Ministry of Economic Affairs

Framework for assessing ecological and cumulative effects

of offshore wind farms

Part A:

Methods

Version 1.1

Contents

Summary of FAECE

Introduction

The nature conservation legislation includes an obligation to assess the cumulative effects of new initiatives with possible adverse effects in combination with other plans and projects. The Framework for Assessing Ecological and Cumulative Effects (FAECE) has been drawn up to determine how to deal with the cumulative ecological effects of the development of offshore wind farms in the southern North Sea. These wind farms are now being rolled out according to the Roadmap for Offshore Wind Power, as included in the letter to the lower house of the Dutch Parliament of 26 September 2014. The scale of these developments in the Netherlands and surrounding countries and their associated ecological risks further underline the need for this assessment framework. Moreover, the measures taken so far to prevent significant adverse cumulative effects based on the precautionary principle are no longer considered to be adequate in the light of the preferred development of offshore wind farms. A suitable method for describing and assessing these cumulative effects was lacking..

Purpose and target audience

The FAECE provides a method based on existing publicly available scientific knowledge and applies it to the Roadmap to identify the cumulative effects, in combination with other developments in the biologically relevant regions, and assess how serious they are. The national policy strategy for offshore wind power (Structuurvisie Windenergie op Zee) and the draft Second National Water Plan (NWP2) prescribe the use of this method for describing and assessing the cumulative effects to support decision-making on the development of offshore wind farms. The FAECE does not apply to location-specific effects.

The FAECE has been prepared in the first instance for use by the government authority responsible for decisions on the development of offshore wind power (such as strategic planning (scoping) documents (structuurvisies) and wind farm site decisions (kavelbesluiten)). This also makes it relevant to consultancies preparing the environmental impact assessments (EIAs) and appropriate assessments (AAs) in support of these decisions and for stakeholders in offshore wind power. The FAECE will be regularly updated to include the latest developments and knowledge.

Method

The FAECE first describes in general terms how cumulative effects can be identified and described. It then focuses on applying this to the development of offshore wind farms, drawing a distinction between a legal and an ecological approach. This is because simply meeting the legal requirements of the Nature Conservation Act (*Nbw*) will not always adequately protect the ecological values of the North Sea. In some respects, the North Sea requires a different approach. The wildlife of the North Sea comprises a wide variety of species, several of which migrate across the North Sea or over longer distances each year, while the distribution of other species within the North Sea is difficult to predict. National borders are largely irrelevant, but the legislation places considerable importance on area protection and is only applicable within the national territory. For this reason it was decided to assess the effects at the level of the biogeographic regions. This also satisfies the requirements of the nature conservation legislation, although assessments of specific planning decisions, such as EIAs/AAs for wind farm site decisions, must also address location-specific aspects.

The description and assessment of the cumulative effects of a proposed activity take place in a step-by-step procedure. The first two steps are carried out at the same time and are interrelated.

1. Identify the relevant pressures the envisaged activities could cause.
2. Identify the habitats and species that may be affected by these pressures.
3. Describe all other activities that could affect the same species.
4. Describe the nature and scale of the cumulative effects of all the activities selected in Step 3 on the selected habitats and species.
5. Evaluate the significance of the effects on the selected habitats and species.
6. If necessary, adapt the activity by taking measures to prevent the activity causing significant effects.

Calculation of effects

The effects are calculated for those species that are expected to experience significant effects:

1. Harbour porpoise. The effects of underwater sound have been calculated in a series of steps to identify the numbers of harbour porpoises that will be disturbed and for how many days, and what this means for the population during the implementation period of the Roadmap.

2. Birds (seabirds, coastal breeding birds and migratory birds). The calculation of cumulative effects on birds took account of collisions with wind turbines in combination with the barrier effect and habitat loss resulting from the presence of wind farms.

3. Bats. Knowledge of the presence, behaviour and therefore the sensitivity of bats at sea to operational wind farms is still in its infancy. Indicative estimates of collisions have been made based on expert judgements.

Assessment

The assessment of effects on species is based on the principle that there must be no structural decline in population numbers. If there is, the natural resilience of the population will have been damaged. If recovery is not possible, the species will eventually become extinct or disappear from part of its range. The FAECE assesses bird and bat species against potential biological removal (PBR), a measure of the maximum number of individuals of a species that may be removed from the population in addition to natural mortality and emigration without the population undergoing a structural decline. Population characteristics such as capacity for growth and recovery and the trend in population size are incorporated into this measure. As long as the PBR is not exceeded, there will be no significant – and therefore unacceptable – effects. Effects on the harbour porpoise are assessed against the threshold values in ASCOBANS (Agreement on the Conservation of Small Cetaceans in the Baltic, North-East Atlantic, Irish and North Seas). There is no usable PBR for harbour porpoise because of the type of effect caused by pile driving (disturbance).

Evaluation of the results when applied to the Roadmap

The evaluation of the effects shows that the implementation of the Roadmap could lead to significant effects, particularly on harbour porpoise, lesser black-backed gull, greater black-backed gull, herring gull, Nathusius's pipistrelle and possibly two other bat species. For the harbour porpoise population, other activities (certainly seismic research and fisheries) are already likely to exert an excessively high pressure on the population. Under the nature conservation legislation, due care should also be given to limiting the number of deaths of migratory birds. This means that additional measures will be needed to provide adequate protection for these birds. Part A of the report mentions measures that can be used.

The FAECE draws no conclusions about the measures to be taken. Decisions on whether measures should be taken and, if so, which ones will be made when the site decisions and any other planning or environmental decisions are made about the development of offshore wind power.

1 Introduction

1.1 Background

There has been a need to describe and assess the effects of human activities on natural ecosystems since at least the 1970s. In the 1980s it was realised that it is not enough to describe and assess the effects of specific proposals and activities, but it is also necessary to examine whether the effects of various different activities can accumulate to produce larger or more damaging ecological or environmental impacts.[1]

Despite the difficulties, the importance of properly describing and addressing the issue of cumulative effects was acknowledged and incorporated into the legislation. This can be clearly seen in the wording of the EU Birds Directive (1979) and EU Habitats Directive (1982). These directives require that the ecological values, in terms of natural habitat types, species habitats and species, should not only be protected from the possible adverse effects of each separate human activity in and around protected areas on the ecological and environmental values in these areas, but also from the cumulative effects of all human activities. In the Netherlands the transposition into national law of these directives has created an explicit requirement under the Nature Conservation Act 1998 *(Natuurbeschermingswet (Nbw))* not only to assess the effects on ecological values of individual initiatives with potentially significant adverse effects, but also their cumulative effects in combination with other plans and projects. The Flora and Fauna Act *(Flora- en faunawet (Ffw))* also takes account of cumulative effects, but more implicitly by requiring an assessment of effects on favourable conservation status at various spatial scales.

In the period 2005–2009 the Dutch government received a large number of development consent applications for offshore wind farms and had to decide how to assess not only the effects on the marine ecosystem of the separate wind farms, but also the cumulative effects with other wind farms and in combination with other activities. In connection with a number of issues, including knowledge gaps about the cause–effect relationships, the presence of marine species and the resulting mandatory application of the precautionary principle, the assessment led to the imposition of restrictions on the development of offshore wind power and to a number of mitigation measures.

In response to these knowledge gaps, research programmes were established *(Shortlist Ecologische monitoring [Ecological Monitoring] 2010–2011; Vervolg Uitvoering Masterplan*[1] *2012–2015)*. Other countries have also recognised the problem of identifying and assessing the effects of offshore wind farms and have conducted considerable research in recent years.

The SER Energy Agreement for Sustainable Growth *(Energieakkoord voor Duurzame Groei or SER-akkoord)* published in 2013 heralded a new phase for offshore wind power. Given the size of the task and the costs involved, it was necessary to establish whether it would be possible, on the basis of the new insights obtained, to draw up a new framework for determining the effects of offshore wind farms, and especially for identifying and assessing their cumulative effects.

1.2 Development of offshore wind power

In September 2013 it was agreed in the SER Energy Agreement for Sustainable Growth to increase the proportion of energy generated from renewable sources in the Netherlands to 14% in 2020 and 16% in 2023. For offshore wind power it was agreed to scale up production to 4450 MW by 2023. This means that in addition to the existing and planned wind farms a further 3450 MW of operational capacity will have to be built over the coming years.

To achieve the targets in the SER Energy Agreement the Government has decided to change the decision-making procedures for the construction of offshore wind farms. In the new system the Government designates wind farm sites in a procedure in which an EIA/AA (environmental impact assessment / appropriate assessment) is prepared and conditions for protecting ecological values are set down in a wind farm site decision. The decision-making process for the site decision includes the consideration of the effects on habitats and species as required under both the Nature

[1] The *Vervolg Uitvoering Masterplan* (VUM) is a four-year follow-up research programme on Shortlist ecological monitoring studies into acoustics, fish larvae, birds, bats and mammals.

Conservation Act and the Flora and Fauna Act. The allocation of responsibilities in the Offshore Wind Energy Bill (Wetsvoorstel windenergie op Zee) and the use of this Framework for Assessing Ecological and Cumulative Effects (FAECE) are explained below

Offshore Wind Energy Bill
The Offshore Wind Energy Bill provides a comprehensive legal framework for the large-scale development of offshore wind farms. It introduces a 'wind farm site decision' in which the Government designates the areas where offshore wind farms may be built. In this site decision the Minister of Economic Affairs and the Minister of Infrastructure and the Environment define the locations where, and the conditions under which wind farms may be developed, and where the connections to the national grid are to be made. In an SDE+ tendering process a developer will be selected for each site and awarded a grant to build the wind farm on the site and the connection to the grid. The developer will also be granted a licence giving exclusive rights to build and operate a wind farm on the site.

An important part of the site decision is the assessment of ecological impacts. Since 1 January 2014 the Nature Conservation Act (*Nbw*) 1998 and the Flora and Fauna Act (Ffw) also apply to activities in the Exclusive Economic Zone (EEZ). Both Acts implement the Birds Directive and the Habitats Directive for the Dutch territory. The Nature Conservation Act provides for the protection of natural habitats of individual species in special protection areas, the Natura 2000 sites that make up a European ecological network. The Flora and Fauna Act provides for the protection of certain animal and plant species in the whole of the national territory. The bill integrates the assessment that has to be carried out under these directives into the site decision.

The site decision is a decision within the meaning of Section 7.1 of the Environmental Management Act. This means that an environmental impact assessment (EIA) must be carried out when preparing a decision to designate a site. In the event that a wind farm could have significant effects on a Natura 2000 site, an appropriate assessment (AA) must also be made. The EIA and the AA must also investigate what the cumulative effects will be.

The Framework for Assessing Ecological and Cumulative Effects (FAECE) contains an estimate of the cumulative effects of all the wind farms planned until 2023 (both Dutch and foreign wind farms) in the study area (see Chapter 5). The best available scientific knowledge has been used to come to an assessment of whether the cumulative effects exceed the acceptable limits for three species groups: marine mammals, birds and bats.

If the EIA and AA indicate that unacceptable adverse effects may occur, a study must be made to determine whether these effects can be sufficiently mitigated by taking additional measures. This mitigation measures must be included in the site decision as a set of conditions.

Wind farm sites are designated only in zones reserved for this purpose in the National Water Plan (NWP). The NWP (2009–2015) contains two such zones reserved for wind power generation (Borssele and IJmuiden Ver). In September 2014, in the national spatial strategy for offshore wind power *(Rijksstructuurvisie Windenergie op Zee)*, the Government made spatial reservations for six areas in the Holland Coast zones and an area north of the West Frisian Islands for the generation of wind power. In a letter to the lower house of the Dutch Parliament of 26 September 2014 on offshore wind power, the Minister of Economic Affairs and the Minister of Infrastructure and the Environment presented a Roadmap setting out the areas in which the offshore wind farms needed to achieve the targets in the SER Energy Agreement will be built and in what order. The Roadmap also states that a new strategic planning document *(structuurvisie)* will be prepared in which two zones off the coast of North and South Holland bordering the 12 mile zone will be extended to a distance of 10 nautical miles from the coast.

The EIA/AA (Royal HaskoningDHV, 2014) drawn up for the national spatial strategy for offshore wind power *(Rijkstructuurvisie Windenergie op Zee)* notes that additional mitigation measures and continuous monitoring of effects (with the possibility of intervening immediately when effects become unacceptably severe) will be needed to prevent significant adverse effects occurring, including cumulative effects. In its advice on this EIA the Netherlands Commission for Environmental Assessment observed that the question of cumulative effects in particular had not been satisfactorily dealt with and pointed to the need for an independent assessment framework for cumulative effects.

How exactly cumulative effects, on land as well as at sea, should be identified, measured and assessed is an issue which has not been satisfactorily resolved since the Nature Conservation Act came into force. Identifying and describing cumulative effects is a complex matter. In principle, it can involve investigating a great many species and individual effects, so in practice it is necessary to decide which effects and which species are relevant. Decisions also have to be made on how exactly these effects should be described and evaluated. Specific field data are scarce, so obtaining the best available scientific knowledge will often require modelling.

Moreover, what is known about the cumulative effects of offshore wind farms, both in combination with each other and with other plans and projects, is still insufficient on a number of essential points, and to address this an additional research package has been established. The initial results from this research have been used in the development of the FAECE. This assessment framework shows how the decisions were made on the species, populations and activities to be included in the assessment of cumulative effects and how these effects should be identified and described (and, where appropriate, the models to be used to do this). It includes generic information on the accumulation of effects and more specific information on how cumulative effects of offshore wind power activities should be incorporated into environmental assessments. The method described here has been used to calculate the effects of developing offshore wind farms, as set out in the Roadmap, to meet the wind power target in the SER Energy Agreement. The results of this modelling exercise can be found in Part B of this report.

1.3 Structure of the report

Part A of this report describes the methodology used for describing and assessing cumulative effects. Part B contains a description and assessment of the cumulative effects of implementing the Roadmap.

Chapter 2 examines the purpose and intended audience of the assessment framework and describes its scope and underlying principles. It contains an explanation of how cumulative effects are dealt with in the Dutch nature conservation legislation and the basic approach chosen in this assessment framework. Chapter 3 describes the generic approach for identifying and describing cumulative effects and Chapter 4 explores the aspects specific to offshore wind power. Both chapters give an answer to the question of how to treat cumulative effects and which aspects should be included in the assessment and which should not. The factors that need to be considered, from an ecological and a legal point of view, are identified in a step-by-step process. Chapter 5 examines the methodological steps to be taken to calculate the effects of rolling out the SER Energy Agreement. Chapter 6 discusses important points to be considered in the subsequent stages.

1.4 Remit and execution

This Framework for Assessing Ecological and Cumulative Effects (FAECE) has been drawn up by Rijkswaterstaat (the part of the Ministry of Infrastructure and the Environment responsible for the design, construction and maintenance of the country's main infrastructure facilities) for the Ministry of Economic Affairs, with assistance from an interdepartmental steering group of representatives from various departments of the Ministry of Economic Affairs and the Ministry of Infrastructure and the Environment. Two impact studies were carried out for Rijkswaterstaat for use in the preparation of this assessment framework:

- 'Cumulative effects of impulsive underwater sound on marine mammals' *(Cumulatieve effecten van impulsief onderwatergeluid op zeezoogdieren)*, carried out by a consortium led by TNO;
- 'A first approach to deal with cumulative effects on birds and bats of offshore wind farms and other human activities in the Southern North Sea', carried out by a consortium led by IMARES.

During the preparation of this document several meetings were held with the wind energy sector and with nature conservation and environmental organisations.

2 Scope and legal basis

2.1 Purpose and scope

Purpose

This document is a generic framework for identifying, describing and assessing the cumulative ecological effects of development decisions, particularly in relation to the development of offshore wind farms. It describes a methodology for calculating cumulative effects. Given the reason for preparing this framework, it focuses mainly on offshore wind power. It has been used to assess the wind farm zones and sites in the Roadmap for Offshore Wind Power, as included in the letter to the lower house of the Dutch Parliament of 26 September 2014, in order to ascertain in advance whether the Roadmap can be implemented in full and, if so, within which ecological parameters. The framework will also have to be used when drawing up environmental impact assessments (EIAs) and appropriate assessments (AAs) of the individual site decisions and all other planning decisions on the development of offshore wind farms. The use of the methodology for calculating the effects of implementing the Roadmap, including the results of the underlying research reports, is described in Part B. The calculated effects will be used as a generic input to the EIAs/AAs of the site decisions. To make the framework more widely applicable in future, a generic approach was taken and then this was refined specifically for assessing the effects of offshore wind farms. This report also identifies possibilities for mitigating the effects of developing offshore wind farms as proposed in the Roadmap.

Who are the intended users of the FAECE?

The FAECE has been prepared primarily for use by all government departments and agencies involved in the decision-making on offshore wind power (e.g. preparing strategic planning documents *(structuurvisies)* and wind farm site decisions *(kavelbesluiten)*). Because it provides transparent information on how the cumulative effects of these developments should be identified and assessed it is also relevant to consultancies preparing EIAs/AAs in support of these decisions and to stakeholders in offshore wind power.

Scope

When adapting the FAECE specifically for offshore wind power, a decision was made to include only those impacts that could lead to significant adverse effects, either on their own or in combination with other activities.

The effects of the Roadmap for rolling out the SER Energy Agreement were calculated only for the already designated areas outside the 12 nautical mile zone. Any effects in the 10–12 nautical mile zone have not been taken into account because the decision to designate these areas was taken too late for them to be included in the study. This study is therefore based on the assumption that generating capacity will be located in the designated zones outside the 12 nautical mile limit. In the EIA/AA of the strategic planning document *(structuurvisie)* designating the 10–12 nautical mile strips, these effects will have to be calculated again, taking account of the additional wind farm areas.

It must also be made clear that the assessments of the seriousness of the effects on conservation status have been made at the national level or at the population level where relevant. As the exact locations of the wind farm sites are not yet known, the possibility that more detailed calculations in a project EIA will reveal significant adverse effects on specific protected populations cannot be ruled out. For example, there are protected breeding colonies of lesser black-backed gulls on Texel (one of the West Frisian Islands) and near Veerse Meer lake (in the delta area in the province of Zeeland). At this generic level it is not possible to determine whether these breeding colonies would experience significant adverse effects from the development of sites in the North Holland Coast and Borssele wind farm zones respectively. These types of effects will have to be calculated when carrying out EIAs/AAs for the relevant site decisions. Moreover, effects have not been calculated for all species. This will be discussed further in Chapter 5.

2.2 Status and follow-up

In the national spatial strategy for offshore wind power (Rijkstructuurvisie Windenergie op Zee, 26 September 2014), the partial revision of the First National Water Plan (NWP1) and the draft NWP2 (2016–2021) it is stated that the FAECE must be used to support decision-making on the boundaries and exploitation of future wind farms within the designated

zones. When taking decisions on the development of offshore wind farms, such as designations of wind power zones and site decisions, the FAECE will be used to determine whether the combination of a wind farm with other wind farms and other activities will lead to any significant ecological effects, or whether this possibility can be ruled out. The Dutch government is therefore committed to using the FAECE in decision-making procedures for the development of offshore wind farms.

The FAECE is a living document: it makes use of the knowledge and expertise available at the present moment and so new developments may give cause to revise the document. These revisions may reflect advances in knowledge (e.g. population changes, understanding of cause–effect relationships, effects on species about which little was known), changes in the activities included in the assessment or the techniques used in the activities, changes in the legislation (including the relevant case law) or a broadening of the field of application of the FAECE (e.g. beyond offshore wind power). Deserving special mention in this regard is the EU Marine Strategy Framework Directive. Consideration must be given in future to incorporating some of the indicators stipulated by this directive into the FAECE. Ongoing research into the effects of offshore wind farms, such as the research for the Resulting Execution Masterplan will be completed by mid-2015 and may generate new input to the FAECE. In addition, a list of knowledge gaps has been drawn up regarding the methodology (ecological and legal) and its application (ecological information). In the years to come attempts will be made to investigate and fill in these knowledge gaps as far as possible.

2.3 Underlying principles

The description of effects is based on the most recent publicly available knowledge and the following underlying principles:

- transparency about knowledge gaps and assumptions;
- use of the precautionary principle assumes a realistic *worst case* within the range of expected developments;
- absolute clarity about the geographical scale and time horizon of the calculated effects;
- use of substantiated expert judgements where there are knowledge gaps;
- an emphasis on possible adverse effects.

2.4 Legislative conservation requirements for plans and projects

Cumulative effects in European legislation and international conventions

Including cumulative effects in the assessment of plans and projects is required under international conventions and EU directives. These legal obligations have been taken into consideration when preparing the FAECE. A brief review of the relevant international conventions and laws and their requirements regarding cumulative effects is given below.

The aim of the OSPAR Biodiversity and Ecosystem Strategy, the EU Birds and Habitats Directives, the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) is to protect or restore generic ecosystem qualities or specific habitats and species. In the Netherlands the Birds and Habitats Directives have been implemented via the Flora and Fauna Act (species protection) and the Nature Conservation Act 1998 (area protection). From 1 January 2014 both these Acts apply to the whole of the Dutch Continental Shelf. All this legislation places certain requirements on marine and other activities with the aim of achieving the specific objectives stated in these two Acts.

The aim of the EU EIA/SEA Directives, UNECE (United Nations Economic Commission for Europe) Espoo Convention and the OSPAR Strategies on Offshore Oil and Gas, Hazardous Substances and Radioactive Substances is to reduce the environmental impacts of activities. They require a full assessment of the effects of plans, projects and activities on the whole ecosystem. The Espoo Convention, the MSFD and the WFD require a cumulative effects assessment (CEA).
The WFD takes the ecological status of the coastal waters as its starting point, whereas the MSFD takes an ecosystems approach. The Espoo Convention is an important tool for bringing all stakeholders together before any environmental impacts occur and obliges parties to assess the environmental impact of certain activities at an early stage of the planning process. It also lays down a general obligation on parties to notify and consult each other about activities that are expected to have significant adverse effects across borders. When the additional impact of a project cannot be absorbed by the ecosystem, a CEA is needed. The only directives that require a CEA are the EU EIA/SEA Directives and the Birds and Habitats Directives. CEA is a mandatory part of the EIA in these cases.

National nature conservation legislation

The EU Birds and Habitats Directives are implemented in the Netherlands via the Nature Conservation Act 1998 and the Flora and Fauna Act. The Nature Conservation Act provides for the protection of natural habitat types, species habitats and species in the key sites for these habitats and species. These Natura 2000 sites together form the international Natura 2000 network of protected areas. The Flora and Fauna Act provides for the protection of named plant and animal species and the habitats of these species, both within and outside the Natura 2000 sites in the Netherlands.

The Offshore Wind Energy Bill states that the assessment of the ecological impacts of offshore wind power projects must be made in support of the site decision, which means that no separate consent is required under the Nature Conservation Act or discretionary permit under the Flora and Fauna Act. For practical purposes we refer in this document to the Nature Conservation Act and the Flora and Fauna Act because the assessment for the site decision is the same as the assessment required under these two Acts.

Cumulative effects assessment

The Nature Conservation Act requires a specific ex ante assessment of projects and plans which are not directly connected with or necessary to the management of the site, and which on their own or in combination with other plans or projects could have adverse effects on the quality of the natural habitats and species habitats in a Natura 2000 site, or cause significant disturbance to species for which the site has been designated. This also applies to activities that take place outside a Natura 2000 site, but which may have consequences for protected habitat types, species habitats or species within the Natura 2000 site. In this case an assessment must be made of whether the activities concerned will have consequences for the protected ecological values in the site. These are referred to as external impacts on Natura 2000 sites.

If a development consent is required under the Nature Conservation Act, the project or plan must be appropriately assessed, including an assessment of the cumulative effects in combination with other projects and plans. Other activities do not have to be included in the assessment of cumulative effects; the assessment only has to include projects consented but yet to be built or projects that have been built but the consequences of which have not yet been incorporated into the background situation.

All protected species enjoy a generic level of protection under the Flora and Fauna Act, which also applies outside Natura 2000 sites. An initiative with potentially adverse effects on these species (fatalities or the destruction of/disturbance to permanent resting or essential habitats) can only be granted a discretionary permit if all the requirements stated in the Flora and Fauna Act have been met. The requirement for most species is that their favourable conservation status must not be endangered. However, for some strictly protected species there are additional requirements, such as the existence of a legitimate interest. When determining the consequences of the activities for the favourable conservation status of a species, the assessment under the Flora and Fauna Act must also take into account, albeit implicitly, possible cumulative effects resulting from combined impacts with other activities.

Although the text of the Flora and Fauna Act and the explanatory memorandum do not mention cumulative effects, it almost always makes sense to consider cumulative effects on species in the marine environment, especially for sizeable projects such as offshore wind farms. This topic is examined in more depth in section 2.5 (under the heading Flora and Fauna Act and cumulative effects).

2.5 Legal and ecological approaches

The FAECE makes a distinction between a legal and an ecological approach, because satisfying the legal requirements of the Nature Conservation Act and Flora and Fauna Act does not necessarily mean that a favourable conservation status, in ecological terms, will be guaranteed. In the Netherlands the legal basis for protecting areas and species is the Nature Conservation Act, under which the Natura 2000 sites (special protection areas under the Nature Conservation Act) have been designated and concrete protection measures have been gradually introduced. The intention is that all the habitats and species for which a conservation objective has been designated for these sites will achieve and/or be maintained at a favourable conservation status as a result of the contributions made by all these sites to the protection of those habitats and species.

This area and species protection policy works well for the terrestrial ecosystems in the Netherlands, including the inland lakes, rivers and coastal waters. However, this approach is less appropriate for protecting species in the North Sea, which in general have large ranges that extend far beyond the boundaries of the designated Natura 2000 sites and even far beyond the national borders.

Differences between 'land' and 'sea'

The natural functioning of the North Sea ecosystem is characterised by a large variation in the spatial and temporal distribution of species. The system is driven to a large extent by short-lived and local hydrogeographical conditions (e.g. fronts) to which animals react. As a result, many species are highly mobile and not limited to the Natura 2000 network of protected areas. These include marine mammals (especially harbour porpoise, common seal and grey seal) and seabirds, but also some larger fish species (e.g. sharks and rays).

This means that according to the EU Birds and Habitats Directives the favourable conservation status of these species has to be maintained at the biogeographical population level. However, because the distribution of species varies within and between seasons and years, the value to certain species of specific areas within the North Sea compared to the rest of their range is hard to predict or establish, which limits the possibilities for the Netherlands to establish and warrant a good conservation status. For many species the best available knowledge is insufficient to identify any areas which fulfil a specific ecological function over any prolonged period of time. For example, the harbour porpoise protection plan (Camphuysen & Siemensma, 2010) states that the areas of special ecological value (GBEW, Lindeboom et al. 2005) do not contain a higher number of harbour porpoises than the surrounding areas. We may conclude that in all these areas the level of protection is insufficient to maintain and restore these migratory species at a favourable conservation status. These species require protection across the whole of the North Sea. This is recognised in the draft designation order for Natura 2000 sites in the North Sea.

Although the harbour porpoise is mentioned specifically, the same also applies to many marine species, such as the various species of seabird, dolphin and seal. For these reasons the FAECE interprets the objectives of the Natura 2000 sites as a need to assess the effects on the populations in the study area, because these have a direct bearing on the presence of the species in the Natura 2000 sites.

This does not alter the fact that for initiatives near Natura 2000 sites with an additional or special function for some species (such as breeding grounds of the sandwich tern and lesser black-backed gull; resting, moulting and nursery habitats of common and grey seals; and moulting habitats of guillemots) the assessment of effects under the provisions of the Nature Conservation Act deserves particular attention. Location-specific assessments will also remain necessary under the Flora and Fauna Act. These site-specific assessments will have to be conducted in support of the wind farm site decisions.

Dutch legislation

More specifically, the following aspects of Dutch nature conservation legislation are relevant in relation to the points discussed above:

1. Dutch legislation only applies to activities within the territory of the Netherlands and the Dutch Exclusive Economic Zone in the North Sea. However, species and their habitats do not recognise national borders. Animals can migrate across borders and can inhabit ranges that extend across many countries, so when considering the ecology of a species, the area relevant for the whole population must be looked at. The long-term maintenance of a species depends on the quality of different habitats in different areas. A legal assessment of the acceptability of activities is therefore logically limited in scope to within the national borders of the Netherlands, but should also consider the effects on protected species outside the territory of the Netherlands.
2. Under the Nature Conservation Act it is necessary to establish beyond doubt that the effects of an activity or development are not significant and/or that the quality of a protected habitat will not deteriorate. Only then can a development consent be issued, possibly with conditions attached. The ecological reality is that the environment is complex, species and habitats are influenced by a great variety of factors and it is seldom possible to determine exactly how big the effect of an activity is, which is why the identified effects are always within a range of uncertainty. When the degree of uncertainty is too high, the precautionary principle must be used. The precautionary approach, either on its own or in combination with adaptive management, brings together the legal and ecological approaches.
3. The protection of sites requires that activities be assessed for any adverse effects on the integrity of Natura 2000 sites as defined by the conservation targets set out in the designation orders. If the range of a species extends far beyond

the boundaries of a Natura 2000 site or beyond the borders of the Netherlands, it may still become extinct, even if the quality of the sites in the territory of the Netherlands is good. This may happen, for example, as a result of the effects of human activities in other parts of the species' range (e.g. off the British coast for species that breed there, but return to the Dutch Continental Shelf (DCS) in the autumn). From an ecological perspective and in the interests of species protection, therefore, activities and developments should be assessed for their effects on the conservation status of the species.

4. A project or plan may have no significant consequences, either on its own or in combination with other plans or projects. Article 6 (3) of the Habitats Directive requires a specific ex ante assessment of projects and plans which are not directly related to or necessary for the management of the Natura 2000 site and which individually or in combination with other plans or projects could have significant implications for the site.

In addition to Article 6(3) of the Habitats Directive, Section 19f of the Nature Conservation Act requires that the cumulative implications of plans and projects must be assessed. This means that the cumulative implications of 'other activities' – as referred to in Section 19d of the Nature Conservation Act – do not in principle, from a legal point of view, have to be included, because they have already been incorporated into the current situation (see also Annex 1). However, as these 'other activities' could well have a major ecological impact (an example being fisheries), from an ecological perspective it would be relevant to take these 'other activities' into account.

Flora and Fauna Act and cumulative effects

As described in section 2.4, the Flora and Fauna Act does not state specifically how the cumulative effects of different projects are to be dealt with. From a strictly legal point of view one could argue that the assessment for the Flora and Fauna Act does not have to take cumulative effects into account. However, the case law indicates that cumulative effects do have to be included in the assessment, although it is not clear how this is to be done. This CEA is necessary because the assessment of the impacts of a project must include its effect on the favourable conservation status of the relevant plant and animal species. If other projects that have been implemented or are going to be implemented also have an influence on these plant or animal species, they will also have to be assessed in order to properly estimate the effects on the conservation status of these species. If this is not done, there will be a risk that species will not receive sufficient protection.

A good example of this are the effects of offshore wind farms on bats. Natura 2000 sites have been designated for three bat species: the pond bat, Geoffroy's bat and the greater mouse-eared bat. These are not species expected to be found at sea, which means that when assessing the effect of development of offshore wind farms on all other bat species, which are protected by the Flora and Fauna Act, only the effects of each individual wind farm would have to be considered. There is only a slim chance that a single wind farm would cause so many bat deaths that the favourable conservation status of any bat species would be endangered. However, it is possible that all the different wind farms together, as planned in the Roadmap for Offshore Wind Power (and definitely if taken in combination with all other existing and planned wind farms in the rest of the international areas of the North Sea), could cause enough deaths among bats to adversely affect the favourable conservation status of the relevant bat species.

The aim of the Flora and Fauna Act, and the underlying Birds and Habitats Directives, is the maintenance of a favourable conservation status of the designated species. Not taking cumulative effects into account does not do justice to this aim. Although cumulative effects are not explicitly mentioned in the wording of the law, we must conclude that it is necessary to include cumulative effects in the assessment, because otherwise the effects of the project concerned on the conservation status cannot be properly estimated.

Ecological and legal approaches: sometimes more of one, sometimes more of the other

Meeting the legal requirements makes it possible to issue a development consent or discretionary permit, or – specifically for offshore wind power – adopt a site decision. To guarantee meeting the conservation objective, though, it is not always enough to take a purely legal approach to cumulative effects. Doing so could eventually lead to a legal risk if certain agreed conservation objectives cannot be met.

This is why the FAECE assesses the cumulative effects on non-location-specific species primarily at the biogeographical population level. If this leads to a positive judgement, the requirements of both the Flora and Fauna Act and the Nature Conservation Act will have been met, because specific effects that affect the population of these species will also affect the sub-populations in the protected areas. Not only does this meet the conservation objective, but it leaves sufficient room for offshore wind farms after the SER Energy Agreement has been rolled out.

The legal aspects of the assessment concern the conservation objectives of the Natura 2000 sites. Effects on sub-populations of species restricted to specific protected areas (such as some breeding colonies) may differ from the effects on the biogeographical population. In such cases the project EIA/AA in support of the wind farm site decision must include specific consideration of these effects. For further information on how this assessment should be made, see Annex 1.

The ecological effects are assessed at the level of the biogeographical population.
This involves:

- assessing effects at biogeographical scales;
- assessing effects on the conservation status instead of at the scale of one or more individual Natura 2000 sites;
- including transboundary effects;
- including other activities if it is not certain that these have already been incorporated into the conservation status;
- excluding uncertainties through application of the precautionary principle;
- taking into account the full proposals for offshore wind farms in the SER Energy Agreement for Sustainable Growth, including those farms that have not yet been granted a development consent;
- including foreign offshore wind farms expected to be developed in the period to 2023 (see Annex 8);
- ignoring the Round 2 wind farms that have been granted consent but are not under development, because these are cancelled by the Offshore Wind Energy Bill.

2.6 Towards an assessment framework

In order to take advantage of the experience and views of consultancies, during the development of the FAECE a number of interviews were held with consultants who have prepared EIAs and AAs that included investigations of the cumulative effects of a project or plan in combination with other projects and plans. In these interviews the following issues and recommendations were raised:

Issues:

- There is no clear scoping of the cumulative effects to be included in the study: geographical scope, activities, species and time period.
- Information is hard to find, spread over many different sources and incomplete, and the status of projects and activities is often not clear.
- Required information and knowledge (e.g. on dose–effect relationships, populations, etc.) and methods for identifying and describing effects are often lacking.
- The legislation is restrictive, for example by being limited to within national borders, is sometimes stricter than necessary and sometimes not strict enough where it is relevant.

Recommendations:

- Provide a clear and structured method for assessing cumulative effects, including a cumulative effects accounting system, and make a central database available.
- Identify knowledge gaps (not only on species, but also on the system and the use of the system) and give priority to filling in these knowledge gaps.
- Bring about international cooperation and coordination on methods, defining assessment frameworks and thresholds (limits of acceptable change), apportioning environmental headroom (the room that the ecosystem offers for impacts of human use without significant negative effects) and monitoring and/or research programmes.

Appendix 9 provides a more comprehensive overview of the issues and recommendations from the interviews.

2.7 DPSIR model for assessing cumulative effects

The description and assessment of the cumulative effects of plans and projects in the FAECE is a step-by-step procedure based on the DPSIR method. This method systematically identifies the Drivers (activities), Pressures, State (conservation status [2]), Impacts and Responses in six steps (see Annex 2). The first two steps are iterative and are carried out together.

- Step 1: Identify the relevant Pressures the envisaged activity could cause.
- Step 2: Identify the habitats and species that may be affected by these pressures.
- Step 3: Describe all other activities (Drivers) that could affect the same species.
- Step 4: Describe the nature and scale of the cumulative effects of all the activities selected in Step 3 on the selected habitats and species for the relevant [3] populations of those species (Impacts).
- Step 5: Evaluate the significance, through comparison with the legally established conservation targets, of both the State (e.g. conservation objectives) and the Impact (e.g. on ecosystem biodiversity) of the effects on the selected habitats and species.
- Step 6: If necessary, adapt the activity by taking mitigation or compensatory measures (Response) in order to prevent the activity from contributing to any significant effects.

Chapters 3 to 5 are structured according to this model. This means, for example, that section 2 of these chapters concerns Step 2 of the DPSIR model and section 5 of these chapters concerns Step 5. The procedure is represented schematically in the diagram below.

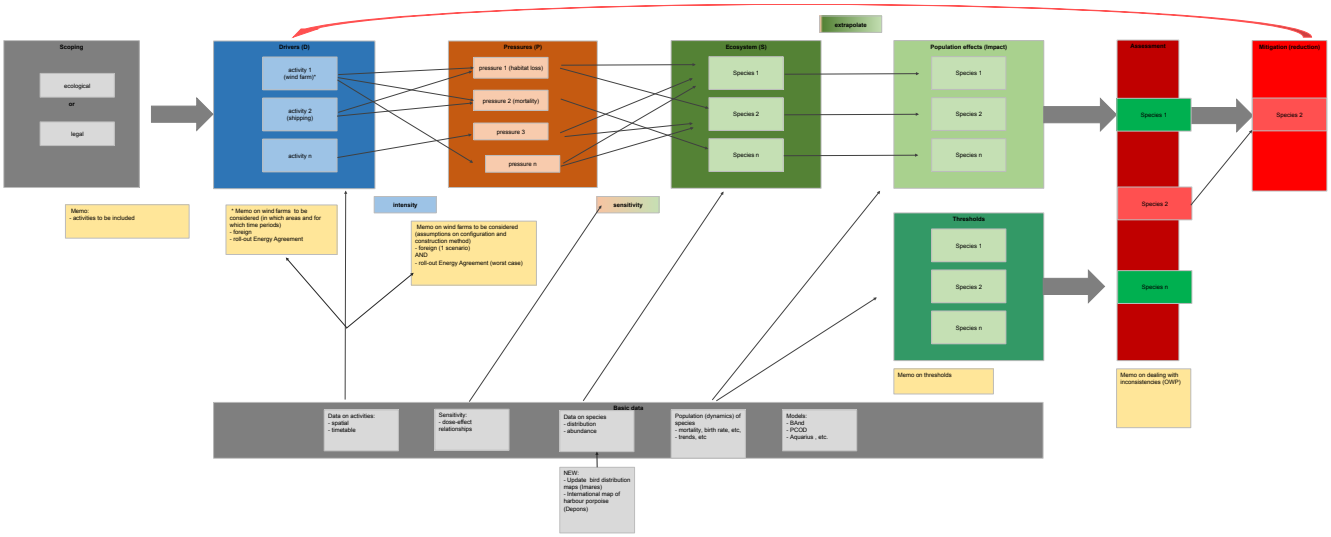

Figure 1: *Schematic diagram of the DPSIR steps*

The diagram also shows that as activities, pressures and species are added, the number of operational steps or calculations that have to be made in the process increases exponentially. This makes it necessary to select only the most relevant species and pressures in order to keep the calculations required within manageable proportions.

[2] In the DPSIR method, this 'conservation status' can, of course, be 'unfavourable-bad', 'unfavourable-inadequate' or 'favourable', the aim being to achieve favourable status through the response.

[3] In this context the 'relevant' population is the population of the whole geographical area within which the proposed activity will take place.

3 Generic approach to the assessment of cumulative effects

This chapter describes the steps to be taken at the generic level to make an adequate assessment of the cumulative effects of proposed developments. The following sections describe the steps to be taken in the DPSIR approach at a generic level. Corresponding sections in the subsequent chapters examine these steps specifically for offshore wind farms. Each step contains a description of what is necessary from a legal and an ecological point of view (to the extent that these differ).

3.1 Identification of pressures from the activities to be assessed (Step 1)

Describing the pressures from the activity to be assessed is done in conjunction with Step 2 and is dependent on Step 2, the identification of sensitive species and habitats. The activity to be assessed is the human activity that may have impacts on the species, habitats or other ecological values of prime concern for the assessment. Pressures are those aspects of the activities that cause impacts. Examples of pressures are:

- disturbance caused by mechanical activities and obstacles;
- disturbance caused by light;
- disturbance caused by sound;
- habitat loss;
- toxic effects of contamination;
- killing or injuring animals;
- changes in species composition through the introduction of species or new habitats.

Pressures are only relevant if there are species and/or habitats sensitive to them in the area. Identifying the pressures starts with a detailed description of the proposed activity, its physical characteristics, dimensions and duration for all phases: preparation, construction, operation, and decommissioning and removal. Different activities occur during each of these phases (for offshore wind farms: shipping movements, excavation, construction, maintenance and decommissioning) and these activities exert different pressures. The spatial dimensions of these pressures must then be identified and this cannot be seen in isolation from the sensitivity of species. For example, if a species is affected by sound above a certain level, the spatial dimension of this pressure is the area within which the sound is louder than the maximum level acceptable to the species. The level of detail required when identifying and describing the pressures has to be decided in conjunction with Step 2.

3.2 Identification of sensitive species and habitats (Step 2)

3.2.1 Ecological

The next step is the identification of species and habitats that could be affected by the pressures from the activities under consideration. In this step a list should be made of the species present within the sphere of influence of the pressure and the species that are sensitive to the pressures identified in Step 1.

These pressures are only significant in relation to what they can disturb, or in other words how sensitive a certain species or habitat is to that pressure, and whether there is any overlap in space and time between the presence of the pressures and the species sensitive to these pressures.
For example, certain bird species are susceptible to colliding with the blades of large wind turbines, but fish are not because the above-water parts of the turbine are not relevant to them.

3.2.2 Legal

The first point to note from the legal perspective is that not all species enjoy the same level of protection. In the Netherlands, species habitats are protected under the Nature Conservation Act and species under the Flora and Fauna

Act (see section 2.4). The various species and habitats protected by these two laws enjoy different protection regimes. The Flora and Fauna Act provides different gradations of protection. Species listed in Annex I of the Birds Directive and Annex IV of the Habitats Directive enjoy the highest level of protection.

In this step those species on the list of sensitive species drawn up in 3.2.1 that are protected under the Nature Conservation Act and Flora and Fauna Act must be identified. However, care should be taken to consider any indirect effects on protected species resulting from adverse effects on non-protected species (e.g. via the food web). The abiotic (structure) and ecological function of habitats are also protected. These are not described as clearly as the above-mentioned species lists (only to a certain degree in the Natura 2000 profile documents), but are just as relevant.

3.3 Inventory of other relevant activities with effects (Step 3)

3.3.1 Ecological

In this step all other relevant activities in or in the vicinity of the plan area are identified. It is important to realise that proximity to the plan area is not necessarily as significant for the inventory of other relevant activities as the area within which the relevant effects on the species or habitats concerned could occur. For highly mobile animals, such as birds and harbour porpoises, the areas within which relevant effects could occur are large. Effects and populations do not stop at national borders, which means that the assessment should be international in geographical scope.

Only those activities that lead to cumulative effects should be considered. The activities to be included should be identified on the basis of their ecological effects and the relevance of those effects, not on their legal status. Activities are relevant only if they can exert an influence on the habitats and species identified in Step 2, either via the same pressures identified earlier or via entirely different pressures. For example, when assessing the effects of the construction of a wind farm (the activity to be assessed from Step 1) on sea mammals, it is important to consider not only the influence of the construction of other wind farms, but also the influence of other activities (e.g. fishing or seismic exploration) within the habitats of sea mammals. Effects on habitats or species populations other than those identified in Step 2 are not to be considered.

3.3.2 Legal

The legal requirement in the Nature Conservation Act is that, when assessing plans and projects, the cumulative effects of their combined impacts with other plans and projects must be taken into consideration. More detailed requirements are contained in the case law of the Dutch Council of State and the Court of Justice of the European Union. Annex 1 contains further details on which plans, projects and activities should and should not be considered from a legal point of view.

As the Flora and Fauna Act does not mention cumulative effects, it contains no requirements on what should or should not be included in the CEA. However, because it is necessary to make an assessment of effects on the favourable conservation status, each activity which could have an adverse effect on the favourable conservation status must be included in the assessment, unless it can be considered to be already incorporated into the estimated conservation status used for the assessment.

3.4 Determination of the cumulative effects of all activities (Step 4)

In this phase, the effects of all the activities selected in Steps 1 and 3 that could have an influence on the species and habitats selected in Step 2, are described. When doing this, it is advisable to draw up a list of priorities based on expert judgement. The first selection should be based on a qualitative assessment of the cause–effect relationships between pressures and species/habitats that could lead to significant adverse cumulative effects, the key criterion being the protection of the most sensitive species. Other, less sensitive species will often benefit from the mitigation measures required for the most sensitive species. Having thus obtained a list of priorities (which must be made explicit), a more detailed study will have to be made of those aspects that could lead to significant adverse effects, including those of which the significance is in doubt. This more in-depth study, where possible based on quantitative research or modelling studies, should indicate for each activity how big an influence each pressure has per habitat or per species. If this is not possible, the amount of the influence should be determined qualitatively by expert judgement.

The set of effects determined for each pressure per species or habitat forms the basis for the analysis to determine whether, and if so to what degree, the various effects of the pressures act to reinforce or weaken the overall effect. For example, a seabird population that experiences a loss of habitat resulting from the presence of a wind farm will avoid the area and thus be less affected by collisions. An example of effects that could strengthen each other is when habitat loss and a barrier effect occur at the same time: not only is the habitat reduced in area, but the remaining area of habitat is less accessible.

3.5 Assessment of cumulative effects (Step 5)

3.5.1 Ecological

In this step the effects are assessed. Whereas the determination of the size or scale of the effects, which took place in Step 4, is a value-free exercise, in Step 5 these effects are given a value. In other words, the changes in the status of the protected species at the population level and any loss of area or quality of protected habitats are measured against a threshold value (limit of acceptable change). For species, this threshold is determined by population changes, in line with the principle that there should be no structural decline in population numbers. For habitats the threshold is the favourable conservation status; there must be no reduction in the size and/or quality of habitat in relation to the conservation objective of a site. If there is an objective for improving a habitat type, this objective must not be endangered as a result of individual or cumulative effects. In legal terms, the likelihood of such a decline or deterioration is referred to as a 'potentially significant' effect.

The ecological assessment of the effects seeks to establish the extent to which the adverse effects of the activity can have a significant influence on a conservation objective (e.g. on the area or quality of a habitat or on the population of a species). The natural size of a healthy species population is limited mainly by the amount of food and other environmental factors, such as the area of safe reproduction and roosting habitats required and the presence of natural predators. A temporary increase in the mortality rate may be compensated for by higher survival rates of the remaining animals and the ability to raise more offspring (density-dependent factors). Additional mortality in animal populations (e.g. due to a virus infection) may be caused by unexpected temporary or permanent changes in environmental factors. The likelihood of a population recovering from a disturbance depends on the magnitude of the disturbance and the speed at which it occurs.

The mechanism described above gives the population a certain degree of 'resilience' against additional deaths resulting from individual or cumulative effects of human activities. But if the increase in mortality continues year on year, it means the carrying capacity of the environment has been reduced. If recovery is not possible, the species will eventually become extinct or disappear from part of its range, and if a population is already under pressure from human influences, such as pollution and disturbance, additional adverse effects will more readily lead to a significant cumulative effect. The 'resilience' argument is only valid for direct adverse effects on the size and/or quality of a species' habitat if such a loss is offset by positive effects, such as a richer environment in the remaining areas, natural migration or habituation.

The outcome of this step is an assessment of whether the cumulative effects on a habitat or species are within the limits of acceptability or not. If the cumulative effects act to permanently reduce the size of a species population or pose a structural threat to the favourable conservation status of a habitat (expressed as area and/or quality), the activity in its proposed form is not acceptable.

From an ecological perspective, the thresholds (limits of acceptable change) must ensure that the conservation status of the habitat is not adversely affected (reduction in size and/or quality) and the population does not decline as a result of the cumulative effects of the initiative in combination with all other influences of human activities. The carrying capacity of the ecosystem for the populations of the protected species must be maintained at the level of the favourable conservation status.

In the FAECE, effects on species are assessed against potential biological removal (PBR). The PBR is a measure of the maximum number of individuals of a species that may be removed from the population in addition to natural mortality and emigration by the cumulative effects, expressed as a virtual annual additional mortality, without the population undergoing a structural decline. Population characteristics such as capacity for growth and recovery and the trend in

population size are incorporated into this measure. As long as the PBR is not exceeded, there will be no significant – and therefore unacceptable – effects. The PBR is an approach based on the principle of equilibrium population size. The PBR was developed by Wade (1998)[ii] to calculate the acceptable level of mortality among sea mammals (cetaceans and seals) as a result of human activities. As the population dynamics of many seabird species are, like those of seals and cetaceans, characterised by a high life expectancy, relatively late sexual maturity and a relatively low rate of reproduction, Wade's model is also applicable to seabirds (Dillingham & Fletcher 2008[iii]; Richard & Abraham 2013[iv]). Moreover, the findings of Milner-Gulland & Akçakaya (2001)[v] show that the PBR concept can be applied to other, shorter-lived bird species as well. The PBR approach as applied by Lebreton (2005)[vi], Niel & Lebreton (2005)[vii] and Dillingham & Fletcher (2008) can also be used to describe and assess cumulative effects on bats. The results of these studies underline the fact that the PBR is a useful instrument for predicting whether the impact of a source of additional mortality will remain within acceptable limits or not, and for identifying vulnerable populations and/or situations in which mortality reduction (mitigation) measures should be introduced (Wade 1998; Neil & Lebreton 2005).

Individual and cumulative effects of proposed activities on habitats are assessed for the degree to which they cause a measurable reduction in the total area of the relevant habitats (criteria for this are provided in the guidance document on significant effects (*Leidraad significantie*) published by the Ministry of Economic Affairs, Agriculture and Innovation in 2009) and/or a measurable decline in the quality of those habitats (expressed in terms of abiotic characteristics, vegetation structure, presence of typical species, etc.).

3.5.2 Legal

From a legal point of view it is important to assess the effects of activities on the favourable conservation status of species (under the Flora and Fauna Act) or the conservation objectives as set down in the designation orders for Natura 2000 sites (under the Nature Conservation Act).

As the Flora and Fauna Act does not contain a definition of the term 'favourable conservation status' it is necessary to fall back on the definition given in Article 1 of the Habitats Directive:
'The conservation status of a natural habitat will be taken as "favourable" when:
- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'

Conservation objectives are defined as follows:
- Bird species: in terms of the 'size and quality of habitat with a carrying capacity for a population of a certain number of birds (season average)';[4]
- Habitats Directive species: in terms of the 'size and quality of habitat for the population';
- Habitat types: in terms of the 'area and quality'.

The conservation objectives may be targets for the maintenance, expansion or improvement in the quality of habitat. The minimum requirement for all bird species is a maintenance target, but in some cases there may be an improvement task.

These conservation objectives must be described in a Natura 2000 management plan for each of the designated Natura 2000 sites, stating a timetable for the targets (when the targets will be achieved), the location of the targets (where in the site the targets will be met) and the size of the targets (the area involved or numbers to be achieved and at what quality). The amount of detail to be included in these plans must be appropriate to the objectives for and characteristics of the site. These management plans also serve as reference documents for the assessment under the Nature Conservation Act.

The consequences of activities for species can be assessed using rules of thumb, such as the ORNIS criterion established by case law. In this regard it is important to realise that as soon as a better assessment method becomes available the ORNIS criterion will no longer be legally required. It will always be possible to use the best available set of criteria at any

[4] For some bird species (for which less quantitative data are known) such 'target numbers' are not stated in the designation orders.

time, as long as sufficient evidence can be provided to demonstrate that those criteria provide sufficient safeguards for the conservation objectives.

For the assessment of the effects on habitats, use can be made of the guidance document on significant effects (Ministerie van Economische Zaken, Landbouw en Innovatie; Steunpunt Natura 2000, 2009[viii]).

3.6 Reduction of cumulative effects (Step 6)

3.6.1 Ecological

If the outcome of Step 5 indicates that the project or plan may have significant adverse effects, this should lead to a response in which measures are taken that will either reduce or remove the effects of the activities (mitigation) or in another way ensure maintenance of the conservation status of the affected species (compensation).

3.6.2 Legal

If there is a likelihood that a project will have significant adverse effects on a conservation objective that could endanger the favourable conservation status of a protected species or habitat (either from individual effects of the project or cumulative effects in combination with other projects or plans), the next step is to investigate whether the consequences of the project can be limited to such an extent that the adverse effects are no longer significant and that therefore the favourable conservation status is no longer endangered. This is called mitigation.

If, despite taking mitigation measures, significant effects on the conservation objectives cannot be ruled out, the Nature Conservation Act stipulates that an 'AIC' assessment must be carried out (application of Article 6(4) of the Habitats Directive). The first step is to examine whether there are alternative solutions (A) for the activity concerned. If there are no alternatives, the next step is to examine the existence of imperative reasons of overriding public interest (I). If there are none, the final step is to determine whether compensatory measures (C) can be taken. These are measures that offset the adverse consequences of the activity, for example by creating new areas of habitat to meet the objectives for the relevant species or habitats. In principle, compensation should be completed before the initiative can be implemented.

Although the Flora and Fauna Act does not specifically mention mitigation or compensation, these are both possible under the Act when the possibility of the activity having an adverse effect on the favourable conservation status of a species cannot be ruled out. The definition of mitigation and compensation is the same for both Acts.

Under the Flora and Fauna Act an 'AIC' assessment does not have to be carried out before compensation measures are taken. When an application is made for a discretionary permit involving a strictly protected animal species, the Flora and Fauna Act requires that an examination be made of the possibility of other satisfactory solutions that have a less adverse effect on the species in question. In fact, this is essentially the same as the consideration of alternatives under the Nature Conservation Act. Such a discretionary permit is only given when there is a statutory interest in the development or activity.

Should the above-mentioned mitigation and compensatory measures not result in a sufficient reduction in the adverse effects, it would be theoretically possible to look for possible reductions in other pressures. However, this is outside the scope of the activity being assessed and is therefore not considered in the FAECE. This aspect will be examined further in the recommendations in Chapter 6.

4 Cumulative effects of offshore wind power

Below we go through the same steps as in Chapter 3, but this time specifically for offshore wind power.

4.1 Identification of relevant pressures of the activity

To obtain insight into the relations between the relevant pressures and the vulnerable habitats or species to be considered, it is helpful to distinguish between the construction phase, the operational phase and the decommissioning phase of the wind farms.

The main pressure in the construction phase is underwater sound from piling the foundations. The following pressures are also relevant in this phase:
- disturbance caused by mechanical activities, such as vibration and sound;
- attraction to and disturbance caused by light;
- disturbance caused by intensive shipping activity during construction;
- disturbance caused by excavation;
- disturbance caused by dumping material (foundation protection riprap).

In the operational phase it is the wind turbines themselves and the total area of the sea taken up by the wind farms that can have adverse effects on animals.
The following pressures are relevant in this phase:
- habitat loss, possibly resulting in habitat fragmentation;
- disturbance of the migration routes of birds and bats;
- vibrations and sound;
- attraction to and disturbance caused by light (lighting);
- disturbance caused by maintenance vessels;
- contamination caused by released substances such as corrosion inhibitors and antifouling compounds;
- change in hydromorphological processes (such as currents and sedimentation);
- death or injury caused, for example, by collision with turbines;
- change in species composition and food availability or competition for food through the introduction of new habitats (hard substrate), such as foundation piles and riprap around piles;
- effects of a prohibition on certain forms of use within the wind farm (fisheries);
- electromagnetic radiation from cables.

In the decommissioning phase the most important pressure is again most likely to be underwater sound and excavation. As there has been so little experience with this, the effects cannot be included in the assessment.

4.2 Identification of sensitive habitats and species

4.2.1 Ecological

For the protection of the marine habitats on the DCS listed in the Habitats Directive it will in all probability be sufficient to avoid the Natura 2000 sites when planning the offshore wind power activities and wind farm locations. No wind farms will be planned in the areas protected under the Habitats Directive and the quality of the habitat types within these areas will not be endangered as a result of the wind farms constructed elsewhere in the marine environment.

The protection of species listed in the Birds and Habitats Directives is a more complicated issue. The Netherlands cannot guarantee the national favourable conservation status of typical marine species or their habitats via the designation and protection of Natura 2000 sites. This is because the relevant species are distributed across the whole of the North Sea and so no distinction can be made between populations belonging to the Dutch Natura 2000 sites and those belonging to sites elsewhere (and neither is this possible for the DCS and the rest of the southern North Sea). The presence of these

species within the marine Natura 2000 sites is therefore not a sufficient guarantee that a national favourable conservation status for them can be restored and maintained. In fact, for these species of seabirds and sea mammals it would be necessary to designate the whole of the southern North Sea as a Natura 2000 site. As this approach was not taken, the next best alternative is to pursue more intensive species protection measures. This does not alter the fact that international coordination of the protection, management and use of Natura 2000 sites remains essential. This species protection is enshrined in Dutch law in the Flora and Fauna Act, which offers protection for these 'marine species' on the DCS and which now also explicitly includes consideration of cumulative effects.

Working method
In the FAECE the effects on marine species are assessed at the level of the biogeographical populations to obtain a picture of the effect on the conservation status of the species in question. Any significant effects on the populations in the Dutch North Sea can then be allocated proportionally to the relevant Natura 2000 sites.

New activities with potentially adverse effects on the species, such as the construction of wind farms as proposed in the Roadmap, should always be assessed to determine the scale and seriousness of any effects on sensitive or potentially sensitive species. An initial assessment of the development of offshore wind farms has revealed that in the construction phase underwater sound in particular may have adverse effects on marine mammals, and in the operational phase the wind turbines may have adverse effects on birds and bats.

Within the group of marine mammals the most relevant species are the harbour porpoise, the common seal and the grey seal. Besides these species, the white-beaked dolphin, common minke whale and common bottlenose dolphin are occasionally present on the DCS. Of the group of sea mammals in the North Sea, the harbour porpoise appears to be by far the most sensitive to the possible effects of very loud sound from pile driving during the construction of offshore wind farms. Data from monitoring in the operational wind farms show a broad range of potential effects on harbour porpoises and seals. In some cases the animals were observed to display avoidance behaviour, while in other cases animals were attracted to the sounds.

The North Sea contains many saltwater and migratory fish species. All these species of fish are expected to be affected by underwater sound during the construction of the wind turbines. However, as yet much remains unknown about the effects of underwater sound on fish. Their behaviour may be affected, which in turn may influence their availability as a source of food for other animals or influence the distribution of those predator species.

The birds found in the North Sea area can be divided into three main groups:
1. true seabirds, which spend 100% of their time at sea outside the breeding season;
2. coastal birds, which breed or rest on or near the coast and fly over the Dutch North Sea every day during either the breeding period or the whole period they are present in Dutch coastal waters;
3. migratory land- and waterbirds, which in general are not ecologically bound to the coast or the sea, but display migratory tendencies in spring and autumn, either parallel to the coast in a NE–SW direction or in an E–W direction between the European mainland and the British Isles.

All three groups should be taken into account when assessing effects.

In recent years the presence of bats in offshore wind farms has turned out to be a less marginal phenomenon than thus far had been assumed. Not enough is known yet about whether their presence in offshore wind farms is due to migratory movements or foraging flights.

4.2.2 Legal

In the Dutch sector of the North Sea (including the coastal waters) there are three habitat types for which special areas of conservation (Habitats Directive sites) have been or are in the process of being designated. These are sandbanks which are slightly covered by sea (H1110), mudflats and sandflats not covered by seawater at low tide (H1140) and reefs (H1170). Three areas of these habitat types have been designated in the DCS (Vlakte van de Raan, Voordelta and Noordzeekustzone near the coast) and two other open sea areas will shortly be designated (Dogger Bank and Cleaver Bank). In addition to these special areas of conservation designated under the Habitats Directive, the Friese Front will

also be designated under the Birds Directive for the protection of the guillemot, and at a later stage the Bruine Bank [5] will be designated for the protection of the guillemot and the razorbill. So far, these seven areas have not been nominated for the development of wind farms and the protected habitats within them will therefore not be adversely affected by the wind farms included in the Roadmap. With regard to habitats, therefore, there is no question of external impacts on Natura 2000 sites (i.e. where an impact outside the Natura 2000 site affects a conservation objective for the site). Effects are conceivable on species or their habitats via the barrier effect, loss of habitat outside the limits of the Natura 2000 site and/or structural decline of source populations.

All species of marine mammals enjoy the highest level of legal protection under the Flora and Fauna Act. In addition, there is an extra level of protection for harbour porpoise, common seal and grey seal in those marine and coastal Natura 2000 sites for which conservation objectives have been set for these species under the Habitats Directive.

All the bird species found at sea also enjoy the highest level of legal protection under the Flora and Fauna Act and many species have an additional protection status via the designation of specific Natura 2000 sites for which conservation objectives have been set under the Birds Directive. Annex 5 contains a list of bird species which regularly occur on or above the southern North Sea in large enough numbers to warrant a description of the possible effects on their habitats and populations.
All bat species also have a strict protection status under the Habitats Directive (at European level) and the Flora and Fauna Act (at national level). The protection regime implies, among other things, that the animals may not be killed or 'deliberately' disturbed. 'Deliberately' means that one knows (or can suspect) that effects may occur. Initiatives with such effects can only be allowed by granting a discretionary permit. Such a development consent can only be issued if it can be shown from an assessment that the conservation status of the species will not be endangered. This assessment must be made for the populations of the relevant species at the level of the southern North Sea and the DCS.

All fish species not designated in the Fisheries Act 1963 (Visserijwet, Vw) are automatically protected under the Flora and Fauna Act. A total of 86 species of saltwater fish and migratory fish are protected by the Act. The Atlantic sturgeon and houting enjoy the strictest level of protection under the Flora and Fauna Act because they are listed in Annex IV of the Habitats Directive. Five species that are not included in the Flora and Fauna Act are protected under the Nature Conservation Act. These species are listed in Annex II of the Habitats Directive and are therefore species for which special areas of conservation have been designated: Atlantic salmon, Allis shad, twait shad, European river lamprey and sea lamprey.

4.3 Inventory of other relevant activities

4.3.1 Ecological

In Step 3 all the relevant activities that can exert pressure on the species described in the previous step are identified. The sounds produced by seismic exploration and activities by the Ministry of Defence (sonar and shooting exercises and recovery of ordnance) are additional sources of underwater sound and should be included in the determination of the cumulative effects.

For marine mammals other activities are also important, such as mortality due to by-catches in certain fisheries, disturbance by and possible collision with vessels, pollution and, for seals, disturbance by coastal recreation. Annex 3 contains a brief overview of the main activities at sea and their associated pressures.

For birds, activities that lead to a loss of habitat area and/or quality[6] and collisions are primarily other wind farms, including those on land, commercial shipping (which also causes disturbance in parts of the habitat), commercial fishing (via disturbance and effects on food availability) and perhaps to a certain extent mining activities (including sand and

[5] In the FAECE it is assumed that the Bruine Bank will be designated before 2023 and so with a view to the future the calculations of effects have been made as if this zone were already designated.

[6] It is possible that habitat quality in a wind farm could increase as a result of improved food availability, but as long as seabirds do not become habituated to the presence of wind farms and avoid these areas, they can of course not benefit from this improved food availability. Whether such habituation occurs cannot be deduced from existing research results.

shell extraction) and Ministry of Defence activities at sea. Pollution in the form of oil, microplastics and bioaccumulation of microcontaminants may also be relevant.

4.3.2 Legal

The case law shows that only certain activities need to be included in the assessment of cumulative effects. Future activities do not have to be included if it is not certain that these activities will indeed be carried out. Neither do existing uses have to be included, because the effects of these should already be incorporated into the background situation (i.e. the current conservation status). The activities which must be included are the Dutch and foreign wind farms on land and in the North Sea, new mining activities that can reasonably be expected to be carried out, as well as other consented activities that have not yet been carried out (because their net effects cannot already have been incorporated into the current conservation status of the selected species), such as sand extraction and seaweed cultivation.

The effects of recently started activities that have not yet had an effect on the current conservation status may form a serious threat to ecological values. This is particularly relevant for series of consecutive projects taking place within a short period of time, the construction of wind farms as set out in the SER Energy Agreement being a case in point.

4.4 Determination of the cumulative effects of all activities

Below we describe how the cumulative effects of underwater sound on marine mammals and of the operation of wind farms on birds and bats were determined. Very little is known about how the different effects can interact to reinforce or weaken the overall effect, so nothing can be said about these in this assessment framework.

Underwater sound and marine mammals
Research has shown that of the marine mammals in the southern North Sea, the harbour porpoise is the most sensitive to disturbance by underwater sound. For this reason it is assumed that providing sufficient protection for the harbour porpoise will also provide sufficient protection for the other species of marine mammals. The sound disturbance contours from the construction of wind farms (both in the Netherlands and in the other North Sea countries) were determined and added to those of other sound producing activities, such as seismic research, to give an impression of the total area of the sea disturbed by impulsive sound for a certain period of the year for the species considered to be most sensitive to this sound, the harbour porpoise. These contours can be compared with information on the distribution of harbour porpoise to obtain an estimate of the number of harbour porpoises that will be disturbed, and for how many days, by the construction of the proposed wind farms (harbour porpoise disturbance days).

The cumulative effect of underwater sound on the harbour porpoise in Step 4 was calculated using the expert model developed for this purpose: Interim PCoD (Population Consequence of Disturbance). This model can convert the consequences of disturbance to the numbers of harbour porpoise determined in Step 3 into the consequences for the population of this species compared with the situation without the proposed activity. A more detailed explanation of the way in which this PCoD model is used in the FAECE can be found in the Annex to Part B.

Fish
As far as is known, fish are only affected by sound levels higher than those affecting marine mammals. For this reason it is assumed that if the harbour porpoise if given sufficient protection, sufficient protection will also be given to the protected fish species or the fish species that form an important source of food for protected mammals or birds.

Birds
Wind farms affect birds in four ways:
1. Avoidance of the areas of sea where the wind turbines are situated. This leads to the displacement of certain species which no longer ‘recognise’ the wind farm as part of their habitat. As long as there is no habituation, these species will lose some of their habitat area.
2. Barrier effects of wind farms. If wind farms are located on the routes to foraging habitats elsewhere at sea, the birds affected may be forced to fly around them. In addition to natural factors such as wind strength and direction, this may lead to greater energy use, loss of foraging time, loss of condition and/or a much higher risk of collision with rotating turbine blades (see 3).

3. Collision fatalities and injuries. This mainly affects birds that fly through areas with wind farms, either while foraging or during their seasonal migrations in spring and autumn along the coast and/or over the southern North Sea.
4. Attraction of bird species experiencing enhanced foraging opportunities and food supplies ('better habitat quality').

The first three ways birds are affected during the operational phase of the wind farms were cumulated for each species for each individual wind farm. The fourth effect (attraction) will be left out of the equation for the time being, because concrete indications of this effect have only been observed for the great cormorant. If it should later be shown that, for whatever reason, wind farms provide a higher quality foraging habitat for seabirds and that the species that now display a behavioural avoidance reaction to the presence of wind turbines start habituating to them, this factor could become more important in the future.

The effects per species of all the Dutch wind farms and all wind power initiatives in the southern North Sea were then cumulated and the virtual mortality calculated, based on a 10% mortality of disturbed birds (expert judgement based on Bradbury et al. 2014) and the modelled number of collision victims per species. Finally, an attempt was made to take into account the similar effects of other plans, projects and activities in the southern North Sea on the same species or species groups.

The cumulative pressures in Step 3 that lead to loss of habitat (for seabirds), barrier effects (for coastal waterbirds) and collision mortality while migrating (for all bird species) were converted to population loss per species (annual 'additional' mortality or removal from the study area of the southern North Sea).

Two models are available for quantifying collision mortality. These models are described below. More details on these models can be found in the background report accompanying Part B.

1. Bradbury model

An expert model has recently been developed to calculate the combined effects of habitat loss and collision mortality (Bradbury et al. 2014) and this model can be used at least for seabirds and coastal birds. The Bradbury model uses data on the presence of seabird species and their species-specific sensitivity indices to wind farms to map the relative sensitivity of marine waters to offshore wind farms. This makes it a suitable tool for marine spatial planning.

This model assumes, for the time being, [7] that loss of habitat for seabirds and coastal birds will lead to a 10% increase in mortality (or definite emigration) among the birds experiencing this habitat loss. This assumption is based on just one reference (Bradbury et al. 2014) and no further clarification is given. The assumption must therefore be considered to be a highly arbitrary choice. The part played by density effects on populations has hardly been investigated at all and is largely unknown. Unfortunately, no other estimates are known. In a *worst case* scenario, 100% displacement (mortality or definite removal from the population) could be justified, but this does not reflect reality and has no basis in the literature. In any case, it is safe to assume that the 'additional mortality' as a result of habitat loss will increase as a percentage if wind farms take up a much greater share of the marine area than is proposed for the period to 2023. Conversely, the additional mortality could be reduced almost to zero if the species that avoid turbines become habituated to the presence of operational wind farms.

The model also calculates what the increase in mortality would be for the same species of seabirds and coastal birds as a result of collisions with the wind turbines. The model makes use of assumptions based on expert judgement about the species-specific behaviour of the different species (e.g. proportion of time flying/swimming, flying altitude, micro avoidance, etc.). Each bird species was assigned to categories for the various parameters. This means that the values for the proportion of time spent flying/swimming were not specific for each individual species, but that each species was assigned to one of five categories. The Bradbury model cannot be used for landbirds.

[7] If the proportion of habitat that has become unsuitable (e.g. as a result of a further increase in the area of wind farms) increases much more and the seabird species that avoid these areas do not become habituated to the presence of the wind farms, the 'mortality/emigration percentage' will of course increase considerably. This will happen when the remaining areas of sea either become too small to provide sufficient carrying capacity for these seabirds or become inaccessible because of the barrier effect of the wind farms.

2. Band model

In 2012 the Crown Estate's Strategic Ornithological Support Services (SOSS [8]) group published a model to quantify bird collisions with offshore wind farms (Band 2012). This 'Band model' originated from the theoretical model of collision risk of birds with wind turbines first described by Tucker (1996) and later by Band (2000) and Band et al. (2007).

This model can be used for all bird species (including migratory landbirds) and is based on existing data on bird fluxes per species per place, data on flight altitudes and flight velocities per species, the sizes of the individual bird species, data on the wind turbines themselves (lowest point of the rotor, total height, rotor diameter, rotor speed, etc.) and avoidance indices for macro avoidance (wind farm) and micro avoidance (wind turbine). The Band model can be used to calculate the collision risk for all the selected species.

The table below shows the effects on bird species groups and the model used to obtain these effects in the FAECE (- = not calculated, + = calculated).

		Band model	Bradbury model
seabirds	avoidance / habitat loss	-	+
	barrier effect	-, because local	
	collisions	+	+
	attraction	-	
coastal birds	avoidance / habitat loss	-	-
	barrier effect	-, because local	
	collisions	-	-
	attraction	-	
migratory birds	avoidance / habitat loss	not applicable	
	barrier effect	-, because local	
	collisions	+	-
	attraction	-	

Table 1: *Features of effect models for birds*

The applicability of the Band model depends on the availability of location-specific data on wind turbines and bird presence. This is why the Band model is more detailed than the Bradbury model (2014), making it suitable for use in project EIAs. The methodological update for appropriate assessments (2012) states that the Band model should be used as the standard methodology in AAs for calculating possible collision victims.

None of the models have been validated with actual measurements of collision victims at sea, because it has proven to be extremely difficult to make reliable measurements of the numbers of actual collisions between rotating turbine blades and flying birds (or bats). This is difficult primarily because it is impossible to recover carcasses, which in turn makes it extremely difficult to identify the species of bird or bat concerned. Techniques that make use of cameras or heat cameras to identify the species just before the moment of impact are under development and some are in use, but no firm results have yet been published. As long as we still do not know how many actual victims there are among the various species of birds and bats, the Band model would seem, for the time being at least, to provide the most realistic estimates of the numbers of collision victims, especially given the fact that this model contains the best descriptions of the features of wind turbines.

For some bird species there are models to determine energy loss as a result of the barrier effect of wind farms. These show that offshore wind farms lead to negligible effects for long-distance migrants (e.g. eider duck) (Masden et al. 2009). For other birds it also appears unlikely, given the scale of the southern North Sea in relation to the location of the (currently planned) wind farms and the flexibility of the usual migration routes, that the barrier effect will lead to structural avoidance behaviour that could cause any more than negligible effects.

[8] A group established by the UK Crown Estate to identify important ornithological issues for the UK offshore wind sector. Bureau Waardenburg (Netherlands) was at the time an SOSS Secretariat Partner.

Barrier effects are only likely to have any significant effects in specific locations, but even then collisions would appear to be a more serious risk. These types of effects should be described and assessed in site-specific EIAs and AAs.

Bats

For bats there is not enough information to determine whether or not they are present at sea in large enough numbers to suffer potentially significant effects. Neither do we know enough about their behaviour in the presence of operational wind farms. In addition, there is no reliable model for estimating the number of collision victims at sea for this species group. The only relevant model that has been developed is for estimating bat victims in wooded environments inland (Brinkmann et al. 2011[xiv]), but this model is not considered suitable for more open areas near the coast (Bach et al. 2014). The conclusion is that there is still insufficient knowledge available for estimating the numbers of bat victims for use in a CEA, other than by expert judgement.

4.5 Assessment of results

This section discusses the standards for evaluating whether the effects are acceptable or not.

4.5.1 Ecological

Potential biological removal (PBR)

In this assessment framework the preferred standard for assessing cumulative mortality is the PBR. The idea is that as long as the additional annual mortality due to the cumulative effects does not exceed the PBR the population will not decline. The cumulative effects are therefore not significant if they are smaller than the PBR.

Harbour porpoise

The most relevant question when assessing the consequences of underwater sound is whether it endangers the conservation status of the harbour porpoise. Recent calculations (Scheidat et al. 2013[xv]) show that according to the PBR method the threshold of acceptable mortality for the DCS is 272 animals/year for all activities. However, this is the direct mortality and does not allow for the possible effects of reduced reproduction. For this reason, the thresholds (limits of acceptable change) for effects on marine mammals have been derived from ASCOBANS (Agreement on the Conservation of Small Cetaceans in the Baltic, North-East Atlantic, Irish and North Seas). The interim objective of ASCOBANS for harbour porpoise is to maintain the population at a minimum of 80% of the carrying capacity, but the relevant population size is not specified in more detail. For the time being, therefore, the benchmark is taken to be the current population. The Dutch part of the population during the period 2010–2014 has been estimated by Scheidat to be on average 51,000. Assuming that the current population of the harbour porpoise is at the carrying capacity of the DCS, a reduction of more than 20% (10,200 individuals) is therefore not acceptable.

Besides the possible effects of offshore wind power facilities, other activities also have an influence on the harbour porpoise population. Major influences are fisheries by-catches and disturbance by underwater sound, especially from seismic research for oil and gas extraction. Shipping effects, explosions [9] and other anthropogenic sources cannot be estimated at this point. The Conservation Plan for the Harbour Porpoise Phocoena phocoenain in The Netherlands assumes that 150 to 250 animals are killed by fishing activities each year. The effects of seismic research may well be much more substantial. It is not clear to what degree the effects of these activities and fisheries have already been incorporated into current population trends.

Birds

The standard for assessing the cumulative bird mortality in the FAECE is the PBR. The idea is that as long as the virtual additional annual mortality due to cumulative effects does not exceed the PBR the population will not decline. The cumulative effects are then not significant and therefore acceptable.

[9] A study into explosions is ongoing. On completion of the research it may be possible to say more about the effects of explosions.

Bats

For bats the rough estimates of the cumulative effects of collisions and barotrauma are also compared with the (equally roughly estimated) PBR for the three species in question. As the population data on Nathusius's pipistrelle, common noctule and parti-coloured bat are still rudimentary, this assessment is at best indicative and certainly cannot yet be considered reliable.

4.5.2 Legal

Marine mammals

Harbour porpoises are covered by the ASCOBANS agreement, which contains agreements on the protection of all toothed whales, with the exception of the sperm whale. For the harbour porpoise, ASCOBANS contains a 'best efforts' standard.

Bats

As yet there are no standards for determining adverse effects on bats in national or international legislation.
The standard for assessing the effects on bats in the FAECE is also the PBR.

Birds

At the moment there are two methods in use for determining the threshold for significant effects on birds.

1. ORNIS criterion

According to this criterion, drawn up by the ORNIS Committee, in the absence of any contrary scientific evidence each increase in mortality of less than one per cent of the annual natural mortality rate [10] of the population concerned (average values) may be considered to be not significant. The Court of Justice uses this criterion as its benchmark for assessing whether an effect is significant or not (e.g. case C-79/03 (Commission/Spain)). In this regard it is important to realise that as soon as a better assessment method becomes available it should be used, also from a legal point of view. In practice, when there are sufficient data available on the natural mortality rate of a population, this criterion can be used to determine whether the occurrence of any significant effects can be ruled out. If the extra mortality rate of a species due to the effects remains below the threshold, it no longer has to be considered in the assessment. If the extra mortality exceeds the 1% threshold, the effect may be significant and a more detailed investigation into possible population effects will be necessary.

2. Potential biological removal (PBR)

The PBR method (see section 3.5.1) makes use of scientific information on the populations of the relevant species. This makes it a generally applicable method, but one that also provides sufficient confidence of maintaining actual population levels while offering more leeway for initiatives. For the species for which there is sufficient information on population parameters, the use of the PBR as a threshold value is also preferable from a legal point of view to the use of the ORNIS criterion, which is used when there is no scientific basis for a threshold value.

Legislative requirements

Under the Flora and Fauna Act the effects on the animal species mentioned above must be assessed at the level of their biogeographical populations to obtain an indication of the effect on the conservation status of the species in question.

The assessment against Natura 2000 conservation objectives can be carried out along two tracks:

1. Effects on populations in the southern North Sea. These have a direct bearing on the presence of the species in the Natura 2000 sites. This applies specifically to mobile species that move across national borders and for which protection in Natura 2000 sites does not guarantee the continued survival of the populations (see section 2.5). If the expected effects are larger than the acceptable levels (e.g. PBR), significant effects on the conservation objectives cannot be ruled out.

2. For initiatives near Natura 2000 sites that have an additional or special function for some species (such as breeding

[10] We should note that determining the natural mortality rate of a species is only possible if sufficient population dynamics parameters for that species have been measured in the field.

grounds of the sandwich tern and lesser black-backed gull; resting, moulting and nursery habitats of the common and grey seals; and guillemot moulting habitats) a location-specific assessment must be made under the Nature Conservation Act. This assessment must include a determination of whether the cumulative effects of the initiative within the Natura 2000 sites damage the integrity of the sites regarding the size, quality and carrying capacity of the habitat types and species habitats that are the subject of the conservation objectives of the Natura 2000 sites.

Due to their location-specific character, track 2 assessments should take the form of project EIAs/AAs for site decisions.

4.6 Reduction of cumulative effects

4.6.1 Ecological

If adverse effects cannot be ruled out, mitigation measures will have to be taken to reduce the effects on the species of the construction and/or operation of the new wind farms to such a degree that the cumulative effects can no longer damage the conservation status of the selected species, and so will not increase the risk of not meeting the conservation objectives for these species in the relevant Natura 2000 sites.

Annex 6 contains a list of effective and realistic measures to mitigate the ecological effects of offshore wind farms. This is a snapshot in time; in various fields research is being conducted into the viability and effectiveness of new techniques and procedures. When formulating measures allowances must be made for innovation.

4.6.2 Legal

As described in section 3.6.2, mitigation measures are obligatory when adverse effects on Natura 2000 sites and their protected habitats or species cannot be ruled out.

If after assessing the effects of the initiative with mitigation measures, the effects in question have not been sufficiently reduced, the Nature Conservation Act requires that the initiative be rejected, unless it can still be implemented by virtue of the 'AIC' criteria (application of Article 6(4) of the Habitats Directive). For the alternatives, other areas designated for offshore wind farms will in any case be an option (as long as the significant cumulative effects do not occur there). The generation of renewable energy can presumably be seen as an imperative reason of overriding public interest. Compensation can only be considered if there are no alternatives.

The Flora and Fauna Act also provides for the possibility of compensation as an option for allowing a discretionary permit to be issued when mitigation measures are not sufficient.

5 Determination of effects and assessment of the Roadmap for Offshore Wind Power

Whereas Chapter 4 describes a general method for determining the cumulative effects of offshore wind power, this chapter takes a more detailed look at several options for drawing up a final calculation of the cumulative effects for the Roadmap. The calculations themselves can be found in the research reports attached to Part B of this report.

5.1 Identification of relevant pressures

For the calculation of effects it was decided to take the whole Roadmap as the starting point for the assessment of cumulative effects when preparing the first wind farm site decisions. The reason for this is that later site decisions will have to take account of the previous site decisions. The aim here is, therefore, to provide as accurate a picture as possible of the total cumulative effect to maximise the chances of completing the Roadmap without constraints arising from the possible occurrence of cumulative effects. This also takes account of the comments made by the Netherlands Commission for Environmental Assessment on the national spatial strategy for offshore wind power (Rijksstructuurvisie Windenergie op Zee). All the future wind farms proposed until 2023 were therefore included in the assessment of the SER Energy Agreement for Sustainable Growth. We reiterate that for the North and South Holland Coast wind farm zones no areas between 12 and 10 nautical miles from the coastline have been included because the decision on these areas was made too late to be included in the studies. The effects of this decision will be assessed, using the FAECE, in the relevant EIA/AA of the amendment to the Second National Water Plan (NWP2). The study presented here is therefore based provisionally on the assumption that all the planned wind farms will be built within the already designated areas outside the 12 nautical mile limit, without taking into account any existing constraints due to mining activities, the presence of cables and pipelines, and the distances between wind farms.

The key pressures that determine the cumulative effects are, for the construction phase, underwater sound caused by pile driving and, for the operational phase, collision mortality of birds and bats.

5.2 Identification of sensitive habitats and species

For the identification of effects at the level of biogeographical regions a pragmatic decision was made to define a study area for birds and bats: the southern North Sea. This choice was based primarily on the characteristics of the area and the functions it has for the relevant species. This area is a relatively shallow (predominantly less than 200 m deep), warm and sheltered part of the North-East Atlantic region. Further north the North Sea 'bottleneck' becomes wider, the water becomes deeper and colder and the direct influences of the Atlantic Ocean are more strongly felt, making it a habitat for different species. The southern North Sea is a highly varied area with influences of cold Atlantic water and eutrophic water from the land. Gulls, terns, divers and guillemots are the most relevant birds in this area; harbour porpoises, common seals and grey seals are the most relevant marine mammals. Moreover, the south of the North Sea is an important flyway between the European mainland and the United Kingdom and acts as a bottleneck for a number of north–south migration routes, mainly for landbirds. In consultation between IMARES and Rijkswaterstaat the boundaries of the southern North Sea (see Figure 2) were drawn so that the whole of the Dogger Bank is included in the study area. It now consists of the southern North Sea between 51°N (about the latitude of Calais) to 56°N (just to the north of the point where the three national continental shelves meet at the northern tip of the DCS, and from the British coast to the European coastline (excluding the Wadden Sea and the Zeeland sea inlets behind the delta barrier).

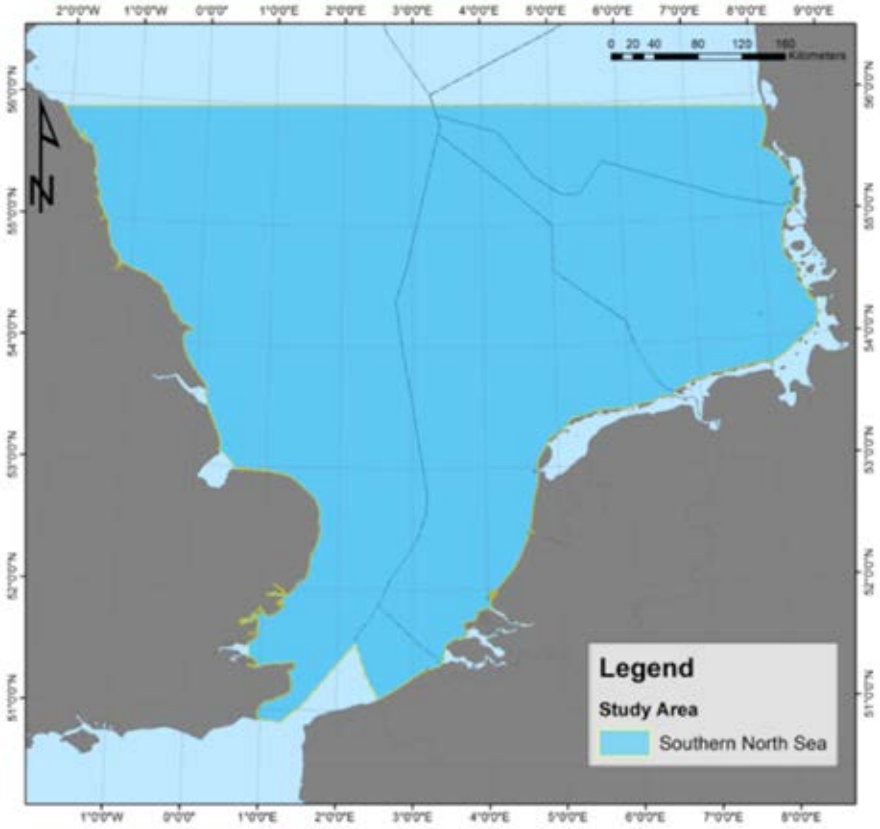

Figure 2: *Study area for birds and bats*

For underwater sound the effects on the harbour porpoise appear to be the key factor. As a relevant sub-population for the harbour porpoise, use is made of the management units defined by ICES at the request of the European Commission and the OSPAR Commission (see Figure 3). This division into sub-populations is internationally recognised. As the DCS population of the harbour porpoise is part of the population within the NS management unit, this sub-population is taken as the basis for the calculation of international scenarios.

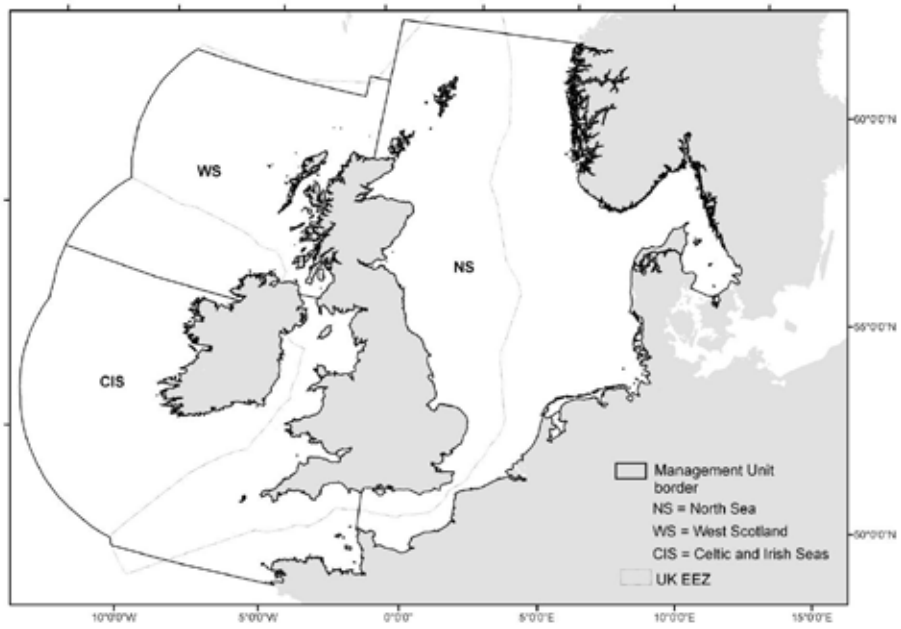

Figure 3: *Study area for harbour porpoise*

5.3 Inventory of other relevant activities

The calculated effects on harbour porpoises included underwater sound from offshore wind power activities (national and foreign wind farms in the study area of the North Sea (see Annex 8)) and seismic research activities, and by-catches in commercial fisheries. Insufficient information was available about military activities (particularly clearing unexploded ordnance) to be able to include them in the calculation of cumulative effects.

The calculations for birds and bats included the effects of national and foreign wind farms in the study area of the North Sea (see Annex 8) that are almost certain to be built and the disturbance effects of major shipping lanes on true seabirds. In addition, qualitative estimates have been made of the effects of commercial fisheries, oil and gas extraction (platforms) and associated activities, sand extraction and beach replenishment.

5.4 Calculation of cumulative effects

Harbour porpoise

The effects of underwater sound on the harbour porpoise population were calculated in a series of steps. These are::

1. sound diffusion per piling strike or seismic airgun pulse;
2. disturbance area;
3. number of disturbed animals;
4. animal disturbance days per offshore project and total;
5. population trend over the years (via Interim PCoD model).

The final outcome of the model is expressed as a reduction in the harbour porpoise population over six years (i.e. after implementation of the whole SER Energy Agreement for Sustainable Growth). The reduction per year has also been calculated for comparison with the threshold (limit of acceptable mortality, expressed as numbers per year). The exact steps taken and assumptions made in this project are described in the background report to Part B.

The model calculations were made for 16 scenarios with different assumptions about the number of wind farms (10 scenarios with only the wind farms in the SER Energy Agreement and 4 scenarios with these wind farms plus foreign wind farms), the pile driving season, the duration of disturbance and disturbance thresholds, and 1 scenario for the seismic activities.

Birds

The calculation of cumulative effects on birds included the habitat loss resulting from the presence of the wind farms in combination with bird collisions with wind turbines. Habitat loss also included the effect of disturbance by shipping on the presence of birds and was based on the assumption that 10% of the 'displaced' birds die or are lost from the population of the southern North Sea. Two models have been developed for collision victims. In line with the methodological update for AAs (Boon et al. 2012) we used the outcome of the Band model.

Bats

Knowledge of the presence, behaviour and therefore the sensitivity of bats at sea to operational wind farms is still in its infancy. Indicative estimates of effects were made based on expert judgement.

5.5 Assessment of results

5.5.1 Ecological

Harbour porpoise
The results of the model calculations for wind farms must be assessed against the thresholds (limits of acceptable change) derived from the ASCOBANS interim objective.

Birds
The results of the model calculations for wind farms must be assessed against the thresholds (limits of acceptable change) obtained using the PBR method.

Bats
Too little is known about bats to be able to make any sort of reliable calculation of cumulative effects. However, based on the assumptions made above, it has been estimated that the favourable conservation status of Nathusius's pipistrelle could be endangered. The precautionary principle in the Birds and Habitats Directives requires that mitigation measures must be prescribed to limit the number of bat victims (for an analysis of the available methods for limiting bat victims, see Annex 6: 'Mitigation measures'). In addition, in 2015 a more detailed field study will begin on the presence and behaviour of bats at sea in relation to distance from the coast and the presence of offshore wind farms. Moreover, a desk study will have to be carried out on the size and trends in the relevant populations of Nathusius's pipistrelle, common noctule and parti-coloured bat.

The results of these studies may indicate that the favourable conservation status of these bat species will not be endangered. If so, the prescribed measures can be revoked.

5.5.2 Legal

Underwater sound
Besides determining the effects on the harbour porpoise at the population level, an EIA must be carried out for a specific area to identify the consequences for any local populations of marine mammals. Although there may be no significant consequences for the total population of harbour porpoise, significant effects on sub-populations of these and other marine mammals cannot be ruled out in advance if they are severely affected in their specific habitats by sound from nearby pile driving activities. This may be the case, for example, in the Borssele zone, where the populations of common and grey seal in the Natura 2000 sites Voordelta and Vlakte van de Raan could be subject to external impacts (i.e. where an impact outside the Natura 2000 site affects a conservation objective). For the Holland Coast wind farm zones the distance between the potential pile driving locations and the resting habitats of both seal species in the North Sea coastal zone are large enough for sound disturbance to the animals to be insignificant. Significant adverse effects may also occur due to the location of specific wind farm sites, such as disturbance of seals on sandbanks near the lanes used by maintenance vessels. These location-specific aspects are not investigated in more detail in the FAECE, but should be investigated in the project EIAs.

Birds
Natura 2000 sites that have an additional or special function for some species and that are near to planned wind power initiatives should be given special attention in the assessment under the Nature Conservation Act (see Section 2.4).

For birds, these are the Natura 2000 sites in which seagoing birds such as sandwich tern and lesser black-backed gull breed. During the breeding season these birds regularly go on foraging flights within a certain range of the nesting areas. Cumulative effects on the conservation objectives for these species in these areas are only expected from those initiatives located within this flight range.

Bats
The available information on bats is too limited to be able to make a sufficiently reliable calculation of the cumulative effects. In accordance with the precautionary principle in the Birds and Habitats Directives, measures must be taken to protect bats and these will have to be based on assumptions. A research programme should also be established.

6 Quality assurance and follow-up actions

6.1 Results and recommendations on quality assurance

An external quality assurance audit has been carried out by the following experts:
Parts A and B of the report and Annexes to Part A:
- Prof. C.W. Backes, Professor of European Administrative Law, Maastricht University
- L. Boerema and P. Mendelts of Bestia et Lex

Underwater sound studies:
- J. Haelters, Royal Belgian Institute of Natural Sciences (KBIN)
- J. Derweduwen, Institute for Agricultural and Fisheries Research (ILVO)

Studies into effects on birds:
- Dr V. Dierschke of Gavia EcoResearch (Germany)
- A.D. Fox, I.K. Petersen and T. Skovbjerg Balsby of the University of Århus

Although some assumptions were questioned and some knowledge gaps pointed out, these reviews have shown that the general methodology works well and can be justified from a legal point of view. A more extensive summary is included in Annex 10.

6.2 Knowledge gaps and additions to the models and methods used

There are a considerable number of knowledge gaps, both on methodological aspects (process, ecological, legal) and on ecological aspects. Some of these gaps have been filled by assumptions based on expert judgement; others have been filled by pragmatic assumptions (see Annex 7). However, in due course these assumptions will have to be validated if at all possible. In addition, lists of ecological knowledge gaps are included in the research reports in Part B.

The research community is not standing idle, though. Research is underway into the effects of offshore wind farms on marine life, both in the Netherlands and elsewhere. These studies will deliver partial answers to the research questions. Moreover, in the near future research will also be carried out in the priority knowledge gaps mentioned in this assessment framework. These will begin with field studies on bats.

6.3 Broadening the scope of application of the Framework

This Framework for Assessing Ecological and Cumulative Effects has been developed to ensure that the effects of the development of offshore wind farms do not exceed the environmental headroom of the North Sea ecosystem. This means that when the effects of an initiative remain within the limits of acceptable change, the initiative can be permitted from both an ecological and a legal point of view. However, this also means that when a subsequent initiative is assessed, the remaining environmental headroom of the ecosystem will be less; its resilience will have decreased. This is the reason why it was decided to assess the development of offshore wind farms as set out in the Roadmap. The FAECE was used to identify and assess the total cumulative effects of the whole Roadmap, despite the fact that, strictly speaking, there is no legal reason to include consideration of planned wind farms that have not yet been granted a development consent. Taking this approach when designing and building the first wind farms makes it possible to ensure that the final wind farm can also be built and operated without incurring any ecologically or legally problematic effects.

For the time being, the FAECE does not look beyond 2023, when the planned roll-out of the offshore wind power programme should be complete. However, it does give an indication of the maximum amount ofenvironmental headroom that will be taken up by the wind farms in 2023, as well as how this stress can be minimised by taking specific mitigation measures. It is clear that after 2023 the North Sea ecosystem should still have sufficient environmental

headroom to absorb the effects of either additional wind farms or other initiatives. It therefore makes sense to take this into account right from the start when implementing the Roadmap for the SER Energy Agreement for Sustainable Growth. One way to do this would be to deploy mitigation measures for each wind farm site to avoid damage to ecological values as far as possible. The initial high levels of investment this may involve can be recouped over the longer term in the form of the benefits of maintaining some of the environmental headroom of the North Sea ecosystem.

The generic approach taken by the FAECE as described in Chapter 3 will also be applicable to very different interventions in other places, but other options should be used for the defining pressures, species, calculation models and assessment frameworks.

Terms and definitions

Netherlands Commission for Environmental Assessment
The Netherlands Commission for Environmental Assessment is an independent advisory body that gives advice on all environmental impact assessments (with or without an accompanying appropriate assessment) prepared for plans or projects.

Cumulative effects
Effects are described as changes in the physical, natural or cultural environment, caused by a development project, that fall outside the natural range of events. Cumulative effects are all the effects on the environment resulting from an activity or project in combination with the overlapping effects of other, earlier, current or future projects and activities.

Biogeographical region
Europe is divided into areas called biogeographical regions within which species and habitats are protected. These regions are found both on land and at sea. The Netherlands is located in the Atlantic region. This large region is divided into smaller sub-regions, often derived from international agreements and protocols. For example, OSPAR uses a different division into sub-regions than the Marine Strategy Framework Directive. The region used in this document covers the southern North Sea biogeographical region, which falls within the exclusive economic zones of the UK, the Netherlands, Germany, Denmark and Belgium.

Significant effect
An effect of human activities on a legally protected ecological value (e.g. a conservation objective for a Natura 2000 site or a conservation status of a protected species) is considered significant, in the legal meaning of the word in European nature conservation legislation, if as a result of that effect the realisation of that conservation objective or favourable conservation status cannot be guaranteed.

Good/favourable conservation status
The population size of every species in a specific area is always influenced by a balance of factors. If the population size is higher than the carrying capacity of its habitat, numbers will inevitably decline due to insufficient food and competition for resources between the individuals, because the reproduction rate will be lower than the mortality rate. A minimum number of individuals, depending on the species and the area concerned, are needed to maintain the population, prevent inbreeding and to absorb the effects of disease and natural calamities. A good/favourable conservation status is the minimum number of individuals needed to maintain the population in that specific area on a long-term basis. It is advisable not to work from this minimum number, but to increase it by a certain number as a reserve capacity to absorb any unforeseen additional effects or accumulation of effects in the future without the population collapsing.

Mitigation
Mitigation measures are measures aimed at minimising or removing the disturbance or damage caused by a project or activity by altering or amending the proposed activity. Such measures may be things like sound abatement systems, such as bubble curtains around the places where pile driving operations are held to construct the foundations of the wind turbines, which aim to reduce the propagation of sound from pile driving. Mitigation measures may also involve choosing alternative methods that make it unnecessary to drive piles at all and so reduce or eliminate the underwater sound, such as using other types of foundations for the wind turbines.

Compensation
Compensatory measures aim to offset the negative effects of a project or activity by taking measures outside of or independent of the proposed activity. Compensation measures may be taken only when mitigation measures have already been taken but have not eliminated the disturbance or damage, there are no alternatives available for the proposed activity and there are imperative reasons of overriding public interest for carrying out the proposed activity. Compensation involves either creating a new or enlarged area of habitat or improving the habitat quality of part of the site. Choosing between these options depends on the location of the damaged area, its legal status, the species affected and the possibilities for compensation. If no compensatory measures can be taken and significant effects cannot be ruled out, the proposed activity may not be carried out.

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Annex 1 Clarification of legal aspects: Nature Conservation Legislation and Cumulative Effects

1 Introduction

This annex outlines the legal aspects of a *cumulative effects* assessment based on Dutch nature conservation legislation.[1] Then, the activities that need to be included in a cumulative effects assessment when preparing decisions on the siting of wind farms will be determined.

2 European area protection: Habitats Directive

2.1 Object and implementation

The explicit goal of the Habitats Directive is to provide a network of legal protection for the most vulnerable and endangered habitat types and habitats of species within the Member States of the European Union (EU). The aim is, by this means, to guarantee conservation of the natural biodiversity within the EU and at the same time to give substance to the international agreements made in this respect in the 1992 Convention of Rio de Janeiro.

The Habitats Directive requires the most important habitat types and species habitats to be given special protection. The European Commission has provided details on the implementation of the Habitats Directive in 'guidance' documents. These stipulate that all Member States must work together to ensure a favourable conservation status for each of the habitat types and habitats of species at the level of their own 'biogeographical region'.

2.2 Legal framework

A project or plan, individually or in combination with other plans or projects, may not have any significant effects. Article 6(3) of the Habitats Directive requires a specific ex ante assessment with respect to plans and projects not directly connected with or necessary for the management of a Natura 2000 site, but which are likely, individually or in combination with other plans or projects, to have significant effects on the site in question.

Activities taking place outside a Natura 2000 site may also have an effect on that site. This is known as external impacts on Natura 2000 sites. The potential range and significance of external impacts depend on the circumstances in a given case. The case-by-case assessment that will therefore need to be made in this respect is whether the activity in question will have any consequences for the ecological values subject to protection in the area covered by the Directive (Parliamentary Proceedings II 2001/02, 28 171, no. 6, p. 14). The need for this assessment does not depend so much on the distance between this activity and the site concerned, but more especially on the nature and scope of specific pressures caused by the activity, the specific circumstances in the relevant site and the sensitivity of the species and habitat types concerned to the consequences. As a result, it is impossible to pre-establish in a general sense the distance to the site in question from which no significant effects could occur.[2]

A project or plan could have an effect on more than one Natura 2000 site. In that case the effects for all the Natura 2000 sites concerned must be taken into consideration when assessing whether there are any significant effects for these sites.

The competent authority may only authorise that plan or project after it has received assurance that the plan or project will not adversely affect the integrity of the Natura 2000 site. This is the case where no reasonable scientific doubt remains as to the absence of such effects, says the European Court of Justice.[3]

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[1] Relevant case law has been incorporated up to 1 December 2014.

[2] See also Administrative Jurisdiction Division of the Council of State (*ABRvS*) 5 November 2008, Environmental Case Law (*JM*) 2008/141

[3] CJ 7 September 2004, case no. C-127/02

The criterion of 'no reasonable doubt'
The European Court of Justice has determined that no reasonable scientific doubt may remain as to the adverse effects of activities. This must be assessed on the basis of the best scientific knowledge. If it is not the case, there can be no question of the requisite certainty. A margin of uncertainty or a residual risk may be acceptable, taking into account the complexity of the situation, the accumulation of uncertainties, degree of rarity and vulnerability of the habitat or species, the possibility of recovery, the seriousness and potential irreversibility. A monitoring system may also make a residual risk acceptable, but is only permissible if there is a possibility of remedying adverse effects and further research would not provide greater certainty.

3 Area protection in the Netherlands: Nature Conservation Act (*Nbw*)

Area protection is implemented through the designation and gradual explicit protection of the 'Natura 2000 sites' (the special areas of conservation designated under the Nature Conservation Act (*Nbw*)). The object of this protection is that all habitat types and habitats of species that have been assigned a 'conservation objective' should acquire a 'favourable conservation status' nationally as a result of the aggregate contribution of all these areas to the protection of these habitat types and habitats of species.

For individual - and hence not cumulative - projects and other activities that may have an adverse effect on the habitat types and species habitats in Natura 2000 sites or that may have a significantly disruptive effect on the species for which the Natura 2000 sites have been designated, the Nature Conservation Act introduces a new requirement for obtaining development consent on the basis of this Act. It is known as the ex ante assessment and is based on Section 19d *Nbw*. If an activity 'survives' the ex ante assessment, it may be carried out without development consent.

Section 19f *Nbw* stipulates that for projects requiring consent [4] which individually or in combination with other projects or plans could have significant effects on the relevant site, an appropriate assessment must be made of the effects on the site, taking into account the conservation objective. For the appropriate assessment it is therefore necessary to carry out a cumulative effects assessment.

Legal review for conformity with conservation objectives
The order designating Natura 2000 sites lays down the conservation objectives for the habitats and species in the sites concerned. They are put in terms of maintenance, improvement or restoration. The conservation objectives are then worked out in detail for each Natura 2000 site in the respective management plans.

Projects or other activities (further: actions) in or near a Natura 2000 site could affect the conservation objectives of Natura 2000 sites. The effects of actions must be examined against these objectives, which are incorporated in the designation order.

To assess whether there are any significant effects it is necessary to take into account the conservation objectives formulated for the relevant Natura 2000 site. The question of whether there are any significant effects depends on, among other things, the type of conservation objective (maintenance, improvement or restoration). If the objective is improvement, an action may not result in the likelihood of improvement and restoration being substantially reduced. Added to this, the answer to this question depends on the degree to which, as a result of the effects of the proposed actions, the conservation objectives will still be met. Also, the specific environmental characteristics and conditions of the site to which the project or plan relates must be taken into account when answering this question.

[4] For the sake of completeness see Section 19j *Nbw*.

[5] *ABRvS* 4 november 2009, zaaknr. 200900671/1/R1

Ultimately a favourable conservation status in a given biogeographical region, or the Dutch part of that region, must be achieved. Each site must make a specific contribution towards this goal. It is therefore not absolutely necessary for a favourable conservation status to be achieved in every Natura 2000 site. The determining factor when assessing concrete plans and projects is whether the consequences of this plan or project could endanger the conservation objectives of the relevant site, hence the contribution made by the site to the ideal of a nation-wide favourable conservation status.

It is important to note that the usual method of assessment, as described above, does not seem appropriate for sites that have also been designated for species of which the habitat is very large and is not confined to a specific area, such as the harbour porpoise. The courts have as yet to express an opinion on this matter.

If a designation order for a Natura 2000 site covering a species or habitat type does not contain any general or other conservation objectives, then these species or habitat types cannot be included in the assessment. This does not alter the fact that the effects on non-protected species must also be taken into consideration if they are important in the food chain of species that are protected in the relevant Natura 2000 sites.

Offshore Wind Power Bill (Wet windenergie op zee)

Under Article 5 of the Offshore Wind Power Bill, the ecological effects assessment stipulated in Section 19j of the Nature Conservation Act must be conducted when deciding on the site for a wind farm. The bill does not require separate development consent covering nature conservation

4 Which plans or projects must be involved generically in the cumulative effects assessment?

Article 6(3) of the Habitats Directive and Section 19f *Nbw* stipulate that the cumulative effects of plans and projects must be assessed. The plans and projects that need to be incorporated are discussed below. A link is also made to 'other activities', existing use and autonomous and other developments.

4.1 Projects

The term 'project' can be defined as in Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (OJ L 175, p. 40; EIA Directive), in particular as in Article 1(2) of this Directive. [7] The execution of a project is an intervention in the natural surroundings and landscape, such as the execution of construction works or of other installations or schemes.[8]

The Administrative Jurisdiction Division of the Council of State (*ABRvS*) has stipulated that an 'intervention' must involve 'physical changes in the Natura 2000 sites concerned, which changes can be interpreted as works or interventions that alter the material condition of a place'.[9]
Only those plans and projects requiring development consent under the Nature Conservation Act – and hence alone are likely to produce adverse effects, significant or otherwise – need to be included in the cumulative effects assessment.[10]

This means that projects not requiring consent under the *Nbw* (or similar assessment of ecological impacts) do not need to be included in any cumulative effects.
Projects can be at various stages. Depending on which stage they are at, projects will have to be incorporated into the cumulative effects assessment. Three stages that have emerged in the case law are outlined below.

[6] *ABRvS* 4 mei 2011, zaaknr. 200901310/1

[7] CJ EC 7 September 2004, C-127/02, Cockle-fisheries ruling, *NJ* 2005/233, AB 2004/365

[8] *ABRvS* 27 December 2012, no. 201111811/1

[9] *ABRvS* 17 September 2014, no. 201303436/1; *ABRvS* 25 September 2013, 201201701/1

[10] *ABRvS* 27 December 2012, no. 201111811/1

Stage 1: Development consent requested but not yet granted

Projects only need to be included in cumulative effects if there is sufficient certainty that these projects will be carried out. So projects for which development consent has been requested but for which consent has not yet been granted do not need to be included in the cumulative effects assessment because it is not certain whether these requests will be granted.
[11]

Stage 2: Development consent granted but yet to be built

Projects for which development consent has been granted under the *Nbw*, but which have not yet or have only been partially implemented at the time the controversial decision is reached and which could adversely affect the integrity of the Natura 2000 sites concerned, do need to be individually incorporated into the assessment of the possible cumulative effects.
[12]

To be on the safe side it would be prudent to include draft *Nbw* development consents in the cumulative effects as well, as it is highly likely that these projects will be granted consent and executed.

Given the wording used by the Administrative Jurisdiction Division, plans or projects for which development consent has been granted under the Birds or Habitats Directive must also be included in the cumulative effects assessment. *Nbw* consent is no longer required for these plans or projects. Examples include the development consents granted under the Water Act (*Ww*) for Round 2 wind farms, site decisions or all-in-one permits for physical aspects, with a link being made to the development consent granted under the Nature Conservation Act.

In the sequence of cumulative effects the above means that new projects must incorporate projects that have already received development consent but have not yet been executed. It also means that projects do not need to anticipate new projects for which no consent, draft or otherwise, has yet been granted, because it is not yet certain whether these projects will be carried out.

Stage 3: Development consent granted and project built

With regard to other projects for which *Nbw* development consent has been granted at the time the decision is reached and which have already been built, or to existing activities for which *Nbw* consent is not required, the Administrative Jurisdiction Division finds that the effects of these activities can in most cases be deemed to have already been incorporated into the environment and hence in principle no longer need to be included individually in the assessment of the cumulative effects.[13] The effects of these projects have in this case been incorporated into the present, background situation, which is the departure point for drawing up the appropriate assessment.

Incorporating effects of executed projects into the residual environmental stress

The stand taken by the ABRvS as given above should be considered carefully. In which instances have the effects been incorporated into the background residual stress load is the question. This depends on a number of factors.

One of these factors is the time it took for the effects to occur. If it takes five years, then the effects can only be deemed to have been incorporated into the environment from that moment on. The answer to this question also depends on how up-to-date the population data are. If these studies are updated once every three years, then the effects cannot be deemed to have already been incorporated into the background situation within this period.

It is relevant to draw a distinction between temporary and permanent residual or other effects. For example, when can a permanent effect (e.g. collision victims) be deemed to have been incorporated into the background situation? If the projects are lengthy and have chronic or long-term effects, the effects must be included in the cumulative effects assessment. The same applies to negative residual effects that continue to have an impact on the protected species and habitats.

[11] ABRvS 30 October 2013, case no. 201203812/1

[12] ABRvS 30 October 2013, case no. 201203812/1

[13] ABRvS 30 October 2013, case no. 201203812/1; ABRvS 16 April 2014, case no. 201304768/1

4.2 Plans

Section 19f *Nbw* stipulates that in addition to projects, plans must also be included in the cumulative effects assessment. A number of different types of plan are mentioned below.

I. Policy

Developments and projects outlined in policy documents – e.g. a strategic planning (scoping) document (*Structuurvisie*) or National Water Plan – do not need to be included in a cumulative effects assessment. From the legal perspective it is not certain whether the policy will actually be implemented, so policy can be deemed to be an uncertain future event.
If the policy is put into effect – by carrying out projects, for example – these projects must be assessed and included in the cumulative effects.

II. Zoning plans

It is not necessary to take into account the projects included in zoning plans which could have an effect on Natura 2000 sites. The Administrative Jurisdiction Division states that further decision-making is required for these projects if no *Nbw* development consent has been granted, [14] as the developments that give rise to a zoning plan can be deemed to be uncertain future events.
If the projects in a zoning plan are carried out, these projects too must be assessed and included in the cumulative effects.

III. Natura 2000 management plans

The activities permitted within the framework of Natura 2000 Management Plans must be included when assessing cumulative effects because these activities can, in combination, have an impact on the management plan goals and objectives.

4.3 Other activities

Article 6(3) of the Habitats Directive and Section 19f *Nbw* stipulate that the cumulative effects of plans and projects must be assessed. This means that the cumulative effects of 'other activities' – as referred to in Section 19d *Nbw* – do not *in principle* need to be included.
Examples of other activities include conducting beach excursions with a beach bus[15] and opening an existing road.[16]

I Existing use

An example of an 'other activity' is existing use,[17] to the extent the existing use does not qualify as a project in the meaning of Section 19d(3) *Nbw*. Existing use therefore does not in principle need to be included in the cumulative effects assessment. The Administrative Jurisdiction Division clarifies this by stating that existing activities *for which Nbw development consent is not required* need not be included in the cumulative effects assessment.[18]

The above could justify the argument that existing use *should* be incorporated into the cumulative effects assessment if *Nbw* consent *is* required for the existing activity (cf. Section 19d(3) *Nbw*). This is the case if the competent authority is not or could not reasonably have been aware of the use on 31 March 2010 (Section 1(m) *Nbw*), and the use therefore cannot generate any rights. It is also the case if the use is not included in a management plan and there are no existing rights. In these instances the existing use will require consent after all, unless the effects of that use have already been incorporated into the background data.

II Alteration of existing actions

An alteration in or amendment to existing use can also be deemed to be a project and so must be included in the cumulative effects assessment. An example of this is the alteration or expansion of an existing farm engaging in intensive livestock farming. [19]

[14] ABRvS 16 April 2014, 201304768/1

[15] ABRvS 27 December 2012, case no. 201111811/1

[16] ABRvS 6 March 2013, case no. 201113007/1

[17] ABRvS 31 March 2010, case no. 200903784/1

[18] ABRvS 16 April 2014, 201304768/1

[19] ABRvS 31 March 2010, case no. 200903784/1

4.4 Autonomous developments

Autonomous developments do not need to be incorporated into the cumulative effects assessment because these developments cannot be attributed to the action requiring development consent, nor can they be deemed to be a plan or a project.
[20]

4.5 Other developments

Changes or events could occur which cannot be deemed to be projects or other activities, including existing use, but which do have an effect on Natura 2000 sites. Examples include forest fires, flooding or natural causes (e.g. predation by foxes on the lesser black-backed gull). From the legal perspective these aspects do not need to be included in the cumulative effects calculation as they are not plans or projects.

Their effects should, however, be expressed in the data on the background situation, in population data or calculations of population trends, for example, as the effects calculation must be based on the best scientific knowledge and data. If the effects of these developments have not yet occurred, it will be necessary to take them into account from the ecological perspective. Thus the effects of these developments will be included when drawing up appropriate assessments and when assessing requests for *Nbw* development consent. In addition, these developments will be included when finalising and revising management plans.

5 Which actions need to be involved for offshore wind power?

This section looks at the actions – on land or in the North Sea – that need to be included in the cumulative effects element of appropriate assessments for offshore wind farm site decisions.

Based on the above, a non-exhaustive list is given below of actions that in any event, from a legal point of view, need to be included in the cumulative effects assessment in the context of the Nature Conservation Act.

5.1 Offshore wind farmse

I Wind farms in the Dutch sector of the North Sea
The Dutch wind farms that have already been or have yet to be built must be included in the cumulative effects assessment to the extent the effects have not yet been incorporated into the background situation. These wind farms are Amalia, OWEZ, Luchterduinen and Gemini (Buitengaats and ZeeEnergie).

It is not a legal requirement for the entire Roadmap to be taken as departure point for the cumulative effects assessment when preparing the initial site decisions, because from the *legal perspective* the Roadmap can be deemed to be an uncertain future event. As the most recent site decisions are required to take into account the preceding ones in the cumulative effects assessment, it is prudent to have an idea of the total cumulative effects. This may help to avoid ecological blockages occurring at a later stage which could result in unnecessary cost increases or construction delays.

II Foreign offshore wind farms
The same applies to foreign offshore wind farms as to Dutch ones, except that *Nbw* development consent does not prevail when deciding whether a foreign wind farm should be included in the assessment. If a foreign wind farm has received development consent but has not yet been built, or has been built but its effects have not yet been factored in, the wind farm must be included in the cumulative effects assessment, irrespective of whether it has been checked against the Habitats Directive.

5.2 Shipping and fisheries activities

Shipping and fisheries activities cannot be designated as projects. On the one hand this is because a different company or person is responsible for the effects of each vessel and there is no question of coordinated activities. The Council of

[20] *ABRvS* 28 February 2007, case no. 200500691 7/1

State, for example, has ruled that an increase in traffic on the A28 motorway is not a plan or project. [21] On the other hand, shipping movements and (non-seabed-disturbing) fishing activities do not constitute an intervention and so there is no question of a project. For these reasons shipping and fisheries do not need to be included in the cumulative effects assessment.

The effects of shipping movements do have to be included if they are the result of the wind farm – shipping traffic for construction and exploitation (including maintenance), for example.

5.3 Offshore mining activities

Existing activities such as mining platforms can be designated as a project to the extent they are likely to have significant effects on Natura 2000 sites (Section 19d(3) *Nbw*). The *existing* platforms presumably do not have any significant effects because their effects are already considered to have been incorporated in the present situation. For this reason they do not need to be included in the cumulative effects assessment. If this is not the case (e.g. because the platforms have only recently come into existence so that their effects have not yet occurred), then they should be included in cumulative effect considerations.

New mining activities do have to be included in the cumulative effects assessment if there is a possibility from the start of significant adverse effects (based on the ex ante assessment). This refers in particular to the construction of mining platforms. In the case of seismic surveys there is no question of any intervention and hence no question of a project.[22] So, from the *legal perspective* it is not compulsory to include seismic surveys in the cumulative effects assessment.

5.4 Military activities at sea

The Navy conducts various activities in the North Sea, including pursuits, low-flying and shooting exercises. These activities are not designated as a project as there is no question of any intervention.[23]

5.5 Onshore wind farms

Activities for which development consent has been obtained but have not yet been executed plus those that have and whose effects have not yet been fully factored into the background situation must be included in the cumulative effects assessment. This applies, for example, to onshore wind farms. More specifically it concerns wind farms on the Maasvlakte, in Eemshaven, the IJsselmeer, on the Afsluitdijk and other large-scale projects.

[21] *ABRvS* 19 January 2011, case no. 201006773/1

[22] *ABRvS* 17 September 2014, case no. 201303436/1; *ABRvS* 25 September 2013, case no. 201201701/1.

[23] *ABRvS* 17 September 2014, case no. 201303436/1; *ABRvS* 25 September 2013, case no. 201201701/1.

ANNEX 2 DPSIR method

Introduction to DPSIR

Drivers, Pressures, States, Impact, Response model – Netherlands (TNO commissioned by EEA)

The DPSIR model, commissioned by the European Environmental Agency (EEA), was set up in 1999 in order to develop a common language/approach for mapping cumulative effects (see the literature). In this system the relationships between activities, effects on species and policy responses are visualised diagrammatically in a number of steps (drivers, pressures, states, impacts and responses).
The original aim of the DPSIR method was to assess cumulative effects at a fairly high level of abstraction (Fig. 1). However, it is also very useful for a systematic approach at the concrete level of planned interventions/projects.

Details of DPSIR

In the DPSIR method the drivers represent governmental economic and social policy objectives (e.g. society needs electricity as a power source). These drivers result in pressures on the environment and as a result of these the state of the environment changes (e.g. health, availability of resources and biodiversity). This change of state itself has a given impact on both human health and on ecosystems. This in turn can result in a given social response which can cause drivers, pressures or state to change through adaptation or solutions.
See the next section for further details on the various elements of DPSIR in relation to the impacts of offshore wind power.

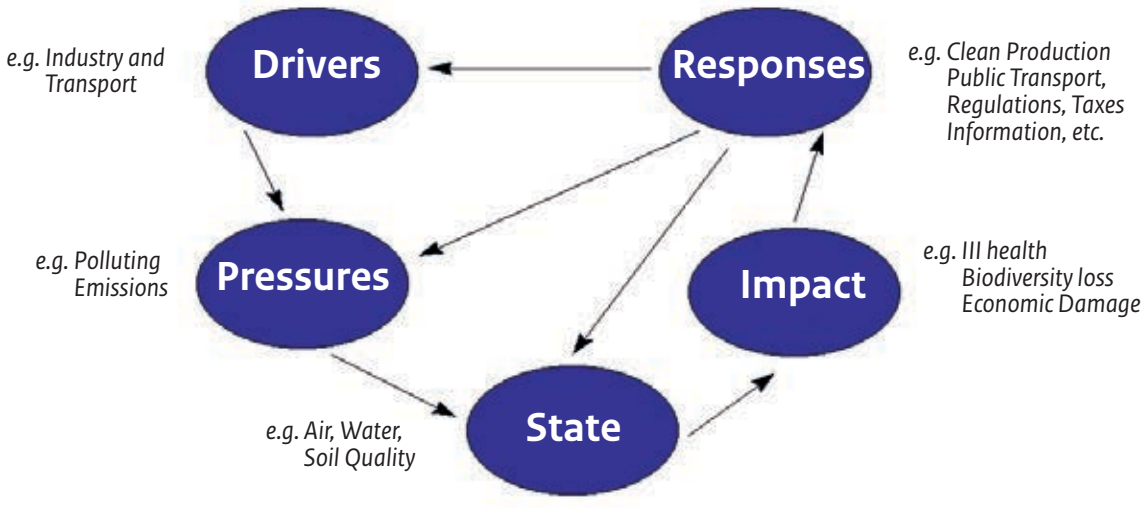

Figure 1: *A generic reproduction of the DPSIR model*
http://www.eea.europa.eu/publications/92-9167-059-6-sum

DPSIR in the Framework for Assessing Ecological and Cumulative Effects

The DPSIR model, as implemented in the Framework for Assessing Ecological and Cumulative Effects (FAECE), is at a slightly different level of abstraction than the original DPSIR abstraction level. DPSIR is used to examine the cause–effect relationships of anthropogenic *pressures* on various species.

The *drivers* level is defined as human activities that could have an effect on the environment, for example, offshore wind turbines, as well as entirely different activities, such as sand extraction, oil and gas production, commercial shipping, fisheries, etc. Based on the original DPSIR method this would be at a higher level of abstraction, namely the *driver* considered is 'society needs electricity as a source of power'.

The main driver that will be incorporated as much as possible on a quantitative basis in the FAECE is in the first place offshore wind power. The chief *pressures* emerging from this are underwater sound, collision victims and habitat loss. These *pressures* could, however, be the result of other drivers as well, such as:
- Seismics (*pressure* = underwater sound)
- Explosives (*pressure* = underwater sound)
- Shipping (*pressure* = displacement and underwater sound)

These *drivers* will also be briefly dealt with in the FAECE.

Examples of the *pressures* on the environment that can emerge from these *drivers* are: loss of habitat, excessive underwater sound and mortality among bats and birds as a result of colliding with turbine rotor blades.

The effect of these *pressures* on the states of species/species groups is then considered. The *states* are the situations of the species/species groups as they would be in natural, undisturbed conditions.

The *impact* on these *states* as a result of the pressures caused by the *drivers* is then, for example, decreasing populations (as a result of collision victims) or reduced fitness (as a result of habitat loss caused by underwater sound).

The subsequent human *response* is that which could/would/should be done in order in future to prevent or counteract the undesired *impact*, such as mitigation measures during the installation of wind turbines (sound screens, bubble curtains, etc.).

One *driver* can be the cause of several *pressures* but a given *pressure* can also emerge from several *drivers*. Subsequently, several *pressures* can have a cumulative *impact* on the same species/species groups.

In summary, the *drivers* are in this case the types of use; *pressures* are the consequences of this use which have an effect (undesired) on the ecological/natural parameters (species/species groups). The *states* is the description of the ecological/natural parameters in their desired, undisturbed state. The *impact* per species at population or sub-population level can then be identified and the *response* that can be made indicated.

As applied to the FAECE, the DPSIR is a systematic approach in which use can be made of models and/or expert judgements for the detailed quantitative interpretation of the relationships.

Annex 3 Overview of pressures and estimated cumulative effects

Activity	Pressure	Marine mammals & fish	Seabirds	Coastal birds	Migrating landbirds	Bats
Operational wind farms	Mortality resulting from collisions and/or barotrauma	None	Medium	Medium	Medium	(much not yet known)
Commercial fishing (especially gillnetting)	Mortality due to by-catches (in gillnets)	Medium – large	Medium	Medium	None	None
Commercial shipping (discharges and disasters)	Mortality caused by oil and other pollution	Medium	Medium – large	Medium – large	None	None
Oil and gas platforms	Mortality caused by attraction to/blinding by lights and subsequent collision/incineration	None	Light	Light – medium	Medium	Possibly light (not known)
Operational wind farms	Permanent loss of habitat as a result of unrecognisability	Possibly light (for now)	Light (for now)	Possibly light	None	None
1. Pile driving for wind turbines 2. Pile driving for wind turbines 2. Seismic surveys for oil and gas extraction 3. Military exercises 4. Clearing ordnance (Military) 5. Commercial shipping	Temporary (but long-term) loss of habitat caused by underwater sound	Large	Probably light at most (not yet known)	Probably not	None	None
1. Commercial shipping 2. Operational wind farms 3. Oil and gas platforms	Temporary (but frequently repeated) loss of habitat caused by: 1. Busy through routes for shipping 2. Construction, management and mainten-ance of wind farms and oil and gas platforms	Possibly light	Light	None	None	None
Commercial fishing	Adverse impact on food availability caused by depletion of seabed fauna and/or overfishing of small fish	Possibly light (and local)	Possibly light (and local)	Possibly light (and local)	None	None
Sand extraction and/or beach replenishment	Adverse impact on food availability caused by sludge plumes (reduced primary production)	Probably not	Possibly light (and local)	Possibly light (and local)	None	None

The above table gives an overview of pressures caused by offshore activities, their relationship to that activity and their estimated contribution from a qualitative perspective to the cumulative effect on five species groups sensitive to aspects of offshore wind farms.
The approach taken in this table is that of generic quality. At the local level effects may differ considerably from generic assessment and are also species-dependent. The above table should therefore be viewed with care.

Annex 4 Assessing cumulative effects on the harbour porpoise

TNO was commissioned by Rijkswaterstaat to identify and describe the cumulative effects of implementing the Roadmap for Offshore Wind Power on marine mammals and specifically the harbour porpoise. The scale of the effects was calculated for various scenarios for the development of wind farms in the Netherlands as well as abroad (focus of study: harbour porpoise). The calculated effects then needed to be assessed against the thresholds or limits of acceptable change within the framework of national and international legislation and regulations for the protection of the harbour porpoise.

Nationally, this assessment has to take into account the Nature Conservation Act (*Nbw*) and the Flora and Fauna Act (*Ffw*), the 'Conservation Plan for the Harbour Porpoise *Phocoena phocoena* in The Netherlands' and, internationally, ASCOBANS[24].

The goal of ASCOBANS for the harbour porpoise is to reduce human-induced mortality among porpoises to zero and to raise the level of the harbour porpoise population to one at which disruptive human influences are reduced to a minimum and to keep it there. This is a long-term goal. To enable steps to be taken in the short term and to be able to assess impacts, ASCOBANS has formulated an interim goal: to raise the harbour porpoise population to a level of 80% of the area's carrying capacity and to keep it there. In 2000, ASCOBANS stated that removing 1.7% or more of the animals from the population annually was not acceptable, and within that 1.7% the by-catches should not exceed 1% of the population.

The figure below shows diagrammatically how the acceptable mortality calculated according to the ASCOBANS and potential biological removal (PBR) method relates to the PCoD method, which calculates the population reduction directly from the days of disturbance for harbour porpoise. In ASCOBANS and PBR a maximum permissible non-natural mortality is calculated from a population size. In PCoD both the effect on reproduction and the effect on mortality among juvenile animals is translated into population reduction on the basis of days of disturbance for harbour porpoise.

In each approach population size is a major input, and for the entire North Sea there are only two counts available: from 1995 and 2005. Although annual counts are available for the Dutch Continental Shelf, large seasonal variations mean they need to be interpreted carefully. The Underwater Sound working group recommended estimating the population on the Dutch Continental Shelf once again, taking this variation into account.

This number has been incorporated into the Framework for Assessing Ecological and Cumulative Effects (FAECE) and is estimated at 51,000 animals. From this population size it is possible to calculate the threshold value directly and that is 40,800 animals (80% of 51,000), below which the population must certainly not drop. In the FAECE 'certainly not' means a 95% statistical certainty, leaving a faint possibility of 5% that the effect could be larger.

[24] ASCOBANS is an agreement on the conservation of small toothed whales, of which the harbour porpoise is one.

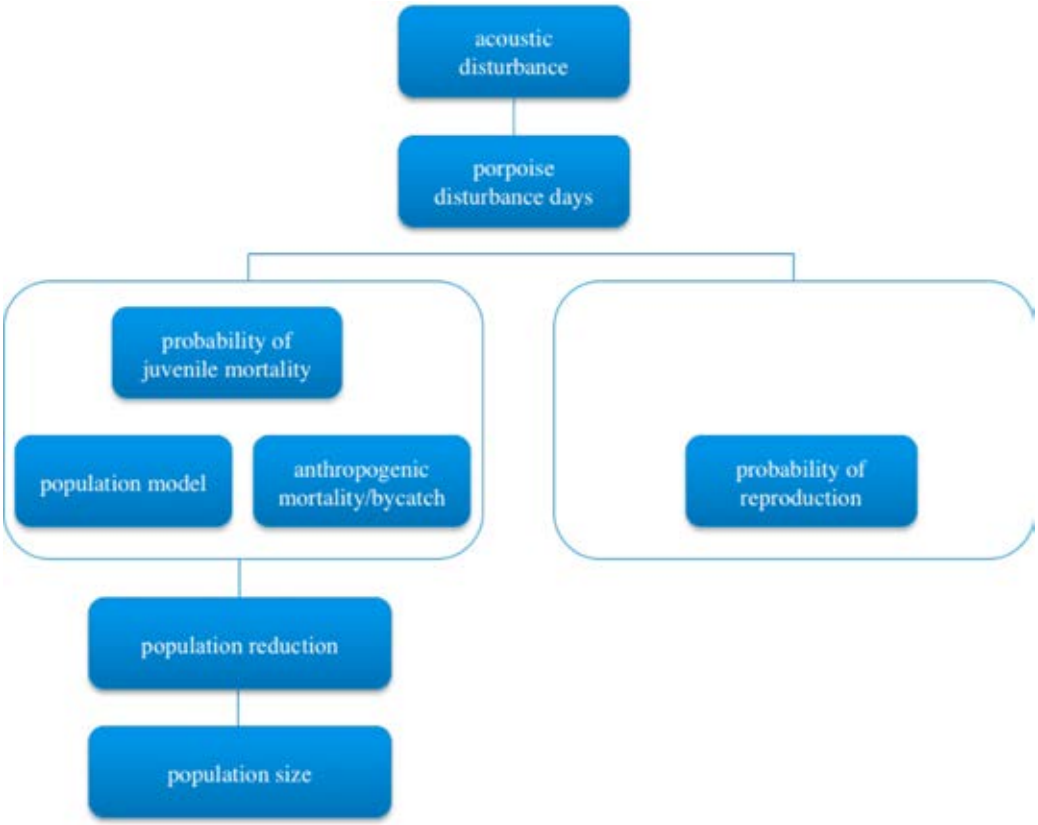

Figure 5: *Heinis, F, 2015. Offshore windpark Borssele - effecten van aanleg op zeezoogdieren. HWE rapport, 16 april 2015*
NIET VERTAALD!

Annex 5 Assessing cumulative effects on birds

Significant effects

The size of the population or the habitat of a protected species of bird may not decline (for a population) or deteriorate (for a habitat) significantly as a result of the effects of an initiative, cumulative or otherwise. The assessment as to whether or not the effects or the cumulative effects of an initiative could result in a significant reduction in the surface area of a habitat is described generically in the 'Guidance on determining significance. Definition of the concept "significant effects" from the Nature Conservation Act' (Leidraad bepaling significantie: Nadere uitleg van het begrip "significante gevolgen" uit de Natuurbeschermingswet) (Information Point Natura 2000 2009). The conclusion of this document in this respect is:

An effect may be significant if as a result of human actions (with the exception of the management activities relating to the conservation objectives) the area covered by a habitat type or the size of a species habitat will in the future, on average, be smaller than intended in the conservation objective, taking into account the resilience of the site. It then needs to be determined whether or not the area envisaged will be achieved. If the size of the area is reduced, it indicates the possibility of significant effects. Reductions smaller than the minimum area of the habitat type or species habitat will be deemed to be non-measurable.

As regards assessing the potential significance of effects or cumulative effects on the population of species, the guidance document concludes:

A significant effect may be possible if as a result of human actions (with the exception of the management activities relating to the conservation objectives) the size of the population will in the future, on average, be smaller than envisaged in the conservation objective, taking into account the resilience of the site. It then needs to be determined whether or not the envisaged number will be achieved. If this number declines, it is an indication of the possibility of significant effects. In order to be able to express a definite opinion as to whether an effect is significant or not, it will be necessary to assess in the light of the specific circumstances and environmental characteristics of the protected site affected by a plan or project whether the conservation objective is endangered by the activity. These circumstances and environmental characteristics could also mean that, despite a decline in the population, there is no question of any significant or potentially significant effects. Therefore, this does not mean that every reduction in the current size of the population is significant. A reduction in the expansion of the population can only be a significant effect in the case of an expansion objective and further depends on the details of the management plan.

The '1% norm for additional mortality' was devised specifically for assessing significant effects on populations of birds. The guidance document provides the following information on this:

The '1% norm for additional mortality' among birds means the following. The average annual natural mortality for a species of bird is first determined in the area under consideration (this could be a country, a region or a Natura 2000 site). Next, a calculation is made of whether, as a result of human activity, the additional annual mortality averages more than 1% of the natural mortality.[25] *This norm was devised by the ORNIS Committee, a group of ornithological experts the European Commission considers to be authoritative. The aim of the norm was to be able to establish whether in the case of 'judicious use' of a species (in particular hunting) more than 'small numbers' would die (Birds Directive, Article 9(1)(c). As such it has been adopted by the European Court of Justice.*

In practice this norm has been applied in the Netherlands in two situations:

1. To establish (in an ex ante or an appropriate assessment) whether there is any effect at all, caused by humans, on top of the natural mortality. If the norm is not exceeded, there is no demonstrable effect on the size of the population of the species, let alone a significant adverse effect.
2. To determine a significant adverse effect in the event that it is clear that birds affected by additional mortality outside Natura 2000 sites are subject to one or more conservation objectives, but it is not clear which. This involves, for example, mortality among birds when they migrate from one Natura 2000 site to another. These birds are certain to belong to a population subject to a conservation objective in one or more Natura 2000 sites. However, it is difficult to

[25] N.B.: so it is not a question of a more than 1% mortality in the population, but of a more than 1% additional mortality compared to natural mortality.

establish which proportion of the birds can be linked to which site. In order, nonetheless, to be able to provide for an adequate external impact from the Natura 2000 network, it is assumed that if there is less than 1% additional mortality among the visitors to the location, there will be no significant adverse effect. In other words, if all the birds in a Natura 2000 site were to visit the location, it is certain that no significant effects will occur. If the percentage is exceeded, a more detailed analysis may be necessary in order to pinpoint the relationship between individual Natura 2000 sites and the location.

The Council of State has accepted the use of a 1% norm for additional mortality [26] and ruled that, for lack of another scientifically substantiated criterion, this criterion should be applied as the basis for determining whether in a concrete instance the expected numbers of bird victims caused by the wind turbines adversely affect the integrity of the site concerned or could have a disruptive effect on the species for whose conservation the site has been designated.

The phrase 'lack of a scientifically substantiated criterion' further means that if the 1% norm is exceeded, it is still possible to rule out significance on the basis of scientific substantiation. The 1% norm is therefore not an absolute criterion which, if exceeded, must always lead to the conclusion of a significant effect.

In conclusion, with regard to the quality of habitat types or species habitats the guidance document comments as follows:

A significant effect is likely if in the future the quality of a habitat type or species habitat is, on average, lower than intended in the conservation objective as a result of human activities (with the exception of the management activities relating to the conservation objectives), taking into account the resilience of the site. It must then be determined whether or not the envisaged quality will be achieved. If the quality declines, it is an indication of the possibility of significant effects. Reductions smaller than the units in which the quality of the habitat type or species habitat is expressed will be deemed to be non-measurable. In order to be able to express a definite opinion on whether an effect is significant or not, it will be necessary to assess in the light of the specific circumstances and environmental characteristics of the protected area affected by a plan or project whether the conservation objective is endangered by the activity. These circumstances and environmental characteristics may also mean that despite a decline in the quality to be maintained there is no question of any significant or potentially significant effects.

A reduction, or expected reduction, in the improvement of the quality can only be a significant effect in the case of an improvement target and also depends on the details of the management plan.

For offshore wind

When describing and assessing the cumulative or other potential effects on birds of the presence and operation of offshore wind farms we run into a number of discrepancies between what is obvious from the ecological perspective and what has become customary in the practice of nature conservation legislation when interpreting these effects. These discrepancies relate to the scale of the areas in which the populations live and are to be protected. The 'best' areas for the various species of bird listed in the Birds Directive should have been designated as Birds Directive sites (so Natura 2000 sites as well) and as a result of their protected status should collectively provide the guarantee that the relevant species are given and retain a favourable conservation status both at the national and the biogeographical level. In addition, all species of birds are also protected as a species under the Birds Directive, but this protection mainly comprises a ban on killing or deliberately disturbing the species, although in this case the conservation status (local/regional/national) is also a factor that has to be taken into account. In the Dutch sector of the North Sea hardly any Natura 2000 sites have actually been designated under the Birds Directive (at any rate for seabirds) outside the coastal zone. The only site designated is the Friese Front (for the guillemot). Obviously it is not possible for the Netherlands to raise the status of the guillemot (or the relevant biogeographical population in the southern North Sea) to that of favourable conservation status and maintain it simply by granting the Friese Front Natura 2000 status. Added to this, other seabirds that are found in significant numbers in the Dutch sector of the North Sea but that have not been assigned a conservation objective in Dutch Natura 2000 sites do not enjoy protection via the site protection track of Natura 2000. The nature conservation legislation currently in force in the Netherlands (in which the EU Birds and Habitats Directives are anchored), comprising the Nature Conservation Act (*Nbw 1998*) and the Flora and Fauna Act (*Ffw*), requires that each new initiative with potentially adverse effects on birds is assessed to determine the scale of these effects.

[26] Administrative Jurisdiction Division of the Council of State 1 April 2009, no. 200801465/1/R2

To obtain development consent under the Nature Conservation Act (*Nbw*) it is then also necessary that the potential effects of that initiative should have no significant impact on the conservation objectives for birds for the Natura 2000 sites located within the potential area of impact of the initiative to be assessed. It is necessary to look not only at the possible effects of the initiative itself, but also to take into account cumulative effects, that is to say the effects of other potentially disruptive activities must also be taken into consideration. The cumulative effects of the initiative to be assessed and the other activities may not result in the possibility of the conservation objectives for birds in the relevant Natura 2000 sites being endangered. However, all bird species also enjoy generic protection under the Flora and Fauna Act, which also applies outside the Natura 2000 sites. An initiative with potentially adverse effects on birds (killing or destroying/disturbing permanent resting places or essential habitats) can in that case only obtain a discretionary permit under the Flora and Fauna Act if the legal requirements are met. For most bird species the requirement is that the favourable conservation status should not be endangered. But for a number of strictly protected species there are additional requirements, such as the need for a legal status. When determining the effects of the activities on the favourable conservation status, potential cumulative effects of other activities also need to be taken into account, albeit implicitly, for an assessment under the Flora and Fauna Act.

To enable an ecologically responsible 'roll-out' of offshore wind farms on the Dutch Continental Shelf between 2015 and 2023, as agreed in the SER Energy Agreement for Sustainable Growth, it is necessary to obtain as clear a picture as possible of the limits within which the potentially adverse effects of operational offshore wind farms must remain from the ecological and legal perspectives. This applies to the entire roll-out as well as to the individual wind farm sites to be awarded within the designated wind power zones.

A study has been made of the impact of the entire planned roll-out of offshore wind power on birds, together with the wind power plans in neighbouring countries and (albeit necessarily mainly qualitative) with other plans, projects and activities at sea. The impact at the level of the relevant biogeographical populations of the bird species concerned was first examined. This is mainly of importance from the ecological perspective and hence also applicable for assessing 'consentability' under the Flora and Fauna Act. [27] However, for a legally acceptable assessment under the Nature Conservation Act it is necessary to also look at the effects of offshore wind farms (via 'external impacts') on the conservation objectives for birds formulated for the Natura 2000 sites. This has been done in support of the development consents issued for offshore wind farms thus far.

A list has been compiled of bird species that occur in such significant numbers in the southern North Sea, or that regularly fly over this area in such numbers that they could potentially be affected by the presence of operational wind farms and those under construction in this area. Table 1 contains this list, which also indicates per species (with a 1) whether it is a seabird, a coastal bird or a landbird.[28] It also indicates per species whether, if it is a seabird, it is known to avoid wind farms (in which case a loss of habitat may occur), or whether it is sensitive to a daily barrier effect (i.e. whether during its daily foraging flights between colony/resting place and feeding grounds it passes over potential wind farm sites on a daily basis for long periods of the year) or whether it is sensitive to collisions with wind turbines. Finally, it states for every species whether they are (1) or are not (0) present in one or several Natura 2000 sites elsewhere in the Netherlands and have a conservation objective and, if they do, the number of sites for which they have been designated.

[27] The term 'consentability' is placed in inverted commas because the Flora and Fauna Act does not work with 'consents' but with so-called 'discretionary permits'.

[28] Here, 'landbirds' also includes waterbirds that are mainly found on freshwater bodies and only visit the sea and coast during migration.

	Scientific name	Seabirds	Coastal birds	Land birds	Avoider (loss of habitat)	Sensitive to daily barrier effect	Potential accepter	Natura2000 objectives NL	Number of Natura 2000 sites with objective
Bewick's swan	*Cygnus bewickii*	0	0	1	0	0	1	1	24
Greylag goose	*Anser anser*	0	0	1	0	0	1	1	27
Greater white-fronted goose	*Anser albifrons*	0	0	1	0	0	1	1	30
Pink-footed goose	*Anser brachyrhynchus*	0	0	1	0	0	1	1	4
Barnacle goose	*Branta leucopsis*	0	0	1	0	0	1	1	25
Dark-bellied Brent goose	*Branta bernicla*	0	1	0	0	0	1	1	5
Shelduck	*Tadorna tadorna*	0	1	0	0	0	1	1	14
Tufted duck	*Aythya fuligula*	0	0	1	0	0	1	1	17
Scaup	*Aythya marila*	0	1	0	0	0	1	1	7
Eider	*Somateria mollissima*	0	1	0	1	1	1	1	7
Common scoter	*Melanitta nigra*	0	1	0	1	1	1	1	2
Velvet scoter	*Melanitta fusca*	0	1	0	1	1	1	0	0
Golden-eye	*Bucephala clangula*	0	1	0	0	0	1	1	9
Red-breasted merganser	*Mergus serrator*	0	1	0	0	0	1	1	7
Gadwall	*Anas strepera*	0	0	1	0	0	1	1	28
Wigeon	*Anas Penelope*	0	1	0	0	0	1	1	38
Northern shoveler	*Anas clypeata*	0	0	1	0	0	1	1	30
Mallard	*Anas platyrhynchos*	0	0	1	0	0	1	1	11
Pintail	*Anas acuta*	0	1	0	0	0	1	1	20
Teal	*Anas crecca*	0	0	1	0	0	1	1	20
Red-throated diver	*Gavia stellate*	0	1	0	1	1	1	1	2
Black-throa-ted diver	*Gavia arctica*	0	1	0	1	1	1	1	1
Great northern diver	*Gavia immer*	0	1	0	1	1	1	0	0
White-billed diver	*Gavia adamsii*	0	1	0	1	1	1	0	0
Fulmar	*Fulmarus glacialis*	1	0	0	1	0	0	0	0
Manx shearwater	*Puffinus puffinus*	1	0	0	1	0	0	0	0
Balearic shearwater	*Puffinus mauretanicus*	1	0	0	1	0	0	0	0
Storm petrel	*Hydrobates pelagicus*	1	0	0	1	0	0	0	0
Leach's storm petrel	*Oceanodroma leucorhoa*	1	0	0	1	0	0	0	0
Northern gannet	*Morus bassanus*	1	0	0	1	0	1	0	0

	Scientific name	Seabirds	Coastal birds	Land birds	Avoider (loss of habitat)	Sensitive to daily barrier effect	Potential accepter	Natura2000 objectives NL	Number of Natura 2000 sites with objective
Cormorant	*Phalacrocorax carbo*	0	1	0	0	1	1	1	26
Great crested grebe	*Podiceps cristatus*	0	1	0	0	0	0	1	19
Osprey	*Pandion haliaetus*	0	0	1	0	0	1	1	5
Oystercatcher	*Haematopus ostralegus*	0	1	0	0	0	1	1	8
Ringed plover	*Charadrius hiaticula*	0	1	0	0	0	1	1	13
Golden plover	*Pluvialis apricaria*	0	0	1	0	0	1	1	12
Grey plover	*Pluvialis squatarola*	0	1	0	0	0	1	1	8
Lapwing	*Vanellus vanellus*	0	0	1	0	0	1	1	8
Red knot	*Calidris canutus*	0	1	0	0	0	1	1	5
Sanderling	*Calidris alba*	0	1	0	0	0	1	1	6
Dunlin	*Calidris alpine*	0	1	0	0	0	1	1	8
Common snipe	*Gallinago gallinago*	0	0	1	0	0	1	1	5
Woodcock	*Scolopax rusticola*	0	0	1	0	0	1	0	0
Bar-tailed godwit	*Limosa lapponica*	0	1	0	0	0	1	1	7
Curlew	*Numenius arquata*	0	1	0	0	0	1	1	14
Spotted redshank	*Tringa erythropus*	0	1	0	0	0	1	1	5
Greenshank	*Tringa nebularia*	0	1	0	0	0	1	1	3
Redshank	*Tringa tetanus*	0	1	0	0	0	1	1	9
Ruddy turnstone	*Arenaria interpres*	0	1	0	0	0	1	1	6
Arctic skua	*Stercorarius parasiticus*	1	0	0	0	0	1	0	0
Great skua	*Stercorarius skua*	1	0	0	0	0	1	0	0
Kittiwake	*Rissa tridactyla*	1	0	0	0	1	1	0	0
Black-headed gull	*Chroicocephalus ridibundus*	0	1	0	0	0	1	0	0
Little gull	*Hydrocoloeus minutus*	1	0	0	0	0	1	1	4
Common gull	*Larus canus*	0	1	0	0	1	1	0	0
Lesser black-backed gull	*Larus fuscus*	0	1	0	0	1	1	1	5
Herring gull	*Larus argentatus*	0	1	0	0	1	1	0	0
Greater black-backed gull	*Larus marinus*	0	1	0	0	1	1	0	0
Little tern	*Sternula albifrons*	0	1	0	0	1	1	1	8
Black tern	*Chlidonias niger*	0	1	0	0	0	1	1	13
Sandwich tern	*Sterna sandvicensis*	0	1	0	0	1	1	1	6
Common tern	*Sterna hirundo*	0	1	0	0	1	1	1	11
Arctic tern	*Sterna paradisaea*	1	1	0	0	1	1	1	3

	Scientific name	Seabirds	Coastal birds	Land birds	Avoider (loss of habitat)	Sensitive to daily barrier effect	Potential accepter	Natura2000 objectives NL	Number of Natura 2000 sites with objective
Guillemot	*Uria aalge*	1	0	0	1	1	0	1	2
Razorbill	*Alca torda*	1	0	0	1	1	0	1	1
Little auk	Alle alle	1	0	0	1	0	0	0	0
Puffin	*Fratercula arctica*	1	0	0	1	1	0	0	0
Short-eared owl	*Asio flammeus*	0	0	1	0	0	1	1	7
Peregrine falcon	*Falco peregrinus*	0	0	1	0	0	1	1	4
Common swift	*Apus apus*	0	0	1	0	0	1	0	0
Northern wheatear	*Oenanthe oenanthe*	0	0	1	0	0	1	0	0
Robin	*Erithacus rubecula*	0	0	1	0	0	1	0	0
Redwing	*Turdus iliacus*	0	0	1	0	0	1	0	0
Blackbird	*Turdus merula*	0	0	1	0	0	1	0	0
Song thrush	*Turdus philomelos*	0	0	1	0	0	1	0	0
Willow warbler	*Phylloscopus trochilus*	0	0	1	0	0	1	0	0
Goldcrest	*Regulus regulus*	0	0	1	0	0	1	0	0
Barn swallow	*Hirundo rustica*	0	0	1	0	0	1	0	0
Starling	*Sturnus vulgaris*	0	0	1	0	0	1	0	0
Skylark	*Alauda arvensis*	0	0	1	0	0	1	0	0
Meadow pipit	*Anthus pratensis*	0	0	1	0	0	1	0	0
Blue-headed wagtail	*Motacilla flava*	0	1	0	0	1	0	0	0
Chaffinch	*Fringilla coelebs*	0	1	0	0	1	0	0	0

Table 1. *Overview of bird species regularly occurring in significant numbers on or above the southern North Sea. The list is based on the one drawn up by IMARES and Bureau Waardenburg, supplemented by Rijkswaterstaat (Maarten Platteeuw).*

Based on these criteria it is possible to categorise birds as follows:

1. Seabirds that enjoy protection only under the Flora and Fauna Act and that tend to avoid wind farms[29] (fulmar (Fulmarus glacialis), Manx shearwater (Puffinus puffinus), Balearic shearwater (Puffinus mauretanicus), storm petrel (Hydrobates pelagicus), Leach's storm petrel (Oceanodroma leucorhoa), northern gannet (Morus bassanus), little auk (Alle alle) and puffin (Fratercula arctica))
2. Seabirds that enjoy protection only under the Flora and Fauna Act and that ignore wind farms (Arctic skua (Stercorarius parasiticus), great skua (Stercorarius skua) and kittiwake (Rissa tridactyla))
3. Seabirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act (so in Natura 2000 sites) and that tend to avoid wind farms (guillemot (Uria aalge) and razorbill (Alca torda))
4. Seabirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that ignore wind farms (little gull (Hydrocoleus minutus))
5. Coastal birds that enjoy protection only under the Flora and Fauna Act and that tend to avoid wind farms (velvet scoter (Melanitta fusca))
6. Coastal birds that enjoy protection only under the Flora and Fauna Act and that ignore wind farms (black-headed gull (Chroicocephalus ridibundus), little gull (Hydrocoleus minutus), herring gull (Larus argentatus) and greater black-backed gull (Larus marinus))

[29] The active avoidance of wind farms by true seabirds or coastal birds is a potentially important point, because this leads directly to a loss of habitat as a result of the presence of a wind farm. We express no opinion at this stage on how this loss of habitat should be interpreted.

7. Coastal birds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that tend to avoid wind farms (eider (Somateria mollissima), common scoter (Melanitta nigra), red-throated diver (Gavia stellate), black-throated diver (Gavia arctica), great northern diver (Gavia immer) and white-billed diver (Gavia adamsii))
8. Coastal birds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that ignore wind farms (dark-bellied Brent goose (Branta bernicia), shelduck (Tadorna tadorna), scaup (Aythya marila), golden-eye (Bucephala clangula), red-breasted merganser (Mergus serrator), wigeon (Anas Penelope), pintail (Anas acuta), cormorant (Phalacrocorax carbo), great crested grebe (Podiceps cristatus), oystercatcher (Haematopus ostralegus), ringed plover (Charadrius hiaticula), grey plover (Pluvialis squatarola), red knot (Calidris canutus), sanderling (Calidris alba), dunlin (Calidris alpine), bar-tailed godwit (Limosa lapponica), curlew (Numenius arquata), spotted redshank (Tringa erythropus), greenshank (Tringa nebularia), redshank (Tringa tetanus), ruddy turnstone (Arenaria interpres), lesser black-backed gull (Larus fuscus), little tern (Sternula albifrons), black tern (Chlidonias niger), sandwich tern (Sterna sandvicensis), common tern (Sterna hirundo) and arctic tern (Sterna paradisaea))
9. Landbirds that enjoy protection only under the Flora and Fauna Act (woodcock (Scolopax rusticola), common swift (Apus apus), robin (Erithacus rubecula), redwing (Turdus iliacus), blackbird (Turdus merula), song thrush (Turdus philomelos), willow warbler (Phylloscopus trochilus), goldcrest (Regulus regulus), barn swallow (Hirundo rustica), starling (Sturnus vulgaris), skylark (Alauda arvensis), meadow pipit (Anthus pratensis), blue-headed wagtail (Motacilla flava) and chaffinch (Fringilla coelebs))
10. Landbirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act (Bewick's swan (Cygnus bewickii), greylag goose (Anser anser), greater white-fronted goose (Anser albifrons), pink-footed goose (Anser brachyrhynchus), barnacle goose (Branta leucopsis), tufted duck (Aythya fuligula), gadwall (Anas strepera), northern shoveler (Anas clypeata), mallard (Anas platyrhynchos), teal (Anas crecca), osprey (Pandion haliaetus), golden plover (Pluvialis apricaria), lapwing (Vanellus vanellus), common snipe (Gallinago gallinago), short-eared owl (Asio flammeus) and northern wheatear (Oenanthe oenanthe)).

For each of these 10 categories an indication is given below of how they should be treated in the ecological, conservation and legal assessments.

1. Seabirds that enjoy protection only under the Flora and Fauna Act and that tend to avoid wind farms [30]

For these species it is merely necessary to calculate the effect/cumulative effect of offshore wind farms on the biogeographically relevant population, namely that of the southern North Sea in the period that the species concerned are found there. With these species it is necessary to map the cumulative effect of habitat loss (as a consequence of avoiding the wind farms) and the potential or actual losses resulting from collisions. Naturally, the avoidance behaviour largely displayed by these species means that the risks of collision will be minor and that this will then be factored into the collision calculations because these 'avoiding' species are highly underrepresented in the estimates of the 'fluxes' of birds that fly through wind farms. The bulk of the effects of wind farms on birds from this category lies in the loss of habitat, but nowhere does this result in the potential biological removal (PBR) being exceeded in the case of the wind farms planned up to 2023 (Leopold et al. 2014). It is important to note that the sensitivity to collisions within this category of species is still slightly higher for the northern gannet than for the various species of petrels and auks, because the first-mentioned species regularly flies at greater heights above sea level than the last two groups mentioned.

One problem that occurs in particular when assessing loss of habitat as a result of avoidance behaviour is that no-one knows how the loss of habitat among seabirds should be determined. After all, it is quite conceivable that in a habitat 'so large' in size as the 'southern North Sea' a certain loss of habitat resulting from the areas where wind farms are built becoming unattractive can be fully offset by moving to a different area and by concentration. In this best case scenario there would then be no question of any adverse effect on the population level. What does become clear, however, is that we will not be able to carry on endlessly building offshore wind farms if they continue to be routinely avoided by certain species of seabird (so if no habituation occurs), because in that case there would come a time when such a large part of the marine area would become unsuitable and the presumed concentration would no longer be possible. This then leads us to a theoretical *worst case* scenario, namely the assumption that every seabird that avoids wind farms either dies from a lack of food or leaves the southern North Sea. In both instances habitat loss on the scale of the southern North Sea

[30] It has to be assumed that the construction and gradual commissioning of a wind farm (on- as well as offshore) will in every instance require a discretionary permit under the Flora and Fauna Act, because collisions of species of birds and bats that enjoy strict protection under this Act will most certainly occur. The question then follows as to whether the favourable conservation status of the species protected under the Flora and Fauna Act is being adversely affected. To decide whether that favourable conservation status will be endangered by carrying out the assessable initiative, it will therefore be necessary to look at the cumulative effects.

results one-to-one in the loss of a number of individuals of this species, which can be calculated by multiplying the area of habitat lost (= the area of wind farms, etc.) by the density of that species usually found there.

It is conceivable that a total of 10 wind farms in the Netherlands (SER Energy Agreement), certainly in combination with another 90 wind farms in surrounding North Sea countries,[31] each measuring roughly 50 km², could in the above *worst case* assumption result in significant levels of impact on the relevant southern North Sea populations. After all, 100 x 50 = 5000 km² and at a density of roughly 20 guillemots (Uria aalge) per km² this alone results in 100,000 birds that would be removed from the southern North Sea population. In terms of the Flora and Fauna Act this would point very much towards a relevant adverse effect [32] on the 'favourable conservation status'.[33]

For the moment the *worst case* described above is not being considered. While there are no very large sections of the southern North Sea being developed for wind farms it is assumed, in line with Bradbury et al. (2014), that 10% of the 'displaced' birds will either die or will structurally disappear from this area and so can no longer be counted as part of the relevant population. The initial calculations show that it is indeed the guillemot (Uria aalge) that on these assumptions will suffer most from loss of habitat, but also that at any rate until 2023 the total number of wind farms planned in the international sector of the southern North Sea will not result for the moment in the PBR being exceeded (Leopold et al. 2015).

NB: It will be obvious that the proportion of birds that are actually removed by displacement will not be independent of the area that is ultimately taken from the habitat of the species concerned by the construction of wind farms or other developments. After all, there will come a point when the amount of habitat which has become unsuitable will be irreversibly so large that any further adverse effect will certainly result in one-to-one mortality or to the birds affected leaving the southern North Sea.

To obtain a better understanding of the key question with regard to the eight species of category 1 birds of whether, and to what degree, the *worst case assumption* of 'all birds that will avoid wind farms will be removed from the southern North Sea population', a theoretical approach is the only one possible in the short term.[34] In the long term, if we want to continue developing and building offshore wind farms, gathering hard facts through more detailed research on the spatial resilience of the southern North Sea as a habitat for the relevant species of seabird will be inevitable.

At present we have to make do with estimating on the basis of existing data relating to the size and trends of North Sea populations of the eight species of 'avoiding' seabirds whether or not the size of these populations is determined by the conditions the birds encounter offshore. For example, it seems unlikely that species that have increased in numbers over recent decades will be highly sensitive to relatively minor losses of habitat on the open sea. Conversely, a population that demonstrates a clear decline will be more vulnerable to a loss, or additional loss, of habitat and it may already even be possible to attribute this decline in part to a declining carrying capacity of the marine habitat for this species. Estimates can be fine-tuned further on the basis of what can be drawn from the literature on the species in question concerning the relative importance of other pressures in the ecology of these species. For some species it may be possible to make a case for their numbers being determined by the availability of suitable and sufficiently safe (= predator-free, for example) breeding areas rather than by feeding and other conditions and the safety at sea, whereas for other species that is quite obviously not the case. Various species are known to be highly sensitive to fisheries-related effects, often in a specific part of the year and/or in certain places. It will also be obvious that a loss of richer feeding grounds will have a

[31] Only those wind farms (international) that have either already received development consent or that are at such an advanced stage of planning that construction within the time horizon of the SER Energy Agreement (2023) is deemed highly likely are included.

[32] In the Flora and Fauna Act the criterion for discretionary permits is: '[will be] granted only if it is not detrimental to a favourable conservation status of the species.'

[33] How serious this adverse effect on habitat will actually be depends, incidentally, on the degree to which habituation can occur and the degree to which the unaffected part of the marine habitat is still able to provide 'shelter' for the displaced specimens of the species concerned. This will need to be the subject of more specific research.

[34] Granted, these gaps in our knowledge are not relevant for the short term, because no problems are expected at least until 2023. The gaps that can be noted are, however, most certainly relevant for consideration now, because we will also have to face the post-2023 period and we are of course already imposing stress on the ecosystem in the preceding period. Research into potential habituation to wind farms in seabirds can be started up now.

harder knock-on effect than a loss of poorer feeding grounds, but that will, of course, already be factored into the way in which effects are calculated via the species-specific densities. Finally, it is to be hoped it will be possible to include detailed calculations of wind farm avoidance behaviour among auks and guillemots as a function of the spatial configuration of these wind farms. Avoidance may decline if the turbines are spaced further apart.

2. Seabirds that enjoy protection only under the Flora and Fauna Act and ignore wind farms

There are three species of seabird that enjoy protection only under the Flora and Fauna Act on the Dutch Continental Shelf and of which the distribution appears to ignore the presence of offshore wind farms, operational or under construction. There will therefore be no loss of habitat among these species, although there is a theoretical possibility that some birds (in given circumstances) will collide with the rotating blades of the wind turbines. For these species it is only necessary to map out the effect at the southern North Sea population level. Moreover, in the case of these species the potential effects will only be due to collisions.

3. Seabirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act (in Natura 2000 sites) and tend to avoid wind farms

Although Table 1 shows two species in this category (guillemot (Uria aalge) and razorbill (Alca torda)), the actual situation at present is that this only applies to the guillemot. In the current Natura 2000 sites designated in the Netherlands and on the Dutch Continental Shelf only the guillemot enjoys protection under the Nature Conservation Act (*Nbw*). The razorbill has for the moment been included although strictly speaking this is not yet the case. In the meantime it has become known that in 2015 the Ministry of Economic Affairs (EZ) will probably decide to designate the Bruine Bank as a Birds Directive site (= Natura 2000 site) for both the guillemot and the razorbill. Table 1 anticipates this.

Everything that has already been stated for category 1 species also applies to birds from this category as regards assessing the effects and the interpretation of the *worst case scenario*. Following the practices that have become customary when examining initiatives against the Nature Conservation Act, it will further be necessary to conduct a review of the cumulative effects (of both avoidance and collision, which in the case of the guillemot and the razorbill are expected to be few) against the conservation objective of the Friese Front (for the guillemot) and the likely conservation objectives of the Bruine Bank (for both species). This kind of review can be kept very simple, while remaining correct from the legal perspective, by assuming that the SER Energy Agreement will not be implemented at all within the wind energy zones currently designated (even including within the 12 nautical mile zone), so no wind farms will be built within the (possible) boundaries of the Friese Front and Bruine Bank. So, theoretically, only external impacts could cause the quality and/or carrying capacity of these zones to be negatively affected by the wind farms and that is only conceivable if this were to be the result of collisions. This is because habitat loss outside the Friese Front and Bruine Bank will not result in a loss of quality within the potential Natura 2000 sites. However, if the quality of the habitat within the Natura 2000 boundary deteriorates and/or its carrying capacity is not up to par, while the habitat outside that boundary is demonstrably essential for the species subject to a conservation objective within the area in question, then an adverse effect on the habitat outside the boundary may still result in a relevant, significant effect under the Nature Conservation Act. The calculations made give no reason to expect significant effects before 2023 at the earliest (Leopold et al. 2014).

'Collision risks for the guillemot and razorbill are also limited on account of the behaviour of these species: firstly they avoid wind farms, secondly they spend a large part of their time swimming instead of flying and thirdly they generally fly low or very low over the sea, well below the lowest point of the rotors of virtually all turbines' (Leopold et al. 2014).

4. Seabirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that ignore wind farms

The little gull (Hydrocoleus minutus) is the only species of seabird that enjoys protection under the Nature Conservation Act (*Nbw*) as well and, apparently, ignores the presence of operational wind farms and those under construction. This species will therefore not suffer a loss of habitat as a result of the development of offshore wind farms. In addition to the 'standard assessment' under the Flora and Fauna Act ('favourable conservation status' of the local, in this case southern North Sea, population) it is necessary to assess what the numbers of collision victims, if any, might mean for the adverse effect on quality and/or carrying capacity of the Natura 2000 sites in the Netherlands for little gulls. In the case of this species it involves four Natura 2000 sites with a conservation objective, namely: the IJsselmeer region, Markermeer-IJmeer region, the North Sea coastal zone and the Voordelta. The presence of operational wind farms and wind farms under construction as per the current 'roll-out' proposal of the SER Energy Agreement certainly has no impact on the size and quality of the habitat of little gulls in the IJsselmeer and Markermeer regions. On the basis of the calculations made any impediment to achieving and maintaining the objectives for the North Sea coastal zone and the Voordelta is also ruled out until 2023 at least (Leopold et al. 2014).

5. Coastal birds that enjoy protection only under the Flora and Fauna Act and that tend to avoid wind farms

The only species of coastal bird that enjoys protection in Dutch waters only under the Flora and Fauna Act and that will tend to avoid wind farms is the velvet scoter (Melanitta fusca). No loss of habitat will occur for this species, at least not within the Dutch territory and Exclusive Economic Zone (EEZ), due to the fact that in the case of the roll-out of the offshore wind power component of the SER Energy Agreement as it now stands, no wind farm sites have been designated within 10 nautical miles of the coast. So for this species there is only the possibility of collision risks during migration, and even then probably only to a very limited degree given its avoidance behaviour. On top of this, migrating velvet scoters also have the tendency to fly relatively low, so the risk of collision for them appears to be minor. Daily flights of groups that stay in one place for a lengthy period will mostly occur within the 10 nautical mile zone from the coast, which is where their roosting and feeding areas are located. The small numbers have been incorporated into the fluxes with which collision victims will be calculated, and these calculated numbers will then be checked against the local, southern North Sea population to see whether the 'favourable conservation status' which the Flora and Fauna Act requires to be maintained there could be adversely affected by the cumulative effects. The calculations show that until 2023 no significant changes are expected (Leopold et al. 2014).

6. Coastal birds that enjoy protection only under the Flora and Fauna Act and that ignore wind farms

This category consists exclusively of a number of species of gull which for the moment are relatively common in Dutch coastal waters. Gulls appear to take no notice of the presence of wind farms, operational or under construction, either offshore or near the coast. So they will definitely not be affected by loss of habitat caused by wind farms. The fact that gulls are found within the boundaries of wind farms, regularly fly at great heights above sea level and are not always very agile means they do run a relatively high risk of collision with the rotating blades of wind turbines. In addition, these are also the very species that in principle are sensitive to a daily barrier effect if for extended periods of the year they fly back and forth between areas further out to sea to forage and the coast where they breed or rest. This will largely have been incorporated into the fluxes used to calculate collision victims, but it may be necessary to include an adjustment variable here for the fact that these birds pass over wind energy zones more than twice a year. The effects only need to be checked against the local, southern North Sea populations. For a number of species with a relatively low population size, the calculations made do already show that for the lesser black-backed gull (Larus fuscus) (actually ranked in group 8) estimated casualties may exceed PBR by a factor of 1.5, for the herring gull (Larus argentatus) estimated casualties fall slightly above PBR and for the greater black-backed gull (Larus marinus) PBR has almost been reached (Leopold et al. 2014, 2015, Van der Wal et al. 2015).

7. Coastal birds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that tend to avoid wind farms

Category 7 consists of four species of coastal-dwelling waterbirds which spend most of their time swimming and diving to a depth of around 20–30m in search of food, which consists either of shellfish (eider (Somateria mollissima) and common scoter (Melanitta nigra)) or fish (red- (Gavia stellate) and black-throated diver (Gavia arctica)). Although these species are known to be fairly sensitive to disturbance and so certainly tend to avoid wind farms, operational or under construction, there will in practice be no structural loss of habitat from the currently proposed roll-out of offshore wind power in the Netherlands (not within the 10 nautical mile limit from the coast) – comparable to the situation of the velvet scoter (Melanitta fusca) from category 5. Collision risks among these species can also be expected to be relatively minor because they generally display avoidance behaviour. Moreover, eider and common scoter as a rule fly relatively low and so will not easily come into contact with rotating turbine blades. Migrating red- and black-throated divers on the other hand fly a little higher and so probably run a slightly greater risk of collisions. Daily flights between resting and foraging habitats are not likely to be made through potential or actual Dutch wind power zones, so any barrier effect is likely to be marginal.

In addition to the standard protection provided under the Flora and Fauna Act (assessment against the 'favourable conservation status' of the southern North Sea population), eider, common scoter, red- and black-throated diver also have conservation objectives in Dutch Natura 2000 sites. For eider these are seven sites (dunes on Ameland, Texel, Schiermonnikoog and Vlieland, North Sea coastal zone, Voordelta and Wadden Sea). For none of these seven areas is there a direct adverse effect on size, quality and/or carrying capacity as a result of wind farms that may be constructed and commissioned. However, here again it is the case that if the habitats within the respective Natura 2000 boundaries are insufficient in size and/or quality and the habitats outside them are essential for the survival of the species in question, there may then be a case of indirect significant effects from outside the relevant Natura 2000 sites in the meaning of the Nature Conservation Act. The same applies mutatis mutandis to common scoter and red- and

black-throated diver, which have conservation objectives in only two, two and one Natura 2000 sites respectively (North Sea coastal zone and Voordelta). The only thing that could occur would be the number of calculated collision victims rising so high that it would be impossible to achieve the desired target numbers in the sites mentioned. The calculations made show that there will be no question of this at least until 2023 (Leopold et al. 2014).

8. Coastal birds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act and that ignore wind farms

Category 8 consists of a fairly large number of species of coastal birds which, moreover, differ quite considerably as regards terrain use and ecology. In the first place these are waterbirds that occur in substantial numbers in the coastal waters during migratory periods and in the winter months. The second group comprises coast-bound waders that are likewise found mainly in the migratory periods and the winter months, and the third consists of gulls (e.g. lesser black-backed gull, already discussed with the other large Larus gulls from group 6) and terns that visit foraging habitats at sea from coastal breeding colonies, mainly during the breeding season. None of the birds from this group is bothered by the presence of wind farms, operational or under construction, either because they do not actively avoid them or because there is virtually no overlap between their near-coast habitat and the area in which the wind farms in the SER Energy Agreement are planned (namely outside the 10 nautical mile zone). In the case of the waterbirds and waders it is almost exclusively a question of the cumulative effect of collision victims on the southern North Sea population level (Flora and Fauna Act), whereas in the case of the gulls and terns (especially the sandwich tern (Sterna sandvicensis) and lesser black-backed gull (Larus fuscus), which fly relatively far out to sea) the impact of the daily barrier effect when flying between coastal colonies and foraging sites further out to sea will possibly/probably have an effect (particularly in regard to additional collision risks). As long as the planned wind farms remain more than 12 nautical miles from the coast, the barrier effect alone will not be relevant (Leopold et al. 2014).

For all the species in this group it is necessary, in addition to the effects related to the Flora and Fauna Act on the southern North Sea population, to identify the potential effects on individual Natura 2000 sites where these species have conservation objectives as well. This effectively only applies to potential adverse effects on the size and/or quality of the habitats of these species in or around these Natura 2000 sites as a consequence of their becoming less suitable as a result of external impacts or an unacceptably high additional toll caused by extra mortality in these populations. Effects of this kind are only to be expected in those Natura 2000 sites located in coastal areas, i.e. dunes, Voordelta, Delta waters and/or the Wadden Sea. For Natura 2000 sites located further inland, external impacts caused (in part) by operational wind farms or wind farms under construction are no longer likely.

9. Landbirds that enjoy protection under the Flora and Fauna Act only

Category 9 covers those species of landbirds that according to the expert assessments of the Bureau Waardenburg ecologists regularly (i.e. certainly twice a year, in the spring and autumn) fly over or along the North Sea in numbers that constitute an essential part of the north-west European population of the relevant species, but that are so numerous that in the Netherlands no Natura 2000 targets have been set for these birds for specific areas. Consequently, the only protection regime that applies to these species (but then does so all over the Netherlands and on the Dutch Continental Shelf) is the Flora and Fauna Act. Often, not much more will be known about these relatively general species than a global impression of the size of the north-west European or Dutch population and (with a little more luck) of the trend in that population. On the basis of these impressions an estimate has been made of what the calculations of the numbers of collision victims during the bi-annual migration over and along the sea (and over and through the projected wind farms) could mean for maintaining the 'favourable conservation status' required under the Flora and Fauna Act. The calculations made for the species from this group give no cause for assuming that up to 2023 there will be any reason to fear such numbers of victims that the favourable conservation status will be endangered (Leopold et al. 2015).

10. Landbirds that enjoy protection under both the Flora and Fauna Act and the Nature Conservation Act

The same applies in any event (as a minimum) to this group of species as applies to the category 9 species, with the proviso that this group includes a substantial number of species that are so much rarer or whose population size is so much smaller that effects on the 'favourable conservation status' will reach an unacceptable 'significant' level much sooner. This group contains only waterbirds and waders, two groups for which the Netherlands, with its – still – extensive wetlands and its strategically favourable position in the international flyways of birds that inhabit wetlands, occupies an internationally important position. Many of these species therefore have a conservation objective in many, even very many (rising to some dozens of) Natura 2000 sites in the Netherlands. It would be going too far to calculate the cumulative and other effects of the calculated additional mortality caused by collision among these species in each of these Natura 2000 sites and their quantitative and other objectives. Only in those instances in which the cumulative calculated

mortality on a north-west European (or Dutch) scale starts to mount up is there call for a pro rata calculation to be made for each of the Natura 2000 sites for which the relevant species has been designated. In this category too, the calculations made for a number of species with a relatively low population size do reveal estimated casualty numbers in the range of 40–60% of PBR resulting from collisions for the situation in 2023, which although not a significant effect, could account for a substantial part of the stress imposed on the resilience of the species populations (Leopold et al. 2014).

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Annex 6 Mitigation measures

This annex first provides a general list of possible mitigation measures around wind turbines and then looks in more detail at the knowledge available in relation to bats, because relatively speaking this species group has been the least studied so far.

General

- Ecologically sound choice of location, avoiding as far as possible the most favourable areas for the most vulnerable marine mammals, bats and/or birds when releasing the sites for award.

Underwater sound

- Reducing the production of underwater sound (based on a sound standard or other specifications) during construction through technical measures such as: a) alternative foundation technologies for piling and/or b) sound reduction screens, bubble curtains, covering structures, etc. and/or c) other methods of piling (e.g. 'blue piling'), [35] etc.
- International coordination of the piling periods (compiling an international North Sea 'piling agenda' based on ecological concerns).
- Not allowing the piling period to coincide with the most sensitive period in ecological terms.

The standard mitigation measures for preventing mortality during piling activities (e.g. ADDs and start-stop procedures) are not included, neither is location-specific mitigation.

Birds (and bats)

- Minimising the total area to be covered by each wind farm site by, for example, installing larger wind turbines with greater capacity per turbine in order to minimise the number of turbines.
- Minimising the total volume of air occupied by revolving blades at the average migration height of bats and/or birds through a) fewer (and larger) turbines and b) working out the optimum range between minimum depth and maximum height of the blade tip (in principle per location and adjustable to the combination of species and flight height that can be expected there).
- Maximising distance between turbines and individual wind farms (so that wind farm has less of an 'impact' on species sensitive to habitat loss). As this will increase the total area covered by a wind farm, it will only contribute to mitigation if the effect of 'displacement' and the resulting loss of habitat is clearly reduced when turbines are spaced further apart.
- Not fishing in or in the immediate vicinity (radius of 1–5 km) of a constructed wind farm, thus avoiding large concentrations of gulls in flight entering the wind farm at rotor height.
- 'Stopping' the turbines (or having them revolve very slowly) at times when it is virtually certain that a mass migration of birds can be expected, or does actually occur.
- Raising the cut-in speed (the velocity at which the wind turbines start to rotate) or adjusting the position of the turbine blades at low wind speeds, so that they catch as little wind as possible and so do not rotate, or do so very slowly ('feathering') (specific to bats and only at low wind speeds: < 4 Bft (6.5 m/s)). Whether and, if so, to what extent the risk of collisions resulting from certain turbine configurations within a wind farm will be raised or lowered is a subject about which little is as yet known.

Bats

By far the largest amount of research into mitigating bat fatalities near wind turbines has been conducted in North America. Although the species there are different, the behaviours of the bats that fall victim to wind turbines in North America and in Europe coincide to such a degree that results from this research can also be applied in the European context (Cryan et al., 2014). The most recent scientific publications on mitigation in the case of bats show that there are only two proven methods of avoiding fatalities among bats near wind turbines:

1. raising the cut-in speed (the velocity at which the wind turbines start to rotate);
2. adjusting the position of the turbine blades at low wind speeds so that they catch as little wind as possible and so do not rotate or do so only very slowly ('feathering').

[35] In blue piling a large column of water is accelerated upwards through the combustion of a mixture of gases. While rising this column of water pushes the pile down and when the water column falls back it knocks the monopile further into the seabed. This piling technique is considerably quieter than conventional piling and will cause less foundation fatigue. The technology is still new but is currently being improved on in pilots.

Both measures involve taking action at low wind speeds only, because at high speeds bats are not active. In order to minimise production losses these measures should ideally be further concentrated in vulnerable periods, whereby species-specific algorithms in relation not only to wind speed, but also to temperature and humidity, for example, are included. The problem with this is establishing these values because studies show there are differences in activity and wind tolerance. For example, Amorim et al. 2012 found a wind-speed threshold of 5.0 m/s, whereas in 2009 and 2010 Bach & Niermann (2011, 2013) established a level of 6.3 m/s and in 2012 a value of 7.3 m/s. Arnett et al. (2013a) analysed information from 10 different mitigation studies in North America and concluded that both raising the cut-in speed by 1.5 to 3.0 m/s and turning the turbine blades out of the wind until the cut-in speed was reached resulted in substantial reductions in bat fatalities (in most of the studies a minimum reduction of 50%). Few studies quantified the actual loss of production and economic cost of mitigation. In the studies that did, the total loss of annual output was estimated at less than 1%.

In France a system known as Chirotech has been developed which is based on a variable cut-in speed, modulated by adjustment variables that have an impact on bat activity – season, temperature, wind speed and direction, time, etc. This system was tested twice in two different wind farms and showed a reduction in bat fatalities of 64% (2009/2010) and 90.7% (2011/2012). The loss of power calculated was in each case less than 0.15% (Lagrange et al., 2012a, b).

In the Netherlands Topwind, working together with ecologists and bat experts, developed the Bat Protection System (BPS). The Topwind BPS monitors the activity of bats in the vicinity of the turbine and the turbine is only switched off if there are bats actually present. The BPS is installed in the nacelle of the turbine. With the aid of a high-tech ultrasonic receiver the BPS filters the noise, monitors activity and records findings. The BPS can switch the turbine off the moment a bat is detected and automatically start it up again once no more bats are present. This method should allow production loss to be minimised. However, no data have as yet been published on field studies that have been conducted which show the effectiveness of this system.

Another potential form of mitigation for bats are acoustic deterrents, but so far very little is known about them. In 2009 and 2010 Arnett et al. (2013) conducted a two-year study to test the effectiveness of an ultrasonic acoustic deterrent. This study showed that transmitting broadband ultrasonic sound can reduce the number of bat fatalities by discouraging bats from approaching the source of the noise. However, the effectiveness of ultrasonic deterrents is limited by the distance over which the ultrasonic sound can be transmitted, in part as a result of the swift damping of the sound in high humidity conditions. The research shows there is as yet no operational deterrent available and that further adjustments and research are needed. The conclusion has to be that acoustic deterrents cannot (yet) be considered to be an effective mitigation method for bats.

Amorim, F., H. Rebelo & L. Rodrigues (2012): Factors influencing bat activity and mortality at a wind farm in the Mediterranean region. – Acta Chiropterologica 14(2): 439-457.

Arnett E.B., G.D. Johnson, W.P. Erickson & C.D. Hein (2013a) *A synthesis of operational mitigation studies to reduce bat fatalities at wind energy facilities in North America*. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International. Austin, Texas, USA.

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Bach L. & I. Niermann (2011) *Monitoring der Fledermausaktivität im Windpark Langwedel – Endbericht* 2010. unpubl.report to PNE Wind AG: 72 pp.

Bach L. & I. Niermann (2013) *Monitoring der Fledermausaktivität im Windpark Langwedel – Bericht 2012 – Überprüfung des Abschaltalgorithmus.* unpubl.report to PNE Wind AG: 28 pp.

Cryan et al. (2014) Behavior of bats at wind turbines. PNAS 111 (42) :15127

Lagrange H., E. Roussel, A.-L. Ughetto, F. Melki & C. Kerbirou (2012a) *Chirotech - Bilan de 3 années de régulation de parcs éoliens pour limiter la mortalité des chiroptères.* Rencontres nationales . chauves-souris . de la SFEPM (France).

Lagrange H., E. Roussel, A.-L. Ughetto, F. Melki & C. Kerbirou (2012b) *Chirotech, tres años de test de mitigación para reducir la mortalidad de quirópteros en parques.* Talk presented in I Congreso Ibérico sobre Energía Eólica y Conservación de la Fauna. Jerez de la Frontera (Spain).

Annex 7 Assumptions in the Framework for Assessing Ecological and Cumulative Effects

General

- It has been assumed that the principal effects found in the EIAs/AAs accompanying Round 2 development consent requests are indeed the priority effects which in combination can lead to problems. Other effects have been disregarded.
- The decision on which foreign wind farms to include in the cumulative effects assessment was based on all the wind farms planned or already under construction in the period covered by the plan. For Germany it was based on the mandatory standard in that country for restricting underwater sound. In the case of the other wind farms it was assumed that no mitigation measures were implemented. This is a worst-case approach.
- It is assumed that the principal effects occur during the construction phase (underwater sound) and operational phase (habitat loss for birds and collisions for bats and birds). Nothing is known as yet about the decommissioning and removal phase, but it is assumed that cumulative effects will not result in problems.

Birds

Populations and fluxes

- It was not possible to include all the existing data on counts in the study; for some seasons there are no data and some of the data used are more than 10 years old. It has been assumed that the data used do provide a representative picture of the species of birds found in the southern North Sea. Experts indicate that variation occurs mainly over seasons and not so much over years.
- In the case of migratory birds knowledge of the areas they originate from and the hazards they face there is highly fragmented and has therefore been disregarded.
- Density maps are based on numbers from the ESAS database which have then been extrapolated by means of Inverse Distance Weighing (IDW). The underlying data come from various studies in which different methods were applied. The data may be distorted by zero counts or by occasional very high counts, and the IDW technique is unable to smooth them out sufficiently.

Collisions

In the models for calculating collision risks the following assumptions were used:

- For each species of bird one fixed flight velocity was used, independent of location and weather conditions (velocities from Alerstam et al., 2007; Pennycuick, 1997; Guilford et al., 2008; Welcker et al., 2009). Where no velocity is known for a species, the velocity for a closely related species is used.
- Birds fly at one fixed height, independent of location and weather conditions (heights from Johnston et al., 2014).
- Birds fly at an angle of 90 degrees (i.e. perpendicular) to the rotor surface.
- A *worst case* of 3 MW is assumed (small rotor, low turbine).
- The decision on the *worst case* was based on seabirds (reason: landbirds fly much higher and are not bothered by turbines).
- It is assumed that the spacing between the turbines has no influence.
- Avoidance is a very important factor in determining collision victims, but little is known about this either. Avoidance percentages are based on estimates from three studies: Maclean et al., 2009; Cook et al., 2012; Wright et al., 2012a,b. Data on avoidance are based on daytime sightings in good conditions. The extent to which these data change in conditions of poor visibility is not known.
- The Band model was used to estimate collisions. However, this model has not yet been validated using 'real' bird victims in the field as for the time being there is no good method available. The same applies to the Bradbury model.

Avoidance

- In the case of wind-farm avoidance it is assumed that this loss of habitat results in the loss of 10 per cent of the birds in the population (based on Bradbury, 2014). This is an estimate based on expert judgement. There are no quantitative data on the effects of habitat loss on bird populations.
- It is assumed for the time being that no habituation occurs.
- The assumption is that the largest surface area generates the highest avoidance.
- The maximum surface area for a 350 MW wind farm is taken to be 60 km^2.

Bats

- Very little is known about the numbers, behaviour, flight paths and flight heights of bats crossing the North Sea. On the basis of expert judgement the number of bat fatalities is estimated at 1 bat per turbine per year.
- Population data on the species of bats concerned are very limited. When calculating the PBR, the minimum population size was calculated by adding up the lowest known estimates from countries where these sizes are known.

Underwater sound

Sound propagation

- The sonar source level from piling is estimated on the basis of measurement data from Q7. Experimental validation of this estimate is very limited, although similar levels have been measured at distances around 1 km from the pile at OWEZ and in German wind farms.
- The hybrid model developed by the Netherlands Organisation for Applied Scientific Research TNO was used to calculate the piling sound from detailed data on the pile, pile driver and surrounding area. This model needs further validation and it requires more detailed information from wind farm construction projects than is currently available.
- The propagation of sound was calculated using the AQUARIUS model. This model has not yet been experimentally validated for distances in excess of 6 km.

Threshold values for disturbance/behaviour change

- The calculated distances over which an effect is felt depend to a great extent on the discrete threshold value chosen. The information used on the dose–effect relationship for harbour porpoises is limited to a laboratory study (SEAMARCO) and a number of German field studies.
- The threshold value for avoidance/disturbance of seals is based on a single study conducted by SEAMARCO.
- In the calculations for harbour porpoises, no allowance has for the moment been made for auditory sensitivity as a function of the frequency. The unweighted threshold values currently used are taken from studies of piling sound and airguns, that is to say for the relevant low-frequency impulsive signals. For seals a kind of dependent (Mpw) frequency weighting is being used for the time being. The effect of signal form and frequency content (this depends on the distance to the piling location, among other things) on the dose-effect relationship requires further research. Relating threshold values for avoidance and TTS/PTS to the auditory threshold, as proposed by Tougaard et al. (2014), may have an effect on the estimate of the number of animals affected.

Threshold values for raising auditory threshold

- As it is not ethical to establish the threshold values for PTS onset experimentally, they are in this case estimated on the basis of the limited data available on the increase in threshold elevation at an increasing level of exposure. On the basis of data on land animals it is cautiously assumed that at an increase in the auditory threshold of 40 dB the risk of permanent damage is so great that it can be taken as an approximation for 'PTS onset'. There are currently no data on the increase in threshold elevation on exposure to piling sound.
- It is assumed that the occurrence of a rise in the auditory threshold depends on the total SELCUM exposure dose. Meanwhile, it has been demonstrated in various studies that the 'duty cycle' of the exposure (continuous noise versus a single pulse or a series of pulses) is of importance in this. In addition, allowance should probably also be made for an 'effective silent' threshold value, below which sound levels do not contribute to the SELCUM that results in a rise in the auditory threshold.
- In the calculations for harbour porpoises no allowance has yet been made for auditory sensitivity as a function of the frequency or for disturbance. The effect of signal form and frequency content on the dose-effect relationship requires further research. Relating threshold values for avoidance and TTS/PTS to the auditory threshold, as proposed by Tougaard et al. (2014), may have an effect on the estimate of the number of animals affected.
- In this study it has been assumed that the possible occurrence of TTS can be ignored when estimating population consequences. However, no research has yet been conducted into the possible ecological consequences of a temporary increase in the auditory threshold.

Number of animals subject to disturbance and animal disturbance days

- The number of animals subject to disturbance was calculated by multiplying the estimated area of disturbance by the estimated animal density in that area for the time of the year in which the disturbance took place.
- The available density estimates for harbour porpoises are subject to a high level of uncertainty (95% confidence

interval surrounding the average estimates used here is between about -50% and +100% [Geelhoed et al., 2011]). Virtually nothing is known about any seasonal patterns of migration, site fidelity and possible age- and sex-specific variation in this either. As a result, it remains difficult to make a more accurate assessment of the number of animals affected at different times of the year.

- For the Dutch Continental Shelf IMARES prepared a map showing the spatial variation in the relative density of harbour seals based on telemetry data [Brasseur et al., 2012]. A similar map was also prepared for grey seals [Brasseur et al. 2010], but this one is based on data on a limited number of animals and hence is less reliable. In recent years many new transmitter data, both for the harbour seal and the grey seal, have become available. The quality of the data is also much better as GPS transmitters were used. Drawing up maps incorporating these new data, if possible for different seasons, would enable a better estimate to be made of the number of harbour and grey seals disturbed by sound.
- The total number of disturbance days was calculated by multiplying the number of animals possibly disturbed on a given day by the duration of the disturbance. No clear picture has yet emerged from the information currently available on the duration of the disturbance (see § 2.4.2). However, the model results appear to be relatively sensitive to choices made in this (8, 24 and 48 hours).
- The accuracy of the number of estimated disturbance days also depends on the accuracy of the information available on the planning of future wind-farm construction projects. For the many international projects in the North Sea this planning is currently highly uncertain. The accuracy of the number of estimated animal disturbance days likewise depends on the accuracy of the information available on the developments in seismic exploration in the North Sea, which is at least as uncertain.

Vulnerable sub-population

- For calculations using the Interim PCoD model the user needs to define a 'vulnerable sub-population'. This is the part of the total population – in the case of the North Sea the harbour porpoise – that can be affected by the sound-producing activity. The size of the population depends greatly on how strongly the animals are tied to a given area (depending possibly on age and sex, and the time of the year). There is no information on this.

Translating animal disturbance to vital rates

- A major assumption is that the response level characterised as 'disturbance' corresponds with the interpretation of disturbance given by the experts consulted for the Interim PCoD model. This model assumes a statistical relationship between the number of days an animal experiences a 'significant behavioural response' and that animal's 'vital rates', which is estimated on the basis of an 'expert elicitation'. The suggestion was made to the experts that a 'significant behavioural response' corresponded to a level 5 on the scale from the Southall et al. 2007 paper. In the workshop with ecologists it was concluded – with the approval of John Harwood, one of the creators of the Interim PCoD model – that the interpretation of avoidance/disturbance used in the line of reasoning was based on similar departure points to the definition of 'significant behavioural response' given by SMRU to the experts.
- The most important gaps in knowledge lie in the area of translating sound disturbance of individual animals to effects on that animal's health/condition and what the consequences of this could be for its chances of survival and success in producing offspring. This knowledge gap is bridged in the Interim PCoD model by making use of expert assessments for the relationship between disturbance and 'vital rates' in a formal 'expert elicitation' process.

Interim PCoD model

- In the Interim PCoD model it was assumed that the harbour porpoise population was stable and that changes in the population did not depend on its density. For the results of the model this means that following a one-time effect on the population – for example, a decline as a result of the activities – the population will not recover after the activities have been terminated. This is probably not realistic. A more realistic estimate of population change in the years of the disturbance, but more so following termination of the activities, requires greater knowledge of density-dependent effects on population change.
- Has the 'carrying capacity' been reached and, if so, which factors limit population growth?
- Does competition for food play a part if the density of animals increases when they are driven away from a given area by underwater sound?

Seismic surveys

- No data are available on where, when and how much exploration will be carried out in the next few years. A scenario was therefore drawn up on the basis of past exploration. This is the best information currently available. It is a broad scenario, intended simply and solely to allow the relative impact of seismic surveying to be compared with the impact

of piling for wind farms. The following assumptions were made:

- Each year 20,000 km² of 3D seismic surveys are conducted in the southern part of the North Sea (Netherlands, Germany, Denmark and the UK together).
- For a surface area of 1000 km² one survey period of six weeks is adhered to (incl. 20% down time, when the airgun is switched off), irrespective of method, type of airgun and resolution.
- The seismic exploration is carried out between March and October.
- A maximum of eight surveys are carried out at any one time in the North Sea.
- The majority of the surveys are conducted in the spring (same as the wind farm scenario).

General

- Harbour porpoises are more sensitive to underwater sound than seals. It is assumed that where there is no effect on porpoises, there is no effect on seals. Following the same reasoning it is assumed that no particular effects occur on species of fish either.

Annex 8 Foreign wind farms

This annex specifies the foreign wind farms that should be included when determining cumulative effects..

1. Assessment framework for foreign wind farms

When determining cumulative ecological effects of the construction of Dutch wind farms in the North Sea, the effects of relevant foreign wind farms need to be included. This memo justifies the choices of the foreign offshore wind farms that should be included.

2. Area of study

There are two areas of study: the entire North Sea for harbour porpoises and the southern North Sea for other species.

Other species

The maximum area of study comprises the southern North Sea between 51°N (roughly Calais) up to 56°N (just north of the point where three national continental shelves meet on the northern side of the Dutch Continental Shelf, and from the UK's east coast to the European continental coastline (excluding the Wadden Sea and Zeeland sea inlets behind the delta barrier) (Figure 1). The wind farms located within this area or that are expected to be built within the period covered by the study should be included if they satisfy the other conditions of the FAECE.

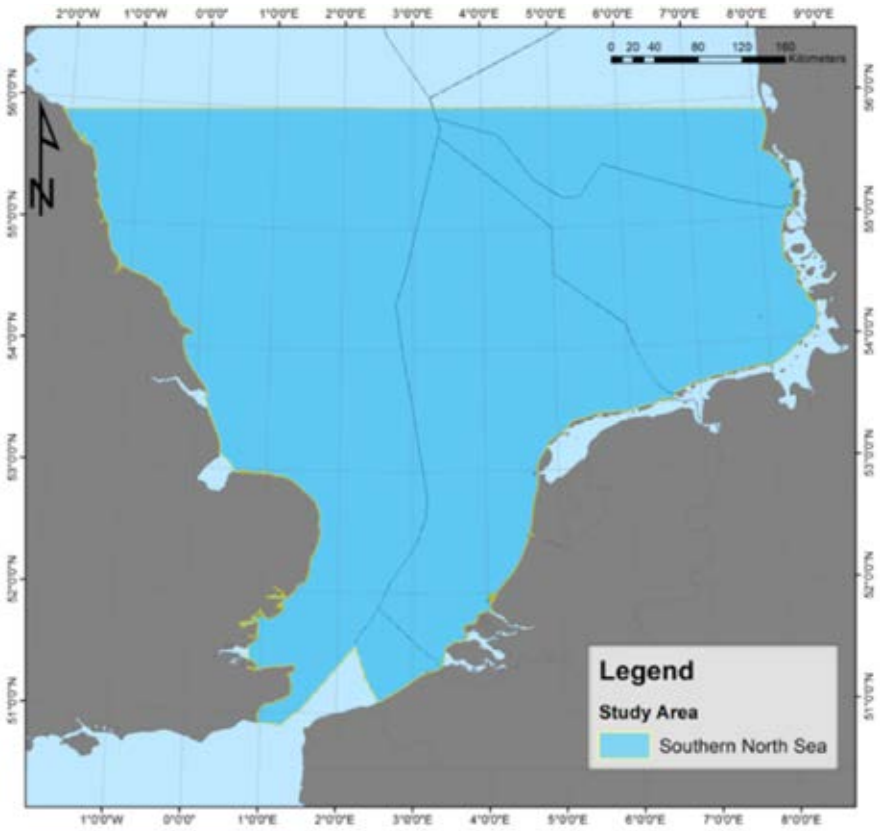

Figure 1: *Area of study: other species*

This area is the area of maximum impact for which in the context of the FAECE the cumulative effects have been mapped out and assessed.

Harbour porpoise

The area of study was chosen from the management units defined by ICES at the request of the European Commission and the OSPAR Commission; this division into populations/sub-populations is internationally recognised. The harbour porpoise population on the Dutch Continental Shelf constitutes part of the population within the North Sea management unit, which is why the population of this management unit was chosen as starting point for the calculations of international scenarios. This is the area marked NS in Figure 2.

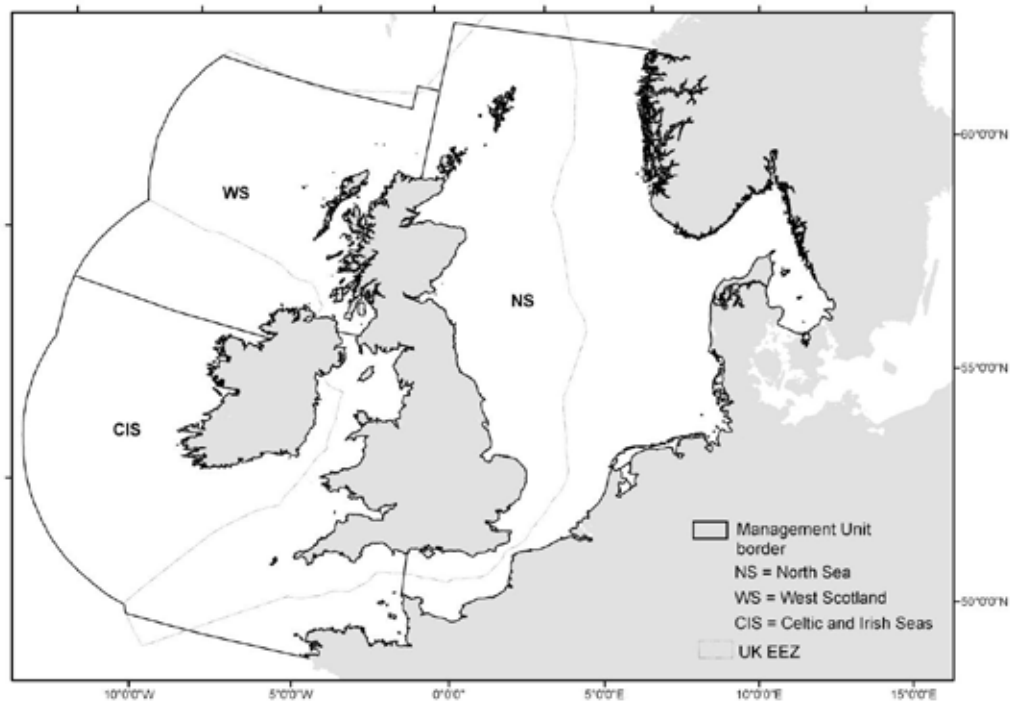

Figure 2: *Area of study: harbour porpoise*

3. Period

In the first instance the FAECE looks at the effects of the entire offshore wind power programme in the SER Energy Agreement as detailed in the Roadmap. This agreement states that wind farms must be operational within 4 years of the tender being won. This means that by the end of 2023 the full 4450 MW from the energy agreement will be operational. These 4450 MW consist of 3450 MW for which tenders will be submitted between 2015 and 2019 and 1000 MW of existing wind farms and the planned wind farms Luchterduinen and Gemini. The foreign wind farms that will be constructed in this period should therefore be included in the assessment of cumulative effects. The period is therefore fixed until 31-12-2023.

4. Which wind farms to include?

The departure point for deciding which foreign wind farms should be included is the working document 'What counts towards cumulative effects' (Alterra, 2007). This document contains a provisional set of guidelines for compiling an inventory of relevant activities. According to the guidelines the following should as a minimum be included in the assessment of cumulative effects:

- All activities planned or already underway for which (at the time a decision needs to be taken on the granting of development consent for the activity under consideration) a development consent order has already been issued and for which it is possible that they will have an adverse effect on the same conservation objectives as those that could be affected by the activity under consideration.
- Existing adverse effects which combined with the effects caused by the activity under consideration could have an interactive impact on the conservation objectives (e.g. if in combination with an existing load a threshold could be exceeded).

Given that the Framework for Assessing Ecological and Cumulative Effects of offshore wind farms looks at the full list of offshore wind power from the SER Energy Agreement, there is no activity under consideration in the sense that an EIA is being drawn up for one specifically described project. In this context the activity under consideration is the full list from the energy agreement and the time agreed for its completion. In addition, the FAECE maps out the cumulative effects of all wind farms in the North Sea using different pressures. It covers wind farms and other activities of which the effects are assumed to have not yet been incorporated into the current situation of relevant populations. That is why already completed wind farms should also be included.

For birds the FAECE should include the following wind farms, which are located in the area of study specified in 3.1 and which will be completed within the period of time given in 3.2:
- existing operational wind farms, because effects have not yet been factored into the current population status;
- wind farms currently under construction (within the given period and for which a development consent order has been issued);
- wind farms for which a development consent order has been issued and which will be completed within the given period;
- wind farms for which a development consent order can reasonably be expected within the given period and which will be fully or partially completed within the period set, in order to be able to deal with their effects pro-actively.

Section 5 goes into more detail on which wind farms can reasonably be expected to be completed within the area studied in the given period stipulated in the energy agreement.

5 Details of data for consideration

The following parameters are relevant for the assessment:
1. Location of wind farm
2. Area covered by wind farm zone
3. Number of turbines
4. Turbine model
5. Total turbine height
6. Rotor diameter
7. Start of offshore activities (date)
8. Wind farm fully operational (date)
9. Type of foundation
10. Water depth

Where possible and available, these parameters will be collected and listed for the various wind farms. It is highly likely that not all these data will be available for every wind farm. In these cases the best possible estimate will be given where possible.

When this assessment framework is used for an Environmental Impact Assessment for a Dutch wind farm, the wind farms to be included will probably be listed in the policy document on scope and level of detail (Nota Reikwijdte en Detailniveau (NRD)). About 2 months prior to the publication of this document a decision will be taken on which foreign wind farms need to be included. This inventory can be taken as the starting point for the entire EIA.

The relevant data for the foreign wind farms can be gathered via existing databases. Unless stated otherwise, use is made here of www.4coffshore.com.

Turbine
The turbines used for the effect calculations are further detailed in the relevant reports. They differ for each calculation because the *worst case* differs for each pressure.

Type of foundation
The sound intensity depends on, among other things, the type of foundation. The highest sound intensity can be expected with a monopile, higher than with a piled jacket or piled tripod. Piled monopiles are suitable for water depths up to approx. 30 metres, with a trend towards deeper water depths. Piled jackets are suitable for water depths up to approx. 60 metres. The type of foundation will probably not be known for every wind farm, in which case a monopile (*worst case*) should be

assumed. If the minimum water depth is greater than 35m, it can be assumed that a monopile foundation is – technically – not feasible and in that case a piled jacket can be assumed.

6 Details per country

All the data given below come from www.4coffshore.com, as of July 2014.
The probable configuration of the wind farms can also be found on this site.

Germany

In Germany wind farm planning depends on the construction of grid connection points (offshore transformers) to which the wind farms are connected.

If these connection points have not been built when the wind farm is completed and operational, the electricity generated cannot be delivered to the grid. For this reason the construction of wind farms is coordinated with the construction of the grid connection points.

The planning for the construction of the grid connection points in Germany is given in the draft Ten-Year Network Development Plan 2014 (ENTSO-E, 2014), which was open for inspection from 10 July to 20 September, and also in the Offshore Grid Development Plan .

This provides the following schedule for the construction of the grid connection points: see Figure 3.

The name of the German wind farms that will be connected to each grid connection point is also given. The German wind farms being built were selected on the basis of these data. The wind farms that will be connected to the SylWin 2 grid connection point and that come under the heading 'which foreign wind farms to include' will be taken into account up to 25%, it being assumed that it will take a maximum of 3 years to build a wind farm and that construction will commence in 2023.

Grid connection points in Germany					
Name grid connection point	Final year of construction	Power output	Name grid connection point	Final year of construction	Power output
BorWin 1	**2009**	**400 MW**	**Riffgat**	**2014**	**108 MW**
Bard 1			Riffgat		
DolWin 1	**2014**	**800 MW**	**HelWin 1**	**2014**	**576 MW**
Trianel Borkum 1&2			Nordsee Ost		
MEG offshore 1			Meerwind Ost/Sud		
Borkum Riffgrund 1					
BorWin 2	**2015**	**800 MW**	**SylWin 1**	**2015**	**864 MW**
Global Tech 1			DanTysk		
Veja Mate			Butendiek		
Deutsche Bucht			Sandbank		
DolWin 2	**2015**	**900 MW**	**HelWin 2**	**2015**	**690 MW**
Gode Wind I			Amrumbank West		
Gode Wind II					
Nordsee One					
Nordergründe	**2016**	**111 MW**	**DolWin 3**	**2017**	**900 MW**
Nordergründe			Borkum Riffgrund 1		
			Borkum Riffgrund 2		
DolWin 4	**2020**	**900 MW**	**BorWin 4**	**2019**	**900 MW**
Delta Nordsee 1			Deutsche Bucht		
Innogy Nordsee 2			Kaikas		
BorWin 3	**2018**	**900 MW**	**DolWin 6**	**2021**	**900 MW**
EnBW Hohe See			Innogy Nordsee 3		
Albatros			Delta Nordsee 2		
			Gode Wind III		
			Gode Wind IV		
Borwin 5	**2022**	**900 MW**	**DolWin 5**	**2021**	**900 MW**
EnBW He Dreiht			Borkum Riffgrund West		
Global Tech II			OWP West		
			Borkum Riffgrund West II		
SylWin 2	**2024**	**900 MW**	Source: draft Ten-Year Network Development Plan 2014 - ENSO-E & www.4coffshore.com		
Nördlicher Grund					
Nordpassage					
Sandbank Extension					

Figure 3: *Construction of grid connection points in Germany plus wind farms*
Source: Draft Ten-Year Network Development Plan 2014 – ENSO-E & www.4coffshore.com

Construction for a number of wind farms will commence prior to 2017 and a number will not be fully operational when the period covered by the study ends. In that case the wind farm will be included as a percentage, classified as 25%, 50%, 75% or 100%.

For two wind farms in Germany the maximum possible turbine is one of 5 MW. For these two cases a 5 MW turbine is assumed and is indicated as 5 MW turbine (FAECE). This turbine has a rotor diameter of 135 metres, with the rotor depth being set at 25 metres (total turbine height therefore being 160 metres).

The location of the German offshore wind farms is illustrated in Figure 4.
The German wind farms concerned plus associated parameters are listed in Table 1.

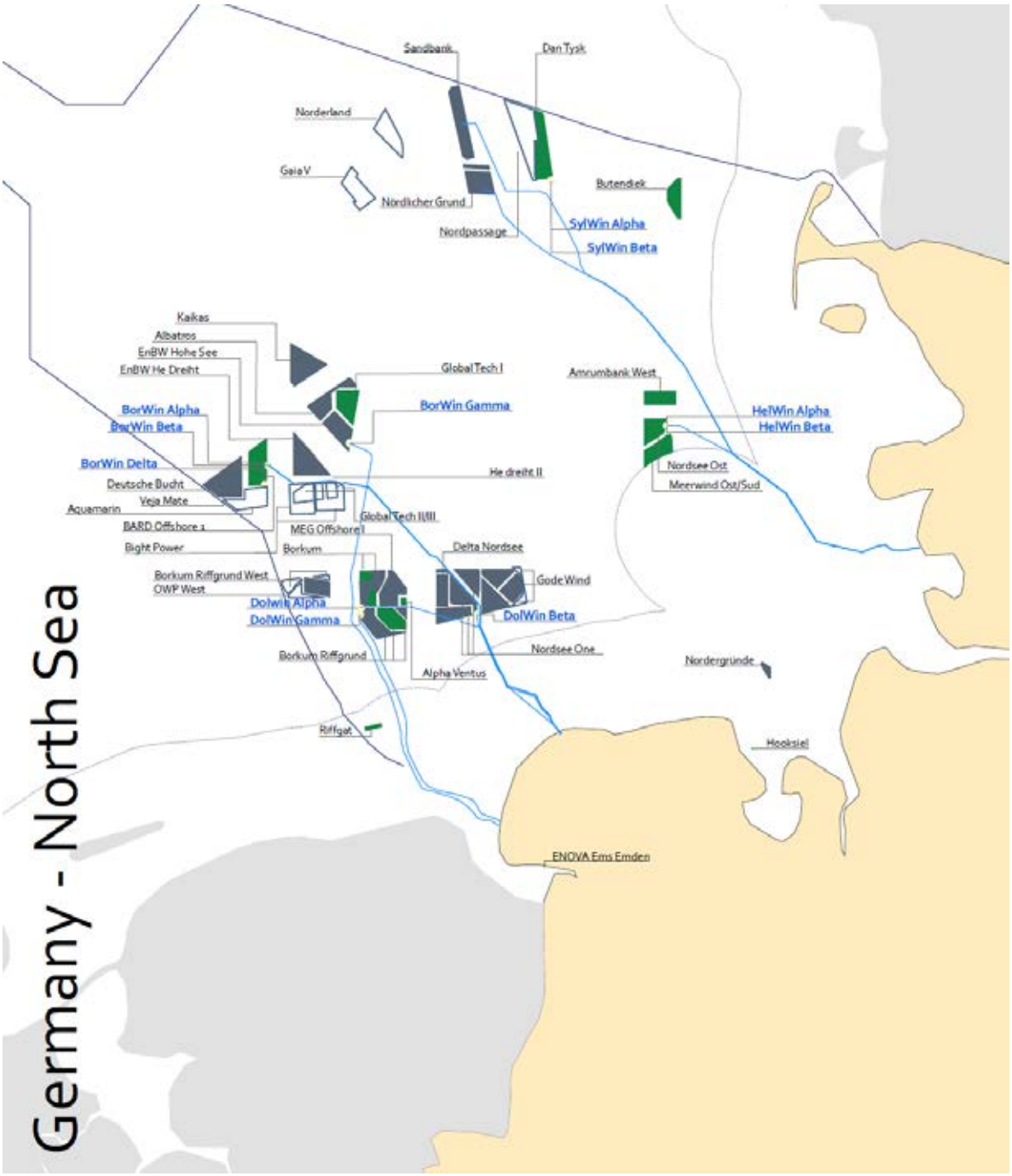

Figure 4: *German offshore wind farms in the North Sea*
Source: 4coffshore.com

United Kingdom

For the United Kingdom the wind farms listed in Table 2 should be included in the cumulative effects assessment. These are the wind farms which are located in the area concerned and which have been completed, are under construction, for which a development consent order has been issued, for which a development consent application has been submitted or which are in the planning or pre-planning stage. It is expected that most of the wind farms listed in Table 2 will have been completed by the end of 2023. A few of the wind farms are not expected to be operational, or fully operational, until after 2023. In these instances these wind farms are included as a percentage.

Construction for a number of wind farms will commence prior to 2017 and a number will not be fully operational when the period covered by the study ends. In that case the wind farm will be included as a percentage, classified as 25%, 50%, 75% or 100%.

Given the uncertainty as to whether the funding will be found and the schedule for all of these wind farms achieved, this can be assumed to be a *worst case scenario*. In addition, full development consent has yet to be granted for a number of wind farms. In the case of these farms it is possible that, for example, the consented capacity will ultimately be lower, the turbine model will change, etc.

The location of the UK Offshore Wind Farms is illustrated in Figure 5.

The relevant GIS data can be downloaded from: http://www.thecrownestate.co.uk/coastal/downloads/maps-and-gis-data/.

Figure 5: *United Kingdom offshore wind farms*
Source: 4coffshore.com

Belgium

For Belgium the wind farms listed in Table 3 should be included in the cumulative effects assessment. These are the wind farms that have a domain concession.

The realisation of the Belgian wind farms not yet under construction or completed depends on the construction of the Belgian grid connection point Elia, with the exception of the Belwind 2 wind farm.

Construction for a number of wind farms will commence prior to 2017 and a number will not be fully operational when the period covered by the study ends. In that case the wind farm will be included as a percentage, classified as 25%, 50%, 75% or 100%.

The location of the Belgian Offshore Wind Farms is illustrated in Figure 6.

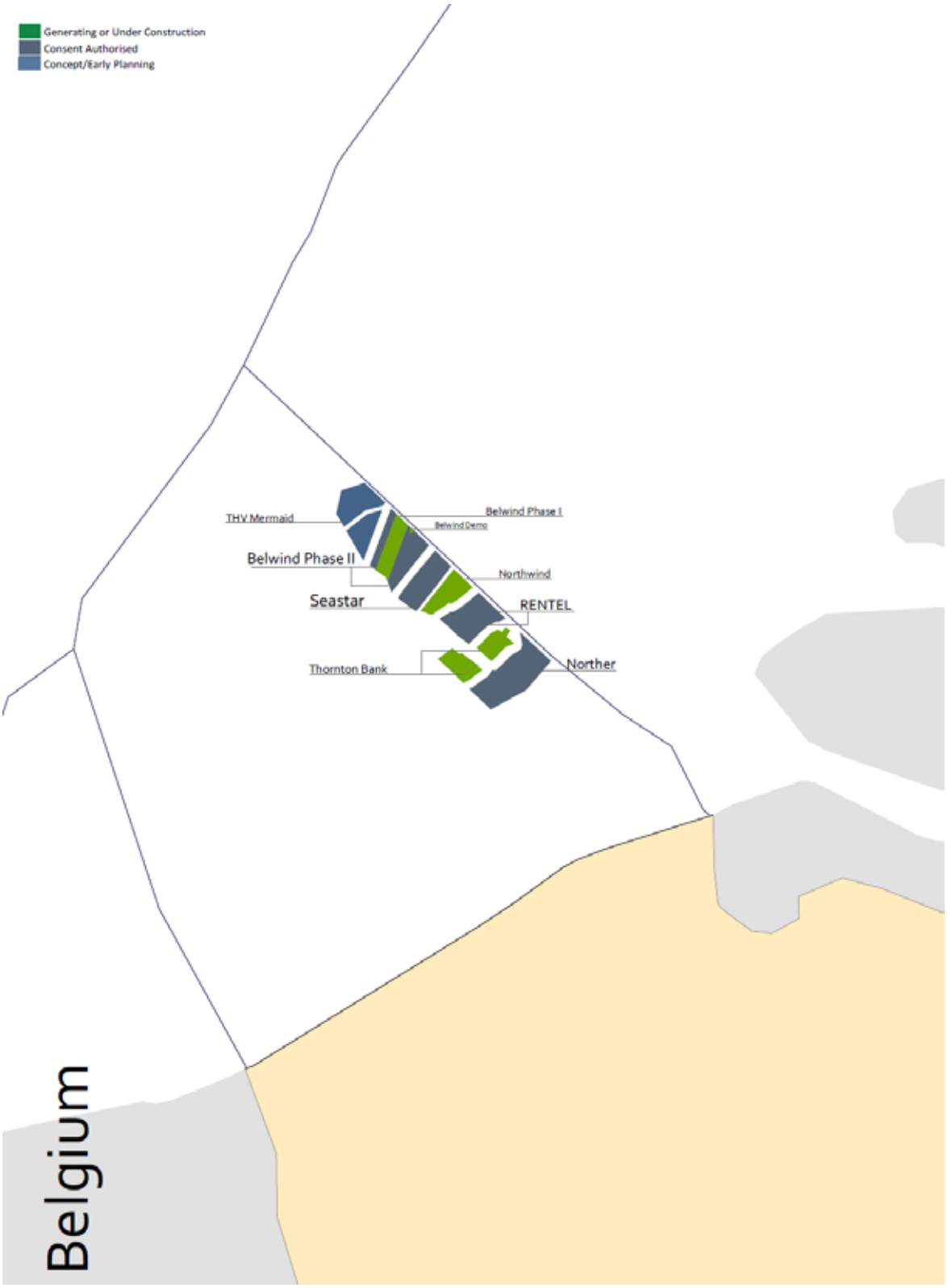

Figure 6 *Belgian offshore wind farms*
Source: 4coffshore.com

Denmark

For Denmark the wind farms listed in Table 4 should be included in the cumulative effects assessment. These are the wind farms which are located in the area concerned and which have been completed, are under construction, for which a development consent order has been issued, for which a development consent order application has been submitted or for which tenders will be submitted and construction completed within the set period.

Construction for a number of wind farms will commence prior to 2017 and a number will not be fully operational when the period covered by the study ends. In that case the wind farm will be included as a percentage, classified as 25%, 50%, 75% or 100%.

The location of the Danish Offshore Wind Farms is illustrated in Figure 7.

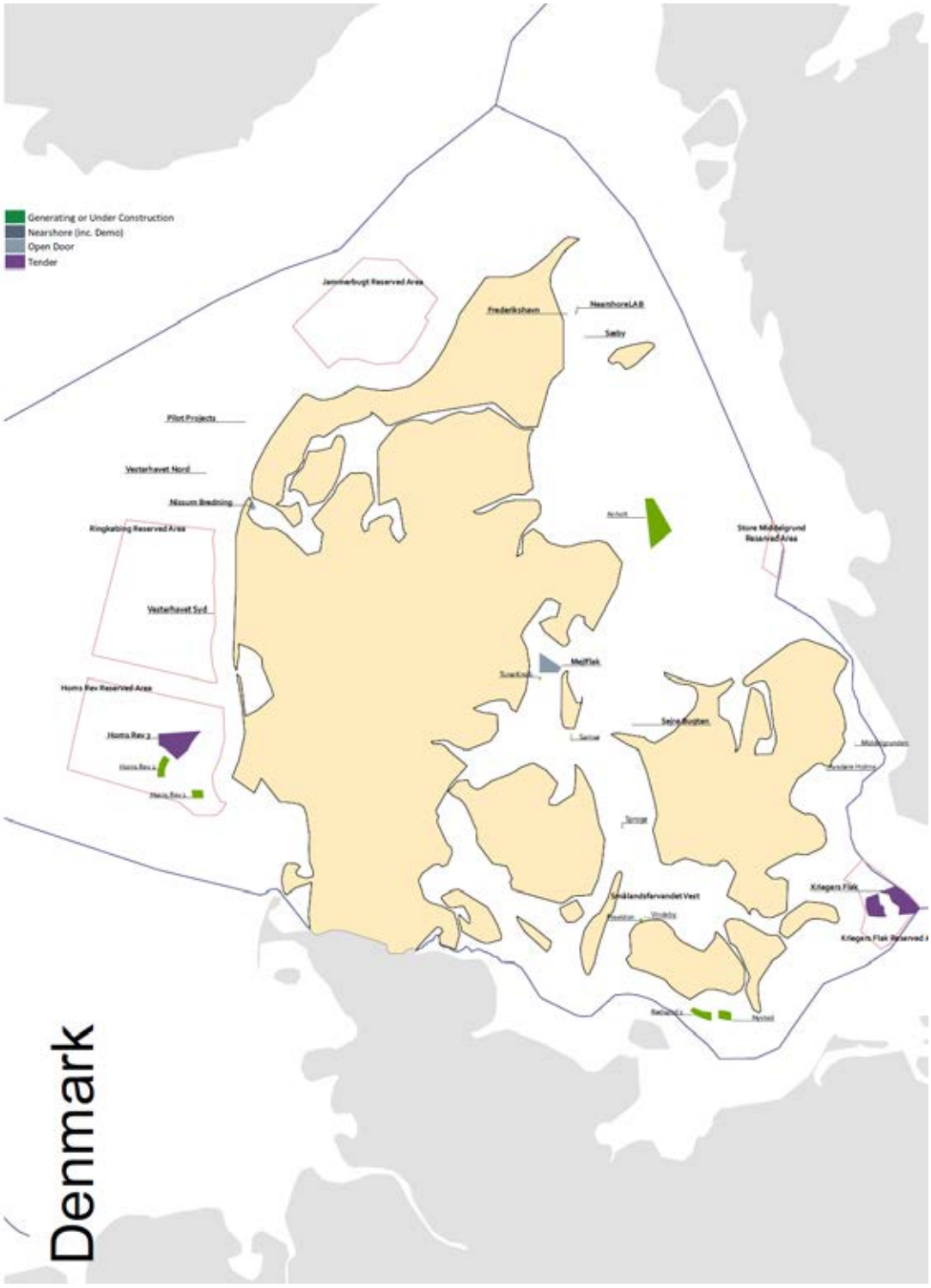

Figure 7: *Danish offshore wind farms*
Source: 4coffshore.com

Norway

For Norway the wind farms listed in Table 5 should be included in the cumulative effects assessment. These are the wind farms located in the study area for harbour porpoise and which have been completed, are under construction, for which a development consent order has been issued or for which a development consent order application has been submitted.

Construction for a number of wind farms will commence prior to 2017 and a number will not be fully operational when the period covered by the study ends. In that case the wind farm will be included as a percentage, classified as 25%, 50%, 75% or 100%.

Naam		Windfarm Status	Meenemen (%)	Verwachte start offshore constructie	Verwacht Windpark Volledig Operationeel	Verwachte First Power	Capacity MW (Max)	Capacity MW (op basis van 6MW turbine (KEC))	Turbine Model	Aantal Turbines (Max)	Aantal Turbines (op basis van 6MW turbine (KEC))	Fundering	Fundering (KEC)	MW/KM2	Oppervlakte km2	Waterdiepte meter (Min)	Waterdiepte meter (Max)
Borkum Riffgrund II	Duitsland	Definitief Besluit	25	jan-16	2018	2017	349		SWT-3.6-120 (Siemens)	97		Geheid: Monopile		8	44,65	25	30
Borkum Riffgrund West	Duitsland	Definitief Besluit	100	jan-21	2023	2022	270	270	6MW turbine (KEC)	45	45	Niet Besloten	Geheid: Monopile	9	29,7	30	35
Borkum Riffgrund West II	Duitsland	Definitieve vergunningsaanvraag ingediend	100	jan-21	2023	2022	265	258	6MW turbine (KEC)	43	43	Niet Besloten	Geheid: Tripod of Jacket	16	16,11	29	31
Delta Nordsee 1	Duitsland	Definitief Besluit	100	2019	2021	2020	210		6MW turbine (KEC)	35		Geheid: Monopile		13	16,76	27	33
Delta Nordsee 2	Duitsland	Definitief Besluit	100	jan-20	2022	2021	192	192	6MW turbine (KEC)	32	32	Geheid: Monopile		20	9,68	29	33
EnBW He Dreiht	Duitsland	Definitief Besluit	75	jan-22	2024	2023	400	400	5 MW turbine (KEC)	80	80	Niet Besloten	Geheid: Jacket of Tripod	6	62,49	39	39
EnBW Hohe See	Duitsland	Definitief Besluit	100	jan-18	2020	2019	492		6.2M 126 (Senvion)	80		Niet Besloten	Geheid: Monopile	12	41,78	26	39
Global Tech II	Duitsland	Definitieve vergunningsaanvraag ingediend	100	2021	2023	2022	553	553	6MW turbine (KEC)	79	79	Niet Besloten	Geheid: Jacket of Tripod	11	48,99	37	39
Gode Wind 03	Duitsland	Definitieve vergunningsaanvraag ingediend	100	jan-20	2021	2020	90		SWT-6.0-154 (Siemens)	15		Geheid: Monopile		8	11,62	30	34
Gode Wind 04	Duitsland	Definitief Besluit	100	jan-20	2022	2021	252		SWT-6.0-154 (Siemens)	42		Geheid: Monopile		9	29,28	30	34
Innogy Nordsee 2	Duitsland	Definitief Besluit	100	2019	2021	2020	295,2		6.2M 126 (Senvion)	48		Niet Besloten	Geheid: Monopile	8	36,45	26	34
Innogy Nordsee 3	Duitsland	Definitief Besluit	100	jan-20	2022	2021	369		6.2M 126 (Senvion)	60		Niet Besloten	Geheid: Monopile	13	28,99	26	34
Kaikas	Duitsland	Definitief Besluit	100	jan-17	2019	2018	581	581	6MW turbine (KEC)	83	83	Niet Besloten	Geheid: Jacket of Tripod	9	62,42	40	41
MEG Offshore I	Duitsland	Definitief Besluit	25	feb-16	2017	2017	400		M5000-116 (Areva Wind)	80		Geheid: Tripod		9	46,84	27	33
Nördlicher Grund	Duitsland	Definitief Besluit	50	2023	2025	2024	384	384	6MW turbine (KEC)	64	64	Niet Besloten	Geheid: Monopile	9	42,12	27	38
Nordpassage	Duitsland	Definitieve vergunningsaanvraag ingediend	50	2023	2025	2024	400	400	5 MW turbine (KEC)	80	80	Niet Besloten	Geheid: Monopile	4	89,75	23	33
OVP Albatros	Duitsland	Definitief Besluit	100	jan-18	2019	2018	553	553	6MW turbine (KEC)	79	79	Niet Besloten	Geheid: Jacket of Tripod	14	38,99	39	40
OWP West	Duitsland	Definitief Besluit	100	jan-21	2022	2021	328	328	6MW turbine (KEC)	41	41	Niet Besloten	Geheid: Monopile	23	14,28	29	32
Sandbank extension	Duitsland	Definitieve vergunningsaanvraag ingediend	50	2023	2025	2024	240	240	6MW turbine (KEC)	40	40	Niet Besloten	Geheid: Monopile	6	37,34	25	37
Veja Mate	Duitsland	Definitief Besluit	50	jan-16	2017	2017	400	396	6MW turbine (KEC)	80	66	Niet Besloten	Geheid: Jacket of Tripod	8	50,08	39	41

Table 1: *Wind farms Germany*
Source: www.4coffshore.com.

Naam	Land	Windfarm Status	Meenemen (%)	Verwachte start offshore constructie	Verwacht Windpark Volledig Operationeel	Verwachte First Power	Capacity MW (Max)	Capacity MW (op basis van 6MW turbine (KEC))	Turbine Model	Aantal Turbines (Max)	Aantal Turbines (op basis van 6MW turbine (KEC))	Fundering	Fundering (KEC)	MW/KM2	Oppervlakte km2	Waterdiepte meter (Min)	Waterdiepte meter (Max)
Beatrice	Verenigd Koninkrijk	Definitief Besluit	100	jan-17	apr-20	jul-19	664	660	6MW turbine (KEC)	140	110	Niet Besloten	Geheid: Jacket		131	35	50
Blyth Offshore Wind Demonstration site	Verenigd Koninkrijk	Definitief Besluit	50	apr-16	okt-18	sep-16	99,9	90	6MW turbine (KEC)	15	15	Niet Besloten	Geheid: Jacket	25	4	35	58
Dogger Bank Creyke Beck A (Tranche A)	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	jul-19	jul-22	2020	1200	1200	6MW turbine (KEC)	200	200	Niet Besloten	Geheid: Monopile	2	515	19	30
Dogger Bank Creyke Beck B (Tranche A)	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	jul-19	jul-22	2020	1200	1200	6MW turbine (KEC)	200	200	Niet Besloten	Geheid: Monopile	2	599	15	30
Dogger Bank Teesside A (Tranche B)	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	apr-20	jul-23	2021	1200	1200	6MW turbine (KEC)	200	200	Niet Besloten	Geheid: Monopile	2	562	20	35
Dogger Bank Teesside B (Tranche B)	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	apr-20	jul-23	2021	1200	1200	6MW turbine (KEC)	200	200	Niet Besloten	Geheid: Monopile	2	593	20	40
Dogger Bank Teesside C (Tranche C)	Verenigd Koninkrijk	Concept / Planvorming	100	apr-21	jul-24	2022	1200	1200	6MW turbine (KEC)	400	200	Niet Besloten	Geheid: Monopile		4	29	44
Dogger Bank Teesside D (Tranche C)	Verenigd Koninkrijk	Concept / Planvorming	100	apr-21	jul-24	2022	1200	1200	6MW turbine (KEC)	400	200	Niet Besloten	Geheid: Monopile		4	32	42
Dudgeon	Verenigd Koninkrijk	Definitief Besluit	50	apr-16	dec-17	apr-17	402		SWT-6.0-154 (Siemens)	67		Geheid: Monopile		7	55	18	25
East Anglia Four	Verenigd Koninkrijk	Concept / Planvorming	100	okt-21	dec-24	2023	1200	1200	6MW turbine (KEC)	240	200	Niet Besloten	Geheid: Monopile		5567	25	40
East Anglia One	Verenigd Koninkrijk	Definitief Besluit	100	2018	sep-20	2019	1200	1200	6MW turbine (KEC)	240	200	Niet Besloten	Geheid: jacket of tripod	4	297	31	53
East Anglia Three	Verenigd Koninkrijk	Concept / Planvorming	100	2019	dec-22	2021	1200	1200	8 MW turbine (KEC)	172	150	Niet Besloten	Geheid: jacket of tripod		5567	35	45
European Offshore Wind Deployment Centre - EOWD	Verenigd Koninkrijk	Definitief Besluit	100	apr-17	okt-18	2017	84	66	6MW turbine (KEC)	11	11	Niet Besloten	Geheid: jacket of tripod		7	20	30
Galloper Wind Farm	Verenigd Koninkrijk	Definitief Besluit	25	sep-15	apr-18	apr-17	340		M5000-135 (Areva Wind)	68		Niet Besloten	Geheid: Monopile	2	175	25	39
Hornsea Project One - Heron Wind	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	jul-17	dec-20	dec-18	498		SWT-6.0-154 (Siemens)	83		Geheid: Monopile		2	214	25	40
Hornsea Project One - Njord	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	jul-17	dec-20	dec-18	498		SWT-6.0-154 (Siemens)	83		Geheid: Monopile		3	193	25	40
Hornsea Project Three SPC 5	Verenigd Koninkrijk	Concept / Planvorming	50	sep-21	dec-25	2025	600	600	6MW turbine (KEC)	111	100	Niet Besloten	Geheid: Monopile		3874	30	40
Hornsea Project Three SPC 6	Verenigd Koninkrijk	Concept / Planvorming	50	sep-21	dec-25	2025	600	600	6MW turbine (KEC)	112	100	Niet Besloten	Geheid: Monopile		3874	30	40
Hornsea Project Three SPC 7	Verenigd Koninkrijk	Concept / Planvorming	50	sep-21	dec-25	2025	0	0	6MW turbine (KEC)		0	Niet Besloten	Geheid: Monopile		3875	30	40
Hornsea Project Three SPC 8	Verenigd Koninkrijk	Concept / Planvorming	50	sep-21	dec-25	2025	0	0	6MW turbine (KEC)	112	0	Niet Besloten	Geheid: Monopile		3875	30	40
Hornsea Project Two - Breesea	Verenigd Koninkrijk	Concept / Planvorming	100	apr-18	dec-22	2022	900	900	6MW turbine (KEC)	180	150	Niet Besloten	Geheid: Monopile		483	30	40
Hornsea Project Two - Optimus Wind	Verenigd Koninkrijk	Concept / Planvorming	100	apr-18	dec-22	2022	900	900	6MW turbine (KEC)	180	150	Niet Besloten	Geheid: Monopile		483	30	40
Hywind Scotland Pilot Park	Verenigd Koninkrijk	Concept / Planvorming	0	2016	2017	2017	30	30	6MW turbine (KEC)	5	5	Drijvend: Spar Floater			4	100	120
Inch Cape	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	100	apr-17	apr-20	2018	1050	1050	6MW turbine (KEC)	213	175	Niet Besloten	Geheid: jacket of tripod		150	40	55
Moray Firth Eastern Development Area 1	Verenigd Koninkrijk	Definitief Besluit	100	apr-17	okt-21	mei-19	504		MHI Vestas	93		Niet Besloten	Geheid: jacket of tripod		295	38	57
Moray Firth Eastern Development Area 2	Verenigd Koninkrijk	Definitief Besluit	100	apr-17	okt-21	mei-19	496		MHI Vestas	93		Niet Besloten	Geheid: jacket of tripod		295	35	60
Neart na Gaoithe	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	50	apr-16	dec-18	apr-17	450		SWT-6.0-154 (Siemens)	75		Niet Besloten	Geheid: jacket of tripod		105	48	54
Race Bank	Verenigd Koninkrijk	Definitief Besluit	50	mei-16	2018	2018	580	546	6MW turbine (KEC)	91	91	Geheid: Monopile		9	62	4	22
Seagreen Alpha	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	75	jul-16	jul-20	2018	525	450	6MW turbine (KEC)	75	75	Niet Besloten	Geheid: jacket		197	31	71
Seagreen Bravo	Verenigd Koninkrijk	Definitieve vergunningsaanvraag ingediend	75	jul-16	jul-20	2018	525	450	6MW turbine (KEC)	75	75	Niet Besloten	Geheid: jacket		194	31	71
Triton Knoll	Verenigd Koninkrijk	Definitief Besluit	100	2019	2021	2019	900	900	6MW turbine (KEC)	250	150	Niet Besloten	Geheid: Monopile	7	134	10	20

Table 2: *Wind farms United Kingdom*
Source: www.4coffshore.com

Naam	Land	Windfarm Status	Meenemen (%)	Verwachte start offshore constructie	Verwacht Windpark Volledig Operationeel	Verwachte First Power	Capacity MW (Max)	Capacity MW (op basis van 6MW turbine (KEC))	Turbine Model	Aantal Turbines (Max)	Aantal Turbines (op basis van 6MW turbine (KEC))	Fundering	Fundering (KEC)	MW/KM2	Oppervlakte km2	Waterdiepte meter (Min)	Waterdiepte meter (Max)
Norther	België	Definitief Besluit	50	2016	2017	2017	470	468	6MW turbine (KEC)	100	78	Geheid: Monopile		12	38,1	16	29
Seastar	België	Definitief Besluit	100	2017	2018	2018	540	372	6MW turbine (KEC)	62	62	Niet Besloten	Geheid: Monopile	27	20,26	20	25
RENTEL	België	Definitief Besluit	50	mei-16	2018	2017	550	468	6MW turbine (KEC)	78	78	Niet Besloten	Geheid: Monopile	24	23,12	22	38
Belwind 2	België	Definitief Besluit	25	2015	2017	2017	165		V90-3.0 MW Offshore (Vestas)	55		Geheid: Monopile		7	22,08	15	37
THV Mermaid	België	Concept / Planvorming	100	2017	2018	2018	465	462	6MW turbine (KEC)		77	Niet Besloten	Geheid: Monopile	27	17,39	23	35

Table 3: *Wind Farms Belgium*
Source: www.4coffshore.com

Naam	Land	Windfarm Status	Meenemen (%)	Verwachte start offshore constructie	Verwacht Windpark Volledig Operationeel	Verwachte First Power	Capacity MW (Max)	Capacity MW (op basis van 6MW turbine (KEC))	Turbine Model	Aantal Turbines (Max)	Aantal Turbines (op basis van 6MW turbine (KEC))	Fundering	Fundering (KEC)	MW/KM2	Oppervlakte km2	Waterdiepte meter (Min)	Waterdiepte meter (Max)
Horns Rev 3	Denemarken	Concept / Planvorming	75	1-jul-16	2020	2017	400	396	6 MW (KEC)	136	66	Niet Beslote	Geheid: Monopile		4	10	21
Vesterhavet Nord	Denemarken	Concept / Planvorming	100	2017	2020	2020	83		Not Decided	67		Niet Beslote	Geheid: Monopile	1,4	58,8	15	25
Vesterhavet Syd	Denemarken	Concept / Planvorming	100	2017	2020	2020	83		Not Decided	67		Niet Beslote	Geheid: Monopile	1,5	57,08	15	25

Table 4: *Wind Farms Denmark*
Source: www.4coffshore.com

Naam	Land	Windfarm Status	Meenemen (%)	Verwachte start offshore constructie	Verwacht Windpark Volledig Operationeel	Verwachte First Power	Capacity MW (Max)	Capacity MW (op basis van 6MW turbine (KEC))	Turbine Model	Aantal Turbines (Max)	Aantal Turbines (op basis van 6MW turbine (KEC))	Fundering	Fundering (KEC)	MW/KM2	Oppervlakte km2	Waterdiepte meter (Min)	Waterdiepte meter (Max)
Kvitsøy Wind Turbine Demonstration Area	Noorwegen	Definitief Besluit	?				8	6	6 MW (KEC)	2	1	Niet Besloten	Geheid: Monopile		0,23	20	40
Marine Energy Test Centre (Metcentre)	Noorwegen	Definitief Besluit	?				20	12	6 MW (KEC)	2	2	Niet Besloten	Geheid: Monopile		1,93	20	40
Rennesøy Wind Turbine Demonstration Are	Noorwegen	Definitief Besluit	?				8	6	6 MW (KEC)	2	1	Niet Besloten	Geheid: Monopile		1,2	20	40
Siragrunnen	Noorwegen	Definitieve vergunningsaanvraag ingediend	?				200	198	6 MW (KEC)	67	33	Niet Besloten	Geheid: Monopile		38,74	10	40
SWAY 2.6MW Test	Noorwegen	Definitief Besluit	?				2,6		2.6 MW	1		Drijvend: Spar Floater				210	210

Table 5: *Wind Farms Norway*
Source: www.4coffshore.com.

Annex 9 Analysis of the interviews with and recommendations made by 6 consultancies

Introduction

The Netherlands Commission for Environmental Assessment reviewed the environmental impact assessment of the national spatial strategy for offshore wind power (*Rijksstructuurvisie Windenergie op Zee* (*WOZ*)). One of the Commission's recommendations is that further study be made of the potential cumulative effects of offshore wind farms at project level and of the total number in the entire North Sea. The reason for this is that the EIA Commission feels that the section on cumulative effects (in the general sense for EIAs and AAs) currently tends to be treated as an afterthought and is reduced to the absolute minimum necessary, is insufficiently substantiated and expressed mainly in qualitative rather than quantitative terms.

For the purposes of the energy agreement (section on Offshore Wind Power (WOZ)) Rijkswaterstaat has prepared a Framework for Assessing Ecological and Cumulative Effects (FAECE). On the one hand it involves the development of a robust mechanism and on the other the implementation of this mechanism, at least for wind power projects. The mechanism needs to be robust enough to enable its use at a later stage for other activities as well.

To assist in the development of methods and the parameters for completing the framework Rijkswaterstaat conducted a series of interviews/consultations with six external consultancies and knowledge institutes with experience in writing EIAs and/or AAs. The aim of this series of consultations was to gather ideas for method development. Subjects discussed included difficulties in writing the required paragraphs on cumulative effects assessment (content & process) and recommendations for solving these difficulties.

The interview/consultation round was conducted in the period 15-25 September 2014. The following consultancies were interviewed by the project manager and a Rijkswaterstaat ecologist: Royal HaskoningDHV, Arcadis, Bureau Waardenburg, Witteveen+Bos, Deltares and Grontmij.

This policy document contains the FAECE project group's report on the interview round. Where possible and appropriate the FAECE has implemented the recommendations from this round of interviews.

Conclusion

All parties made the following observations:

- Central government should do more to facilitate the preparation of EIAs and AAs, for example by maintaining a cumulative effects accounting system, central databases, carrying out and divulging (eco)system studies.
- The market parties noted as a problem the fact that there is no fixed, national framework for the EIA/AA procedures that enable an EIA or AA to be successfully completed. This is due to the prevailing environment and regulations in the field of ecological interpretation and legal interpretation (including case law) in which sources of data and information are not available or not clearly available at a central point. Another factor that plays a part is that beyond national borders it is necessary to take into account all our partners in the North Sea in a spatial and ecological environment that is continuously changing (insights, knowledge, current developments).

A number of parties also noted:

- that within the context of these issues the attitude of the ministries involved was not found to be active or participatory. The conduct of cumulative effects assessments at an adequate and qualitatively higher level for AAs could be better supported by the competent authorities (ministries as well as provincial authorities) by maintaining a central register of both developments in plans, projects and 'other' activities with potential effects on conservation objectives in the designated Natura 2000 sites and of the best available methods for mapping the cause–effect relationships between these activities and the habitats/species in these sites. For nitrogen deposition, habitat types and species habitats this is in principle addressed in the programmatic approach to nitrogen (PAS) and, although there are many obstacles to

this, a similar approach forming a basis for a 'cumulative effects accounting system' could avoid a great deal of work being done twice and considerably improve the quality and unity of meaning of the assessments.

Issues raised by the consultancies

'developers ask consultancies in veiled terms: "*are cumulative effects our responsibility*"'?

Environment (developer/competent authority/Netherlands Commission for EA)

- Knowledge has been draining away from ministries/competent authorities for years. In the past, the National Institute for Coastal and Marine Management (RIKZ) and the Institute for Inland Water Management and Wastewater Treatment (RIZA) provided better guidance on all manner of processes. The research institutes were intended to provide continuity following the disappearance of various government departments. This has not been fully achieved, partly as a result of market forces.
- The role of central government is felt to be defensive.
- Advice by the Netherlands Commission for Environmental Assessment is not binding. This also means that advice on improvements in methods does not need to be reflected in subsequent environmental assessments.
- The competent authority does not make sufficient demands prior to or during the preparation of environmental or appropriate assessments (e.g. they do not require a quantitative substantiation of some of the effects). This leaves consultancies with considerable scope for interpretation. When consultancies ask the competent authority what information they require in environmental impact and appropriate assessments in order to reach a decision they do not get a satisfactory answer, because the competent authorities themselves now lack the requisite expertise.

Process

- An environmental impact assessment or appropriate assessment comprises a large number of activities which all need to be considered and this is quite time-consuming for the consultancies involved. It means that complex elements not subject to strict requirements are dealt with fleetingly and qualitatively. Cumulative effects form one of these elements.
- Limited time and a limited budget, resulting from competition when tendering. Cumulative effects are left until the effects of the initiative have been described and assessed. Developers make no explicit request for the section on cumulative effects to be looked at in greater depth (quantification) or breadth (greater and better consideration of the other plans, projects and activities whose effects could contribute to the significance of the total cumulative effect).
  - There are insufficient safeguards for the recording of autonomous developments and their effects. This too costs the consultancies a lot of time, to the detriment of the cumulative effects element. Doing this for every environmental impact assessment is time-consuming and this time is not available, so their description remains highly qualitative.
- At present no sanctions are imposed for a poorer quality cumulative effects section; the Council of State has yet to issue any rulings on this. It even appears to be advantageous to leave everything as vague as possible because the more you put down in writing, the more questions you get asked.

Content – Scope

- Lack of clarity in the scope of the assignment concerning what needs to be included for assessing cumulative effects: geographical, activities, species, timeline, etc.; division of tasks between the parties involved.
- Legislation has a limiting effect, for example with regard to national boundaries, plus the fact that legislation is sometimes stricter than necessary and other times not strict enough where it is relevant. It is not always clear when assessing cumulative effects which goal is higher (national, European) in those situations in which achieving the one goal could stand in the way of the other, and whether there is indeed an obstacle to an initiative if you look beyond national boundariesThere are opportunities as well as constraints here, but from the ecological point of view it is more accurate to make an assessment not merely from a national or purely legal perspective.
  Explanatory note: Even if the aim is to look at the biogeographical population, this is not always possible because the Natura 2000 objective in one or a number of sites has to be considered. This means that an effect may be smaller if it is related to the entire biogeographical population (i.e. advantageous to your project) or if you add up all the effects on that biogeographical population, the project could turn out to be the last straw (hence further constraints). This can also be seen in the content-effects assessment.

- The fact that the potential range and significance of external impacts (e.g. impacts from drivers/activities from outside the Natura 2000 boundaries) can vary (considerably) from case to case is seen by consultancies to be difficult and time-consuming.
- The cumulative effects section contains many different activities but from the legal perspective only the already consented activities need to be included, making it necessary to constantly check whether consent has been granted for new activities during the course of the EIA/AA.

Content – Accessibility of necessary information

- Information is hard to find, fragmented sources, incomplete, unclear status of projects or activities.
- Time and again having to search for information updates, especially regarding pressures; continuously having to re-invent the wheel.
- Confusion caused by concepts, jargon and cultural differences between parties.

'There are various gaps in ecological knowledge; in the case of offshore wind it is difficult to estimate habitat loss for birds. There is no instrument or method available that can be refined. That is why allowance is made for "*worst case*" scenarios even though it is not always necessary.'

Content- Determining effects

- Knowledge gaps in intervention–effect and dose–response relationships.
- Knowledge gaps and lack of methods for 'recasting' various types of effect into a single type (for example, turning disturbance into reduced reproduction or such like)
- Substantiating trends by clarifying the impacts on the relevant populations of the activity to be assessed in combination with other plans, projects and activities, for example by indicating how the effects vary according to the availability of food for the individuals of these populations.
- There is a lack of system studies that indicate at the level of the relevant ecosystems where the sensitivities of habitat types and habitats of species to certain pressures from activities lie and what effects they could have as a result of new or modified activities.

Content- Assessing effects

- Uncertainty about the population to which the assessment should relate (individual, local, national, international, Natura 2000) and the legislative requirements on this.
- Uncertainty about the limits of acceptable change caused by effects on the relevant populations and how to deal with migrating species.
- An earlier appropriate assessment often used a different method for calculating effects, with the result that matters like disturbance/mortality cannot be added up in the cumulative effects section, for example.
- Effects of existing uses such as fisheries, shipping and sand extraction are often only described qualitatively.

Content – Monitoring

- Make a clear decision on what really needs to be measured in a monitoring programme and ensure that causal connections can be made between the intervention and the effects/trends observed.

'Current practice is often for activities to be played down.
From the legal perspective it is permitted but from an ecological point of view it does not always feel right'

Legal/legislation/frameworks/directives

- Directives are not always clear. For example, definitions in the Habitats Directive are not clear: when is an effect significant, for example? [36] There is room for personal interpretation.

- An EIA/AA is mainly a legal document and less so an ecological document. A greater emphasis on quantification increases the ecological value of the document.
- Which norms do we employ for effects? Currently, effects (for birds) are related to the 1% norm. How realistic is this? Is it more realistic, for example, to look at PBR (potential biological removal)?

Consultancy recommendations

1. Provide a clear and structured method for cumulative effects assessment, including a cumulative effects accounting system, and make a central database available.
   This database should list all activities and transparent choices for defining activities as well as the geographical choice and the definition of species/relevant populations, including nature, size, place, timing, duration, potential pressures caused by the activities, status and an accounting system recording effects on Natura 2000 sites.
2. Bring about international cooperation and coordination in the field of methods, defining frameworks and thresholds (limits of acceptable change), apportioning ecological headroom for activity-related pressures, and monitoring and/or research programmes. One option is to embed this in a large, long-term cumulative effects programme to ensure international coordination as well as research and/or monitoring, funding and international agreement on a sustainability approach to cumulative effects (2020/2050).
3. Identify knowledge gaps (not only on species but on the system and the use of the system) and give priority to filling these gaps.
4. Create a programme-based approach to monitoring/research, focusing on the system and the dissemination of results and the underlying data.
5. Make the existing population dynamics models available from a central source and decide which parameters are currently sensitive to assumptions for determining limits of acceptable change (tip: assess at several population levels). At the same time ensure there is broad support for the models among the relevant parties.
6. All this requires a strong coordinating/facilitating role by government/the competent authority. The actual appropriate assessment, but in any event the 'cumulative effects' part of it, should be drawn up by the competent authority, with developers supplying the factual material on their own planned activities, assisted by experts (including consultancies). The remaining facts (relating both to the other activities and to the data on the ecological parameters and their sensitivities to the various potential pressures) would then need to be obtained from the central or other databases on which the 'cumulative effects accounting system' is based.
7. Ensure that the Framework for Assessing Ecological and Cumulative Effects becomes a 'living document', growing from what is absolutely necessary now to continuous updating, from expert judgement to quantification.
8. Provide a correct balance between the ecological and the legal relevance of the various activities in an EIA or AA. Act more in 'the spirit of the law' rather than merely doing what is legally permissible.
9. A different attitude from central government: government is requested to open its mind more to ecological aspects and to play a more pioneering role in which there is room for ideas, ecological input and innovation. An example of this is the desirability of basing the protection of certain species in some cases more on the relevant scale for the populations concerned than on the specific Natura 2000 sites that have been designated for these species. Sometimes it seems a little petty to insist, for example, on sticking rigidly to the objective of two Bewick's swans (seasonal average) for a given Natura 2000 site if much good has been or could be done for this species elsewhere. Government was said to take a domineering attitude when dealing with nature conservation legislation and assessing EIAs/AAs. Valid ecological arguments are rejected by government lawyers.
10. As a developer, state clearly in the invitation to tender which aspects the consultancies need to quantify in the EIA or AA and which may be described in qualitative terms. This will contribute to an improvement in the documents and ensure there is fair competition between consultancies.
11. A number of those interviewed pointed to a decline in government expertise in its role as developer.

Model projects:

[36] A guidance document on significance from 2009 (Leidraad significantie) is available from the former ministry of Agriculture, Nature and Food Quality (Leidraad bepaling significantie Nadere uitleg van het begrip 'significante gevolgen' uit de Natuurbeschermingswet), but is now far too out of date to use without a good grounding in legal and ecological aspects. Also, the guidance document is written in very generally terms and often does not give sufficiently practical guidance on the level of detail required in an environmental impact assessment and/or appropriate assessment.

The projects below can serve as a model for any follow-up steps:

- Setting up an ecological accounting system for the Markermeer/IJmeer region, in which a record is kept of the creation or restoration of habitats and what is lost through the effects of activities and projects, so that the scope for new development is clear at any given time.
- PAN: although its translation into practice leaves much to be desired, the basic idea behind the Programmatic Approach to Nitrogen is indeed to keep a central record of cumulative effects for the pressure 'nitrogen deposition' and use this to allocate the available scope for development in relation to existing sources of nitrogen emissions and planned nitrogen-emitting projects and activities.
- Under the direction of GPO (the hydraulic engineering and ecotechnology department headed by Marcel van de Leemkule) the first steps are now being taken towards an ecological compensation accounting system. This 'database' will probably be assigned to the research and planning office (*Programmabureau Verkenning en Planuitwerking*) for land and freshwater projects, and in the longer term possibly a link to marine projects.

By-catches

The following recommendation emerged from the interviews. This itself is seen as a 'by-catch' as this recommendation does not make a direct contribution to a better approach to cumulative effects, but from the ecological perspective the project group did find it relevant.

- Consider making a link between the Red List species and a clear, legal protection status for these species. At the moment the Red List forms no part of an EIA/AA or of a cumulative effects assessment, which from the point of view of nature conservation (the principal aim of nature conservation legislation in fact) is very strange.

Annex 10 Summary of reviews

Quality assurance has been carried out by the following people:

Framework for Assessing Ecological and Cumulative Effects; main text
Prof. C.W. Backes, Professor of European Administrative Law at Maastricht University and a member of the Netherlands Commission for Environmental Assessment:
His main conclusion was that the approach taken to calculating cumulative ecological effects and assessments against the biogeographical population is entirely justified and resulted in a legally correct assessment method. However, there were a number of points for improvement, in particular with regard to the difference between the Nature Conservation Act (*Nbw*) and the Flora and Fauna Act (*Ffw*). These have been processed.

L. Boerema and P. Mendelts of Bestia et Lex:
The authors are in agreement with the approach taken and legal basis of the Framework for Assessing Ecological and Cumulative Effects (FAECE). Not all the choices made in the FAECE are explained clearly enough. For example, the relationship between the FAECE and the offshore wind energy bill does not emerge clearly, specifically the site decisions and appropriate assessments that have to be prepared. The aim and position of the FAECE was further elaborated to clarify and further substantiate this.

TNO's research report on the effects of underwater sound on harbour porpoises
Jan Haelters, Royal Belgian Institute of Natural Sciences (KBIN), and Jozefien Derweduwen, Belgium's Institute for Agricultural and Fisheries Research (ILVO):
Both reviews are positive and full of praise. They state that the report fleshes out a topic that until now had received little attention, namely an initial quantitative estimate of the effects of building wind farms on marine mammals. There is praise for the way in which the choices made were described and substantiated. The report was also found to be useful for neighbouring countries and a request was made to seek international cooperation and coordination on this subject matter. This international cooperation is planned for 2015 and later.

In addition, a number of calls for a follow-up were expressed. These are highly interesting, but would take time and can best be tackled later on, perhaps even in the context of the international cooperation. A proposal was made to incorporate a recent publication on the neurological and physiological effects of sound into the model. The developers of the PCoD model have said that if given the opportunity they would re-consult experts so that the most up-to-date knowledge can be incorporated in the model. Further, a number of questions were asked about the choices and assumptions made and further explanation was requested regarding the reason for a specific choice. In the final version of the report more details will be given on the choices the reviewers found to be not clear.

The IMARES research report on the effects of wind farms on birds and bats
Dr V. Dierschke of Gavia (Germany): The main conclusion was that the work done was good and constituted a major step forward in describing and assessing the cumulative effects of offshore wind farms on seabirds and coastal birds as well as migratory landbirds. The estimates for seabirds and coastal birds appear to be more realistic than those for migratory landbirds, although the assumption that loss of habitat would result in additional mortality of up to about 10% a year could do with further empirical substantiation. In the case of all birds, but especially in the case of migratory landbirds, other sources caused by human activities would need to be described more precisely in order to justify the PBR approach. Finally, the reviewer was concerned that in the case of migratory landbirds occasional extremely bad weather conditions could result in much higher collision risks, because instead of displaying avoidance behaviour the birds could actually be attracted to the turbines by the lighting. In a qualitative sense this qualification has already been included in the present version of the FAECE. Other knowledge gaps will need to be tackled in follow-up research.

A.D. Fox, I.K. Petersen and T. Skovbjerg Balsby of the University of Århus:
Their chief point of criticism was that the IMARES report probably contains a considerable overestimate of the total 'mortality' of both seabirds and migratory birds because 1) loss of habitat will not necessarily lead to 10% mortality (wrongly concluded from Bradbury et al. 2014; according to the reviewers there is in any case no question of a physical loss of habitat, but at most of changes in behaviour that could result in this), 2) seagull flight heights where there is no

association with boats were said to be wrongly estimated (too low) and 3) too large a proportion of the populations of migratory landbirds were assumed (potentially) to migrate across the southern North Sea. Their suggestion for a 'more realistic' handling of fisheries-associated seagull concentrations has meanwhile been incorporated in a re-calculation of effects on birds found en masse behind vessels engaged in fishing (annex to part B of the report). Neither the overestimate of mortality as a result of habitat loss nor the mortality among migratory birds lead as yet to effects anywhere near the PBR and so they have no influence at present on the evaluation of the results. Further research will be needed in the future to decide on a better value for this.

Colophon

The Framework for Assessing Ecological and Cumulative Effects of offshore wind farms was drawn up for the Ministry of Economic Affairs by Rijkswaterstaat, under the guidance of an interdepartmental steering group of representatives from the relevant directorates of the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs.

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