

ENERGINET

## ENERGY ISLAND BORNHOLM

SCOPE OF WORK

WPI FISH AND FISH POPULATIONS

23-11-2022







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ENERGINET

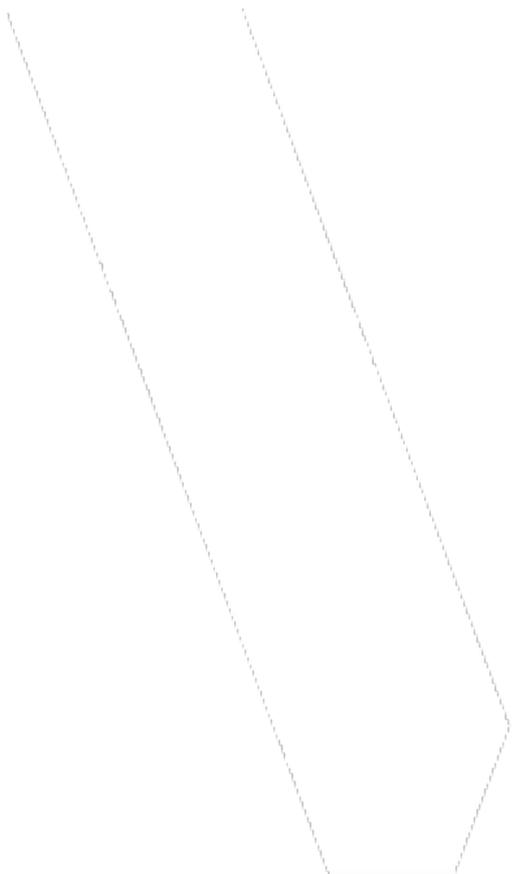
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Abbreviation	Explanation
<b>BSH</b>	Bundesamt für Seeschifffahrt und Hydrographie.
<b>CC</b>	Cable corridors
<b>CC1</b>	Cable corridor from Project Area 1 to Bornholm
<b>CC2</b>	Cable corridors from Project Area 2 to Bornholm
<b>Client</b>	Energinet
<b>CMID</b>	The Common Marine Inspection Document is a standard format for the inspection and auditing of offshore vessels.
<b>Contractor</b>	WSP
<b>CTDO</b>	Conductivity-Temperature-Depth-Oxygen
<b>CPUE</b>	Catch per unit effort
<b>DEA</b>	Danish Energy Agency
<b>DEPA</b>	Danish Environmental Protection Agency
<b>DFA</b>	Danish Fisheries Agency
<b>HAZID</b>	Identification of hazards
<b>ICES</b>	International Council for the Exploration of the Sea
<b>Investigation area</b>	Gross area for the benthic survey including the two project areas and the surrounding area
<b>IMCA</b>	International Marine Contractors Association
<b>HSE</b>	Health, Safety and Environment
<b>mob/demob</b>	Mobilization/demobilization
<b>Project area</b>	Area within which the Energy Island Bornholm and planned turbines may be placed. There are two possible project areas, which are investigated
<b>OSPAR</b>	Convention for the Protection of the Marine Environment of the North-East Atlantic
<b>PA1</b>	Project area 1 – Northwestern project area
<b>PA2</b>	Project area 2 – Southeastern project area
<b>RAMS</b>	Risk assessment and method statement
<b>SEA</b>	Strategic Environmental Assessment
<b>StUK4</b>	Standard Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment

## 1 SUMMARY

The energy islands mark the beginning of a new era for the generation of energy from offshore wind. The islands are expected to play a major role in the phasing-out of fossil fuel energy sources in Denmark and Europe. In the Baltic Sea, the offshore wind farms will be constructed approximately 15 km south-southwest of the Danish island Bornholm, and electricity will be routed from the island to electricity grids on Zealand and neighbouring countries.

This report defines the scope of work for WPI fish and fish populations. The aim of the present study is to document the fish and fish populations in the investigation area of the Energy Island Bornholm. The study will determine the structure of the fish community in terms of species composition, density and distribution, size and weight distribution, including biodiversity and dominant species. In addition, the fish survey will focus on determining the area's importance as a spawning and nursery area.

The baseline study consists of fish sampling using beam trawl, multimesh gillnet and trammel net to ensure that as many species as possible are represented in the baseline. WSP plans to do 18 trawl hauls – 15 in the investigation area and three in the cable corridor (cc). A total of 10 gill net stations is planned – five in the investigation area and five in the cc. Trammel net stations is positioned in the habitat area where dredging gear should be avoided according to Danish authorities. All stations will be supplemented by CTDO measurements and weather observations. In general, a random station grid is favoured, but the aim is a station grid where all relevant habitats are represented.

Deliverables in this work package include a fish survey scope report, operational reports for the spring and autumn survey, respectively, an environmental status report presenting the baseline based on existing knowledge and data, and finally a technical report. After the completion of the technical report, data from field investigations will be handed over to the Client. The data will also be entered into relevant official databases, as required by Danish environmental regulations and practices.

## 2 INTRODUCTION

The energy islands mark the beginning of a new era for the generation of energy from offshore wind, aimed at creating a green energy supply for Danish and foreign electricity grids. Operating as green power plants at sea, the islands are expected to play a major role in the phasing-out of fossil fuel energy sources in Denmark and Europe.

After political agreement on the energy islands has been reached, the Danish Energy Agency plays a key role in leading the project that will transform the two energy islands from a vision to reality. The islands are pioneer projects that will necessitate the deployment of existing knowledge into an entirely new context.

In the Baltic Sea, the electrotechnical equipment will be placed on the island of Bornholm, where electricity from offshore wind farms (OWF) will be routed to electricity grids on Zealand and neighbouring countries (Figure 1). The offshore wind farms will be constructed approximately 15 km south-southwest of the coast and will be visible, but not dominate the horizon. The turbines off the coast of Bornholm will have an installed production capacity of up to 3,8 GW including overplanting.

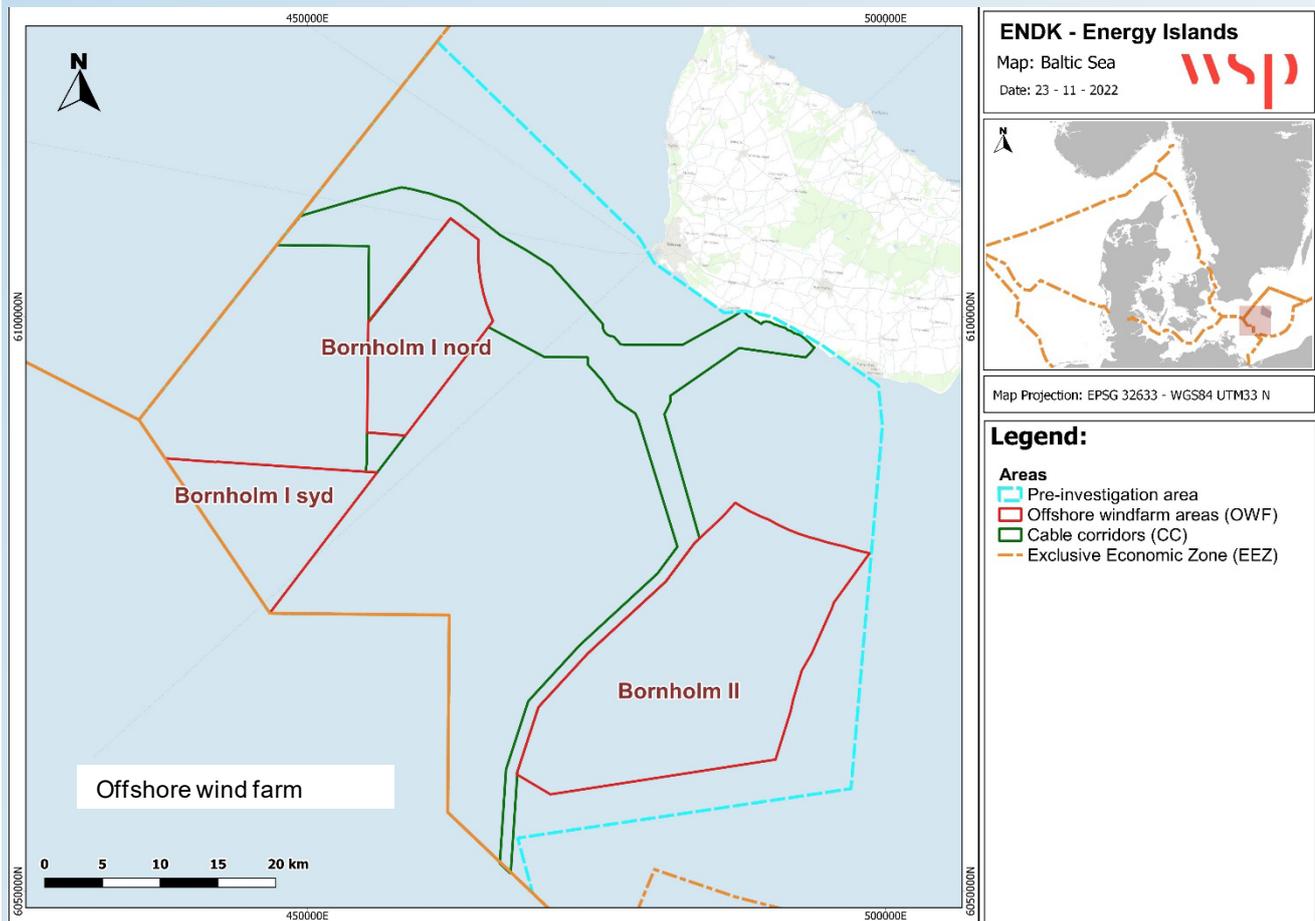


Figure 1 Energy Island Bornholm

# BILAG

This report defines the scope of work for WP-I fish and fish populations. The aim of the present study is to document the fish populations in the investigation area of the Energy Island Bornholm. The study will determine the structure of the fish community in terms of species composition, density and distribution, size and weight distribution, including biodiversity and dominant species. In addition, the fish survey will focus on determining the area's importance as a spawning and nursery area. No standardized Danish method exists for this purpose. For this reason, WSP intends to use the German method StUK4 (BSH, 2013), which describes the spatial and temporal distribution of fish as a baseline for offshore windmill parks. The method utilizes trawl hauls to sample fish in the project area, which is an ideal method for sampling benthic and demersal fish species. The station grid will take substrate type into consideration, and the aim is to conduct hauls in each habitat type affected by the OWF.

However, trawling is not possible in areas with high density of rock due to risk of damaging the gear. Therefore, in addition to the StUK4 method, WSP intends to sample fish with multimesh gillnets, in accordance with standardized NOVANA method (Strand, 2006) as a supplement to the trawl surveys. The multimesh gillnets are optimized for sampling pelagic, demersal and benthic fish of various sizes, age groups and species. The gillnet stations are primarily positioned in hard bottom areas and in habitats mostly affected by the OWF. In the habitat area east of I OWF, no dredging is allowed. Therefore, sampling in this area is carried out using trammel nets as a substitute for beam trawl fishing. The trammel nets are suitable for sampling flatfish and can be used in areas with higher water current compared to traditional gillnets. The station grid may change as more precise data regarding sediment/habitat types is obtained.

All methods meet the international requirements in connection with ICES (International Council for the Exploration of the Sea) and OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic). The methods are described in detail in the following chapters.

## 3 AREA OF INVESTIGATION

WSP intends to conduct fish surveys in the investigation and project area (Figure 2). This will ensure a proper baseline that covers all relevant sediment types in the area. The survey consists of two different gear types for sampling fish – beam trawl and gillnets.

WSP will do a total of 18 trawl hauls – 12 stations in the investigation area and three stations in the cable corridor (cc) (the latter is not shown in the map). The trawl hauls are distributed randomly in the area but ensures coverage of all sediment types in the sampled. In addition, WSP plans a total of 10 gillnet stations – five stations in the investigation area and five stations in the cc. Finally, WSP intends sampling at eight trammel net stations in the habitat area where no dredging is allowed.

All stations will be supplemented by CTDO measurements and weather observations.

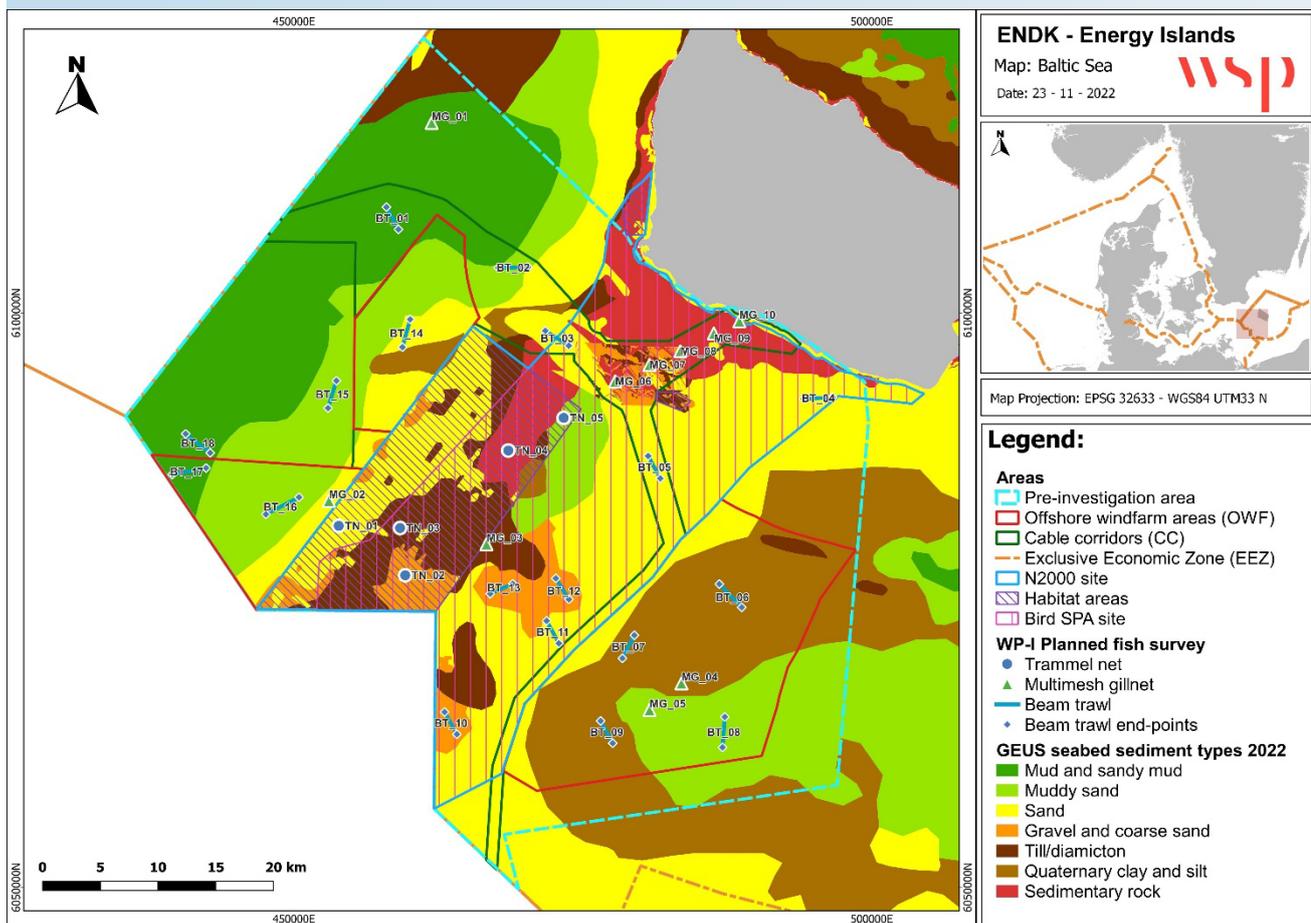


Figure 2 Outline of the Energy Island Bornholm in the western part of the Baltic Sea with the planned beam trawl hauls, multimesh gillnet and trammel net stations.

It is possible that the final station grid may be altered as new and more specific data concerning sediment and habitat type is acquired. The final station grid will be discussed and approved in collaboration with the client.

## 4 METHODOLOGY

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### 4.1 STUK4 METHOD

The StUK4 (BSH, 2013) method recommends two surveys – a spring and an autumn survey. This ensures sampling of fish within the two seasons where most fish species spawn, but also represents the period before the juveniles migrate into deeper waters when sea temperatures drop during winter. Therefore, this method will give valuable information about the importance of the area as a spawning ground as well as provide information determining if the area serves as a nursery grounds for specific fish species. Furthermore, the StUK4 method will provide a general description of the distribution and density of the fish fauna communities within the project area.

In this project, the StUK4 method has been altered slightly to compare results with e.g., the Thor OWF (Rambøll & WSP, 2021) in the North Sea, where the same trawl was used for fish sampling. Therefore, WSP utilizes a beam trawl of four meters width build by Hvide Sande Vodbinderi ApS (**Figure 3**). The trawl is 4 m wide and 16.35 m long when fully deployed. The cod end consists of 2 mm meshes to catch even small fish and juveniles. The trawl is deployed from the side of the vessel with the LARS and hauled for 30 minutes at 3-4 knots towing speed, so the overall area sampled is identical to the area recommended in the StUK4. This gives an average towing distance of 4,000 m with a total area of 16,000 m<sup>2</sup> pr. haul. The trawl is hauled across the seabed which makes it ideal for catching benthic and demersal fish species incl. flatfish and cod. All trawl hauls will be conducted during daylight.

All sampling stations will be accompanied by representative measurements of CTDO (salinity, temperature, depth, and oxygen), which will be recorded for surface and bottom water. Weather conditions will also be recorded.

The following data will be recorded at each station during fieldwork:

- Air temperature
- Wind speed and direction
- Intensity of clouds
- Wave height
- Position at each beginning and end of haul/trawling position
- Depth at each beginning and end of haul/trawling position
- Water temperature of surface and bottom at each haul/trawling position
- Oxygen concentration and saturation at the surface and bottom
- Salinity at the surface and bottom



Figure 3 Beam trawl utilized for the fish survey

## 4.2 SAMPLING WITH MULTIMESH GILLNETS

The NOVANA fish survey method utilizes multimesh gillnets (ny-nordisk-norm garn) with 12 panels of various mesh sizes ranging from 6-110 mm (please see specifications for the gillnet in section 4.4). The nets are deployed in the afternoon between 15-18 and retrieved the following morning after approximately 16 hours of fishing. In case multiple cc will be constructed, the survey plan for the extra corridor will be revisited. All gillnet stations will be supplemented by CTDO measurements and weather observations.

The multimesh gillnets (ny-nordisk-norm garn) (Figure 4) consists of 12 panels of various mesh sizes ranging from 6-110 mm (6.5 mm, 8,5 mm, 11mm, 15mm, 18,5 mm, 25mm, 30mm, 40mm, 55mm, 70mm, 90mm, 110 mm). The mesh sizes increase geometrically with a factor 1,25. In WSP's experience, the gillnets can fish effectively in winds up to 8 m/s. The nets have a sink line keeping the nets on the seabed, while the float line keeps the net stretched upwards. The nets are deployed with anchors in each end attached to a buoy with contact information to the discipline manager for the fisheries authorities in case of a control. The gillnets require a special license from the Danish Fisheries Agency (DFA) due to the small mesh sizes and because the catch will include fish of a length under the legal size limit.

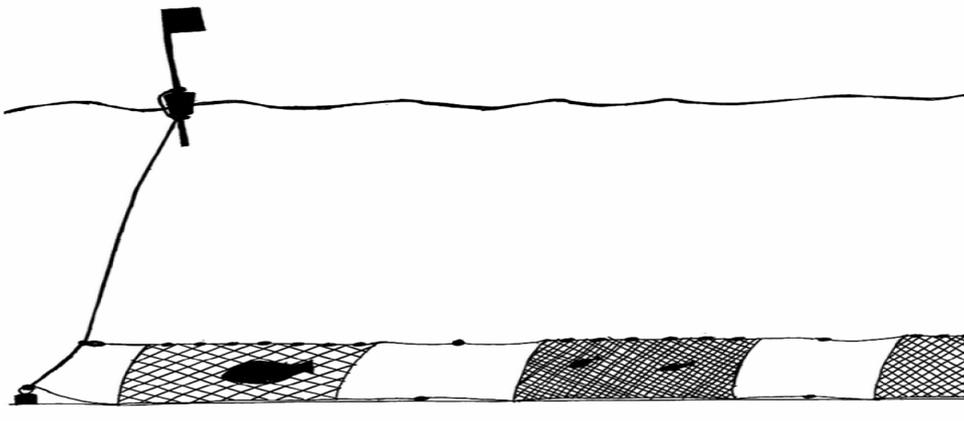


Figure 4 Multimesh gillnets with various mesh sizes specialized for catches of a certain fish size.

## 4.3 SAMPLING WITH TRAMMEL NETS

Due to regulations on no dredging in the habitat area, trammel nets will be used to substitute beam trawl for fish sampling. The trammel net consists of three layers of netting, which catches the fish inside a “bag” of net rather than catching the fish by its gills as in traditional gill nets. The nets are deployed in the same way as multimesh gillnets, set in the afternoon between 15-18 and retrieved in the following morning after approximately 16 hours of fishing. All trammel net stations will be supplemented by CTDO measurements and weather observations.

The trammel nets (**Figure 5**) consists of three layers of netting with the middle net having smaller mesh sizes (70-80 mm) and the two outer layers of larger meshes. The fish swims through the outer layer and pushes the middle layer through the third layer of net with large meshes and thereby catching the fish in a bag. The trammel nets are deployed on the seabed with a sink line and are approximately 1.5-2 m high kept floating with a float line. The nets are deployed with anchors in each end attached to a buoy with contact information of the discipline manager for the fisheries authorities in case of control. The nets require a special license from the Danish Fisheries Agency (DFA).

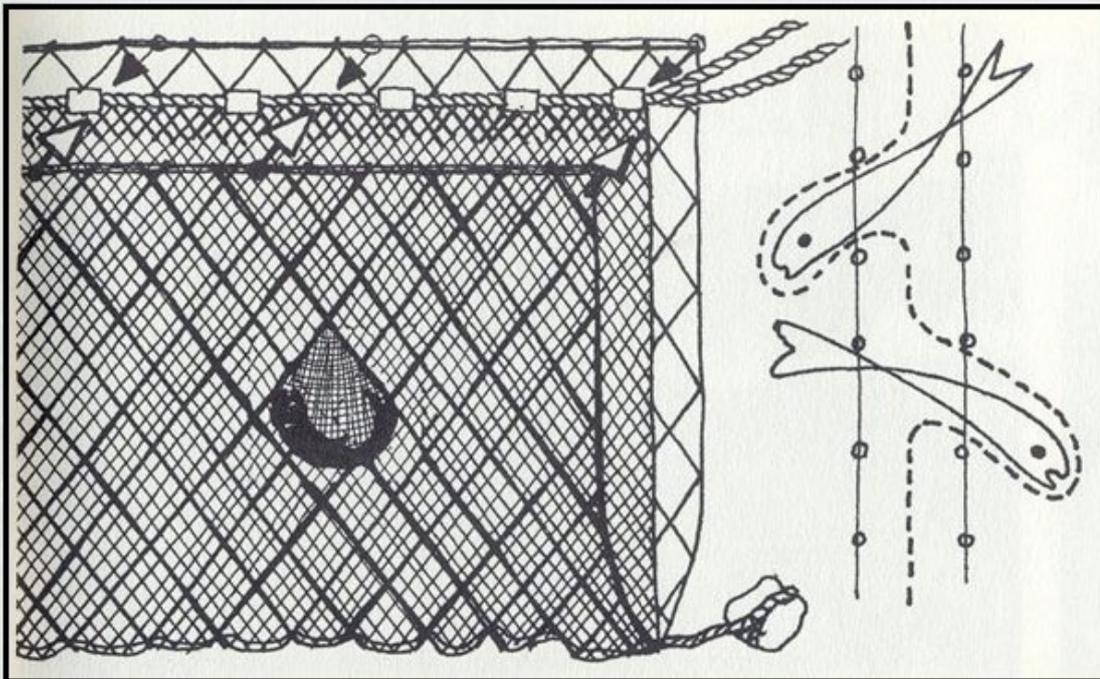


Figure 5 Trammel net with three layers of netting. The net layers catch the fish inside a “bag” instead of catching it by the gills. (Source: <http://www.mitfanoe.dk/index.php/da/134-fanos-historie/fiskeri/475-fiskeredskaber>)

## 4.4 SURVEY MATRIX

In general, a random station grid is favored, but the aim is a station grid where all relevant habitats are represented. Therefore, WSP plans a total of 33 stations - 18 trawl hauls, 10 gillnet stations and five trammel net stations (Table 1).

Table 1 Sample matrix for the fish survey.

Offshore wind farm (OWF) and Cable corridor (CC)	Trawl hauls + CTDO	Gillnets + CTDO	Trammel net + CTDO
OWF	15	5	
CC	3	5	
Habitat area			5

### 4.4.1 HANDLING OF THE CATCH

Due to the focus on the importance of the area as a spawning and nursery area, supplementary analyses have been added to the StUK4 methodology. The additional work includes the processing of fish gonads on board the survey vessel to estimate gonad ripeness and spawning progress. In addition to this, emphasis is put in to measuring the length of more individual fish than usual in order to determine the length distribution of fish utilizing the project area and determine the distribution of juvenile fish in the investigation area. Both tasks will require statistical analysis included in the final report to enable a solid evaluation of the importance of the area regarding spawning and nursery.

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All fishes of each haul will be determined to lowest possible taxonomical level, measured, and weighed individually. All measurements are noted during the survey and later transferred to excel. The specifics of the handling of the catches are described in detail in the following.

## HANDLING OF LARGE CATCHES

For larger catches, which cannot be worked during a reasonable period, representative subsamples of (in terms of length and weight measurement) at least 75 specimens of the species are to be taken. The total catch is sorted and determined to species level, or lowest possible taxonomical level. Fish species with a very high number of individuals in the hauls are evaluated for length and weight measurements with representative subsamples. During data recording, and when the data is to be transmitted, these subsamples are labeled accordingly. The total weight of a fish species and the total length of each individual of a species is always specified both in the work of the entire hauls as well as in the work of the subsamples.

## LENGTH DISTRIBUTION

The length distribution is determined for all fish species. The total length (TL) is measured for all individual fish, meaning the length from the tip of the snout to the longest caudal fin ray. The length is measured in half centimeter (0.5 cm) length classes, each rounded to the next lower 0.5 cm ("0.5 cm below"). The individual weight of each fish is measured in grams. Significantly damaged fish, whose weight and length, due to abnormal measurements, would bias the results, are excluded from the results.

For each species, the exact representative length distribution is recorded. This can be composed of either the total catch or a representative subsample of this species. A representative subsample consists of at least 75 individuals of a fish species. If a subsample cannot be selected for a specific fish species, this species is divided into two or more size categories - i.e., single large or small animals are weighed and measured separately. The rest are extrapolated as a representative subsample of the total catch and the single large or small fish is included in their real number. See two examples below:

Example 1: A species consists of 999 individuals of length 18 - 26 cm and 1 individual of length 40 cm. A subsample of 100 individuals would result in either no or 10 individuals with length of 40 cm for this species. The correct approach is to remove this one individual from the sample and to measure separately (size category 1) and from the remaining 999 individuals (size category 2) a subsample is taken. This is measured and the number (or weight) of the size category 2 is extrapolated.

Example 2: A species consists of 994 individuals of length 18 - 26 cm, 3 individuals of length 10 - 12 cm and 3 individuals of length 38 - 40 cm. A subsample of 100 individuals would give values of 0, 10, 20 and 30 for the smallest (10-12 cm) and for the greatest length categories (38-40 cm). This leads to an underestimation or overestimation of the real numbers. Therefore, both length categories must be measured separately from the medium category (18-26 cm). The subsample must be drawn from the middle class and length are extrapolated to this.

For very large catches of a single species ( $n > 1000$ ), the minimum number of subsamples should be doubled in order to ensure the length distribution is represented in its extreme values.

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## DETERMINATION OF GONAD MATURITY STAGE

To describe the maturity stage of the most important fish species in the survey area, the gonads of cod, herring, sprat, and flatfish will be examined. The gonad maturity index in cod will be determined macroscopically (Tomkiewicz, et al., 2002). The index describes ten stages of maturity within the annual reproduction cycle. The gonadal development stages for herring and sprat describe eight maturity stages (Bucholtz, Tomkiewicz, & Dalskov, 2008). The gonad maturity index for all other species will be determined according to Strand (Strand, 2006). The gonad stage will be determined for both male and female fish.

## HANDLING OF PROBLEMATIX TAXA

There are several genera and families whose members are difficult to determine to species. It is recommended to use additional identification literature. If this is not available, the unidentified individuals are photographed and subsequently stored frozen and analyzed in a laboratory. Arrangements have been made so that the specialist Peter Rask Møller at the National Zoological Museum will be consulted if proper identification of the fish cannot be carried out.

## KEY LITERATURE

The total catch is processed on board unless the samples are too large to process within an appropriate time frame. The species identification is carried out to the lowest possible taxonomic level. From the literature listed below, at least two works should be consulted during determination:

1. Muus, B.J.; Nielsen, J.G. 2006: Havfisk og Fiskeri i Nordvesteuropa. Gyldendal. København.
2. Wheeler, A. 1969: The Fishes of the British Isles and North-West Europe. Michigan State University Press, East Lansing, 613 S.
3. Wheeler, A. 1978: Key to the Fishes of Northern Europe. Warne, London, 380 S.
4. Whitehead, P.J.P.; Bauchot, M.-L.; Hureau, J.-C.; Nielsen, J.; Tortonese, E. (Hrsg.) 1984-86: Fishes of the North-Eastern Atlantic and the Mediterranean. Vols I-III, Unesco, Paris.

When transmitting information (to the authorities or by the protocol in digital form), uniform scientific, English and German names of species are used. The scientific names of species are to be checked for validity using the Catalog of fishes (Eschmeyer 2012; <http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>). The English name is checked for validity under <http://fishbase.se>.

## DATA PROCESSING

Initially, field registrations will be noted on paper in tables, and as soon as possible hereafter entered in Excel-worksheets. Additional data processing follows the Danish standards and will correspond to the actual guidelines. The data delivery must meet the requirements by the client and the authority and will include e.g. length histograms and cohort analysis to determine which age groups of fish utilize the area. The Contractor does not undertake any responsibility for the data and documents provided by the Client or any errors resulting from them. However, the Contractor is obliged to check the information for its basic plausibility in the spirit of good cooperation.

The following data will be analyzed for documentation of fish condition:

- Total number of individuals per area/number of individuals per species and area (species table). For gillnet sampling, the catch is converted to CPUE (Catch Per Unit Effort) e.g., catch pr. 16 hours.
- Total biomass per area/biomass per species and area.
- Dominance structure (related to number of individuals and biomass).

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- Diversity (e. g. Shannon-Wiener Index) and evenness (e. g. according to Pielou).
- Average number of species per haul/gillnet.
- Length frequency distribution of dominant species and cohort analysis.
- Gonad maturity of cod, herring and dominant species and investigate the area's importance as spawning area
- Analytical statistics (univariate analyses, community analysis (cluster analysis, MDS plot)).

## QUALITY ASSURANCE

During survey operations related to WP-I, the quality of the acquired data will be monitored on a continuous basis in order to ensure that the technical requirements are met.

After all data has been submitted to excel, quality assurance will be carried out on a sample of data by a person other than the one entering the data into excel. If data proves not to be entered correctly, the sample will be extended additionally.

Any new staff working on the project will require a thorough introduction by experienced personnel.

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## 4.5 EQUIPMENT

In the following section, vessel and gear used for the fish surveys is described in detail.

### 4.5.1 VESSEL

The survey vessel M/S Skoven will be used to accommodate the technical requirements for WP-I (**Figure 3**). Skoven has excellent facilities regarding lifting equipment and deck area as well as launch and recovery systems (LARS). The fish survey for WP-I will be operated on a 12-hour basis, as all trawl hauls must be carried out during daylight and gillnets are deployed during late afternoon and retrieved the following morning approximately 16 hours later.

M/S Skoven is equipped with an Azimuth thruster in front, keeping the vessel in position during deployment of gillnets if needed. Experience shows that the weather limitations for M/S Skoven during survey operations is about 2.0-2.5 meters of wave height – depending on the actual task. M/S Skoven has an adequate size regarding operating in the Baltic Sea and appropriate working space on deck for handling relevant equipment and catches, as well as good experiences with similar tasks for WSP. M/S Skoven can accommodate a contractor inspector during surveys if needed and an inspection from the International Marine Contractors Association (IMCA) based on the Common Marine Inspection Document (CMID) which will be renewed if needed during the project.



Figure 6 Research vessel M/S Skoven.

## CTDO – PROFILING IN THE WATER COLUMN

A CTDO is used for profiling of temperature, salinity and oxygen concentration and saturation in the water column. Based on previous good experiences, a CTDO with optional water sampler will be used. The core element in the CTDO is a Campbell Scientific CR310 datalogger with online ethernet connection to the surface, which can host a wide variety of sensors. For this specific task, the following sensors are used:

- Conductivity with a digital Ponsel C4E sensor,
- Temperature with a fast responding temperature sensor (I2C,  $\pm 0.1$  °C),
- Depth with a Bar30 pressure sensor (MS5837-30BA),
- Oxygen with a Ponsel OPTOD (Optical Dissolved Oxygen) sensor,
- Water sampling with a General Oceanics 1.7 L model 1010 Niskin Water Sampler

## 5 DELIVERABLES

Deliverables included in this work package:

- A fish survey scope report (see section 5.1)
- An environmental baseline report presenting the baseline based on existing knowledge and data (5.3)
- An operational report for the spring and autumn survey, respectively (5.3)
- A technical report (5.4)
- Data from field investigations of fish and fish populations
- Entering of collected data into relevant official databases, as required by Danish environmental regulations and practices.

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### 5.1 FISH SCOPE REPORT

This document constitutes the first draft of the fish survey scope report. First draft is delivered to Energinet in week 38, final draft will be delivered in Q1 2022. The fish scope report is presently based on the geophysical survey data provided by Energinet or from public available data sources (GEUS's marta-database, Emodnet and (Orbicon & GEUS, 2014)) along with data from recent projects by WSP.

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### 5.2 ENVIRONMENTAL BASELINE REPORT

WSP intends to deliver an environmental status report to Energinet no later than 1<sup>st</sup> of April 2022. This report will present the existing data for fish and fish populations in the investigation area based on baseline mappings from other projects in the area, historical observations of fish species (Fiskeatlas) and fisheries statistics (WP J). This report will support the writing of the SEA.

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### 5.3 OPERATIONAL REPORT

During field work, daily updates from the vessel will be sent from the Survey Manager/survey guide by e-mail to the Client. The reports will contain information regarding:

- Project
- Survey number and purpose of survey
- Name of vessel
- Name of harbour
- Dates and time for vessel departure and arrival at harbour
- Survey date and time (excluding arrival and departure time to and from the survey area) incl. weather down time
- Name of captain
- Names of scientific crew and their respective roles
- Weather information
- Information on abandoned survey procedures in respect to the methods outlined in the scope of works

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- Description of what has been done, when and how long
- Experienced limitations and/or special events and/or sightings
- Description of sightings, incidents or special events

After each survey has been completed, the information from the daily updates is combined in an operational report which also includes the following information:

- Executive summary
- Description of any QHSE events
- Project introduction and background
- Description of the applied vertical and horizontal reference systems
- Description of all applied vessels (or plane)
- Detailed description of all instruments and measurement equipment
- Description of planned offshore scope such as survey line plans and seabed test locations etc.
- Description of completed offshore scope including cumulative quantities
- Description of data processing and interpretation methods
- Description of norms and standards applied for the work package
- Description of the cumulative time

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## 5.4 TECHNICAL REPORT

The technical report will be delivered as a final and approved version to Energinet (in English) including a review process. The report includes the description of the distribution and abundance of fish species. The area's importance as a spawning and nursery area is investigated.



## 6 MILESTONES

Reporting and time schedules for WP I will strictly follow the deadlines stipulated in the tender documentation. A summary of these is shown in **Table 2**. A Client Review period of 15 days has been incorporated into the schedule to review the 1<sup>st</sup> Draft Version of the Fish and Fish Populations Report (M48). For the second Client Review, a period of 10 days has been incorporated to review the Final Draft Version of the Fish and Fish Populations Report (M49).

**Table 2 Milestones and deadlines for all work packages**

Work package	Milestone No.	Milestone	Deadline
WPI	M46	Scope Report, 1 <sup>st</sup> Draft	Week 38 - 2021
WPI	M47	Scope Report, Final Version	Week 51 - 2021
WPI		Environmental Baseline Note, 1st Draft, Fish and Fish Populations Report	Q1 - 2022
WPI		Environmental Baseline Note, Final version, Fish and Fish Populations Report	Q1 - 2022
WPI	M48	Technical report, 1 <sup>st</sup> Draft	Q4 – 2022
WPI	M49	Technical report, Final draft, including appendices and data input to SEA)	Q4 – 2022
WPI	M50	Technical report, Final version	Q1 - 2023

### 6.1 FISH SURVEY

WSP plans to start the field operations on the 1<sup>st</sup> of April 2022, to comply with the fish survey methodology (1<sup>st</sup> of April – 15<sup>th</sup> of May) in the StUK4 program, and to provide as much time as possible to field work contingencies, data analysis as well as reporting. The autumn survey is planned to commence field operations on the 1<sup>st</sup> of October according to the methodology (1<sup>st</sup> of October to 30<sup>th</sup> of November). The spring survey is estimated to be completed in eight days + two days mob/demob + three day of weather stand by (total of 13 vessel days) and for the autumn survey, an additional weather standby day is incorporated into the program (total of 14 vessel days) with the vessel Skoven (Table 3). The extra day in autumn is due to the statistical higher chance of bad weather conditions in this season. This leaves 32 days contingencies for the fieldwork in spring and 52 days for autumn, respectively. The vessel and scientific crew will be mobilized two weeks before the planned start of the survey. In case of bad weather conditions, the vessel and crew will be on standby. Thus, the time loss will be minimized.

WSP has an availability statement for Skoven that is unlimited, in order to provide a buffer contingency, which is adequate for the Baltic Sea. Additionally, WSP has a back-up agreement with FOGA in case it becomes necessary. Fish samples will be analyzed during 2022 and data processing will be completed ultimo December 2022.

The time schedule for the fish field survey is planned as follows. Bad weather may change the weeks available for survey and may postpone survey start.

**Table 3 Days for fish survey in spring and autumn of 2022, respectively.**

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Fish survey	Spring survey	Autumn survey
Mob/Demob	2 days	2 days
Fish sampling	8 days	8 days
Weather standby	3 days	4 days
Total	13 days	14 days

## 7 PERMITS

The Client has requested permission to trawl inside the NATURA 2000-area Rønne Banke. The request was denied, and therefore, the fish sampling in this area will be carried out with trammel nets instead.

Permits to fish with gear that differ from standard commercial fishing gear is applied for at the DFA. The contractor will obtain the relevant permission, which will be provided as a copy and brought on board of the survey vessel in case of check by the fishery authorities.

## 8 REFERENCES

- BSH. (2013). *Standard Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment (StUK4)*. Hamburg und Rostock: Bundesamt für Seeschifffahrt und Hydrographie.
- Bucholtz, R., Tomkiewicz, J., & Dalskov, J. (2008). *Manual to determine gonadal maturity of herring (Clupea harengus L.)*. DTU Aqua report 197-2008. Charlottenlund: DTU Aqua.
- Orbicon & GEUS. (2014). Natura 2000 basisanalyse 2016-2021. Revideret udgave. Adler Grund og Rønne Banke. Natura 2000-område nr. 252, Habitatområde H261.
- Rambøll & WSP. (2021). *Thor OWF - Technical Report - Fish and Fish Populations*. Energinet.
- Strand, J. (2006). *Teknisk anvisning for marin overvågning. 6.1 Fiskeundersøgelser i kystnære marine områder. NOVANA. Vers. 15-03-06*. Roskilde: Danmarks Miljøundersøgelser - Teknisk anvisning fra DMU's Marine Fagcenter.
- Tomkiewicz, J., Tybjerg, L., Holm, N., Hansen, A., Broberg, C., & Hansen, E. (2002). *Manual to determine gonadal maturity of Baltic cod. DFU-rapport nr. 116-02*. Ministry of Food, Agriculture and Fisheries, Danish Institute for Fisheries Research .

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