9 Non-technical summary (North Sea)

9.1 Brief presentation of contents and the most important objectives of the Maritime Spatial Plan , relationship to other relevant plans and programmes, objectives of environmental protection

9.1.1 Brief presentation of contents and the most important objectives of the Maritime Spatial Plan

The Maritime Spatial Plan at hand specifies for the first time the targets and principles for the development of the German Exclusive Economic Zone (EEZ) on the basis of § 18 a Spatial Planning Act of 18 August 1997 (BGBl. I, p. 2081, 2102), which was last amended through Article 10 of the Act dated 9 December 2006 (BGBl. I p. 2986; in the following: ROG 1998), which still applies under § 29 para. 1 ROG dated 22 December 2008 (BGBl. I p. 2986; in the following: ROG) for procedures regarding the preparation of Maritime Spatial Plans, which were initiated formally before 31 December 2008.

The Maritime Spatial Plan at hand concerns an overall spatial plan with spatially-relevant designations for the following issues:

- Ensuring the safety and efficiency of navigation
- Protection of the marine environment
- Commercial uses
- Scientific uses.

The designation of targets and principles are especially based on the following developmental requirements:

- The special importance of shipping – as expressed in the United Nations Convention on the Law of the Sea (UNCLOS) – shall also be taken into consideration within the scope of spatial planning. Therefore the recognized sea lanes essential to international navigation as defined by Art. 60 Para. 7 UNCLOS will be defined as the basic structure, which must be kept undisturbed, of the Maritime Spatial Plan . Other uses have to fit into this structure.
- In accordance with the Federal Government's sustainability strategy, the objective of spatial planning is to support the development of offshore wind energy utilisation. This comprises the provision of sufficiently dimensioned areas for achievement of the development objectives mentioned in the strategy as well as safeguarding of an orderly conduction of the electricity produced in offshore wind parks through the sea in the direction of land.
- Uses such as exploitation of non-living resources, laying cables and pipelines as well as research are to be given enough space and security for further development, and at the same time to retain sufficient flexibility for not yet foreseeable future developments. Based on this background, for one thing designations will be made for mentioned uses; and for another thing, wide portions of the EEZ will be kept free of designations. For instance, the concerns of the fishing industry – for which a stipulation of spatial categories is not possible on account of the EU's regulatory competence and the lacking definability of fishing grounds – can also be taken into consideration.

Moreover, a contribution to the protection of the marine environment as a valuable natural and open space shall be provided not just by the planning safeguard of NATURA 2000 areas. Special consideration of the marine environment is to be given when other uses formulate demands concerning the marine area.

9.1.2 Relationship to other relevant plans and programmes

The Maritime Spatial Plan for the German EEZ concerns single-stage planning, i.e. it is neither derived from overriding plans nor does it provide specifications for subordinate plan levels. The approval level immediately follows the spatial development planning.

However, it is important to consider other plans and analyses in or adjacent to the analysis area. This particularly applies to the stipulation of the preferred area for wind energy “Northern Borkum” according to § 3a Marine Facilities Ordinance (SeeAnlV), for which strategic environmental assessments have been carried out and which, after including further concerns and conclusive consideration on level of spatial planning have been adopted as priority areas in the spatial plan, as also stipulated by § 18 a para. 3 sent. 2 ROG 1998.

In addition, coordination processes are indicated with the federal states which have been active in the coastal waters on a regional planning basis. This is the case in the North Sea area for the State of Lower Saxony. After amendment of the State Regional Planning Programme (LROP) in July 2006 and as amended and promulgated on May 2008, the State of Lower Saxony is now making planning statements for the coastal waters. Also the draft of the regional development plan 2009 adopted by Schleswig- Holstein includes statements about the territorial sea. Coordination is also required with The Netherlands, which has presented the “Integrated Action Plan North Sea 2015” (*Integraal Beheerplan Nordzee 2015*).

9.1.3 Presentation and consideration of environmental protection objectives

Environmental protection objectives provide information on which environmental status will be targeted in the future (environmental quality objectives). Environmental protection objectives can be gathered in an overall display of the international, joint and national conventions or regulations which deal with marine environmental protection and on the basis of which the Federal Republic of Germany has advocated certain principles and obligated itself to objectives. These conventions or regulations serve as a specification for the pending arrangement of the Maritime Spatial Plan and the Environmental Report.

Specifications mostly ensue from:

- International conventions on marine environmental protection in which the Federal Republic is a contracting party
- Relevant EU directives and specifications particularly FFH-RL (Habitats Directive; Flora Fauna Habitat Directive; FFH Directive), Vogelschutz-RL (Birds Directive), WRRL (EU Water Framework Directive; WFD), MSRL, GFP (Common Fisheries Policy; CFP) as well as other objectives within the scope of the European Maritime Policy.
- National objectives which particularly ensue from the general outline and the principles of the ROG, the protection and preservation objectives of NATURA 2000 areas in the EEZ as well as the “Federal Government Strategy for Wind Energy Utilisation at Sea” within the scope of the Federal Government’s sustainability strategy.

The aforementioned environmental objectives will be taken into consideration in various ways within the Maritime Spatial Plan:

- Definition of guidelines regarding spatial development of the EEZ for implementation of environmental protection objectives
- Source-related regulations for environmental protection with regard to the individual uses
- Textual principles regarding protection and maintenance of marine nature and landscape
- Consideration of protected areas according to Habitats- and Bird Directives.

9.2 Description and assessment of environmental status

9.2.1 Seabed

The North Sea is a shallow shelf or marginal sea of the Atlantic Ocean with an average water depth of 94 metres. In general, it has a relatively structureless bottom relief, which is distinguished through a uniform depth increase averaging 25 to 35 metres in the southern North Sea to 100 to 200 metres on the continental slope in the northern region. In addition to the atmospheric influences, the seabed topography plays an important role in the circulation and mixture of bodies of water.

The North Sea basin has existed as a structural unit since roughly 16 million years, whereby its geometry is strongly influenced by tectonic processes and structures of the deeper bedrock. The essential elements of the bedrock are tectonic structures which are linked with fault zones as well as salt domes, which are important for the formation of deposits as petroleum and natural gas traps.

Several sea level fluctuations in the course of the great glaciations, which set in about 2.4 and 1.8 million years ago and ended about 10,000 years ago, characterised and shaped the seabed forms and sedimentary characteristics of the seabed. The present-day sedimentary distribution on the North Sea seabed is to a great extent an expression of this changeable sedimentation.

Four sub-areas are essentially demarcated on the basis of geological conditions:

The sub-area **“Borkum & Norderney Reef Ground”** encompasses the region of the Borkum and Norderney Reef Ground between the two sea traffic separation areas “German Bight Western Approach” and “Terschelling – Western Approach”, and borders in the east on the 12 sea mile limit off Helgoland. The water depths lie between 18 metres in the southwest and 42 metres in the north. The spurs from tongue reefs on the southern edge of the sub-area, which run in a northwest-southeast direction and are subject to distinct sedimentary dynamics, are morphologically significant. Small-scale ripple fields in varying expression will be observed on the sand areas, which indicate recent sedimentary transport or sand rearrangement. The sedimentary distribution on the seabed in the area of actual Reef Grounds is characterised by medium-grain to coarse-grain sandy sediments, which are sporadically interspersed with gravels and head-size stones. Four seismostratigraphic units can be identified in the bedrock, which – on the basis of prior knowledge regarding the history of the origin of the North Sea – can be assigned to Holocene and Pleistocene sedimentary layers.

The sub-area **“Northern Helgoland”** extends from the 12 sea mile limit off North Friesland seawards to the east shore of the former Elbe Glacial Valley and ends in the north along the EEZ boundary to Denmark. The water depths range from 9 metres on the western edge of the Amrum Bank to 50 metres in the northwest of the sub-area. The western part is particularly distinguished through a relief which is very irregular for the conditions in the German Bight. In particular, the prominent submarine “Geestkante” (edge of superficial alluvial soil) along the Elbe Glacial Valley, the western rim of the Amrum Bank and the ridges in the northern region which extend from the Danish substratum into the German EEZ are to be mentioned. These autochthonous glacial ridges have the characteristic covering with residual and relict sediments (coarse sands, gravels and stones). Marginally dense fine to medium-grain sands appear between these residual sediment deposits, which are subject to constant rearrangement or lacking in places. In contrast to the “Borkum & Norderney Reef Ground”, a greater density of

stones on the seabed is to be observed in this sea area. In exceptional cases, the till within the residual sediment fields crops out directly on the seabed. The bedrock is passed-through to a varying extent by filled-in meltwater troughs and depressions. In addition to sands, clay, silt and gravel, peat is also found in these structures.

The sub-area **"Elbe Glacial Valley & Western Plains"** extends northwest from Helgoland to the German-Danish or German-Dutch EEZ boundary, but excludes the region of the so-called "Duck's Bill". The water depths lie between 30 and 50 metres. The seabed has a very balanced relief and is to a great extent level. It consists of fine sands with partially distinct concentrations of silt and clay. The determining element in the bedrock is the Elbe Glacial Valley on the eastern edge of the sub-area, which runs along the submarine Geestkante in a northwest or northern direction. This former, approx. 30 km wide valley is filled with an alternating stratification comprised of sandy and silty-agrillaceous sediments. The thickness of the sedimentary filling reaches a maximum of 16 metres. In the region of the adjacent western plains, thicknesses of 1 metre will only be exceeded in exceptions. As in the sub-area "Borkum & Norderney Reef Ground", the bedrock can be arranged in four seismostratigraphic units.

The sub-area **"Dogger Bank & Northern Shell Bank"** encompasses the region of the so-called "Duck's Bill", the oblong projection in the extreme northwest, which lies in the region of the central North Sea and extends to the EEZ boundaries to Denmark, Great Britain and the Netherlands. The seabed morphology is characterised by the Dogger Bank, whose northeast spur, the "Tail's End", crosses the sub-area as a submarine ridge. The seabed is in general relatively devoid of structure and consists mainly of fine sand covering with appreciable concentrations of silt and clay. The Dogger Bank contains a Pleistocene core of solid clay which has local gravels and stones, and can reach a thickness of several tens of metres. Glacial troughs, which are filled with clays, appear in the bedrock on the southeast boundary of the Duck's Bill. In the northwest slope area of the Dogger Bank, the Holocene layer of sand thins out or is completely lacking in places.

The status assessment was made for the aspects "Rarity/Threat", Diversity/Characteristic" and "Naturalness". Since the sediment types and soil forms are found throughout the North Sea, the aspects of Rarity/ Threat will be assessed as slight. In the North Sea EEZ, one comes across a medium "Diversity/Characteristic", which is reflected in the form of a heterogeneous sedimentary distribution and deficient soil forms or homogeneous sedimentary distribution and distinct soil forms. On account of anthropogenic changes, which do not lead to loss of ecological functions, however, a medium "Naturalness" will be assumed.

Pollutants

Pollutants in the soil, together with nutrients and pollutants in the water will be presented in Chapter 9.2.2.

9.2.2 Water

Marine physical properties

The North Sea is a relatively shallow shelf sea with a wide opening to the North Atlantic on the northern edge, so that the oceanic conditions in the North Sea will be influenced to a great extent through the interaction with the Atlantic Ocean. In the southwest, the Atlantic has a much lesser influence on the North Sea because of the shallow English Channel and the narrow Straits of Dover.

The currents in the North Sea consist of an overlapping of half-day tidal currents with the currents driven by wind and density. In the North Sea, an extensive cyclonic (anticlockwise) circulation generally predominates; this is associated with a strong inflow of Atlantic water on the northwest edge, and with an outflow into the Atlantic via the Norwegian Channel. The strength of the North Sea circulation depends on the prevailing barometric pressure distribution over the North Atlantic, which is parameterised through the North Atlantic Oscillation (NAO) Index.

In dependency on the NAO Index and the local wind field, 9 typical circulation models develop in the German Bight. The most frequent models are cyclonic circulation (approx. 45 %) with distinct inflow on the southwest edge of the German Bight and outflow on the north and/or northwest edge, discordant anti-cyclonic circulation (approx. 10 %) and a variable current model (25–30 %), which is occasionally characterised by eddy structures.

Six further categories are of secondary importance, with frequencies of clearly under 10 %. In general, the chronological variability of the current model is relatively high. Occasionally the circulation models change from day to day; generally they have a permanence of only a few days. But phases of more than 12 days will also be observed for the cyclonic model.

In the climatological annual course (1950-1986), the highest wind velocities in the inner German Bight appear in November (with about 9 m/s) and then decrease to 7 m/s up until February. In March, the velocity reaches a local maximum of 8 m/s, only to rapidly decrease afterwards and to stay at a flat level of about 6 m/s between May and August, before around mid-August it also rapidly increases to the maximum in late autumn.

This annual course is based on monthly averages and is transferable to the height of the waves. The directional distribution of the waves analogous to wind direction with the unmanned lightship (ULS) *Deutsche Bucht* (German Bight) shows a maximum from WSW and a second maximum from ESE. At the North Sea Buoy II (55°N, 6°20'E), the significant wave height in the 5-year average amounts to 1.6 metres with a maximum of nearly 10 metres.

In the winter months, the climatological monthly averages of the surface temperature in the first approximation show a coastal-parallel gradient of colder water near the coast ranging towards warmer temperatures in the central North Sea, which reverses in the spring and autumn. In the summer, the shallower area near the coast warms up stronger than the deeper central North Sea. The lowest temperatures appear in February. The summery warming starts in April/May and reaches the maximum in August. The cooling phase starts in September. The most extreme temperatures will always be observed in the shallow coastal region. This is vertically intermixed throughout the year. Starting in May, a thermal stratification with increasing incident radiation develops. The maximal range of the stringently layered region is reached in June. The analogy to the course of the 20-30 m depth line is remarkable. The tidal current friction becomes effective from this region. It prevents that a stable stratification builds up over the shallower area. The so-called "tidal mixing fronts" are created in this transition region between layered and vertical homogeneous water. Starting at the end of September, the German Bight is once again completely intermixed in the longstanding average.

The salinity also shows a coastal-parallel gradient in the climatological average. Here the salt content increases year-round with increasing distance from the coast. The low salt contents in the estuaries of the Elbe and Weser rivers are conspicuous, with minimal values of approx. 12 in the months January, April and December as a consequence of increased fresh water runoffs. If one follows the position of the 34-isohaline (line of equal salinity) over the year, it is recognisable that this shifts seawards from April to August due to the diminished circulation. Since the rivers

permanently supply fresh water, the percentage of brackish water in the German Bight thus increases.

Haline stratification (salt content stratification) also forms on a seasonal basis with regard to the salt content. The area in the region of the Dogger Bank and the North Frisian tidal flats is vertically homohaline throughout the year and layered year-round in the area of the Elbe outflow due to the shallow water depths. From spring up until summer the layered area spreads further in a north-northwest direction, whereas the remaining area is only occasionally layered (depending on the meteorological conditions and the runoff rates of the rivers).

In the German Bight, frontal zones originate in the transition zone from fresher and lighter coastal water to heavier and more saline North Sea water. Infrared photographs show that these transition zones consist of a system of smaller fronts and eddy, with typical spatial scales ranging between 5 and 20 km. Furthermore, the system is subject to considerable chronological variability, with time scales of 1 to about 10 days. In dependency on the meteorological conditions, the runoff rates from the Elbe and Weser rivers and the circulation conditions in the German Bight, continuous dissolution (frontolysis) and formation (frontogenesis) of frontal structures comes about. Discrete frontal structures can only be observed over longer periods of time with extremely calm weather conditions.

In the German Bight there are thermal fronts whose position can be determined with the help of a stratification parameter. This divides the German Bight into two areas: the outer area shows the typical seasonal stratification for the North Sea (see above); the inner area is thermally vertically homogeneous. Between the areas lies a frontal system brought about through tidal current turbulence, the aforementioned tidal mixing front. This thermal frontal system overlaps the river plume fronts with strong salinity gradients, which have their origin in the mainland runoffs from the Elbe, Weser and Rhine rivers. An accumulation of inorganic and organic material, and thus also an accumulation of metabolites, comes about on these fronts through convergence.

There is no regular formation of ice in the eastern North Sea during the winter. The nature and lasting quality of the general weather conditions prevailing over Europe and the input of relatively warm and saline Atlantic water in the North Sea are responsible for this. But with stable east weather conditions the sea can rapidly cool down. The extent and duration of the ice cover in the eastern North Sea depend on the number, strength and length of cold spells and the time of their occurrence. Usually, a very strong icing takes place after an early start of winter and long-lasting frost only at the end of January to mid-February. Ice only forms very rarely in the open German Bight. The open waters off the North and East Frisian Islands are ice-free in two thirds of all winters. In the longstanding average, the edge of the ice extends to directly behind the islands and into the estuaries of the Elbe and Weser rivers. Slush and ice floes can be observed far west and northwest of Helgoland in approximately 8 % of all winters. Usually the ice in the North Sea coastal area melts away by the third February decade. In very ice-heavy winters in which the maximum of icing is first reached by mid-February, the last ice remnants only dissolve at the end of March.

With regard to suspended matter, it is to be stated that this consists of mineral and/or organic material. The organic portion of suspended material is strongly dependent on the season; the highest values appear during the plankton bloom in early summer. In the event of stormy weather conditions with high seas, the suspended matter contents in the entire water column strongly increase through the whirling up of ground sediments. Increases of suspended matter content by up to ten times the normal values are easily possible during the passage of severe storms.

Time series of suspended matter concentration show a distinct half-day tidal signal. On average, the tidal current transports the water about 10 sea miles seawards, or in the direction of the coast. Accordingly, the high suspended matter content is also constantly exported. Furthermore, suspended matter is constantly input from the rivers and from the southeast coast of England. In the tidal flats landwards of the East and North Frisian Islands and in the large river estuaries, the concentration amounts on average around 50 mg/l with extreme values >150 mg/l. Further seawards the values rapidly decrease to 1 to 4 mg/l. Eastward of 6° E there is an area with increased suspended matter content. The slightest concentrations with values around 1.5 mg/l appear in the 'Duck's Bill' and over the sand areas between the Borkum Reef Ground and the Elbe Glacial Valley.

The monthly climatology of the high-water levels near Cuxhaven for the period 1971–2000 shows a weak annual course for the reference value of 150 cm designated as "average high water". The variability of high-water levels in the autumn and winter months significantly exceeds those in the spring and summer. This high spread of high-water levels in the winter months documents the considerable influence of meteorological factors, under which the wind plays a pre-eminent role. Since the air pressure differences over the North Sea are basically weaker in the summer and consequently light-wind weather conditions prevail, the water-level fluctuations here are primarily dominated by the tides.

With regard to the assessment of the long-term increase of the average water level on the German North Sea coast, an increase of 15 cm/100 years ensues for the overall period from 1965 to 2001, and of about 19 cm/100 years for the period 1965 to 2001 .

Nutrients and pollutants

On the one hand, the mass balance of the North Sea is determined through natural processes and balances, but is also burdened through human activities. Pollutants from agriculture, industrial production and commerce will be transported into the sea via atmosphere and rivers. Wastewater from sewage plants and the direct runoff of surface waters polluted through fertiliser and pesticide leads to an increased input of nutrients, heavy metals and non-natural organic chemicals.

Many of the compounds and elements released and entering into the North Sea have long retention periods in the marine environment. They will only be degraded with difficulty and slowly eliminated from the environment. So they have – intensified through their accumulation in the food chain – a high potential to accumulate in marine organisms and to have a negative effect on their immune system, reproductive ability and metabolism.

In addition to the toxicological aspects of the chemical burden of the marine ecosystem, special importance is attached to the nutrient mass balance of the sea. Nitrate, phosphate and silicate are essential components of the natural mass balance in the sea, without which biological growth is impossible.
A prerequisite for the assessment of the ecological status of the North Sea is a precise as possible knowledge of the spatial and chronological changes of the chemical parameters.

Nutrients
Industrialisation has led to a substantial increase of nutrient concentrations in sea water. The high inputs from various sources which are burdened with nitrogen and phosphorus compounds as well as atmospheric nitrogen input (agriculture, industry and traffic) are one of the main problems. Increased nutrient inputs can lead to increased plankton growth (extensive algal

bloom) and cause shifts in the species spectrum (toxic algae). A surplus of nutrients can bring about oxygen deficiency situations, amongst other things.

The BSH carries out several monitoring surveys a year to monitor the nutrients and oxygen contents in the German Bight.

The nutrient concentrations show a typical annual course with high concentrations in the winter and lower concentrations in the summer months. All nutrients show similar distribution structures. A gradual concentration decrease is to be observed from the river estuary to the open sea. The nutrient input through the Elbe River is clearly discernible.

The January analysis will be utilised for trend statements, since the biological activity is the slightest at this time and the remineralisation of the biomass of the previous summer is nearly completed.
A significant decrease of phosphate is to be recorded because of the ban on detergent containing phosphate and the reduction of mineral fertiliser. But whereas the reference value from 1936 still has not been reached in the coastal area, the values in the open sea have matched the reference values from 1936. The concentrations of nitrogen compounds are retrograde, but these compounds still provide the greatest contribution towards the overall nutrient load.

Metals
Although substantial advances have been made in the past decade in waste gas and wastewater purification, even today – above all near the coast, i.e. in spatial proximity to the emitters – metal concentrations which lie substantially above the background values are still being measured. They particularly enter into the marine environment via the rivers and the atmospheric transport. However, emissions at sea – e.g. through the increasing shipping traffic and other offshore activities – are also of importance. The introduction of industrial waste was of historic importance.

In the spatial distribution pattern and the chronological development of metal contents in the German EEZ, the influence of inflows from the German river systems and the river systems lying further westward and the metal loads transported with them are clearly discernible.
The influence of the Elbe River is particularly distinct. The metal contents in the fine-grain fraction of the surface sediments caused through human activities, above all in the coastal area, have for the most part been declining since the start of regular monitoring. One exception is the area southeast of Helgoland under the direct influence of the Elbe River, in which some metals have again shown clearly increased concentrations since 1999.

The dissolved metals show a typical spatial distribution with low concentrations in the outer German Bight and an increasing gradient in the direction of the coast. Whereas above all the metals zinc, mercury, copper and cadmium clearly exceed the background values near the coast, with salt contents greater than 34 concentrations in the range of the background values are measured in the open North Sea.

Organic pollutants
The majority of organic pollutants are of anthropogenic origin. About 2,000 mainly industrially-produced substances are currently seen as environmentally relevant because they are poisonous (toxic) or persistent in the environment and/or can accumulate in the food chain (bioaccumulation). Since their application and their utilisation can be extraordinarily varied, and their physical and chemical properties can also be very different, their distribution in the environment is dependent on a multitude of factors. For these reasons the various pollutants in

the sea show very different concentrations and distributions. Despite environmental protection measures taken in the past and the utilisation restriction for many substances, a great number of organic pollutants are still being verified in the North Sea.

Within the scope of its monitoring surveys the BSH has presently determined up to 120 different pollutants in the sea water, in suspended matter and in sediments. Since the Elbe River is the main input source for most of the pollutants in the German Bight, the highest pollutant concentrations (which generally decline towards the open sea) are generally present in the Elbe plume off the North Frisian coast. At the same time, the gradients for non-polar substances are particularly strong, since these substances will be mainly adsorbed (attached) to suspended matter and will be removed from the water phase through sedimentation. This is why the concentrations of non-polar pollutants are usually very low beyond the coastal regions rich in suspended matter. For instance, the chlorinated hydrocarbons hexachlorobenzene (HCB), polychlorinated biphenyl (PCB) and DDT, but also the polycyclic aromatic hydrocarbons (PAH) show such a distribution. However, many of these substances will also be introduced into the sea through atmospheric precipitation or have direct sources in the sea (e.g. PAH inputs through offshore industry and shipping). The PAH usually show a substance spectrum that indicates combustion residues of fossil fuels (coal, oil, wood) as the source. The loading of the water through petroleum hydrocarbons is marginal, although numerous acute oil contaminations through shipping are verifiable on the basis of visible oil slicks. Most hydrocarbons stem from biogenic sources; traces of acute oil contamination will only be occasionally observed in the water phase.

A vast number of “new” pollutants (emerging pollutants) with polar characteristics in the environment have been verified in recent years through new analysis methods. Many of these substances (e.g. the herbicides isoproturon, diuron and atrazine) are found in much greater concentrations than the classic pollutants.

No robust trends can be indicated for most pollutants on account of high concentration fluctuations and relatively short observation periods. But a more long-term, clearer decline was determined for α and γ hexacyclohexane (HCH) concentrations in the sea water; this decrease can be attributed to application prohibitions for these pesticides. No trend has been recognisable in the past 15 years for PAH concentrations, yet a seasonal influence with maximum values are observable in the winter. Some herbicides and insecticides also indicate strong seasonal concentration fluctuations.

Although lipophilic (fat-soluble) pollutants in the sediment are found in ca. 10^4 to 10^6–fold concentrations than in the sea water, statistical connections (correlations) with sources or chronological trends can hardly be determined. The distribution of pollutants is mainly influenced through sedimentary properties, so that the highest concentrations will be measured at stations with relatively high silt portions (e.g. in the Elbe estuary and the White Bank). In comparison, very slight pollutant content will be observed at sandy stations.

According to present-day state of knowledge, there are no direct dangers to the marine ecosystem based on the observed concentrations of most pollutants in the sea water. An exception is the load through the tributyl tin (TBT) utilised in ship’s paint, whose concentration near the coast partially reaches the biological effect threshold. Furthermore, sea birds and seals can be affected through the oil films from acute oil contaminations floating on the water surface. The toxicity consideration of individual pollutants is insufficient during the ecotoxicological evaluation; on the contrary, the combined effect of the vast number of available pollutants has to be considered, which can possibly be intensified through synergy effects.

Radioactive substances (radionuclides)
The radioactive load of the North Sea has been characterised for decades through the discharges of reprocessing plants for nuclear fuels. Since these discharges are very slight nowadays, the radioactive load of the North Sea does not present any danger for man and nature according to the present-day state of knowledge.

9.2.3 Phytoplankton and zooplankton

Plankton encompasses all organisms which float in the water. Plankton includes plant organisms (phytoplankton) and small animals or developmental stages of the life cycle of marine animals such as eggs and larvae (zooplankton). These mostly very small organisms constitute a fundamental component of the ecosystem. Zooplankton has a pivotal role in the marine ecosystem as a primary consumer of phytoplankton and moreover as the lowest secondary producer within the marine food chain. Bodies of water constitute the habitat of plankton. This is why a precise demarcation of habitats (other than for benthos, for instance) is only very restrictively possible for plankton.
In the German EEZ there is a lack of long-term series. Only the long-term data series “Helgoland Roads”, which has provided data since 1962, is to be mentioned from the region of the German Bight.

Previous findings on the phytoplankton and zooplankton in the North Sea can be summarised as follows:

Changes in the entire North Sea ecosystem are to be noted:
- Slow changes after the beginning of the 1980’s, abrupt change after 1987/88

Changes of phytoplankton involve:
- Increase of dinoflagellata and decrease of diatoms
- Reduction of the late-summer diatomaceous bloom
- Increase of phytoplankton biomass and extension of growth phase
- Aperiodic and unpredictable appearance of toxic algal bloom
- Introduction of non-indigenous species, from which some algal blooms can be brought about

In addition to the aforementioned changes in the overall region of the North Sea, the following has been determined particularly in the German Bight (Helgoland Reede):
- The temperature has increased by 1.12 ℃ since 196 2.
- The spring diatom bloom appears on a delayed basis at the end of the first quarter if a warm winter quarter has preceded it.
- The non-indigenous thermophilic diatom species *Coscinodiscus wailesii* has slowly established itself since 1982 and even formed the spring bloom in 2000.

Changes of zooplankton in the German Bight encompass the following aspects:
- A slow change of the zooplankton has been taking place since the beginning of the 1990’s.
- The group of small herbivorous copepods has declined on the whole.
- Organisms which serve as food for fish larvae have accelerated their start of growth, whereby the growth phase of many species has extended overall.
- The species composition has changed and the number of non-indigenous species has increased.
- Many non-indigenous species have already become established, whereas many area-typical species have declined, among them such which belong to the natural food resources of the marine ecosystem

- The dominance conditions within the zooplankton group have changed, whereby the merozooplankton has increased.

The changes of phytoplankton and zooplankton are connected with the changes of the entire North Sea ecosystem In addition to the natural variability, these changes are due to anthropogenic influences and climate change.

9.2.4 Biotope types

Water depth, sediments and coastal distance as well as production and availability of food are the key factors in the development of biotope types in the German North Sea EEZ.

From a nature conservation point of view, special importance is attached to natural biotope complexes ("mosaics") such as residual sediment deposits, which are particularly found in the region of the east slope of the Elbe Glacial Valley (Sylt Outer Reef) and on the Borkum Reef Ground. Gravel fields, coarse, medium and fine sand areas – yes, sometimes even in small depressions substrates (generally only a thick silt layer, which will be remobilised again depending on hydrodynamic conditions) – are associated with these biotopes. This structural diversity (together with the protection through the stones) gives rise to a large species diversity overall.

In the German North Sea EEZ, the biotype types – 1110 "Sandbanks" and 1170 "Reefs" – to be protected according to EU law (FFH Directive, Annexe 1) have been identified up to now.

To date, several sandbanks worthy of protection have been ascertained from a nature conservation point of view. The Dogger Bank and the Amrum Outer Bank are large sandbanks. According to a nature conservation viewpoint, the Borkum Reef Ground is an example of a sandbank with stone fields or stony-gravelly areas as reef-like structures. Typical sandy soil communities which develop in dependency on sediment type (fine, medium and coarse sand) and the water depth have been found here. Areas in which various communities alternately appear next to each other appear to be particularly worthy of protection. Large areas of the identified sandbanks "Dogger Bank" (DE 1003-301), "Sylt Outer Reef" (DE 1209-301) and "Borkum Reef Ground" (DE 2104-301) have been listed as FFH areas by the EU Commission for these reasons.
Reefs have also been found in some areas in the EEZ. Areas in the region of the Borkum Reef Ground, the eastern slope of the Elbe Glacial Valley as well as the Helgoland Stone Ground are to be particularly mentioned here. These areas lie for the most part in the above listed FFH areas.

An identification of the habitat type 1180 "Submarine structures made by leaking gases" has not been successful up to now in the area of the German North Sea EEZ.

Furthermore, species occurrence (populations) and habitats in the German North Sea EEZ to protect and to develop have been regionally identified according to OSPAR recommendations (OSPAR Agreement Ref. No. 2004-06). With regard to the populations of the Icelandic cyprine (*Arctica islandica*) it is to be stated that the Icelandic cyprine could be identified in modest abundances (frequencies) in vast parts of the North Sea (see Chapter 2.6). Habitats of sea pens (*Pennatularia*) and of deep-burrowing megafauna occasionally appear in the north of the German Bight in the Elbe Glacial Valley and in the western German Bight.

9.2.5 Benthos

Benthos encompasses the community living on the substrate surfaces or in soft substrates on the seabed, whereby the animals which mainly reside in (endofauna) or on the bottom (epifauna) are described as zoobenthos.

Based on the strong bonding of macrozoobenthos to the sedimentary structure in conjunction with the water temperature and the hydrodynamic system (currents, wind and water depth), seven natural spatial units in the German EEZ in the North Sea have been defined. Here this concerns:

A Eastern German Bight (North Frisian EEZ)
B Elbe Glacial Valley
C Southwest German Bight (coastal East Frisian EEZ with Borkum Reef Ground)
D Northwest German Bight (offshore East Frisian EEZ)
E Transition region between German Bight and Dogger Bank
F Dogger Bank
G Central North Sea north of the Dogger Bank

A total of approximately 1,500 macrozoobenthos species are currently known in the North Sea. Of those, roughly 800 will be found in the German North Sea region. A total of 670 species were able to be identified in the German North Sea EEZ through topical studies (2000 – 2005) of macrozoobenthos within the scope of the Federal Government's research projects and various offshore wind energy park projects. Most species are attributed to the Polychaeta (Diantennata) with 215 species, followed by the Crustacea (molluscs) with 183 and the molluscs with 143 species.
For the natural spatial units of the German EEZ , extensive data records are available for the natural spatial units a – d and f. The identified number of species range from 209 (Dogger Bank) to 393 (Southwest German Bight, coastal East Frisian EEZ with Borkum Reef Ground).

With regard to the threat of macrozoobenthos, it is to be stated that 14.7 % of the total ascertained species (98 of 670) show a threat category according to the Red List. To be emphasised are the endangered species (Cat. 1) *Upogebia deltaura* and *Upogebia stellata* as well as *Alcyonium digitatum, Buccinum undatum, Neptunea antiqua, Tridonta montagui* and *Urticina felina*, which are strongly endangered (Cat. 2). The percentage of Red List species in proportion to the total number of species of the respective natural regions lies between 14.8 % in the Natural Region D and 19.9 % in the Natural Region
B.
In the overall view, the Mollusca show the most endangered species (32). However, the percentage shows that the Echinodermata represent the most endangered group, since 57.7 % of the identified Echinodermata species in the EEZ are listed in the Red List

The largest regions in the EEZ are occupied by the *Amphiura filiformis* community, the *Tellina fabula* community as well as the *Nucula nitidosa* community; the *Bathyporeia Tellina* community is to be particularly found on the Dogger Bank. The *Nucula nucleus* community occurring on an isolated basis in the deep troughs in Helgoland coastal waters has strongly changed in the past decades. In addition to the area of the Borkum Reef Ground, the variants of the *Gondiadella Spisula* community frequently associated with stone reefs and stone fields particularly appear east of the Elbe Glacial Valley. The *Myriochele* community found in the transition region to the central North Sea north of the Dogger Bank is widespread there beyond the German EEZ. However, this community is unique for German waters.

Based on the current state of knowledge, it is to be stated in summary that the macrozoobenthos

of the German EEZ in the North Sea is to be regarded as average with regard to the utilised criteria Rarity and Threat as well as Diversity and Characteristic. This assessment is supported by the fact that a total of 172 species are listed in the “Red List and Species List of Soil-Dwelling Invertebrate Animals in the German Sea and Coastal Area of the North Sea”. The 172 species represent over 20 % of the total population size. In the current studies in the EEZ, 98 Red List species (see Table 14) have been identified, which represent approx. 14.7 % of the total identified species (670). Furthermore, no Cat. 0 (missing or extinct) species and only two endangered species (Cat. 1) were able to be identified. Five more Cat. 0 species and seven more Cat. 1 species have been listed. The species inventory of the German EEZ in the North Sea with its currently identified 670 macrozoobenthos species (without fishes) is also to be regarded as average, because a total of approximately 1,500 macrozoobenthos species are known in the North Sea at present, and roughly 800 will be found in the German North Sea region. The benthos communities also do not show any special features, because the main structuring natural factors for the composition of the macrozoobenthos in the German Bight are the water temperature, the hydrodynamic system (currents, wind and water depth) and the resulting sedimentary composition. Commensurate with the predominant sediments, the largest regions are occupied by the *Amphiura filiformis* community, the *Tellina fabula* community as well as the *Nuculanitidosa* community. The *Goniadellaspisula* community predominates in coarse sandy regions. In the German EEZ in the North Sea, the *Bathyporeia Tellina* community is restricted to the Dogger Bank. But their occurrence extends throughout the German EEZ. The *Myriochele* community connects north of the Dogger Bank and is widespread beyond the German EEZ. The *Nucula nucleus* community occurring on an isolated basis in the deep troughs in Helgoland coastal waters represents a special case. The species of this community have further stable populations on the Norwegian or British coast. All in all, no outstanding importance is to be attached to the benthos community found in the region. 6 benthos communities found in the North Sea are characterised through frequently represented key forms. But this does not mean that their respective species inventory is restricted to individual communities. Only the frequencies are characteristic; however, the individual species are also thoroughly present in the other communities. This is why one cannot differentiate these communities in their significance; on the contrary, all communities would have the same importance. With regard to the criterion “Naturalness” it is to be additionally stated that the benthos deviates from its original status on account of preloads (eutrophication, pollutant discharge and fishing industry). Especially to be emphasised in this connection are the destruction of the ground surface through intensive trawling activity, which causes a shift from long-lived species (mussels) to short-lived rapidly reproducing species. This is why today neither the species composition nor the zoobenthos biomass corresponds to the status which would be expected without human utilisations. In this sense the North Sea no longer has any undisturbed natural areas.

The individual consideration of the natural spatial also does not lead to any divergent status assessment of the macrozoobenthos. The percentage of Red List species in the respective total population ranges from 14.8 % (Natural Region D) to 19.9 % (Natural Region B). However, the different study effort can be causative for these differences. For fishes there is a general connection between the number of identified species and the pursued fishing effort.

9.2.6 Fishes

Fishes represent the most well-known group of marine fauna, and populate the seas from the surface down into the deep-sea trenches, where they have adapted to the respective prevailing habitat conditions.

Fishes are amongst the most important biological marine resource due to their commercial

utilisation. But this commercial utilisation, which is accompanied by an intensive fishing industry, also has significant negative consequences for the fish stocks. Amongst other things, these consequences are particularly conspicuous in the composition of the demersal (bottom living) fish community. For instance, the demersal fish community of the North Sea at the beginning of the 20th century was distinguished through a greater diversity than today's fish community.

According to recent studies, the fish fauna of the North Sea consists of 200 to 224 fish and lamprey species (including summer visitors and accidental visitors), of which about 30-40 fish species will be commercially exploited. According to current studies in the German EEZ as well as studies which have been conducted within the scope of environmental impact studies (EIS) for the wind park projects in the region of the EEZ), a total of 106 fish species have been identified in the German EEZ in the North Sea of which 28 species (approx. 28 %) show a threat category according to current Red List. To be emphasised are the endangered species (Cat. 1) *Alosa alosa* (allis shad), *Salmo salar* (Atlantic salmon) and *Trachinus draco* (weever fish) as well as *Alosa fallax* (red herring)*, Labrus bergylta* (Ballan wrasse)*, Lampetra fluviatilis* (river lamprey)*, Petromyzon marinus* (sea lamprey), *Salmo trutta* (sea trout) and *Zeus faber* (John Dory), which are strongly endangered (Cat. 2).

A regional classification of fish communities is contingent on various environmental parameters. For instance, the availability of food and hydrographical parameters such as water temperature and salinity play an important role in the survival and reproduction of many fish species. The water depth and the oxygen content of the sea water encompass other important habitat characteristics, and the sedimentary composition of the seabed plays a particularly important role for the demersal fish fauna. Recent studies revealed a gradual change of fish communities from the coastal to the offshore regions due to the hydrographical regime, so that they make the following classification:

(1) Areas in the influence zone of channel waters (study area Borkum Reef Ground, priority area Northern Borkum and east slope of the Elbe Glacial Valley)
(2) Areas of the central North Sea (Dogger Bank, "Stepping Stone" Elbe Glacial Valley North and the then potential special suitability area Sylt)
(3) Areas in the influence zone of coastal bodies of water (study area Amrum Ground)
(4) The area „Stepping Stone" Elbe Glacial Valley Centre, which is juxtaposed between the two first-mentioned groups (study area "Stepping Stone" Elbe Glacial Valley Centre)

A separation into regions will be refrained from in the status assessment of the EEZ fish fauna, since mainly the water depth and the distance to the coast are the triggers for typical fish communities in the German Bight. A further classification into smaller faunistic areas is usually not possible, since significant differences in the abundances of the dominant fish species are not ascertainable through analysis of long-term data series. The reason for this is the mobility of these fishes, which leads to the fact that they are found everywhere.

The criteria which have already been proven in the environmental impact assessments relating to the offshore wind energy park projects in the Baltic Sea and North Sea EEZ will be cited for assessment of fish communities. This concerns the criteria such as rarity and threat, regional or national importance, diversity and characteristic as well as naturalness.

Based on the available data base, it is to be stated that the fish fauna of German North Sea EEZ is to be regarded as average to above average with regard to the criterion "rarity and threat". The assessment is justified through the fact that the percentage of Red List species in the total species population lies at 26.4 % below the overall value of 32 %. On top of that is the fact that only seven of the 28 Red List species are listed in the IUCN [International Union for the Conservation of

Nature and Natural Resources (The World Conservation Unit)] Red List (Atlantic salmon, sea trout, thornback ray, river and sea lamprey, dogfish and shad). On the other hand, four FFH species (shad, red herring, river and sea lamprey) which are the focus of Europe-wide protection efforts have been identified. The status of the fish population is assessed as average with regard to the criteria “regional or supra-regional” importance as well as “diversity and characteristic”. This assessment from recent projects and numerous environmental impact studies reveal that the demersal fish community found in the EEZ is dominated through a flatfish coenosis which shows two highly abundant small fish species with solenette and scaldfish. But with dabs and plaice they also represent two important fish species that are important to the fishing industry due to the high numerical abundance. Cod, whiting and herring are also amongst the most frequent fish species. The current findings and the comparison with bibliographical references show that the fish fauna of the EEZ is to be regarded as typical for the location (shelf region of the southern North Sea with predominantly sandy ground). With the occurrence of only seven fish species of the IUCN Red List the EEZ is also merely of average supra-regional importance. The assessment of the diversity of the fish population as average is based on the fact that the 106 fish species found in the EEZ constitute only approx. 50 % of more than 200 species presumed amongst the fish species spectrum in the entire North Sea. On account of the habitat-typical fish communities the characteristic also has an average importance, since the anticipated pelagic fish community represented through herring, bream and whiting have also been identified like the demersal fish community consisting of large fish species such as cod, plaice, flounder and dab.

With regard to the naturalness of fish population in the EEZ, it is to be stated that the fish fauna is affected by human activities, particularly fisheries. The use of the (comparatively) little dominant target species throughout the North Sea is managed in the context of the common fishery policy all over Europe by the EU.
In spite of the EU- management, the populations of some fish species are endangered. This particularly applies to demersal fish species (e.g. plaice). The plaice population of the entire North Sea (with a strength of 260,000 t) lies below the “safe biological limit” of 300,000 t. The populations of haddock and whiting are also over-caught. The situation with cod, whose hauls have continually declined under fluctuations since the 1980’s, is dramatic. This is why in the autumn of 2002 scientists recommended the discontinuance not only of targeted fishing activities in this way, but also all mixed fishing activities in which cod will be caught as by-catch. Meanwhile it is attempted to manage fisheries in a sustainable manner, concerning some species this goal is not achieved fully. But on the whole, the cod and other species whose populations are being over-caught are not endangered in their continued existence as a species.

Due to the fact that, according to the ICES, the fish species diversity (number of species per 300 hols; tapping- data of the International Bottom Trawl Surveys, IBTS) did not decrease for 40 years now, and that the fish stocks, used in a commercial manner, are subject to fluctuations, the “naturalness” of the fish fauna can be categorised as at least average.

9.2.7 Marine mammals

Three species of marine mammals are regularly found in the German North Sea EEZ: harbour porpoises, grey seals and common seals. The two seal species have their resting & breeding places on islands and sandbanks in the region of coastal waters. As a result of their high mobility, marine mammals are able to undertake long migrations in search of food, and thus to pursue their prey organisms (e.g. schools of fish) through large sea areas. The high mobility in dependence of the special conditions of the marine environment leads to a high spatial and temporal variability in the occurrence of marine mammals.

Based on the vast number of study programmes which have been conducted in the past years, particularly in German waters, the data situation with regard to marine mammals has substantially improved (MINOS, MINOS+, studies regarding the stipulation of sanctuaries, studies within the scope of ECS for offshore wind energy parks and procedures for stipulation of special suitability areas for wind energy).

The previous findings with regard to the occurrence and the status of the harbour porpoise population in the North Sea can be summarised as follows:

- The population in the North Sea has strongly declined in the past decades, mainly as a result of by-catch, decimation of fish stocks and food limitation
- There are no long-term data series in order to be able to estimate the trend development
- The abundance has remained stable in the period 1994 to 2005
- Since the beginning of the 1990's, the population has shifted from the northern into the southern North Sea
- The population shows seasonal distribution patterns, which are spatially as well as temporarily unpredictable, however
- Changes in the marine ecosystem have an effect on the population
- Threats for the population originate from a series of anthropogenic activities:
    - Fisheries (through by-catch and decimation of fish stocks
    - Marine environmental pollution (through introduction of organic and inorganic pollutants or oil accidents)
    - Eutrophication (through introduction of nutrients)
    - Shipping (mainly through acoustic emissions and collision danger
    - Acoustic emissions from other sources, such as research activities, military, construction activities

Threats for the population also originate from:

- Diseases (bacterial or viral origin)
- Climatic changes (impact on the marine food chain)

According to the current state of knowledge, the following also applies to the region of German waters:

- Abundance and distribution vary on an intraannual and interannual basis
- Seasonal distribution patterns are evident as well as seasonal abundance fluctuations
- The importance of various subregions can be estimated as follows:
    - Sub-area Western Sylt: high importance
    - Sub-area Northern Helgoland: mean importance
    - Sub-area in the offshore region north of the two traffic separation areas: mean importance;
    - Sub-area between the traffic separation areas Northern Borkum, mean importance, on a seasonal basis, even high importance in the spring
- By-catch represents the main threat
- Acoustic emissions through anthropogenic activities represent a potential threat, which can be reduced through mitigation measures

Changes in the populations of marine mammals are linked with changes in the entire ecosystem of the North Sea. In addition to natural variability, anthropogenic activities and climate change influence these changes.

9.2.8 Seabirds

In the German North Sea EEZ occur 19 sea bird species which are identified as seabirds on a regular basis and in larger populations. Several areas of German coastal waters and parts of the EEZ have national and international great importance for sea birds and waterfowl. In particular, the IBA (Important Bird Area) region “Eastern German Bight” and the Special Protection Area “Eastern German Bight” (EU bird sanctuary) stipulated by the regulation from 15 September 2005 are to be mentioned here.

Based on the large number of new study programmes, the data base with regard to seabirds was able to be expanded in the past years (MINOS, MINOS+, studies regarding the stipulation of sanctuaries, studies within the scope of environmental impact studies for offshore wind energy parks and procedures for stipulation of special suitability areas for wind energy).

The following seabird species according to Annexe I VRL (Birds Directive) are found in the German EEZ: red-throated diver (*Gavia stellata*), black-throated diver (*G. arctica*), little gull (*Larus minutus*), sandwich tern (*Sterna sandvicensis*), arctic tern (*S. paradisaea*) and common tern (*S. hirundo*). The following frequently found species and species of special importance for the EU bird sanctuary “Eastern German Bight” are also included: lesser black-backed gull (*L. fuscus*), black-legged kittiwake (*Rissa tridactyla*), common gull (*L. canus*), common guillemot (*Uria aalge*), razorbill (*Alca torda*), northern gannet (*Sulla bassana*), northern fulmar (*Fulmarus glacialis*) and great black-backed gull (*L. marinus*).

The previous findings in relation to the occurrence of seabirds which are also found in the southern North Sea or in the German EEZ can be summarised as follows:

- The populations show species-specific, seasonal distribution patterns
- Abundance fluctuations appear on an intraannual as well as interannual basis
- Distribution patterns of populations are spatially and temporarily not predictable
- Endangered species or species under protection occur regionally in varying distribution

Changes of the populations of seabirds are linked with changes in the entire ecosystem of the North Sea. Threats for the populations of seabirds originate from a series of anthropogenic activities:

- Fisheries: directly through catching in the nets or indirectly through decimation of fish stocks
- Eutrophication: indirectly through the marine food chains
- Marine environmental pollution: indirectly via accumulations of organic and inorganic pollutants in the marine food chains
- Oil pollution is a serious threat for resting birds and sea birds
- Shipping: disturbance mainly through speedboats and hydrofoils
- Getting caught in or swallowing waste
- Construction activities: directly through shipping and indirectly via disturbances of the marine food chains
- Structures such as platforms: directly through disturbance effect with loss of habitat and collision danger

Threats for the populations also originate from:

- Diseases (bacterial or viral origin)
- Climatic changes: indirectly via impact on the marine food chains

The previous findings in relation to the utilisation and importance of the sub-areas of the German EEZ in the North Sea for sea birds can be summarised as follows:

*Special Protection Area "Eastern German Bight" (*protected area according to the EU Bird Directive*):*

- High importance as a feeding, overwintering, moulting and resting habitat for the species found there according to Annexe I VRL, especially for red-throated diver, black-throated diver, little gull, sandwich tern, common tern and arctic tern
- High importance for the regularly occurring migratory bird species, especially for common gull, lesser black-backed gull, northern fulmar, northern gannet, black-legged kittiwake, common guillemot and razorbill

Sub-area Western Sylt and Northern Helgoland:

- Typical sea bird community of the southern North Sea
- Mean, intermittently also high importance as a feeding and resting habitat for ocean-going birds and scavenging sea birds
- Mean to high importance as a feeding and resting habitat for species living near the coast
- Marginal to mean importance as a feeding and resting habitat for brooding birds (Helgoland)
- Mean to intermittently high occurrence of endangered species and species particularly worth protecting
- Utilisation of sub-areas through fisheries and shipping
- The sea bird community is subject to the natural or anthropogenic-caused changes of the North Sea

Sub-areas between and north of the two traffic separation areas:

- Typical sea bird community of the southern North Sea
- Mean importance as a feeding and resting habitat for ocean-going bird species and typical scavenging sea birds
- Marginal to mean importance as a feeding and resting habitat for species living near the coast
- Marginal occurrence of endangered species and species particularly worth protecting
- Utilisation of sub-areas through fishing industry and shipping
- The sea bird community is subject to the natural or anthropogenic-caused changes of the North Sea

9.2.9 Migratory birds

Bird migration is usually described as the periodic migrations between the breeding area and a separate out-of-breeding-season residence area in which birds of higher latitudes normally maintain the winter quarters.

Surveys on bird migration across the southeast North Sea were already made on Helgoland in the 19th century. The ecological research in frame of many projects and environmental impact studies (EIS) on offshore wind park projects provide the most up-to-date data on bird migration across the German Bight. The continuous registrations of bird migration at the FINO 1 (platform) started in 2003 are to be particularly emphasised in this connection). In view of the spatial distribution of migratory bird events over the North Sea, a broad front migration is generally assumed, whereby the migratory intensity diminishes seawards. But for the masses of nocturnal migrating songbirds it is not clarified whether the intensity diminished with the distance to the coast. On the other hand, a decline with the distance to the coast is indicated with primarily diurnal migrating songbirds, since a lesser migratory intensity is to be recorded on Helgoland than on Sylt. This tendency is also corroborated for the shorebird migration through radar

registrations. The same seems to apply to waterfowl and wading bird migration.
According to the previous state of knowledge, the season northeast-southwest or southwest-northeast migration dominates on a broad scale. However, there can be certain differences in the migratory direction and in the degree of coastal orientation between diurnal and nocturnal migrants and different taxonomic groups as well as possibly between some nocturnal migrants (such as short-range or long-range migrants). Commensurate with expectations, the migratory direction ascertainable by means of radar in the offshore area in the autumn is primarily southwest-oriented and primarily northeast-oriented in the spring.
The migratory altitudes differ amongst taxonomic groups, the time of day and the method-related ability to record the migratory event or migratory altitude. At least approx. 20 % of the migration ascertainable by means of radar below approx. 1,500 m altitude falls to an altitude of up to 200 m in the autumn. In the spring, the portion of the migration at this altitude turns out to be smaller. The migration above 1,500-2,000 m constitutes only a small portion of the migratory events). But the migratory altitude distribution can vary strongly between individual nights, and is evidently strongly influenced by current weather conditions, wind direction and strength as well as cloud altitude and. The ascertainable diurnal migration of 92 considered species of sea, coastal and predatory birds was at an altitude of 200-500 m (on average with 87.9 %) in the height band of ≤ 50 m.

Bird migration across the German Bight is verified year-round by means of various methods (radar, sea watching, migratory call recording), but in which strong seasonal fluctuations occur. The dominant nocturnal migration is particularly distinct in the spring (from mid-March to May) and in the autumn (October/November). In the spring, more than 50 % of the migrations ascertainable by means of radar were determined in only 11 nights; in the autumn of 2003 and 2004 more than 50 % of the migrations fell on five of 31 or 6 of 61 measuring nights. Lesser intensities are ascertained from December – February and from June – August. Half of all birds peregrinate in 5 – 10 % of all days.

The migratory intensity follows a distinct daily rhythm. The visible migration is strongest in the first three hours after sunrise, but clearly diminished around midday as well as in the last three hours before sunset. The expression of this rhythmicity can vary in relation to site and season. In the spring (on Helgoland and Sylt) as well as in the summer and winter (Helgoland) it was less distinct than on Wangerooge or Sylt.
The majority of the migrations ascertainable by means of radar occurs at night, and also emerge during the light phase in the first three hours after sunrise. In the afternoon hours the activity subsides slightly and increases significantly about an hour after sunset. Then it reaches its highest level of activity before midnight; in turn, the activity diminishes in the second half of the night into the morning.

The migratory events are strongly influenced by weather conditions on a large scale and locally. They likewise have effects on other migratory parameters such as the altitude distribution or speed above ground. The complex relations can only be generally addressed in the following:

- *Large-scale weather conditions, temperature and migratory intensity*
  In particular, general weather conditions can increase the migratory intensity. Autumn migration occurs earliest with increasing air pressure, lower or dropping temperature and lower humidity. On the other hand, low temperatures impede the migratory events in the spring; but after sustained cold spells it can set in strongly with relatively low temperature increases. Weather factors have a corresponding effect on the local migratory activity.

- *Wind*
  According to comparative studies under inclusion of EIS data, migration in the offshore area

is verified with wind strength up to 8 on the Beaufort. But then the intensity is very weak. In the spring as well as in the autumn, an increase of migratory intensity is accompanied by increasing tailwind or increasing tailwind components. In turn, excessive tailwind leads to a decrease of migratory intensity. The slightest migratory intensity occurs with strong headwind. Wind also influences the migratory altitude distribution, with a greater portion of low-flying birds during stronger headwind or high-flying birds during weak headwind and tailwind. However, the flight altitude decreases again with strong tailwind.

- *Rain – cloudiness – visibility*
  Precipitation, strong cloudiness and poor visibility are generally linked with a strong decrease of migratory intensity. In the main migratory period, the migratory intensity in the main migratory phase is strongly diminished after sunset if rain fell beforehand.
  Rain and possibly also a lesser portion of cloudiness leads to lowering of flight altitude. Towering stratus clouds will probably be flown under; in broken cloud layers the flight altitude can possibly also be spread in the gaps. Only a slight lowering of flight altitude has been determined with low cloud cover. After sunrise, an upward displacement of radar echoes was displayed with low cloud cover; on the other hand, downward with average height of clouds.

For assessment of the status of migrating birds, evaluation criteria will be applied, which have already been applied in the environmental impact assessments regarding offshore wind energy projects in the EEZ of the North Sea and Baltic Sea:

- Migratory routess and concentration areas (definition of concentration areas and routes for bird migration in the offshore area is not to be seen as small-scale due to lacking structures; an evaluation of this criterion has to take into consideration the large-scale course of bird migration in the North Sea)
- Migratory events and their intensity
- Number of species; the threat status of the migratory species is to be included

In summary, according to the current state of knowledge it is to be stated that several (10 – 100) million birds (max. 152 million) annually migrate across the German Bight. Songbirds, the majority of which cross the North Sea at night, represent the greatest portion. The masses of birds stem from Norway, Sweden as well as Denmark and to a lesser extent from Finland. The migration occurs as a broad front migration and is particularly typical for nocturnal migration, but also for diurnal migration. A decrease of intensity with the distance to the coast is indicated with primarily diurnal migrating songbirds as well as for the waterfowl and wading birds.
The species spectrum of the visible migration in the light phase in the region of the German Bight in 2003/2004 is numbered at 217 species. Other species which migrate at night are to be included. Based on the consideration of rare sightings in the past, more than 425 species were already able to be identified on Helgoland. Of the 95 bird species which are listed in Table 26, 88 bird species are listed in one or more of the following conventions and annexes regarding the protective status of birds in Central Europe:

- Annexe I of VRL (Birds Directive)
- 1979 Bern Convention on the Conservation of European Wildlife and Natural Habitats
- 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- AEWA (African-Eurasian Waterbird Agreement under the auspices of the Bonn Convention)
- SPEC (Species of European Conservation Concern): classification of Europe’s bird species according to the population percentage in Europe and the degree of threat through the organisation BirdLife International

Of these 88 species, 10 species (the barnacle goose, European golden plover, bar-tailed godwit, little gull, sandwich tern, common tern, little tern, black tern, barred warbler and collared flycatcher) are listed in Annexe I of VRL. Approximately 50 % are strictly protected according to the Bern Convention. For approx. 60% of these species, agreements must be made on their protection according to the Bonn Convention. 39 bird species are subject to AEWA and more than 50 % are assigned to an SPEC category. With regard to threat, it is to be mentioned that none of the 95 bird groups listed in the red lists of IUCN are globally endangered. Three species (the brent goose, scaup und lapwing) are considered endangered in all of Europe, and 30 species are endangered in Germany. Of these 30 species, the populations of the European golden plover, dunlin, common snipe, black-tailed godwit, black tern and collared flycatcher are threatened with extinction. The Northern pintail, red-breasted merganser, Kentish plover, lapwing and Northern wheatear are mostly endangered.

Anthropogenic factors contribute in many ways to the threat of the migratory birds. The highest mortality of migratory birds results from active hunting and collisions with anthropogenic structures (in particular tall structures), which applies mostly to nocturnal migrants.
In summary, it can be ascertained that guidelines and concentration areas of bird migration in the EEZ do not exist. The migratory intensity with estimated amounts of individuals of 40 to 150 million is immense, and it must be assumed that considerable portions of the population of songbirds that breed in Northern Europe migrate across the North Sea. The spectrum of more than 200 species that migrate across the North Sea every year can only be described as average in comparison to the 425 species that have been discovered so far on Helgoland over the years. A very high percentage, however, have an international protective status. For these reasons, the EEZ of the North Sea is of mean to above mean importance to bird migration.

9.2.10 Bats and bat migration

In Germany, occur 23 bat species with completely different distribution areas, resting preferences and populations. Among these 23 species, there are also some long-distance migrating species: the common noctule (*Nyctalus noctula*), Nathusius' pipistrelle (*Pipistrellus nathusii*), the parti-coloured bat (*Vespertilio murinus*), the common pipistrelle (*Pipistrellus pipistrellus*), the Northern bat (*Eptesicus nilssoni*), the lesser noctule (or Leisler's bat – *Nyctalus leislerii*) and the soprano pipistrelle (*Pipistrellus pygmaeus*). These are found in Germany and the neighbouring states of the North Sea and have occasionally been encountered on islands, boats and platforms in the North Sea.

In addition to echolocation, bats have special visual and passive acoustic abilities for perceiving their environment. It is assumed that visual perception plays an important part in orientation and navigation upon long-distance migrations and migratory movements of bats. For instance, the visual perception of prominent landscape elements (rivers, forest edges and coastlines) serve the bat for orientation and navigation along migratory routes. On the other hand, echolocation – the effective range of which is limited to very short distances (of approx. 100 m) – is used almost exclusively for foraging. In the cold seasons, these animals hibernate or migrate to habitats with suitable conditions for surviving the winter.

The migration of bats across the sea is largely unexplored, due to lack of suitable detection methods or large-scale special observation programmes. Unlike positive recordings from a bat detector on Helgoland, the recordings from the FINO I platform have so far delivered no evidence of the presence of bats. The existing data for the North Sea region are sporadic and insufficient for drawing conclusions about migratory movements of bats. From the existing data material alone, it is not possible to obtain conclusive insights into the migratory species, flying directions, altitudes, corridors or possible concentration areas. Quantification of bat migration across the North Sea is not possible at present.

In summary, the following can be stated of the bat populations of species relevant to the North Sea:

- Population and distribution of the migratory species are not conclusively recorded, above all due to the high migratory dynamics;
- There is a lack of adequate methods and observation programmes in order to be able to record and quantify migrations and migratory movements across the open sea

Based on previous findings on the potential bat migration across the North Sea, the following can be stated:

- Observations and single findings indicate that some species, such as the common noctule, Nathusius' pipistrelle, the parti-coloured bat and the Northern bat, migrate across the North Sea;
- It is assumed that broad-front migration takes place along prominent landscape elements, such as coastlines;
- Nevertheless, the species spectrum and migratory directions, altitudes, times and above all possible migratory corridors for bats in the North Sea are still largely unknown.

9.2.11 Biological Diversity

“Biological diversity” as defined by § 2 sec. 1 No. 8 of the Federal Nature Conservation Act (BNatSchG) comprises the diversity of habitats and communities, species and genetic diversity within species. The general public is mostly interested in species diversity. In the North Sea, intensive sea and fishing research has been taking place over the past 150 years, dealing with the animal and plant life. As a result, there are inventory lists and species catalogues that can be referred to in order to be able to document any changes. According to results of the Continuous Plankton Recorder (CPR), there are currently approx. 450 different plankton taxa (phytoplankton and zooplankton) that have been identified in the North Sea. Of the macrozoobenthos, a total of about 1,500 marine species are known. Of these, about 800 are estimated to be in the German North Sea region. The fish fauna of the North Sea comprises 224 fish and lamprey species. 189 species are attributed to the German North Sea. Three species of marine mammals appear regularly in the German EEZ. In the EEZ of the German North Sea, there are 19 seabird species, which are regularly found and occur in larger populations than resting birds.

With regard to the current state of the biological diversity in the North Sea, it must be said that there are lots of indications of changes in the biodiversity and the species composition at all systematic and trophic levels of the North Sea. In this connection, red lists of endangered animal and plant species have an important monitoring and warning function, since they reveal the state of the populations of species and biotopes in a region. From these red lists, it can be ascertained that more than 20 % of the macrozoobenthos species and around 32 % of the habitual cyclostomata and saltwater fish in the North Sea are endangered. The marine mammals are a group of species in which currently all representatives are endangered, where the bottlenose dolphin has already disappeared from the German North Sea region. All three regularly appearing species of marine mammal are under protection. Of the seabirds that regularly appear in the German EEZ, some are classified as endangered and are under protection. The changes can be traced back primarily to human activities such as fishing and sea pollution, and to climatic changes.

9.2.12 Interactions amongst subjects of protection

The components of the marine ecosystem, from bacteria and plankton to marine mammals and seabirds, influence one another through complex mechanisms. The highest components of the marine food chain are the so-called predators. The highest predators within the marine food chains are waterbirds, seabirds and marine mammals. In the food chains, producers and

consumers are dependent on one another, and influence one another in diverse ways. In general, the availability of food regulates the growth and propagation of species. The temporarily adapted succession or sequence of growth amongst the different components in the marine food chains is of critical importance. Predator–prey relations and trophic relations between size and age groups within a species or between species also regulate the balance of the marine ecosystem. Natural or anthropogenic influences on one component in the marine food chains can influence the entire food chains and upset or endanger the balance of the marine ecosystem.

9.2.13 Marine environment pollution and accumulation of pollutants in biota

Pollutants accumulate in the marine ecosystem over the marine food chains, starting from the lowest component – the phytoplankton. Besides the concentration of pollutants in the organisms, the accumulation or magnification of pollutants across the marine food chain is of major significance. In the German coastal waters of the North Sea, pollutants in the benthos (mainly in mussels) have been measured since the 1980s as part of the German National Measurement Programme (BLMP). These studies have revealed, for example, that the concentration of mercury in mussels decreases with increasing distance from the coast. This trend towards lower mercury concentration at greater distance from the coast has also been confirmed in other benthic organisms. Fish, being secondary consumers within the marine food chains, accumulate pollutants in much higher concentrations than mussels. In earlier years, heavy metals, in particular cadmium, lead and mercury, have led to high pollutant loads in fish. The accumulation of pollutants in fish and higher consumers in the marine food chains occurs – unlike water and sedimentation enrichment –with a delay. Direct correlations between dominant events of pollutant introduction into the sea and accumulation in the food chains are therefore difficult to determine. The load of pollutants in fish weakens the immune competence of fish and promotes the outbreak of fish diseases and parasite afflictions. Marine mammals in the North Sea are also highly loaded with organic and inorganic pollutants. Alarming concentrations of pollutants have been found in marine mammals, especially lipophilic, persistent and bioaccumulative substances such as PCBs or DDT. In seabirds, impairment of reproductive ability and physical conditions has already been proven.
Results so far overall make it clear that measures for reducing pollution must continue to be maintained and intensified. In particular, the effect of organic pollutants within the food chains are still not adequately understood.

9.2.14 Natural scenery

The seascape is characterised by a large free space structure. The natural scenery is largely unaffected by disturbances. There are currently only a few tall structures in the EEZ of the North Sea. These are platforms required for obtaining raw materials, or measuring masts for research purposes. Being a long way out at sea, however, these are not visible from land.

9.2.15 Tangible assets, cultural heritage (archaeology)

References to possible tangible assets or cultural heritage are at hand insofar as the spatial locations of a vast number of wrecks are known and are recorded in the BSH nautical charts.

9.3 Prospective development in the event that the plan is not implemented

At present, numerous uses are being pursued or planned in the EEZ, which

- are authorised, approved or planned, as particularly in the realm of raw material extraction or wind energy utilization,

- enjoy special rights according to UNCLOS, such as shipping, laying and operation of pipelines and research,
- fall under the regulatory authority of the EU (fishing industry),
- Or to which no regulation for §18a ROG 1998 (vgl. § 17 sec. 3 ROG) (military exercises) applies

If the plan is not implemented, these uses would continue to be practiced in accordance with the respective legal grounds. The respective effects of the above mentioned uses on the subjects of protection are presented in the following subchapters.

9.3.1 Presentation of the uses in the EEZ

9.3.1.1 Shipping

Shipping takes place over the entire area of the North Sea, where there are some of the most intensively trafficked shipping routes in the world. Shipping and ports play an essential role in international trade. 90 % of foreign trade and more than 40 % of domestic trade in the EU is done by sea. In 2005, for example, more than 68,000 movements of ships longer than 50 m were recorded in the German Bight alone.

The ship traffic in the German Bight predominantly follows east–west routes (in both directions) parallel to the German and Dutch coastal waters. Here, the ship traffic is concentrated on three traffic separation schemes: the German Bight Western Approach (GBWA) and Terschelling German Bight (TGB) in the EEZ, and the Jade Approach in the coastal waters.

According to analyses of WSD Nordwest, a total of 5,529 oil, gas and chemical tankers were counted in the two traffic separation schemes TGB and GBWA in. Monitoring of ship traffic is ensured by the Wasser- und Schifffahrtsverwaltung with the help of the automatic ship identification system (AIS).

Shipping activities result in the production of nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles; nitrogen oxides being considered the most critical emission components). Most of the nitrogen compounds emitted from shipping activities can enter the sea from atmospheric deposition. Also, the emission of heavy metals cannot be ruled out, but there exists no exact data on this.
Oil and pollutants also enter the sea directly due to shipping activities. The discharge of oil into the North Sea is strictly forbidden. Only a discharge of oil from the machine room bilge at a dilution of 15 ppm is permissible, as long as additional control mechanisms are applied. In addition to tank washes, which are permitted at sufficient dilution in the EEZ, oil can also enter the protected water and sediment in the event of shipping accidents.

The international MARPOL convention governs, among other things, the handling of oil-containing residues, chemicals, wastewater and ship's waste. International regulations also contribute towards protecting the seas from environmental pollution from shipping. The international environmental regulations are being continually redeveloped and adapted to new requirements.

Older ship paints release in particular the organic tin compound tributyl tin (TBT) into the water column. TBT is used mostly in so-called anti-fouling paints on ship hulls and underwater surfaces. There, this biocide prevents the growth of epibionts (e.g. algae, mussels, anthozoa and tunicate, crustaceans and annelids). The mechanism of action of most conventional anti-fouling paints is based on a continual leaching of TBT or other toxic compounds into the surrounding aquatic environment.

According to Directive (EC) No. 782/2003 of the European Parliament and of the Council, from 14 April 2003 on the prohibition of organic tin compounds on ships, organic tin compounds that act as biocides in anti-fouling systems may no longer be applied on ships sailing under the flag of a Member State. As of 1 January 2008, ships that approach the port of a Member State may not bear anti-fouling systems that contains organic tin compounds with biocidic action – unless they are given a covering coat that prevents the escape of this compound from the underlying non-conform anti-fouling.

In addition, non-indigenous species are introduced into the North Sea and German Bight with the exchange of ballast water and also as those clinging to the ship hull. Currently, the Ballast Water Convention is being implemented: the propagation of non-indigenous species shall be prevented with the development of suitable technical solutions for treating ballast water, which shall be used on ships starting from 2009.

By their very nature, shipping operations contribute towards the increase in the background noise level in the sea. Depending on the type of ship, the intensity and frequency of the noise input ranges from approx. 158 dB re 1 µPa (source level) and 0.1 kHz from fishing vessels up to 169–190 dB re 1 µPa (source level) and 0.06 to 0.43 kHz from tankers and freight ships.

9.3.1.2 Exploitation of non-living resources

Sand and gravel extraction

Sand and gravel extraction currently takes place to a limited extent in the German North Sea. In the EEZ of the North Sea, the areas for sediment extraction are limited to the sea region north of Helgoland. In the licenced exploitation areas “White Bank” and “OAM III”, only sand and gravel extraction is permitted. In this case, a suction dredger with a drag head typically 2 m wide runs over the extraction field several times, for degradation and navigational reasons, until the maximum permissible degradation depth of 2 m, at a dredger tolerance of 0.6 m, is reached. As a rule, about 2 m to 4 m wide channels of max. 2.6 m depth are created, between which untouched seabed remains.

This substrate-retaining degradation technique is intended to ensure resettlement of the original seabed fauna in relatively short timeframes). Rocky terrains within a distance of 500 m from the exploitation are excluded. In the case of selective sediment extraction, the gravel sands are sieved on board and the unneeded fraction (sand or gravel) is returned to the site.

When extracting marine sediments, a sediment/water mixture is lifted on board the suction dredger. Given the overflow of mud, or when returning parts of the transported material in the case of selective extraction, a vane of turbidity is created in the water column, depending on the sediment concentration.

A large range of physical and chemical changes of the ground and water take place due to sediment dredging: substrate removal and changing of the bottom topography, changing of the hydrographic conditions, formation of vanes of turbidity, remobilization of chemical substances and sedimentation of suspended materials. Sand and gravel extraction also results in increased shipping traffic and noise emissions due to the shipping operation and dredging work.

Extraction of hydrocarbons

In the German EEZ, the production platform “A6-A” has been in operation since September 2000 for extraction of natural gas. The platform stands in 48 m deep water and is about 300 km from

the German North Sea coast. It is a six-legged, steel framework construction with pile foundations (jacket construction). The weight of the jacket is 1,500 t, and the weight of the superstructures mounted on top of this is 3,000 t (see also www.wintershall.com).

Three wells were bored in order to tap the gas reservoir. Additional wells at the location of the A6-A, which are intended to serve the further development of the field, were approved by the Landesbergamt Clausthal-Zellerfeld (now the Landesamt für Bergbau, Energie und Geologie, LBEG) and have been completed.

Well boring leads to so-called drill cuttings, which is debris arising from drilling through the stone above the deposit, and which these days is carried off by so-called drilling mud. When drilling, a comparably more environmentally friendly water-based mud is employed, or wherever the drilling necessitates, oil-based mud. Drill cuttings and adhered water-based muds are introduced into the sea. Drill cuttings produced with oil-based muds are disposed of on land.

Due to the nature of operation, there is notable substance input resulting from the introduction of production and splash water, wastewater from the treatment plant and due to shipping traffic. The production water consists essentially of deposit water (formation water), which naturally contains the components that exist in the deposit, such as salts, hydrocarbons and metals. As the age of a deposit increases, more and more production water is carried along with the gas. The production water can contain chemicals that, among other things, can be applied to improve the delivery or to prevent corrosion in the delivery units. The production water is introduced back into the sea after state-of-the-art treatment and in adherence to national/international introduction standards.

9.3.1.3 Pipelines and submarine cables

Pipelines

Currently, the German EEZ of the North Sea is already traversed by seven pipelines. As a rule, pipelines are laid on the seabed in the EEZ of the North Sea. When crossing traffic separation areas, they must have a sediment cover of at least 60 cm. Crossings with other existing or planned pipelines are secured with rock fill (course-grain gravel, rubble). When there is ample loose sediment, pipelines dig their own way into the seabed as a result of natural sand movement. Given the natural sedimentary dynamics, they can either be completely covered with sand or exposed.

As a rule, in sections where this self-burial is not possible according to the results of the foundation exploration, either a 0.5 m deep trench is dug before laying (“pre-trenching”), or the pipeline is laid on the seabed and secured with rock fill.

In the case of “pre-trenching”, sediment is piled up like walls a few decimetres high along the trench, which is carried away and levelled off after laying by hydrodynamic forces. When digging the trench, the silt and clay fraction is introduced into the bed water and is distributed in the bed water depending on the existing current conditions (speed and directional stability). The resuspended sediments in the vicinity of the pipeline are carried and deposited at different distances depending on the grain size: these distances have been determined to be significantly less than those for the sedimentation of turbidity vanes during sand and gravel production. The concentrations of resuspended, particulate material are at a comparable order of magnitude to natural resuspensions of sediments caused by storms.

The “post-trenching” method, i.e. laying the cable on the sandy seabed followed by pile jetting (filling), has so far not been used in the EEZ of the North Sea.

Hydraulic pressure with sea water is carried out in order to test the pipeline tightness. For this purpose, sea water is generally treated with biocides (as antifouling agent) and oxygen reducing agents (so-called “scavengers”). After the treated water has been pumped out of the pipeline, a drying agent is used to remove the remaining seawater from the pipeline. Typically, treated seawater and drying agent are introduced into the sea near the coast at an appropriate dilution. In exceptional cases (e.g. when laying a pipeline bypass), this can also occur in the EEZ, where in these cases, given the shorter pipeline segments concerned, significantly lower volumes of treated seawater arise.

Laying, maintenance, repair and dismantling of pipelines all lead to increased ship traffic. Also, sediment vanes build up along the pipeline trench. The whirling up of sediments can lead to resuspension of sediment-bound pollutants. There are also noise emissions and possibly pollutant emissions that can result from the works. Work on laying, dismantling, maintaining and repairing pipelines is local and temporary.

Submarine cables

Submarine cables serve either for telecommunications or for transmitting electric power. The German EEZ of the North Sea is already traversed by many telecommunications cables. The NorNed high-voltage direct current transmission cable that shall transmit power from Norway to the Netherlands and spans the EEZ from north to south, has been placed in April 2008 and commissioned in Mai 2008. Moreover a series of electricity conducting submarine cables are planned that shall connect the planned offshore wind parks in the EEZ to the power grid infeed points on land.

As a rule, submarine cables are laid in the sediment using a flushing blade, as long as there is flushable material (sand) on the path. At sections where the geological makeup and seabed conditions forbid this laying method, the cable system is laid on the seabed, as for pipelines, and secured with rock fill.

Laying, maintenance, repair and dismantling of submarine cables all lead to increased ship traffic. Also, sediment vanes build up along the pipeline trench. The whirling up of sediments leads to resuspension of sediment-bound pollutants. There are also noise emissions and possibly pollutant emissions that can arise. Work on laying, dismantling, maintaining and repairing submarine cables is local and temporary. The same applies to maintenance work and repairs.

Normal operation can lead to warming of the sediment in the immediate vicinity, depending on the cable type and load. Electric and magnetic fields can be induced in the immediate vicinity of the undersea cables due to the very nature of their operation.

9.3.1.4 Marine scientific research

Basic and applied research is currently taking place in the EEZ of the North Sea in the form of monitoring measures. Until recent years, fishing aspects were at the centre of research activities in the EEZ. Over the past few years, however, greater effort has been put into research projects into the future use of the EEZ such as offshore wind energy, undersea cabling, mariculture and exploitation of natural resources. For example, the effects of offshore wind energy plants on mammals and birds , have been researched under the projects MINOS, MINOS+ and BEOFINO. In order to stipulate marine protected areas according to EU-VRL and FFH-RL, large-area mapping has been performed as a part of research projects. Furthermore, biological data have been gathered in the planning areas of the EEZ by applicants in the scope of proposed projects subject to UVPG [Environmental Impacts Assessment Act] approval.

- Research activities are currently being performed by the universities of the coastal cities and many other establishments.

In the scope of the research activities, one must generally expect additional ship traffic.
In particular, the activities involved in fishery research take place over wide areas. Seabed dragnets, which generally penetrate a number of millimetres to centimetres into the seabed, are employed on the sandy beds of fishing research areas.
Water and sediment samples are taken regularly in the EEZ for monitoring (BLMP) nutrients and pollutants. Hydrographic parameters (among other things temperature and salt content) are measured using probes. Also, BSH operates automatic measuring stations (MARNET). The measuring platform FINO I is currently being operated in the scope of research programs into the development of offshore wind energy production. Other measuring platforms are still currently being planned. Also currently in the planning is an offshore testfield, the first offshore wind farm alpha ventus, which shall be constructed by BMU together with the Stiftung Offshore-Windenergie and various power suppliers. Ecological research will be performed alongside the construction and operation of the test field, which is located about 45 km off the island Borkum.

Benthos, marine mammals, seabirds and migratory birds have so far only been studied as part of research projects. Benthos samples are taken by grippers or dredges. Also, seabirds, migratory birds and marine mammals are only recorded as part of research projects by ship- and aeroplane-based surveys.

The seabed composition is generally researched over large areas by hydroacoustic methods (side-scan sonar, multi-beam echo sounder, seismic methods). Also, sediment point samples are taken by gripper or as cores in order to determine the sedimentary characteristics.

9.3.1.5 Offshore wind energy

Offshore wind energy production is a newly developing form of use in the EEZ. By April 200p, 18 offshore wind farms with 1257 turbines had been approved for the German North Sea EEZ, although none of these have yet been realized. The first wind farm anticipated to be realized in 2009 is the project “alpha ventus” in the priority area “North of Borkum”, with 12 installations, as a test field project of the Stiftung Offshore Windenergie. The areas of the approved projects vary from 30 to 65 km², with a maximum of 80 installations each – which is currently the maximum number of facilities in a single offshore wind farm. The area taken up by a single turbine is between approx. 50 m² and 2000 m², depending on the type of foundation. The distance between the individual installations shall be 750 m to 1,000 m. The choice of wind farm configuration shall be project- and location-specific, so that the operating efficiency can be coordinated with safety concerns for shipping and marine environment.

The types of foundation mainly preferred are pile foundations in the form of monopile or multi-leg constructions. The multi-leg constructions that come into question include so-called tripod, tripile or jacket constructions. In addition to these, further developments of foundation variants, such as “tension legs” are conceivable on principle. Even the use of gravity foundations, which remain firmly on the seabed due to their own weight, is conceivable. The foundation elements are protected against scouring either by applying suitable scour protection in the form of rock fills around the individual elements, or by sinking the foundation piles appropriately deeper into the ground. Steel foundation piles are normally rammed into the ground. In the case of special ground conditions (e.g. presence of erratic boulders), or when using concrete piles, the foundations are built by first drilling into the ground. Another variant would be the so-called weighed or suspension foundations, which require no ramming or drilling, but which require a larger surface area.

The turbine and the foundation must be regarded as a single unit. All installations are equipped with towers, hubs and rotors with three blades each and horizontal axis turbines with uniform sense of rotation. In addition, there will be supply equipment on the facilities (including equipment and material storage, emergency gear). There are also oil capture systems planned for the OWEFs, in order to prevent pollution. Currently, OWEF types rated between three and six MW are being developed. The rotor diameter and the hub height vary for each OWEF type. The use of 5 MW facilities in particular is currently planned. These have a hub height of about 100 m and a rotor diameter of about 125 m.

An increase in shipping traffic in the respective facility areas is to be expected during the construction phase, given the presence of supply, erection and laying ships. Noise emissions must be expected as a result of the foundation pile driving, these being of differing duration and intensity depending on the methods employed. However, the building of the individual wind energy facilities will take place successively so that pile driving shall be local and temporary.

In the course of erecting OWEFs, the seabed will be stressed by the introduction of foundation elements and the internal farm cabling, and will be permanently sealed locally. In addition, these facilities will also influence the currents, and thus also scouring, on a small scale. Overall, changes in the substrate around the facilities are to be expected. The facilities – being tall structures – also alter the natural scenery.

By the nature of their operation, the wind energy facilities will produce noise emissions and vibrations. However, these would be produced at a much lower level compared to the construction phase. Light reflections and shadows thrown by the rotating blades are possible. The OWEFs and transformer stations will be marked in a particular colour scheme during the day, in order to be highly visible to ships and aircraft. During the dark phases, the facilities will be illuminated with beacons. For the safety of ships, sonar transponders and AIS identification are also planned.

When describing and evaluating the likely significant effects of the stipulation as priority areas for wind energy (see Chapter 9.4.5), the assessment presented here must be taken into consideration before the spatial development plan comes into force.

9.3.1.6 Fisheries and mariculture

Fisheries

Fishing, alongside shipping, is the most traditional use of the North Sea. The fishing haul has become increasingly larger through the development of special catching vessels and techniques. For example, the estimated total annual fish catch increased from approx. 1 million tonnes in 1910 to about 3.5 million tons by the end of the 1970s . The most commercially important species in the North Sea are the herring, cod, pollock, haddock, plaice, sole, sand eel, sprat and mackerel. Given the decline in fish numbers, however, and the regulatory measures, the yields are now dropping once more.

In order to protect the fish stocks, or to allow the regeneration processes, the EU is now defining the total allowable catches for each year as part of the common fishing policy. These are then divided among the Member States, so that each country shall have a given catch quota.

For fishing purposes in the EEZ of the North Sea, beam trawls are used most of all, which generally penetrate a number of millimetres to centimetres into the mostly sandy seabed. Ground dragnets can penetrate several centimetres to decimetres into softer seabeds,

whereupon a reduction of grain size in heavily fished areas cannot be ruled out. Many areas in the southern North Sea are ploughed three to five times a year by beam trawls.

During commercial fishing, even fish species that are of no interest for fisheries are caught in considerable numbers, which are sorted out after the catch and thrown overboard. This portion of the catch is generally referred to as discard. The by-catch and discard is extremely high for beam trawl fishing. Sole fishing especially involves very high discard quantities: for every kilogram of sole caught, there are ten kilograms of. The EU has taken measures to reduce the by-catch and discard.

Mariculture

Mariculture involves the production of fish, crustaceans (shrimp/prawns), molluscs (mussels) and algae in salt or brackish water under controlled conditions in special facilities. Mariculture is a growing market worldwide.

There is currently no mariculture in the German EEZ. Only in coastal waters of the North Sea are mussels grown in largely sheltered locations. Large quantities of nutrients can be released from mariculture facilities, since not all nutrients fed into the fish cultures are converted into biomass. In addition to the soluble excretory products of the culture, solid matter is distributed throughout the water column and, in the vicinity of the cage systems, lead to a constant increase in nutrient concentrations. Since microalgae cannot convert the nutrient supply quickly enough, excreted solids and uneaten feed pellets collect under the cages (depending on the currents), whereby local eutrophication effects can be observed. Due to the microbial breakdown of the substances, there is a danger of oxygen deficiency situations.
Intensive management in maricultures requires the use of medicaments to prevent and treat diseases to which the mass cultures are particularly susceptible. In addition to veterinary medical substances, disinfectants and antifouling substances are also used in mariculture. The substances introduced into the system can lead to contaminant pollution of the water.

Frequently, the species cultivated in mariculture are not indigenous species. If such cultivated organisms escape, there is a risk of them propagating. One example of this is the pacific oyster, introduced into German waters from mariculture. Yet, even the escape of indigenous species from cultivation facilities can endanger the environment in certain circumstances. Parasites from mariculture facilities can also be introduced into the marine environment

9.3.2 Seabed and water

9.3.2.1 Effects of uses on the subjects of protection seabed and water

Effects of shipping on the subjects of protection seabed and water

Shipping traffic leads to a diffuse input of pollutants. Nitrogen compounds contribute significantly to the eutrophication of the North Sea, which occurs primarily in waters near the coast due to additional excessive nutrient input from land.

Effects of exploitation of non-living resources on the subjects of protection seabed and water

In the approved exploitation area of the North Sea EEZ, only area-wide sand and gravel extraction is permitted. As a rule, about 2 m to 4 m wide channels of max. 2.6 m depth are created, between which the seabed remains untouched. A consequence of this exploitation technique is a relief of multiply crossing channels and original seabed, so that the near-bed

current model is altered. The fine grain portion (silt and clay) from the turbidity vane is greatly diluted and deposited on the seabed within a radius of approx. 500 m around the dredger ship. In the case of selective sediment removal, the returned sands or gravels sediment within a considerably smaller area.

The returned material is subject to the natural sedimentary dynamics to different degrees. While the gravel remains largely constant in location, the sands are subject to progressive sorting after sedimentation on the seabed. The finer sand fraction is more greatly relocated, whereas the coarser sand fraction remains in the area of the return line, and undergoes less relocation. The consequence is a change in the substrate; the original sediment type is made either finer or coarser depending on the returned fraction. Given the altered topography, the channels develop a trap action, in which the relocated – usually fine-grained – sand accumulates and permanently changes the substrate.

This change in substrate can lead to a change in several of the physiochemical parameters. With a change in grain composition comes a different penetration depth of oxygen. Oxygen is used in aerobic degradation of organic materials, where the exploitable sediments generally hold only a very small portion of organic substances. Given the low encumbrance with pollutants and the minor effects on the physiochemical parameters, which play a decisive part in the mobilization of pollutants, there is no appreciable release of pollutants from the sediment to be expected.

For the hydrocarbons industry, according to the plan approval decision of the Oberbergamt Clausthal-Zellerfeld (now LBEG) on establishing and operating the drilling and production platform A-6A[27], the following effects can be expected:

As a result of construction: the introduction of drill cuttings / drilling mud can lead to effects of compaction due to the increased load and to changes in the sediment material. Pollutants out of drill cuttings / drilling mud and from ship traffic can have an effect on the water. Water-soluble chemical additives in drilling muds can disperse immediately after introduction into the water body. Upon introduction of drill cuttings / drilling mud, temporary turbidity effects can appear.

As a result of the facility itself: repercussions can occur in the form of compaction of the seabed due to the foundation, pollution from paints and alteration of the currents around the platform.

As a result of operation: anti-corrosive paints, cladding materials, sacrificial anodes used for corrosion protection can give off pollutants in certain circumstances. The introduction of production water and wastewater from the treatment plant can lead to effects on the water and sediment.

Also, as a result of exploiting the natural gas reserve, a long-term subsidence of the seabed in the order of several meters can be expected, which has been described and predicted for the Norwegian and Dutch crude oil and natural gas fields.

Effects of pipelines and submarine cables on the subjects of protection seabed and water

In the EEZ of the North Sea, pipelines are generally laid on the seabed, whereas power cables are laid several decimetres deep into the seabed using a flushing blade. When there is ample

[27] *Planfeststellungsbeschluss des Oberbergamtes für das Land Schleswig-Holstein in Clausthal-Zellerfeld für die Zulassung des Rahmenbetriebsplanes für die Errichtung und den Betrieb einer Bohr- und Förderplattform in den Blöcken A6/B4 in der deutschen Nordsee*, 22 March 1999 - 21 - 23/98 VI- W 60004 Bh. 29 - III -

loose sediment, pipelines dig their own way into the seabed as a result of natural sand movement. Given the natural sedimentary dynamics, they can either be completely covered with sand or exposed.

As a rule, in sections where this self-burial is not possible on account of ground conditions, either a 0.5 m deep trench is dug before laying the line (pipeline or undersea cable) is laid on the seabed and secured with rock fill. The formation of turbidity vanes at seabed level is limited to an area that is considerably smaller than that measured for the sedimentation of turbidity vanes during sand and gravel extraction. The concentrations of resuspended sediment particles are at a comparable order of magnitude to natural resuspensions of sediments caused by storms.

Impression tests with sea water are carried out in order to test the pipeline tightness. Typically, treated seawater is introduced into the sea near the coast at an appropriate dilution.

Effects of scientific marine research on the subjects of protection seabed and water

Seabed dragnets, which generally penetrate a number of millimetres to centimetres into the seabed, are employed on the sandy beds of fishing research areas. This leads to the formation of turbidity vanes at seabed level, due to the whirling up of predominantly sandy surface sediments. As a result of the natural sedimentary dynamics, the drag tracks observed on the predominantly sandy seabed of the EEZ are generally not permanent.

The formation of turbidity vanes at seabed level and possible release of pollutants from the sediment is negligible on account of the relatively marginal fine grain (silt and clay) mantel, the low heavy metal concentrations and the prevailing currents.

Effects of offshore wind energy use on the subjects of protection seabed and water

In the course of erecting OWEFs, the seabed will be stressed by the introduction of foundation elements and the internal wind farm cabling, and will be permanently sealed locally. Setting offshore wind energy facilities and technical platforms into foundations, laying cables between facilities and making on-shore connections all lead to temporary whirling up of sediment and to the formation of turbidity vanes. Downstream in the vicinity of facilities, the incident flow around the piles leads to eddy formation, and thus increased turbulence and intensified vertical mixing. According to previous findings, given the planned distances between the facilities, lasting sedimentary rearrangements caused by currents will only emerge around each individual facility, and will not result in any extensive changes or effects.

Monitoring results for the Danish offshore wind park “Horns Rev” show that two years after erection of offshore wind energy facilities, no changes in the sedimentary characteristics in connection with the facilities were detected. On the contrary, the grain-size distributions in 2001 to 2003 reflect the natural sedimentary dynamics of the North Sea. Temperature measurements on a park-internal cable of the Danish offshore wind park “Nystedt” show that the sediment warming remained below the anticipated temperatures.

Effects of fisheries and mariculture on the subjects of protection seabed and water

For fishing purposes in the EEZ of the North Sea, beam trawls are used most of all, which generally penetrate a number of millimetres to centimetres into the mostly sandy seabed. Ground dragnets can penetrate several centimetres to decimetres into softer seabeds, whereupon a reduction of grain size in heavily fished areas cannot be ruled out.

Mariculture involves the production of fish, crustaceans, molluscs and algae in salt or brackish water under controlled conditions in special facilities. There is currently no mariculture in the German EEZ.

The use of maricultures, say in the form of mussel farms, would lead to deposition of faecal matter within the cultivation facilities.

9.3.2.2 Development of the subjects of protection seabed and water in the event that the plan is not implemented

Whether the plan is implemented or not, the subjects of protection seabed and water would continue to be strongly affected as described, through various approved or unapproved uses, such as raw material extraction or shipping. Developments exclusively in the case of non-implementation of the plan are described below.

Temporarily and spatially uncoordinated laying of submarine cables for diversion of energy obtained in the EEZ is to be expected if the plan is not implemented. This could lead to comparably high area usage, increased sedimentary rearrangements and thus aggravated detrimental effects on the subject of protection, as opposed to chronologically coordinated laying. Moreover, an increase in the number of cable crossings would be expected, which would necessitate the introduction of hard substrate. For instance, rock fills would also have to be added to areas with a predominantly homogeneous, sandy seabed.

The development of additional projects, according to the SeeAnlV, for the use of offshore wind energy could not be excluded in the NATURA2000 areas, if the plan is not implemented. The controlled and alleviated authorisation for projects at ecologically suitable locations, which are intended by the wind energy priority areas, would be omitted.

In the mariculture industry, one could expect an unregulated settlement of mussel cultures in the EEZ if the plan is not implemented. The nutrient and pollutant input these would produce could then have local effects on the subject of protection.

Since the plan makes numerous source-related stipulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of the seabed and water would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.

Furthermore, it is to be expected that the warming of waters already caused by climate changes will also continue in the future. The temperatures in the North Sea near Helgoland, for example, rose by 1.13 °C between 1962 and 2002. This also le ads to changes in the other subjects of protection. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.3 Phytoplankton and zooplankton

9.3.3.1 Effects of uses on the subjects of protection phytoplankton and zooplankton

Effects of shipping on the subjects of protection phytoplankton and zooplankton

Effects of shipping on phytoplankton and zooplankton can be summarized as follows:
Direct effects:

- Cross-regional, permanent effects caused by pollutant discharge, in particular oil residues, in the course of normal operation
- Regional to cross-regional, permanent effects caused by introduction of non-indigenous species with ballast water

Indirect effects:
The accumulation of pollutants resulting from normal shipping operation in phytoplankton and zooplankton, and passing on to other components in the food chains, up to the higher predators and man

- Changes in the species composition through repression of indigenous species and propagation of non-indigenous species
- Changes in available biomass, abundance and primary production of the ecosystem
- Changes in the marine food chains through non-indigenous plankton species and changing food quality
- Effects caused by accumulation in the marine food chains via the plankton on account of oil inputs or pollutant discharge can occur regionally to cross-regionally, temporarily or permanently.

Effects of exploitation of non-living resources on the subjects of protection phytoplankton and zooplankton

According to present knowledge, raw material extraction has no significant effect on the development of phytoplankton and zooplankton.

Effects of pipelines and submarine cables on the subjects of protection phytoplankton and zooplankton

According to present knowledge, the laying, operation or dismantling of pipelines and submarine cables also have no significant effect on the development of phytoplankton and zooplankton.

Effects of scientific marine research on the subjects of protection phytoplankton and zooplankton

See below for the effects of scientific marine research on the subjects of protection phytoplankton and zooplankton. Scientific research also has no significant effect on the development of phytoplankton and zooplankton, according to present knowledge.

Effects of offshore wind energy use on the subjects of protection phytoplankton and zooplankton

According to present knowledge, offshore wind energy has no significant effect on the development of phytoplankton and zooplankton.

Effects of fisheries and mariculture on the subjects of protection phytoplankton and zooplankton

The fisheries exert a strong influence on the entire marine food chains. The effects of overfishing go almost unnoticed at the bottom end of the marine food chains, with phytoplankton and zooplankton, and can only be recorded and quantified with difficulty. But it is precisely these indirect effects at the bottom end of the marine food chains that escalate into changes in the entire marine ecosystem, especially if these changes have an impact on the distribution and

abundance of primary production. The removal of important components from the ecosystem through overfishing or uncontrolled fishing interrupts the trophic interrelations within the marine food chains, which in turn leads to cascade reactions.
The settlement of maricultures can indirectly affect phytoplankton and zooplankton by deteriorating the water quality: pollutants, especially growth hormone preparations and antibiotics, can accumulate in plankton, and then impact higher predators such as the benthos, fishes, marine mammals and seabirds through the marine food chains.

9.3.3.2 Development of the subjects of protection phytoplankton and zooplankton in the event that the plan is not implemented

If the plan is not implemented, the subjects of protection phytoplankton and zooplankton would continue to be strongly affected as described, through various approved or unapproved uses, such as fisheries or shipping. Developments exclusively in the case of non-implementation of the plan are described below.

If the plan is not implemented, then the unregulated settlement of maricultures could lead to detrimental effects on the phytoplankton and zooplankton. Pollutants, especially growth hormone preparations and antibiotics, can accumulate in plankton, and then impact higher predators such as the benthos, fishes, marine mammals and seabirds through the marine food chain.

Since the plan makes numerous source-related regulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of the phytoplankton and zooplankton would be much more difficult to ensure if the plan is not implemented.

Furthermore, the effects of climatic change on phytoplankton and zooplankton are becoming ever clearer. Phytoplankton and zooplankton will in future be increasingly affected by the possible impacts of the climate change, in particular temperature, salinity and current changes. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.4 Benthos and biotopes

9.3.4.1 Effects of uses on the subjects of protection benthos and biotopes

Biotopes are the habitats of a regularly recurring species community. Detrimental impacts on biotopes have direct effects on the communities living in them. As such, the following remarks are limited to the effects of the uses on benthos communities.

Effects of shipping on the subjects of protection benthos and biotypes

Shipping can detrimentally impact the benthos as a result of oil disposal at sea, propulsion-related emissions, waste disposal, noise emissions, consequences of shipping accidents, input of toxic substances such as TBT and introduction of exotic species. The effects are cross-regional, and can be temporary or permanent. They can be summarised as follows:

- Cross-regional, temporary impact due to oil input, emissions and introduction of toxic substances;
- Cross-regional, permanent impact due to introduction of non-indigenous species.

Effects of exploitation of non-living resources on the subjects of protection benthos and biotypes

The significant effects of sand and gravel extraction on the marine benthos can be summarized as follows:

Direct effects:

- Temporary (short-term for opportunistic species; long-term for long-living species), regional (local) loss of individuals of the benthic infauna and epifauna due to substrate removal
- Temporary (short-term), regional (local) damage to individuals, eggs and larvae of benthic organisms caused by turbidity vanes
- Temporary (short-term), regional (local) damage to benthic organisms due to remobilisation of chemical substances
- Temporary (short-term) and regional (local) detrimental impact on development, or even loss of individual benthic organisms due to sedimentation and excess sand.

Indirect effects:

- Temporary (short-term), regional (local) loss of sediment for benthic organisms due to substrate removal, if the nature of the sediment is not altered by the dredging
- Permanent and regional (local) loss of settlement areas due to possible alteration of the hydrographic conditions
- Temporary (short-term) and regional (local) impact on the food supply for benthic organisms due to negative impact on the primary production (phytoplankton and zooplankton) as a consequence of remobilisation of chemical substances.

The conceivable damages to the benthos communities caused by offshore natural gas extraction platforms can be grouped into three classes. These are construction-related, facility-related and operation-related effects. Setting platforms into foundations leads to a detrimental impact on the seabed, whirling up of sediment and the formation of turbidity vanes. With the erection of platform foundations and scour protection, benthic habitats are built over and seabed life forms are damaged or destroyed. Furthermore, the construction of OWEF foundations provides an artificial, hard substrate for benthos communities, which allows species and living communities to settle in areas in which they were not previously found. Changes in the current conditions arise in the vicinity of the foundation structures, which can lead to changes in the local sediment composition, which in turn leads to changes in the benthos communities.
The operation-related ecological effects are above all the risks of pollutant emissions into air and water, in particular of oils, washing agents, lubricants and production water.
The significant effects of natural gas extraction on the marine benthos can be summarized as follows:
Direct effects:

- Local, short-term loss of habitat for the duration of installation of the foundations due to whirling up of sediment and turbidity vanes
- Short-term, local damage to individuals, eggs and larvae of benthic organisms caused by turbidity vanes
- Short-term, local detrimental impact on benthic organisms due to remobilisation of chemical substances
- Local, permanent loss of settlement areas as a result of introduction of platform piles, which necessarily take up space
- Local, permanent provision of an artificial, hard substrate due to the platform materials
- Local, permanent alteration of the sediment parameters due to the platform materials.

Indirect effects:

- Temporary, local impact on the food supply for benthic organisms due to negative impact on the primary production (phytoplankton and zooplankton) as a consequence of remobilisation of chemical substances

- Local, permanent changes to the benthos communities due to the attraction of mobile predators, given the increase in food supply.

Effects of pipelines and submarine cables on the subjects of protection benthos and biotypes

Turbidity vanes at seabed level can appear during the laying of pipelines and submarine cables, and local sedimentary rearrangements can occur, which can affect the benthos organisms. Since the pipelines in the North Sea EEZ are generally laid on the seabed, and then bury themselves over the course of time, the pipelines temporarily present an artificial, hard substrate. However, the pipelines are secured in sections by rock fill, which is a permanent artificial hard substrate. This artificial hard substrate presents the benthos organisms with a new habitat. Operation of power cables can lead to warming of the uppermost sediment layer of the seabed, which brings about a decrease in the winter mortality of infauna, and can lead to a change in the species communities in the area of the cable routes. The same also applies to electric fields. Electromagnetic effects do not appear to a significantly measurable degree with the planned power cables (triple-core, three-phase current cable or bipolar HVDC cable).

The significant effects of pipeline and undersea cable laying on the subject of the marine benthos can be summarized as follows:
Direct effects:

- Local, short-term loss of habitat for the duration of laying the pipelines and undersea cables due to sediment relocation and turbidity vanes.
- Short-term, local damage to individuals, eggs and larvae of benthic organisms caused by turbidity vanes during pipeline and submarine cable laying
- Short-term, local detrimental impact on benthic organisms due to remobilisation of chemical substances during pipeline and undersea cable laying
- Local, permanent loss of settlement areas as a result of the space taken up by the pipelines
- Local, permanent provision of an artificial, hard substrate due to rock fill
- Local, permanent potential influence on the benthos organisms due to sediment warming by undersea cables.

Indirect effects:

- Temporary, local impact on the food supply for benthic organisms due to negative impact on the primary production (phytoplankton and zooplankton) as a consequence of remobilisation of chemical substances during pipeline and undersea cable laying.

Effects of scientific marine research on the subjects of protection benthos and biotypes

The different activities of marine research are associated with different environmental impacts depending on the methods and equipment used.

The significant effects of research activities on the marine macrozoobenthos can be summarized as follows:

- local, temporary damage to or loss of individuals as a result of sampling.

Effects of offshore wind energy use on the subjects of protection benthos and biotypes

The construction and operation of offshore wind energy parks can have construction, facility and operation-related effects on the macrozoobenthos.

As a result of construction: Setting OWEFs and technical platforms into foundations leads to detrimental impact on the seabed, whirling up of sediment and the formation of turbidity vanes.

As a result of the plant itself: With the erection of OWEF and technical platform foundations and scour protection, benthic habitats are built over and seabed life forms are damaged or destroyed. Furthermore, lasting changes in the current conditions are to be expected in the vicinity of the foundation structures of the OWEFs, which can lead to changes in the local sediment parameters, which in turn lead to changes in the benthic fauna In addition, the introduction of foundation components presents benthos organisms with a new habitat – above all pollutant-free (particularly TBT-free) – which also makes it possible for species and communities to settle in areas in which they were not previously found, so that their distribution ranges can expand.

As a result of operation: As a direct result of internal wind farm cabling, the use of three-phase current cables can lead to warming of the uppermost sediment layer of the seabed, which brings about a decrease in the winter mortality of infauna, and can lead to a change in the species communities in the area of the cable routes. Nevertheless, the resistance-related loss of current will be marginal due to the short routes to the transformer station; and also the capacity of power-carrying cables of a wind park will not nearly be reached, given the amalgamation of only a few OWEFs into (cable) groups. With regard to the warming of sediment through power-discharging cables, the Federal Agency for Nature Conservation (BfN) favours a precautionary value of less than 2 K at 20 cm depth in the sediment. Given sufficiently deep laying, and in light of the fact that the effects will occur on a small-scale, i.e. a few metres on both sides of the cable, there are no effects on the benthos communities anticipated according to the current state of knowledge.
The same also applies to electric fields. Electromagnetic effects do not appear to a significantly measurable degree with the above-mentioned variant.

The significant effects of OWEFs on the marine macrozoobenthos can be summarized as follows:

Direct effects:
- Local, short-term loss of habitat for the duration of installation of the foundations and laying of cables due to whirling up of sediment and turbidity vanes.
- Local, permanent loss of settlement area due to the foundation of the OWEF, transformer station, scour protection and cabling (if cables are laid on the seabed), as a result of the space taken up
- Local, permanent provision of an artificial, hard substrate due to the OWEF foundations
- Local, permanent alteration of the sediment parameters due to the OWEF foundations.

Indirect effects:
- Local, permanent changes to the benthos communities due to the attraction of mobile predators, given the increase in food supply.

Effects of fisheries and mariculture on the subjects of protection benthos and biotypes

The entire German EEZ of the North Sea is used by fisheries. For the benthos, fisheries mostly affect the demersal fish species, since the equipment used to catch them includes those with parts that penetrate into the seabed, and plough it up to a depth of 1 m, thus damaging the animal communities that live there.

The effects of the fishing gear on the benthic communities can be classified into temporary and permanent effects:

- *Temporary consequences:* Many of the animals released from the fishing gear are injured or killed. Especially vulnerable here are the larger, hard-shelled representatives such as sea urchins or swimming crabs. Smaller benthos animals such as brittlestars and small, thin-shelled shellfish are hardly damaged.
- *Permanent consequences:* As a result of fishing activities, the mortality of sensitive species increases until only the opportunists are able to exist. At the same time, the species diversity diminishes. Those species that are not affected by the fishing gear increase in abundance to the extent that the sensitive species disappear from the biotope. The production of organic substance could initially increase, since the older, slow-growing specimens will be replaced through fast-growing, young specimens. Then, increasing trawling activity will kill off the younger animals also, with the result that production declines.

The significant effects of fishing on the marine macrozoobenthos can be summarized as follows:

- Loss of individuals, especially long-living and sensitive species, through the fishing gear
- Reduction of sessile epifauna
- Decrease in species diversity
- Shift in size spectrum of seabed fauna
- Habitat levelling due to the “fishing out” of stones.

With regard to mariculture, the following significant effects on the marine macrozoobenthos can be summarized:

- Cross-regional, permanent impact due to introduction of exotic species
- Regional, permanent impact due to increase in nutrient concentrations
- Regional, permanent impact due to increase in pollutant input
- Cross-regional, permanent impact due to increased density of parasites and pathogens.

9.3.4.2 Development of the subjects of protection benthos and biotypes in the event that the plan is not implemented

If the plan is not implemented, the subjects of protection benthos and biotypes would continue to be strongly affected as described, through various approved or unapproved uses, such as raw material extraction or fishing. Developments exclusively in the case of non-implementation of the plan are described below.

Chronologically and spatially uncoordinated laying of submarine cables for diversion of energy obtained in the EEZ is to be expected if the plan is not implemented. This could lead to comparably high area usage, increased sedimentary rearrangements and thus aggravated detrimental effects on the benthos and biotopes, as opposed to chronologically coordinated laying. Moreover, an increase in the number of cable crossings would have to be expected, which would necessitate the introduction of hard substrate. This could in turn lead to a shift or change in both the species spectrum of the benthos and in the biotopes.

The development of additional projects for the use of offshore wind energy could not be excluded in the NATURA2000 areas, if the plan is not implemented. The controlled and alleviated authorisation for projects at ecologically suitable locations, which are intended by the wind energy priority areas, would be omitted.

In the mariculture industry, one could expect an unregulated settlement of mussel cultures in the EEZ if the plan is not implemented. The nutrient and pollutant input these would produce could then have local effects on the subject of protection.

Since the plan involves numerous source-related regulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of the benthos and biotopes would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.

Furthermore, it is to be expected that the warming of waters already caused by climate changes will also continue in the future. This also affects the benthos. For example, it could result in the settlement of new species or to a shift in the species spectrum. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.5 Fishes

9.3.5.1 Effects of uses on the subject of protection fishes

Effects of shipping on the subject of protection fishes

The effects of shipping on fishes come about through oil disposal at sea, propulsion-related emissions, waste disposal, consequences of shipping accidents, input of toxic substances such as TBT and introduction of non-indigenous species. The effects can be summarised as follows:

Direct effects:
- Local, short-term effects due to visual disturbance
- Local, short-term damage including loss of individuals due to oil inputs
- Regional, short-term detrimental impact due to oxygen shortage situations
- Cross-regional, long term impact due to introduction of toxic substances (in particular TBT)
- Cross-regional, permanent impact due to introduction of alien species.

Indirect effects:
- Cross-regional, permanent impact due to biomass increase in benthic organisms.

Effects of exploitation of non-living resources on the subject of protection fishes

The following physical and chemical effects of sediment dredging, relevant to marine fish, are possible:
- Substrate removal and alteration of seabed topography
- Alteration of the hydrographic conditions
- Formation of turbidity vanes
- Remobilisation of chemical substances
- Sedimentation of suspended materials.

The significant effects of sand and gravel extraction on marine fishes can be summarized as follows:

Direct effects:
- Short-term, local loss of spawning ground of a few fish species due to substrate removal
- Short-term, local damage to eggs and larvae of marine fishes caused by turbidity vanes
- Short-term, local impairment of the development of marine fishes due to sedimentation and excess sand.

Indirect effects:

- Short-term, local impact on the food supply of fish larvae caused by impaired primary production (phytoplankton and zooplankton) and influences on the adult fish food supply (benthos organisms) due to remobilization of chemical substances.

The conceivable damages to fish communities caused by offshore natural gas extraction platforms can be grouped into those resulting from the construction, from the facilities themselves and from their operation.

As a result of construction: The construction works lead to noise emissions that frighten the fish, and when of excessive intensity can also lead to physiological damage of the auditory apparatus or other organs, with lethal consequences. The construction work also leads to stirring up of sedimentation and turbidity vanes, which can have adverse physiological effects and frightening effects – even if temporarily and to differing degrees for different species. Furthermore, spawning grounds and larvae can be damaged or killed off due to covering with sediment.

As a result of the plant itself: With the erection of platform foundations and scour protection, habitats are built over.

As a result of operation: Noise emissions and vibrations emanating from WEF foundations during operation can frighten or even allure fishes.

The significant effects of natural gas extraction on the subject of protection fishes can be summarized as follows:

Direct effects:

- Local, short-term loss of habitat due to frightening effect of noise emissions of construction equipment (ships, cranes, other vehicles)
- Local, short-term loss of individuals due to pollutant emissions
- Local, short-term loss of habitat for the duration of installation of the foundations due to whirling up of sediment and turbidity vanes.
- Short-term, local damage to individuals, eggs and larvae of fish caused by turbidity vanes
- Local, permanent loss of habitat due to area overbuilding
- Local, permanent shift/expansion of species spectrum due to settlement of species that normally inhabit hard substrates.

Indirect effects:

- Local, permanent shift/expansion of the nutrient spectrum and food availability for individual species.

Effects of pipelines and submarine cables on the subject of protection fishes

Turbidity vanes at seabed level can appear during the laying of pipelines and submarine cables, and local sedimentary rearrangements can occur, which can affect fish.

The generation of magnetic and electrical fields, which can have effects on individual fish species, cannot be ruled out during the operation of undersea cables. Nevertheless, magnetic effects during the operation of three-core, triple-phase current cables and bipolar DC cables can be neglected or ruled out, since the magnetic fields virtually cancel each other out.

The significant effects of pipeline and submarine cable laying on the subject of protection fishes can be summarized as follows:

Direct effects:

- Local, short-term loss of habitat due to frightening effect of noise emissions of construction equipment (ships, cranes, other vehicles)
- Local, short-term loss of individuals due to pollutant emissions
- Short-term, local damage to individuals, eggs and larvae of fish caused by turbidity vanes
- Local, permanent loss of habitat due to area overbuilding
- Local, permanent shift/expansion of species spectrum due to settlement of species that normally inhabit hard substrates
- Local, permanent potential influence on the migration of a few fish species due to operation of undersea cables.

Indirect effects:
- Local, permanent shift/expansion of the nutrient spectrum and food availability for individual species.

Effects of scientific marine research on the subject of protection fishes

The different activities of marine research are associated with different environmental impacts depending on the methods and equipment used.

The significant effects of research activities on the subject of protection fishes can be summarised as follows:
- Local, temporary damage to or loss of individuals as a result of sampling
- Regional, temporary loss of habitat due to noise emissions.

Effects of offshore wind energy use on the subject of protection fishes

The construction and operation of offshore wind energy parks can have construction, facility and operation-related effects on fish.

As a result of construction: The construction works lead to noise emissions that frighten the fish, and when of excessive intensity can also lead to physiological damage of the auditory apparatus or other organs, with lethal consequences. This applies in particular to explosion-like noises, such as those to be expected during pile driving. The construction work also leads to stirring up of sedimentation and turbidity vanes, which can have adverse physiological effects and frightening effects – even if temporarily and to differing degrees for different species. Spawning grounds and larvae can be damaged or killed off to a small degree due to covering with sediment.

As a result of the plant itself: With the erection of OWEF and technical platform foundations and scour protection, habitats are built over. As a result, the habitats of demersal fish are permanently lost. This loss of habitat, however, is limited to the respective immediate, local sites of the individual OWEFs and platforms.

As a result of operation: Noise emissions and vibrations emanating from OWEF foundations during operation can frighten or even allure fishes. The effects will probably be different for each different species. Furthermore, the electromagnetic fields originating from the cable connections can disturb the orientation of seabed-dwelling fish. This possibly concerns migratory fish species in particular, including the freshwater eel.

The significant effects of OWEFs on the subject of protection fishes can be summarized as follows:

Direct effects:

- Local, short-term loss of habitat due to frightening effect of noise emissions of construction equipment (ships, cranes, other vehicles)
- Local, short-term loss of individuals due to pollutant emissions
- Local, short-term loss of habitat for the duration of installation of the foundations due to whirling up of sediment and turbidity vanes.
- Short-term, local damage to individuals, eggs and larvae of fish caused by turbidity vanes
- Local, permanent loss of habitat due to area overbuilding
- Local, permanent shift/expansion of species spectrum due to settlement of species that normally inhabit hard substrates.

Indirect effects:
- Local, permanent shift/expansion of the nutrient spectrum and food availability for individual species.

Effects of fisheries and mariculture on the subjects of protection fishes

There are many different environmental effects that result from fisheries, and their effects are sometimes severe. The fundamental problem is overfishing on a large scale, extensive fishing fleets and excessive catch quotas. The by-catch of young fish additionally deprives the populations of the potential for reproduction, as almost the entire by-catch is thrown overboard as discard, and the majority dies. The result is that for half of the ten commercially most important fish species in the North Sea, the population sizes as evaluated by the International Council for Exploration of the are outside the “safe biological limits”.
With regard to mariculture, the following significant effects on fishes can be summarized:
- Cross-regional, permanent impact due to introduction of alien species
- Regional, permanent impact due to increase in nutrient concentrations
- Regional, permanent impact due to increase in pollutant input
- Cross-regional, permanent impact due to increased density of parasites and pathogens.

9.3.5.2 Development of the subjects of protection fishes in the event that the plan is not implemented

If the plan is not implemented, the subject of protection fishes would continue to be strongly affected, by the effects of fisheries in particular, since no influence can be exerted on the catch quota or possible catch prohibitions based on the regulatory authority of the EU.

If the plan is not implemented, a radical change in the present structure of the fish communities present in the North Sea would not be expected.
In the mariculture industry, one could expect an unregulated settlement of fish cultures in the EEZ if the plan is not implemented. In the event of disease outbreaks, an increased density of parasites and pathogens could also lead to an increased risk of transfer to natural populations in the waters in the vicinity of the facilities. The escape of cultivated organisms could also pose a problem, were they to mingle with natural conspecifics and be involved in reproduction. This could endanger genetic diversity. If fish species non-indigenous to the region escape and are able to establish themselves, they could repress indigenous fish species.
Since the plan involves numerous source-related regulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of

fishes would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.
Furthermore, it is to be expected that the warming of waters already caused by climate changes will also continue in the future. This also affects the subject of protection fishes. For example, it could result in the settlement of new species and the repression of indigenous fish species. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.6 Marine mammals

9.3.6.1 Effects of uses on the subject of protection marine mammals

Effects of shipping on the subject of protection marine mammals

Shipping can have effects on marine mammals, in particular due to noise emissions, introduction of pollutants during operation and the danger of collisions between animals and ships. In the extreme case, underwater sound from anthropogenic sources such as ship traffic can lead to physical injuries, and also disturb communication or lead to behavioural changes such as disrupting social behaviour and prey-catching behaviour or triggering flight behaviour. The significant effects of shipping on marine mammals can be summarized as follows:

Direct effects:
- Regional, almost continuous stress along very busy shipping routes due to noise emissions of varying intensity, depending on type of ship
- Regional, yet temporary stress due to noise emissions of varying intensity on various shipping routes
- Selective, accidental collisions with ships.

Indirect effects:
- Contamination with pollutants that also enter into the marine environment and the marine food chains as a result of shipping
- Stress through the marine food chains due to accumulation of pollutants, oil and waste from normal shipping operation – to be classified as extensive and continuous.

Direct and indirect effects of shipping are different for the specific marine mammal species. According to the current state of knowledge, the effects of shipping on marine mammals can only be partially estimated:
- Shipping can have severe direct and indirect effects on the level of individuals
- The effects of shipping on marine mammals at the population level are largely unknown, and can hardly be estimated or predicted.

Effects of exploitation of non-living resources on the subject of protection marine mammals

The following influences of sand and gravel extraction are of significance to marine mammals: Noise emissions, sediment vanes and sediment changes and the associated destruction or alteration of the benthos communities. Overall, mainly temporary effects on marine mammals are to be expected from sand and gravel extraction. The significant effects of sand and gravel extraction on marine mammals in the priority areas of the Maritime Spatial Plan can be summarized as follows:
Direct effects:
- Regional stress due to noise emissions for the duration of the dredging works
- Regional, temporary stress due to ship traffic around the exploitation area

- Marginal, regional effects due to sediment vanes.

Indirect effects:
- Regional effects, temporarily limited to the exploitation period, via the marine food chains due to changes in the sediment and benthos
- Regional, temporary effects via the marine food chains due to introduction of pollutants
- Regional, permanent effects due to alteration of the food habitats.

According to the current state of knowledge, severe effects of sand and gravel extraction on marine mammals can only be partially estimated:
- Sand and gravel extraction can have indirect effects at the level of individuals
- The effects of sand and gravel extraction on marine mammals at the population level are largely unknown.

Possible effects on marine mammals through erection and operation of offshore platforms for extracting natural gas can be caused by: ship traffic, noise emissions, pollutant emissions and sediment vanes. During normal operation of platforms, changes to the sediment and benthos are to be expected. The significant effects of platforms on marine mammals can be summarized as follows:
Direct effects:
- Regional medium to strong effects for the duration of the erection due to noise emissions when drilling and pile driving
- Regional, yet temporary, medium effects due to ship traffic around the exploitation area

Indirect effects:
- Regional, temporary, marginal effects due to sediment vanes during erection
- Regional, marginal effects via the marine food chains due to changes in the sediment and benthos
- Regional, temporary, medium effects via the marine food chains due to introduction of pollutants.

Effects due to local erection of platforms can with high probability be ruled out at both the individual and population levels. According to the current state of knowledge, severe effects of gas extraction on marine mammals can be ruled out with relative certainty:

Effects of pipelines and submarine cables on the subject of protection marine mammals

The laying, and in some cases dismantling, of pipelines and undersea cables can affect marine mammals, in particular with regard to shipping, acoustic emissions and turbidity vanes. The possible operation-related effects of submarine cables on marine mammals depend on the respective type of cable.
Direct effects:
- Regional, temporary, medium effects due to noise emissions during laying
- Regional, temporary, medium effects due to ship traffic during laying
- Regional, temporary, marginal effects due to sediment vanes during laying
- Regional, temporary, marginal to medium effects during maintenance and repair work.

Indirect effects:
- Regional, marginal effects via the marine food chains due to changes in the sediment and benthos

Based on previous findings, the following conclusions can be drawn

- Given the linear, narrow course of pipelines and cables, effects on feeding grounds and also on breeding grounds of marine mammals can be ruled out with relative certainty.
- During normal operation, effects of pipelines and submarine cables on marine mammals can be ruled out.

According to the current state of knowledge, severe effects of electricity-carrying cables on marine mammals can be ruled out with relative certainty:

- Marginal effects during laying, maintenance, incidents and dismantling on the level of individuals cannot be fully ruled out
- No effects of current-carrying cables are to be expected on the population level.

Effects of scientific marine research on the subject of protection marine mammals

The various activities of marine research are not anticipated to have any significant effects on marine mammals. At most, local, temporary effects from fishing vessels or through seismic and other high- sonic research activities are possible.

Effects of offshore wind energy use on the subject of protection marine mammals

The main effects of offshore wind energy facilities on harbour porpoises, seals and common seals would be caused through noise emissions during the installation of foundations, if no reduction or preventive measures are taken.

The significant effects of offshore wind energy facilities on marine mammals can be summarized as follows:
Direct effects:

- Regional, high-intensity effects for the duration of the foundation installation due to noise emissions
- Marginal, regional and temporary effects due to sediment vanes
- Regional, yet temporary, medium effects due to ship traffic in the area of the construction site
- Regional, temporary loss of habitat due to avoidance of the construction site for the duration of pile driving

Indirect effects:

- Regional, temporary effects of at most marginal intensity during the construction phase via the marine food chains due to changes in the sediment and benthos
- Regional, permanent effects from the facilities themselves, of marginal to medium intensity, via the marine food chains due to changes in the sediment and benthos and increase in available biomass (attraction effects)
- Regional, temporary effects via the marine food chains due to introduction of pollutants, oil and waste upon accidents

According to the current state of knowledge, the significant effects of OWEFs on marine mammals at different levels can be estimated as follows:

- Noise emissions during erection of the foundations can have direct and indirect effects at the level of individuals
- The effects of offshore wind energy facilities on marine mammals at the population level are as yet unknown, although based on findings from existing offshore wind farms, they can probably be ruled out.

Effects of fisheries and mariculture on the subjects of protection marine mammals

The effects of fisheries on marine mammals are mostly a result of the by-catch of animals in nets or the limitation of food due to overfishing of important fish stocks.
The significant effects of fishing on marine mammals can be summarized as follows:
Direct effects:

- Severe, large-scale, permanent effects due to by-catch
- Regional and temporary effects due to fishing vessels

Indirect effects:

- Severe, large-scale, permanent effects due to the effect of fishing on the marine food chains
- Regional food limitation through catching the fish prey preferred by marine mammals.

Direct and indirect effects of fisheries are different for the specific marine mammal species. According to the current state of knowledge, the effects of fishing on marine mammals can only be partially estimated:
Fisheries can have severe direct and indirect effects on the level of individuals

- There are indications of severe effects of fisheries on marine mammals at the population level.

9.3.6.2 Development of the subject of protection marine mammals in the event that the plan is not implemented

If the plan is not implemented, the subject of protection marine mammals would continue to be strongly affected as described, through various unapproved or already approved uses, such as shipping and fisheries.
Developments exclusively in the case of non-implementation of the plan are described below.

The development of additional projects for the use of offshore wind energy could not be excluded in the NATURA2000 areas, if the plan is not implemented. The controlled and alleviated authorisation for projects at ecologically suitable locations, which are intended by the wind energy priority areas, would be omitted. This could possibly lead to threat of harbour porpoises in important feeding and breeding grounds.

If the plan is not implemented, maricultures could lead to the introduction of substances. Pollutants, in particular growth hormone preparations and antibiotics, could impair the immune system of marine mammals. Changes at the bottom end of the food chains could influence the entire food chain and thus also affect higher predators such as marine mammals.

Since the plan involves numerous source-related regulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of marine mammals would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.

The effects of climate changes on marine mammals are complex and difficult to predict. All species will be indirectly affected by the possible effects of climate change on the organisms they eat – i.e. the fish. The possible displacement of harbour porpoise populations mentioned above has also been connected with climatic changes. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.7 Seabirds

9.3.7.1 Effects of use on the subjects of protection seabirds and resting birds

Effects of shipping on the subjects of protection seabirds

The significant effects of shipping on seabirds are visual disturbance of sensitive species, pollution during operation or upon accidents and attraction effects, especially to fishing vessels. The effects are area-specific and of various intensity and duration. The significant effects of fishing on seabirds can be summarised as follows:

Direct effects:
- Regional, almost continuous frightening effects of ship traffic on sensitive species such as the diver
- Regional, yet temporary effects due to attraction of scavenging birds such as various seagull species
- Regional to cross-regional, permanent effects of marginal to medium intensity during operation due to pollution (waste, plastic items)
- Contamination with pollutants, in particular oil residue, which enter into the marine environment partly as a result of shipping.

Indirect effects:
- Effects via the marine food chains due to accumulation of pollutants – in particular oil and oil residues from normal operation – are to be classified as extensive and continuous.
- Contamination effects due to accumulation in the food chains or changes in the food chain, with consequences for the survival and reproduction rate of seabirds.

Direct and indirect effects of shipping are different for the specific seabird and resting bird species. According to the current state of knowledge, the effects of shipping on seabirds and resting birds can only be partially estimated:
- Shipping can have direct and indirect effects ont the *level of individuals*
- The effects of shipping on seabird species on the *population level* are largely unknown, and can only be estimated or predicted with difficulty.

Effects of exploitation of non-living resources on the subjects of protection seabirds

The following effects of sand and gravel extraction and of construction and operation of gas extraction platforms are of significance to seabird: ship traffic, turbidity vanes and sediment changes and an associated destruction or alteration of the benthos communities. Turbidity vanes and changes in the sediment structure and benthos can indirectly affect seabirds via the food chains. Overall, mainly temporary effects on seabirds are to be expected from sand and gravel extraction. The significant effects of sand and gravel extraction on seabirds can be summarized as follows:

Direct effects of sand and gravel extraction:
- Regional stress due to ship traffic for the duration of the dredging works
- Regional, temporary stress around the exploitation area
- Marginal, regional effects due to sediment vanes.

Indirect effects of sand and gravel extraction:
- Regional, temporary effects via the marine food chains due to introduction of pollutants
- Regional, permanent effects due to possible alteration of the food habitats for seabirds.

According to the current state of knowledge, severe effects of sand and gravel extraction on seabirds can only be partially estimated:

- Sand and gravel extraction can have indirect effects at the *level of individuals*
- The effects of sand and gravel extraction on seabirds and resting birds at the *population level* are largely unknown.

Beyond this, according to the current state of knowledge, significant effects of gas extraction on seabirds can be ruled out with relative certainty:

- Marginal effects during erection, maintenance and dismantling at the *level of individuals* cannot be fully ruled out
- No effects of gas extraction are to be expected at the *population level* of seabirds.

Effects of pipelines and submarine cables on the subjects of protection seabirds

During laying, operation, maintenance and dismantling of pipelines and submarine cables in the sea can lead to effects on seabirds. Most notably, these are: ship traffic, sediment vanes and pollution. Increased ship traffic and pollution can occur during maintenance and repair work. The significant effects of pipelines and submarine cables on seabirds and can be summarised as follows:

Direct effects:

- Regional, temporary, medium effects due to laying work or dismantling
- Regional, yet temporary, medium effects due to ship traffic during laying and maintenance work

Indirect effects:

- Regional, temporary, marginal effects due to sediment vanes during laying and dismantling
- Regional, marginal effects via the marine food chains due to changes in the sediment and benthos

According to the current state of knowledge, significant effects of pipelines and submarine cables on seabirds can be ruled out with relative certainty:

- Marginal effects during laying, maintenance, incidents and dismantling at the *level of individuals* cannot be fully ruled out
- No effects are to be expected at the *population level* of seabirds.

Effects of scientific marine research on the subjects of protection seabirds

According to the current state of knowledge, the effects of scientific research on seabirds can only be partially estimated:

- Local, temporary effects due to by-catch during fishing industry research activities
- Local, temporary effects due to discard during fishing industry research activities
- Local, temporary effects on sensitive species (visual disruption) due to research vessels
- Local effects due to the effect of fishing industry research on the marine food chain
- Food limitation through catching the fish prey preferred by seabirds and resting birds.

Effects of offshore wind energy use on the subjects of protection seabirds

The construction and operation of offshore wind parks can endanger seabirds particularly through habitat loss during the construction phase or facility-related habitat loss during the operational phase. In summary, it can be stated that there is still a lack of sufficient observations and results concerning negative or positive effects on seabirds on the individual or population level. Studies at the “Horns Rev” wind park have given indications of adverse effects on

sensitive species through habitat loss. Other effects of OWEFs on seabirds by prohibition or reduction of ship traffic and fishing activity in the wind park are largely unknown. The significant effects of OWEFs on seabirds can be summarized as follows:
Direct effects:

- Regional, yet temporary effects on sensitive species due to habitat loss caused by ship traffic around the construction site
- Marginal, regional and temporary effects due to detrimental impact on the food supply by sedimentation vanes during the construction phase
- Regional habitat loss limited to the construction phase due to avoidance of the construction area
- Regional, permanent effects on sensitive species by habitat loss caused by avoidance of the facilities
- Regional, permanent attraction effects due to enrichment of the food supply and resting opportunities on the facilities

Indirect effects:

- Regional, effects of at most marginal intensity limited to during the construction phase via the marine food chains due to changes in the sediment and benthos
- Regional, permanent effects from the facilities themselves, of marginal to medium intensity, via the marine food chains due to changes in the sediment and benthos and increase in available biomass (attraction effects).

According to the current state of knowledge, the effects of OWEFs on seabirds at the individual and population levels can be estimated as follows:

- Ship traffic and construction work during erection of OWEFs can have direct and indirect effects at the *level of individuals*
- Direct and indirect, long-term – and even permanent for some species – effects, are possible at the *level of individuals,* in particular habitat loss due to avoidance behaviour of sensitive species
- The effects of OWEFs on seabirds and resting birds at the *population level* are as yet unknown, although based on findings from existing offshore wind parks, they can probably be ruled out.

The abovementioned effects of constructing and operating offshore wind energy facilities on seabirds in the North Sea EEZ can ultimately lead to habitat loss and can be recorded and quantified, or predicted, in the field. Assessments are based on previous results for existing offshore wind parks (Horns Rev and Nysted) and predictions made for concrete plans in the German North Sea EEZ.

Effects of fisheries and mariculture on the subjects of protection seabirds

Essentially, the following effects of fishing on seabirds can be expected:

Direct effects:

- Regional, temporary effects due to sensitive species avoiding fishing vessels
- Regional, temporary effects due to attraction effects during fishing activity (discards)
- Severe, large-scale, permanent effects due to by-catch in nets
- Severe, large-scale, permanent effects due to limitation of food or reduction of the food quality as a consequence of overfishing.

Indirect effects:

- Significant, large-scale, permanent effects due to the effect of fishing on the marine food chains

Direct and indirect effects of fishing are different for the specific seabird species. According to the current state of knowledge, the effects of fishing on seabirds and resting birds can only be partially estimated:

- Severe direct and indirect effects of fishing are known of on the level of individuals
- There are also indications of severe effects of fishing on seabirds at the *population level* due to impairment of the chances of survival and success of reproduction.

Seabirds can also be indirectly affected by deterioration of the water quality and via the food chains in the case of settlement of maricultures.

9.3.7.2 Development of the subjects of protection seabirds in the event that the plan is not implemented

If the plan is not implemented, the subject of protection seabirds would continue to be strongly affected as described, through various unapproved or already approved uses, such as shipping and fishing. Developments exclusively in the case of non-implementation of the plan are described below.

The development of additional projects for the use of offshore wind energy could not be excluded in the NATURA2000 areas, if the plan is not implemented. The controlled and alleviated authorisation for projects at ecologically suitable locations, which are intended by the wind energy priority areas, would be omitted.

If the expansion of wind parks continues unregulated into sensitive areas, significant effects on the populations would be anticipated − above all on divers, which are particularly sensitive to disturbances. Important feeding and resting habitats of seabirds could be endangered.

If the plan is not implemented, maricultures could lead to the introduction of substances (pollutants, in particular growth hormone preparations and antibiotics). Changes at the bottom end of the food chains could affect higher predators such as seabirds by enrichments in the food chains.

Since the plan makes numerous source-related stipulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of seabirds and resting birds would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.

The effects of climate change on the species concerned are complex and difficult to predict. All species will be indirectly affected by the possible effects of climate change on the organisms they eat – in particular fish. The divers nesting in the Arctic or Subarctic are probably also affected at their nesting sites, since according to prediction models the temperature increase in the Arctic will be particularly strong and loss of brooding habitats could arise on a large scale. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.8 Migratory birds

9.3.8.1 Effects of uses on the subject of protection migratory birds

Effects of shipping on the subject of protection migratory birds

The effects of shipping on migratory birds can come about through oil disposal at sea, propulsion-related emissions, waste disposal, noise emissions, consequences of shipping accidents, input of toxic substances such as TBT and introduction of non-indigenous species (. The effects can be summarised as follows:
Direct effects:

- Local, temporary effects due to visual and acoustic disturbance, which can lead to an increased risk of collision, particularly at night under poor visibility due to the lighting of the ships and the associated attraction effect
- Local, temporary effects due to oil input, which can lead to threat of aquatic migratory birds.

Effects of raw material extraction on the subject of protection migratory birds

Effects of sand and gravel extraction and natural gas extraction on migratory birds are mainly expected at night under poor visibility, when the birds are attracted to the illuminated construction vehicles or illuminated platform. In this case, there is a risk of collision.

Effects of pipelines and submarine cables on the subject of protection migratory birds

Possible effects of pipelines and submarine cables are mainly limited to the construction phase. There is a risk of collision with the illuminated construction vehicles at night under poor visibility conditions.

Effects of scientific marine research on the subject of protection migratory birds

The different activities of marine research are associated with different environmental impacts depending on the methods and equipment used. Temporary, local visual and acoustic disturbances can be relevant for the migratory birds.

Effects of offshore wind energy use on the subject of protection migratory birds

The construction and operation of offshore wind energy parks can have construction, facility and operation-related effects on migratory birds.

*As a result of construction: C*onstruction activities are anticipated to have scare and barrier effects on migratory birds. Bird strike can occur on the structures while under construction as well as on all wind park facilities during the subsequent operational phase. Additional attraction and blinding effects which increase the risk of bird strike can also be caused by illumination at night.

As a result of the plant itself and operation: The operation of OWEFs can lead to frightening and barrier effects. The need to circumvent structures and other alterations of flight behaviour lead to increased energy consumption, which can have an effect on the fitness of birds and subsequently on their survival rate or breeding success. How possible barrier effects of larger wind park areas or repeated evasion of OWEFs affect migratory birds cannot be predicted with certainty at the current state of knowledge. But it is to be assumed that sensitivity and reaction towards the facilities occur to differing degrees specific to the different species. Bird strike events can occur on the rotors and piles of OWEFs. Poor weather conditions – especially at night and under strong winds – as well as high migratory intensities increase the risk of bird strike. On top of that are possible blinding or attraction effects through safety lighting or marking of the facilities with beacons, which can lead to disorientation of birds. Furthermore, birds that get caught in the wake and air turbulence near rotors could be strongly impaired in their manoeuvrability. For the

aforementioned factors, as for frightening and barrier effects, it is also assumed that the sensitivities and risks are different for each specific species.

The assessment of the conflict potential was made – differentiated according to species groups – on the basis of different habits, navigation ability and migratory behaviour (diurnal/nocturnal migrants) of the individual species. The aforementioned points can influence the risk of collision. The sensitivity assessment performed also factored in the rarity, threat status of a species and a possible low reproductive rate.

Species-specific observation revealed that the construction and operation of offshore wind energy facilities poses no threat for the majority of migratory bird species or their biogeographical populations found in the North Sea.

Special migratory corridors are not discernible for nocturnally migrating birds in the area of the Southern German Bight. Under normal migratory conditions preferred by most bird species, no indication of any kind has been found to date, for any species, that the birds typically pass through and/or do not recognise and avoid these obstacles during their typical migration in the danger area of facilities, including the rotors of OWEFs. Special dangers emerge for the migratory birds when unexpected weather conditions arise.

The available findings on the migratory behavioural patterns of various bird species, the customary flight altitudes and the daytime distribution of bird migrations allows the conclusion that a majority of migratory birds will not be affected at all by the projects in the priority areas.

Effects of fishing and mariculture on the subjects of protection migratory birds

Fishing results in visual and acoustic disturbances and frightening effects, which depend on the frequentation of sea areas by fishing vessels. For aquatic migratory birds that interrupt their migration for feeding, there is an additional risk of being caught in the fishing nets and drowning. For instance, on the Rönne Bank in the Pomeranian Bight, a large number of divers, auks and sea ducks drown in the gillnets.

The cultivation of mariculture facilities is linked with ship transports and various offshore activities in the facilities, which bring about small-scale visual and acoustical disturbance and frightening effects.

9.3.8.2 Development of the subjects of protection migratory birds in the event that the plan is not implemented

If the plan is not implemented, the subject of protection migratory birds would continue to be strongly affected as described, through various unapproved or already approved uses, such as existing tall structures and fishing. Developments exclusively in the case of non-implementation of the plan are described below.

The development of additional projects for the use of offshore wind energy could not be excluded in the NATURA2000 areas, if the plan is not implemented. The control and alleviated authorisation for projects at ecologically suitable locations, which are intended by the wind energy priority areas, would be omitted.

If the expansion of wind parks continues unregulated into sensitive areas, the risk of a barrier effect against migratory birds would be increased.

If the plan is not implemented, maricultures could lead to the introduction of substances (pollutants, in particular growth hormone preparations and antibiotics). Changes at the bottom end of the food chains could affect higher predators such as migratory birds by enrichments in the food chains.

Since the plan involves numerous source-related regulations regarding the protection of the marine environment, which refer to the most compatible form of uses possible, the protection of migratory birds would be much more difficult to ensure if the plan is not implemented than if the plan is implemented.

The effects of climate change on the species concerned are complex and hard to predict. All species will be indirectly affected by the possible effects of climate change on the organisms they eat – in particular fish. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.9 Bats

9.3.9.1 Effects of uses on the subject of protection bats

Effects of shipping on the subject of protection bats

The effects of shipping on the subject of protection bats are largely unknown. There are only a few individual reports of bat findings on ships. Based on these, it is assumed that ships can have an attraction effect. There is some collision threat of bats with ships under adverse weather conditions.

According to the current state of knowledge, however, the effects of shipping on bats at both the individual level and the population level appear to be insignificant.

Effects of exploitation of non-living materials on the subject of protection bats

According to present knowledge, raw material extraction has no severe effect on the subject of protection bats.

Effects of pipelines and submarine cables on the subject of protection bats

Significant effects of laying, operating and dismantling pipelines and submarine cables on bats can be ruled out with certainty at both the individual level and the population level.

Effects of scientific marine research on the subject of protection bats

According to the current state of knowledge, effects of marine research on bats can be ruled out with certainty.

Effects of offshore wind energy utilization on the subject of protection bats

The construction and operation of offshore wind parks can endanger bats particularly through collisions. Initial information regarding the risk of collision has been gathered from studies in Sweden on the possible threat of bats due to onshore and offshore wind energy facilities. It has been determined that both migratory and non-migratory species are occasionally involved in collisions. Most bats in the area of offshore wind energy facilities have been observed at night in search of food – hunting for the insects found in those places. The reasons for the gathering of insects at OWEFs are still largely unknown. Besides the lighting of the facilities and heat generated by the turbines and rotor blades, there is also the possibility of so-called “hilltopping”.

Based on previous observations, it is assumed that bats more likely migrate in concentration (swarms) across the sea, probably at substantial flight altitudes and on regularly used migratory routes. In summary, it can be stated that there is still a lack of sufficient observations and results concerning negative or positive effects on bats at the individual or population level. However, there are indications of detrimental effects due to collisions of bats with wind energy facilities on land. Nevertheless, there is currently a lack of detection methods for investigating the presence of bats at sea (see Chapters 2 and 4). As such, there is also a lack of concrete information on migratory species, corridors, altitudes and concentrations. An assessment of the possible effects is therefore not possible at the present time.

Effects of fishing and mariculture on the subject of protection bats

According to the current state of knowledge, effects of fishing and mariculture on bats can be ruled out with certainty.

9.3.9.2 Development of the subject of protection bats in the event that the plan is not implemented

Population and distribution of the bat species that possibly migrate over the North Sea are not conclusively recorded, above all due to the high migratory dynamics. Migratory patterns are also largely unknown. The population development cannot be estimated or predicted at the current state of knowledge. There is also relatively little known on the possible negative effects of use on the subject of protection bats.

In light of this, it is only possible to make a very limited assessment of the anticipated development of the subject of protection if the plan is not implemented.

The effects of climate change on bats are also complex and hard to predict. All species will be indirectly affected by the possible effects of climate change on the organisms they eat – in this case insects. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.10 Air

9.3.10.1 Effects of use on the subject of protection air

Effects of shipping on the subject of protection air

Shipping activities result in the production of nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles. These can detrimentally impact the air quality.

Effects of exploitation of non-living resources on the subject of protection air

The extraction of hydrocarbons involves emissions that can influence the air quality. These emissions result in particular from the ship traffic involved in offshore activities (e.g. suppliers), drilling activities, construction activities (e.g. pile driving) and operation of the production platform. During operation of the platforms, for example, carbon dioxide, nitrogen monoxide and volatile organic compounds, including methane, are emitted. Sand and gravel extraction also involves ship traffic and the typically associated emissions. Nevertheless, severe detrimental effects on the air quality are not expected.

Effects of pipelines and submarine cables on the subject of protection air

The laying, maintenance and dismantling of pipelines and undersea cables necessarily involve ship traffic. This in turn leads to pollutant emissions, which can impact the air quality. Severe detrimental effects on the air quality are not expected.

Effects of scientific marine research on the subject of protection air

Due to the local, temporary activities of the scientific research, any effects on the subject of protection air can be excluded.

Effects of offshore wind energy use on the subject of protection air

The construction and operation of offshore wind energy parks leads to pollutant emissions from the construction and maintenance vehicles, which can impact the air quality.

Effects of fisheries and mariculture on the subjects of protection air

Fisheries and maricultures necessarily involve ship traffic. This in turn leads to pollutant emissions, which can impact the air quality. Severe detrimental effects on the air quality are not expected.

9.3.10.2 Development of the subject of protection air in the event that the plan is not implemented

The increased intensity of utilization and a general increase in traffic leads to an increase in ship traffic, which can lead to a detrimental impact on the air quality. On the whole, however, this development is independent of whether the plan is implemented or not.

9.3.11 Climate

9.3.11.1 Effects of uses on the subject of protection climate

Effects of shipping on the subject of protection climate

Effects of shipping on the climate, due to the above mentioned emissions, cannot be completely ruled out.

Effects of exploitation of non-living resources on the subject of protection climate

The substances emitted during shipping activities associated with raw material extraction (e.g. nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles) must be generally classified as relevant to the climate. Nevertheless, severe detrimental effects on the climate due to raw material extraction are not expected.

Effects of pipelines and submarine cables on the subject of protection climate

The substances emitted during shipping activities associated with laying, maintaining and dismantling pipelines and undersea cables (e.g. nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles) must be generally classified as relevant to the climate. Nevertheless, severe detrimental effects on the climate due to laying, maintaining and dismantling pipelines are not expected.

Effects of scientific marine research on the subject of protection climate

Due to the local, temporary activities of the scientific research, any effects on the subject of protection climate can be excluded.

Effects of offshore wind energy use on the subject of protection climate

The substances emitted during shipping activities associated with construction and operation of offshore wind parks (e.g. nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles) must be generally classified as relevant to the climate. Nevertheless, severe detrimental effects on the climate due to construction and operation of offshore wind parks are not expected.

Effects of fishing and mariculture on the subject of protection climate

The substances emitted during shipping activities associated with fishing, installation and operation of maricultures (e.g. nitrogen oxides, sulphur dioxides, carbon dioxide and soot particles) must be generally classified as relevant to the climate. Nevertheless, severe detrimental effects on the climate due to fishing are not expected.

9.3.11.2 Development of the subject of protection climate in the event that the plan is not implemented

Increases in sea surface temperature and mean global sea level are the anticipated large-scale consequences of climatic changes on the oceans. Many marine ecosystems react sensitively to climatic changes (. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.12 Natural scenery

9.3.12.1 Effects of uses on the subject of protection natural scenery

Effects of exploitation of non-living resources on the subject of protection natural scenery

The extraction of hydrocarbons can be associated with the erection of tall structures that can lead to visual changes in the natural scenery. Given the distance from shore, however, severe detrimental effects on the natural scenery as perceived from land are ruled out.

Effects of scientific marine research on the subject of protection natural scenery

Scientific marine research can be associated with the erection of tall structures, in the form of research platforms, which can lead to visual changes in the natural scenery. Given the distance from shore and low numbers, however, severe detrimental effects on the natural scenery as perceived from land are ruled out.

Effects of offshore wind energy use on the subject of protection natural scenery

So far, the landscape in the North Sea EEZ has been characterised by the fact that, with the exception of a few tall structures, such as the FINO 1 research platform and the A6A gas production platform , no structures project above the water column. The creation of offshore wind farms will affect the natural scenery, since it will be changed by the erection of vertical

structures. Furthermore, the individual facilities must be illuminated at night or under poor visibility conditions. This can also detrimentally impact the natural scenery.

In addition to a change in the natural scenery, the subjective impression of the scenery can also be impaired for viewers on the coast. The actual visibility is determined by the distance of the offshore wind farm from the coast or island, the area taken up by the wind farm, the height of the OWEFs, the visibility determined by the actual weather conditions, the altitude of the observer's position and the capability of the human eye.

The results of investigations lead to the conclusion that the offshore wind farms planned for the North Sea EEZ will only be perceptible to a very limited degree, and only under good visibility conditions, given their distance of more than 30 km from the coast. The same also applies to the safety illumination at night.

9.3.12.2 Development of the subject of protection natural scenery in the event that the plan is not implemented

The development of additional projects could not be excluded in the NATURA2000 areas, partly closer to coastal areas, if the plan is not implemented. The risk of visual adverse effects would possibly be marked up. It would also be considerably more difficult to regulate additional, possibly detrimental tall structures if the plan is not implemented.

9.3.13 Tangible assets, cultural heritage (archaeology)

9.3.13.1 Effects of uses on the subject of protection tangible assets, cultural heritage

In the case of all utilizations, which involve interventions in the sediment, one cannot completely rule out the possibility of damage to tangible assets or cultural heritage located on the seabed that were unknown prior to the intervention. This concerns:

- Pipelines and submarine cables
- Scientific marine research
- Offshore wind energy production
- Fisheries.

9.3.13.2 Development of the subject of protection tangible assets, cultural heritage in the event that the plan is not implemented

References to possible tangible assets or cultural heritage are at hand insofar as the spatial locations of a vast number of wrecks are known and are recorded in the BSH nautical charts. There is no information about memorials on the ground or leavings of settlements, yet. If the plan is not implemented, it would be difficult to factor the concerns of this subject of protection.

9.3.14 Biological diversity

Large-scale consequences of climate changes on the oceans are also to be expected (see Chapter 3.9). This affects the biological diversity, given that many marine ecosystems react sensitively to climate changes. For example, it could lead to a shift in the species spectrum. A strong influence on the population density and dynamics of fishes is conceivable, for example, which in turn would have consequences for the marine food webs. Overall, however, this development is independent of whether the plan is implemented or not.

9.3.15 Interactions amongst subjects of protection

Changes in individual components within the marine food webs are associated with changes in the entire ecosystem of the North Sea, as was already explained in Chapter 9.2.12. In addition to natural variability, anthropogenic influences and the climatic change regulate the changes in the ecosystem.
If the rMaritime Spatial Plan is not implemented, it cannot be ruled out that changes – in particular those caused by economic activities – would detrimentally impact the living marine environment.

9.4 Description and evaluation of the prospective significant effects of implementation of the rMaritime Spatial Plan on the marine environment

9.4.1 Shipping

The priority and reservation area designations for shipping are based in particular on available, existing shipping routes identified in the procedure for arrangement of the Maritime Spatial Plan. These specifications serve to keep important shipping routes free of incompatible uses, especially structural facilities, which contributes to the reduction of collisions, as well as the preclusive effect for wind energy constructions in the NATURA2000 areas does. The designation of priority and reservation areas for shipping does not result in any immediate concentration or control effect on ship traffic. Shipping will continue to be able to use the entire sea region in future. As such, the area designations have no additional effects on the subjects of protection and the marine environment as a whole when compared with the actual status and the null variant.

The Maritime Spatial Plan makes further statements regarding the targeted reduction of the burden on the marine environment by consideration of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions on shipping. Negative effects on the subjects of protection are to be avoided as a result of this.

On the basis of the above statements and the presentations in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subjects of protection and the marine environment as a whole are to be anticipated through the designations for shipping in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided, especially by reducing the risk of a collision.

9.4.2 Exploitation of non-living resources

No areas are defined for sand and gravel extraction and the extraction of hydrocarbons.
Given the designated policy of as complete exploitation of the existing extraction fields as possible, the aim is for the most space-saving and concentrated extraction of raw materials possible. In the case of sand and gravel extraction, the naturalness of the unaffected sand and gravel areas in the EEZ, which are important spawning and feeding grounds, is retained. This has correspondingly positive consequences for other subjects of protection, such as benthos communities, plankton and fishes.

The planned dismantling of the production platform after expiry of its use leads to a positive effect in particular concerning the subject of protection “water”, since the temporary and very

local changes in the currents and swell are reversed. Furthermore, the local sediment compaction caused by the platform foundations is also reversed.

The Maritime Spatial Plan makes further statements regarding the targeted reduction of the burden on the marine environment by consideration of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions on the search for and extraction of raw materials. In order to guarantee as environmentally friendly raw material extraction as possible, the effects of raw material extraction on the marine environment should be investigated and presented as part of the monitoring performed by the operator. Proliferation processes and widespread ecological interactions of species and their habitats should be considered into the choice of location. The damage or destruction of sand banks, reefs, submarine structures caused by gas leaks (pockmarks), and delimitable areas in which benthos communities worthy of protection exist, being particularly sensitive habitats, should also be avoided when extracting raw materials. Also, the concerns of cultural heritage must be taken into consideration.Negative effects on the subjects of protection and the marine environment as a whole are avoided as a result of these regulations.

The adoption of raw material extraction areas into the Maritime Spatial Plan also includes positive aspects for the inhabited marine environment as a whole: the interactions among the use and cumulative effects on biological subjects of protection can be better estimated and predicted in existing plans and above all in future plans.

On the basis of the above statements and descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subjects of protection and the marine environment as a whole are to be anticipated through the stipulations for exploitation of non-living resources in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

9.4.3 Pipelines and submarine cables

Protective distances of 500 metres on both sides in the area of existing pipelines are stipulated as reserve areas in the Maritime Spatial Plan. Other corridors for pipelines in the North Sea are not stipulated, so the environmental effects of these area stipulations do not exceed the effects of the actual status and null variant.
The adoption of priority and reservation areas for pipelines in the Maritime Spatial Plan also creates positive aspects for the inhabited marine environment as a whole: the interactions among the uses and cumulative effects on biological subjects of protection can be better estimated and predicted in existing plans and above all in future plans.

For submarine cables for conduction of electricity produced in the EEZ, target corridors (gates) are designated, through which these submarine electricity cables must be run. That is to assure orderly conduction of energy. Furthermore, it is a stipulated rule that cables shall be run parallel to one another and to existing infrastructures. Any intervention, in particular that involved in laying of submarine cables, shall be limited to a few areas so that distant parts of the EEZ can be kept free of possible detrimental impact. This leads to positive effects on the subjects of protection and the marine environment as a whole compared to the null variant. Furthermore, laying works should also be scheduled, which would lead to a reduction in cumulative effects.
Negative effects on the marine environment resulting from interactions are not to be expected in the case of the greatest possible bundling and parallel running to existing offshore facilities, since at corresponding optimal distances between the respective cables, a thermal decoupling is ensured and cumulative heating effects can be ruled out. The extensive avoidance of crossovers of submarine cables with one another and with existing or planned lines also positively effects the marine environment – in particular the subjects of protection seabed and benthos – because

the introduction of artificial hard substrates in the form of rock fill (coarse gravel and rubble) can be avoided, especially in sea areas of mainly homogeneously sandy seabed.
This way, the laying of submarine cables can also, among other things, be made as environmentally friendly as possible, in that the choice of laying method is as low impact as possible, and the submarine cable is only laid as deep as necessary, taking shipping concerns into consideration. That avoids both increased stressing of the sediment and extensive digging into the seabed. With the protection of the sediment, the settlement area for the benthic communities are also protected.
When crossing sensitive habitats, possible detrimental impacts can be avoided by avoiding the periods in which specific species are particularly susceptible to disturbance. For instance, areas of great importance to seabirds will only be used during periods in which no presence of resting birds is expected.

In principle, pipelines and submarine cable must be removed after abandonment of their use, insofar as a threat of life or health of persons or of tangible assets, or an impairment of predominant public interests is to be expected. Among other things, the latter encompasses concerns of shipping as well as the marine environment. If it would result in major environmental impact, dismantling can be disregarded, and the lines left in or on the seabed.
The retreating working is even necessary if, as a consequence of this cables and pipelines, toxic substances of relevant manner or quantity remain in the marine environment. In case of disposition, suitable monitoring measures concerning possible threats should be arranged. Proliferation processes and widespread ecological interrelations of species and their habitats should be considered with regard to the choice of location. The damage or destruction of sand banks, reefs, submarine structures caused by gas leaks, and delimitable areas in which benthos communities worthy of protection exist, being particularly sensitive habitats, should also be avoided when laying and operating pipelines and undersea cables. Also, the concerns of cultural heritage must be taken into consideration. Negative effects on the subjects of protection and the marine environment as a whole are to be avoided as a result of these regulations.
Furthermore, the Maritime Spatial Plan makes further specifications regarding the targeted reduction of the burden on the marine environment by consideration of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions on the laying, operation, maintenance and dismantling of pipelines and submarine cables. This could also reduce detrimental effects, especially on the benthos.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subjects of protection and the marine environment as a whole are to be anticipated through the designations for pipelines and submarine cables in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

9.4.4 Scientific marine research

Reservation areas shall be designated for protection of long-term research series in the realm of fisheries research. This should ensure that these areas are kept free of uses that could endanger the long-term research series. The area designations have no additional effects on the subjects of protection and the marine environment as a whole when compared with the actual status and the null variant.

The Maritime Spatial Plan makes further statements regarding the targeted reduction of the burden on the marine environment by consideration of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions on scientific research. Furthermore, the results of marine scientific research should be recorded as continually as possible for the sake of as complete a description of ecosystem correlations as

possible, and thus an important basis for sustained development of the EEZ created. Also, the concerns of cultural heritage must be taken into consideration. Negative effects on the subjects of protection are avoided as a result of this.
The designation of reservation areas for scientific research in the Maritime Spatial Plan could also have positive aspects for the German EEZ: the interactions among the use and cumulative effects on biological subjects of protection can be better estimated in existing plans and above all in future plans.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subjects of protection and the marine environment as a whole are to be anticipated through the designations for scientific research in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

9.4.5 Offshore wind energy

The designated special suitable area "North of Borkum" has been adopted into the Maritime Spatial Plan as a priority area. Two other priority areas shall additionally be defined, namely "South of Amrumbank" and "East of Austerngrund". A complete development of the areas is taken as a starting point for the evaluation of the priority area designations; for this a minimum distance of 1,000 metres between the wind farms and a minimum distance of 800 metres between the single plants within the farms is assumed. Here, it must be taken into consideration that wind farms in the the priority areas were already approved before the Maritime Spatial Plan came into effect (see also Chapter 9.3.1.5).

Seabed and water
With regard to the subjects of protection "seabed" and "water", OWEFs have a local effect on the environment. While the soil (sediment) in the immediate vicinity is only affected permanently through the introduction of foundation elements and park-internal cabling, the subject of protection "water" will be temporarily influenced in the vicinity of the facilities through relatively marginal current turbulence, attenuation of sea waves and formation of ground-proximate turbidity vanes.

Given the exclusion effect of the NATURA2000 areas designations, negative effects on water and seabed are minimized, in that the areas that come into question for constructing OWEFs are reduced.

Benthos
For all priority areas it applies equally that no significant effects on the population level are to be expected through the construction, the plant itself, the operation or the dismantling of wind energy plants in the priority area, seeing as rapid resettlement is very likely given the usually rapid regenerative capability of the occurring populations of benthos organisms with short generation cycles and their widespread distribution in the North Sea.

A loss of further settlement areas is counteracted by the exclusion effect of the NATURA2000 areas and a possible area-saving arrangement of the individual OWEFs in the designations of offshore wind energy. However, given the foundations and scour protection, new settlement areas are also created, which can have local effects on the naturally occurring benthos communities. This applies especially to the soft bed communities. Local, permanent effects of marginal intensity can be expected as a result of operation.

Indirectly, this designation can also have positive effects on the benthos communities, since trawling will only be allowed on a limited basis within the offshore wind farms. This can lead to a local improvement of the habitat conditions of benthic species that are sensitive to the influence of trawling. In particular, effects on long-living species are expected here. A majority of Red List species could be positively influenced as a result.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subject of protection benthos are to be anticipated through the designations for wind energy in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

Fishes

The typical sandy seabed for demersal fish community of the southern North Sea was encountered consistently in the three priority areas for wind energy use. For all priority areas it applies equally that no significant effects on the population level are to be expected through the construction, the plant, the operation or the dismantling of wind energy plants in the priority area.

Given the exclusion effect within the NATURA2000 areas and the preferably space-saving arrangement of the individual OWEFs in the designations of Offshore windenergy, negative effects on the subject of protection fishes are minimised, in that the areas that come into question for windfarms are reduced.

Indirectly, this designation can also have positive effects on the fish communities, since trawling will only be allowed on a limited basis within the offshore wind farms. The priority areas can therefore become a refuge for fishes, as long as the respective species are not frightened by operational noises. In all previously known studies, an increase in local biomass, possibly associated with species diversity, is predicted from the assumed settlement of plants with marine growth of algae and mussels.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subject of protection fishes are to be anticipated through the designations for wind energy in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

Marine mammals

The designations of the Maritime Spatial Plan for offshore wind energy do not lead to significant effects on marine mammals: The regulations in favour of using the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions shall be implemented at the approval level. For example, regulations regarding noise reduction should also be made here, as in accordance to general approval practice.

The designation of priority areas outside the main feeding and breeding areas of harbour porpoises serves to minimize any threats for the species. At the same time, threats of harbour porpoises in important feeding and breeding grounds will be avoided under consideration of the regulations in favour of the application of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions and through the exclusion of new plans for offshore wind energy within the NATURA2000 areas. The area designations also do not lead to detrimental effects on common seals and grey seals.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subject of protection marine mammals are to be anticipated through the designations for wind energy in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

Seabirds

The effects of offshore wind farms are assessed on the basis of the function and importance of sub-areas for seabirds:

- During the *construction phase*, with average to high, but only temporary burdening, one would have to anticipate significant effects of seabirds in areas with special characteristics and of outstanding importance. In addition to main feeding and resting habitats, hibernation habitats of unique importance and escape habitats of special importance would be designated in critical situations. Due to the high mobility of the animals, no significant effects would have to be anticipated for sub-areas of no outstanding importance.
- During the *operational phase*, with more marginal burdening through ship traffic, significant effects due to the plants would only have to be anticipated in areas of outstanding importance for valuable and endangered species. According to the current state of knowledge, however, significant effects can be ruled out in all other areas.

On the whole, the effects of wind farms on seabirds in the priority areas will probably be insignificant. As a result of the exclusion effect of the NATURA2000 areas and the designation of the three priority areas for offshore wind energy in, from en ecological point of view suitable, locations, significant effects on seabirds will be minimised as the loss of habitat will be reduced.
At the same time, areas of special importance as feeding grounds will be excluded from further plans or constructions of offshore wind farms, respectively barrier effects will be avoided.
The priority areas do not lie in the route between breeding colonies and feeding grounds or between important feeding grounds. This will avoid barrier effects with regard to the foraging of birds.

The regulations in favour of using the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions are targeted at the avoidance and reduction of negative effects on seabirds through construction and operation of OWEFs. This applies in particular to measures for minimization of pollutant and light emissions, as is also general practice in approval procedures.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subject of protection seabirds are to be anticipated through the designations for wind energy in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

Migratory birds

No threat of migratory birds is to be expected from the designation of the priority areas for offshore wind energy.

There is also no threat of bird migration that will result from any cumulative effects of the priority areas "North of Borkum", “East of Austerngrund” and “South of Amrumbank” or other planned or approved wind parks.

The designation of priority areas for offshore wind energy as well as the exclusion effect within the NATURA2000 areas help to minimize effects on migratory birds, in that the areas that come into question for the construction of OWEFs and consequently any barrier effects will be

reduced. Areas of potentially special importance for bird migration will thus be excluded. After expiration of the exclusion period, the Maritime Spatial Plan provides that wind farms shall be arranged spaciously so that barrier effects with regard to bird migration can also be minimised.
The two main conflicts for migratory activities are risks of collision with the single plants and a barrier effect as a consequence of the space taken up by an offshore wind energy farm. The conflict potential of both aspects will be further reduced through a height restriction on OWEFs to a hub height of 125 metres above mean sea level, this restriction is not applicable to the priority area “East of Austerngrund” because of the distance to the coast.

The following prognostic statements can be made in summary:

- Special migratory corridors are not discernible for any migratory bird species in the region of the german EEZ in the North Sea to the west of the eastern and North Frisian Islands, since the bird migration proceeds either coastline-oriented near the coast or as broad front migration across the North Sea that is not definable in greater detail.
- Under normal migratory conditions in good weather conditions, preferred by the migratory bird species, no indication has been found to date, for any species, that the birds typically pass through and/or do not recognise and avoid these obstacles during their migration in the height of plants, including the rotors of OWEFs. Potential threats emerge when unexpected bad weather conditions arise.
- There are no negative effects on the further development of populations to be expected from migration around the priority areas.

An examination of the available findings on the migratory behavioural patterns of various bird species, the typical flight altitudes and the daytime distribution of bird migration allows the conclusion that a majority of migratory birds will not be affected at all by the projects in the priority areas, and that there will be no threat of bird migration through the construction and operation of OWEFs – even under cumulative consideration of already constructed or approved wind energy farms lying on migratory routes. However, it must be conceded that this prediction is made according to the state of knowledge and technology under premises that are not yet suitable to safeguard the basis for the subject of protection in a satisfactory manner. This is to be regulated at the approval level.
In this way, a threat of bird migration can be lastingly ruled out with the appropriate certainty.

On the basis of the above statements and the descriptions in Chapter 9.3, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subject of protection migratory birds are to be anticipated through the designations for wind energy in the Maritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

Bats

The effects of OWEFs in the priority areas on bats that possibly migrate across the sea cannot be assessed at present due to a lack of adequate survey methods and information.

However, the designation of priority areas at distances greater than 30 km from the mainland (coastline) allows the assumption that bats migrating in large concentrations along the coast are not threatened. The designation of the three priority areas for offshore wind energy goes along with an exclusion effect outside these areas. However, threats of single individuals through collisions cannot be completely ruled out.

Climate

Detrimental effects on the climate due to construction and operation of offshore wind farms in the priority areas for wind energy are not expected. On the contrary, substantial advantages for the climate ensue from the development of the regenerative source wind energy, and the

substitution of fossil energy source made possible by this. An important contribution can be made towards achieving the development objectives for offshore wind energy defined in the "Federal Government Strategy for Wind Energy Use at Sea".

Natural scenery

The seascape in the German EEZ of the North Sea is so far characterised by the fact that no structures arise above the water surface in the adjacent environment, with the exception of the FINO research platform and Amrumbank measurement mast. The construction of offshore wind farms will thus affect the natural scenery, since it will be changed by the erection of vertical structures. The single plants must also be illuminated at night or under poor visibility conditions for safety reasons, which can also detrimentally impact the natural scenery.

The extent of the impairment of natural scenery through wind energy plants is strongly dependent on the respective visibility conditions, but also on subjective perceptions as well as the viewer's basic attitude towards offshore wind energy as a form of renewable energy. The vertical structures atypical to the natural scenery on the coast can be perceived by some as disturbing, but also as technically interesting by others. However, they bring a change in the natural scenery. The character of the area will also be fundamentally modified by this.

Given their distance of more than 30 km from the coast, the OWEFs will only be perceptible to a very limited degree, and only under good visibility conditions. This also applies to the safety illumination at night.

The detrimental impact on the natural scenery or its perceptibility associated with wind energy plants, which will be constructed in visual range of the coast and islands, will be reduced by the fact that the hub height of wind energy facilities is restricted to 125 metres above mean sea level in the Maritime Spatial Plan. Furthermore, the exclusion effect in the NATURA2000 areas will result in vast portions of the EEZ remaining free of OWEFs.

In conclusion, the detrimental impact on natural scenery through the designation of priority areas is to be classified as marginal.

Tangible assets, cultural heritage

Based on the available hydroacoustic studies, and according to analyses of the underwater obstacle databank, no findings are available concerning tangible assets or cultural heritage in the priority areas.
If culturally significant findings or tangible assets are ascertained during the approval procedures for the construction of offshore wind farms in the prescribed environmental impact assessment (EIA) and foundation exploration, suitable measures for their preservation must be implemented. A corresponding textual specification has been made for this purpose.

9.4.6 Fisheries and mariculture

Area designations will not be made for fisheries and mariculture. As such, no changes of environmental effects can come about whatsoever compared with the null alternative.

The Maritime Spatial Plan, however, includes statements regarding the targeted reduction of the burden on the marine environment through fisheries under consideration of the respective state of technology as well as the best environmental practice commensurate with the OSPAR and HELCOM conventions. In addition, the fish stocks shall be managed as much as possible on a sustainable basis for lasting safeguarding of the fisheries use under consideration of the concept

of maximum sustainable yield developed by the EU Commission. Negative effects on the subjects of protection are avoided as a result of this.

In addition, facilities for mariculture shall be installed in combination with already available installations. Also, the concerns of cultural heritage must be taken into consideration. Negative effects on the subjects of protection are also avoided as a result of this.

On the basis of the above descriptions and evaluations, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the subjects of protection and the marine environment as a whole are to be anticipated through the statements for fisheries and mariculture in the rMaritime Spatial Plan; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

9.4.7 Marine environment

In the Maritime Spatial Plan, regulations regarding the marine environment will be made in Chapter 3.7, which will also have effects on the subjects of protection and the marine environment as a whole.

The textual principles regarding the marine environment target the protection and the development of marine nature as well as the safeguarding of the marine landscape and the preservation of the extensive open-space structure. In this way, the EEZ – as a natural region in its respectively typical, natural characteristics and with its exchange modalities and interactions for preservation of biological diversity – shall be secured and developed on a sustainable basis. At the same time, the natural resources shall be used economically and considerately in accordance with the general principle of sustainability. Impairments of natural balance shall be avoided and reduced under consideration of the precautionary principle as well as the ecosystem approach. In areas no longer used on a lasting basis, the functions of the natural balance shall be restored in their original condition or be secured in its efficiency in state of new ecological balance in a condition adapted to the new living conditions.

In terms of the marine landscape, efforts will be targeted at securing this landscape in its natural characteristics, and to preserve its characteristic extensive open-space structure extensively. The EEZ shall be permanently preserved as an extensive, ecologically intact open space, and also be developed and secured in its importance for functional seabeds, for the water resources, the fauna and flora (biodiversity) and the climate. Also, the open space shall be kept free of uses, especially buildings and structures that would also be comparably possible on land. This does not encompass the uses which are also basically possible on land, but benefit from special site characteristics at sea.

These principles pursue an integrative approach for protection and development of the marine environment as well as for minimization of possible detrimental impact through specific uses. They take into consideration the idea of sustainability, the ecosystem approach with its holistic perspective, and possible cumulative effects, interactions and exchange modalities.

Against this background, positive effects on the marine environment due to the designations of the Maritime Spatial Plan regarding the marine environment are to be anticipated for the totality of the subjects of protection.

9.4.8 Interactions of uses with the marine environment and biological diversity

The Maritime Spatial Plan has effects on the marine environment and biological diversity, particularly for wind energy use as well as for the laying and operation of submarine cables for conduction of the energy generated in the EEZ. The following effects are essentially to be anticipated through the construction and operation of offshore wind energy plants and submarine electricity cables:

- Sedimentary rearrangement and turbidity vanes during the construction phase of a wind farm or during the laying of electricity cables will influence the food conditions on a short-term basis.
- Noise emissions, whereas the strongest noise emissions will probably be caused by the driving of foundation piles. These would probably lead to temporary flight reactions and temporary avoidance of the area by some fish species, many sea bird species and marine mammals.
- The construction of foundations can bring about a deprivation of settlement area for the benthos community, which can also result in changes in the food web.
- Introduction of artificial hard substrate in the form of foundations, masts and transformer stations leads to a local change in soil characteristics and sedimentary conditions. The food web at the site can be influenced by changes in the species composition of the macrozoobenthos community.
- Prohibition of uses, like navigation and fisheries in the area of offshore wind energy farms can lead to an increase in the biomass of fish species of commercial or non-commercial importance.

The implementation of the Maritime Spatial Plan for the German EEZ in the North Sea makes it possible to arrange activities on an environmentally compatible basis. Given the source-based regulations regarding protection of the marine environment in the case of the aforementioned uses, as well as spatial and temporal planning and coordination of activities, it is to be assumed that the status of the marine environment and the biological diversity will more likely develop positively, if the Maritime Spatial Plan is implemented. The designation of priority areas outside areas of outstanding importance for protected and threatened species serves to protect these species. Possible threats of species that need protection shall be avoided through the exclusion of new plans for offshore wind energy within the NATURA2000-areas. For example, valuable habitats for benthos with large numbers of Red List species will be excluded from these plans. Important resting, feeding, moulting and overwintering habitats of seabirds will also be excluded. The same applies to important feeding and breeding habitats of marine mammals. The biological diversity shall be protected through the exclusion of ecologically important habitats from plans. Long-term positive effects on global environmental protection and the preservation of biological diversity are to be anticipated through the operation of OWEFs and the associated CO_2 savings during electricity generation.

Positive aspects for the living marine environment as a whole could emerge through a holistic view in the Maritime Spatial Plan under consideration of the interactions of all existing and planned uses for the German EEZ in the North Sea: the interactions among the uses and cumulative effects on biological subjects of protection can be better estimated and predicted in existing plans and above all in future plans.

On the basis of the above descriptions and evaluations, for the SEA (Strategic Environmental Assessment), it is to be stated in conclusion that no significant effects on the marine environment and in particular the biological diversity are to be anticipated through the designations for shipping, exploitation of non-living resources, pipeline and submarine cables, offshore wind energy, fisheries and mariculture and scientific marine research in the Maritime Spatial Plan for the German EEZ in the North Sea; and moreover that in comparison with the non – implementation of the plan detrimental effects will be avoided.

9.5 Impact assessment regarding the areas of Community importance or regarding European bird sanctuaries

According to 7 sec. 7 ROG 1998 (cf. § 7 sec. 6 ROG), it is to be examined whether the objectives and targets for the sites of Community importance or for special protection areas according to the EU Bird Directive can be significantly impaired through the regulations of the Maritime Spatial Plan. The corresponding assessment complies with § 38 in conjunction with § 34 BNatSchG.

In the German North Sea EEZ are the special protection area (SPA) “Eastern German Bight” (according to EU Bird Directive)) designated by the regulation from 15 September 2005 and the three special areas of concern (SAC) “Borkum Reef Area”, “Sylt Outer Reef” and “Dogger Bank” (according to the EU Habitat Directive). These last three protected areas have been adopted into the community list by the EU commission in 2007. Other special areas of concern or special protection areas have not yet been registered by Germany.

The assessment is based on the objectives and targets for nature conservation of the respective protected areas.

9.5.1 Pipelines and submarine cables

Pipelines

The German EEZ of the North Sea contains pipelines of an overall total length of 912 km. Reservation areas along these existing pipelines have been designated, including a safety distance of 500 m on both sides. That ensures that other uses allow for the special requirements of pipelines. Exceptions to this are the areas in which pipelines cross priority areas for wind energy, for these crossing areas priority areas for pipelines are designated.. These reservation areas and priority areas cover a total area of 847 km². Of this, 230 km^2 are located in FFH areas: 179.5 km² in the "Dogger Bank" area and 50.5 km² in the "Sylt Outer Reef" area. These are exclusively reservation areas; there are no priority areas for pipelines in any FFH area.

Since both the designations of priority and reservation area for pipelines relate to the existing situation and provide no scope for further projects, the objectives for the FFH areas cannot be impaired by the designations. As such, there is no need for additional investigation into the compatibility with the nature conservation objectives of the FFH areas.

Submarine cables

Target corridors, so called gates are being defined in three areas of the North Sea, through which the electricity cables of the offshore wind energy farms shall run. Possible significant impairments of the nature conservation objectives or protection objectives of the areas of Community importance (FFH) or the protected areas according to the EU Bird Directive can be ruled out. The investigation was performed according to the corresponding conservation and protection objectives.

Gates for crossing the traffic separation areas or for submarine cables that run towards Norderney/Hilgenriedersiel:

- The gates in the reach of the southern traffic separation scheme lies 15 km away from the FFH- protected areas “Borkum Reef Area”. The southern target corridor, which stands on the 12nm boarder, lies 8 km away from the national park Lower Saxon Wadden Sea.
- Possible effects (noise emissions) of cables are generally limited to the laying phase, and are thus temporary and local. Effects on the nature conservation objectives of the protected areas are also not expected, given the distances.

Gates for submarine cables that run towards Büsum:
- The gate lies in the SPA “East of the German Bight” and borders the seabird sanctuary Helgoland near the Schleswig-Holstein coast. The distance from the FFH area “Sylt Outer Reef” is about 13 km, from the FFH area “stoneground” in the territorial sea about 10 km and from the FFH-area “Helgoland” und “Helgoländer continental shelf” in the territorial sea about 18 km.
- Reefs and sandbanks / marine mammals (long-distance effects): There are no long-distance effects on the nature conservation objectives of the FFH area "Sylt Outer Reef" and the FFH-areas in the territorial sea expected from the designation of the gate, since effects of submarine cables (noise emissions) are generally limited to the laying phase, and are thus temporary and local.
- Special Protected area (SPA) “East of the German Bight” (according to the EU Bird Directive): There are no effects of the gate on the nature conservation objectives of the SPA “East of the German Bight” due to laying and operation of cables in the area of the designated gate. The cable laying works only last a few days and are only associated with noises typical of ships. Possible effects shall be further minimized by additional textual regulations.

9.5.2 Offshore wind energy

Three priority areas for offshore wind energy shall be designated in the Maritime Spatial Plan: “North of Borkum”, "East of Austerngrund” and “South of Amrumbank”. Possible significant effects on the nature conservation objectives of the areas of Community importance (FFH, SAC) or the SPA areas can be ruled out. The assessment considered the nature conservation objectives of the protected areas.

Wind energy priority area “North of Borkum”
- The special suitable area according to § 3a SeeAnIV "North of Borkum”, which was designated by BSH in December 2005, has been adopted into the Maritime Spatial Plan as a wind energy priority area. This priority area, approx. 542 km² in size, is currently in the immediate vicinity of the assigned FFH area “Borkum Reef Area”. Five wind parks totalling 297 plants have been approved in the priority area (as of February 2009).
- The assessment came to the conclusion that the construction and operation of wind energy facilities in this area, under consideration mitigation measures, would have no significant impact on the nature conservation objectives of the assigned FFH area “Borkum Reef Area”.

Wind energy priority area “East of Austerngrund”
- The priority area “East of Austerngrund” is 189 km² in size. It is at least 25 km away from the reported FFH area “Sylt Outer Reef”. The EU bird sanctuary “East of the German Bight” is at least 60 km away. Two offshore wind parks of 80 facilities each have already been approved in the priority area (as of February 2009).

- An investigation into compatibility based on the preliminary preservation objectives of the reported FFH areas, or based on the protection objectives of the EU bird sanctuary “East of the German Bight” is not necessary, given the distance from the areas.

Wind energy priority area “South of Amrumbank”

- The priority area “South of Amrumbank” is 149 km² in size. To the north, the area directly borders the FFH area “Sylt Outer Reef” and SPA “East of the German Bight”. To the east – except for the area of the approved wind farm “Amrumbank West” – a safety distance of 2 km to the SPA is respected. The small-whale protection area in the Schleswig-Holstein Wadden Sea national park in turn borders the FFH area “Sylt Outer Reef”. Four offshore wind parks totalling 240 facilities have been approved in the priority area (2 x 80 WEFs, 2 x 40 WEFs; as of February 2009).
- Reefs and sandbanks (long-distance effect): Given the sufficient distance from protected areas, the construction and operation of offshore wind farms in the priority area are not expected to have any impact on the habitats “reef” (EU code 1170) and “sandbank” (EU code 1110), with their characteristic and threatened communities and species.
- Marine mammals (long-distance effect): Detrimental impact can arise especially during pile-driving work during the construction phase, and also due to the noise produced during the continual operation of the plants. However, both of these impacts can be mitigated by specifications of measures at the approval level, which is indeed the normal practice in approvals.
- SPA “East of the German Bight” (long-distance effect): The construction and operation of wind energy plants in the priority area will not have any significant effect (long-distance effect) on the bird species to be protected in the SPA “East of the German Bight” or on the available food resources. The priority area will not lead to any loss of habitat for the named seabird species in the SPA “East of the German Bight”.

Species-specific observations have also revealed that migratory bird species occurring in both the priority area and in the SPA are not threatened at population level.
In the priority area there are no regular concentrations of protected species according to annex 1 of the birds directive.
The priority area causes no interruption of resting habitats or food resources for the seabirds.

9.6 Measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the marine environment through the implementation of the Maritime Spatial Plan

Basically, an improvement in consideration for the marine environment concerns can be expected as a result of the Maritime Spatial Plan. Positive effects on the development of the environmental status are to be anticipated as a result of the implemented planning designations. This is particularly due to the fact that the investigated uses would also develop on at least the same scale without a Maritime Spatial Plan. In that case, however, this would occur without the control and mitigation effect of the Maritime Spatial Plan, in which the development of marine environment concerns was a major factor for consideration. Furthermore, the designations underwent a continual optimisation process, since the continuously acquired findings from the SEA implemented concurrently to the arrangement of the Maritime Spatial Plan were taken into consideration (see also Chapter 5 of the Maritime Spatial Plan).

Specific spatial and textual regulations have been made in the Maritime Spatial Plan, which, in accordance with the corresponding environmental protection objectives presented in Chapter 1.3 of the Environmental Report, serve to avoid and reduce significant detrimental impact of the implementation of the Maritime Spatial Plan on the marine environment. Given the designations

of the Maritime Spatial Plan, no significant detrimental impact is to be expected, but rather positive effects on the marine environment are expected if the Maritime Spatial Plan is implemented.

The following aspects in particular were taken into consideration during the selection of regulations for avoidance and reduction of significant adverse impact on the marine environment:

- Results of the SEA with regard to the importance of individual sub-areas for biological subjects of protection during the designation of priority and reservation areas for the single uses, particularly with offshore wind energy, including consideration of interactions amongst the biological subjects of protection during the site selection for the respective use
- Findings acquired at the project level, in particular results of project and site-related environmental impact studies (basic phase) as well as results from impact assessments regarding the areas of Community importance (FFH, SAC) or regardingSPAs
- Cumulative effects of use in various sub-areas, on specific subjects of protection, regional and/or overregional.

Source-related designations will also be made in the Maritime Spatial Plan, which shall ensure the most environmentally compatible arrangement of the uses. Also, additional principles regarding protection and care of the marine environment and marine landscape – which also have a mitigation effect – will be set forth in addition to the presented source-related designations. Regulations, which go even further, will be additionally adopted for the use of offshore wind energy.

It generally applies that designations of the Maritime Spatial Plan are to be further specified at the project level for the planning, construction and operational phase by the respectively responsible approval authority.
For the sake of the most environmentally compatible arrangement possible of any updates to the Maritime Spatial Plan, the following measures will be aimed at:

- Description and evaluation of the effects of use on the marine environment within the scope of monitoring
- Evaluation of monitoring results with regard to cumulative effects of a use in various sub-areas
- Evaluation of monitoring results with regard to cumulative effects or interactions of different uses
- Consideration of the monitoring results and, if necessary, adaptation of the use strategy

9.7 Examination of possible alternatives and description of the environmental assessment implementation

9.7.1 Examination of possible alternatives

Shipping

In order to express the freedom of shipping defined in Art. 58 Para. 1 UNCLOS and the shipping routes important for international shipping as recognized in Art. 60 Para. 7 UNCLOS also in terms of spatial planning, a basic network of shipping routes will be assured, above all as grounds for defence against uses that are incompatible with shipping. Therefore a null variant, i.e. a renunciation of area designations for shipping, is not an alternative. Also, this null variant would not lead to any changes with regard to environmental effects, since nothing in ship traffic would change.

Exploitation of non-living resources

No area designations for raw material extraction will be made for theGerman EEZ of the North Sea. The sand and gravel extraction areas officially licensed by plan approval have already a legal status. Additional designations in a Maritime Spatial Plan would present no additional potential for control over this, due to which there shall be no designation of priority or reservation areas.

Pipelines and submarine cables

The laying and the maintenance of pipelines enjoy the freedom granted by Art. 58 UNCLOS, where due consideration must to be given to existing pipelines, pursuant to Art. 79 Para. 5 UNCLOS. In particular, the possibilities of repairing existing pipelines may not be impaired. In order to satisfy these specifications, it is necessary to designate areas for the protection of existing pipelines, amongst other things to justify claims for defence against incompatible uses. A null variant is not taken into consideration here. Again, this would not lead to any changes with regard to the environmental effects compared with the implemented designations. Since the designations are oriented along the existing pipelines, there are no spatial alternatives to the chosen area designations.

The planned development of offshore wind energy in the EEZ results in the need for an accordingly large number of planned cables for conduction of power generated in the EEZ. For the connection to the mainland power grid, it is necessary to secure the cable routing at suitable transfer points on the boundary to coastal waters. Also, the highly frequented traffic separation areas off the East Frisian Island coast must be crossed such that shipping is impacted as little as possible. In light of this, target corridors or gates through which the cables for conduction of the power generated in the EEZ shall run must be designated. A null variant does not come into consideration. Given the omission of the gates' bundling effect due to the increased area consumption, this would also entail more detrimental environmental impact. There are no spatial alternatives to the chosen gates.

Scientific marine research

There are extensive study areas in which long-term research series are running in the EEZ, particularly for analyses of fish stocks. Reservation areas must be designated in order to keep the long-term series. The null variant can be ruled out, since it would endanger the continuation of the research series.

Since the designations assume the existing situation, there are no spatial alternatives.

Offshore wind energy

Within the scope of the Federal Government Strategy for Wind Energy Utilization at Sea, the special suitability area for wind energy "North of Borkum" was designated on 19 December 2005, in accordance with §3a SeeAnlV. After inclusion of further concerns – in addition to shipping and the marine environment – and after final consideration, special suitability of this area for use for wind energy generation was also noticed at the Maritime Spatial Plan, whereupon the area was adopted as priority area for wind energy. Since this suitability area designation according to SeeAnlV has led to a high concentration of wind farm plans in this area – of which one series has already been approved – the null variant is not an alternative. Furthermore, additional development aims must be achieved as part of the above strategy respectively of the integrated energy and climate program of the federal government, amended by 2007, which make it necessary to provide additional areas with priority for wind energy. As such, there are also no alternatives for the identification of priority areas in addition to the previous special suitability areas according to SeeAnlV.

In light of this, approved or approval pending neighbouring wind energy farms that cover a large, continuous area outside the special suitability areas according to SeeAnIV are being investigated. Two of these areas have proven extensively suitable for use for wind energy. There are no spatial alternatives for this.

Fisheries and mariculture

It is not possible to designate areas for fisheries; on the one hand because of the EU's regulatory competence for fisheries policy, and on the other hand because of spatially non-definable fishing grounds. As such, no area designations have been taken into consideration for fisheries.

Area designations are conceivable for mariculture. However, since there is neither any experience for the EEZ area nor any emergent developmental trends in the realm of mariculture, spatial designations have been abandoned.

Marine environment

No specific area designations will be made for the protection or development of the marine environment. There are various reasons for this. Basically, the Maritime Spatial Plan may not make nature conservation area designations in lieu of the competent authorities. As such, the legally determined Natura2000 areas are already granted protective status. Additional designations in a Maritime Spatial Plan would present no additional potential for control over this, due to which there shall be no designation of priority or reservation areas.

When pondering areas of special importance to benthic communities, the clear spatial definability of areas presented another difficulty. Therefore, the protection of areas in which benthos communities worthy of protection occur was anchored as a textual principle for the separate uses with respect to each source, and was omitted from area designations.

The problem of clear spatial definability of areas arises once again with regard to possible areas of special importance to bird migration, so that, again, no area designations were able to be made here. However, this concern shall be given due consideration in form of the exclusion effect in the NATURA2000 areas and in form of the adoption of a textual principle for mitigation of barrier effects during the construction and operation of OWEFs.

9.7.2 Description of the implementation of the strategic environmental assessment, including possible difficulties in the compilation of necessary information

In the existing Environmental Report, the current status of the environment is described and evaluated, and the prospective development should the plan not be implemented is presented. Furthermore, the prospective significant environmental impact expected as a result of the plan's designations are discussed and evaluated. A detailed description and assessment of the environmental status is the basis for the assessment of possible impacts of the Maritime Spatial Plan. The necessity of this ensues from the special features of the EEZ planning region: on the one hand, this is the first time that exhaustive planning will be pursued here, so it is first necessary to prepare a comprehensive inventory even of the subjects of protection. On the other hand, the special nature of the "sea" planning region necessitates a comprehensive analysis of the actual status.
The current status of the environment and the prospective development should the plan not be implemented have been described and evaluated with regard to the various subjects of protection.

The description and evaluation of the prospective significant effects of implementation of the Maritime Spatial Plan on the marine environment are also related to the aforementioned subjects of protection. Here, it must be considered that the Maritime Spatial Plan in the EEZ is a single-stage plan, i.e. that project level follows immediately.

All matters addressed by the plan that can possibly result in significant environmental impact will be investigated. The evaluation shall take place as verbal argument.

With regard to those designations for which significant impact on the nature conservation objectives or the protection objectives of the areas of Community importance and of theSPAs cannot be completely ruled out as a possibility, an appropriate assessment commensurate with § 38 in conjunction with § 34 BNatSchG. will be implemented for the FFH areas that are incorporated in the Commission List since 2007. The criteria for these assessments are the respective protection objectives and conservation objectives of the SPAs or FFH areas (SACs) designated through regulation. Wherever available, the results of impact assessments already implemented will be incorporated within official plan approval procedures or designation procedures.
In accordance with the requirements of the SEA Directive, measures to prevent, to reduce and as fully as possible offset any significant adverse impact on the environment through the implementation of the Maritime Spatial Plan are presented. As such, all of the plan's designations will be investigated with regard to their potential to reduce this impact.

With regard to investigation of alternatives to plan contents, their environmental impact will be scrutinised to the same extent required for selection decisions made at the Maritime Spatial planning level.
For the designation of planned monitoring measures, existing monitoring measures and national and international monitoring measures are being investigated for suitability for the Maritime Spatial Plan.

Information gaps and lack of evaluation criteria

Seabed
The description and evaluation of the environmental impact on the subject of protection seabed are based mainly on the analysis of selective data surveys. There is a lack, in particular, of an exhaustive description of the sediment, with regard to the distribution of coarse sand-fine gravel areas, residual sediments in the form of gravels, stones and blocks, and the potential occurrence of the habitat type "undersea structures arising through escaping gas". No definite statements of a quantitative nature concerning the spatial and chronological wrap-around of sand movements can be made for the natural sedimentary dynamics. Here, there is an extensive lack of information on the distribution and thickness of moving or shifting sands, or suitable operational tools for modelling sediment transport to provide definite model results concerning the rearrangement events on the seabed.

Water

There is sufficient knowledge available for this subject of protection.

Phytoplankton and zooplankton
There are gaps in the information regarding the possible effects of different uses on the occurrence of phytoplankton and zooplankton:
Effects of fisheries and mariculture on phytoplankton and zooplankton in the EEZ are largely unknown.

- Interactions between the effects of different uses and abiotic factors on plankton are still inadequately described and still not recorded in their entire diversity.
- Cumulative effects of eutrophication, fisheries, shipping and other uses on the plankton are largely unknown.
- The likely consequences of fisheries on plankton through the marine food webs cannot be reliably assessed.
- The likely consequences of marine environmental pollution on plankton and enrichment in the food webs cannot be reliably assessed.
- Changes in phytoplankton and zooplankton cannot be reliably ascribed to either natural or anthropogenic causal influences.

Gaps in information regarding natural variability and various effects of uses do not allow a definite prediction of the development of phytoplankton and zooplankton in the German EEZ:
- The impact of long-lasting activities that generate turbidity vanes (such as gravel and sand extraction) is largely unknown.
- Cumulative impact and/or interactions of climatic changes, fisheries, shipping, marine environmental pollution and other uses at sea on the phytoplankton and zooplankton in the EEZ cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring the status of phytoplankton and zooplankton as the basis of the entire marine food webs. In order to fill these gaps in knowledge, there is a need for further research, and monitoring measures in particular. Recommended in particular are, among others: long-term investigations of species spectrum, abundance and biomass, interactions between biotic and abiotic factors of the marine environment, climate change, consequences of utilization and cumulative impact of changes in the marine environment on plankton.

Benthos

Information gaps still exist with regard to possible impacts of different uses on the benthos:
- Impact of pollutants on the benthos are not sufficiently known.
- Chronic impact and cumulative impact of various pollutants on the benthos are largely unknown.
- The likely consequences of fisheries on the benthos through the marine food webs cannot be reliably assessed.
- The likely impact of introducing hard substrates on the development of the benthos communities are still largely unknown.
- The likely impact of restricting fishing activity by prohibiting the navigation of certain fishing vessels in offshore wind energy farms are largely unknown.
- Previous findings from the coastal waters and from different biotope types cannot be directly applied to the situation in the EEZ.
- The likely cumulative impact of different uses on the benthos cannot be reliably assessed.

Gaps in information regarding natural variability and various impacts of uses do not allow a definite prediction of the development of the benthos:
- Data of assured quality on the impact of specific uses (in particular offshore wind energy and sand and gravel extraction) on the benthos are lacking; impact of offshore wind farms on the benthos cannot yet be reliably predicted.
- Habitat expansion for the benthos through introduction of hard substrate in offshore wind parks cannot be reliably predicted; cumulative impact of uses on the development of benthic species populations are largely unexplored; the development of Red List species populations cannot be assessed.

- Cumulative impact and/or interactions of climatic changes, fisheries, marine environmental pollution, sand and gravel extraction, offshore wind energy utilization and other uses at sea on the benthos cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring the status of benthic communities.

Fishes

Information gaps still exist with regard to possible impacts of different uses on fish populations:

- Interactions between the development of specific fish species populations (as both prey organisms and predators) and fisheries are largely unclear.
- Impact of pollutants on fish, particularly on commercially important species, are partially known.
- Chronic impact and cumulative impact of various pollutants on fish are largely unknown.
- The likely consequences of fishing on fish through the marine food webs cannot be reliably assessed.
- Information on the reaction of fishes to sound, in particular noise emissions from offshore wind energy plants, are only available on a very limited basis.
- The likely impact of changing the habitat and food spectrum, by introducing hard substrates, on the development of fish fauna are still largely unknown.
- The likely impact of restricting fishing activity by prohibiting the navigation of certain fishing vessels in offshore wind energy farms are largely unknown.
- The likely cumulative impact of different uses on fish fauna cannot be reliably assessed.

Gaps in information regarding natural variability and various impacts of uses do not allow a definite prediction of the development of fish fauna in the German EEZ:

Data of assured quality on the impact of specific uses (in particular offshore wind energy and sand and gravel extraction) on fish fauna are lacking; the consequence of which is that the impact of offshore wind farms on fish cannot yet be reliably predicted.

A possible habitat and food expansion for fishes through introduction of hard substrate in offshore wind farms cannot be reliably predicted; cumulative impact of uses on the development of fish species populations are largely unexplored; the development of Red List species populations cannot be assessed.

Cumulative impact and/or interactions of climatic changes, fisheries, marine environmental pollution, sand and gravel extraction, offshore wind energy use and other uses at sea on fish fauna cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring the status of fish fauna.

Marine mammals

Information gaps still exist with regard to possible impact of different uses on the occurrence of marine mammals:

- Impact of pollutants on marine mammals are not sufficiently known.
- Chronic impact and cumulative impact of various pollutants on marine mammals are largely unknown.
- The likely consequences of fisheries on marine mammals through the marine food webs cannot be reliably assessed.
- The likely cumulative impact of different uses on marine mammals cannot be reliably assessed.

Gaps in information regarding natural variability and various impacts of uses do not allow a definite prediction of the development of marine mammals in the German EEZ:

- Data of assured quality on the impact of specific uses on marine mammals are lacking, so that the use of offshore wind farms by harbour porpoises or the possible loss of habitat for harbour porpoises by the avoidance of wind farms cannot yet be reliably predicted.
- Furthermore, possible impact such as injuries and physiological damages due to uses, and behavioural changes due to operational noises or other operation-related factors in offshore wind farms and their environment are largely unexplored.
- Cumulative impact and/or interactions of climatic changes, fisheries, shipping, marine environmental pollution and other uses at sea on marine mammals cannot be reliably assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring the status of marine mammals.

Seabirds

Information gaps still exist with regard to the possible impact of different uses on the occurrence of seabirds:

- Impact of pollutants on seabirds are not sufficiently known.
- Chronic impact and cumulative impact of various pollutants on seabirds are largely unknown.
- The likely consequences of fisheries on seabirds through changes in the marine food web cannot be reliably assessed.

Gaps in information regarding natural variability and impact of different uses only allow a limited prediction of the development of seabirds in the German EEZ:

- Data of assured quality on the impact of specific uses on seabirds (e.g. offshore wind energy or sand and gravel extraction) are lacking.
- The species-specific use of offshore wind farms by seabirds cannot be reliably predicted.
- The loss of habitat for specific species of seabird as a result of avoidance of offshore wind parks cannot be reliably yet.
- Possible impact, such as injuries and physiological damages resulting from uses is largely not researched.
- The danger of collisions of certain species of seabird with offshore wind energy plants is only predictable to a limited extent.
- Behavioural changes in seabirds due to the operation of offshore wind energy plants are largely unknown.
- Impact resulting from disturbances or habitat losses for seabirds in the offshore area at the species population level is largely unknown.
- Habituation effects of sensitive species to uses in the offshore area are still not researched.
- The loss of habitat for certain species of seabirds as a result of avoidance of shipping routes remains uncertain.
- The likely consequences of habitat loss in use areas and displacement of seabirds into neighbouring areas cannot be reliably assessed.
- The likely consequences in the case of population displacement (chance of survival, reproductive success) cannot be reliably assessed.
- Cumulative impact and/or interactions of climatic changes, fisheries, shipping, marine environmental pollution and other uses at sea on seabirds and in the EEZ cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring the status of seabirds.

Migratory birds
Information gaps still exist with regard to possible impacts of different uses on migratory birds:
- Sufficient findings on the effects of uses (in particular offshore wind energy) on migratory birds are still lacking at present.
- Previous findings on the effects of wind energy plants in coastal waters and on land are only applicable to a very limited extent, due to the different conditions.

Gaps in information regarding natural variability and impacts of different uses do not allow a definite prediction of the development of migration in the German EEZ:
- Data of assured quality on the impact of specific uses on migratory birds (e.g. shipping, production platforms, offshore wind energy plants) are lacking.
- The danger of collisions of certain species of migratory bird with offshore wind energy fplants is largely unknown.
- Possible barrier effects through offshore wind energy farms on migratory routes of certain species across the sea are largely not researched.
- Cumulative impact and/or interactions of climatic changes, marine environmental pollution and uses at sea on migratory birds cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring bird migration over the North Sea.

Bats
Information gaps can be seen with regard to the possible effects of different uses on the occurrence of bats:
- Data on the effects of uses on bats are lacking at present.

Gaps in information regarding natural variability and impacts of different uses do not allow a definite prediction of the occurrence of bats in the German EEZ:
- Data of assured quality on the impact of specific uses on bats (e.g. shipping, production platforms, offshore wind energy plants) are lacking.
- The danger of collisions of certain species of bats with offshore wind energy plants is largely unknown.
- Cumulative impact and/or interactions of climatic changes, marine environmental pollution and uses at sea on bats cannot be assessed at the current state of knowledge.

The list of gaps in knowledge makes it clear that there is still a major lack of suitable measures for recording and monitoring migratory movements of bats over the North Sea.

Lack of evaluation criteria
Given the existing information gaps, it is particularly evident that there is still a major lack of criteria for evaluating the status of biological subjects of protection or for evaluating the effects of anthropogenic activities on the development of the living marine environment.

There are many reasons for the lack of criteria for evaluating the status and the natural trends of the biological subjects of protection in the marine area, each specific to the respective subject of protection:
- Lack of historical data and long-term data series
- Lack of analysis of all available data relating to specific subjects of protection
- Lack of trend analyses
- Lack of overlapping information from marine physics, marine chemistry, marine geology, marine biology and marine meteorology

- Lack of suitable methods for developing evaluation criteria on the status of the living marine environment.

Overall, there are several factors that make it difficult to assemble criteria for evaluating the impacts of different uses on biological subjects of protection.
- Lack of criteria for evaluating the natural status of biological subjects of protection
- Lack of data on the impact of individual uses (particularly with regard to new forms of use) on the development of biological subjects of protection.
- Lack of long-term impact data from which to draw conclusions on permanent behavioural changes or detrimental impact on populations
- Lack of suitable methods for developing evaluation criteria on the impact of uses on biological subjects of protection.

Summary
The knowledge gaps presented above make clear that suitable measures for recording and monitoring the status of individual subjects of protection are still under development. And yet, with increased use on the one hand and rapidly progressing changes in the marine ecosystem on the other, it would be positive to have highly targeted measures for recording and monitoring the status of the subjects of protection – as a basis for adequate Maritime Spatial planning and as an effective protection of the marine environment. As such, the following actions would help greatly when making predictions in the event of any future updates.

- Analysis of all available data records from all research and monitoring programmes and environmental impact assessments as part of the approval procedures for various uses.
- Analysis and overlapping of biological data with physical and chemical data.
- Analyses of monitoring data, in order to be able to record possible impacts of uses such as sand and gravel extraction or offshore wind energy farms on the subjects of protection.

9.8 Planned measures for monitoring the significant impacts of implementation of the Maritime Spatial Plan on the environment

The significant impacts of implementation of the Maritime Spatial Plan on the environment must be monitored according to § 7 sec. 10 ROG 1998 (cf. § 9 sec 4 ROG). This is to ensure that any unforeseen detrimental impacts are discovered in good time for suitable remedial measures to be taken (cf. Art. 10 SEA Directive or § 14 m UVPG).

Accordingly, the planned measures for monitoring the significant impacts of implementation of the plan on the environment are to be designated in accordance with § 7 sec. 8 ROG 1998 (cf. § 9 sec.. 4 ROG) of the Environmental Report. The monitoring is the responsibility of BSH, since this agency is the responsible authority for the Strategic Environmental Assessment (see § 14 m Para. 2 UVPG). At the same time (as is intended by Art. 10 Para. 2 of the SEA Directive or § 14 m Para. 5 UVPG), existing monitoring mechanisms can exploited in order to avoid duplicate work during the monitoring. The results of monitoring efforts must, in accordance with § 14 m Para. 4 UVPG, be taken into consideration whenever there is a renewed arrangement or a change in plan.

While discussing and designating the planned monitoring measures, it must be noted that the actual monitoring of significant impact on the marine environment can only be performed at the time when the Maritime Spatial Plan is implemented, i.e. the uses regulated in the Maritime Spatial Plan are realised. Nevertheless, the natural development of the marine environment, including the development of climate changes, may not be disregarded when analysing the

monitoring measures. Also, no fundamental research can be pursued within the scope of the plan-related monitoring efforts.
As such, special importance is attached to monitoring the impact of the single uses regulated in the Maritime Spatial Plan. The spatial development plan regulates, for example, that the impact on the marine environment shall be investigated and presented within the scope of project-related monitoring efforts, in order to guarantee the most environmentally-friendly application of the uses raw material extraction and wind energy.

The essential task of the monitoring efforts accompanying the plan is to consolidate and analyse these results from the various monitoring programmes implemented at the project level (so-called impact monitoring). The analysis will also refer to the unforeseen significant effects of the implementation of the Maritime Spatial Plan on the marine environment as well as the examination of the predictions and assumptions of the Environmental Report. In this connection and in accordance with § 14 m Para. 4 UVPG, the BSH will query the monitoring results – which are required for safeguarding of monitoring measures – on hand with the responsible authorities. In this connection, and in accordance with § 14 m Para. 4 UVPG, BSH shall query the monitoring results kept by the responsible authorities – which are required as assurance of the monitoring measures.

In summary, the intended plan-related monitoring measures in the North Sea can be presented as follows:

- Consolidation and analysis of project-related impact monitoring efforts implemented at the project level and any accompanying research

- Analysis of national and international monitoring programmes, in particular:

    - National BLMP monitoring programme
    - BSH marine environmental monitoring network “MARNET”
    - Monitoring programme within the scope of OSPAR (e.g. Joint Monitoring and Assessment Program, Quality Status Report)
    - Monitoring programme within the scope of ICES
    - Monitoring of the preservation status of specific species and habitats according to Art. 11 FFH Directive
    - Management plans for the SPA “East of the German Bight” (European bird sanctuary) or studies for the assigned FFH areas.
    - Environmental monitoring according to § 12 BNatSchG
    - Measures according to the EU Marine Strategy Directive
    - Measures according to the EU Water Framework Directive

Since the regulations of the Maritime Spatial Plan are predominantly related to existing uses, the ecological impact of many uses only depends to a certain degree on the implementation or non-implementation of the plan. Offshore wind energy is an exception.

Initial findings for the monitoring at the spatial planning level are expected from the effect monitoring at the project level prescribed according to the standard for analysis of the impact of offshore wind energy on the marine environment (BSH standard assessment concept [StUK]), and from the accompanying ecological research by the Foundation of German Business (SDW) on the test field project located in the priority area for wind energy “Northern Borkum” (offshore wind park “alpha ventus” with 12 wind energy facilities), sponsored by BMU research funds. In 2009, this wind farm shall be the first German wind farm to be constructed.

A series of measures for monitoring the impact on the marine ecosystem has been prepared until the end of 2007 during the designation of the project-specific scope for the impact monitoring and development of a concept for accompanying research for the test field project. For monitoring the implementation of the Maritime Spatial Plan, there are also certain measures planned that shall help to verify assumptions made with regard to significant impacts of offshore wind energy, and, wherever necessary, help to adapt use strategies and planned preventative and mitigating measures, or help to verify evaluation criteria, particularly those concerning cumulative effects.

It is planned to submit the entire impact monitoring concept (as formulated in StUK 3) for initial evaluation during the construction and operation of the test field project in the priority area “Northern Borkum”.