As a result, significant cross-border impacts are also not probable.

12.4 Species protection assessment

The species protection assessment in accordance with Article 44(1) of the Federal Nature Conservation Act (BNatSchG) comes to the conclusion that, according to current knowledge, the construction of a wind farm on Site N-7.2 will not have any significant negative impacts which would trigger species protection prohibitions, provided that prevention, avoidance and mitigation measures are strictly adhered to and the requirements of the noise protection concept of the Federal Ministry for the Environment are implemented.

12.5 Impact assessment

In the German EEZ of the North Sea, the nature conservation areas of "Sylter Außenriff - Östliche Deutsche Bucht" are 49.8 km away from Site N-7.2, "Borkum Riffgrund" is 27.0 km away, "Doggerbank" is 154.3 km away, and the "Lower Saxony Wadden Sea National Park" is 57.7 km away.

According to Article 34 of the Federal Nature Conservation Act (BNatSchG), the compatibility of plans or projects must be assessed and it must be determined whether, individually or in combination with other plans or projects, they can significantly impair the conservation objectives of a Natura2000 region and/or the conservation purposes of a nature conservation area. This also applies in principle to projects located outside of the area or region.

Within the framework of the impact assessment, the habitat types "reef" and "sandbank" with their characteristic and endangered biotic communities and species, as well as protected species, specifically fish, certain marine mammals according to Appendix II of FFH-RL (Habitats Directive), (harbour porpoise, grey seal and common seal), are to be considered in accordance with the conservation objectives of the aforementioned nature conservation areas as well as protected bird species according to Appendix I of the Birds Directive (in particular red-throated loons, black-throated loons, little gull, Sandwich tern, Common tern and Arctic tern) and regularly occurring migratory bird species (in particular storm gulls and herring gulls, fulmar, gannet, kittiwake, guillemot and razorbills).

Due to the shortest distance of Site N-7.2 of at least 27.0 km to the nature reserve "Borkum Riffgrund" in the German EEZ, construction-related, installation-related and operation-related impacts on the FFH habitat types "reef" and "sandbank" with their characteristic and endangered biotic communities and species can therefore be excluded. Site N-7.2 lie far outside the drift distances which has been discussed in the literature so that no release of turbidity, nutrients, and pollutants which could adversely affect the nature conservation and FFH areas in their components relevant to the conservation objectives or the conservation purpose is to be expected. The same applies to fish and round mouth mammals.

A significant impairment of the nature conservation areas in the German EEZ "Borkum Riffgrund" and the "Lower Saxony Wadden Sea National Park" in the coastal sea with regard to the harbour porpoises, grey seals and harbour seals, which have to be protected there, can also be ruled out with the required degree of certainty, taking into account the requirements for noise protection. In particular, any impacts from construction-related noise emissions can be efficiently prevented by specifying noise abatement measures and subsequently coordinating them with the construction measures of other projects.

With regard to the seabird species which are to be protected in the nature reserve of "Sylter Außenriff - Östliche Deutsche Bucht" (Sylt Outer Reef - Eastern German Bight), Site N-7.2 and thereby also an offshore wind farm on the site are of no significance according to current knowledge due to the distances involved.

12.6 Planned measures for preventing, reducing and offsetting any significant negative impacts on the marine environment

In accordance with Article 40 (2) UVPG and the requirements of the SEA Directive, the measures planned to prevent, reduce and, as far as possible, compensate for significant adverse environmental effects resulting from the implementation of the plan are presented. While some avoidance, prevention, mitigation and compensation measures can already be implemented at the planning level, others can only come into play during the actual implementation phase.

With regard to planning avoidance, prevention and mitigation measures, the Site Development Plan defines spatial and textual specifications which, according to the environmental protection objectives set out therein, serve to avoid, prevent and/or mitigate significant negative effects on the marine environment. The specifications from the FEP are taken into account in the suitability assessment. Due to the specific reference to the site, the measures can also be specified here and additional measures can be specified within the framework of the legal ordinance on the suitability determination. Project-specific or location-specific measures relating to the specifically planned project will be added in the subsequent planning approval procedure.

Within the framework of the suitability assessment, measures in accordance with Article 12(5) Sentence 2 of the WindSeeG can be proposed as specifications for the subsequent project in the ordinanceon the suitability determination of the site, if the erection and operation of wind turbines on the site might otherwise impair criteria and concerns in accordance with Article 10(2) of the WindSeeG.

Specifically, and in order to prevent hazards to the marine environment from noise emissions, measures must therefore be implemented, particularly during the construction of the wind turbines, in order to comply with limit values for sound pressure and peak sound pressure levels and to always execute the work as quietly and briefly as possible. Immissions and emissions must be prevented and any which cannot be prevented must be minimised so that pollution of the seabed is not a concern.

12.7 Review of alternative options

In accordance with Article 5 (1) Sentence 1 SEA Directive in conjunction with the criteria in Appendix I SEA Directive and Article 40(2) No. 8 UVPG, the environmental report contains a brief description of the reasons for the choice of the reasonable alternatives examined.

Essentially, different types of alternatives can be considered for an assessment of alternatives; in particular strategic, spatial or technical alternatives. The prerequisite is always that these are reasonable or can be seriously considered.

Alternatives are already being examined within the context of the upstream SEA for the FEP 2020 (BSH 2020a). At this planning level, these are primarily the conceptual/strategic design, the spatial location and technical alternatives.

Therefore, in the context of the suitability assessment, only alternatives which relate to the specific site to be assessed according to the FEP specifications, in this case N-7.2, are to be taken into account in the sense of stratification between the instruments. These can primarily be process alternatives i.e. the (technical) design of the wind turbines and the facilities in detail (BALLA et al. 2009). At the same time, the exact design of the facilities which are to be erected on the site has not yet been determined at the time of the suitability assessment. Examining alternatives with regard to the specific design of the subsequent project can therefore only be executed in the concluding planning approval procedure. At this point, therefore, only alternatives will be examined which relate to the respective site and can already be undertaken without detailed knowledge of the specific construction project in question. Implementing the project with various wind turbine concepts on the basis of model scenarios can therefore be considered. Both alternative scenarios differ in particular with regard to the number of wind turbines which are to be erected to achieve the capacity to be installed (Scenario 1: 98 compared to Scenario 2: 49 wind turbines) as well as hub height and rotor diameter, which result in the total height of the individual wind turbines (about 225 m compared to 350 m). As a result, neither of the two scenarios can be rated as clearly preferable due to their lower environmental impacts. Rather, the evaluation differs depending on the protected asset. Scenario 2, for example, is more advantageous with regard to the protected assets of soil and benthos, since the smaller number of wind turbines and the scour protection associated with each wind turbine means that hard substrate from other, third-party locations is introduced. In the case of avifauna, on the other hand, the lower number of wind turbines in Scenario 1 is expected to have a slightly lower impact.

Another alternative is to evaluate the use of different foundation types. Suction bucket, vibration piling or gravity foundation are discussed as conceivable alternatives for the foundation of wind turbines using driven pile foundations for the German North Sea EEZ.

Only very limited information is available for the aforementioned foundation types which are under consideration. In particular, there is insufficient knowledge available from monitoring other comparable offshore installations. Based on the current state of knowledge with regard to the specific parameters, and in particular with regard to the impacts on the various protected assets during construction and operation, the environmental impacts of these foundation types cannot be determined, described and evaluated.

Consideration of these alternatives in detail is therefore ruled out, as the necessary information or details cannot be obtained with reasonable effort.

12.8 Measures planned to monitoring the environmental impacts of implementing the site development plan

The potential significant impacts on the environment resulting from the implementation of the plan are to be monitored in accordance with Article 45 UVPG. This is intended to enable unforeseen negative impacts to be evaluated at an early stage and suitable remedial measures to be taken.

Therefore, in accordance with Article 40(2) No. 9 of the UVPG, the environmental report is to specify the measures envisaged for monitoring the significant environmental effects of the implementation of the plan. Monitoring is the responsibility of the BSH, which is the authority responsible for the SEA (refer to Article 45(2) UVPG). As intended by Article 45(5) UVPG, existing monitoring mechanisms may be used in order to prevent duplication of monitoring work.

With regard to the planned monitoring activities, it should be noted that the actual monitoring of the potential effects on the marine environment can only begin when the plan is implemented, i.e. when the project on Site N-7.2 is implemented. However, general research cannot be carried out based on the monitoring. Therefore, the project-related monitoring of the impacts of the project on the site and its surroundings is of particular importance.

The essential task of monitoring this suitability determination in conjunction with the FEP as well as the individual planning approval procedures is to bring together and thereby evaluate the results from various phases of monitoring. The evaluation will also cover the unforeseen significant effects of the implementation of the plan, the marine environment and the review of the forecasts in the environmental report. The procedure which is envisaged for this here, the planned measures for monitoring the potential impacts of the plans and the data required are described in the Environmental Report on the Site Development Plan 2020 for the German North Sea in Chapter 10 (particularly in Chapter 10.1 for the potential impacts of the areas and sites for offshore wind turbines) (BSH 2020a).

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