STRATEGIC ENVIRONMENTAL ASSESSMENT ON NORTH SEA ENERGY

as an aid for Maritime Spatial Planning

SUMMARY REPORT

SEANSE

Co-funded by the European Maritime and Fisheries Fund of the European Union

PREFACE

INTRODUCTION

In 2016, North Sea countries signed a Political Declaration on energy cooperation as a follow-up of the Paris Climate Agreement. North Sea countries are now in the process of preparing Maritime Spatial Plans (MSPs), including offshore wind parks. It is known that the construction and operation of large-scale wind farms will affect the marine environment and other users of the North Sea.

In order to understand cross-border cumulative effects of large scale wind farms, new arrangements must be made to foster a transparent, coherent evaluation system that applies to the entire North Sea. To do so, the SEANSE project (Strategic Environmental Assessment North Sea Energy) was carried out between 2018 - 2020. Project partners include planning authorities in the Netherlands, Germany, France, Scotland and Denmark.

MAIN OBJECTIVES

The SEANSE project focused on developing a Common Environmental Assessment Framework (CEAF), through

- Development of a coherent approach to SEAs, with a focus on renewable energy and testing it in practice through case studies;
- Creation of a coherent understanding of how and when to use this part of the SEA through knowledge transfer and information exchange;
- Demonstration of the benefits of the implementation of a coherent SEA approach for the preparation of national MSPs;
- Facilitation of the efficient implementation of the "**Political Declaration on energy cooperation between the North Seas Countries**".

RESULTS

In the SEANSE-project, three baseline studies were performed:

- A comparison of planning criteria for offshore windfarms;
- A comparison of North Sea SEAs and EIAs;
- Development of the CEAF methodology.

Furthermore, two main case studies were commissioned in which the CEAF-methodology was tested:

- German-Dutch case study on the cumulative effects of North Sea wide offshore wind energy;
- Regional case study on the cumulative effects of offshore wind energy in East-Scotland;
- In Denmark a case study is being prepared.

Another main result of the SEANSE project is the development of a data portal. Data sharing is a crucial part of the Strategic Environmental Assessment.

Finally, the SEANSE project put considerable effort into communication and dissemination of results. Various workshops were held to engage stakeholders and experts, including a workshop on knowledge sharing and a workshop on the evaluation of the methods and models used in CEAF.

FINAL REMARKS

On 9th and 10th January 2020, the final conference of SEANSE was held in Rotterdam. The results of the project were presented and discussed with a group of stakeholders.

I would like to thank all partners for the good cooperation and partnership over the last few years. Let us continue working in that spirit for the future. I hope you will enjoy reading this summary report.

Leo de Vrees (SEANSE project coordinator), Rijkswaterstaat, the Netherlands.

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1. BASELINE STUDIES

In SEANSE, three baseline studies were performed:
- **A comparison of planning criteria for offshore wind farms;**
- **A comparison of North Sea SEAs and EIAs;**
- **Development of the CEAF methodology.**

1.1 PLANNING CRITERIA FOR OFFSHORE WIND FARMS

Maritime Spatial Planning (MSP) is a planning process for the sustainable development of the sea by coordinating and balancing sectoral interests while protecting the ecosystem. MSP plays an important role in locating offshore wind farms, as it designates areas for renewable energy and regularly also corridors for energy transmission. SEANSE partners jointly performed an examination and comparison of planning criteria in MSP for offshore wind. The study gives an overview on MSP and offshore wind development in the North Seas countries, and compares general siting criteria and various sectoral arrangements.

Almost all North Sea countries have maritime spatial plans in place or are in the process of developing their first plans (Denmark), and most countries started a revision of their plans. Planning conflicts exist between offshore wind developments and, among others, shipping routes, fisheries, marine protected areas, species protection, flight safety and cables and pipelines. Specific siting criteria differ between the countries, but safety zones (shipping), ecological buffer zones, specifications on the type of allowed activities (fisheries), and restricted areas are some of the common ways to prevent or minimise conflicts.

Overall, the multitude of planning conflicts underlines the need for MSP as a tool to balance the spatial needs of different sectors in the North Sea, while at the same time protecting the environment and biodiversity.

>>> **Planning criteria report**

1.2 NORTH SEA SEAS AND EIAS

To deal with potential ecological effects of planned wind farms, Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs) of planned activities are performed in the different countries. Within SEANSE, an analysis of similarities and differences between North Sea countries' SEAs and EIAs for offshore wind was carried out. Only countries with established SEA procedures were included in the study (Germany, the Netherlands, Belgium, England and Scotland).

Following the assessment steps as described in the next chapter, similarities and differences were analysed for each of the following six themes:

- Describing the relevant pressures of the planned activity (offshore wind farm);
- Describing and evaluating habitats and species that may be affected;
- Describing all other (planned) activities with pressures/effects on those species/habitats ;
- Estimating possible ecological impacts of those activities on the evaluated (sensitive) species and habitats by using models or expert judgment;
- Evaluating cumulative effects;
- Implementation of mitigation measures where significant effects on the environment resulting from the planned activity cannot be discounted.

The most common pressures are taken into account in every SEA by all examined countries: collision risk, noise disturbance and the physical presence of the structure. Most countries also take barrier effects into account. For the EIA, countries cover mostly the same species in their assessment. In general, there is a focus on the national EEZ and less on transboundary issues.

Different levels of cumulative ecological effects

Important differences are seen in the way SEAs and EIAs deal with cumulative effects on species of main concern. Cumulative effects of offshore wind farms can be assessed on different levels (Figure 1):

- Level 1 refers to the cumulative effects of all wind turbines in one farm;
- Level 2 implies also adding the ecological effects of other offshore wind farms;
- Level 3 includes all present and relevant activities with ecological effects on the same species and habitats. This also includes other types of activities, such as fishing or oil and gas production, and could also imply activities across national borders.

All national assessments thoroughly cover the effects on the first two levels, but effects on the third level are often missing. When no significant effect is expected on this level, most methodologies require no further calculation. This results in a lack of cumulative impact assessments at the biologically meaningful level.
The Common Environmental Assessment Framework (CEAF) aims at solving the current lack of comparative results, by developing a coherent framework to assess cumulative effects of offshore wind farm development at the biologically relevant level. CEAF does not include assessment of other activities. However, within SEANSE, a qualitative study was carried out on the relative importance of pressures from windfarms compared to other pressures on selected receptor species.

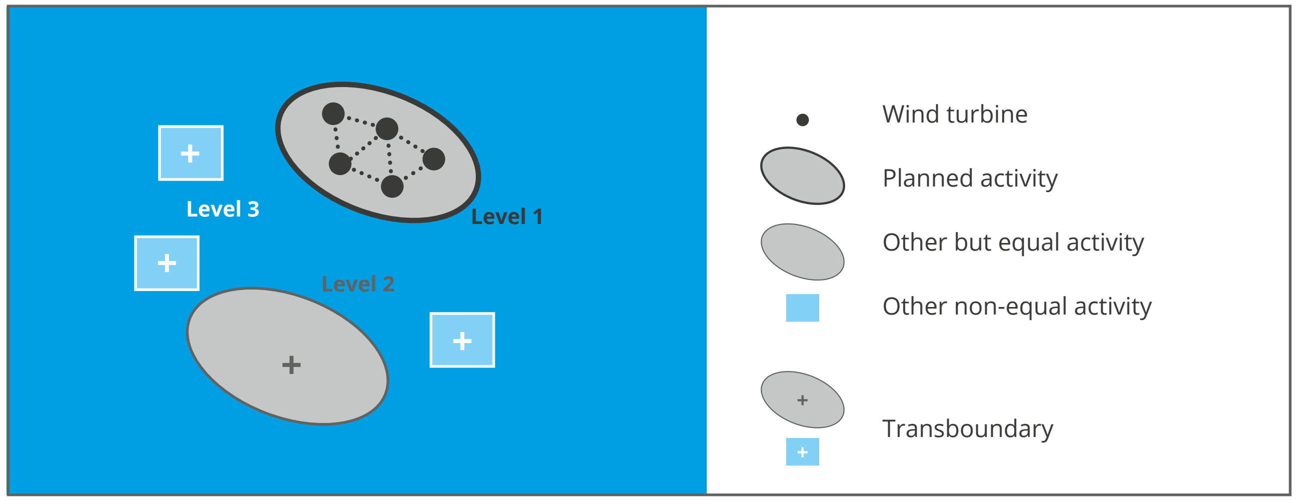


Figure 1: Different levels of cumulative effects

Baseline study on SEA and EIA <<<

Relative impacts of activities on marine species <<<

1.3 COMMON ENVIRONMENTAL ASSESSMENT FRAMEWORK

The Common Environmental Assessment Framework (CEAF) is meant to become a widely accepted set of tools and approaches to support decision-making in MSP, regarding assessing and dealing with unwanted potential ecological impacts of wind farm developments. As a first step, a set of modelling approaches for cumulative effects assessment for potential use in Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) has been selected and discussed. These approaches have been tested within the SEANSE case studies, as described in the next chapter.

Steps of a cumulative effects assessment (CEA)

The general approach for a cumulative effects assessment is described in Figure 2. For the SEANSE case studies, the focus lies on selected representative species for main impacts of offshore wind energy. This cumulative effects assessment takes into account the developments in the whole North Sea as the entire biogeographical region (within the jurisdiction of collaborating countries) of the possibly affected population of the species.

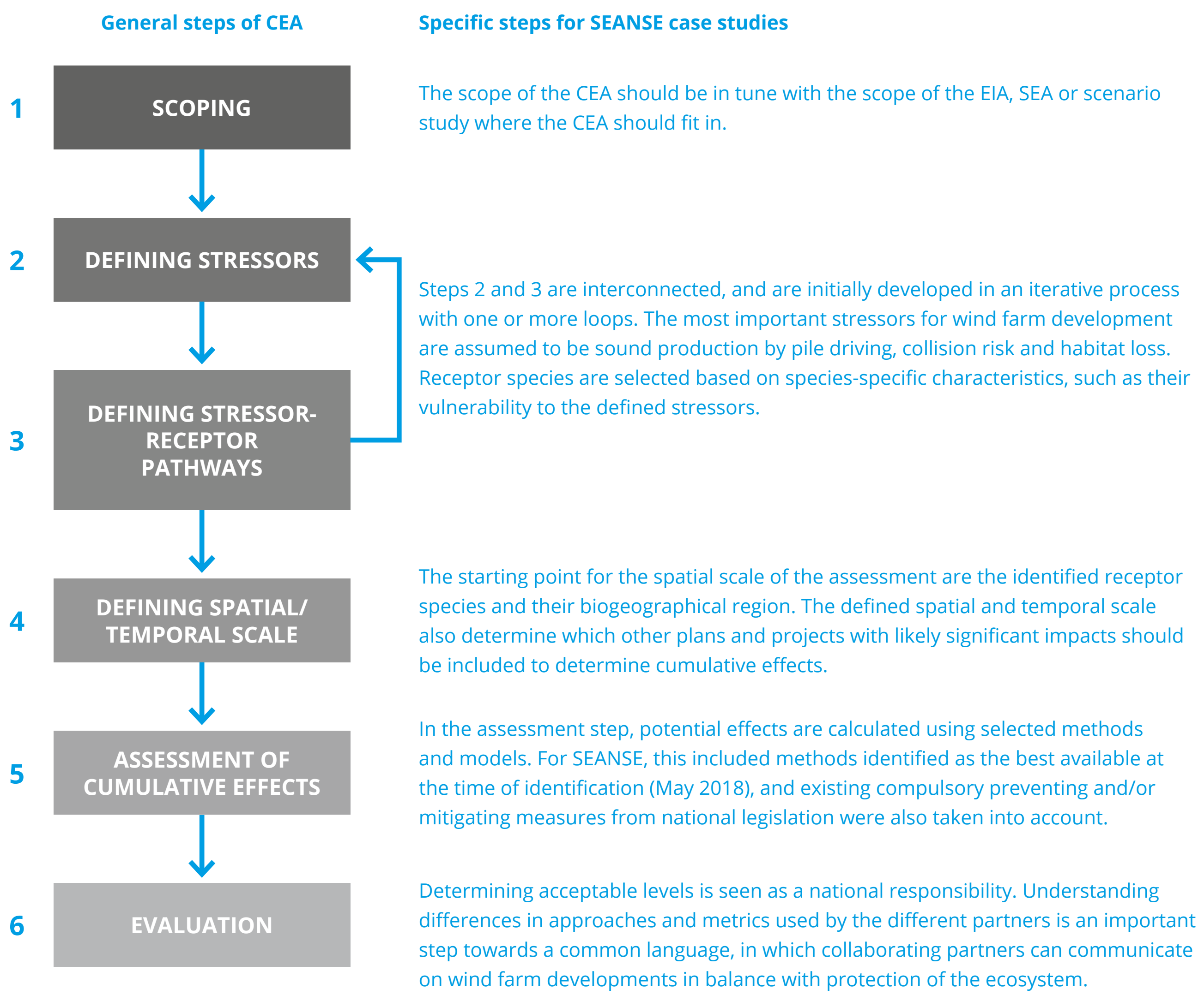


Figure 2: The general approach for a cumulative effects assessment

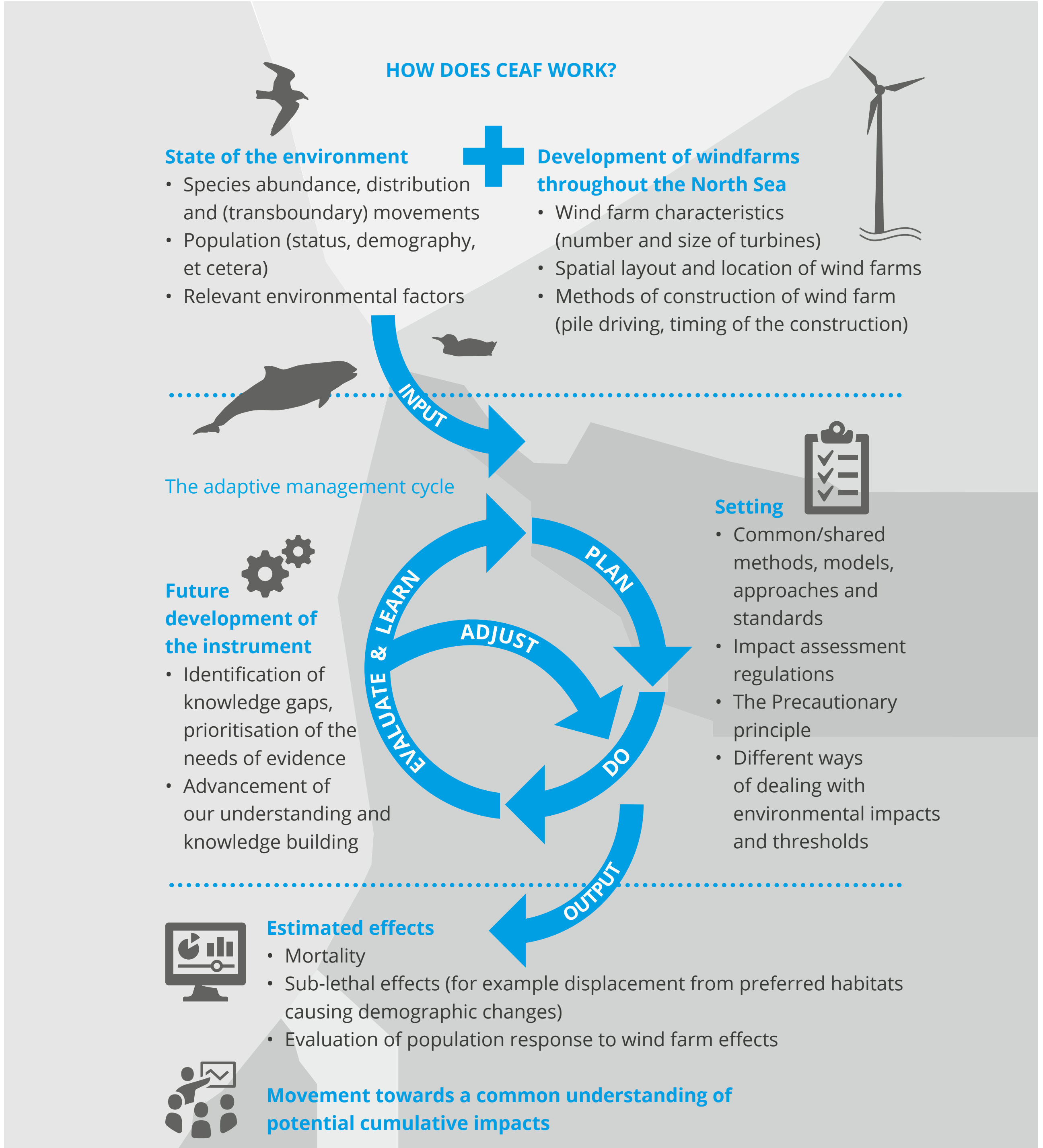
Assumptions are made at each stage of the assessment process, to deal with lack of knowledge or contradictory information. Transparency on the assumptions used is an important principle in the CEAF approach. Further elaboration of the methods, definitions and assumptions can be found in the CEAF guideline.

Selected stressors and stressor-receptor pathways
For testing in SEANSE, three stressors were defined, for which the following species have been selected from a longlist of species of international concern, within the following stressor-species pathways:

1. **Input of anthropogenic sound by pile driving during construction**
   Harbour porpoise (*Phocoena phocoena*) is considered to be the most vulnerable receptor species for underwater sound production by pile driving during the installation of offshore wind turbines.
2. **Collision risk in operational wind farms**
   For assessing the cumulative effects of bird collisions with rotating rotor blades of offshore turbines, the most representative receptor species are assumed to be Black-legged kittiwake (*Rissa tridactyla*) for the UK and Norway, and Lesser black-backed gull (*Larus fuscus*) for continental NW Europe.
3. **Habitat loss or displacement due to the presence of wind farms**
   With respect to habitat loss or displacement, two representative seabird species are taken into account, each of which has different ecological requirements. The first is the Red-throated diver (*Gavia stellata*), because of its high vulnerability to human disturbance, and because it tends to prefer relatively shallow waters also currently favoured by wind farm developers. As a second species, the Common guillemot (*Uria aalge*) was selected, as this species has a wide distribution range and is thus likely to be influenced by large scale offshore wind energy development.

Selected spatial and temporal scale
Based on an ecologically sound spatial scale for assessment of effects of pressures, the area for calculating effects on the chosen species depends on the area of importance for the population of this species; in the case of SEANSE, this is the Greater North Sea. For pragmatic reasons, the biogeographical area is taken into the assessment for as far as it is part of the area of jurisdiction of the countries participating in the Political Declaration.

Other projects and plans to consider in the assessment include completed, approved and foreseen activities. For SEANSE, available information from wind energy plans and projects were compiled in three scenarios. Effects of activities other than wind farm development or outside the defined North Sea region, are assumed to have been incorporated in the baseline state of the species distribution.



2. CASE STUDIES ON THE CUMULATIVE EFFECTS OF OFFSHORE WIND ENERGY

Within the SEANSE project, a set of modelling approaches has been tested through case studies by calculating the cumulative effects of different wind farm development scenarios on five selected species. The assessment approaches have been discussed within the environmental subgroup of the MSP support group of the North Sea Energy Cooperation and were evaluated based on the case studies in an expert workshop.

2.1 NORTH SEA CASE STUDIES

Scenarios

The Netherlands and Germany performed comparable case studies to assess cumulative effects of offshore wind in the southern North Sea. Three scenarios of North Sea wide wind farm development were derived from information on planned and foreseen wind farms, as made available by the cooperating parties in SEANSE and CEAF (Figure 3):

- Wind farms installed until end 2023: 23 GW in operation;
- Wind farms installed until end 2030: 50 GW in operation;
- Beyond 2030: 68 GW in operation (information from Germany and the Netherlands).

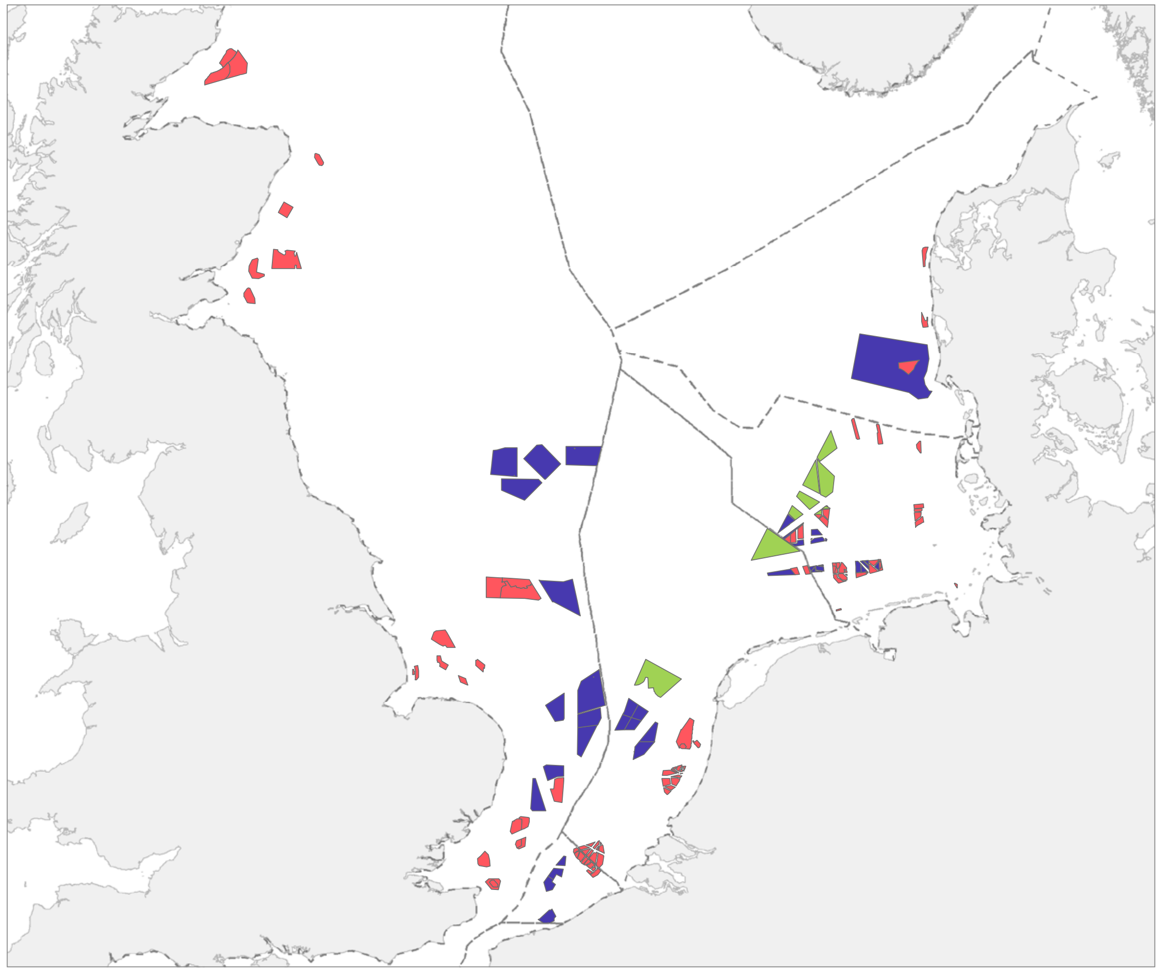


Figure 3: Installed, planned and foreseen wind farm areas in the North Sea (red: 2023, blue: 2030, green: 2030+, as of 09/2018)

Species

Selected species and related pressures for the case studies are representative of potential cause-effect relationships and of high concern in participating countries:

- Harbour porpoise (*Phocoena phocoena*) for assessing the cumulative effects of underwater sound from pile driving;
- Black-legged kittiwake (*Rissa tridactyla*) and Lesser black-backed gull (*Larus fuscus*) for assessing the cumulative effects of bird collisions;
- Red-throated diver (*Gavia stellata*) and Common guillemot (*Uria aalge*) for assessing the cumulative effects of displacement.

COLLISION RISK FOR SEABIRDS

The numbers of collisions for Black-legged kittiwake and Lesser black-backed gull were calculated for all three scenarios using the extended SOSS Band model (Strategic Ornithological Support Services Band model, Dutch case study) and for scenario 2030, also the updated stochastic CRM (Collision Risk Model, German case study).
The basic input for a collision risk model are species-specific parameters and densities, and wind farm- and turbine-specific parameters (Figure 4).

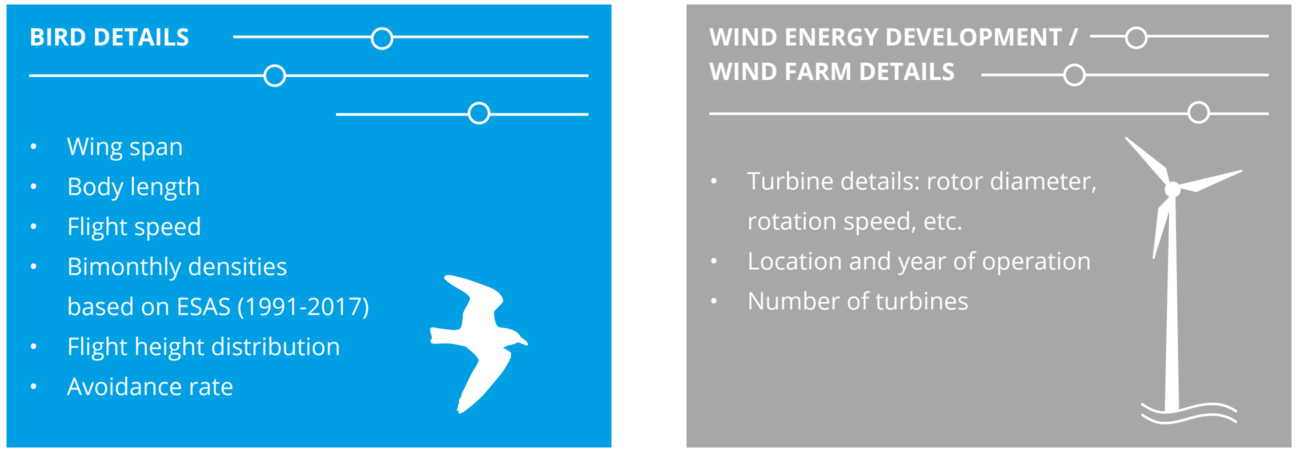


Figure 4: Parameters for collision risk modelling

Findings

The model output on collision effects estimates total numbers of individuals killed per two-month period for each installed and planned wind farm in the North Sea. The SEANSE study did not extend the results to population level. Detailed results for the three scenarios can be found in the Bureau Waardenburg report.
The range of results obtained depending upon the assumptions made, illustrates the importance of careful consideration of the assumptions and the need for further research. Table 1 compares the results from the Dutch and German case studies, applying the Band model and the stochastic CRM model, respectively, for the second scenario (up to 2030). Although different model versions were used, results from the German and Dutch studies are in the same order of magnitude. Further information on the assumptions used can be found in the case study reports by Bureau Waardenburg (Dutch report) and DHI (German report).

Table 1: Estimated collision mortality for two-month periods with highest species-specific densities, based on empirical and generic assumptions (German and Dutch studies results for wind farm development until 2030)

	Black-legged kittiwake		Lesser black-backed gull	
	Empirical assumptions	Generic assumptions	Empirical assumptions	Generic assumptions
Dutch study (Band model)	16	47	78	208
German study (stochastic CRM)	11,5	32,6	82,4	245,1

2. CASE STUDIES

When interpreting the model output, assumptions need to be considered carefully. The assumptions on flight speed and avoidance rate used in different calculations might look comparable, but the results differ substantially (Table 2). For example, changing the avoidance rate from 99.5% (generic avoidance rate) to 99.8% (empirical avoidance rate) resulted in a 60% reduction in estimated collision mortality.

Table 2: Estimated collision mortality per species for wind farm development until 2030, with different assumptions on avoidance rate and flight speed (Dutch study)

Species and period with highest densities	Black-legged kittiwake Dec/Jan	Lesser black-backed gull Aug/Sep
Generic avoidance rate + Generic Speed	47	208
Generic avoidance rate + Empirical Speed	39	195
Empirical avoidance rate + Generic Speed	19	83
Empirical avoidance rate + Empirical Speed	16	78

>>> Bureau Waardenburg report

>>> DHI report on collision

Suggestions for next steps from the expert workshop

- Improving the data quality and accessibility;
- Developing an understanding of North Sea´s seabird populations;
- Developing individual-based models;
- Clarifying the scope of model applications.

DISPLACEMENT EFFECTS FOR SEABIRDS

The numbers of Red-throated divers and Common guillemots affected by offshore wind farms through displacement are estimated for each two-month period by multiplying the area of the footprint of the wind farms with the local density of the species in this area. The footprint consists of the wind farm layout and an additional buffer zone related to the assumed disturbance range of the respective species, which is 5.5 km for divers and 2 km for Common guillemots.

Findings

The calculation results on displacement effects provide total estimates of displaced birds per two-month period for each installed and planned wind farm in the North Sea. As for collision risk, the displacement study did not extend to population level. Details of the calculations and results can be found in the Bureau Waardenburg report and DHI report. Results from the German and Dutch calculations on the number of displaced birds are very similar (Table 3). Assumptions on the percentage of displaced birds in different zones can change the results substantially, e.g. the number of displaced divers is 40% higher with precautionary displacement rates.

Table 3: Number of displaced birds per species for the scenario of wind farm development until 2030

	Common guillemot	(Red-throated) diver	
	75% displacement in wind farm and 50% in 2 km buffer zone	100% displacement in windfarm and 5.5 km buffer zone	99% displacement in wind farm, 50% in 5.5 km buffer zone
Dutch study	159.038 in Dec/Jan	12.543 in Feb/Mar 14.625 in Apr/May	-
German study	163.169 in Dec/Jan	12.439 in Feb/Mar	7.684 in Feb/Mar

>>> DHI report on displacement

Suggestions for next steps from the expert workshop

- Expanding knowledge about displacement rates by improving knowledge on individual behavior through tracking;
- Developing an understanding of displacement and its effect on population level;
- Merging collision and displacement models;
- Studying approaches of precautionary spatial planning through mapping of sensitive habitats.

UNDERWATER NOISE FOR MARINE MAMMALS

When assessing the cumulative effects of wind farm development in the North Sea, there is evidence that Harbour porpoises show behavioural changes due to sound produced by pile driving during windfarm construction. It is assumed that these behavioural effects (i.e. avoidance) may have fitness consequences for the individual, with potential influence on the population.

Two model approaches have been developed to estimate the cumulative effects of noise generating activities at sea: iPCoD and DEPONS. Both models are in principle suited to estimate the cumulative impact of sound disturbances on Harbour porpoise populations in the North Sea.

iPCoD

As a top-down approach, a sound propagation model was used by RWS in combination with the iPCoD model (interim Population Consequence of Disturbance). The AQUARIUS model (for acoustic modelling of underwater sound) was used to calculate the area of disturbance. Together with the density of Harbour porpoises, this area was used to generate the Harbour porpoise disturbance days as input for the iPCoD model. Where applicable, national mandatory sound reduction measures were taken into account in the calculations. The iPCoD is a non-spatially explicit model, with population parameters being estimated by expert elicitation rather than empirical data.

DEPONS

The study commissioned by BSH assessed the feasibility of using DEPONS (Disturbance Effects of Porpoises in the North Sea) to assess cumulative effects of noise. DEPONS is an agent-based model, where the behaviour of the individuals is modelled and the population consequences are estimated as emergent properties of the model. DEPONS is spatially explicit, which means that population consequences can be resolved in space and time.

Findings

Both models produce population size estimates and reflect changes in populations over time. However, the DEPONS model can provide a wider range of model output and predictions than the iPCoD model, including estimation of spatial changes in distributions in relation to noise disturbances, along with estimations of energetic variations in time and space.

Table 4: Comparison of key differences of DEPONS and iPCoD (DHI 2019)

Output	DEPONS (DHI)	iPCoD (TNO)
Sound propagation	Spherical spreading incorporated into the model	AQUARIUS
Level of noise exposure	Distance to the sound source per individual	Categorical, either disturbed or not disturbed.
Consequence of disturbance on survival and birth rate	Indirectly affected through effects on foraging efficiency, which can affect energetic levels	Relationship parametrized by expert elicitation, relating the number of days disturbed to birth rates and survival
Spatial distribution of noise	Spatially explicit, meaning that individuals outside noise range will not be affected	Not spatially explicit, but user defines the proportion of the population that is affected

TNO report on underwater noise <<<

DHI report on underwater noise <<<

Model outputs from iPCoD are presented as probability of impacts on the population. The probability of a population reduction due to the piling scenarios modelled, is quantified by the 5%, 10% and 50% (median) percentiles of the difference in size between the disturbed and undisturbed populations. The results show a 5% probability of a population reduction by 13% in 2038, and a 50% probability of a population reduction by 2% (see Figure 5). Further interpretation and results can be found in the case study reports by TNO and DHI.

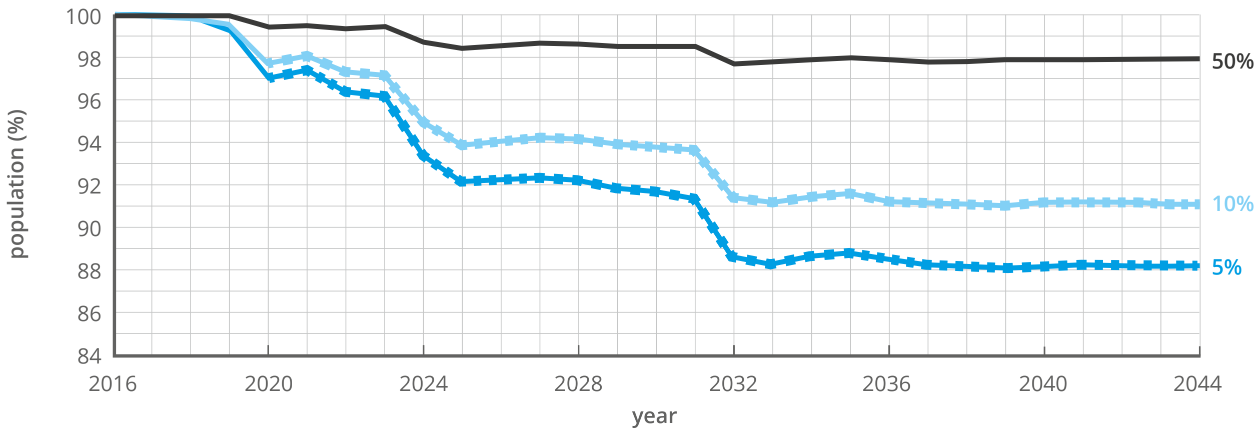


Figure 5: Calculated population development for the years up to 2038 with iPCoD.
Harbour porpoise population: 350,000 animals. Dashed lines: standard deviation (Dutch study).

Suggestions for next steps from the expert workshop
- Improving the differentiation of underwater sound;
- Improving the understanding of impacts of sound disturbance levels on the recipient;
- Further comparison of model output from iPCoD and DEPONS through calculation studies.

2.2 REGIONAL CASE STUDY: EAST SCOTLAND

Marine Scotland commissioned a case study as part of the SEANSE project to develop a regional strategic assessment framework for impacts on seabirds that may result from offshore wind development scenarios. In the case study, the developed framework was applied to a strategic assessment in the Forth and Tay region of Scottish waters for five key seabird species. The assessment provided a baseline of seabird populations and habitat use in the area, utilising best available seabird data products and tools.
Then, three different scenarios of increasing offshore wind development were assumed. The framework was applied to these scenarios to examine how different datasets and assessment methods, with different assumptions, affected the combined impact assessment and population projections.

Scenarios for offshore wind in the Scottish North Sea
Wind farm footprints in the different scenarios of the Scottish case study (Figure 6):
- Scenario 1: No Offshore Wind Farm (OWF);
- Scenario 2: Grey, 1.2 GW = all currently consented developments;
- Scenario 3: Blue, additional 2.8 GW.

Black-legged kittiwake
(*Rissa tridactyla*)

Common guillemot
(*Uria aalge*)

Razorbill
(*Alca torda*)

Atlantic puffin
(*Fratercula arctica*)

Northern gannet
(*Morus bassanus*)

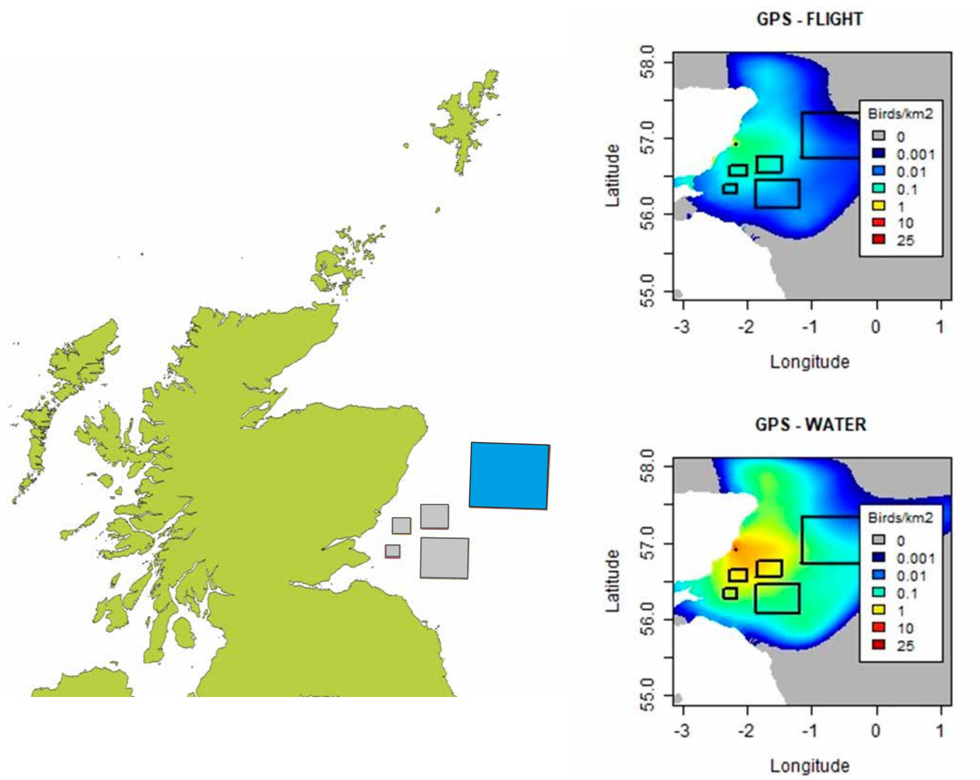


Figure 6: Final layout and size of hypothetical Offshore Wind Farm (OWF) footprints to be used in Scenario 2 (grey) and 3 (blue) in the SEANSE project.

Findings
The developed framework included the use of two displacement assessment approaches, the SeabORD tool and the displacement matrix, and one collision assessment tool, a stochastic model for collision risk. The number of birds exposed to a pressure (displacement or collision) was assessed through distribution maps either derived from at sea survey data or from colony specific GPS tracked distributions. Mortality effects from displacement and collision were apportioned to four Natura sites .

The potential for population level impacts was then assessed through population viability analyses (PVA) comparing predicted population trajectories with and without the presence of the offshore wind developments. Throughout these steps uncertainty was estimated either quantitatively, where possible, or otherwise qualitatively.

For assessment of displacement, the effective mortality rates are typically much higher for SeabORD than the mortality rates calculated following the Displacement Matrix approach. The rates estimated by SeabORD are based on the latest available data and understanding of the ecology of seabirds, whereas the Displacement Matrix is based on Expert Judgement.

General recommendations
The Scottish case study led to a number of recommendations for future work:
- Improve accounting for birds originating from outside the region;
- Outputs from simulations of displacement effects using the SeabORD tool should be used to refine estimated levels of effect from displacement when applying the displacement matrix approach;
- Further development of SeabORD to better model uncertainty in parameters and incorporation of more ecologically realistic foraging movements;
- Refine quantification of uncertainty in assessment in model parameters and in estimating bird distributions, densities, and colonies of origin;
- Further research into better quantification of some of the key processes used within PVA models including assessments of climate effects on population demography.

Report case study Scotland <<<

2.3 EVALUATION OF THE CASE STUDIES

Different methods and models for assessing the cumulative effects of offshore wind energy have been tested in case studies and evaluated in an expert workshop held in October 2019 in Hamburg. The experts concluded that:

1. Modelling approaches can be applied under conditions for comparing MSP options at national and international level;
2. The results of the case studies do not facilitate international evaluations on the acceptability of cumulative effects in the North Sea region because this is considered national responsibility.

During the discussions on next steps for the applied methods and models, four general controversial themes were identified:

Complexity of the ecosystem	< >	Need to predict environmental impacts
Models can help to assess environmental impacts	< >	Models can be misleading if results are used for SEAs
Red lines for the decline of population size are needed	< >	Thresholds might only apply for a certain location and are not transferable
Precautionary approach on ecosystems	< >	Rapid upscaling of offshore wind energy as a contribution to combat the global climate crisis

Participants acknowledged that identifying common grounds among North Sea countries and among different approaches to assess environmental impacts remains a reasonable pathway towards the overall goal of the European energy transition. The workshop contributed to this goal, as it broadened the expert community's understanding of the variety of different approaches taken by countries, and thus marked a step towards better harmonised environmental assessments.

Participants of the workshop in Hamburg

General recommendations

- Improvement of data accuracy and generation of further data on distribution and behaviour through monitoring and research cooperation;
- Development of a roadmap to improve existing methods and models and to build in the longer term individual-based models to improve the quality of assessments;
- Provision of a guidance for authorities on how to use model results;
- Discussion on alternative approaches to assess and manage cumulative environmental effects, e.g. through mapping and safeguarding of important habitats;
- Application of an adaptive management approach to support decision-making in MSP by learning from impacts of plans and projects and using that information to improve assessment methods in the next planning cycle;
- Institutionalising the dialogue among authorities, researchers and model builders on how to assess, evaluate, monitor and mitigate cumulative effects of offshore wind energy development.

>>> **Report evaluation workshop**

3. SHARING KNOWLEDGE

3.1 WORKSHOP ON KNOWLEDGE EXCHANGE

The Conference of Peripheral Maritime Regions (CPMR), its North Sea Commission and the French Naval Hydrographic and Oceanographic Service (Shom) co-organised a knowledge sharing workshop in Antwerp focussing on the challenges of Maritime Spatial Planning (MSP) in the North Sea area, in the framework of the SEANSE project.

This workshop aimed to enable exchange between partners of the project, regions and socio-economic actors on issues including the MSP implementation process in the North Sea, land-sea interactions and smart grids in the North Sea, and data sharing to integrate an ecosystem-based approach in MSP.

Presentations provided an update on the status and schedule of the MSP Directive implementation in France, Belgium and the Netherlands. Land-sea interaction remains a subject of discussion and is interpreted differently among disciplines and countries. A session on data sharing, enabled the Shom to present its data portal demonstrator. It centralises data available in web services that is relevant for Maritime Spatial Planning from multiple sources related to the countries of the North Sea and Channel. The discussion was about how to facilitate and encourage the spatial data sharing for MSP between the countries.

Participants of the workshop in Antwerp

Minutes workshop knowledge exchange <<<

3.2 PRE-ANALYSIS OF MSP IN DENMARK

The first national Danish Maritime Spatial Plan (MSP) will enter into force in March 2021. As Denmark will be conducting the SEA of its first MSP in the first half of 2020, Denmark has not - within the time frame of SEANSE – experience with conducting SEAs of MSPs. Therefore, the Danish contribution to the project is a pre-analysis of conducting the SEA of the MSP based on national experiences from SEAs of the different developments of wind energy at sea from 2006 and onwards.

The analysis thus draws on historic Strategic Environment Assessments (SEAs) and Environmental Impact Assessments (EIAs) conducted in the Danish maritime renewable energy sector. The report investigates how SEAs can contribute to and improve permit procedures for individual activities included in the Danish MSP and the environmental issues linked thereto.

The pre-analysis was carried out by the Danish consulting firm that will also carry out the SEA of the first Danish MSP. The pre-analysis generates valuable insights for the actual implementation of the SEA. The pre-analysis concludes that the SEA may assist in targeting and clarifying environmental issues in exploitation and utilisation of resources in the marine renewable energy sector in Denmark.

Danish report <<<

4. USE AND SHARING OF DATA FOR MSP

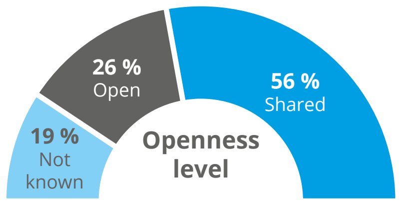
In order to implement the Maritime Spatial Planning (MSP) Directive, it is fundamental to use spatial data related to administrative boundaries, physical, chemical and biological characteristics, socio-economic factors, human activities and spatial policies. SEANSE includes a work package which assesses the availability of MSP data in Denmark, France, Germany, Netherlands, and Scotland. It covers a number of issues including interoperability of datasets and data portals, metadata and web services stability.

Analysis
An initial inventory of data useful for MSP, available in INSPIRE web services and associated with metadata, has been carreid out. INSPIRE provides standards and protocols to share datasets across Europe. The inventory provides an initial overview of data organisation in the Channel and North Sea. "The analysis of data needs and existing gaps" report, is available at the **SEANSE website**.

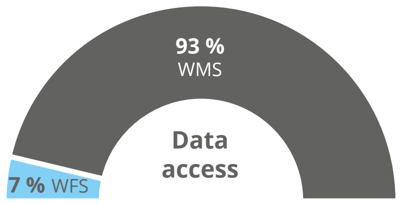
EXAMPLE
Physical, biological and chemical information - Physical characteristics

Data scale

European	✓
National	✓
Regional	
Local	



Physical characteristics openness level



Physical characteristics data access

Open data means datasets are free to use, reuse and publish without restriction.
Shared data means users or a group of users can use, reuse and publish some data under a control (e.g. copyright).

SEANSE Data portal
A Spatial Data Infrastructure (SDI) has been set up to share transboundary MSP knowledge and to explore data gaps and needs, as well as potential solutions to solve them. This tool gathers the datasets disseminated by the existing marine SDI (harvesting process). The data portal architecture is designed to provide services useful for MSP and, in particular, for cooperation among countries regarding MSP issues of transnational nature, such as:

- Gathering a multitude of data formats;
- Clear identification of the data producers;
- Accessing the data content (attributes) and metadata;
- Organising datasets either by theme, country or through maps;
- Language configuration either for the general interface of the data portal, for the data layers name or the metadata records;
- Displaying data of different points in time thanks to a time series tool;
- Developing dynamic web pages to enhance the understanding of complex data, what is a final indicator?

>>> **Link to Data portal**

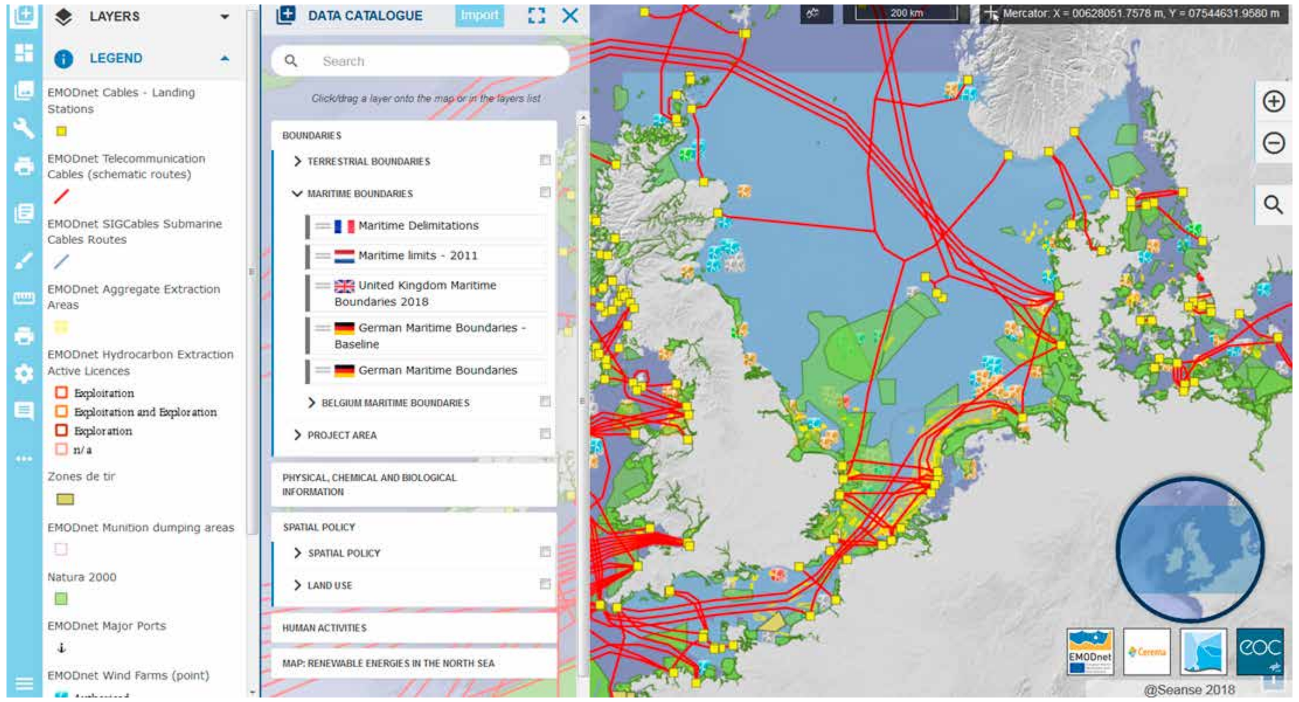


Figure 7: Example from Data portal

Report on Analysis of data needs and existing gaps relating to transboundary working <<<

Annex with data layers <<<

Recommendations
MSP implementation is a national process with cross-border implications, urging states to inform and collaborate with neighbouring countries. Countries assess and process large amounts of data regarding their waters to establish the national marine plans. Due to resource constraints, it does not seem realistic to develop activities on harmonising all of these datasets to ease transboundary cooperation. However, to ease MSP data sharing among countries, through Maritime Spatial Data Infrastructure, several recommendations can be made:

- Geoportals should manage numerous input data formats (stored data and web services). Nevertheless, OGC (Open Geospatial Consortium) compliant web services are preferable;
- Efforts have to be undertaken to provide harmonised data for users, when the data is not produced on an international scale or at the scale needed for transboundary issues;
- Develop solutions to provide access to MSP information in multiple languages, in particular in English and in the languages of the countries sharing the same sea basin. In case data has previously not been translated, priority can be given to layer names and contents in the associated metadata;
- Establish collaboration between GIS specialists, data experts, and marine spatial planners through a permanent transboundary working group. A first action of such a working group could be to identify priority datasets to share;
- Provide tools (searching tools, data organisation, etc.) to facilitate data access for users on MSP data portals;
- Improve communication on complex data;
- Ensure the permanent maintenance of web services.

4. USE & SHARING DATA

5. COMMUNICATION AND DISSEMINATION

Through an opening and a closing conference, as well as with an extensive project website, key stakeholders were involved in the SEANSE project. Furthermore, SEANSE was present at several conferences and events.

Opening Conference
On 5 July 2018, the Opening Conference for the SEANSE project was held in Brussels, Belgium. The project objectives, activities and possible outcomes were presented by the SEANSE partners to a total audience of 30 participants, including a variety of stakeholders.

>>> **Report of the Opening Conference**

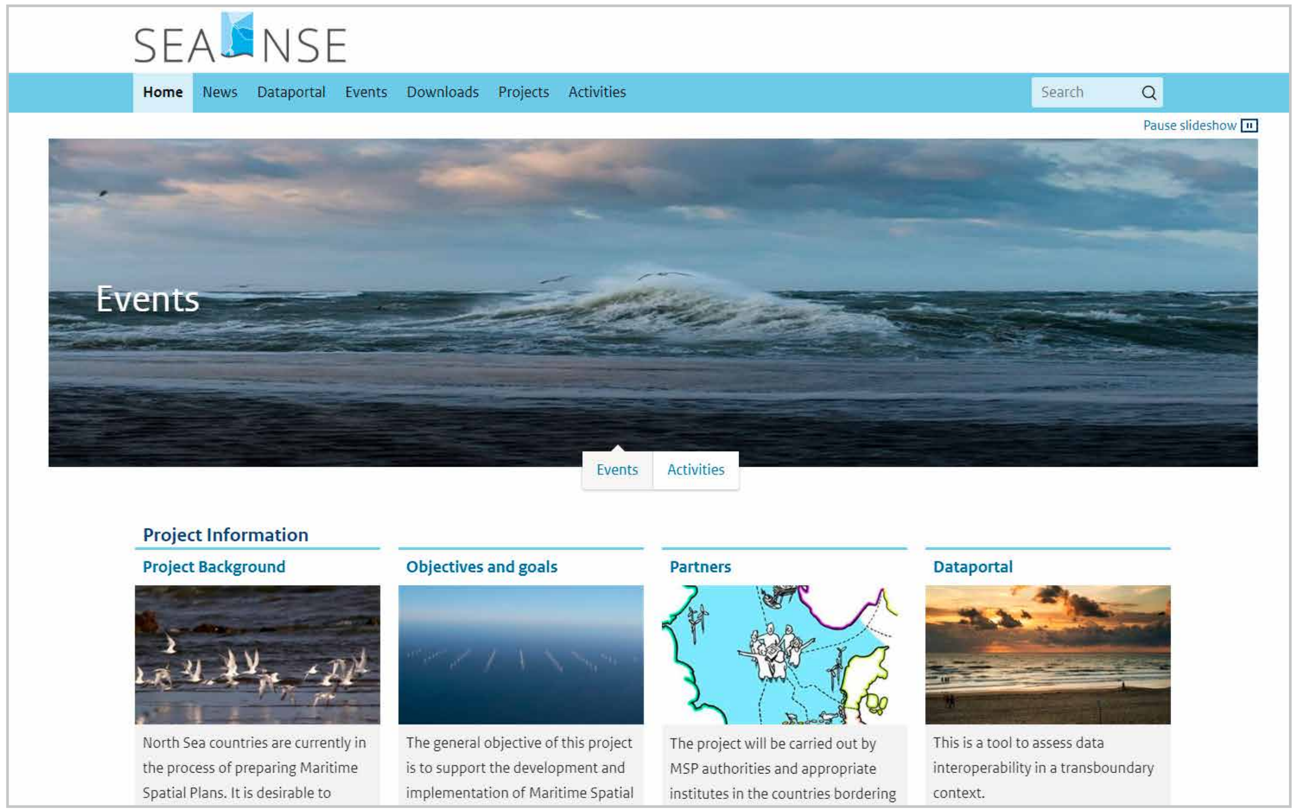
Participants at the Opening Conference

SEANSE website and leaflets
A website was launched at the start of the project, with information for the public. Two leaflets were made, explaining SEANSE and CEAF. Materials for the various workshops including presentations and results of the project, as described in this final report, are downloadable from the website via the download page.

>>> **Link website SEANSE**

>>> **Download page of SEANSE**

5. COMMUNICATION



SEANSE present in external events
Representatives of SEANSE were present in a number of national and international events. The international events were:

- Annual merlGeo Conference in Aix-en-Provence, France, 20-22 March 2018;
- Annual INSPIRE Conference in Antwerp, 18-21 of September 2018;
- Pan Baltic Scope workshop on SEA and the ecosystem based approach, 23-24 October 2018 in Hamburg and Malmö, 9-10 May 2019;
- NorthSEE and Baltic Lines MSP conference, 13-14 February 2019 in Hamburg;
- European Maritime Days, 16-17 May 2019 in Lisbon;
- Data workshop organised by EASME and EU/DG Mare with EMODnet on 3 October 2019 in Brussels;
- MSP Forum “Global meets regional”, 19-21 November 2019 in Riga, Latvia.

Final conference
On 9 and 10 January 2020, a Final Conference of the SEANSE project was held in Rotterdam. The meeting was meant for stakeholders, project partners and other interested participants. The most important conclusions of the project were shared and discussed.

6. FINAL CONFERENCE

About 60 participants attended the 'SEANSE Final Conference' in Rotterdam on January 9th and 10th 2020. Attendees were from the SEANSE partner countries, such as the Netherlands, Germany, Scotland, Denmark and France, but also from several other countries. Among the attendees were representatives from North Sea countries' governments, the European Commission, research institutions and consultancies, the wind industry and NGOs.

At the conference, the results and conclusions of SEANSE were presented and discussed. Four workshop sessions were held to discuss the key themes in SEANSE: the development of environmental assessment tools; Maritime Spatial Planning conflicts & planning criteria; data & tools to aid this planning process; and cross-border processes & stakeholder involvement. During the conference, an interactive tool (Mentimeter) was used to collect input from the audience on various questions. Here's a brief summary of these workshops.

Participants at the Final Conference

WORKSHOP SESSIONS

1. SEA: methods & models
In this workshop the methods and models developed and tested within SEANSE were discussed. Participants seemed to have different views on how to use the models, but they all agreed that decisions about Marine Spatial Plans should not entirely be based on models. Some participants though prefer to use expert judgement and data from monitoring to decide on MSP, rather than put effort in the development of a model. The second workshop theme, 'rethinking species protection when conflicting with combatting climate change', also resulted in different opinions. On one hand it was argued that climate change would affect global biodiversity, and protecting species in a dynamic system - such as the North Seas - should not delay combatting climate change. On the other hand, there was a general feeling that biodiversity should not pay the bill for combatting climate change. One should approach this from a broader perspective. Lastly, different views were expressed on the need for international collaboration on a voluntary or a (legal) binding base. The necessity to have a binding agreement to ensure good environmental status of the North Sea was acknowledged. However, reaching such an agreement would take a long time and the gains compared to the voluntary approach might not be substantial.

2. MSP: planning criteria
In this workshop, several conflicts between Offshore wind farms (OWF) and other marine uses as well as planning solutions were identified and discussed among the participants. For shipping, OWFs are an obstacle and safety distances must be kept. In addition, the designation of shipping routes is a good planning solution. Fisheries are displaced by OWF and it is important to avoid valuable fishing grounds. To solve conflicts between OWF operators and fishermen, communication between those sectors has highest priority. Concerning the marine environment, it was confirmed that habitat loss for seabirds, collision risk and underwater noise during construction, are the most pressing conflicts. Planning solutions are the avoidance of sensitive areas, curtailment, noise mitigation measures and long-term monitoring. On MSP level, the precautionary principle should be applied by avoiding environmentally sensitive areas and highly frequented shipping routes for the siting of OWF. Spatial designations as well as rules and conditions for marine sectors should be specified as detailed as possible in order to minimise conflicts.

3. Cross-border processes & stakeholder involvement
This workshop provided a state-of-play of efficient and existing stakeholders involvement tools and methodologies from the North Sea area. A fruitful debate enabled participants to identify and analyse main barriers and needs for further cooperation, and to encourage the transferability of successful concrete stakeholder involvement initiatives within the North Sea area and beyond. The main recommendation was that a mix of formal and informal approaches is usually successful in cross-border cooperation between national authorities in charge of MSP. Regarding cross-border cooperation, there is no specific dedicated structure taking the lead or developing and implementing a common North Sea cross border MSP cooperation strategy. However, a common work is being developed focusing on the energy issue through the Political Declaration. There might be a gap to be filled on enhancing stakeholder consultation at cross-border level. The use of the existing structures, based on a voluntary basis, still is a feasible solution to be further explored.

4. Data and tools for MSP
During the workshop on data and tools, the participants learnt about the SEANSE Data-portal, as well as its functionalities, and engaged in two practical exercises. Firstly, the discussion on the role of a potential working group on data illuminated opportunities and challenges, as possible tasks were considered. In a second exercise, it was debated what type of content should be given priority on a potential European geoportal. The various backgrounds and perspectives of the participants have shown that different directions are possible, focussing either on planning evidence or communicating MSP plans.

OVERALL EVALUATION

The main conclusions of SEANSE, as presented in the next chapter, were evaluated in a panel discussion with panel members Felix Leinemann (European Commission), Jan Busstra (Rijkswaterstaat, The Netherlands), Mattia Cecchinato (Wind Europe), Kai Trümpler (BSH, Germany) and Damien Périssé (CPMR/NSC).

The audience was also asked which of these conclusions poses the biggest challenge to offshore wind farm development. 'Political cooperation' was identified as the biggest challenge (Figure 8).

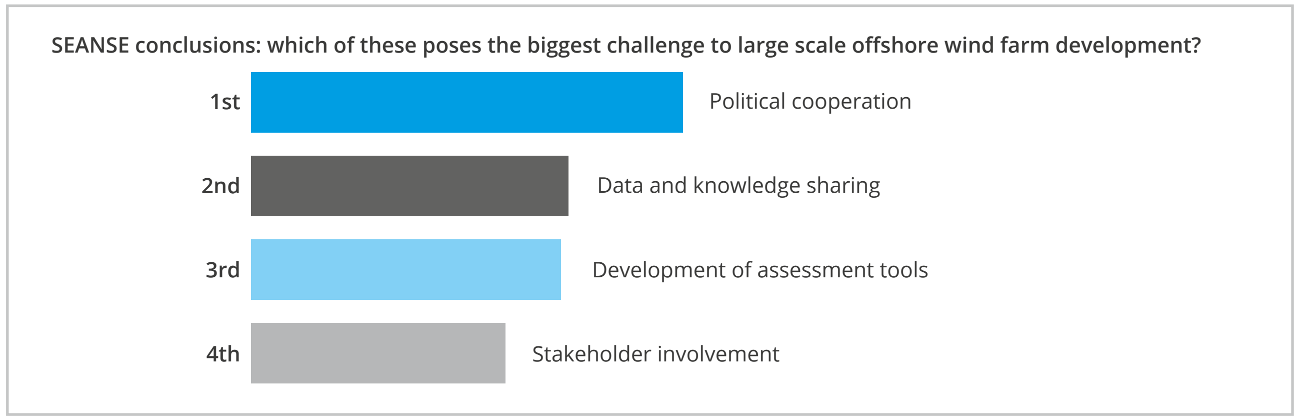


Figure 8: Audience voting results on which of the SEANSE conclusions poses the biggest challenge to large scale offshore wind farm development.

Report of the Final Conference <<<

7. FINAL CONCLUSIONS AND RECOMMENDATIONS SEANSE

In order to reach the EU's energy and climate targets as a contribution to the Paris Agreement, large areas for offshore renewable energies are required and need to be designated. However, the space in the North Sea is finite and the demands of both traditional and non-traditional marine uses are increasing. There is a need to understand the spatial implications of these large scale energy areas for the North Sea as a whole. Besides, there is the need to better understand the ecological impacts of large scale wind development in the North Sea, especially on (but not limited to) seabirds and sea mammals. Lastly, in order to prevent biodiversity losses, there is a need to understand whether and how these impacts can be kept within acceptable limits. The following conclusions and recommendations contribute to these concerns.

1. DATA AND KNOWLEDGE:
Maritime Spatial Data Infrastructures can facilitate the use and sharing of existing data among countries. This is particularly relevant for the dissemination of information of cross-border interest (shipping traffic, offshore renewable energy sites, etc.). Despite INSPIRE mechanisms, aiming to facilitate the sharing of spatial data across Europe, it is necessary to further define the priorities in data sharing and harmonization. It is recommended that the North Sea countries address these topics through a dedicated working group, which could be supported by EC initiatives in this field. In addition, the existing gaps in data, information and knowledge need to be filled, in order to be able to make reliable assessments of the human activities at sea. It is therefore recommended that North Sea countries, in addition to sharing currently available data, work together on generating new and standardized data and build on further knowledge. This applies both to cross-border issues of human activities and to knowledge on species, habitats and ecosystems to be enhanced through monitoring and joint research.

2. ASSESSMENT TOOLS:
Assessing cumulative impacts of offshore wind energy development is of increasing importance and different methods and approaches are developed and applied to comply with national planning and assessment procedures. It is recommended to strive for a functional coherence of these different methods and to work together in the further development of assessment tools. This will support decision-making in maritime spatial planning, enhance wind farm development and contribute to safeguarding the marine environment. Collaboration on research and tool development should be continuously evaluated and aligned to changing conditions and applied in adaptive management.

3. DIALOGUE AND INVOLVEMENT:
Stakeholder involvement at all levels (national, regional, local) is essential for successful maritime spatial planning. It also requires cooperation between all governmental levels. Within this project the focus was on the development and use of assessment methods and approaches. This requires involvement of competent national and regional authorities and policy makers as users of these methodologies and associated tools. Continued and enhanced cooperation and exchange between these competent authorities, especially on cross-border issues, is highly recommended.

The development of methodologies also requires the involvement of scientists, both as researchers and as peer reviewers of these tools. Within SEANSE both groups were involved. It is recommended to foster this dialogue at the international (regional) level when further developing functional coherent tools, for instance through an institutionalized dialogue through the environmental subgroup (CEAF) of the extended North Sea Energy Cooperation. Relevant working groups of ICES and of OSPAR – such as the Intersessional Correspondence Group of Cumulative Impacts - could be engaged.

4. COOPERATION BETWEEN AUTHORITIES ON RENEWABLE ENERGY:
The results of SEANSE contributed to a large extent to the implementation of the work programme of the Support Group 1 on Maritime Spatial Planning of the North Seas Energy Cooperation (NSEC, 2016-2019). The project findings and recommendations with regard to data and coherent assessment methodologies fit well with the new work programme for the NSEC which was adopted by the ministers on December 4th 2019, which states: "Further work is needed on maritime spatial planning and environmental assessments to be able to utilise the energy potential of the North Seas, herein developing a common framework for assessing environmental impacts, which requires an integrated approach and close cooperation between responsible authorities for energy, maritime spatial planning and environment."

Almost all of the project team members

WHO WAS INVOLVED?
The SEANSE project has been carried out by Maritime Spatial Planning authorities and appropriate institutes in the countries bordering the North Sea:

The Netherlands (Ministry of Infrastructure and Water Management/Rijkswaterstaat)
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Germany (Maritime and Hydrographic Agency/BSH)
Kai Trümpler, Marie Dahmen, Dominic Plug, Ramona Beckmann, Ulrich Scheffler

France (French Hydrographic Office/SHOM)
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Denmark (Danish Maritime Agency/DMA)
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The Conference of Peripheral Maritime Regions (CPMR)
Damien Périssé, Lise Guennal, Clare Booth

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