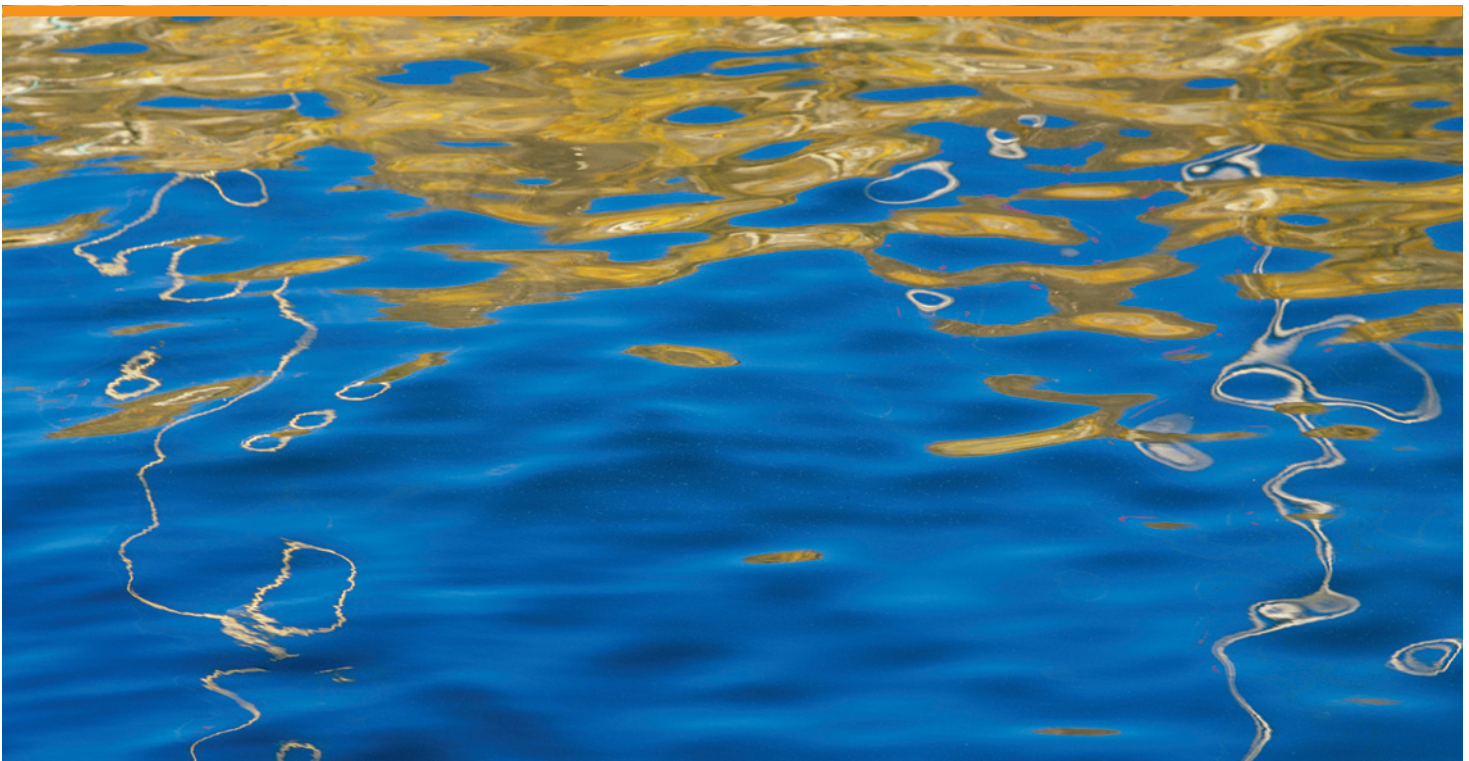


# Danish Sampling of Commercial Fishery

## Overview with special attention to discards

### 2010 data



**DTU Aqua Report No 250-2012**

By Marie Storr-Paulsen, Kirsten Birch  
Håkansson, Josefine Egekvist, Henrik Degel  
and Jørgen Dalskov

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## Summary

Utilization of our common marine resources has in later years had an increasing focus among the EU member states, with societal demands to reduce discarding. Discards have for many years been an unavoidable component of most commercial fisheries due to management regulation and profit optimizing. However, the first step into reducing the discard problem is to investigate where discard is occurring in larger amounts, to highlight the pattern in different fleet components and to document the monitoring of the sampling program. In 2010 the total discard observed in Danish waters were 21500 t corresponding to 26% of the total catch from these fleets. In Denmark sampling onboard commercial vessels has been ongoing since 1995. In this report the aim has been to describe the Danish commercial at sea sampling strategy and results from 2010.

## Introduction

When commercial vessels are getting rid of unwanted catch of fish, crustacean or other marine organism by throwing it over board it is considered to be discard. Discards have for many years been an unavoidable component of most commercial fisheries due to management regulation and profit optimizing. Very few species will survive being discarded, if they first have been in contact to the gear for a longer period of time, and then handled onboard before being re-introduced to the sea. However, not all species and fisheries have low survival rate when discarded. This is e.g. the case in the pound net fishery and for some flatfish- and shellfish species. Low air temperature, short tow duration and short handling time on deck are also important factors to increase survival (Mehault et al. 2011). However, in most fisheries the main part of the discard will not survive.

The main reasons influencing discard is considered to be (Feekings et al. 2012,):

- The catch is below the minimum landing size, see appendix 5;
- “Mixed fisheries”. The quota for a given species is already used, however the fisherman still has quota for other species caught in the same métier;
- To optimize total catch value the smaller individuals are discarded (high-grading);
- The catch does not fulfill the regulation of preservation or by-catch regulations;
- Lack of marketing opportunities or it is not possible for the fisherman to sell the species to a price that will cover the cost of handling and landing the species (as could be the case for flounder in the East Baltic).

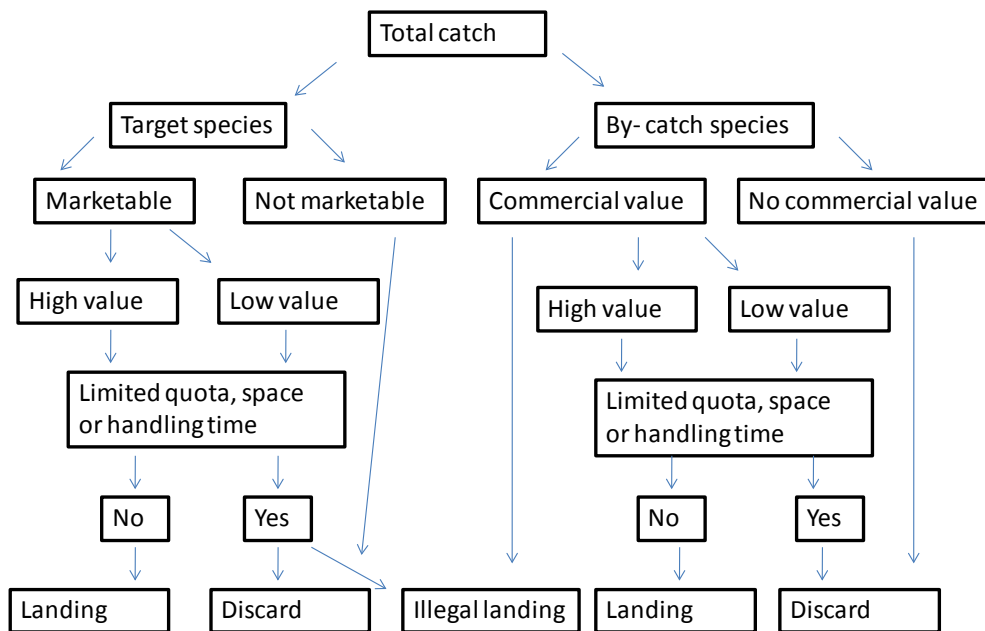


Fig. 1. Discard flow chart. After "Rapport om discard i dansk fiskeri, Fødevareministeriet, januar 2006".

Although the main reason for a fisherman to discard is listed above, the amount of discard can be very fluctuating and depended on other reasons as well (Rochet and Trenkel 2005, Frandsen et al. 2010).

- Environmental conditions, such as seasonal and area depended discard. This is the assumption behind real time closures.
- Year-class strength depended discards. In years with a very high abundance of a year-class the discard is often believed to be larger.
- The amount of discard will be affected by the fishing time.
- The fishing gear and mesh size and shape will have large influence on the level of discard.
- If legal mesh sizes are not adjusted to minimum landing sizes this can result in an increase in discard.

In many fisheries the discard is a substantial part of the catch and represents a significant mortality component to the fish and shellfish stocks. Therefore, the amount of yearly discard is essential information and necessary input for a trustworthy assessment for most stock assessments. Furthermore, substantial discards has in recent years been seen as an unethical component of modern commercial fishery and societal demands to reduce discarding and other impacts associated with fishing are growing. Pressure is increasing on policy makers, fishermen and scientists to 'do something about the discard problem' and discard is off course not an optimal way of utilizing the resources, especially if the resource is limited. Discarding has come high on the agenda in the upcoming review of the Common Fisheries Policy (CFP) and within the Commission, Member States and the fishing industry there is considerable discussion on appropriate management measures to mitigate discarding.

### Why sample discard?

Catch data is the main input data used to conduct stock assessment. To have a true input data set, both the discarded and landed fish has to be included in the analysis as the amount of yearly discard

is essential information and necessary input for a trustworthy assessment for most stock. If only the landed part is included, recruitment estimate will come from survey information only (if a survey is conducted for the relevant species in the relevant area). Furthermore, discard data is also relevant to report if a species is considered to be substance for a high mortality or to increase the knowledge on the utilizing of the resources. Since the introduction of the EU data collection regulation (2002-2008) and the subsequent data collection framework (Commission decision -2008/949/EC) monitoring the catches onboard commercial fishing vessels has routinely been undertaken by the member states. In Denmark discard data has been sampled by DTU Aqua on board commercial vessels since 1995 (Annon. 2006). The variance in discard pattern between métier's, seasons or even between vessels in the same métier can be large. The optimal, although unrealistic, solution would be to have information from every single vessel from every single trip. This is off course not equitable and therefore some assumptions off similarity between métiers have to be drawn.

### Discard results 2010

Discard rates can be calculated in different ways depending on the purpose of the analyses. In the section "Processing of data and raising of discard" and in appendix 1 a more detailed description is available. In this section a short overview of the Danish discard amounts and rates are given by métier (fleets groups) and areas. It is only from the fleets where DTU Aqua has onboard observers that discard are calculated. This indicates that discard amounts by area are minimum levels, as some fleets are not covered by observers. In Appendix 1, 2 and 3 all discard, landings and discard rates are shown by area and métier and species; however in this section only species with discard of more than 200 t are included.

From all the areas (Baltic, Kattegat, Skagerrak and North Sea) the total observed discard by DTU Aqua was 21500 t. in 2010. This corresponds to a discard rate of 26% of the total catch from these fleets. The main species discarded from the fleets with observers were in 2010: dab, cod, Norway lobster, European plaice, flounder, thorny skate, whiting, haddock, long rough dab and Norway pout in decreasing total amount.

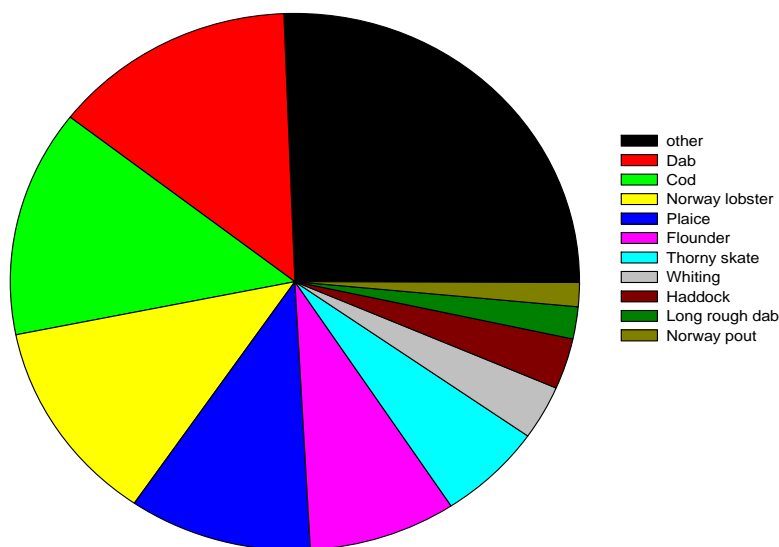


Fig. 2. Species composition of the total discard 2010.

**Western Baltic (Area 22-24):** In the western Baltic Sea the main discard in weight, from the fleets where observer trips have been conducted was: flounder, dab, plaice and cod with discard weights between 600 t and 1000 t in 2010 (appendix 1, area 22-24). From the fleets with observers onboard 33% of the total catch was discarded in this area.

In total these four species have a discard amounting close to 3070 t or 93% of all observed discard in the area. When comparing the discard, with the catch of the same species, cod has a discard rate of 11%, followed by plaice with 53%, flounders with 64% and dab with 67%. Some of these species have a minor commercial interest (see figure 1) and the landing level of the species will be lower or at level with the discard amount giving a high discard rate.

**Eastern Baltic (Area 25-32):** In the eastern Baltic Sea the main discard in weight, from the fleets where observer trips have been conducted was: flounder, plaice and cod with discard weights between 200 t and 440 t in 2010 (appendix 1, area 25-32). From the fleets with observers on board 8% of the total catch was discarded in this area.

In total these three species, cod, flounder and plaice have a discard amounting close to 900 t or 99.7% of all observed discard in the area. When comparing the discard, with the catch of the same species, cod has a discard rate of 3%, followed by plaice with 43% and flounders with 57%. As was the case in the western Baltic some of these species have a minor commercial interest and the landing level of the species will be lower or at level with the discard amount giving a high discard rate.

**Skagerrak (Area 3AN):** In Skagerrak the calculated amount of discard is higher than in the Eastern Baltic area and more species are involved in the catch. The main discards in weight are: Norway lobster, cod, haddock, plaice, long rough dab, whiting, Norway pout and thorny skate in decreasing order. For these eight species the discard in weight amounts between 270-1720 t in 2010 (appendix 1, area 3AN). From the fleets with observers 26% of the total catch was discarded in this area.

In total these eight species have a discard amounting close to 5700 t or 84% of all observed discard in the area. When comparing the discard, with the catch of the same species, Norway lobster has a discard rate of 47%, cod has a discard rate of 36%, followed by haddock with 39% and plaice with 8%, whiting has a discard rate at 92% and the last three species (long rough dab, thorny skate and Norway pout) have a discard rate of 100%, as no commercial landings was registered for these last three species.

**Kattegat (Area 3AS):** In Kattegat the calculated amount of discard is higher than the landings in the area from the fleets where observers have been on board amounting to 65% of the total catch. The main discards in weight are: common dab, Norway lobster, plaice, flounder and whiting in decreasing order. For these five species the discard in weight amounts between 220-1900 t in 2010 (appendix 1, area 3AS).

In total these five species have a discard amounting close to 4100 t or 85% of all observed discard in the area. When comparing the discard, with the catch of the same species, dab has a discard rate of 98%, Norway lobster a discard rate of 33%, plaice has a discard rate of 72%, followed by flounder with 78% and last whiting with a discard rate at 97%.



**North Sea (Area 4):** In the North Sea the calculated amount of discard is also higher than in the Eastern Baltic area and more species are involved in the catch. The main discards in weight are: Common shrimp, thorny skate, Rabbit fish, cod and hake in decreasing order. For these five species the discard in weight amounts between 250-2900 t. in 2010 (appendix 1, area 4). From the fleets with observers 19% of the total catch was discarded in this area.

In total these five species have a discard amounting close to 4675 t or 82% of all observed discard in the area. When comparing the discard, with the catch of the same species, common shrimps has a discard rate of 48%, followed by hake with 18%, cod has a discard rate of 6%, and the last three species (rabbit fish and, thorny skate) have a discard rate of 100%, as no commercial landings was registered.

## Purpose and structure of this report

This report is the first issue of an annually publication which describes the Danish commercial sampling program with special attention to discards. Only data from 2010 are included in this report. We have not included discard of mammals and sea birds.

Further, the purpose of the report is to present the scientific observations on discarding in a non-technical way. The target audience is scientists, managers, policy movers, industry, Non-Government Organizations (NGO's) and the general public.

The main stratification in this report is by métier. "Métier" denotes a cluster of fishing actions, which share some characteristics. Métier acts normally as the general management unit and it is aimed that métier is a consistent stratification in landings statistics, data sampling and data processing.

**Métier:** is the term used in the Data Collection Framework (DCF) to define a somewhat homogeneous group of fishing actions which shares common physical features, e.g. gear type, mesh size range, main target species and discard pattern.

Each defined métier has its name expressed as a code (Fig. 3) The code consists of a combination of gear type, mesh size range, target species assemblage, the existence or non-existence of a selection device (including information of type) and the mesh size in the selection device (if existing). The gear code values follow FAO standards and the target species assemblage and selection device type are given in table 1.

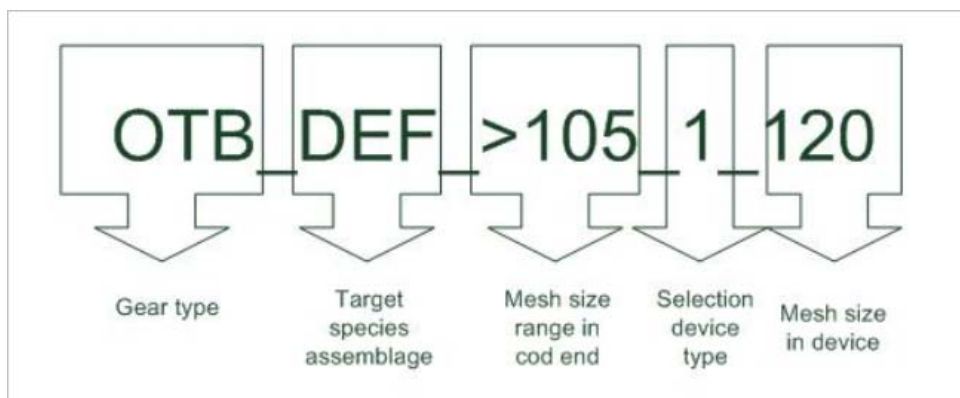


Fig. 3. The métiers code for a bottom Otter board trawl targeting demersal fish and having >105 mm mesh size in cod end and Bacoma exit window with 120 mm mesh size.

<b><i>Gear code</i></b>	<b><i>Gear</i></b>
<i>OTB</i>	<i>Otter trawl bottom</i>
<i>TBB</i>	<i>Beam trawl</i>
<i>OTM</i>	<i>Otter trawl midwater</i>
<i>PTM</i>	<i>Pair trawl midwater</i>
<i>LLD</i>	<i>Longlines Drifting</i>
<i>FPN</i>	<i>Fixed pound nets</i>
<i>GNS</i>	<i>Set gillnet</i>
<i>PS</i>	<i>Purse seine</i>
<i>SDN</i>	<i>Anchored seine</i>
<b><i>Target species assemblage code</i></b>	<b><i>Target species assemblage</i></b>
<i>ANA</i>	<i>Anadromous species</i>
<i>CAT</i>	<i>Catadromous species</i>
<i>DEF</i>	<i>Demersal fish</i>
<i>SPF</i>	<i>Small pelagic species</i>
<i>CRU</i>	<i>Crustaceans</i>
<i>MCD</i>	<i>Mixed crustaceans and demersal</i>
<b><i>Selection device code</i></b>	<b><i>Selection device</i></b>
<i>1</i>	<i>Bacoma window</i>
<i>2</i>	<i>Fixed grid</i>

Table 1. Codes used for target species assemblage and Selection device in the métier names.

For some gear codes, the information in the logbook cannot be trusted. E.g. the fishermen are not obliged to write OTT (twin otter trawl), and write OTB instead, therefore the two gears are combined into OTB. Likewise GN (unspecified gillnets), GTR (trammel nets) and GNS are combined into GNS.

**Merging of métiers.** Two or more métiers can according to the DCF be merged and sampled as one in a given area, if it can be demonstrated that the métiers do not, in the catch, exhibit significant differences concerning species composition and length distributions of the main species and do not differ significantly in discard pattern.

No Logbook, NoMatrix: The allocation of a métier to each landing is based on information from both the logbook register and the sales slips register (registration of purchase of first buyer). To combine these registers is complicated because no direct link combines the two and it is not always possible to match all landings to a logbook. Furthermore, not all vessels with landings are obliged to fill in logbooks if they have an area declaration. This means that some landings miss information which prevents it from getting a regular métier assigned. These landings get assigned a métier called “No logbook”.

Another case which prevents the assignment of a regular métier to a given landing, is when the information associated to the landing leads to a non-defined métier (e.g. if the mesh size falls outside the defined ranges). In such cases, the assigned métier is called “NoMatrix”.

## Danish fisheries, overview

### Data sources

The total Danish sampling effort consists of both a number of sampling schemes and census data of the commercial fishery plus scientific surveys (fishery independent sampling):

- **Logbook data** contain information about species composition of the landings, fishing gear, fishing ground, and fishing effort. Mandatory for vessels larger than 10 meter oal (8 meter oal in the Baltic Sea).
- **Sales slips census data** contain information about landing amount in tons and value from first hand buyer.
- **VMS data** are positions from the vessel send out once per hour in Denmark. In 2010 VMS was mandatory on all vessels larger than 15 meter oal.
- **The market sampling scheme** provides biological information from landings.
- **The Sea Sampling program** provides information about discard rates, species composition in discard and landing and biological information about both discard and landing.
- **Self-sampling** is when fishermen are collecting biological samples. In Denmark this is the case in a gillnet fleet in IIIaN. Scientific surveys provide information about spatial distribution and fishery independent data for model tuning to be used for the stock assessments.
- **Special non-routine survey and sampling schemes** as the "Catch Quota Management Program" (see below), which uses video surveillance and logging of activity of hydraulic systems on board individual fishing vessels for detailed information about catch and effort.

### Sampling frame

Compared to the size of the country, Denmark is a rather large fishing nation and has a relatively large fleet with many métiers represented, in 2010 91 different métiers. In 2010 the number of active vessels (more than 5 trips a year) accounted for 853 and from these 67 (8%) different vessels were sampled in the observers program. The Danish fleet conducted in 2010 close to 60.000 trips where the observers covered less than 1%.

The pelagic fleet is at present not covered in the Danish at-sea-observer program but only in the port sampling program. The rationale is that discarding seldom will occur at sea in the pelagic fleet, as a large part of the pelagic fleet has a closed system and when the fish is first onboard it will not be discarded. Therefore it is possible to obtain the same information from making a port sample, as a discard estimate from an observer trip. However, this is only partly true as slipping is known to occur in the pelagic fleet. Information on how often slipping happens and to what extent the fish can survive (depending on how long the fishery has been going on before the slipping occurs) is not very well described.

Denmark has 5 main fishing areas the Baltic Sea (West and East), Kattegat, Skagerrak and the North Sea (including area I and II). However, Denmark has also a relatively large fishery the North Atlantic VII and VIII, from this mainly pelagic fishery the catches is landed in other nations and are therefore rarely included in the Danish sampling program.

The data collection programme by the EU through the Data Collection Framework (DCF), define that métiers to be sampled by the member states have been selected ranking by value in catch, weight

and value. The system ensures that a given métier is selected for biological sampling if it falls into the top 90% in one or more of the following measures: landing amount (tons), landing value and/or fishing effort. Furthermore, a métier must be sampled if the discard rate exceeds 5% (in weight). The métiers NoLogbook and NoMatrix are both of a size where they are often included in the top90% ranking lists.

The sampling intensity is defined either by the landing amount or by a criterion of obtaining a certain level of certainty on the final estimate.

All sampling schemes are stratified on quarter and area. Further stratification depends on the type of sampling. Market samples are further stratified on commercial size sorting while discard sampling is stratified on métier.

### **The Danish at-sea-sampling program**

The Danish Sea Sampling Program is the main source for information concerning discards. Scientific observers are on board commercial vessels during regular fishery. All relevant information concerning catch, vessel and gear characteristics, mesh size and selective gear devices, fishing ground, weather, ownership etc. are collected. All observers have a detailed manual describing the procedure for handling the catch on board. The data are used for estimating the total discard by number and weight by species, age group, area, quarter and métiers. The primary sampling unit was in 2010 days at sea. The selection of vessels for sampling is described below.

As a part of the program a limited part of the gillnet fleet is conducting self-sampling. These vessels are relatively small and it is therefore difficult to conduct a traditional observer trip. They are all conducting 1 day trips. An arrangement has been made with a selected number of vessels where DTU Aqua at randomly chosen days calls the fishermen and ask them to bring all discard to land where it will be handled as a normal discard trip. On one of the vessels an observer is onboard to have a reference.

### **Selection of vessels for sampling**

In 2010 the sampling system was stratified on vessel groups, area and quarter. Vessels were not selected randomly and success rate was not recorded. Success rate is defined as the number of fishermen willing to participate in allowing the observers to come onboard. An observer was responsible for covering an area with a fixed sets of days at sea however could choose the vessels from own criteria. A large advantage of this system is that active vessels fishing in the area of interest can be followed on AIS or V-track (VMS system) and then only vessels that are fishing active are contacted. A new sampling system was introduced in 2011, where vessels are selected on a stratified random basis, based on last year's data. For each métier and quarter a vessel selection spreadsheet has been computed and the vessels are weighted with the amount of trips conducted in the same quarter and area one year earlier. When a vessel is selected by the computer the observers are calling the skipper to ask for the possibility to conduct an observer trip with his vessel. As the system is weighting the amounts of trips conducted by the vessel it is possible to select the same ship more than once in a quarter.

The fishermen answers are registered in a log. If a skipper decisively refuses to have an observer on board he is not contacted again that year even though the ship is selected again by the system. However, the ship is registered with the same answer. If the skipper says "no" but is given a more

vague answer (try again later or it is not fitting very good right now) he will be called again the next time the vessel is being selected by the system.

## Processing of data and raising of discard

Data collected in the at-sea-sampling and self-sampling program are entered into a national database and then transferred to the international Regional Database (RDB-FishFrame, <http://www.fishframe.org>), together with the official landing and effort statistic. The calculation of discard (ton) is done in the RDB-FishFrame.

**Raising:** To calculate the discard (ton) the discard ratio from the sampled hauls in a strata need to be raised to the total landings in that strata. There are several ways of raising the sampled discard to the landings e.g. by effort, landings of the same species or landings of all species. In Denmark we have chosen to raise the discard with total landings of all species and all our sampling are stratified by area, métier and quarter. In short the discard (ton) is calculated in the following way:

$$\text{Discard ratio}_{\text{Species,Area, Métier, Quarter}} = \frac{\sum \text{Weigth of discard}_{\text{Trip,Haul,Species,Area,Métier,Quarter}}}{\sum \text{Weight of landings}_{\text{Trip,Haul,Area,Métier,Quarter}}}$$

$$\text{Discard(ton)}_{\text{Species,Area,Métier, Quarter}} = \text{Landings}_{\text{Area,Métier,Quarter}} \times \text{Discard ratio}_{\text{Species,Area, Métier, Quarter}}$$

The plain pooling of all sampled hauls means that the hauls are weighted by catch size, see *Jansen et al. 2007* for a complete description of the method.

**Data extrapolating:** Not all strata are sampled. The sampling schedule is a result of a prioritization. If the fishery in e.g. a quarter is marginal the sampling effort is better used elsewhere. Therefore, a number of strata are without biological data. For these strata, data are borrowed from other strata which are as similar as possible to the one without sample data. Data can also be borrowed from another country which has relevant sampling data available. For some métiers discard is not calculated.

Afterwards the number of discarded fish is calculated together with number at length and number at age. The last being the main figures going into the stock assessment.

In the report section of RDB-FishFrame it is possible to tabulate the discard (ton) on e.g. other temporal, spatial aggregation than presented in this report.

## Danish fisheries described by métier sheets

In the following pages, the Danish fisheries are described by métier sheets. Each sheet is an overview of a métier with a spatial overview of the VMS coverage, the number of vessels, number of trips and mean days at sea. Only the métiers selected for sampling have been included. The métier sheets are grouped by areas. An overview of the areas is found in appendix 2.

The information comes from the DFAD database (Danish Fisheries Analysis Database) which is a combination of the fishermen logbooks, sales slips and the vessel register. Using the information in

DFAD the métier is found for each trip. The Sea Sampling trips are merged to this data to find out how well the métier is covered by the Sea Sampling program.

In the métier sheets, maps are visualizing the VMS effort by métier, and the spatial coverage by the Sea Sampling program is shown as green points. The VMS data are merged to the DFAD data by trip, and the points are filtered by speed, to only keep the points with a speed where fishing activity is assumed. This gives many points in top of each other, so a grid is made to show the VMS point density, where a darker color means more VMS pings. In 2010 VMS was mandatory on all vessels  $\geq$  15 m oal., therefore there are cases in the maps, with green points (hauls with observer on board) and no VMS effort, because the fishery in that area is conducted by vessels less than 15 meters oal.

Below the information on sampling coverage, histograms are illustrating the species composition of landings (blue) and discard (orange). Only the top five species in the landings and discard respectively, based on the raised amounts in FishFrame, are included. The rest of the species are combined in an “other” group.

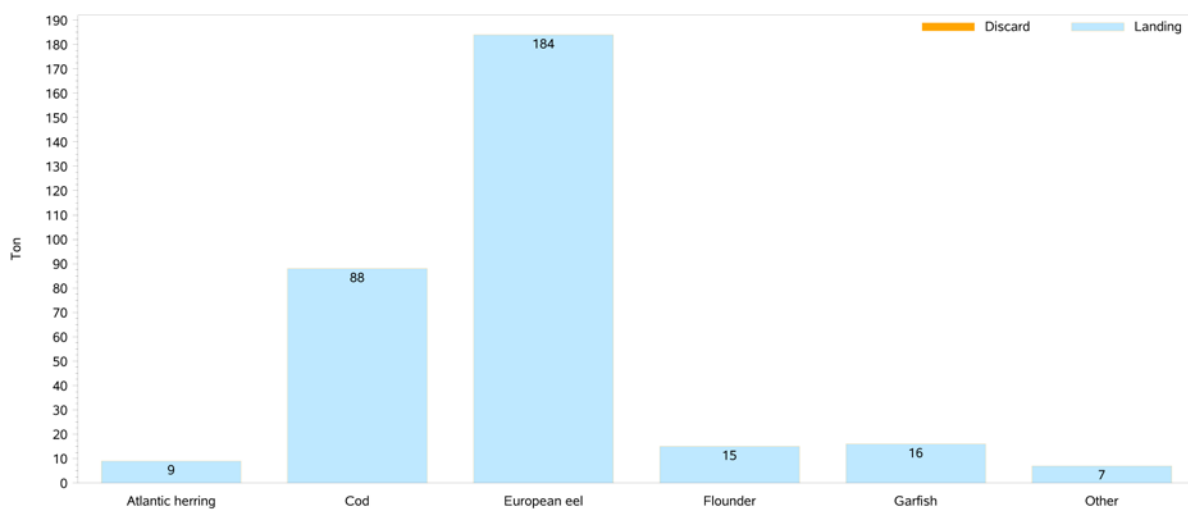
On the bottom of the sheets, there is a box with comments to the métier.

## Western Baltic subdivision 22-24

Western Baltic: Fixed pound nets (FPN\_CAT\_>0\_0\_0)

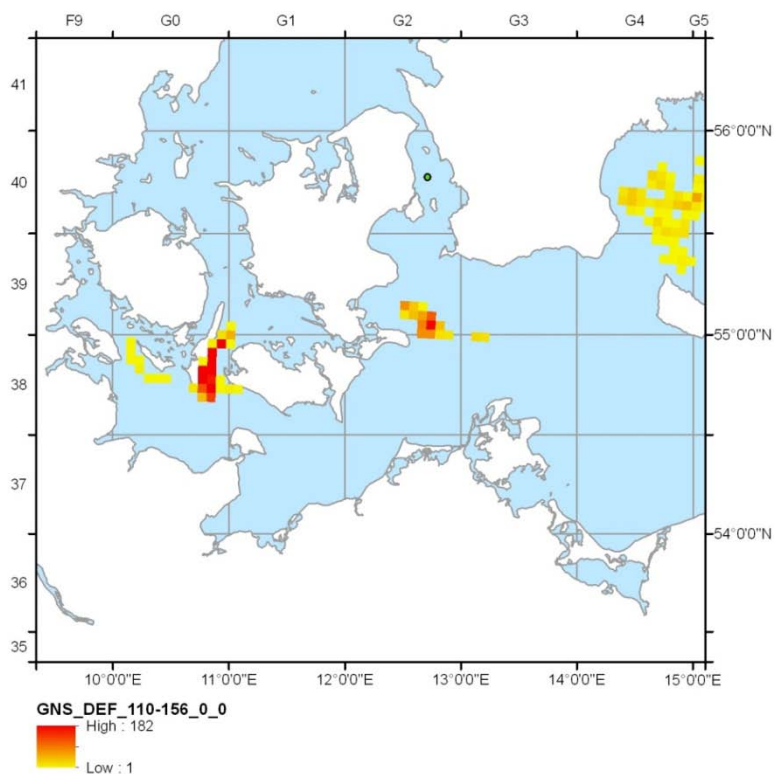
Only 1 vessel had VMS

	Observed (22-24)	Total
Total number of vessels	0	63
Number of vessels with VMS	0	1
Number of trips	0	1110
Mean days at sea	-	1.02

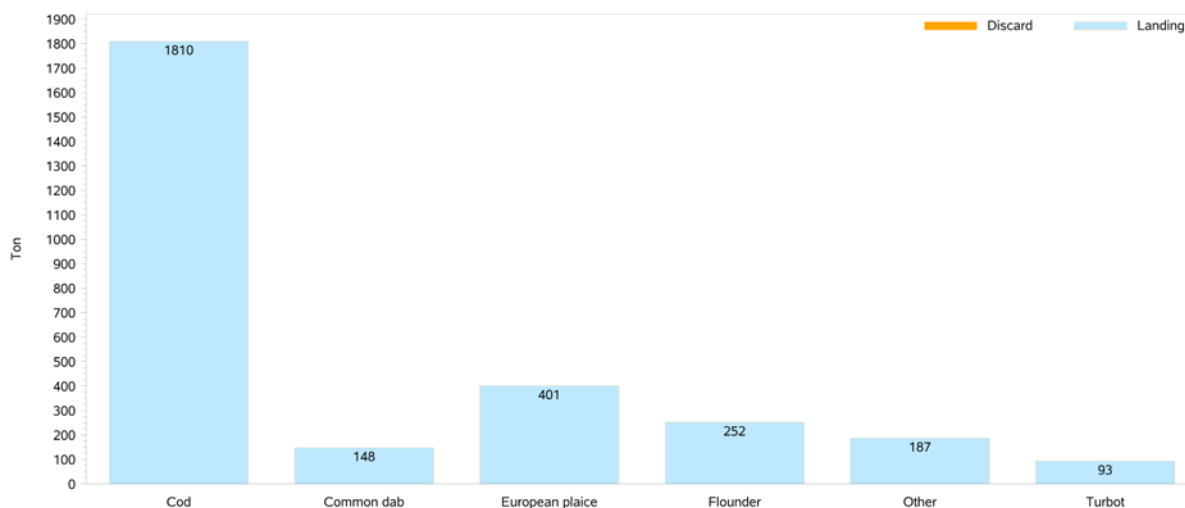


This fishery targets silver eel in the early phase of their migration towards the spawning grounds in the Sargasso Sea. It is the basis of small scale coastal fisheries in many areas along the Danish coast in ICES subdivisions 22, 23 and 24. It is a seasonal fishery, starting in August, and ending in late October-November. Discards are estimated to be very variable but as the gear offers a very high survival rate for un-wanted by-catches no discard sampling is conducted in the métier.

Western Baltic: Demersal Set gillnet (GNS\_DEF\_110-156\_0\_0)



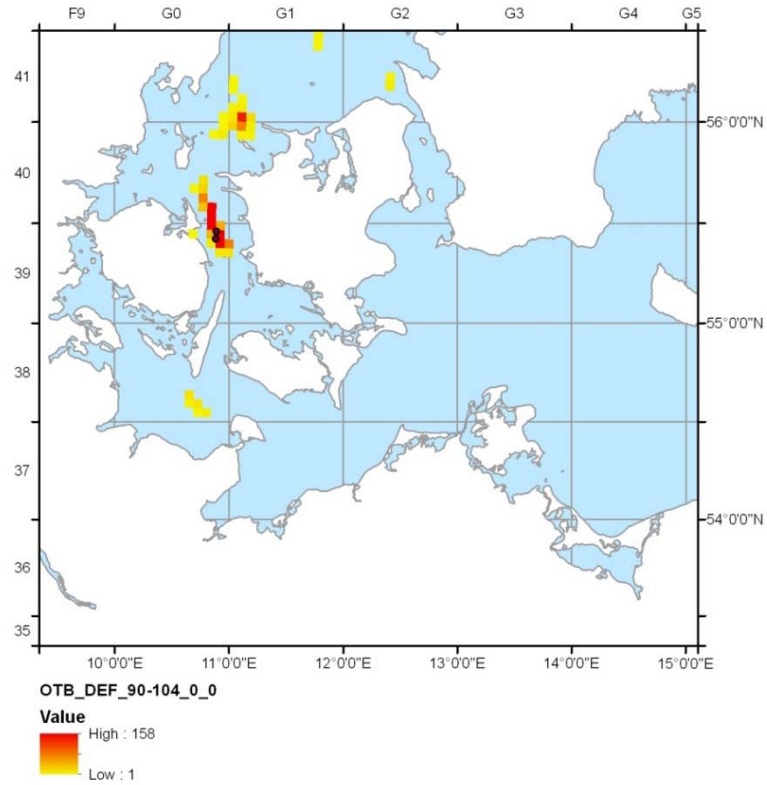
	Observed (22-24)	Total
Total number of vessels	1	218
Number of vessels with VMS	0	6
Number of trips	1	12278
Mean days at sea	1	1.02



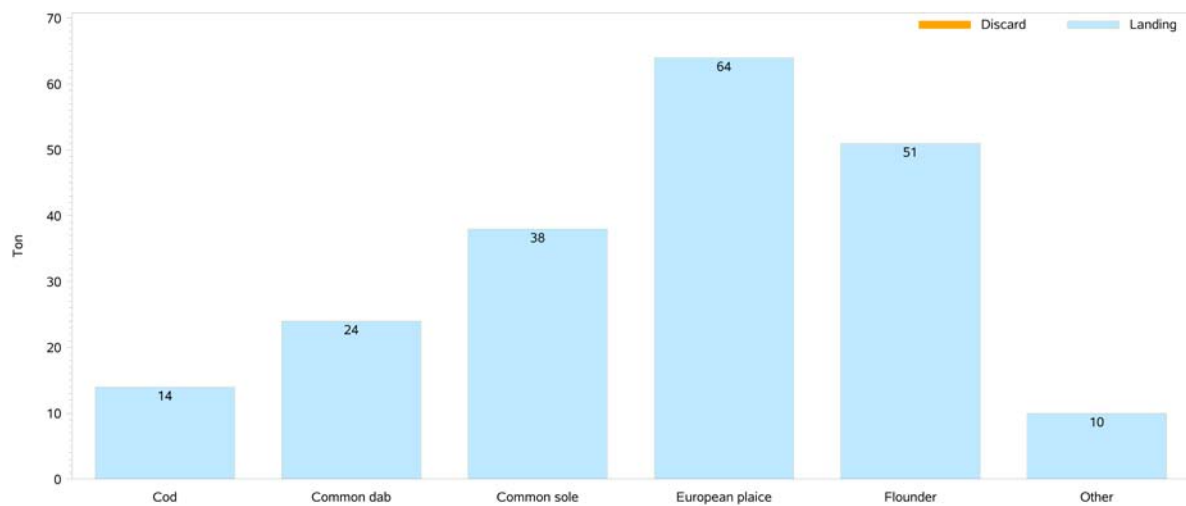
This gillnet fishery is mainly a cod fishery with flatfish as important by-catches. Discard is not calculated due to low level of sampling.



Western Baltic: Bottom otter trawl targeting demersal fish (OTB\_DEF\_90-104\_0\_0)

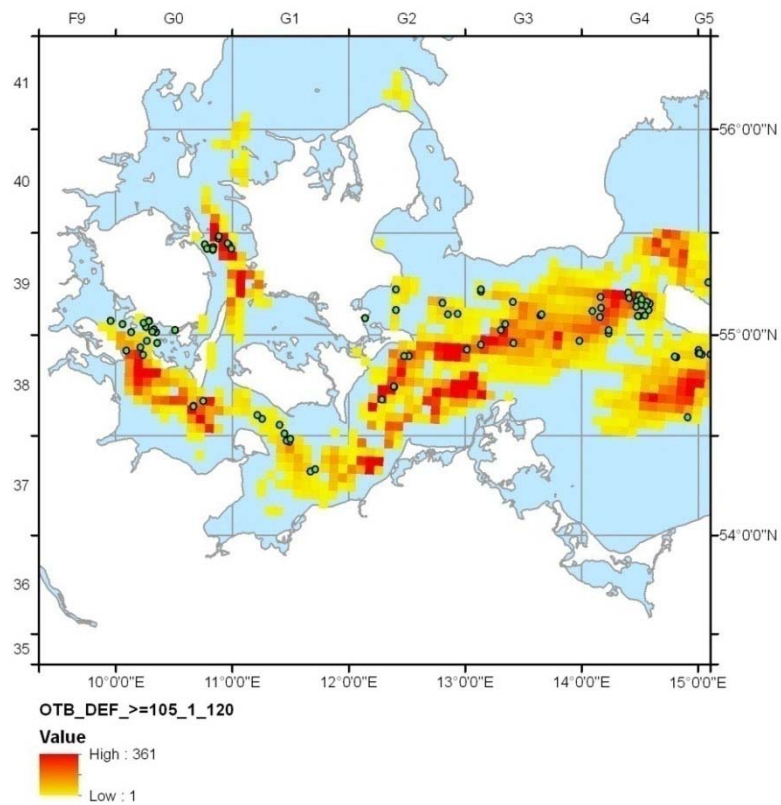


	Observed (22-24)	Total
Total number of vessels	1	35
Number of vessels with VMS	0	10
Number of trips	1	518
Mean days at sea	1	1.6

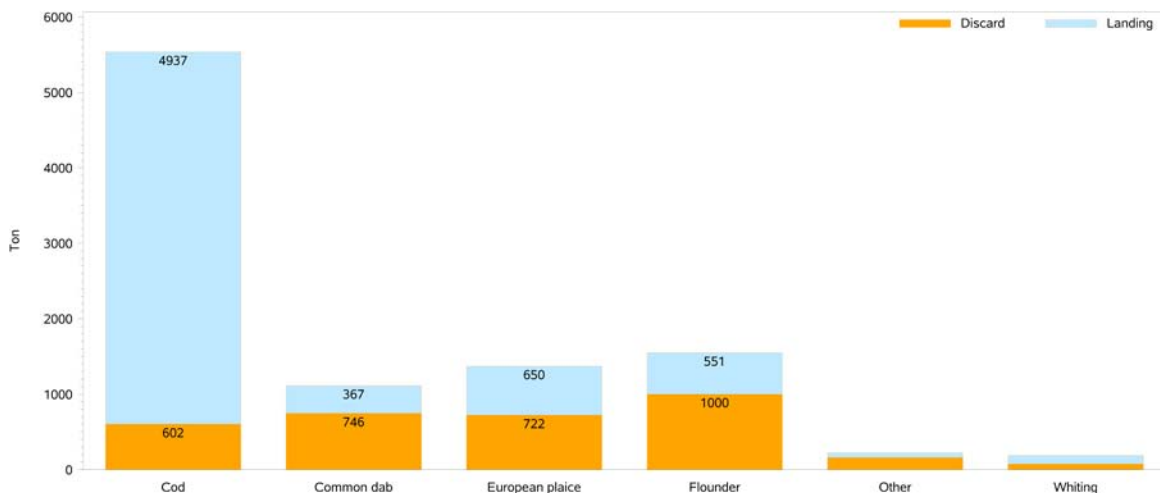


This métier is mainly considered a flatfish fishery with a little bit of cod as by-catch. The fishery is relatively small. Discard has not been calculated due to the low level of sampling.

Western Baltic: Bottom otter trawl targeting demersal fish (OTB\_DEF\_>=105\_1\_120)

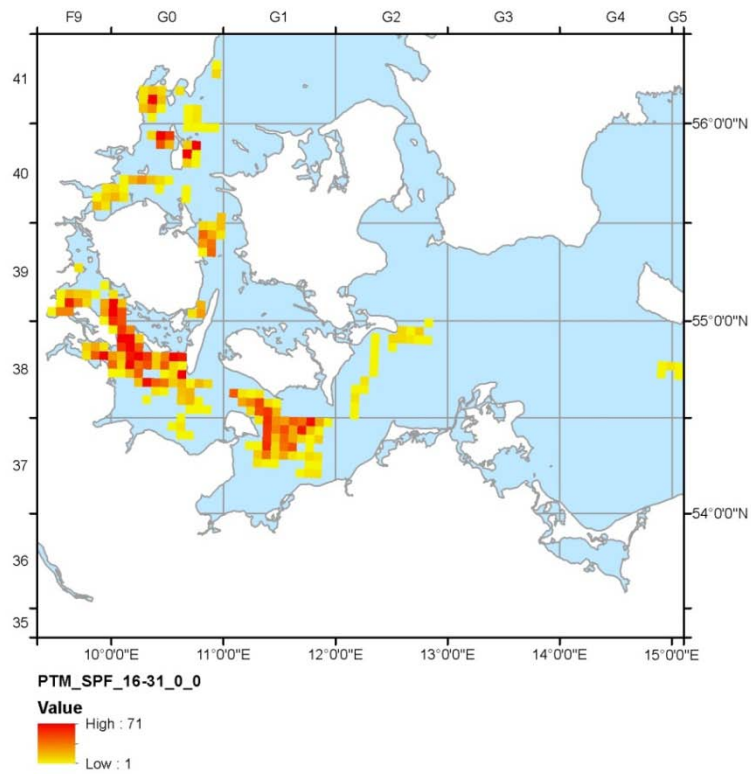


	Observed (22-24)	Total
Total number of vessels	19	125
Number of vessels with VMS	7	54
Number of trips	40	5258
Mean days at sea	1.29	1.23

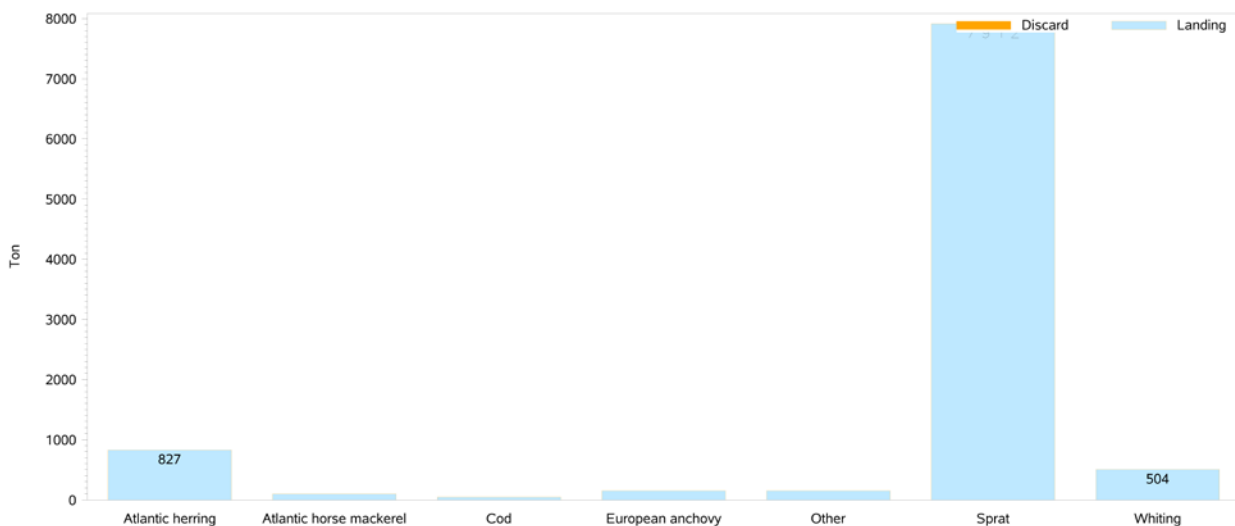


This trawl fishery is an important cod fishery with some flat fish as by-catches. In some periods of the year the flatfish can have a large importance for the fishery; however, western Baltic cod is the main target species. In the discard especially the flounder discard can in periods be significant. 43% of the fleet has VMS.

Western Baltic: Pair trawl midwater, targeting small pelagic species (PTM\_SPF\_16-31\_0\_0)

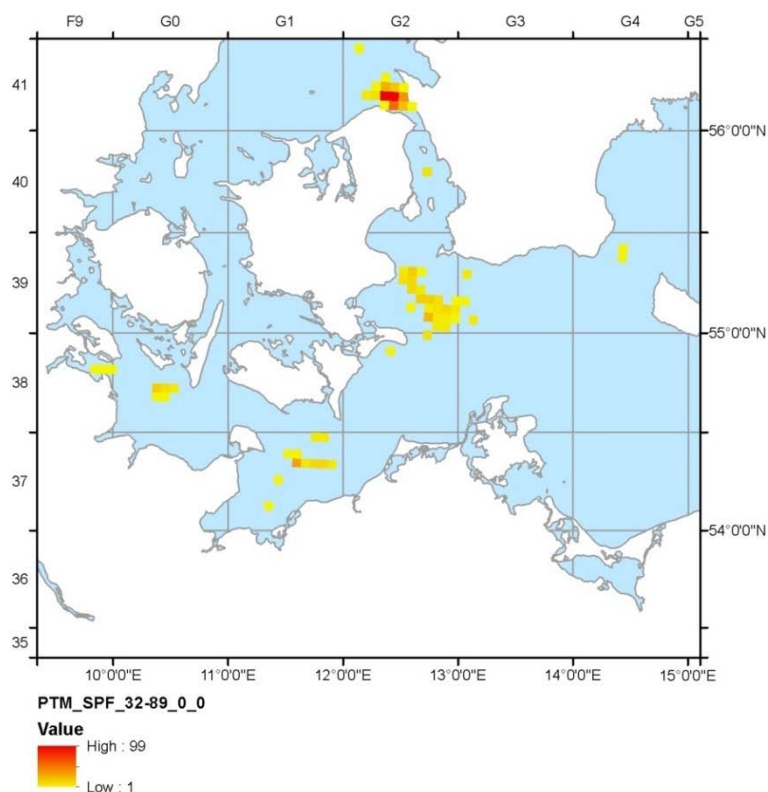


	Observed (22-24)	Total
Total number of vessels	0	27
Number of vessels with VMS	0	13
Number of trips	0	481
Mean days at sea	-	1.32



The landings from the métier is nearly exclusive sprat (99%). The majority of the landings are for industrial purposes but there are also landings for human consumption. The fishery is conducted all the year round but is less intense during summer. There is no discard sampling from the industrial fishery; close to 50% of the fleet has VMS.

Western Baltic: Pair trawl midwater, targeting small pelagic species (PTM\_SPF\_32-89\_0\_0)



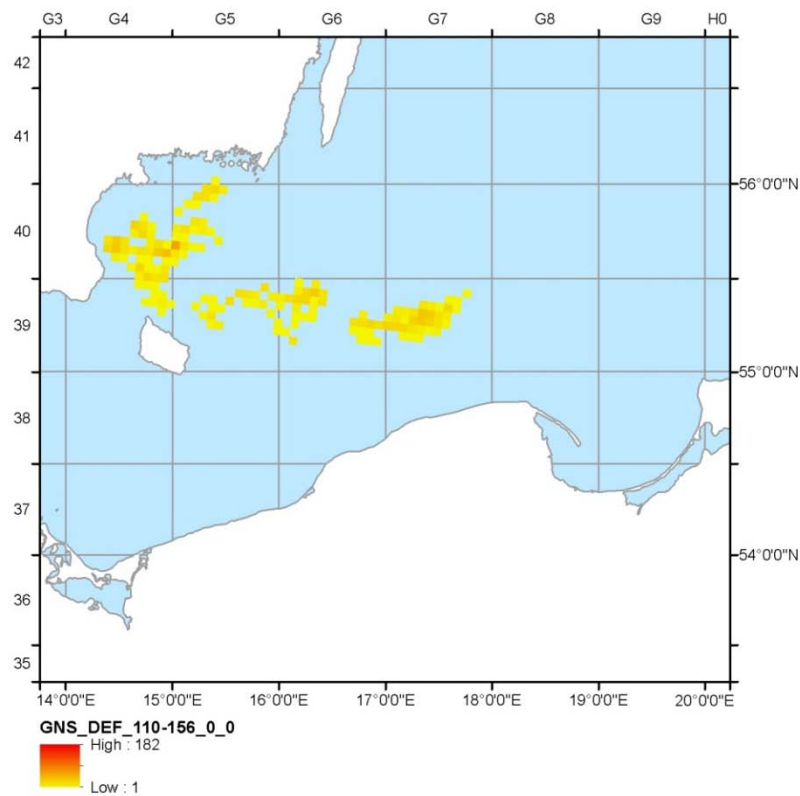
	Observed (22-24)	Total
Total number of vessels	0	12
Number of vessels with VMS	0	9
Number of trips	0	195
Mean days at sea	-	2.01



The majority of the landings are herring for human consumption but there are also landings for industrial purposes. The fishery is conducted all the year around but is less intense during summer. The majority of the catches are taken by pair trawlers using a mesh size of 32-89 mm and the fishery is very intense in the northern part of subdivision 23 when the herring is migrating. 75% of the fleet has VMS.

## Eastern Baltic subdivision 25-32

Eastern Baltic: Demersal Set gillnet (GNS\_DEF\_110-156\_0\_0)

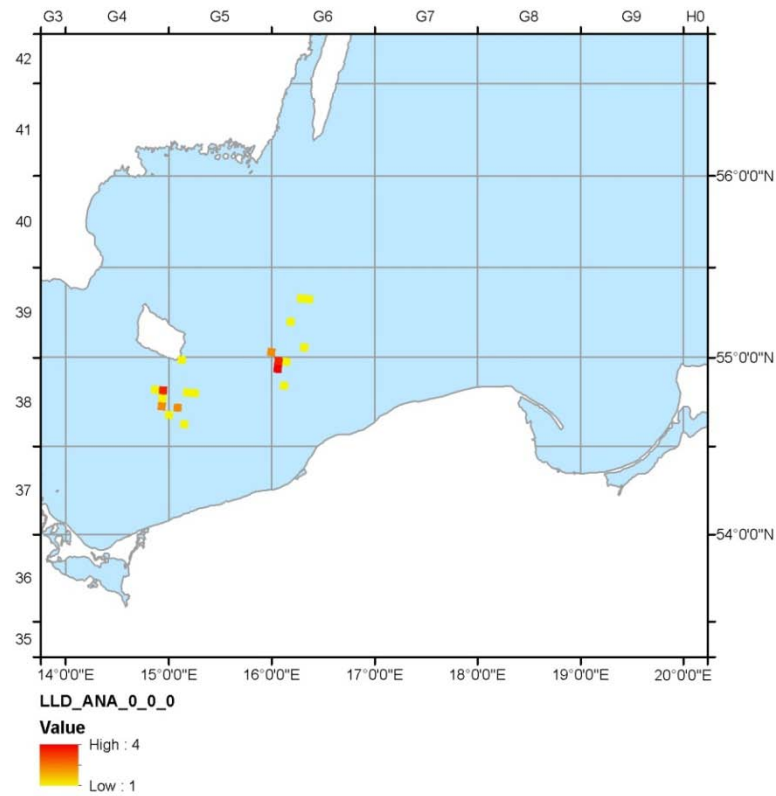


	Observed (SD 25-32)	Total
Total number of vessels	0	32
Number of vessels with VMS	0	3
Number of trips	0	1799
Mean days at sea	-	1

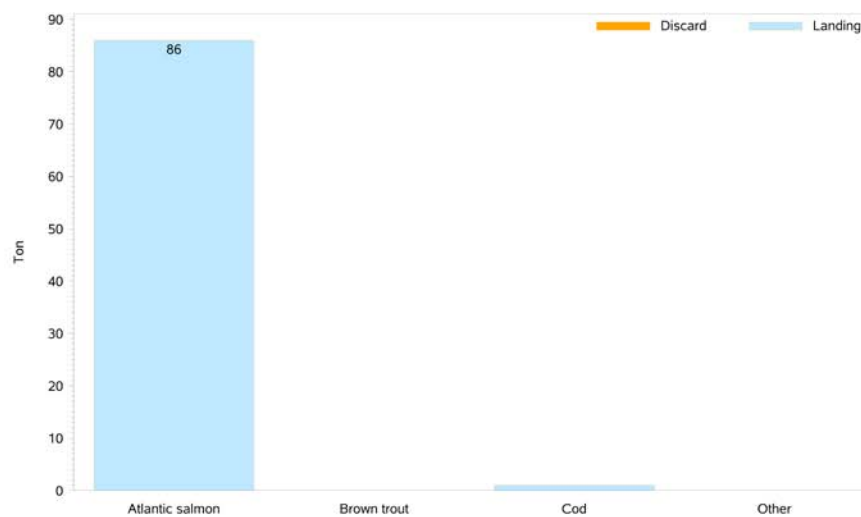


The Danish gillnet fishery predominantly takes place in subdivision 25. The fishery is conducted in relatively small vessels with 1 day trips and only 10% of the fleet has VMS.

Eastern Baltic: Drifting longlines targeting Anadromous species (salmon) (LLD\_ANA\_0\_0\_0)

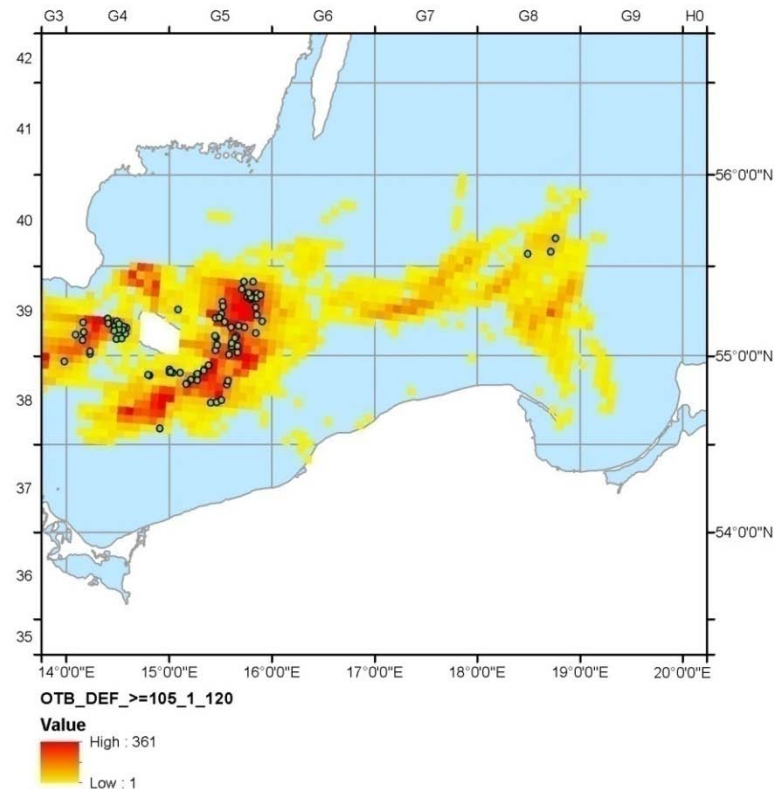


	Observed (SD 25-32)	Total
Total number of vessels	0	19
Number of vessels with VMS	0	3
Number of trips	0	164
Mean days at sea	-	2.17

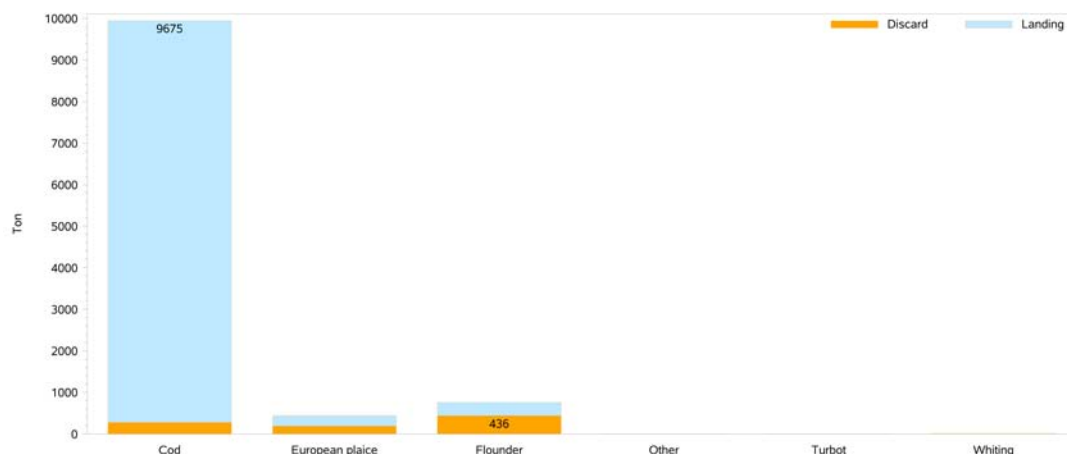


The long liner fishery in the Baltic is almost exclusive a salmon fishery, with trout and cod as by-catch. The Danish fisheries predominantly take place in subdivision 25 in a time period from November-march. Only 16% of the fleet has VMS. Salmon larger than 5.5 kg is not allowed to sell within EU due to the dioxin level.

Eastern Baltic: Bottom otter trawl targeting demersal fish (OTB\_DEF\_>=105\_1\_120)

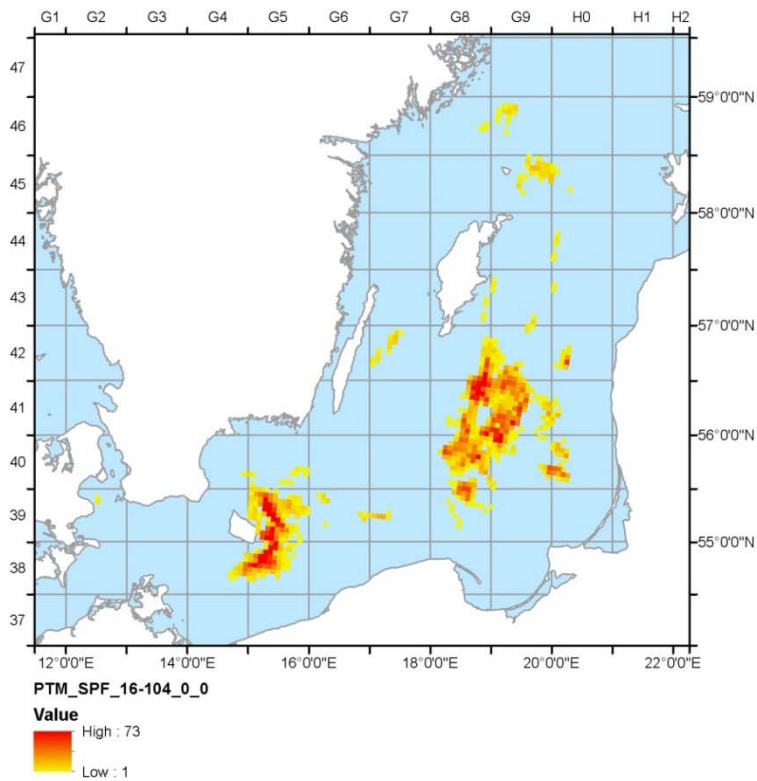


	Observed (SD 25-32)	Total
Total number of vessels	9	74
Number of vessels with VMS	3	37
Number of trips	27	2333
Mean days at sea	1.67	1.42

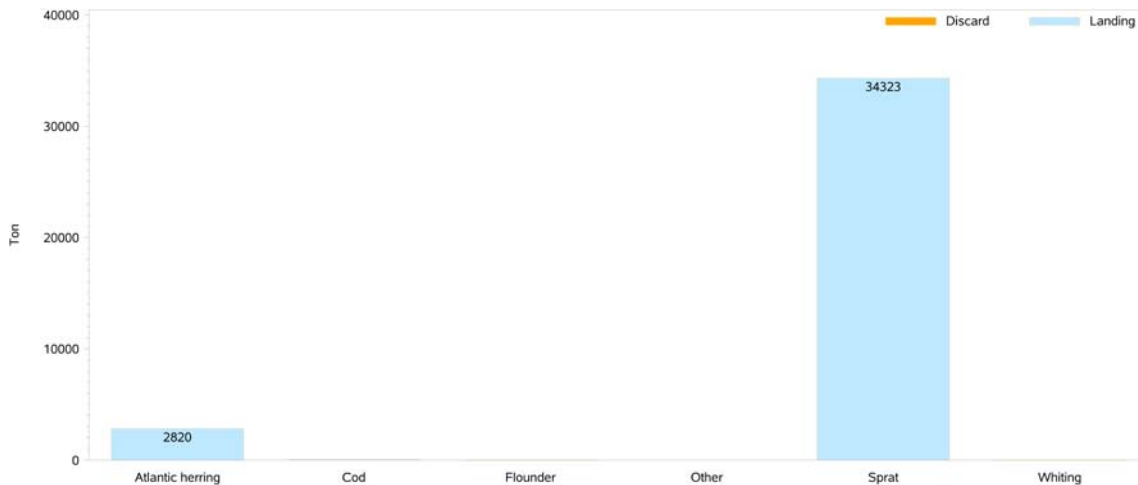


The bottom trawl fishery targeting demersal fish in subdivision 25-32 is almost exclusively a cod fishery, exploiting the eastern Baltic cod stock. In 2010 the mesh size in the BACOMA window was increased from 110 mm to 120 mm. The Danish fishery predominantly takes place in subdivision 25 and 50% of the fleet has VMS. The main discard is flounder, which in periods of the year can be substantial.

Eastern Baltic: Pair trawl midwater, targeting small pelagic species (PTM\_SPF\_16-104\_0\_0)



	Observed (SD 25-32)	Total
Total number of vessels	0	35
Number of vessels with VMS	0	29
Number of trips	0	356
Mean days at sea	-	3.44



The majority of the landings are sprat for industrial purposes but there are also landings for human consumption. The fishery is conducted all year around but is less intense during summer. There is no discard sampling from the industrial fishery. The main part of the fleet has VMS.

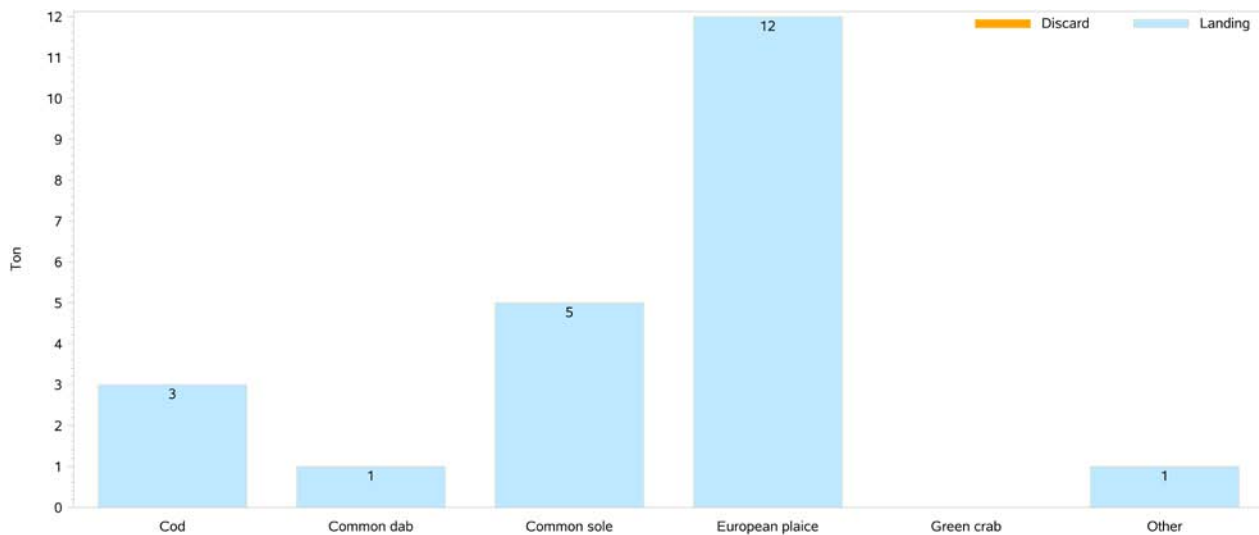


## Skagerrak subdivision 20 – 3AN

Skagerrak: Demersal Set gillnet (GNS\_DEF\_100-119\_0\_0)

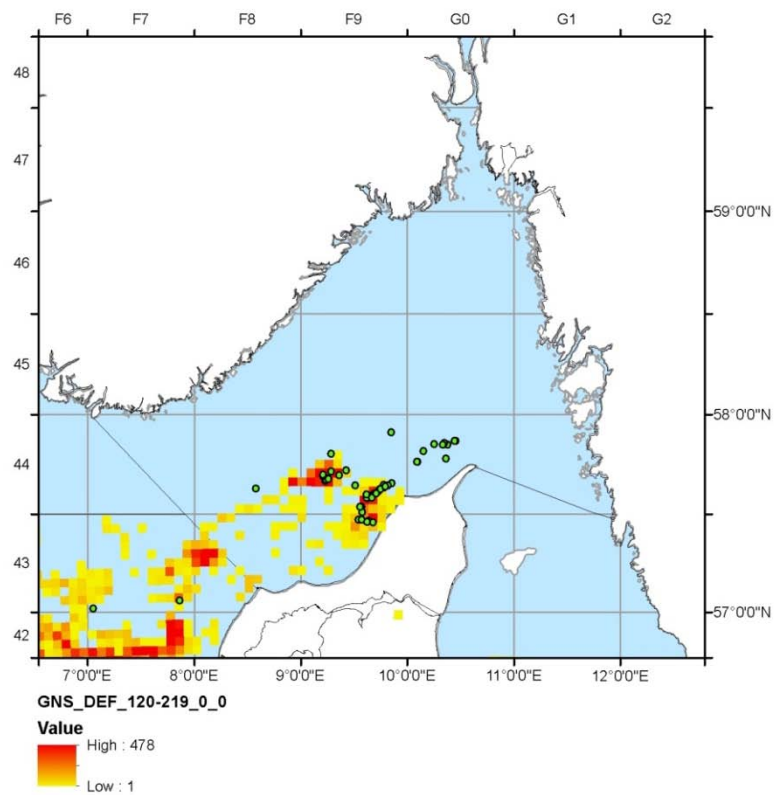
The vessels conducting this métier are all below 15 meters oal, and therefore have no VMS data.

	Observed (20 or 3aN)	Total
Total number of vessels	0	20
Number of vessels with VMS	0	0
Number of trips	0	95
Mean days at sea	-	1.34

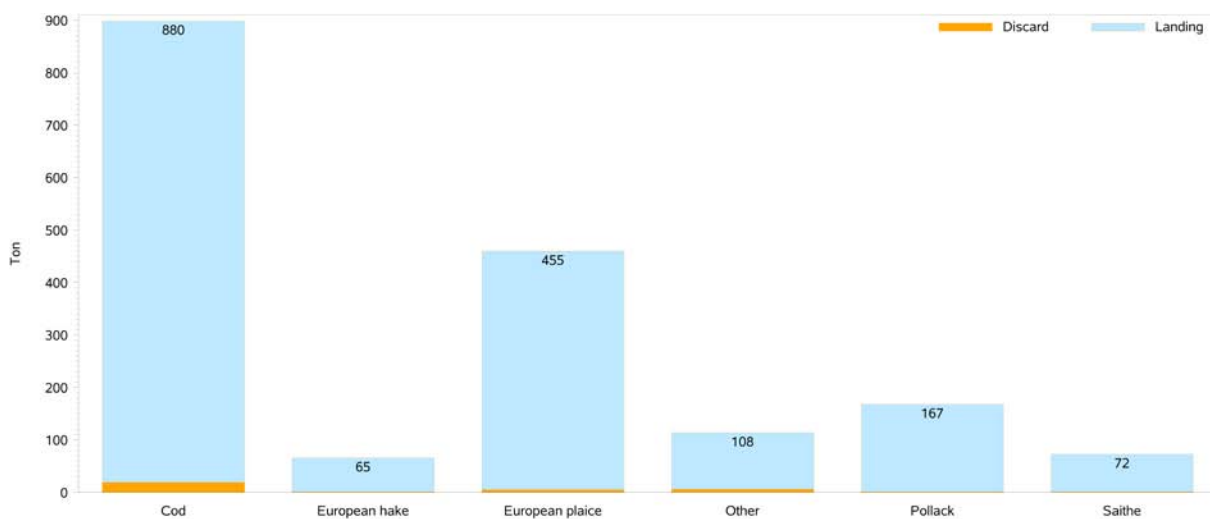


This is a small scale gillnet fishery in Skagerrak where total landing amounts are less than 30t. It is a mixed fishery targeting plaice and sole as the main species, but other species as cod and dab were also landed. None of the vessels are having VMS.

Skagerrak: Demersal Set gillnet (GNS\_DEF\_120-219\_0\_0)

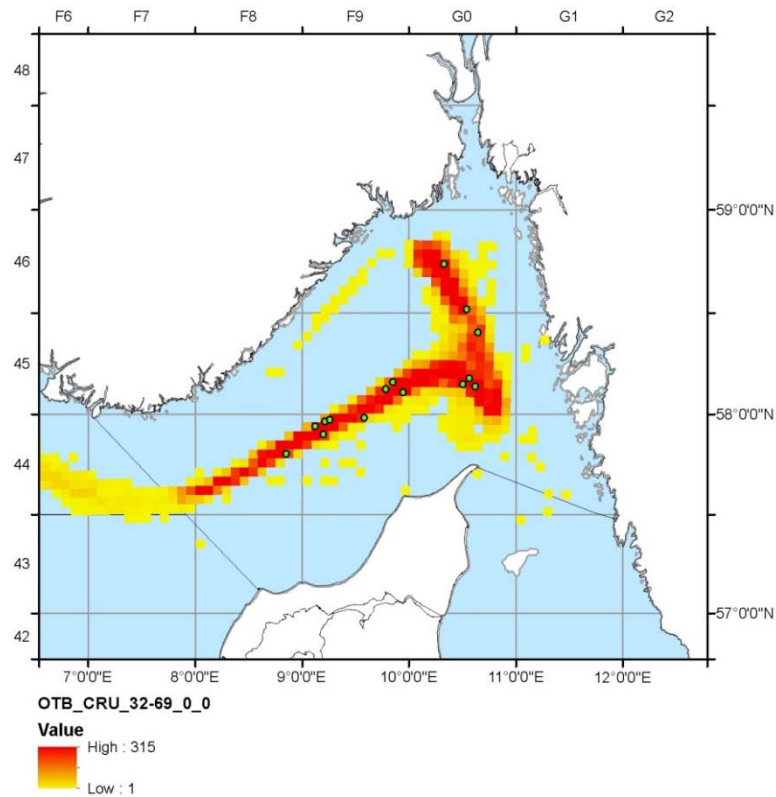


	Observed (20 or 3aN)	Total
Total number of vessels	6	76
Number of vessels with VMS	0	6
Number of trips	38	2886
Mean days at sea	1.03	1.09

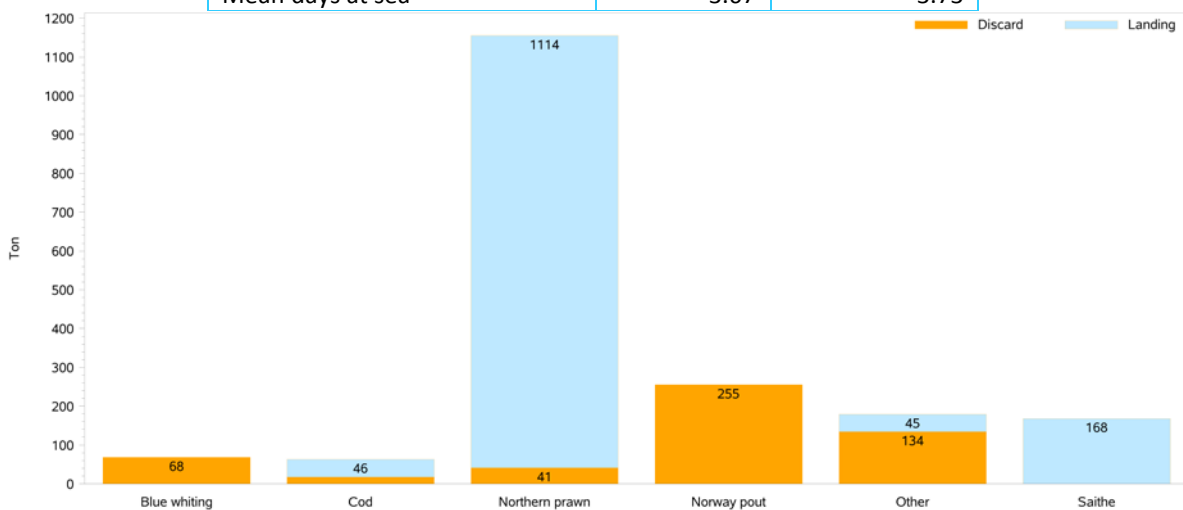


This gillnet fishery is a mixed fishery conducted on small vessels, where the main part is not having VMS < 8%. This is one of the métiers where there a self-sampling program is conducted on a selected part of the fleet.

Skagerrak: Bottom otter trawl targeting Crustaceans (OTB\_CRU\_32-69\_0\_0)

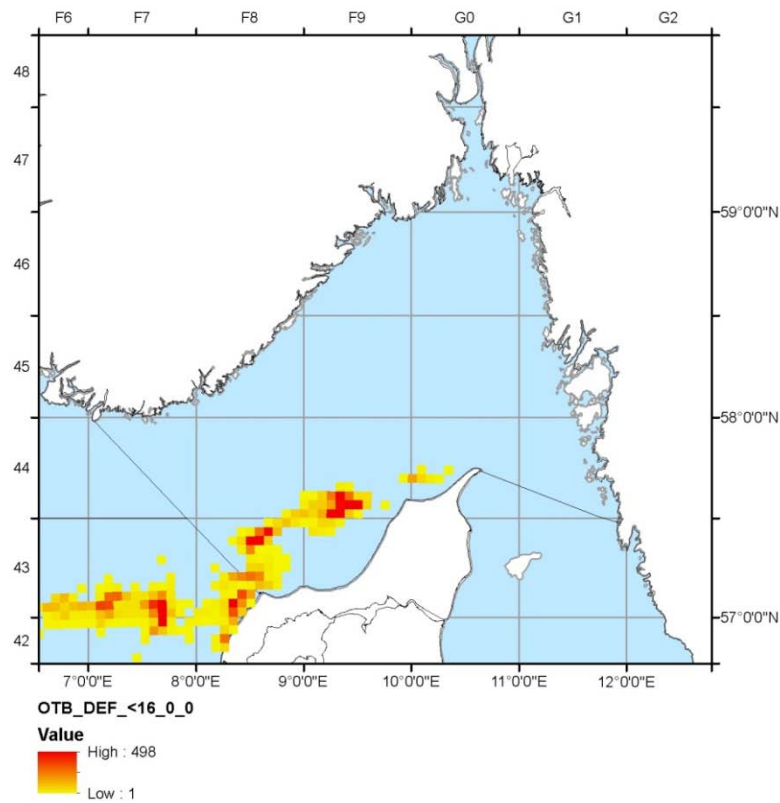


	Observed 20 or 3aN	Total
Total number of vessels	2	15
Number of vessels with VMS	2	15
Number of trips	3	643
Mean days at sea	3.67	3.73

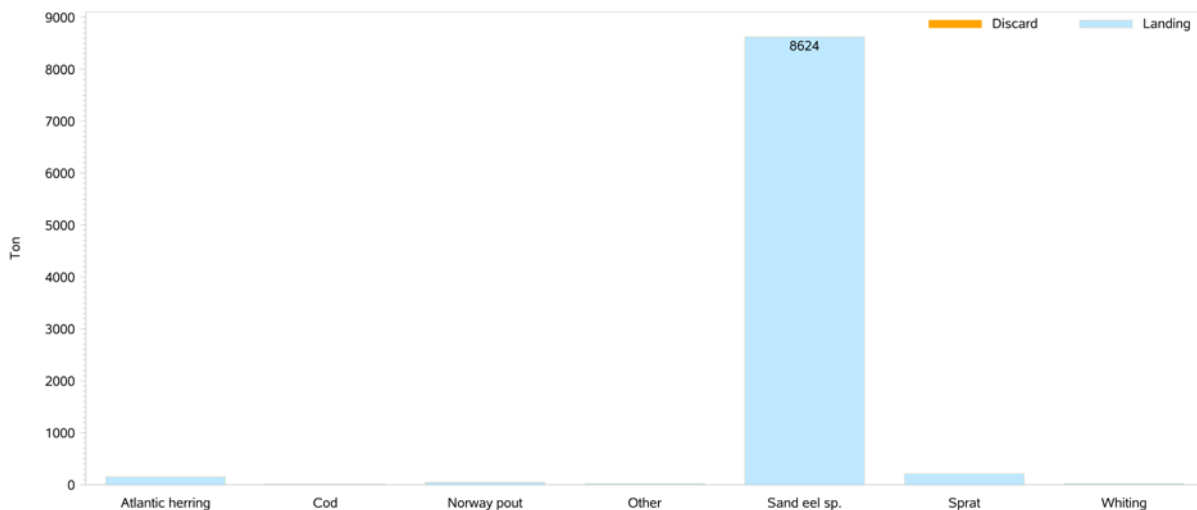


This fishery is a deep water shrimp fishery. Deep water shrimps were in average accounting for the main part of the landings in weight. However some cod- fish are landed as by-catches. Discard have been registered for blue whiting, Norway pout, lumpfish, cod and witch flounders as well as for some other species. The whole fleet has VMS.

Skagerrak: Bottom otter trawl targeting demersal fish (OTB\_DEF\_<16\_0\_0)

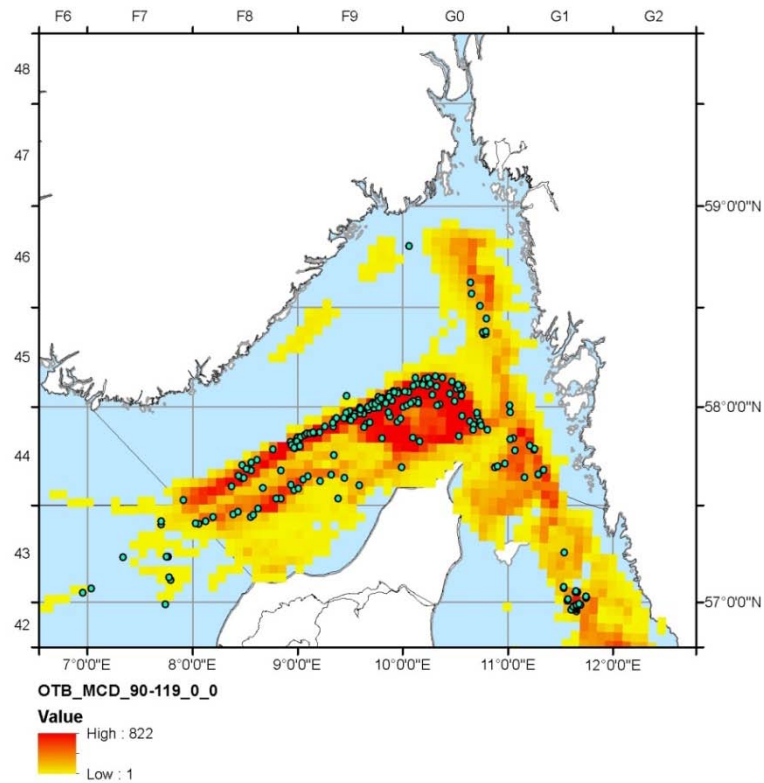


	Observed (20 or 3aN)	Total
Total number of vessels	0	37
Number of vessels with VMS	0	27
Number of trips	0	401
Mean days at sea	-	1.29

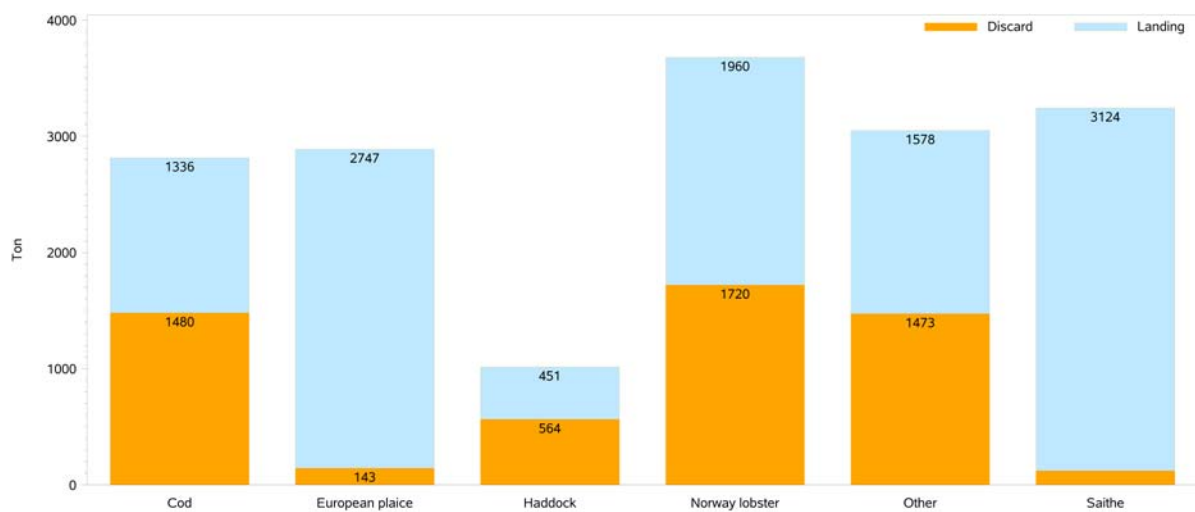


The Danish bottom trawl fishery targeting sandeel is in tons the largest fishery in Skagerrak. The fishery starts normally the 1<sup>st</sup> of April and last to 1<sup>st</sup> of August in years with high catches. In the beginning of the season it is mainly smaller fish and later in the season the fish is getting larger. A large self-sampling program is used in this fishery.

Skagerrak: Bottom otter trawl targeting mixed crustaceans and demersal (OTB\_MCD\_90-119\_0\_0)

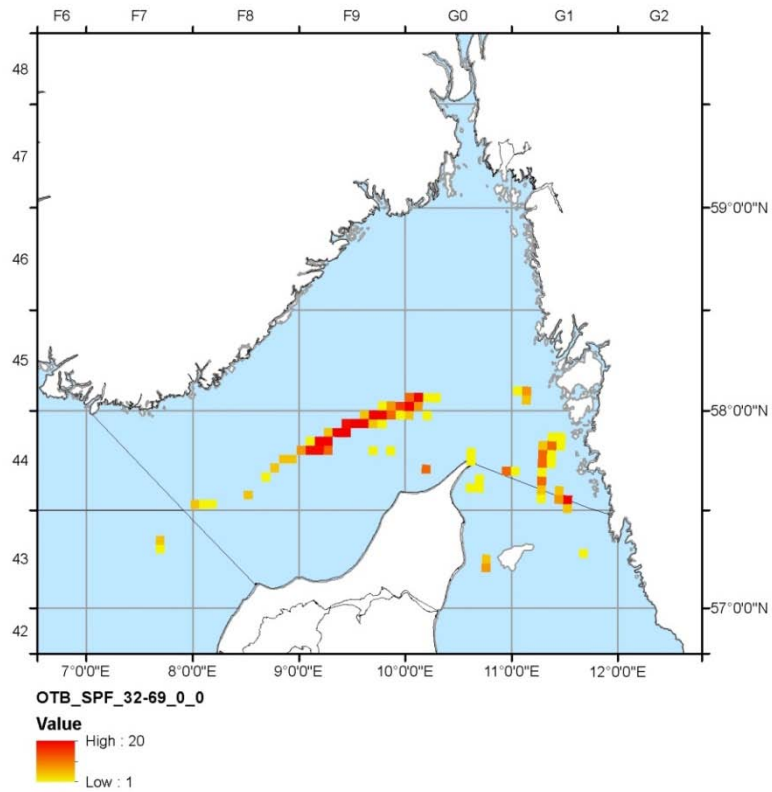


	Observed (20 or 3aN)	Total
Total number of vessels	16	155
Number of vessels with VMS	14	111
Number of trips	26	7739
Mean days at sea	3.27	1.87



The Danish bottom trawl fishery for mixed crustaceans and demersal fish is at present the most important fishery by value in Skagerrak. Compared to Kattegat the fishery in Skagerrak is more mixed with many by-catch species. The main part (>70%) of the fleet has VMS.

Skagerrak: Bottom otter trawl targeting small pelagic species (OTB\_SPF\_32-69\_0\_0)

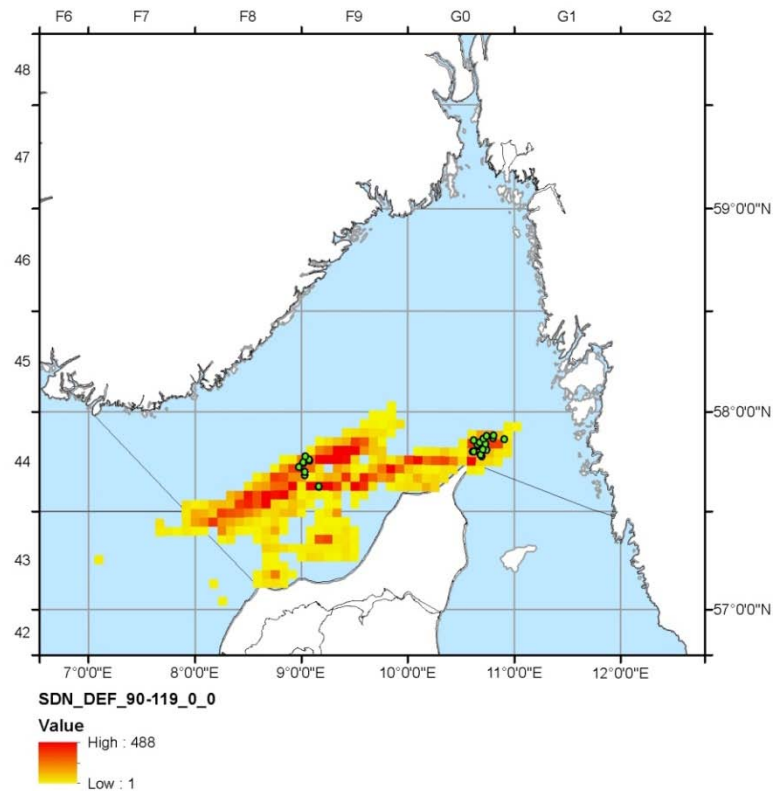


	Observed (20 or 3aN)	Total
Total number of vessels	0	10
Number of vessels with VMS	0	10
Number of trips	0	48
Mean days at sea	-	2.35

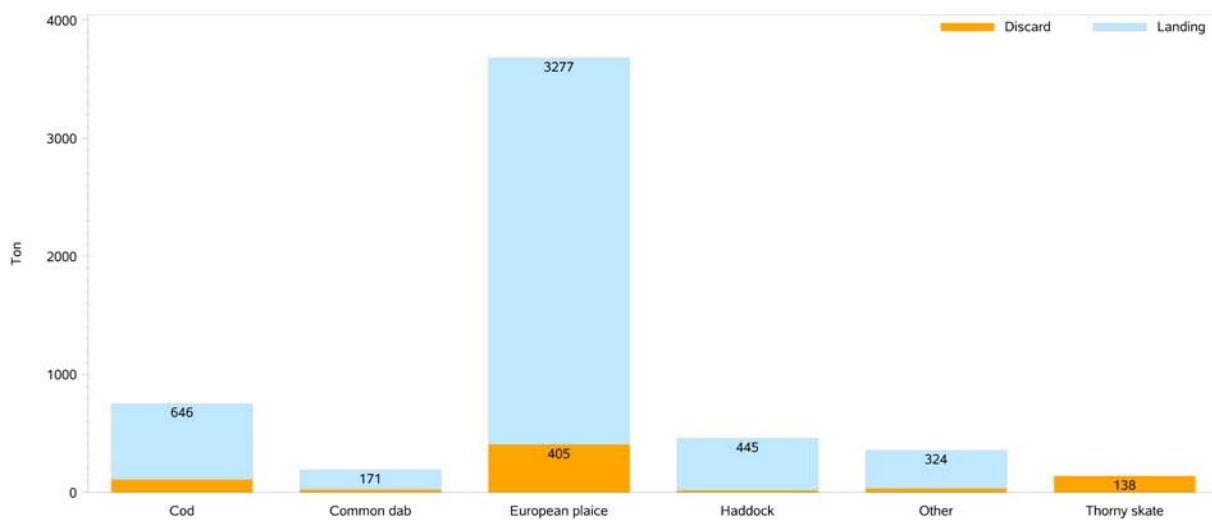


The fishery is mainly herring fishery (landings constitute 98% of herring). The majority of the landings are for human consumption but there are also landings for industrial purposes. The fishery is conducted all year around but is less intense during summer.

Skagerrak: Anchored seine, targeting demersal fish (SDN\_DEF\_90-119\_0\_0)



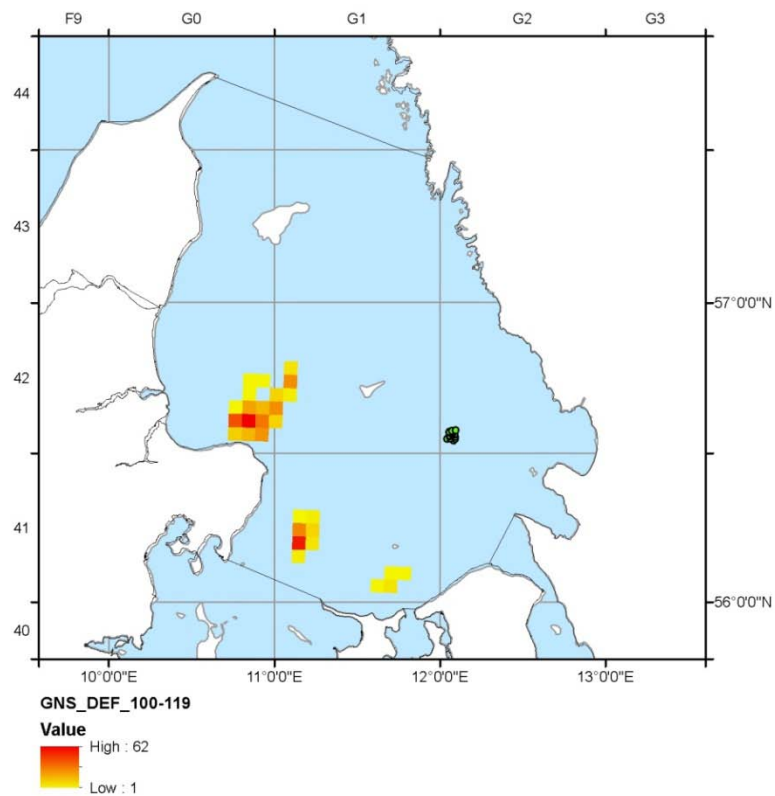
	Observed (20 or 3aN)	Total
Total number of vessels	4	28
Number of vessels with VMS	4	16
Number of trips	7	2077
Mean days at sea	1.57	1.34



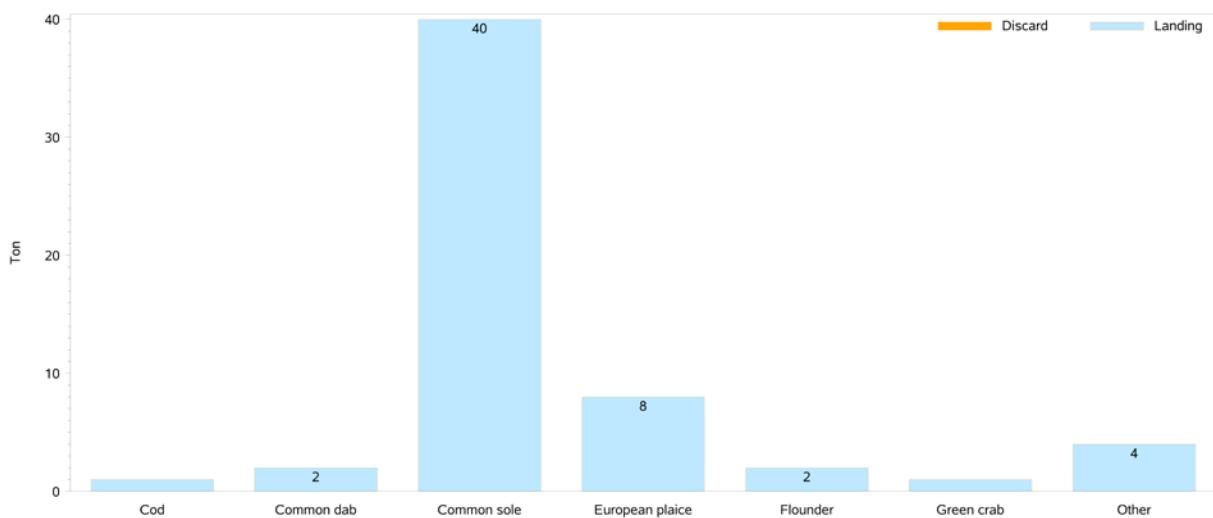
The Danish Seine fishery in Skagerrak is similar to the bottom trawl fishery targeting a mix of species, however compared to the trawlers the plaice is the species of highest value in the Seine fishery. More than half of the vessels have VMS.

## Kattegat subdivision 21 - 3AS

Kattegat: Demersal Set gillnet (GNS\_DEF\_100-119\_0\_0)



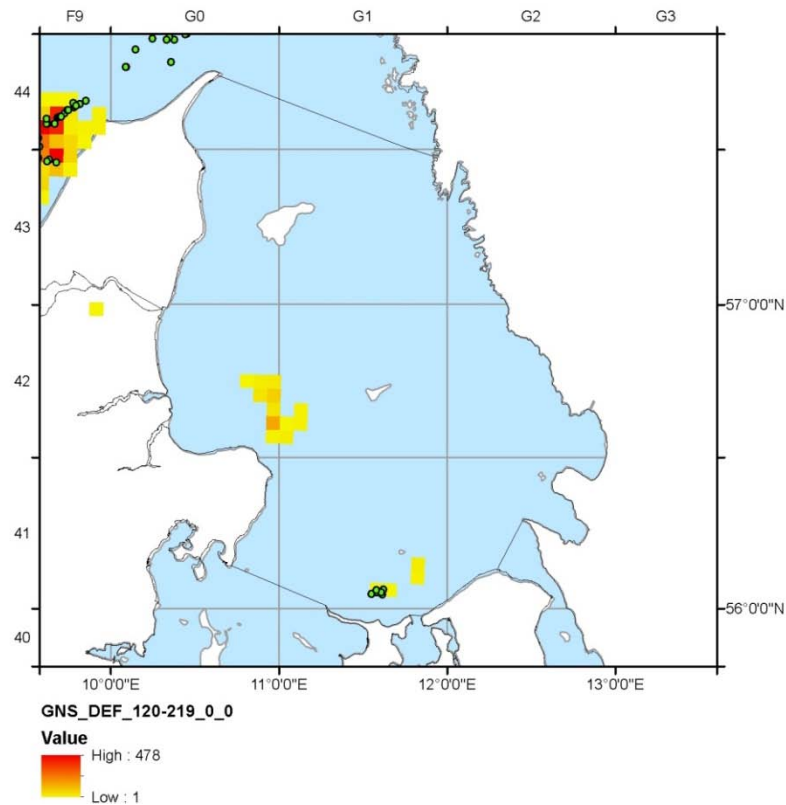
	Observed (21 or 3aS)	Total
Total number of vessels	1	30
Number of vessels with VMS	0	2
Number of trips	1	568
Mean days at sea	4	1.47



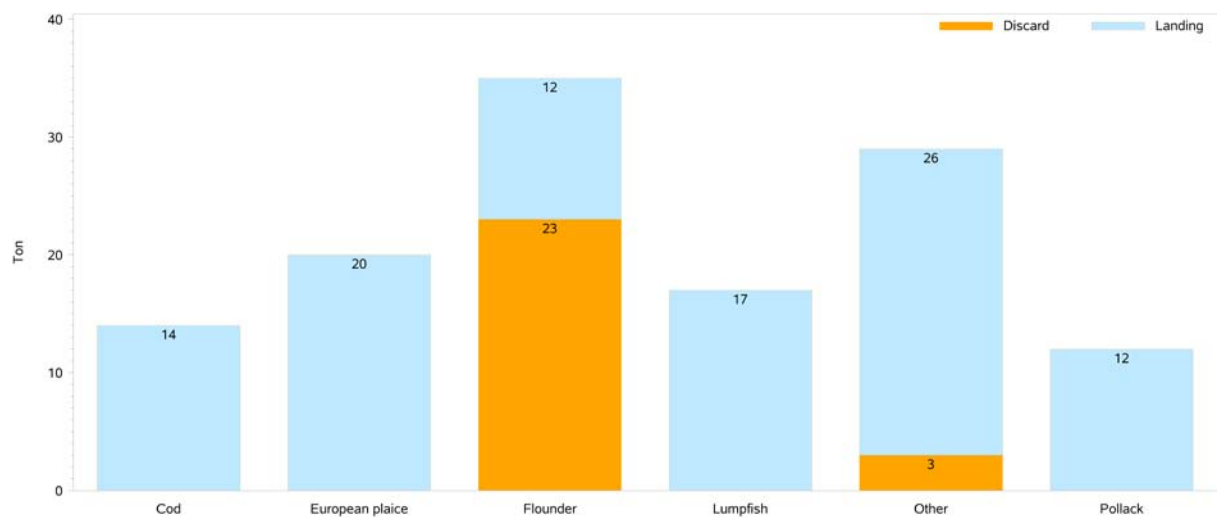
This is a small scale gillnet fishery conducted on relatively small vessels. Less than 7% of the fleet has VMS. Discard is not calculated for this métier due to low level of sampling.



Kattegat: Demersal Set gillnet (GNS\_DEF\_120-219\_0\_0)

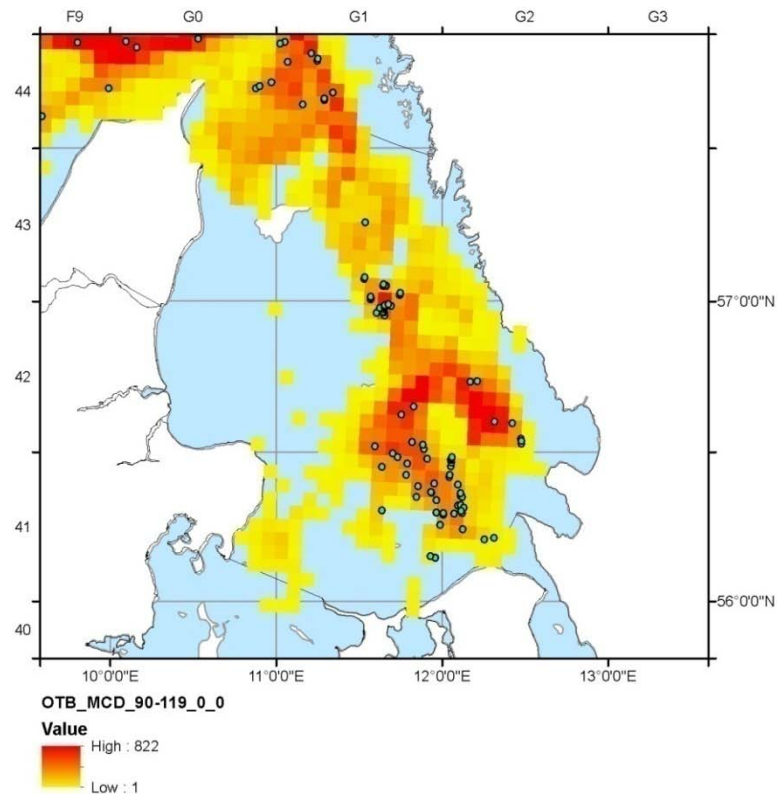


	Observed (21 or 3aS)	Total
Total number of vessels	1	38
Number of vessels with VMS	0	2
Number of trips	2	415
Mean days at sea	1	1.16

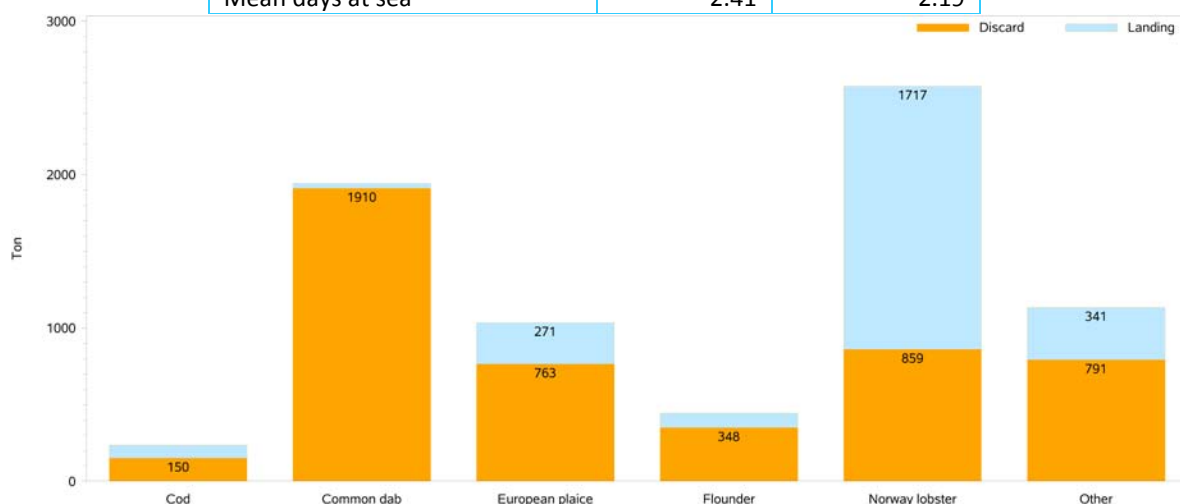


This fishery is a small scale gillnet fishery, where less than 6% has VMS and is a very mixed fishery. Plaice and lumpfish accounted for the largest part in weight of the landings and flounder for the main discard.

Kattegat: Bottom otter trawl targeting mixed crustaceans and demersal (OTB\_MCD\_90-119\_0\_0)

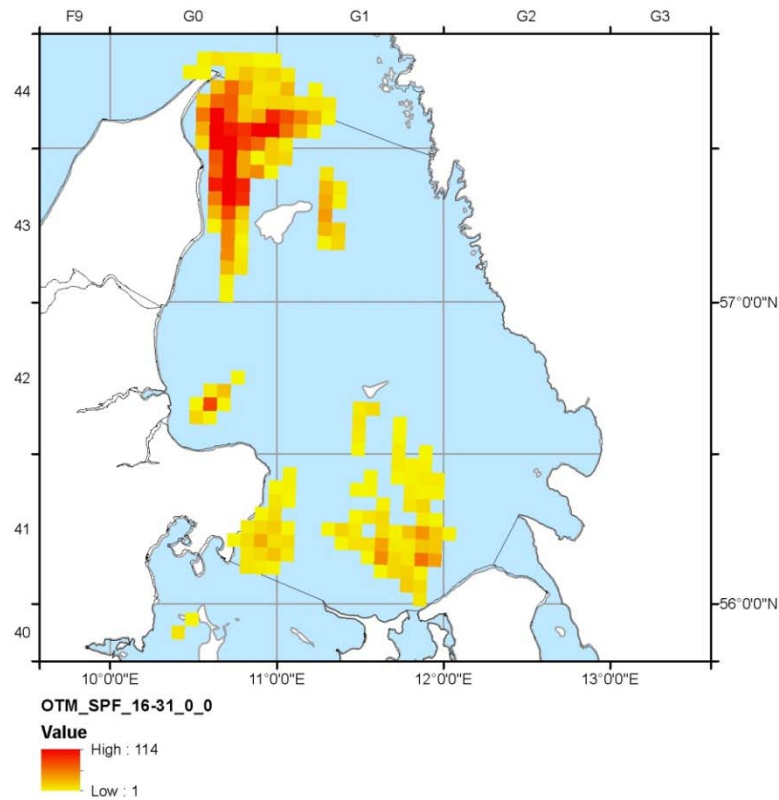


	Observed (21 or 3aS)	Total
Total number of vessels	7	133
Number of vessels with VMS	4	71
Number of trips	22	7251
Mean days at sea	2.41	2.19

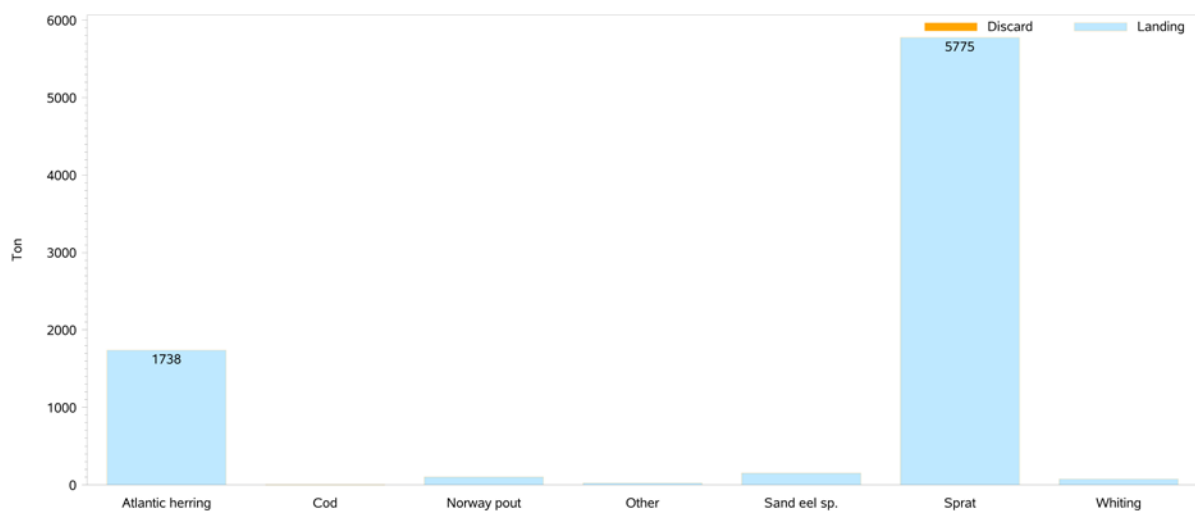


The Danish bottom trawl fishery is at present the most important fishery in Kattegat, the *Nephrops* are the most important target species; however some demersal fish species are also of great importance, especially sole. In Kattegat a large area in the South Eastern part has since 2009 been permanently closed for fishery to protect the Kattegat cod. However in the regulation there is a possibility to target crustaceans within the closed area if a selection device is used. For some species the discard is rather large: dab, plaice and *Nephrops*. More than 50% of the fleet has VMS.

Kattegat: Otter trawl midwater, targeting small pelagic species (OTM\_SPF\_16-31\_0\_0)

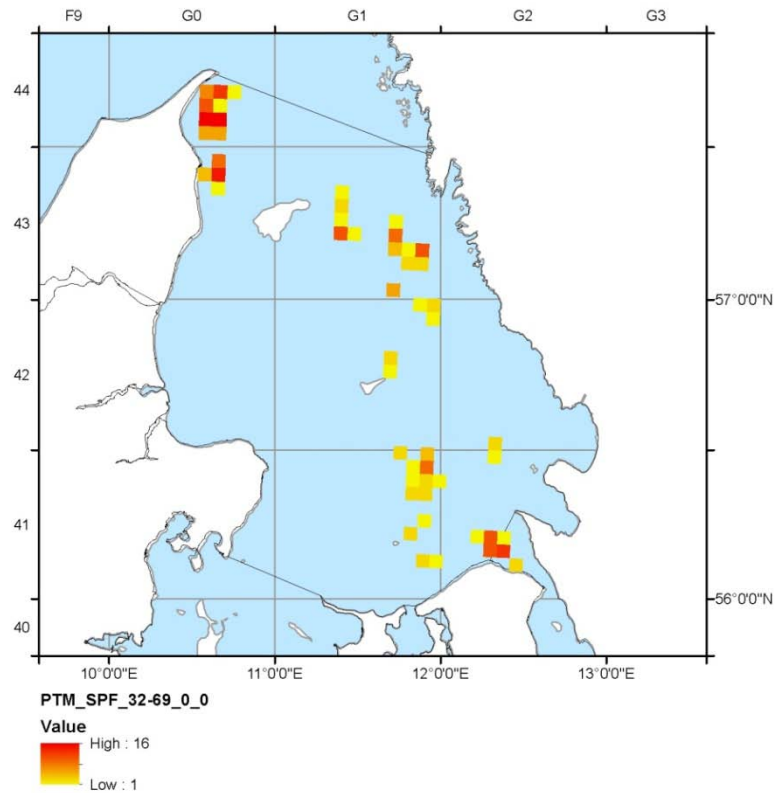


	Observed (21 or 3aS)	Total
Total number of vessels	0	19
Number of vessels with VMS	0	13
Number of trips	0	467
Mean days at sea	-	1.13



This fishery is mainly a sprat fishery, with a relatively large by-catch of herring. 68% of the fleet has VMS. No discard sampling is conducted in the métier.

Kattegat: Pair trawl midwater, targeting small pelagic species (PTM\_SPF\_32-69\_0\_0)

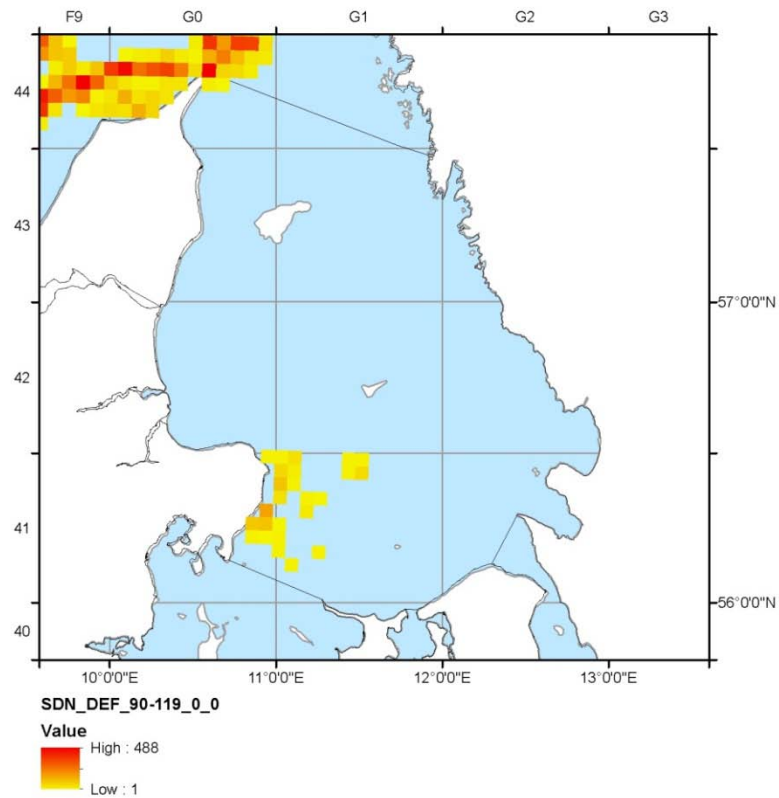


	Observed (21 or 3aS)	Total
Total number of vessels	0	8
Number of vessels with VMS	0	8
Number of trips	0	95
Mean days at sea	-	2.18

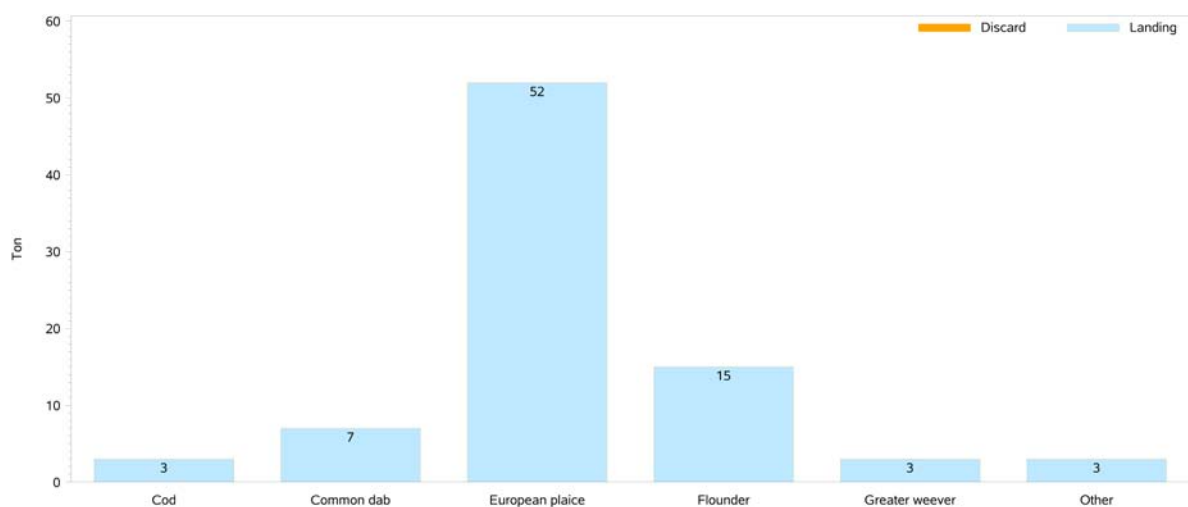


This fishery is mainly a herring fishery, with a relatively large by-catch of sprat. The total fleet has VMS. No discard sampling is conducted in the métier.

Kattegat: Anchored seine, targeting demersal fish (SDN\_DEF\_90-119\_0\_0)



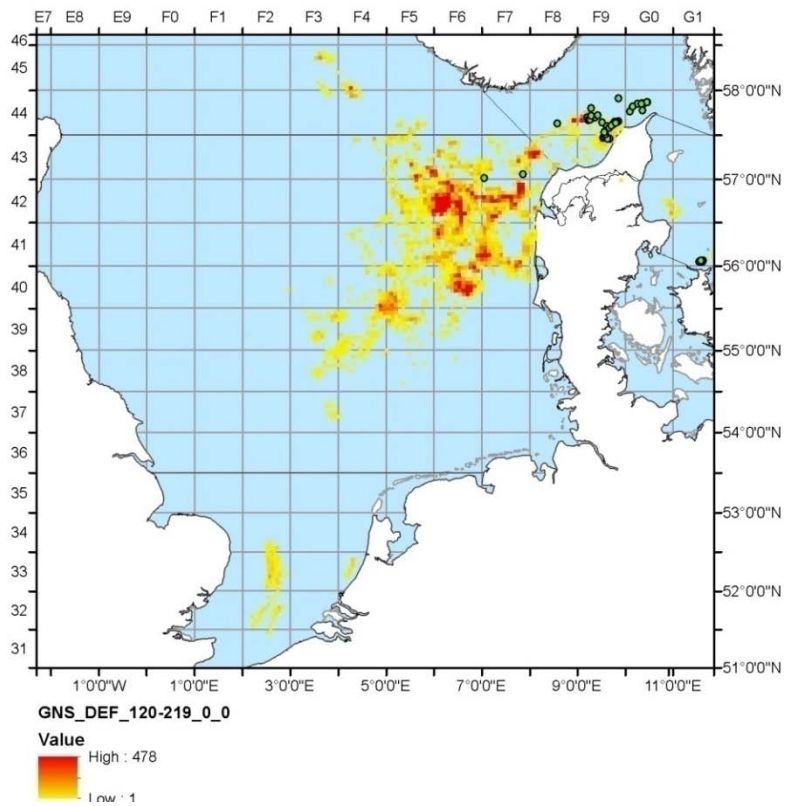
	Observed (21 or 3aS)	Total
Total number of vessels	0	9
Number of vessels with VMS	0	4
Number of trips	0	114
Mean days at sea	-	1.27



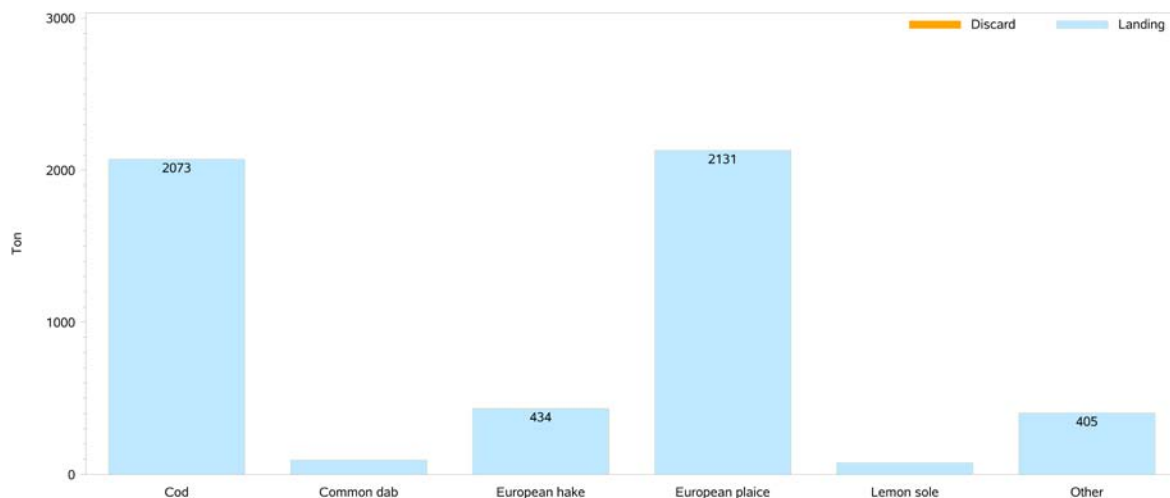
The Danish Seine fishery in Kattegat is very small, targeting demersal fish and is a very mixed fishery. Discard is not calculated for this métier due to low level of sampling and less than 50% of the fleet has VMS.

## North Sea- area IV

North Sea: Demersal Set gillnet (GNS\_DEF\_120-219\_0\_0)

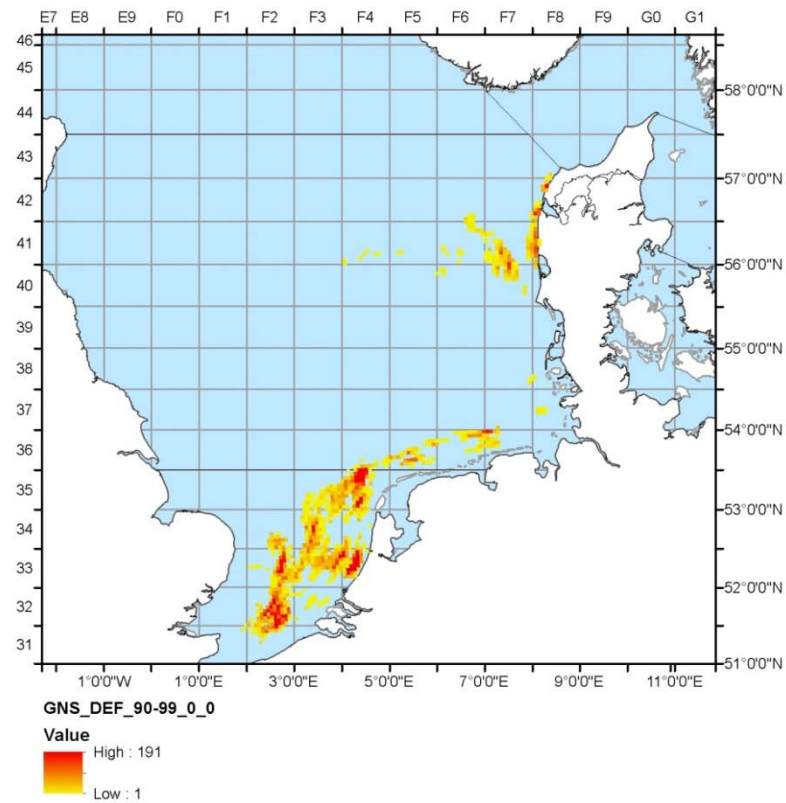


	Observed (IV)	Total
Total number of vessels	1	127
Number of vessels with VMS	0	24
Number of trips	1	3113
Mean days at sea	2	1.8

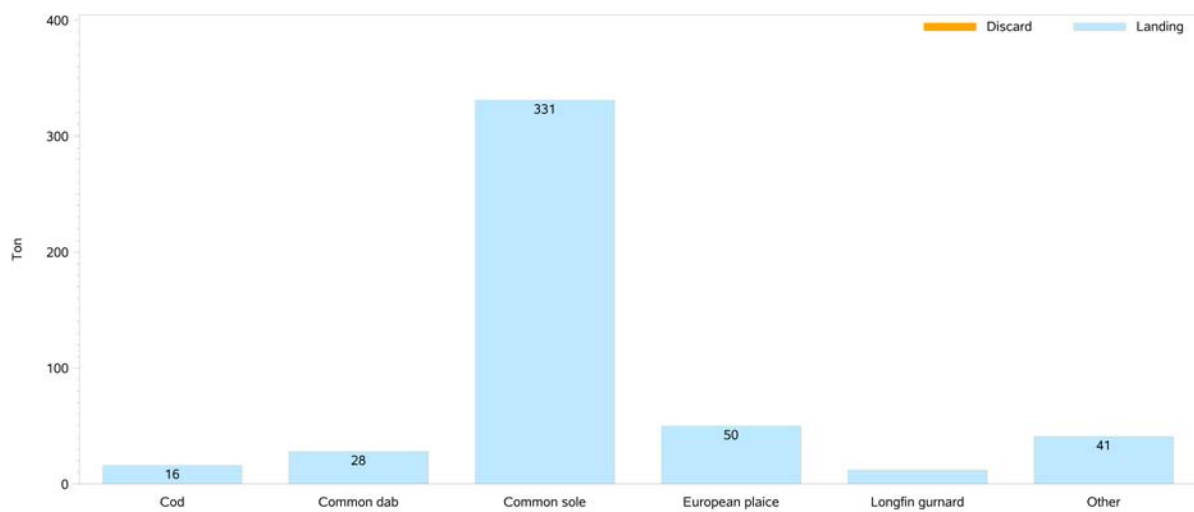


This is a very mixed fishery targeting cod and plaice as the main species. Also hake, dab, and lemon sole were landed in this métier. The fishery is conducted in relatively small vessels with 1-2 day trips and less than 20% of the fleet has VMS. Discard is not calculated due to low level of sampling.

## North Sea: Demersal Set gillnet (GNS\_DEF\_90-99\_0\_0)

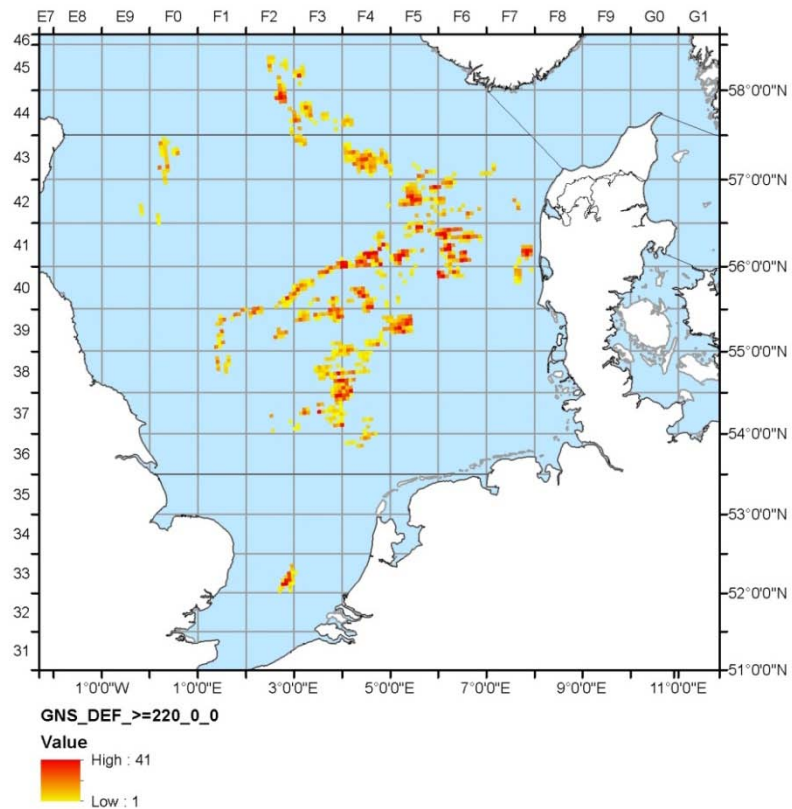


	Observed (IV)	Total
Total number of vessels	0	58
Number of vessels with VMS	0	18
Number of trips	0	624
Mean days at sea	-	2.88

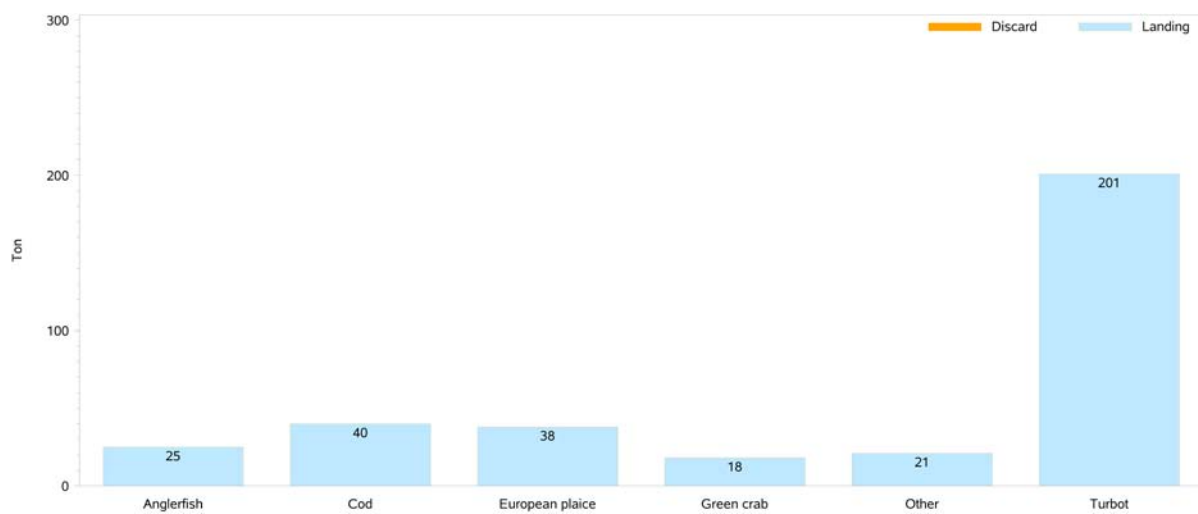


This is a relatively small mixed gillnet fishery targeting mainly flatfish as sole, plaice and dab. Only 30% of the fleet has VMS.

North Sea: Demersal Set gillnet (GNS\_DEF\_>=220\_0\_0)



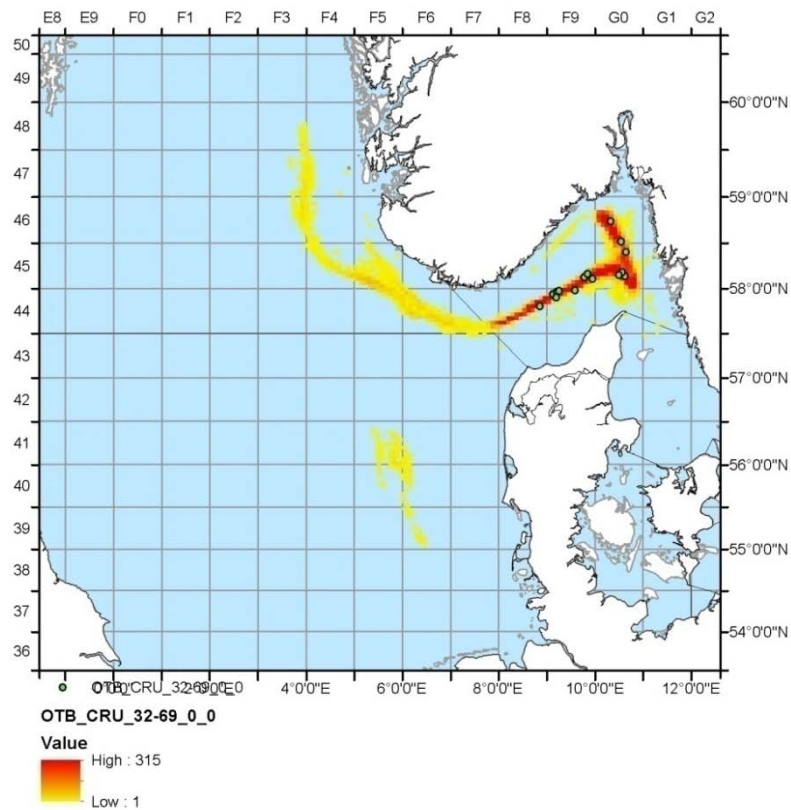
	Observed (IV)	Total
Total number of vessels	0	36
Number of vessels with VMS	0	11
Number of trips	0	334
Mean days at sea	-	2.18



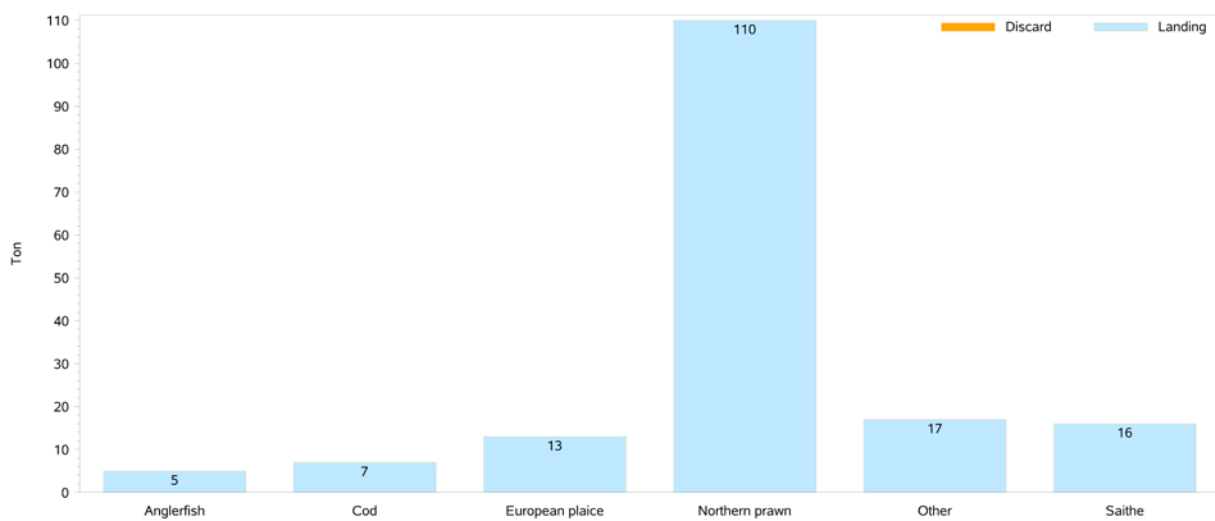
This is small scale turbot gillnet fishery; however plaice, cod, anglerfish and crab are caught as by-catch. 30% of the fleet has VMS.



North Sea: Bottom otter trawl targeting Crustaceans (OTB\_CRU\_32-69\_0\_0)

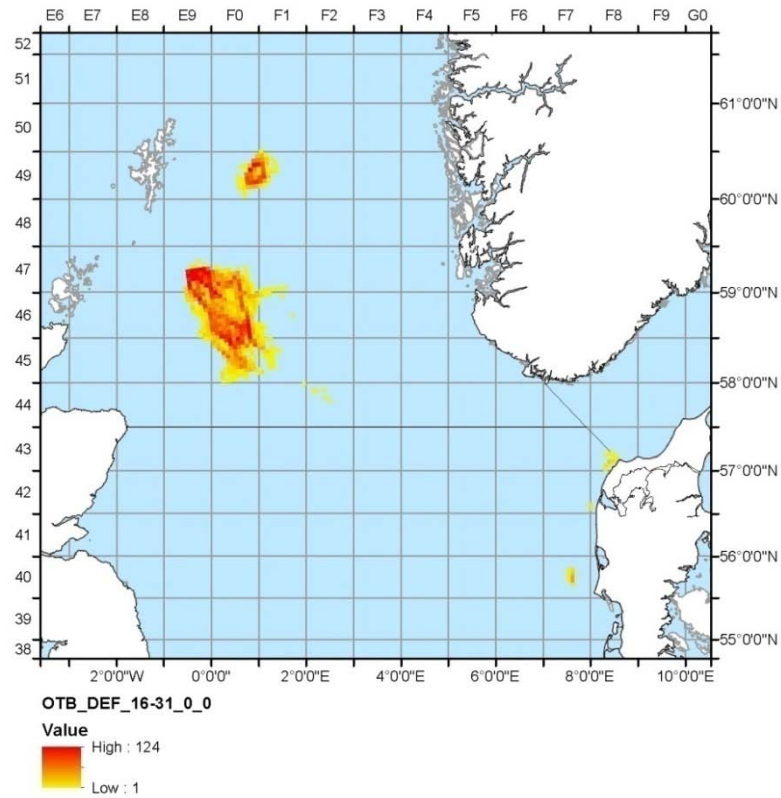


	Observed (IV)	Total
Total number of vessels	0	4
Number of vessels with VMS	0	4
Number of trips	0	67
Mean days at sea	-	5.25

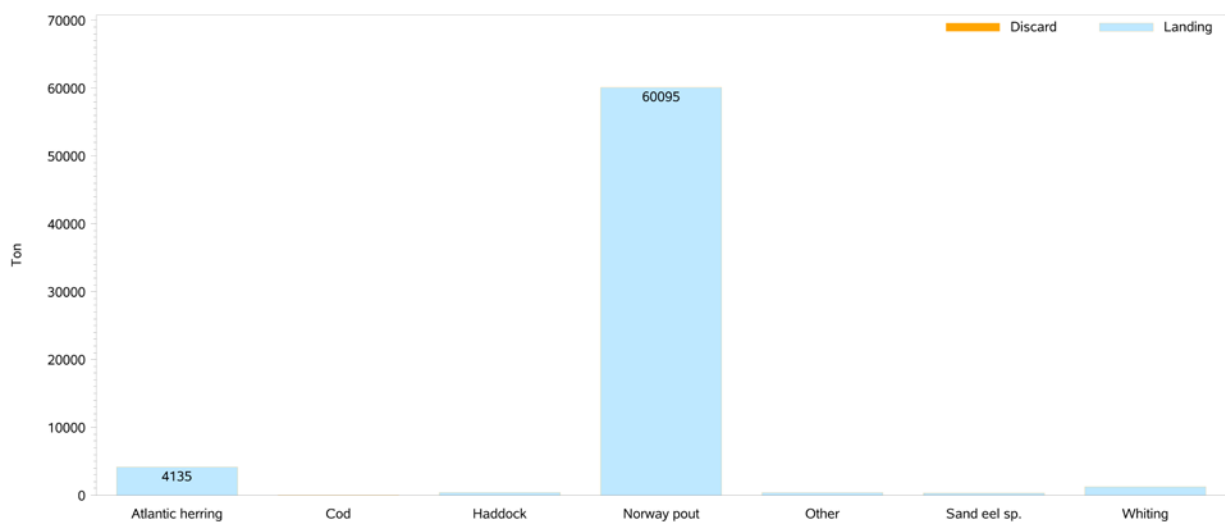


The deep water shrimp fishery is mainly conducted in Skagerrak. However a smaller part of the fishery is also in the North Sea in the deep water.

North Sea: Bottom otter trawl targeting demersal fish (OTB\_DEF\_16-31\_0\_0)

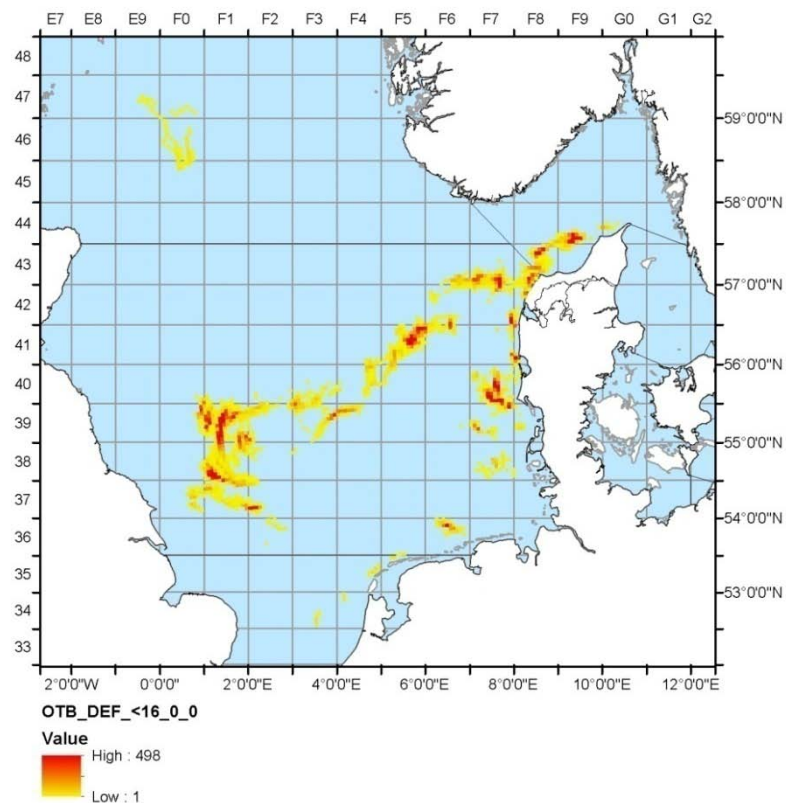


	Observed (IV)	Total
Total number of vessels	0	21
Number of vessels with VMS	0	21
Number of trips	0	123
Mean days at sea	-	8.41



This fishery is an offshore Norway pout fishery with were large landings in some years. All vessels have VMS. There is no discard sampling for this métier.

## North Sea: Bottom otter trawl targeting demersal fish (OTB\_DEF\_<16\_0\_0)

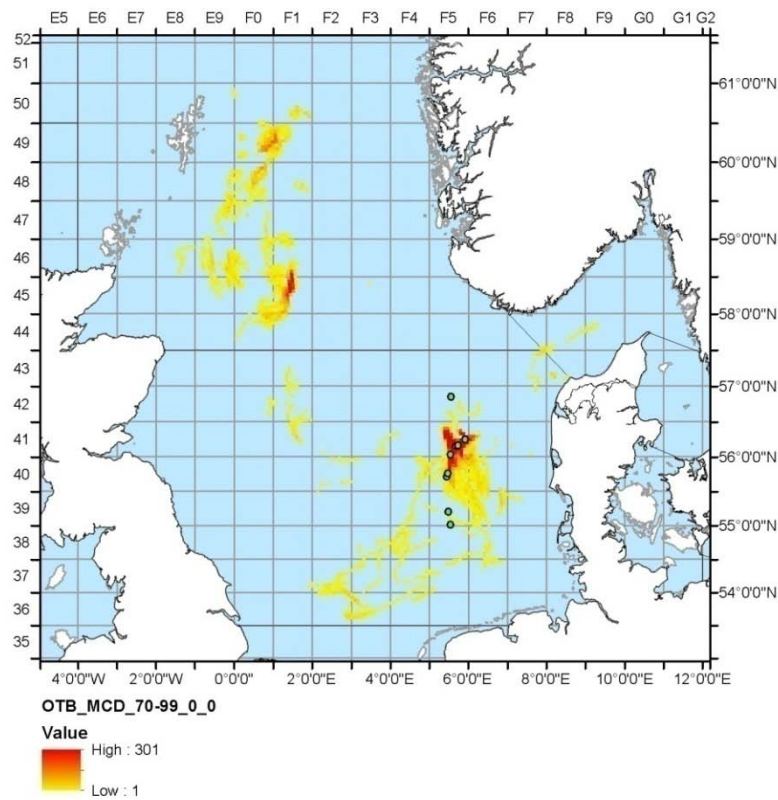


	Observed (IV)	Total
Total number of vessels	0	81
Number of vessels with VMS	0	68
Number of trips	0	1119
Mean days at sea	-	3.42

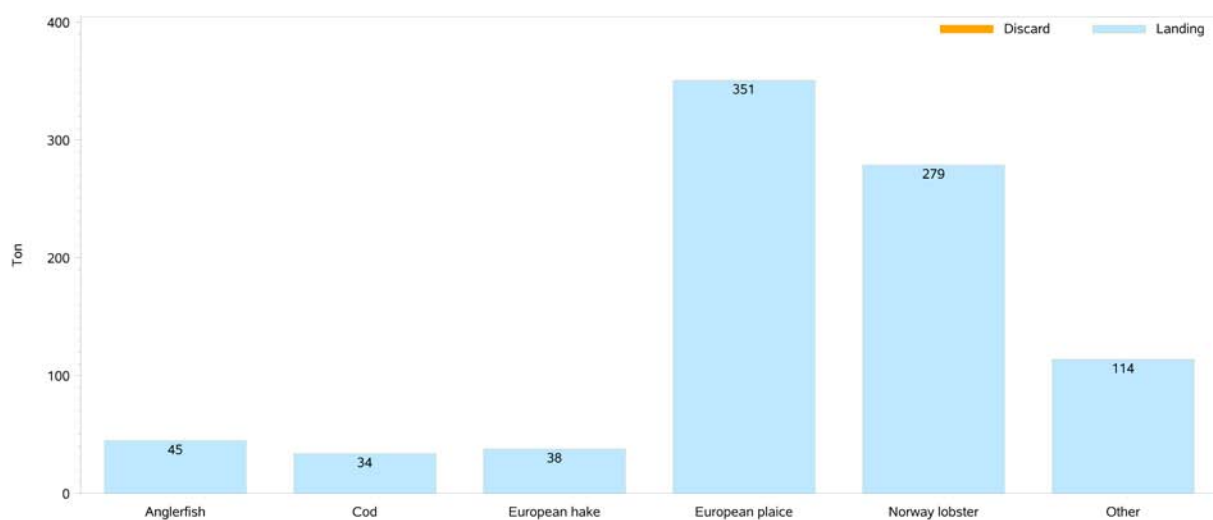


The Danish bottom trawl fishery targeting sandeel is in tons the largest fishery in Denmark. The fishery starts the 1<sup>st</sup> of April with high catches of smaller fish and ends 1<sup>st</sup> of August with catches of larger fish. The species is sampled in three different ways 1) By harbor samples 2) real-time samples and 3) fisherman samples.

North Sea: Bottom otter trawl targeting mixed crustaceans and demersal (OTB\_MCD\_70-99\_0\_0)

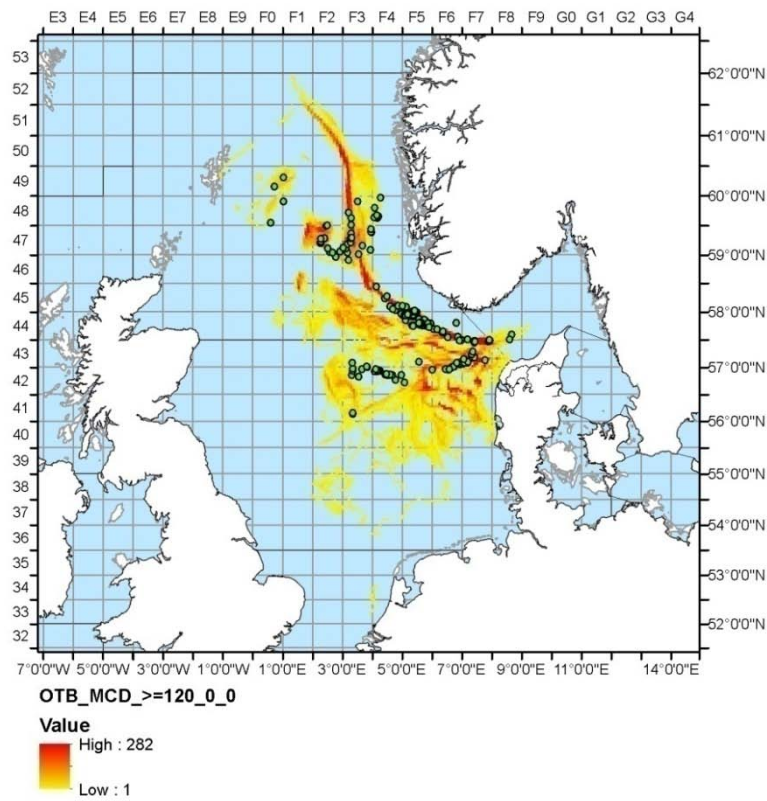


	Observed (IV)	Total
Total number of vessels	1	14
Number of vessels with VMS	1	14
Number of trips	1	127
Mean days at sea	5	7.43

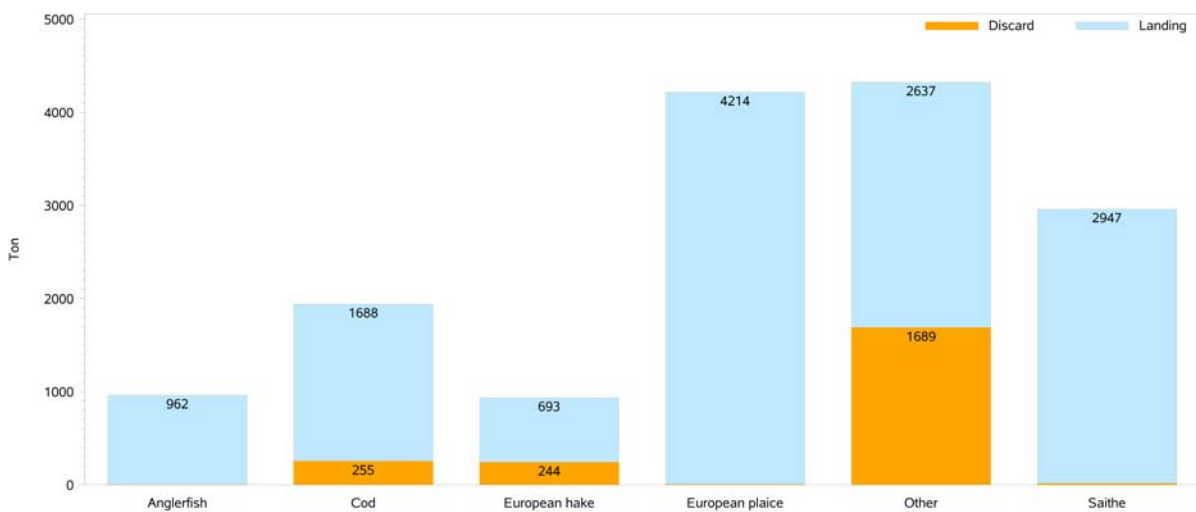


Discard is not calculated for this métier due to low sampling level. The fishery is a mixed fishery mainly targeting *Nephrops* fishery with some by-catches. All vessels have VMS.

North Sea: Bottom otter trawl targeting mixed crustaceans and demersal (OTB\_MCD\_>=120\_0\_0)

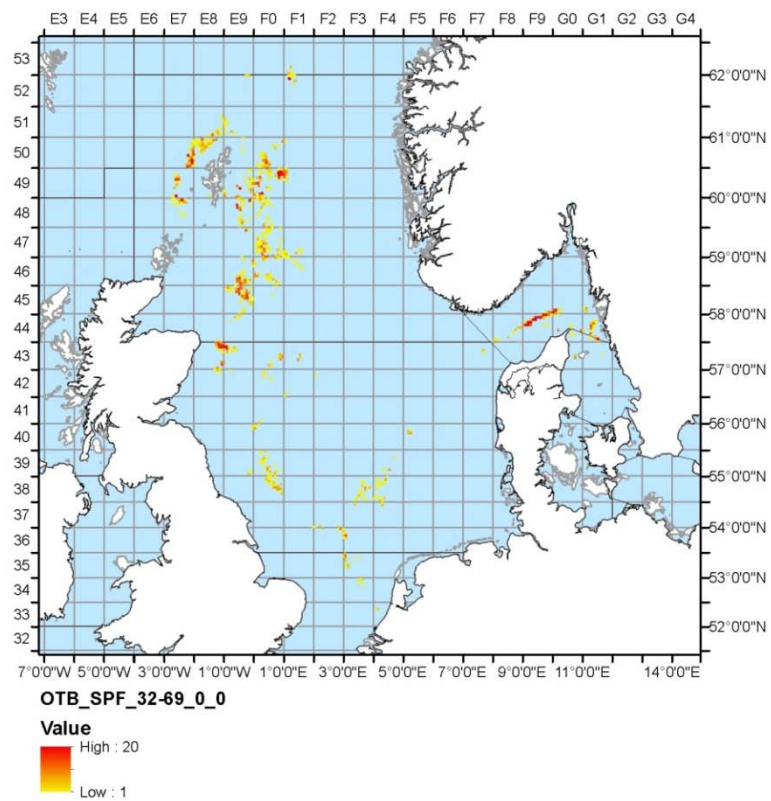


	Observed (IV)	Tobias
Total number of vessels	7	75
Number of vessels with VMS	7	53
Number of trips	11	1780
Mean days at sea	7.18	4.22

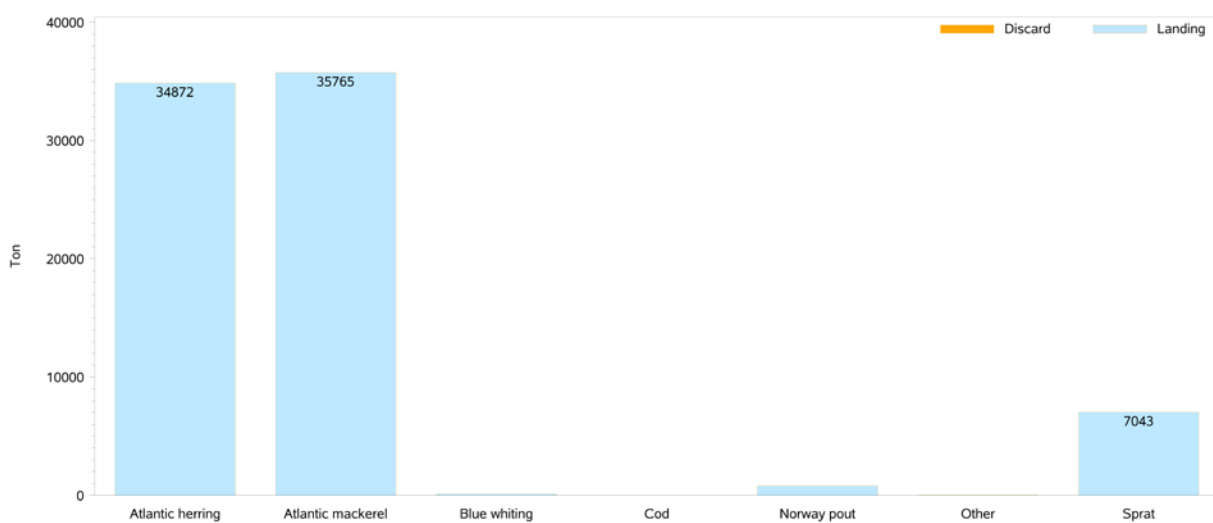


This trawl fishery is in the North Sea the second most important Danish fishery in value and is a very mixed fishery. Catch and discard is very dependent on season and 70% of the fleet has VMS.

North Sea: Bottom otter trawl, targeting small pelagic species (OTB\_SPF\_32-69\_0\_0)



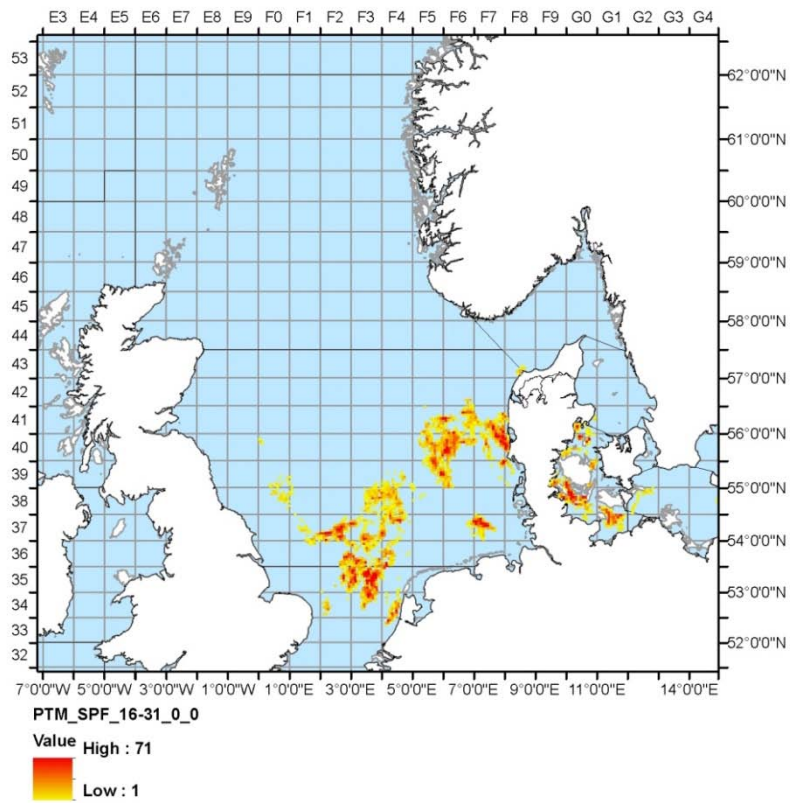
	Observed (IV)	Total
Total number of vessels	0	19
Number of vessels with VMS	0	14
Number of trips	0	224
Mean days at sea	-	3.43



The bottom trawl fishery targeting small pelagic fish in the North Sea is a mixed herring and mackerel fishery. There is no discard sampling from this métier. More than 70% of the fleet has VMS.



North Sea: Pair trawl midwater, targeting small pelagic species (PTM\_SPF\_16-31\_0\_0)

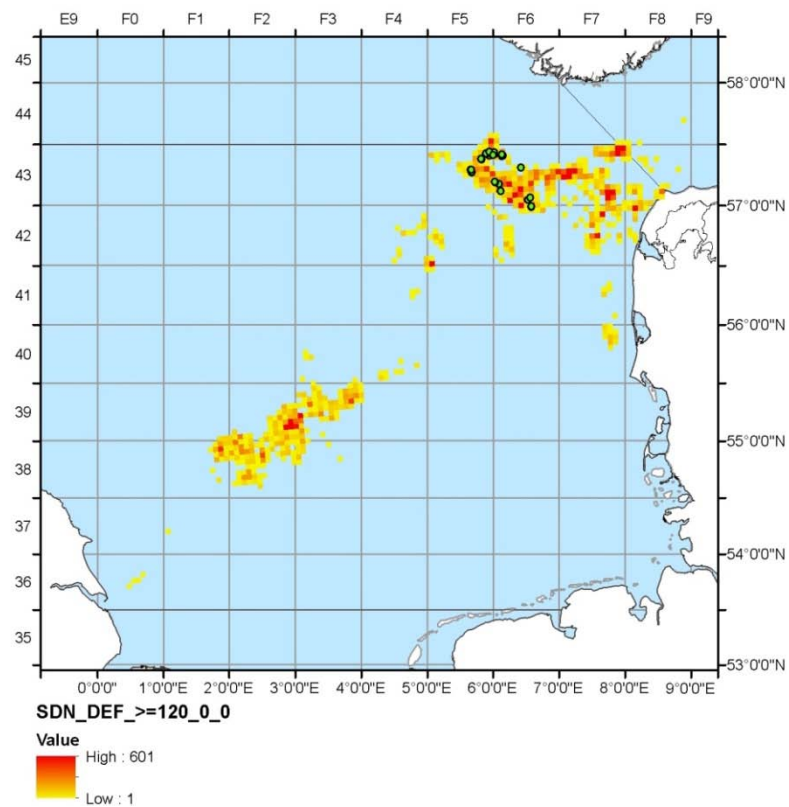


	Observed (IV)	Total
Total number of vessels	0	50
Number of vessels with VMS	0	44
Number of trips	0	513
Mean days at sea	-	3.82

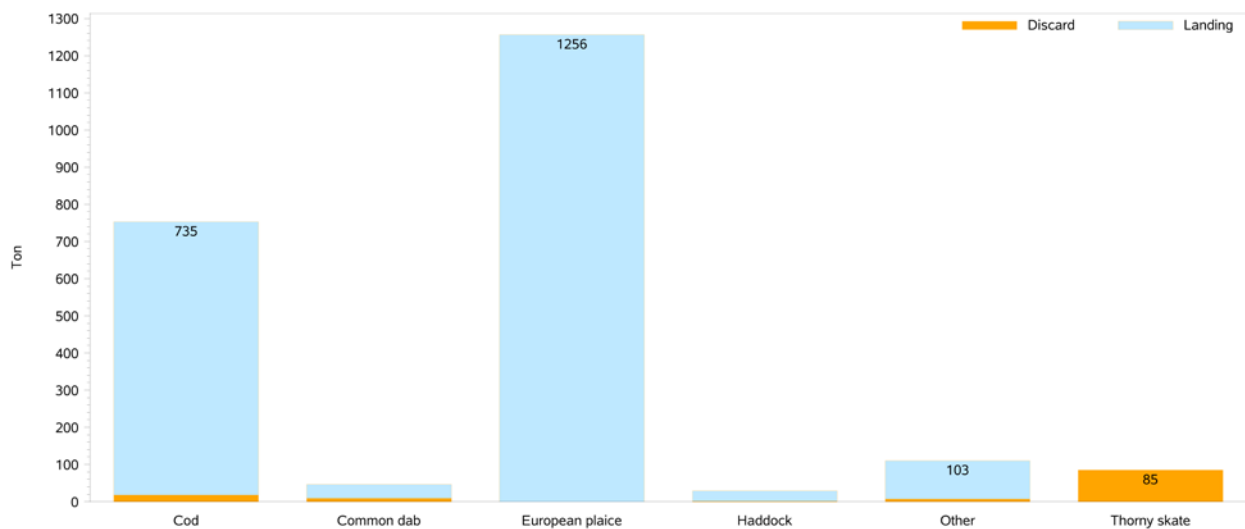


This métier is targeting sprat and mainly conducted in November – January where more than 90% of the catch is taken. The main part of the fleet has VMS.

North Sea: Anchored seine targeting demersal fish (SDN\_DEF\_>=120\_0\_0)



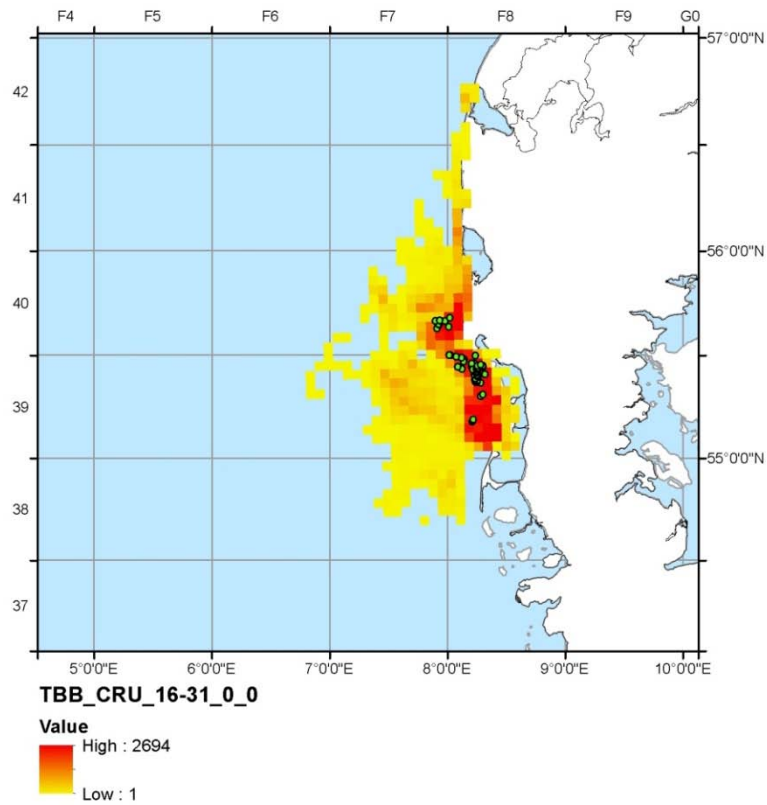
	Observed (IV)	Total
Total number of vessels	1	18
Number of vessels with VMS	1	16
Number of trips	2	360
Mean days at sea	4.5	3.59



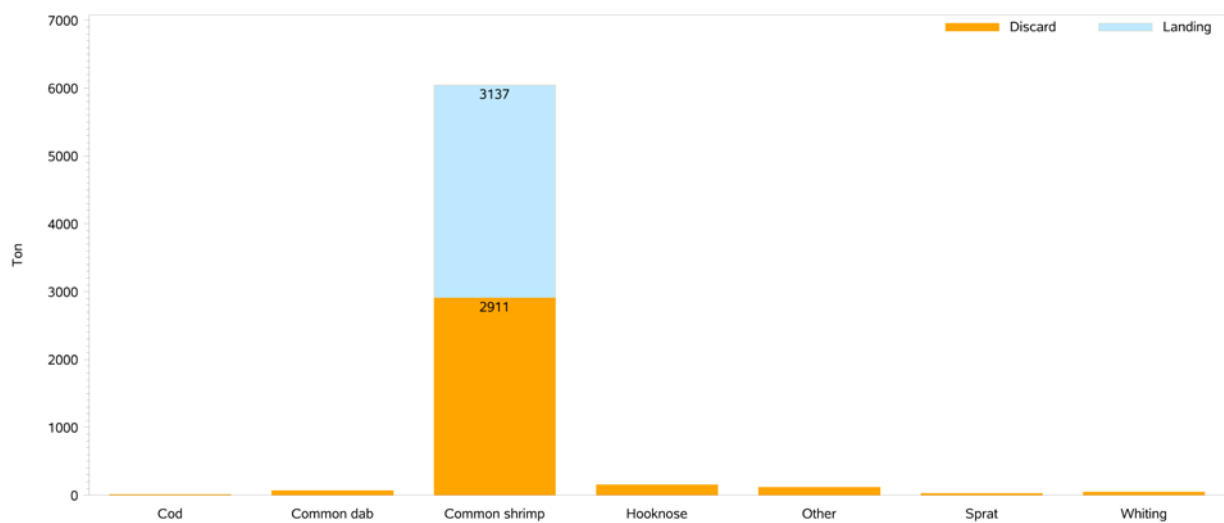
The Danish Seine fishery in the North Sea is a mixed fishery conducted in two areas with plaice and cod as the main target species. The main part of the fleet has VMS.



North Sea: Beam trawl targeting Crustaceans (TBB\_CRU\_16-31\_0\_0)



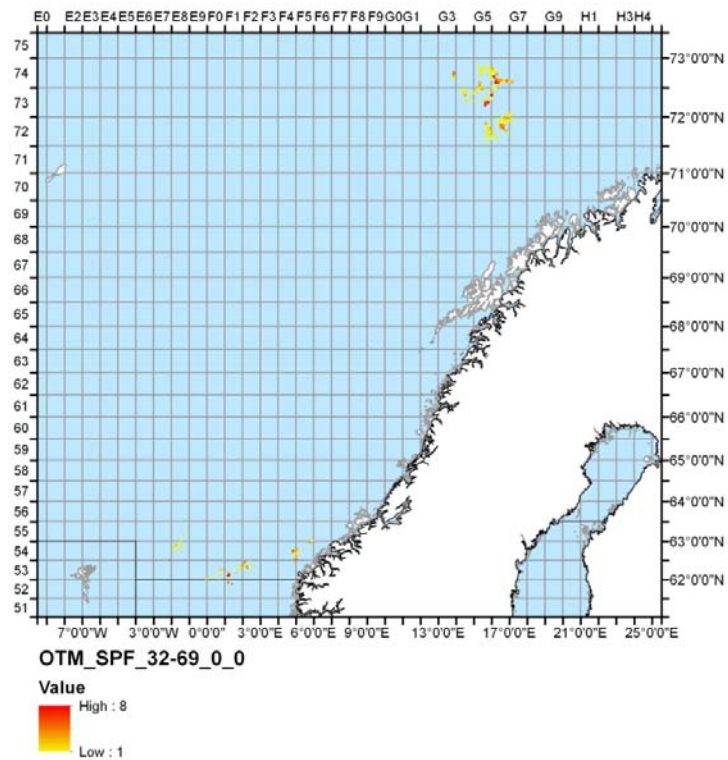
	Observed (IV)	Total
Total number of vessels	2	26
Number of vessels with VMS	2	26
Number of trips	3	1813
Mean days at sea	3.33	3.13



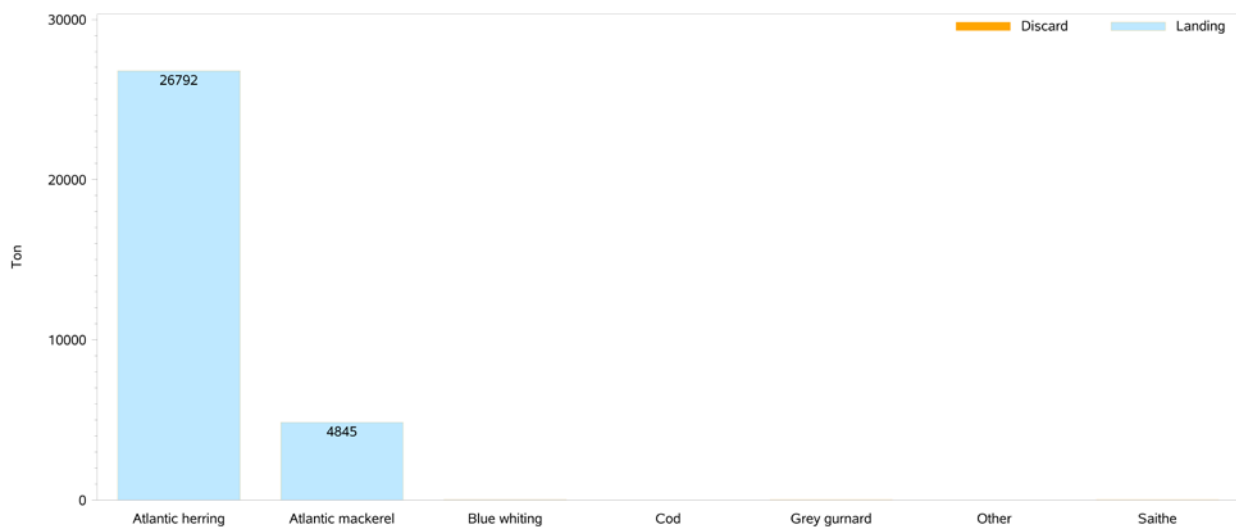
This métier is exclusively landing the brown shrimp. The whole fleet has VMS. The discard of brown shrimp is in the same magnitude as the landings.

## 1 + 2 (Eastern Arctic)

Area 1+2: Otter trawl midwater, targeting small pelagic species (OTM\_SPF\_32-69\_0\_0)



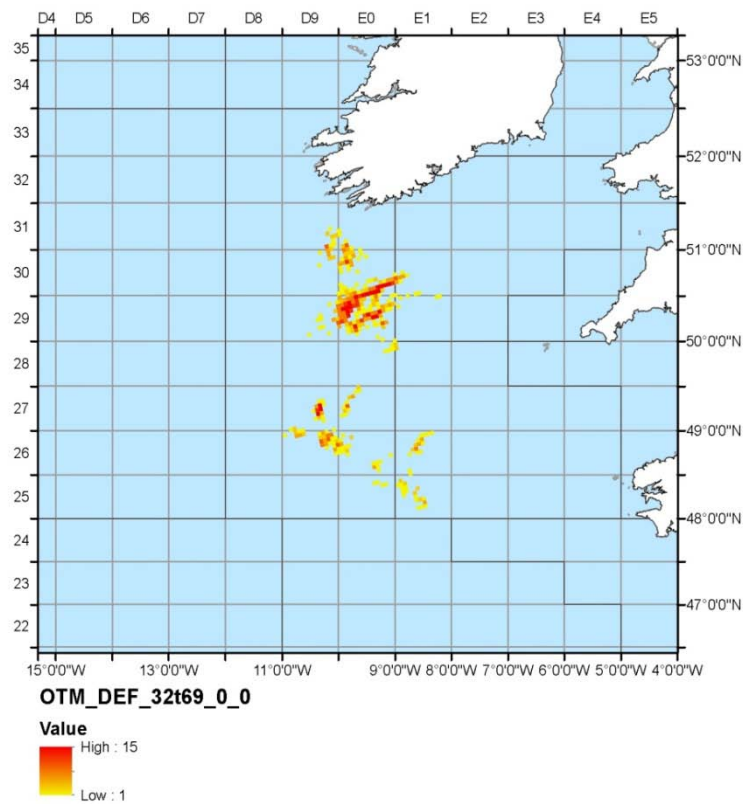
	Observed (1+2)	Non-observed
Total number of vessels	0	7
Number of vessels with VMS	0	7
Number of trips	0	35
Mean days at sea	-	7.11



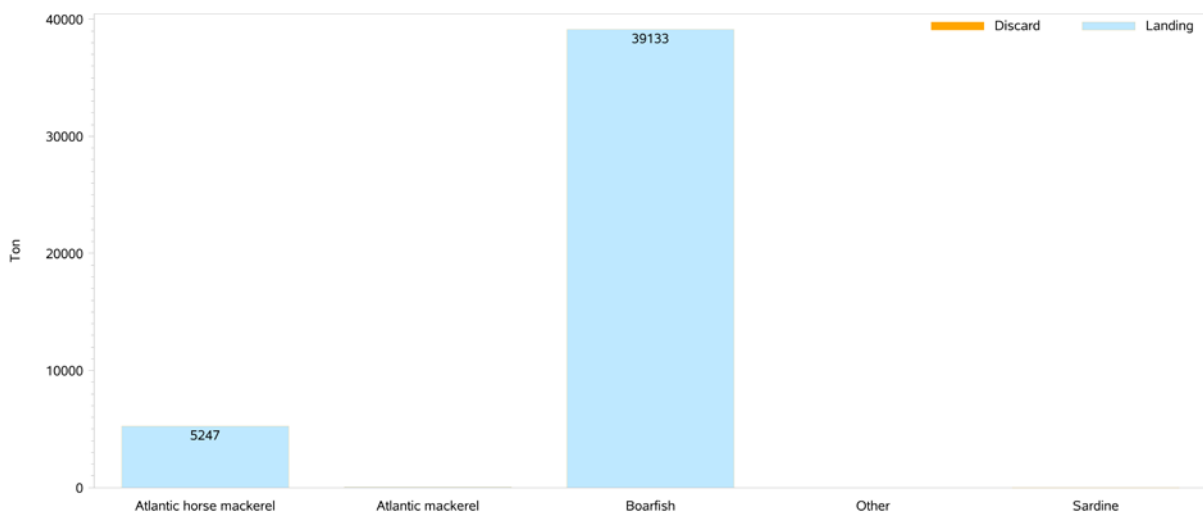
The Danish trawl fishery targeting small pelagic fish in the North East Atlantic (I and II) is a herring and mackerel fishery. No discard data are available for this métier and the whole fleet has VMS.

## North East Atlantic

North East Atlantic: Otter trawl midwater, targeting small pelagic species (OTM\_SPF\_32-69\_0\_0)



	Observed (NE Atlantic)	Non-observed
Total number of vessels	0	7
Number of vessels with VMS	0	7
Number of trips	0	36
Mean days at sea	-	11.22



The fishery targeting Boarfish is a relatively new fishery with the main fishery in 1<sup>st</sup> quarter. There is no discard data for this métier and the whole fleet had VMS.

## Catch Quota Management Program

In 2008 the Danish Government suggested that the revised CFP should follow the requirement that the fisherman accounts for the total removal of fish from the resource rather than the landed catches.

By introducing full accountability catch-quotas system instead of landing quotas the fisherman's incentive to optimize the value by using selective fishing methods would reduce discarding and thereby the total removals from the stocks. To achieve this objective the fisherman should receive increased quotas "catch-quotas" to reflect that all fish is accounted for. A catch quota management system has to be followed by a fully documented fishery to ensure that the total catch is accounted for.

In order to test whether a Catch Quota Management (CQM) system could work and whether a full documentation of the fisheries could be made by the use of electronic monitoring systems a scientific trial was successfully carried out in 2008-2011. The latter trials focused mainly on a concrete management and monitoring context where the purpose of the projects was to assess the catch-quota system's workability in a fisheries management environment and its potential to account for all catches, reduce discards, provide better scientific data and encourage fishermen to fish more selectively through catch-quotas using sensor and camera technology.

"Full documented fishery" is in this context means:

- Detailed recordings in the logbook: Date, time and position of setting the gear, time and position of hauling the gear, total catch in weight, weight of retained part of the catch by species, total weight of discarded cod, length measurement of discarded cod, weight of discard of other species
- Electronic monitoring systems with various sensors and CCTV cameras are recording fishing events and catch handling operations. By using sensor recordings and video footage retrospective, examination of fishing operations makes it possible to verify the fisherman's logbook recordings.

### Data verification

For each fishing trip on average 10% of the fishing events is selected for video footage analysis. The estimated discards of both cod and other species are analyzed as well as whether possible high-grading has taken place. The observer estimated discards are also compared to the discard data recorded in the logbook.

On most vessels the CCTV footage is considered reliable as the vessels have a size and design of the fish handling area that is easily monitored by the cameras. Smaller vessels have in some cases blind angles which can be compensated for by installing additional cameras. More cameras will, however, require more space on the hard disk. The new version of the REM systems can handle 8 cameras and the hard drives can store more than 1 TB. In the future the issue of blind angles and hard drive capacity should not pose a problem.

## Result from Catch Quota Management

Data from the vessels participating in the Danish CQM trials in 2010 origins from more than 302 trips which together constitute more than 20.000 hours at sea (table 2 below). More than 16.000 hours of fishing has been carried out during the 2010 trial. Time gaps in the data where the REM system is not functioning at sea has been 2.7% in 2010.

Table2. Data collected during the CQM trials in 2010

CQM trial	2010
No. Vessels	7
No. Trips	302
Time at sea (hrs.)	20677
No. Hauls	2973
Fishing time (hrs.)	16289
Time gaps in Video (hrs.)	558
Time gaps (%)	2,7
No. Hauls analysed (Image)	249

The CQM trial vessels have been fishing in the North Sea and the Skagerrak and a comparison can be made between these vessels and a group of vessels (reference vessels) fishing in the same areas with the same gear type and mesh size. The comparison is made time and area specific but also in a broader perspective to ensure that all the landings for the relevant reference vessels are covered i.e. the fishing in other ICES rectangles by the reference fleet should be considered in the data as this contributes to the total landing pattern for these vessels. Species and size composition come from the official landings data. Size composition is only analysed for cod and is given in commercial size grades. The data analyses have been separated as before and after the vessels have entered the CQM scheme respectively.

### Size composition cod

The size grade composition for cod catches from the CQM vessels is with the reference fleet compared by their respective landing patterns. The proportion of the smaller size grade (size grade 4 and 5) cod can be an indication of high-grading (discarding with the aim of value optimizing increasing the landings).

For the vessels fishing with  $\geq 120$ mm mesh size in the North Sea (figure 4) the CQM vessels had 5% size grade 5 cod in their landings in 2009 (before joining the CQM scheme) which rose to around 12 and 13% in 2010 and 2011 respectively both years with CQM. The reference fleet showed only a weak increase (1-2%) in landings of size grade 5 cod during the same time span. For the size grade 4 only a slight increase in the landings is seen for both groups of vessels after the onset of the CQM trial.

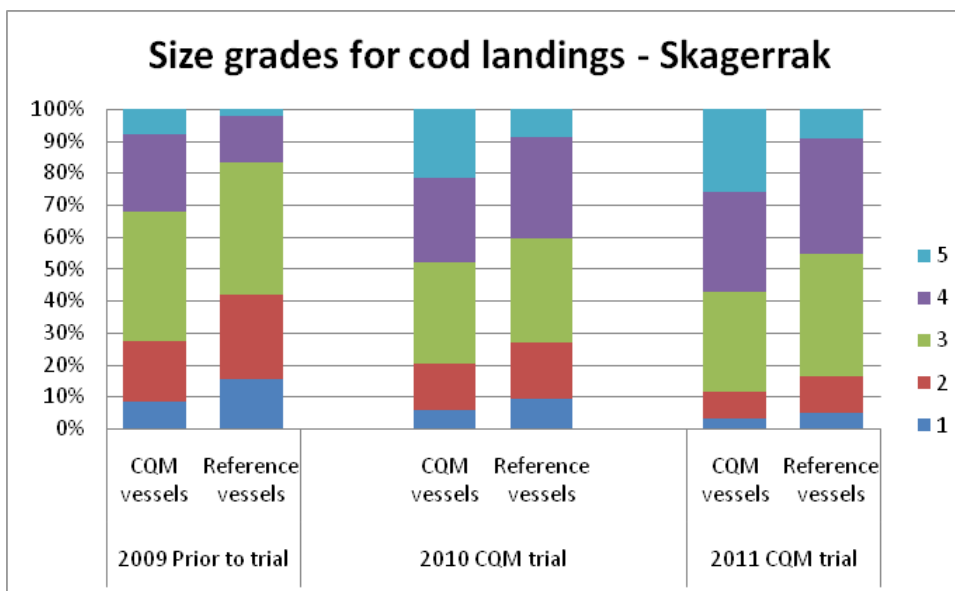
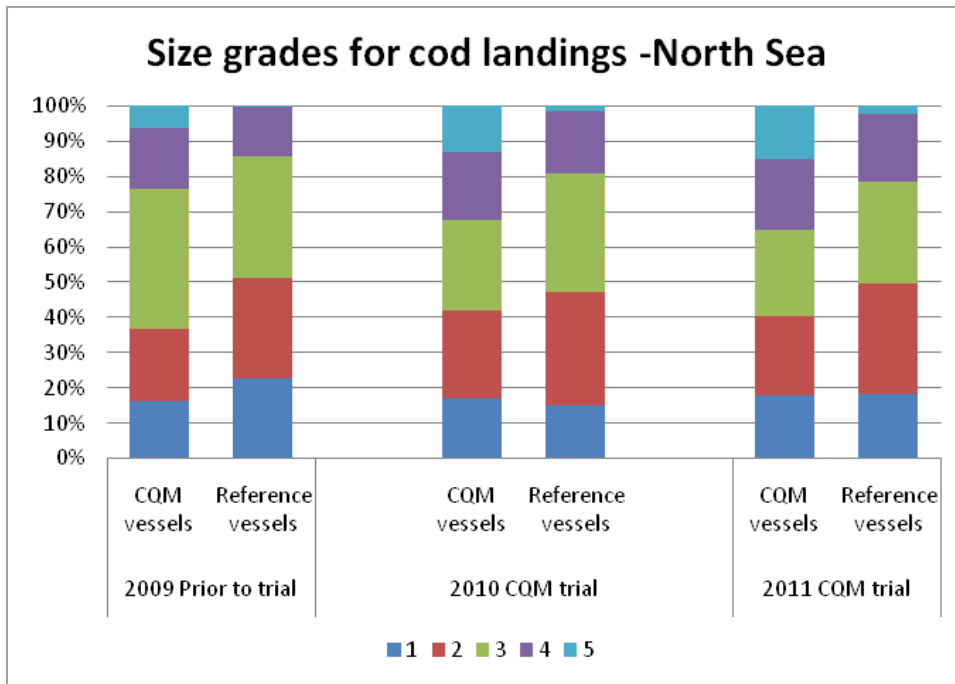


Figure 4. Cod landings from the North Sea for CQM and reference vessels. All vessels have been fishing with trawl or seine, mesh size =>120mm.

For the vessels fishing with  $\geq 120$ mm mesh size in Skagerrak (figure 4) the CQM vessels had approx. 7% size grade 5 cod in their landings in 2009 (before joining the CQM scheme) which after the CQM trial began rose to >20% and 27% in 2010 and 2011 respectively. The reference fleet increased the landings of size grade 5 cod (from 1-2% to 8-10%) during the same time span. For the size grade 4 a small increase is seen for the CQM vessels from 25% (2009) to 30% (2011) while the reference fleet during this period more than doubled the proportion of size grade 4 in the landings from 15% (2009) to 35% (2011).

Change in size grade distribution may be caused by several factors such as the species viability in relation to the set quota, change in prices per kg. per size grade (less differences between size grade 3 – 4 and especially between size grade 4 and 5) and change in selected fishing ground as most demersal fisheries are mixed fisheries and therefore catch opportunities of other species have to be taken into account. However, data used for the analysis is from a large number of vessels therefore it can be concluded that high grading takes place in this area if the fishing is not fully monitored and documented.

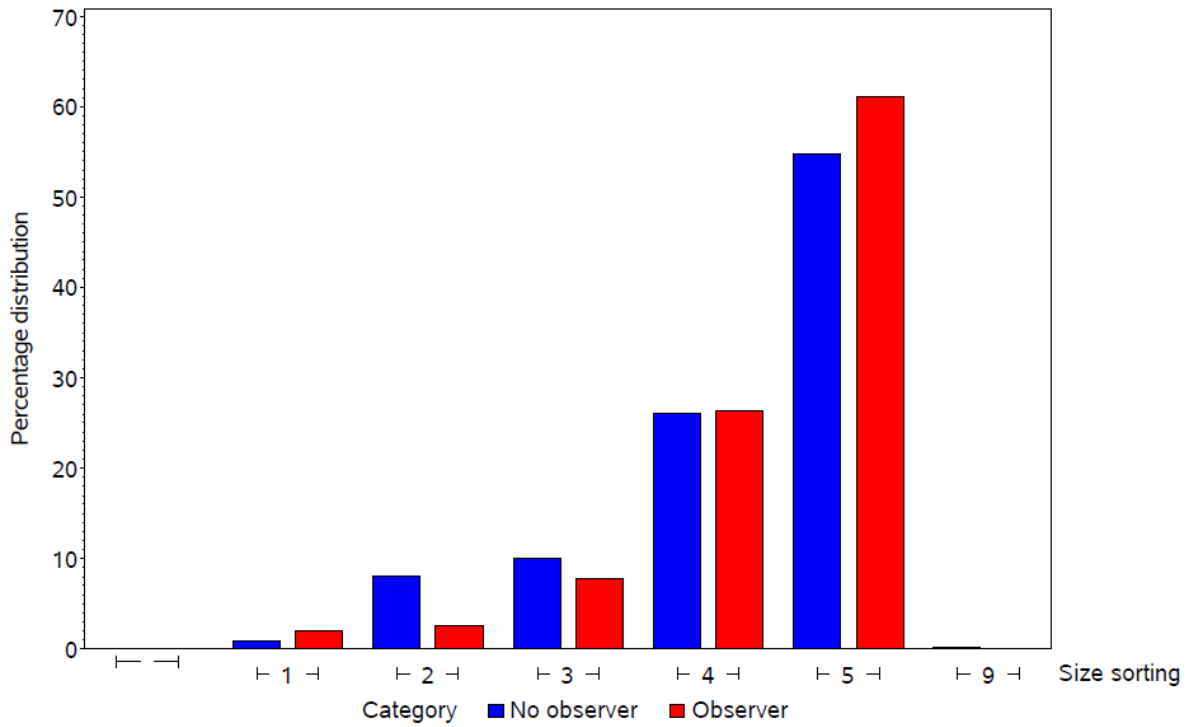
## **Discard of cod**

Discard of cod is often discussed in relation to Danish fisheries. Therefore focus on discard of cod by area and métier is shown in the following pages. Only observed fisheries with a considerable discard of cod are shown in this section. Each sheet is showing a size sorting distribution of cod from trips with and without observer on board. If the patterns are very different, it is an indication that the fishermen might change behaviour when an observer is on board. The number of vessels and number of trips have to be taken into account, and therefore a table showing the observer coverage by number of vessels, number of trips and mean trip length (days at sea) is included below each graph. If the mean trip length of the métier is very different from the mean trip length of the observer trips, the observer trips might not be representative for the métier .

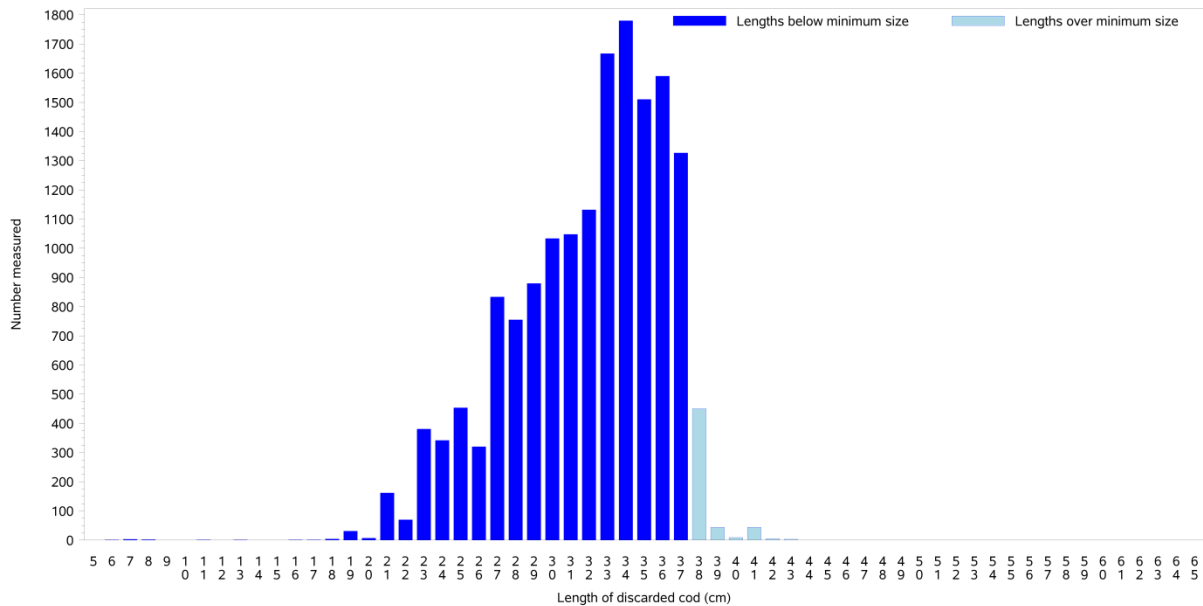
For each represented métier the length distribution of discarded cod on observer trips are shown. Dark blue represent lengths below the minimum landing size, and light blue represent lengths above the minimum landing size. The distributions are based on the actual measured numbers of cod on observed trips. If a representative subsample has been taken from the haul, then the numbers are raised to the level of the haul. The figures are not raised to the total amount of discard for the given area and métier and therefore do not show the estimated length distribution for the total discard. The minimum landing size by area is based on regulation, BEK nr 788 of 25/06/2010, see Appendix 6 for an overview of minimum landings size.

# Western Baltic Area 22-24: OTB\_DEF\_>=105\_1\_120

Size sorting distribution of cod



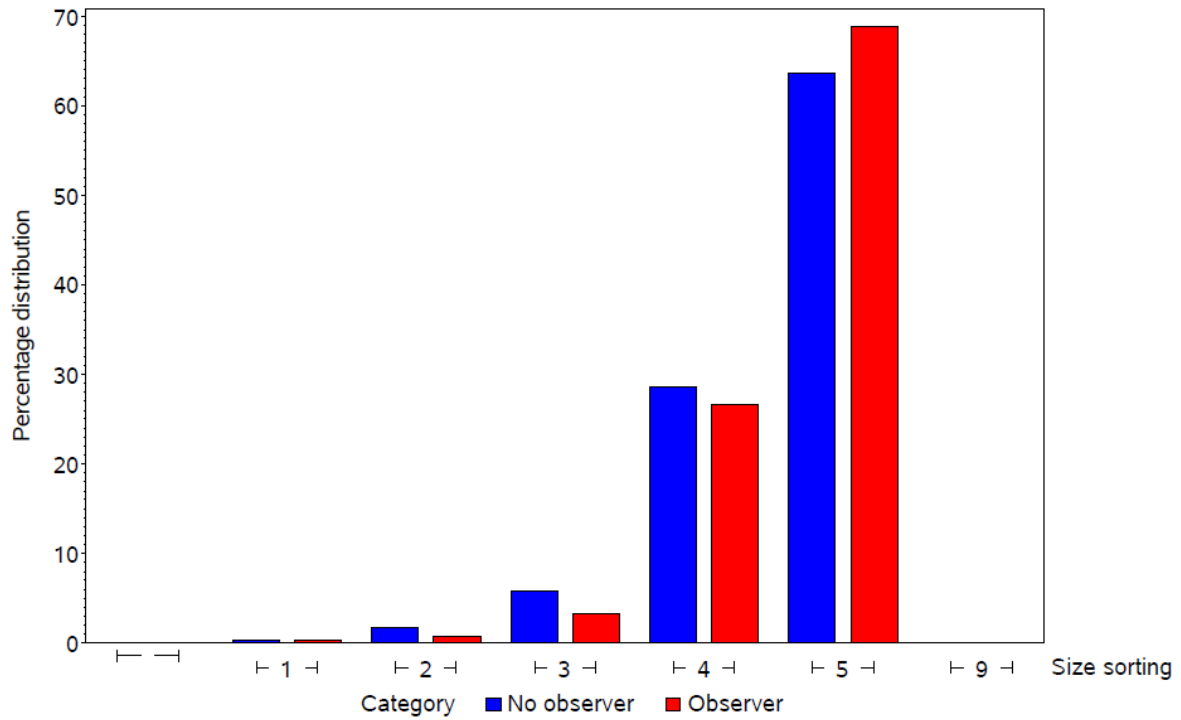
	Observed	Non-observed
Number of vessels	19	125
Number of trips	40	5218
Mean days at sea	1.29	1.23



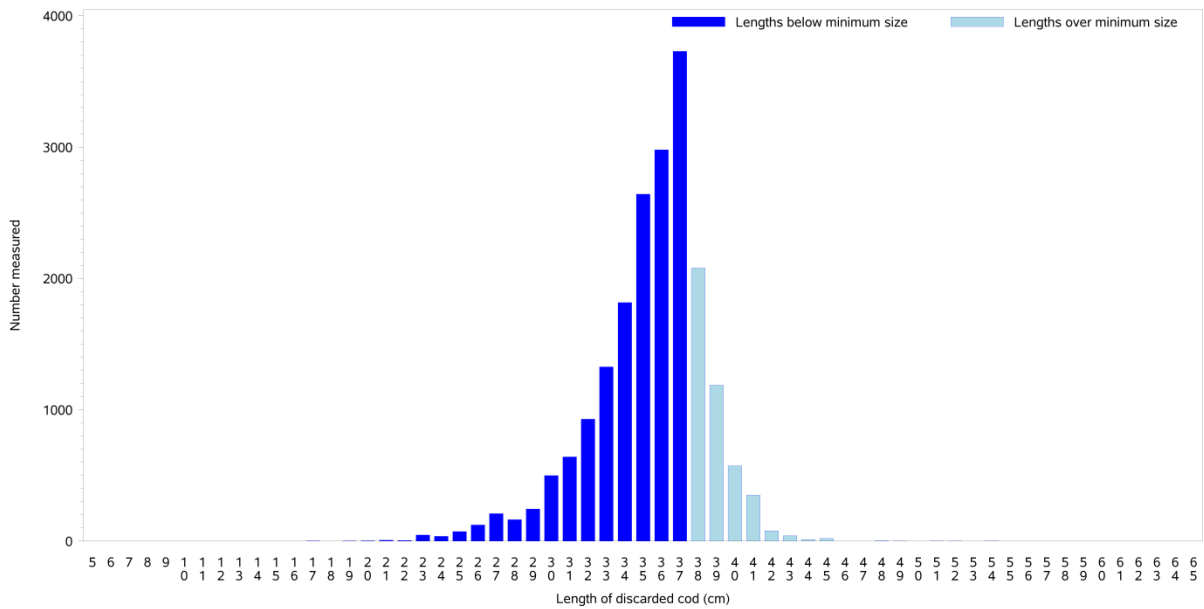


# Eastern Baltic Area 25-32: OTB\_DEF\_>=105\_1\_120

Size sorting distribution of cod

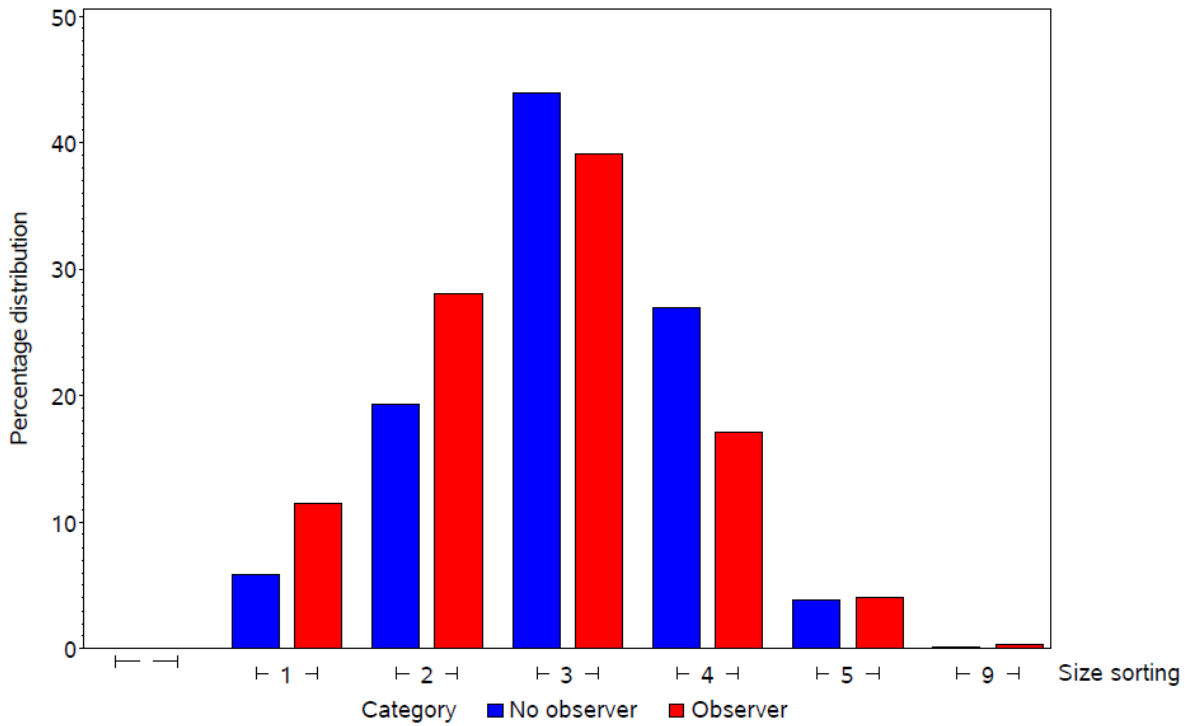


	Observed	Non-observed
Number of vessels	9	74
Number of trips	27	2306
Mean days at sea	1.67	1.42

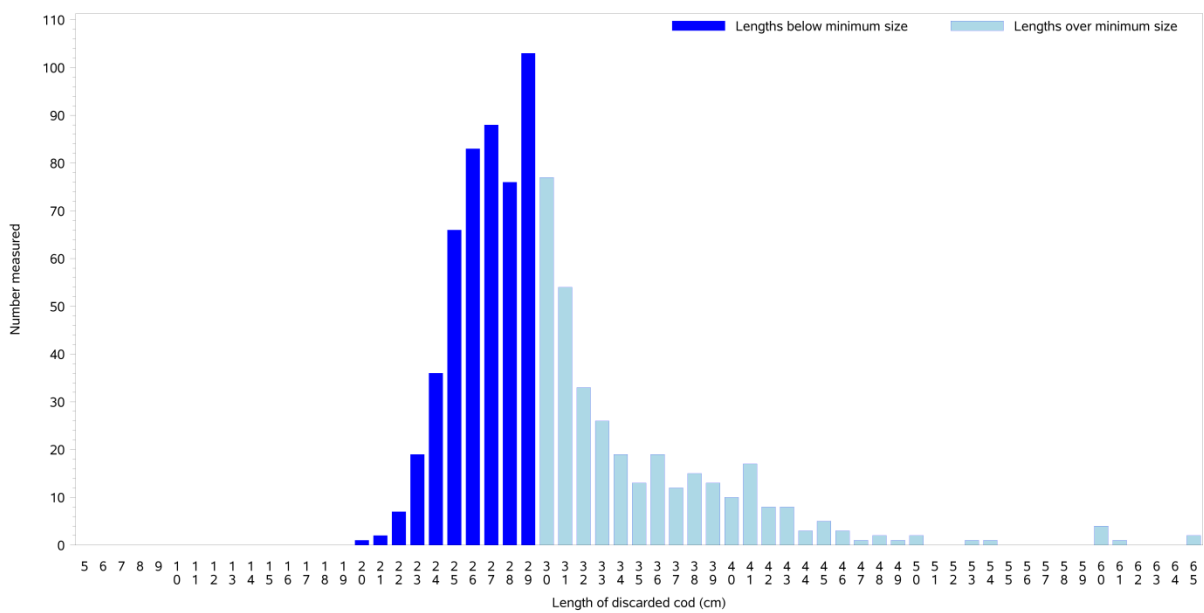


# Skagerrak 3AN: GNS\_DEF\_120-219\_0\_0

Size sorting distribution of cod

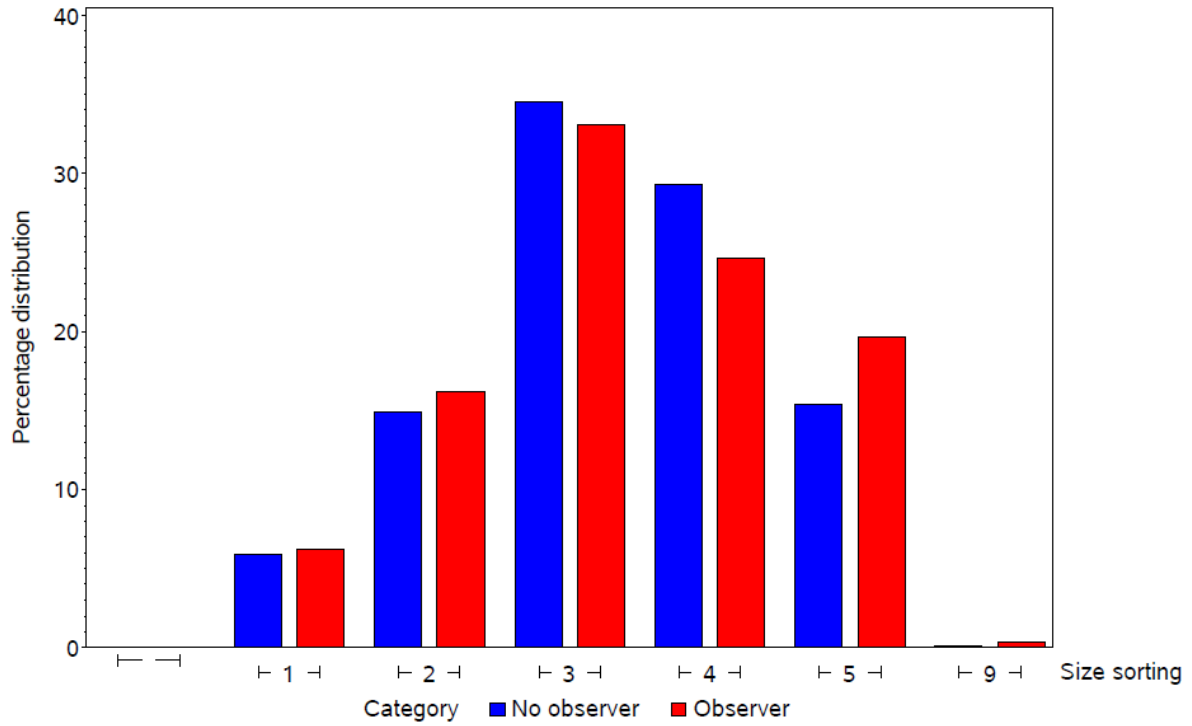


	Observed	Non-observed
Number of vessels	6	76
Number of trips	38	2848
Mean days at sea	1.03	1.09

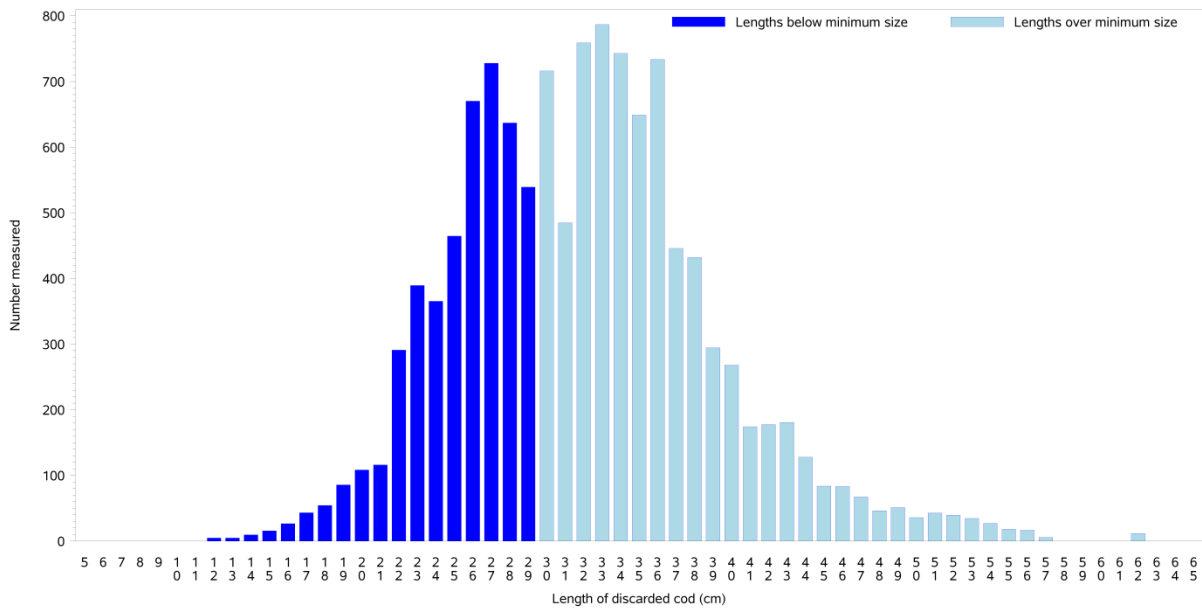


# Skagerrak 3AN: OTB\_MCD\_90-119\_0\_0

Size sorting distribution of cod

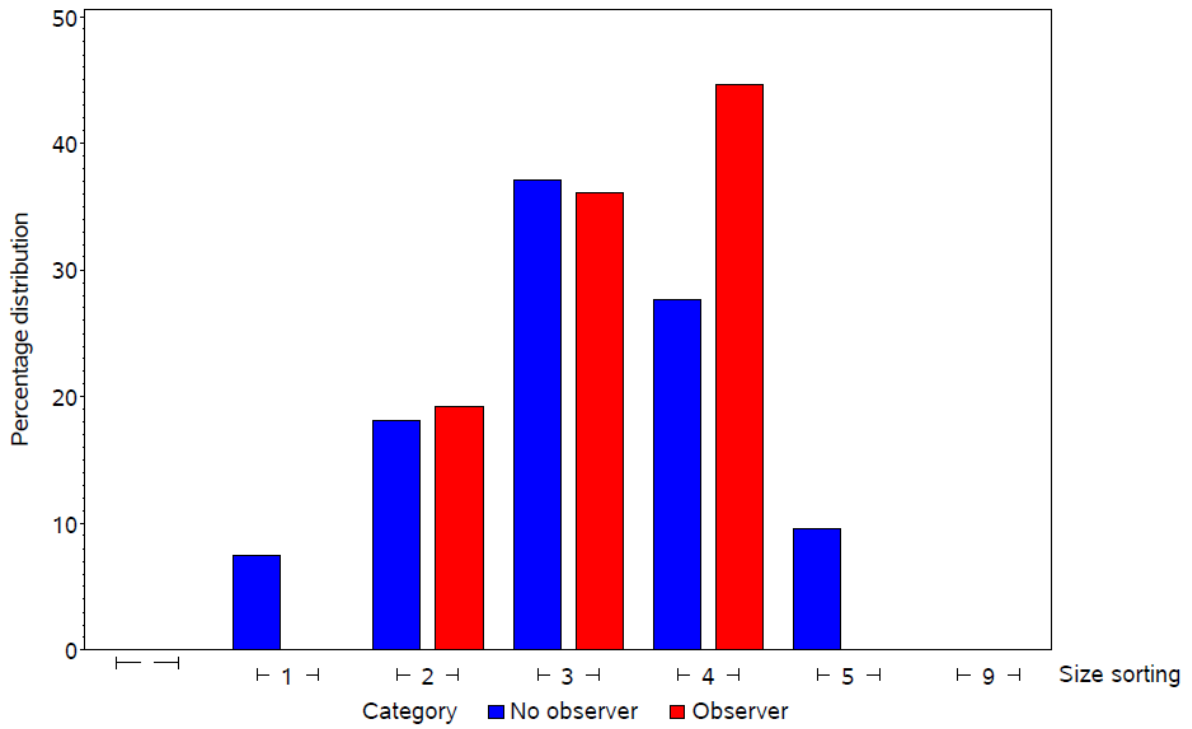


	Observed	Non-observed
Number of vessels	16	155
Number of trips	26	7713
Mean days at sea	3.27	1.87

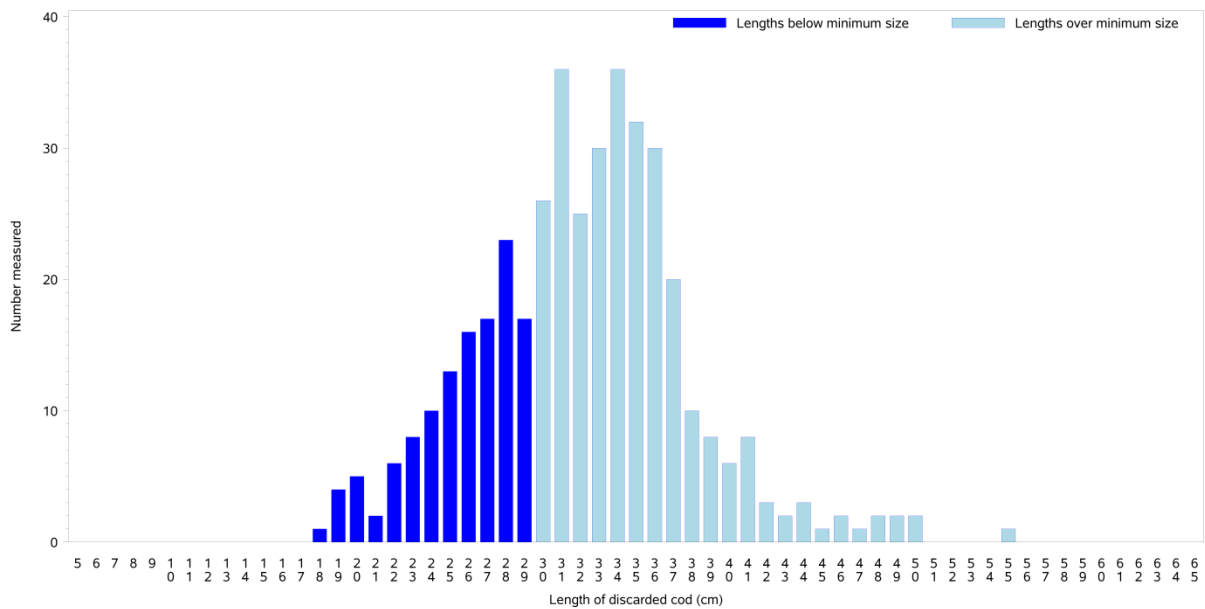


# Skagerrak 3AN: SDN\_DEF\_90-119\_0\_0

Size sorting distribution of cod

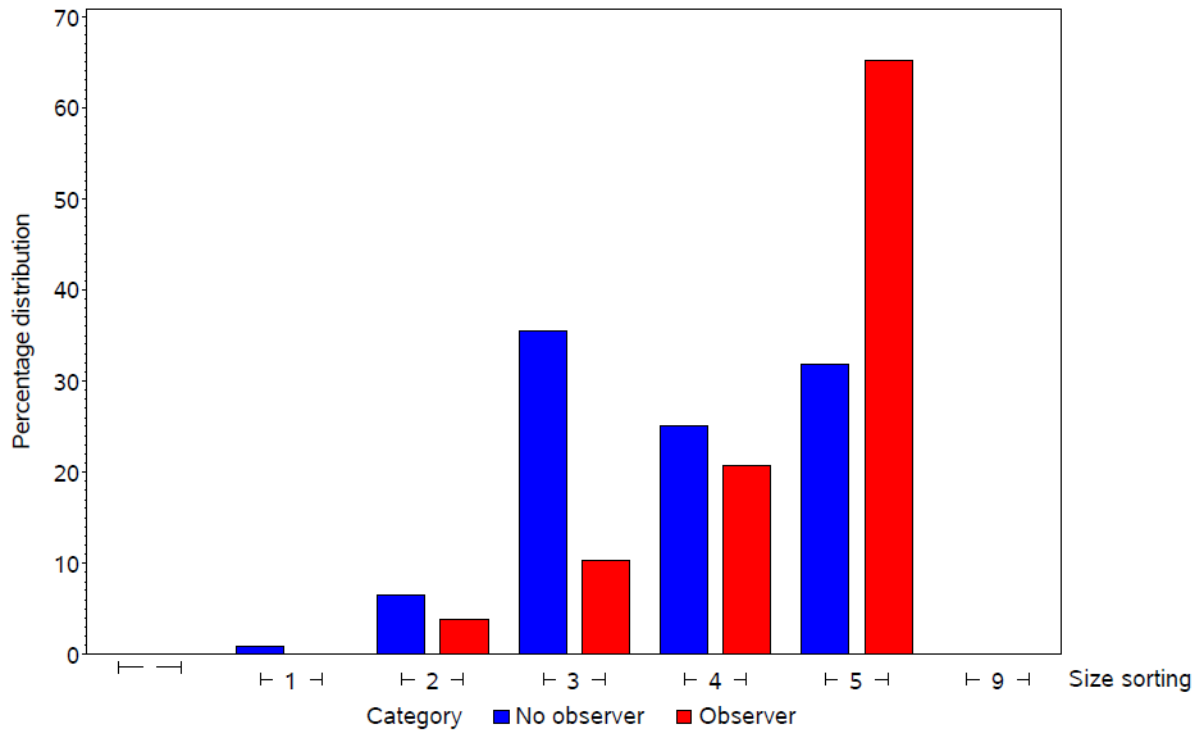


	Observed	Non-observed
Number of vessels	4	28
Number of trips	7	2070
Mean days at sea	1.57	1.34

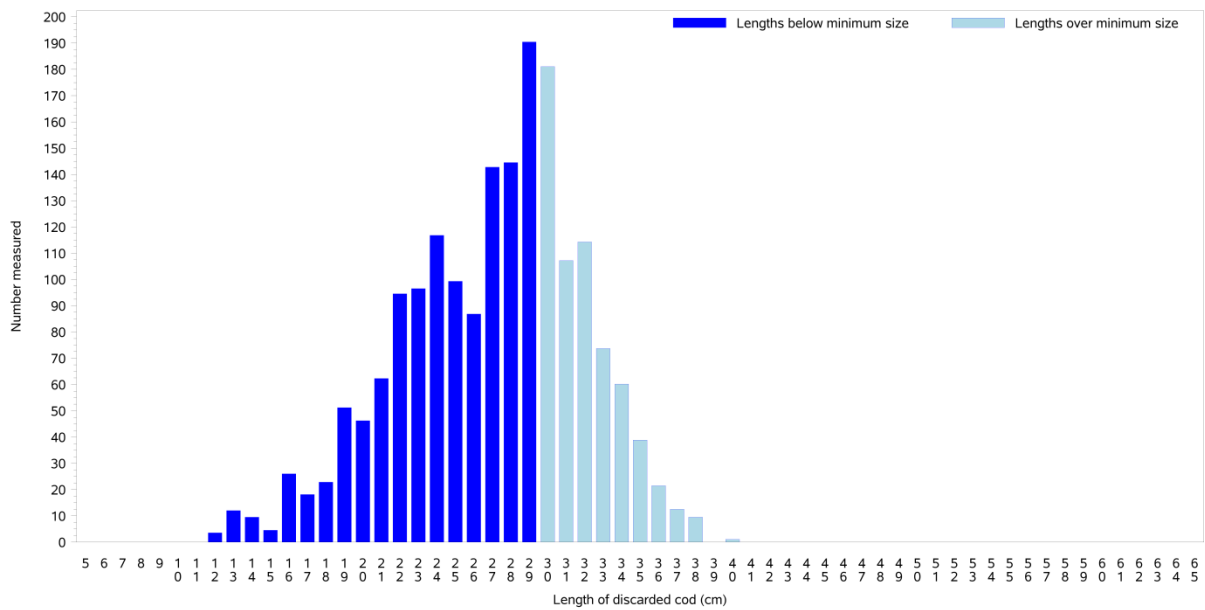


# Kattegat 3AS: OTB\_MCD\_90-119\_0\_0

Size sorting distribution of cod

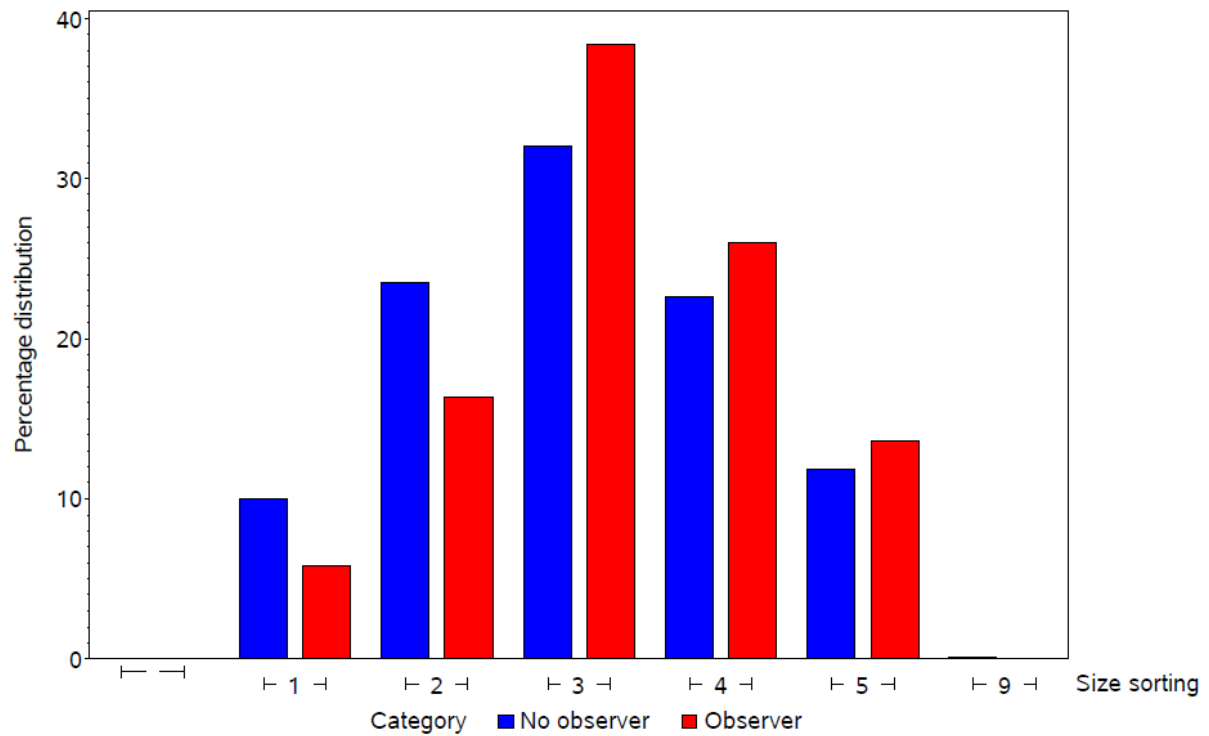


	Observed	Non-observed
Number of vessels	7	133
Number of trips	22	7229
Mean days at sea	2.41	2.19

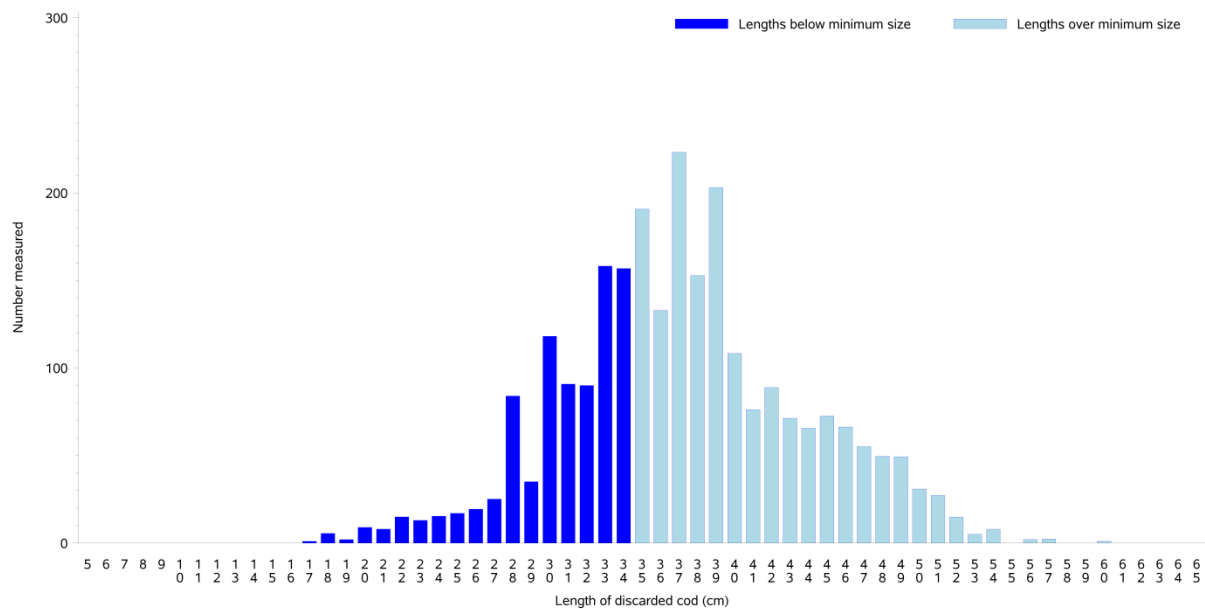


## North Sea Area 4: OTB\_MCD\_>=120\_0\_0

Size sorting distribution of cod



	Observed	Non-observed
Number of vessels	7	75
Number of trips	11	1769
Mean days at sea	7.18	4.21



## References

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Doi:10.1371/journal.pone.0036409
- Frandsen, R. P., Madsen, N., and Krag, L. A. 2010. Selectivity and escapement behavior of five commercial fishery species in standard square and diamond-mesh codends. – ICES Journal of Marine Science, 67: 1721–1731.
- Mehault, S. Morandeau, F., Fifas, S. 2011. Discarded *Nephrops* survival after trawling. Working document for ICES *Nephrops* working group. IFREMER Report of project PRESPO, pp. 15.
- Rochet M.-J. and Trenkel, V.M. 2005. Factors for the variability of discards: assumptions and field evidence. Can. J. Fish. Aquat. Sci. 62: 224–235

## Appendix 1: Detailed overview of landings and discard per area

Discard can be calculated in many different ways depending on the purpose of the data use. As not all vessels have observer cover some assumptions has to be made for the vessels not covered. In this report we have only calculated discards from the fleet segments that have an actual observer cover and we have not extrapolated data from observed fleets onto fleets were we do not have actual data. This will off course then give an underestimation of the total discard for an area as we have a fraction of the total fleet not covered. In the tables we have given the landings of the métiers covered by observers.

**Discard by species from the métiers with on-board observers (Ton):** Discard is only calculated from the fleets with observer cover and where actual data are available. The discard data have then been raised to fleet and species and added within an area.

**Landings by species from the métiers with on-board observers (Ton):** The total landings by these fleets were observers have been on board “Landings n ton by species (only métiers with on-board observers)” is given.

**Discard rate:** The discard rate is calculated as discard by a given species divided by the total catch (discard + landings by métiers with observers) of the same species. This gives an indication of the utilization of a given species. However, even if the actual amount of discard is relatively low, some species will have a high discard rate if the commercial value is low or even none existing.



## Area 22-24- Western Baltic Sea

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Atlantic herring	3.6	0.2	95
Atlantic horse mackerel	0.1	0	100
Atlantic mackerel	0.1	0.1	50
Blue mussel	18.5	0	100
Brill	33.3	18.2	65
Brown trout	0	0.3	0
Bullhead	12.2	0	100
Cod	602.1	4937.4	11
Common dab	746	366.6	67
Common sole	0.6	15.4	4
European plaice	722.1	649.8	53
Flounder	999.8	551.5	64
Greater weever	0.3	0	100
Grey gurnard	0.7	0	100
Haddock	0	0.6	0
Lemon sole	0.3	1.6	16
Ling	0	0.1	0
Long rough dab	19.9	0	100
Longfin gurnard	0.2	0	100
Lumpfish	5.1	1	84
Megrim	0	0.2	0
Norway lobster	0	0.1	0
Saithe	0	0.2	0
Scaldfish	0.1	0	100
Sprat	0.2	0	100
Thorny skate	1.6	0	100
Turbot	62.3	28.7	68
Whiting	74.8	112.5	40
Witch flounder	0.1	0	100
Other	0.2	0.1	67
<b>Total</b>	<b>3304</b>	<b>6685</b>	<b>33</b>

## Area 25-32 – Eastern Baltic Sea

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Atlantic herring	0	0.1	0
Atlantic mackerel	0.2	0	100
Atlantic salmon	0	0.2	0
Cod	272.9	9674.9	3
Common dab	0	0.4	0
European plaice	187	250.1	43
Flounder	436.2	324.6	57
Turbot	0.2	2.6	7
Twaite shad	0.2	0.1	67
Whiting	2.1	5.3	28
<b>Total</b>	<b>899</b>	<b>10258</b>	<b>8</b>

## Area 3AN - Skagerrak

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Anglerfish	0.5	257.1	0
Argentine	16.2	0	100
Atlantic halibut		13.8	0
Atlantic herring	142.4	1.5	99
Atlantic horse mackerel	2.1	0.6	78
Atlantic mackerel	0.2	2.4	8
Blue whiting	93.8	0	100
Brill	0.6	22.5	3
Cod	1623	2908.5	36
Common dab	153.6	356.2	30
Common sole	0	43.3	0
Dragonet	6	0	100
Edible crab	4.2	8.3	34
European anchovy	0.4	0	100
European hake	83.4	332.8	20
European plaice	553.6	6479	8
Flounder	0	17	0
Fourbeard rockling	20.3	0	100
Glass shrimps	12.8	0	100
Green crab	0	15.3	0
Grey gurnard	20.9	4.2	83
Haddock	579.2	913.3	39
Lemon sole	35.7	261.9	12
Ling	54.6	52.8	51
Long rough dab	325.6	0.4	100
Longfin gurnard	0.2	10.5	2
Lumpfish	52.6	18.6	74
Mulletts	0	0.3	0
Northern prawn	41.2	1114.8	4
Norway lobster	1720.1	1966	47
Norway pout	307.1	0	100
Octopus and squids	0.6	29.1	2
Pollack	1.1	274	0
Rabbit fish	9.3	1	90
Roundnose grenadier	4.6	0.6	88
Saithe	123.8	3413.9	3
Spurdog	8	4.5	64
Thorny skate	272.1	0	100
Turbot	0	35.2	0
Whiting	334.6	30.9	92
Witch flounder	144.4	547.8	21
Wolf-fish	0	25.3	0
rays and skates	0	9	0
Other	20	6.8	75
<b>Total</b>	<b>6769</b>	<b>19179</b>	<b>26</b>

### Area 3AS - Kattegat

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Anglerfish	0	0.8	0
Atlantic herring	7.8	0.1	99
Atlantic horse mackerel	0.1	0	100
Atlantic mackerel	0.4	0.4	50
Brill	37.7	58	39
Bullhead	13.5	0	100
Cod	150.1	100.5	60
Common dab	1910.4	35.6	98
Common sole	32	162.9	16
Dragonet	0.8	0	100
Edible crab	3	5.4	36
European hake	8.6	11.1	44
European plaice	763.3	293.4	72
Flounder	371.4	107.6	78
Fourbeard rockling	1.3	0	100
Greater weever	44.9	18.3	71
Green crab	0	12.1	0
Grey gurnard	95.4	5.3	95
Haddock	37.5	18.1	67
Lemon sole	42.4	15.1	74
Ling	0	1.6	0
Long rough dab	38.4	0	100
Longfin gurnard	1	0.3	77
Lumpfish	0	25.8	0
Mulletts	0	0.1	0
Norway lobster	858.9	1716.9	33
Norway pout	0.7	0	100
Octopus and squids	0	5.1	0
Pollack	0.1	13.7	1
Red gurnard	8.6	0	100
Saithe	0	8.7	0
Spotted dragonet	0.6	0	100
Sprat	7.1	0	100
Spurdog	2	0.6	77
Thorny skate	74.4	0	100
Turbot	6.7	26	20
Whiting	219.2	7.6	97
Witch flounder	108.8	5.2	95
Wolf-fish	0	4.8	0
rays and skates	0	2.4	0
Other	1.5	0.7	68
<b>Total</b>	<b>4849</b>	<b>2664</b>	<b>65</b>

## Area 4- North Sea

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Anglerfish	3.2	986.7	0
Argentine	11.6	0	100
Atlantic halibut	0	49.1	0
Atlantic herring	11.4	0	100
Atlantic horse mackerel	29.3	0.1	100
Atlantic mackerel	3.4	0.9	79
Blue whiting	19.5	0	100
Brill	0	60.3	0
Cod	283.6	4495.9	6
Common dab	162.8	436.4	27
Common shrimp	2910.6	3137.4	48
Common sole	17.5	61.9	22
Edible crab	27.9	4.6	86
European hake	245.5	1144.9	18
European plaice	16.1	7601.2	0
Flounder		17.6	0
Golden Redfish	30.5	2.1	94
Greater argentine	12.4	0	100
Greater weever	0	0.6	0
Green crab	0	29	0
Grey gurnard	66.6	4.4	94
Haddock	41	411.7	9
Hooknose	157.2	0	100
Lemon sole	6.7	725.3	1
Ling	0.2	313	0
Long rough dab	34.6	0.9	97
Longfin gurnard	0	13.4	0
Northern prawn	0.3	0	100
Norway lobster	61.3	282.2	18
Norway pout	5.1	0	100
Octopus and squids	0.9	21.8	4
Pollack	0	121.8	0
Rabbit fish	288.3	0	100
Saithe	16	3005.2	1
Sprat	29.4	0	100
Thorny skate	946.7	0	100
Turbot	0	211.7	0
Tusk(=Cusk)	0	25.7	0
Velvet belly	46.6	0	100
Whiting	74.3	88	46
Witch flounder	9.8	191.5	5
Wolf-fish	0.4	156.6	0
rays and skates	0	16.8	0
Other	109	31.6	78
<b>Total</b>	<b>5680</b>	<b>23650</b>	<b>19</b>

## Appendix 2: Overview of landings and discard per area and métier

In contrast to the numbers presented in Appendix 1 detailed numbers for landings and discard in this appendix are given by métiers. Only the métiers selected for on-board sampling are included.

**Landings (Ton):** The official landings by species from the métier in 2010

**Discard (Ton):** The estimated and raised discard by species for the métier in 2010

**Discard rate (%):** Discard by species divided by the total catch (discard + landings) of that species.

### Area 25-32 – Eastern Baltic: OTB\_DEF\_>=105\_1\_120

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Atlantic herring	0	0.1	0
Atlantic mackerel	0.2	0	100
Atlantic salmon	0	0.2	0
Cod	272.9	9674.9	3
Common dab	0	0.4	0
European plaice	187	250.1	43
Flounder	436.2	324.6	57
Turbot	0.2	2.6	7
Twaiite shad	0.2	0.1	67
Whiting	2.1	5.3	28
<b>Total</b>	<b>899</b>	<b>10258</b>	<b>8</b>

### Area 22-24 – Western Baltic: OTB\_DEF\_>=105\_1\_120

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Atlantic herring	3.6	0.2	95
Atlantic horse mackerel	0.1	0	100
Atlantic mackerel	0.1	0.1	50
Blue mussel	18.5	0	100
Brill	33.3	18.2	65
Brown trout	0	0.3	0
Bullhead	12.2	0	100
Cod	602.1	4937.4	11
Common dab	746	366.6	67
Common sole	0.6	15.4	4
European plaice	722.1	649.8	53
Flounder	999.8	551.5	64
Greater weever	0.3	0	100
Grey gurnard	0.7	0	100
Haddock	0	0.6	0
Lemon sole	0.3	1.6	16
Ling	0	0.1	0
Long rough dab	19.9	0	100
Longfin gurnard	0.2	0	100
Lumpfish	5.1	1	84
Megrim	0	0.2	0
Norway lobster	0	0.1	0
Saithe	0	0.2	0
Scaldfish	0.1	0	100
Sprat	0.2	0	100
Thorny skate	1.6	0	100
Turbot	62.3	28.7	69
Whiting	74.8	112.5	40
Witch flounder	0.1	0	100
Other	0.2	0.1	67
<b>Total</b>	<b>3304</b>	<b>6685</b>	<b>33</b>

### Area 3AN- Skagerrak: GNS\_DEF\_120-219\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0	10.5	0
Atlantic halibut	0	0.1	0
Atlantic herring	0	0.2	0
Atlantic horse mackerel	0.1	0	100
Atlantic mackerel	0	0.2	0
Brill	0	3	0
Cod	19	880.3	2
Common dab	1.2	12.3	9
Common sole	0	7.8	0
Edible crab	0	5.6	0
European hake	0.9	65.1	1
European plaice	4.6	454.5	1
Flounder	0	3.4	0
Green crab	0	7.9	0
Grey gurnard	0.3	0.2	60
Haddock	0	13.7	0
Lemon sole	0.1	21.5	1
Ling	2.2	8.5	21
Longfin gurnard	0	0.1	0
Lumpfish	0.1	5	2
Mullets	0	0.1	0
Pollack	0.6	166.9	0
Saithe	0.8	72.4	1
Spurdog	0	0.1	0
Thorny skate	0.3	0	100
Turbot	0	3	0
Whiting	0.6	0	100
Witch flounder	0	0.2	0
Wolf-fish	0	3.4	0
Other	0.9	1.6	36
<b>Total</b>	<b>32</b>	<b>1748</b>	<b>18</b>



### Area 3AN- Skagerrak: OTB\_CRU\_32-69\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0	10.5	0
Argentine	16	0	100
Atlantic halibut	0	2.1	0
Atlantic herring	5.6	0	100
Atlantic horse mackerel	0.2	0	100
Blue whiting	67.8	0	100
Cod	16.6	45.8	27
Common dab	0.3	0	100
Dragonet	0.1	0	100
European hake	0.8	2.5	24
European plaice	0.4	0.7	36
Fourbeard rockling	1.1	0	100
Glass shrimps	12.8	0	100
Haddock	0.1	4.2	2
Lemon sole	0	0.2	0
Ling	0	2.5	0
Long rough dab	2.4	0	100
Lumpfish	43	0.2	100
Northern prawn	41.2	1114.3	4
Norway lobster	0.1	5.5	2
Norway pout	254.6	0	100
Octopus and squids	0.6	0.2	75
Pollack	0	0.7	0
Rabbit fish	7.4	0	100
Roundnose grenadier	3.6	0	100
Saithe	0	168	0
Spurdog	0	0.1	0
Thorny skate	10.4	0	100
Whiting	0.4	0.1	80
Witch flounder	26.3	13.3	66
rays and skates	0	0.2	0
Other	2.8	1.8	61
<b>Total</b>	<b>515</b>	<b>1373</b>	<b>27</b>

### Area 3AN - Skagerrak: OTB\_MCD\_90-119\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0.5	231.3	0
Argentine	0.2	0	100
Atlantic halibut	0	10.3	0
Atlantic herring	136.9	1.2	99
Atlantic horse mackerel	1.9	0.6	76
Atlantic mackerel	0.2	2.1	9
Blue whiting	26	0	100
Brill	0.6	18.7	3
Cod	1479.8	1336.2	53
Common dab	130	173.1	43
Common sole	0	34.8	0
Dragonet	5.9	0	100
Edible crab	4.2	2.7	61
European anchovy	0.4	0	100
European hake	81.7	215.3	28
European plaice	143.3	2746.9	5
Flounder	0	5.1	0
Fourbeard rockling	19.1	0	100
Green crab	0	7.4	0
Grey gurnard	17.1	2.4	88
Haddock	564.1	450.5	56
Lemon sole	34.3	190.5	15
Ling	52.4	40.5	56
Long rough dab	299.6	0.4	100
Longfin gurnard	0	3	0
Lumpfish	9.6	13.2	42
Mullet	0	0.2	0
Northern prawn	0	0.5	0
Norway lobster	1720.1	1960.2	47
Norway pout	52.4	0	100
Octopus and squids	0	25.4	0
Pollack	0.5	92.5	1
Rabbit fish	1.9	0.9	68
Roundnose grenadier	1	0.6	63
Saithe	121.2	3124.3	4
Spurdog	8	4.2	66
Thorny skate	123.6	0	100
Turbot	0	30.6	0
Whiting	333.1	28.6	92
Witch flounder	117	411.1	22
Wolf-fish	0	18.1	0
rays and skates	0	8.8	0
<b>Other</b>	<b>14.8</b>	<b>3.3</b>	<b>82</b>

### Area 3AN - Skagerrak: SDN\_DEF\_90-119\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0	4.8	0
Atlantic halibut	0	1.3	0
Atlantic mackerel	0	0.1	0
Brill	0	0.8	0
Cod	107.6	646.2	14
Common dab	22.2	170.8	12
Common sole	0	0.6	0
European hake	0	50	0
European plaice	405.3	3276.9	11
Flounder	0	8.6	0
Green crab	0	0.1	0
Grey gurnard	3.4	1.6	68
Haddock	15	444.9	3
Lemon sole	1.3	49.7	3
Ling	0	1.4	0
Long rough dab	23.6	0	100
Longfin gurnard	0.2	7.4	3
Lumpfish	0	0.3	0
Norway lobster	0	0.3	0
Octopus and squids	0	3.5	0
Pollack	0	13.9	0
Saithe	1.8	49.1	4
Spurdog	0	0.1	0
Thorny skate	137.8	0	100
Turbot	0	1.6	0
Whiting	0.4	2.2	15
Witch flounder	1	123.1	1
Wolf-fish	0	3.8	0
rays and skates	0	0.1	0
Other	1.5	0.1	94
<b>Total</b>	<b>721</b>	<b>4863</b>	<b>13</b>

### Area 3AS - Kattegat: GNS\_DEF\_120-219\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Atlantic mackerel	0.4	0	100
Brill	0.5	2.4	17
Cod	0	14.3	0
Common dab	0.4	3.2	11
Common sole	0.2	11.1	2
European plaice	0.3	20.3	2
Flounder	23.2	11.7	67
Greater weever	0	0.1	0
Green crab	0	2.5	0
Lemon sole	0	0.8	0
Ling	0	0.2	0
Lumpfish	0	16.8	0
Pollack	0	12	0
Saithe	0	0.8	0
Thorny skate	0.8	0	100
Turbot	0.5	4.8	9
Whiting	0.2	0	100
Wolf-fish	0	0.4	0
<b>Total</b>	<b>27</b>	<b>101</b>	<b>21</b>

### Area 3AS - Kattegat: OTB\_MCD\_90-119\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0	0.8	0
Atlantic herring	7.8	0.1	98
Atlantic horse mackerel	0.1	0	100
Atlantic mackerel	0	0.4	0
Brill	37	55.3	40
Bullhead	13.5	0	100
Cod	149.7	85.9	64
Common dab	1909.6	32.2	98
Common sole	31.6	145.6	18
Dragonet	0.8	0	100
Edible crab	3	5.3	36
European hake	8.6	11.1	44
European plaice	763	270.9	74
Flounder	348.1	95.5	79
Fourbeard rockling	1.3	0	100
Greater weever	44.9	18.2	71
Green crab	0	9.2	0
Grey gurnard	95.4	5.3	95
Haddock	37.5	18.1	67
Lemon sole	42.3	14.2	75
Ling	0	1.4	0
Long rough dab	38.4	0	100
Longfin gurnard	1	0.3	77
Lumpfish	0	0.9	0
Norway lobster	858.9	1716.9	33
Norway pout	0.7	0	100
Octopus and squids	0	5.1	0
Pollack	0.1	1.6	6
Red gurnard	8.6	0	100
Saithe	0	7.9	0
Spotted dragonet	0.6	0	100
Sprat	7.1	0	100
Spurdog	2	0.6	77
Thorny skate	73.6	0	100
Turbot	6.2	19.5	24
Whiting	219	7.6	97
Witch flounder	108.8	5.1	96
Wolf-fish	0	4.4	0
rays and skates	0	1.6	0
Other	1.5	0.6	71
<b>Total</b>	<b>4821</b>	<b>2542</b>	<b>65</b>

#### Area 4 – North Sea: OTB\_MCD\_>=120\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	2.9	961.8	0
Argentine	11.6	0	100
Atlantic halibut	0	45.2	0
Atlantic herring	1.9	0	100
Atlantic horse mackerel	28.8	0.1	98
Atlantic mackerel	1.1	0.5	69
Blue whiting	19.5	0	100
Brill	0	34.1	0
Cod	254.6	1688.3	13
Common dab	83.7	304.3	22
Common sole	0	3.8	0
Edible crab	27.9	0.7	98
European hake	244	692.7	26
European plaice	5.6	4214.1	0
Flounder	0	3.7	0
Golden Redfish	30.5	2.1	94
Greater argentine	12.4	0	100
Greater weever	0	0.5	0
Green crab	0	6.2	0
Grey gurnard	64.7	3.9	94
Haddock	39.9	336.1	11
Lemon sole	6.2	631.9	1
Ling	0.2	289	0
Long rough dab	6.4	0.9	88
Longfin gurnard	0	4.4	0
Norway lobster	61.3	282.1	18
Norway pout	5.1	0	100
Octopus and squids	0.5	20.8	2
Pollack	0	57.6	0
Rabbit fish	288.3	0	100
Saithe	16	2946.6	1
Thorny skate	862	0	100
Turbot	0	153	0
Tusk(=Cusk)	0	25.3	0
Velvet belly	46.6	0	100
Whiting	25	87.7	22
Witch flounder	9.8	172.5	5
Wolf-fish	0.4	138	0
rays and skates	0	14.8	0
Other	55.9	17.5	76
<b>Total</b>	<b>2213</b>	<b>13140</b>	<b>14</b>

#### Area 4- North Sea: SDN\_DEF\_>=120\_0\_0

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Anglerfish	0.3	8.5	3
Atlantic halibut	0	2.3	0
Atlantic mackerel	0	0.1	0
Brill	0	0.7	0
Cod	17.6	735	2
Common dab	9.3	36.8	20
European hake	1.5	18.6	8
European plaice	0.5	1256.4	0
Flounder	0	0.6	0
Grey gurnard	2	0.3	87
Haddock	1.1	28.1	4
Lemon sole	0.1	16.8	1
Ling	0	0.5	0
Longfin gurnard	0	6.7	0
Norway lobster	0	0.1	0
Octopus and squids	0	0.9	0
Pollack	0	2.6	0
Saithe	0	7	0
Thorny skate	84.7	0	100
Turbot	0	3.3	0
Whiting	0.2	0.3	40
Witch flounder	0	17.7	0
Wolf-fish	0	15.4	0
Other	3.2	0.1	97
<b>Total</b>	<b>121</b>	<b>2159</b>	<b>5</b>

#### Area 4- North Sea: TBB\_CRU\_16-31

Species	Discard by species (Ton)	Landings by species (Ton)	Discard rate (%)
Atlantic herring	9.6	0	100
Atlantic horse mackerel	0.5	0	100
Atlantic mackerel	2.3	0	100
Cod	11.4	0	100
Common dab	69.8	0	100
Common shrimp	2910.6	3137.4	48
Common sole	17.5	0	100
European plaice	10	0	100
Hooknose	157.2	0	100
Lemon sole	0.5	0	100
Long rough dab	28.2	0	100
Northern prawn	0.3	0	100
Octopus and squids	0.5	0	100
Other	49.8	0	100
Sprat	29.4	0	100
Whiting	49.1	0	100
<b>Total</b>	<b>3347</b>	<b>3137</b>	<b>52</b>

## Appendix 3: Overview of landings and discard by species

In contrast to the numbers presented in Appendix 1 and 2 numbers for landings and discard in this appendix are given by species only. Only the métiers selected for on-board sampling are included.

**Discard by species from the métiers with on-board observers (Ton):** Discard is only calculated from the fleets with observer cover and where actual data are available. The discard data have then been raised to fleet and species and added within an area.

**Landings by species from the métiers with on-board observers (Ton):** The total landings by these fleets were observers have been on board “Landings n ton by species (only métiers with on-board observers)” is given.

**Discard rate:** The discard rate is calculated as discard by a given species divided by the total catch (discard + landings by métiers with observers) of the same species. This gives an indication of the utilization of a given species. However, even if the actual amount of discard is relatively low, some species will have a high discard rate if the commercial value is low or even none existing.

Species	Discard in ton by species (only métiers with on-board observers)	Landings in ton by species (only métiers with on-board observers)	Discard rate (%) (only métiers with on-board observers)
Anglerfish	3.7	1244.6	0.3
Argentine	27.8	0	100
Atlantic halibut	0	62.9	0
Atlantic herring	165.3	2	98.8
Atlantic horse mackerel	31.6	0.8	97.5
Atlantic mackerel	4.3	3.9	52.4
Atlantic salmon	0	0.3	0
Blue mussel	18.5	0	100
Blue whiting	113.3	0	100
Brill	71.6	159.1	31
Brown trout	0	0.3	0
Bullhead	25.6	0	100
Cod	2931.7	22117.1	11.7
Common dab	2972.8	1195.2	71.3
Common shrimp	2910.6	3137.4	48.1
Common sole	50.1	283.5	15
Dragonet	6.7	0	100
Edible crab	35.1	18.2	65.9
European anchovy	0.4	0	100
European eel	0	0.1	0
European hake	337.4	1488.9	18.5
European plaice	2242.1	15273.5	12.8



Flounder	1807.4	1018.4	64
Fourbeard rockling	21.5	0	100
Glass shrimps	12.8	0	100
Golden Redfish	30.5	2.1	93.6
Greater argentine	12.4	0	100
Greater weever	45.1	18.9	70.5
Green crab	0	56.4	0
Grey gurnard	183.6	13.9	93
Haddock	657.7	1343.6	32.9
Hooknose	157.2	0	100
Lemon sole	85.1	1003.9	7.8
Ling	54.8	367.6	13
Long rough dab	418.4	1.2	99.7
Longfin gurnard	1.5	24.2	5.8
Lumpfish	57.7	45.4	56
Megrim	0	0.2	0
Mulletts	0	0.4	0
Northern prawn	41.5	1114.8	3.6
Norway lobster	2640.4	3965.2	40
Norway pout	312.8	0	100
Octopus and squids	1.6	56	2.8
Other	130.7	39.2	76.9
Pollack	1.1	409.5	0.3
Rabbit fish	297.6	1	99.7
Red gurnard	8.6	0	100
Roundnose grenadier	4.6	0.6	88.5
Saithe	139.8	6427.9	2.1
Scaldfish	0.1	0	100
Spotted dragonet	0.6	0	100
Sprat	36.7	0	100
Spurdog	10	5.1	66.2
Thorny skate	1294.7	0	100
Turbot	69.3	304.1	18.6
Tusk(=Cusk)	0	25.7	0
Twaite shad	0.2	0.1	66.7
Velvet belly	46.6	0	100
Whiting	704.9	244.2	74.3
Witch flounder	263	744.4	26.1
Wolf-fish	0.4	186.7	0.2
rays and skates	0	28.2	0
<b>Total</b>	<b>21500</b>	<b>62437</b>	<b>26</b>



## Appendix 5: Definitions/Terminology

**Landings:** Fish or shellfish that are brought ashore and registered in logbooks and/ or saleslips.

**Discard:** The portion of a catch of fish or shellfish which is not retained on board during commercial fishing operations and is returned, to the sea.

**Catch:** The total number (or weight) of fish caught by fishing operations.  $\text{Catch} = \text{Landings} + \text{Discards}$ .

**By-catch:** The part of the catch that is not captured as the target species and which is landed and sold.

**High-grading:** Discard of species above minimum landing size to optimize the total catch value when the quota is limited. High-grading is illegal.

**Discard Rate:** The percentage of the total catch by species discarded in weight or number. If a vessel catches 10 tons, discards 3 tons and lands 7 tons, the discard rate is 30% by weight. If measured in numbers the rate is typically higher because of the average weight of each individual in the discard normally is smaller than the average weight of each individual in the landing.

**Target species assemblage:** A closed list of fish or/and shellfish species/group among which a given fishing action has its main target species.

**Size sorting stratified sampling:** Sampling of length distributions by species and commercial size sorting independent of métier. The same length distribution is then applied to all métiers catching that size sorting. It follows that the differences in total length distribution (all commercial sortings) between métiers is a result of difference in the catch proportions between the different commercial sortings.

## Appendix 6: Regulation

Minimum landing size in 2010 for several species in Danish waters, BEK nr 788 af 25/06/2010

	Skagerrak/ Kattegat	North Sea	Baltic
Brill	30	30	30
Cod	30	35	38
Dab	25	25	25
Flounder	25.5	25.5	23(SD 22-25)
Haddock	27	30	27
Hake	30	27	30
Herring	18	20	
Ling		30	
Atlantic mackerel	20	30	
Nephrops	13	8.5	13
Plaice	27	27	25
Saith	30	35	30
Salmon	60	60	60
Sole	24	24	24
Trout	40	40	40
Turbut	30	30	30
Whiting	23	27	

## Colophon

### **Danish Sampling of Commercial Fishery**

Overview with special attention to discards  
2010 data

Marie Storr-Paulsen, Kirsten Birch Håkansson, Josefine Egekvist, Henrik Degel  
and Jørgen Dalskov

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