

Energy Island North Sea

Scope Report – Fish Field Surveys

Energinet

Date: 26. January 2022

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1 Project introduction and background

With the Climate Agreement for Energy and Industry of the 22nd of June 2020, the majority of the Danish Parliament decided that Denmark will become the first country in the world to develop two energy islands. One of the islands will be located in the North Sea ("Energieo Nordsoen") with a capacity of 3 GW offshore wind surrounding the island. This island can be further scaled up to allow for grid connection of up to 10 GW offshore wind on the island. It is expected that Energieo Nordsoen will be in full operation by 2033.

The Danish Energy Agency (DEA) has initiated the Strategical Environmental Assessment (SEA) and associated technical reports including field studies of fish communities within the project area for the planned energy island area, the area for the 3 GW offshore wind farms and export cable. The field studies will form the foundation for the baseline descriptions indicating the presence and densities of fish species as well as presence of potential spawning and nursery areas. This will form background information to be used in relations to an impact assessment of a future EIA for Energieo Nordsoen.

This report includes a detailed description of the fish field surveys including 2 trawl campaigns (spring and autumn) and 2 gillnet campaigns (spring and autumn) within the project area of the Energieo Nordsoen.

2 Surveys, data collation and analysis design – Fish and fish populations

Baseline information for fish and fish populations, along with project assumptions (the location and habitat loss due to establishing the Energieo Nordsoen), type and number of turbine foundations, placement of cable corridors etc. and project activities during the construction, operation and decommissioning will form the foundation for the sensitivity analysis of potential project impacts to fish species and fish communities due to establishing the Energieo Nordsoen.

The methods to obtain comprehensive baseline information and perform the sensitivity analysis in WP I are as follows:

2.1 Desktop study – obtaining available information on fish species and fish communities in the project area

To help determine which fish species and communities are present in and near the Energieo Nordsoen project area, information will be gathered and produced from existing data sources:

- DTU-Aqua fish studies.
- ICES data including international trawl survey data (North Sea, NS-IBTS surveys etc.).
- Institute of Marine Research–North Sea database ([Geodata from Institute of Marine Research \(imr.no\)](https://www.imr.no)).
- Fish species observed from ROV surveys during geophysical mapping within the project area.
- Previous OWF fish baseline studies in DK waters of the North Sea.

Fishery data and database information from the Marine Fish Atlas Project indicating the distribution of all marine fish species within a 10x10 km grid in Danish waters.

2.2 Fish surveys in the project area

Targeted fish surveys using a TV3 bottom trawl and gillnets will be undertaken within the project area, in the spring (end of March/April) of 2022 and the autumn (September/October) of 2022 with the research vessel RV Aurora and a hard bottom rigid inflatable boat (RIB) fulfilling safety requirements.

The timing of the surveys will allow for incorporating the results of the geophysical study to optimize the selection of stations in different habitat types to obtain the most beneficial baseline information of the fish community, as well as allowing time for an investigation of what fish data is already available.

Preliminary scoping of GEUS surface habitat maps indicate the seabed characteristics in the planned Energieoe Nordsoen project area appears to be a mixture of soft bottom habitats (sand) and mixed bottoms (coarse sand and gravel) with some hard bottom habitats (moræne – sand, gravel and cobbles). To sample the fish communities in both soft bottom habitats and in hard bottom habitats it will be necessary to undertake fish surveys using 2 different gear types. A trawl will be used to sample fish in the soft and some mixed bottom habitats, while gillnets will be used to sample fish in hard bottom habitats.

Why fish surveys only use bottom sampling gear

The large spatial and temporal variability and species- and size-specific variation in catchability with different types of fishing gear, complicates the process of reliably sampling fish in the open sea. Spatial variability is particularly large in pelagic species whose distribution is often very aggregated (swim in schools and shoals), seasonal/migratory, and their presence/absence not necessarily associated with the seabed habitats, but more with changing hydrographic conditions (water currents, water temperature, salinity etc) and the immediate presence of prey. Thus, the presence of pelagic species in an area does not necessarily reflect the characteristics of the immediate benthic environment and targeting pelagic species in fish surveys to potentially link catches to the surrounding environment is complicated, as. Furthermore, to potentially compensate for the highly aggregated tendencies of most pelagic species, a very large number of samples along with measurements of a variety of hydrographic parameters would be needed and beyond the scope of this project, without necessarily finding a link between the presence of pelagic species and the characteristics of a project area. In contrast, fish surveys primarily focusing on sampling benthic and bottom dwelling fish species (albeit while also catching some pelagic species) can be defended as bottom dwelling species are often more stationary and associated with the seabed habitats that will primarily be impacted by the establishment of the Energieoe Nordsoen installations and cables. Furthermore, the choice of using the TV3 trawl, which is a bottom trawl, however with a relatively high vertical opening is an attempt to also include the possibility of sampling some pelagic species for qualitative information.

2.2.1 Trawl surveys

Trawl surveys will be undertaken in compliance with ICES fish sampling guidelines for monitoring surveys. In brief this includes the following:

- Using a TV3 trawl, which is the standard ICES gear for undertaking fish monitoring and investigations in Danish waters. This trawl is a bottom trawl, however with a relatively high vertical opening. The high vertical trawl opening increases it's effectivity for also catching pelagic species, thus increasing the ability of sampling a wider range of species (both benthic and pelagic).
- Standard haul times are generally 30 minutes (hauls can however be shortened under certain circumstances (hard weather and large catches) – pers. comm. DTU-Aqua)
- Standard speed for hauls is 3 knots (speed over the bottom). This leads to hauls approx. 2.5 km in length.
- Trawling will be undertaken in daylight hours (determined as the period 15 minutes after sunrise until 15 minutes before sunset).

During the fish survey representative CTDO (depth, salinity, temperature, and oxygen) measurements will be recorded for surface and bottom waters.

TV3 trawl

The TV3 trawl (*see figure 1 for specifications*) is equipment that primarily focuses on sampling benthic and bottom dwelling fish species (albeit while also catching some pelagic species because of its high opening). This “active” bottom gear can be defended as the choice of sampling equipment both because in contrast to passive gear, the sampling of fish is independent of the activity level of fish, and because bottom dwelling fish species are generally more associated with the seabed habitats that may be impacted by project activities including the Energy island and its associated wind farm installations and cables. Furthermore, as mentioned sampling in the pelagic where fish are much more aggregated and migratory demands a much greater number of samples and the stochastic results much more difficult to associate with the immediate environment in the project area. Thus, a desktop study on the fish species (including the less targeted pelagic fish species) will be used to supplement fish survey data to complete information on the fish community in the project area.

TV3, 520#
Construction details
Not to scale

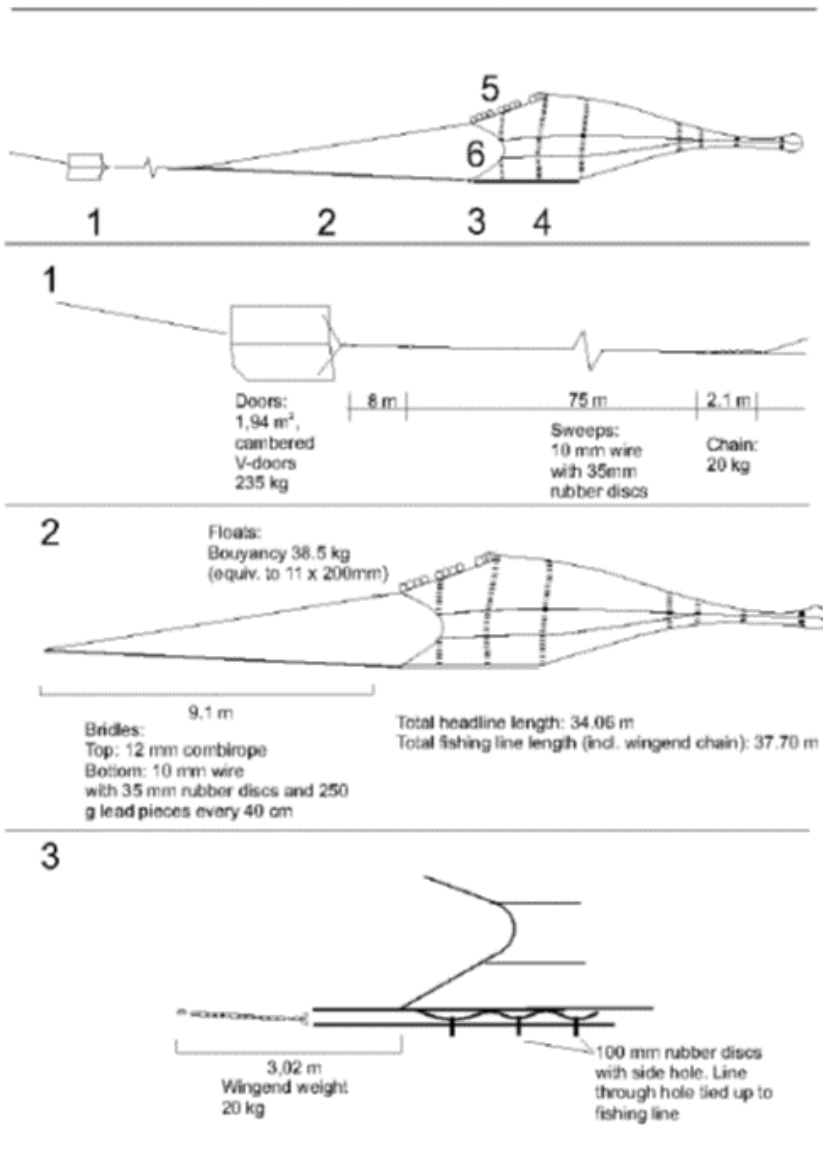


Figure 1: Overall layout of the TV3 trawl to be used in the Energioe Nordsoen project area

The placement of trawl stations in the Energioe Nordsoen project area will be distributed proportionally after information from the geophysical investigation is available and according to the distribution of major habitat types (soft bottom and some mixed bottom habitats) that would allow the use of a trawl and taking into consideration the potential presence of sensitive habitats. Similarly, the distribution of the sampling effort will be slightly weighted to target more effort (greater number of trawl hauls) in the area of the new island where habitat loss will be greatest.

Furthermore, parts of the project area are known to be an important commercial fishery area for bottom trawl activity targeting sandeels, which inhabit seabed areas with very specific sediment characteristics. Thus, these areas may also be specifically targeted for sampling if analyzed fishery data indicates the need for more information from these sensitive sandeel habitats.

Number of hauls

According to the amount of soft bottom habitats in the project area that would allow trawling from preliminary scoping of GEUS surface habitat maps, it is estimated that approximately 15 trawl hauls in the predominantly soft bottom habitats, allocated as mentioned above, will give sufficient baseline data indicating which fish species are present, their relative abundances and their distribution in these habitats.

Field sampling protocols for trawl hauls

For each haul, information will be recorded that falls under three categories:

Haul information (e.g. position, date and time of the start and end of the haul to determine swept area)

Species information (e.g. species determination, numbers per length (length frequency diagrams) and weights of all species caught per haul).

Biological information (e.g. sex, gonad maturity stages, weight and estimated age using length frequency diagrams) of key species based on sub-samples and anticipated spawning.

Furthermore, qualitative recordings of epifauna species and abundance in each trawl haul will be gathered and used to supplement site-specific benthic epifauna information recorded in WP E Benthic flora and fauna.

Based on the trawl survey the following data analysis and results will be provided:

The total and average number of fish and species per haul and swept area.

Number of different species to determine fish diversity (haul and habitat/area specific).

Total and species-specific biomass associated with specific seabed habitats within the project area - to determine the dominant (key) species and their project-specific habitat preference.

Length frequency distributions to determine the importance of the project area to different life-stages (i.e. nursery areas, spawning area (adults with mature gonads)).

Potential spawning areas by assessing gonad maturity stage of the most prominent species, codfish, and primary flatfish species (plaice and flounder) according to ICES maturity key for fish. This information will be combined with fish abundance and length frequency diagrams to model the proportion of juvenile and mature (adult) and ripe (spawning) fish using a binomial distribution to calculate what lengths fish become mature and the extent of the spawning population in the project area.

2.2.2 Gillnet surveys

Habitat characterizations from GEUS maps indicate that there are numerous hard bottom habitats in the project area where trawling on the sea bottom may not be possible. To ensure specific knowledge of the hard bottom fish community in the project area, NIRAS will also undertake supplemental sampling with gillnets in these areas by allocating a number of sampling stations (between 20-25) accordingly. NIRAS suggests using a combination of a NOVANA monitoring nets (Ny Nordisk Norm) made up of 12 sections with different mesh sizes (5-55 mm) together with a fine meshed benthic net (28 mm) and a gill net with a larger mesh size (70 or 110 mm) allocated at different stations) to ensure sampling of a wide variety of different lengths of fish, and to target juvenile codfish and juvenile flatfish to help determine the value of the area as a fish nursery area for these key species.

Setting and retrieving of gill nets at select stations will be undertaken during allocated gillnets surveys in the spring and autumn (September/October) by a vessel fulfilling HSE and vessel requirements.

Field sampling protocols for gillnets stations

For each station the following information will be gathered:

Station information (e.g. position, date and time of the start and end of the setting of nets)

Species information (e.g. species determination, numbers per length (length frequency diagrams) and weights of all species caught per station.

Biological information of key species in relation to anticipated spawning. This will include determining sex, gonad maturity stages, weight and estimated age of adult fish using length frequency diagrams.

This information will lead to performing, calculating and presenting the same factors listed under the trawl surveys.

2.3 Mapping the most important commercial fish species using fishery data

Vessel Monitoring System (VMS) data indicating where fishing vessels undertake their fisheries will be linked to logbook data and used to map the distribution of the most important commercial fish species in and near the Energioe Nordsoen project area and cable corridor to land. Preliminary information on the fisheries indicate the Energioe Nordsoen project area is a well-known fishing area for sand eel. As an example, figure 2. shows a map illustrating the distribution of sand eel in an area around the Horns Rev OWF's in the North Sea using VMS data linked using VMS data linked to logbooks specifically containing catches of sandeel. Similar maps will be made for sandeel and other important commercial species in and around the Energioe Nordsoen project area.



Figure 2.: Mapping of the distribution of sandeel (tobis) in an area around Horns Rev OWF's

3 Survey vessels and backup of vessel and equipment contingencies

RV Aurora is the primary vessel chosen for trawl surveys in the North Sea because this vessel is specifically built for and has experience with surveys using the TV3 trawl. For, example RV Aurora was used to trawl with success in the Hesselø OWF fish survey in the Kattegat. Similarly, NIRAS would like to use a RIB vessel complying with the HSE vessel requirements for the 2 gillnet surveys. This type of vessel is more mobile, and would allow for targeting windows of good weather, thus adding flexibility in planning and improving the chance of success for the gillnets surveys. NIRAS will present documentation of HSE vessel requirements for the RIB vessel to Energinet for final approval for the use of this vessel.

Thus, the use of RV Aurora for the trawl surveys and a modified RIB for the gillnet surveys ensures the best possibility for successfully completing the fish surveys with a high regard for safety and respect for working at sea.

NIRAS will also ensure the availability of an extra trawl onboard and backup vessels to Aurora in the event that damage to or loss of the TV3 trawl or mechanical problems on the vessels hinder the undertaking of the survey. NIRASs will also have a supply of extra bottom nets to ensure that the necessary gear for this survey is available.

4 Technical report

The technical report on fish and fish populations will comprise the following information:

- Non-technical summary.
- A thorough method description including a description of all relevant plan assumptions (specification of wind turbines/foundations, Energy island size, installation methods for turbine and island foundations as well as other relevant parameters).
- A description of baseline situation of fish and fish population in and near the plan area for the Energy Island North Sea based on literature and fish surveys conducted as described above.
- A sensitivity analysis of impact on fish and fish populations and possible cumulative and transboundary impacts as a result of the collected fish data.
- Proposals for measures to mitigate adverse impacts, as appropriate.
- Identification of possible data and knowledge gaps of importance for the future environmental assessment to be conducted by the future concession holder, as relevant.
- Proposal for a monitoring programme to supplement the baseline surveys, as appropriate.