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Discard self-sampling of the Dutch bottom-trawl fisheries in 2022

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Summary

In the European Union the collection and management of fisheries data is regulated through the Data Collection Framework (DCF) of the European Commission (EC). Within this context, Wageningen Marine Research (WMR) coordinates a discards monitoring programme in collaboration with the Dutch demersal fishing industry. A reference fleet of vessels of which the owners are willing to participate in a self-sampling programme, was recruited in 2009 and has been extended and updated regularly. Annually approximately 160 trips need to be sampled by the reference fleet. Fishermen within the reference fleet are requested to collect discard samples of two hauls according to a definite annual sampling plan. In order to avoid any potential bias in trip selection and to conform to the statistical sound principles as defined in the DCF recast, from 2018 onwards the trips are randomly divided over the reference fleet and any refusals are recorded. After the discard samples are brought to shore, WMR collects and analyses these samples. This report summarizes data that has been collected within this self-sampling monitoring programme in 2022.

In 2022 the reference fleet consisted of 22 commercial vessels of which in the end 17 participated in the self-sampling. In total 143 trips, were sampled following the protocol in 2022. All sampled trips were assigned to their respective metiers post sampling, based on gear type, mesh size and species composition of the catch. Eight different metiers were assigned: beam trawlers with 80 mm mesh size (engine power > 300 hp and engine power ≤ 300 hp), 100-119 mm mesh size and ≥120 mm mesh size, and otter trawlers with 32-69 mm mesh size (targeting cephalopods), 70-99 mm mesh size (targeting Norway lobster or mixed crustaceans and demersal species) and 100-119 mm mesh size.

Observed discard patterns are quite similar between all metiers; dab and undersized plaice are the most frequently discarded fish species. The majority of the benthic, non-fish, discards consisted of echinoderms and crustaceans. In order to monitor annual discard percentages, it is essential that the sampled trips follow the distribution of the fleet both in space and time; a mismatch between sampling and the distribution of the fleet could indicate a possible bias in the discard estimate. The results show that sampling effort of the most intensely sampled metiers (i.e. TBB_DEF_70-99, OTB_CRU-70-99) indeed follows the fleet through space and time. However, for the less frequently sampled metiers this does not always appear to be the case.

An important element in the reform of the Common Fisheries Policy (CFP) 2014-2020 is the obligation to land all catches, i.e. a discard ban. Under this landing obligation all discards of quota regulated species have to be landed. For the demersal fisheries the landing obligation has been phased in over a number of years (starting in 2016 and full implementation in January 2019). It is clear that discarding will continue under various forms of exemptions (high survivability, *de minimis*, prohibited species). Therefore, a discards monitoring programme remains necessary under the landing obligation. From 2016 onwards, monitoring of the catch fraction *Below Minimum Size* (BMS) has been included in the sampling protocol of the discards monitoring programme. Similar to previous years, BMS has been observed and registered sporadically in the self-sampling trips in 2022.

Samenvatting

In de Europese Unie wordt het verzamelen en beheren van visserijgegevens gereguleerd door middel van de Data Collectie Verordening (DCF) van de Europese Commissie (EC). Binnen deze regulatie, coördineert Wageningen Marine Research (WMR) een discards zelfbemonsteringsprogramma in samenwerking met de Nederlandse demersale visserij. In dit project wordt gebruik gemaakt van een 'referentie vloot', bestaande uit een groep Nederlandse commerciële vissers die zich willen inzetten voor het onderzoek. Deze referentievloot is in 2009 opgezet en is sindsdien uitgebreid en regelmatig gedeeltelijk vernieuwd. Jaarlijks moeten in totaal ongeveer 160 trips door de referentievloot bemonsterd worden. De vissers van de referentievloot wordt gevraagd om voor specifieke visreizen, die aan het begin van het jaar zijn vastgesteld, een deel van de discards (d.w.z. de vangst die anders overboord zou zijn gegaan) van twee vistrekken aan boord te houden. Om een mogelijk vertekend beeld in de verzamelde gegevens te voorkomen, worden vanaf 2018 de bemonsterde reizen willekeurig over de referentievloot verdeeld, zoals verzocht in de herziene versie van de DCF. De monsters met bijbehorende gegevens over de totale vangst per trek, visserij-inspanning en vispositie worden aangeland en aan WMR overgedragen. WMR zorgt voor de verdere verwerking van de monsters. Voorliggend rapport presenteert de resultaten van het zelfbemonsteringsproject van de Nederlandse demersale vloot opererend in de Noordzee (ICES deelgebied IV) in 2022.

In 2022 bestond de referentievloot uit 22 schepen waarvan uiteindelijk 17 schepen hebben deelgenomen aan de zelfbemonstering. In totaal zijn 143 visreizen in 2022 op de juiste manier volgens het protocol bemonsterd. Op basis van vistuig, maaswijdte en soortensamenstelling van de vangst zijn alle bemonsterde visreizen naderhand aan een metier toegekend. In 2022 zijn acht verschillende metiers bemonsterd: boomkorschepen vissend met 70-99 mm maaswijdte (waarbij onderscheid gemaakt wordt tussen Eurokotters (d.w.z. vissend met een motorvermogen ≤ 300 pk) en grote kotters (d.w.z. vissend met een motorvermogen > 300 pk)), 100-119 mm maaswijdte en ≥120 mm maaswijdte, en otter trawlers vissend met 32-69 maaswijdte (vissend op cephalopoden), 70-99 mm maaswijdte (waarbij gericht op Noorse kreeft, of demersale vis en Noorse kreeft gevangen wordt) en 100-119 mm maaswijdte.

De waargenomen patronen in de discards zijn vergelijkbaar tussen de verschillende metiers; schar en ondermaatse schol zijn de meest voorkomende soorten in de visdiscards. De meerderheid van de benthos discards bestond uit stekelhuidigen (verschillende zeestersoorten) en kreeftachtigen (zoals zwemkrabben en Noorse kreeft). Om jaarlijkse discardsschattingen van de Nederlandse demersale vloot te bepalen, is het essentieel dat de bemonstering de vloot representeert in ruimte en tijd; een mismatch tussen de verspreiding van de bemonstering en de vloot kan tot een vertekend beeld van de discardsschattingen leiden. De resultaten laten zien dat de bemonsteringsinspanning van de meest bemonsterde metier (d.w.z. boomkor metier gericht op tong en de ottertrawl metier gericht op Noorse kreeft) de vloot volgt in de ruimte en tijd. Voor de minder intensief bemonsterde metiers is dit echter niet altijd het geval.

Een belangrijk element in de herziening van het Gemeenschappelijk visserijbeleid (GVB) 2014-2020 is de verplichting om alle vangsten aan land te brengen. Onder deze aanlandplicht moeten alle discards van commerciële soorten die gereguleerd worden door quota aangeland worden. Binnen de demersale visserij is de aanlandplicht tussen 1 januari 2016 en 1 januari 2019 ingevoerd. Het is duidelijk dat onder de aanlandplicht waarbinnen discarden, vanwege verschillende uitzonderingen (hoge overleving, *de minimis*, soorten met een vangstverbod), tot op zekere hoogte zal blijven bestaan, een discards monitoringsprogramma nodig blijft. Sinds 2016 is de monitoring van de vangstfractie *Below Minimum Size* (BMS) opgenomen in het bemonsteringsprotocol van de zelfbemonstering. Net als in voorgaande jaren is BMS alleen sporadisch waargenomen in de zelfbemonsteringsreizen in 2022.

1 Introduction

1.1 Background

Discarding unwanted organisms in European fisheries is unavoidable in mixed fisheries (Feekings et al., 2012). Reasons for discarding could be economic (if there is no commercial value for the species caught) or because of regulatory measures (such as minimum landing size or catch limits (quota)) (Catchpole et al., 2005; Rochet and Trenkel, 2005; Poos et al. 2010; Suuronen & Gilman, 2020). Keeping record of quantities being discarded improves scientific stock assessments and advice on quota, enabling more accurate estimates of total fishing mortality.

Box 1: Data Collection Framework (DCF)
In the European Union (EU) the collection and management of fisheries data is enforced through the Data Collection Framework (DCF) of the European Commission (EC) (EU 2017/1004, EU 2021/1167, EU 2021/1168). The DCF states which information should be collected, managed and made available by the Member States (MS) for scientific advice regarding the Common Fisheries Policy (CFP). For this purpose all MS are obliged to submit a work plan for data collection in the fisheries and aquaculture sectors on a multiannual basis.

The collection of discard data is enforced through the EC DCF (Box 1). The DCF requires the implementation of at-sea monitoring programmes, which should deliver valid estimates of discards for each type of fisheries, temporal periods and areas. To comply with this ruling an observer programme with scientifically-trained observers have been in place since 2000 for which annually 6-18 active demersal fishing trips have been monitored. In 2009, revisions to the DCF required member states to increase sampling intensity to i) improve precision of their estimates and (ii) the number of sampled fishing fleets (metiers). In foresight of the expenses involved, an affordable self-sampling programme commenced in the Netherlands for the Dutch demersal active fisheries in the North Sea in 2009. Within this programme discard data are collected for Dutch bottom-trawl fisheries for a number of metiers, which are defined in the DCF based on gear type, target species assemblage, and mesh characteristics. To verify the accuracy and objectivity of self-sampling, every year, 10 observer trips are carried out on board of fishing vessels that participate in the programme. In addition, the observer trips have proven to be of importance for training crew members in sampling of discards. Also, the observer trips are appreciated by members of the reference fleet, as it bridges the gap between scientists and crew. The data from these observer trips are solely used for verification and, therefore, excluded from this report.

The aim of this report is to present an overview of the data that has been collected within the Dutch self-sampling programme of bottom-trawl fisheries in 2022. The data is used for further analyses within different projects, including stock assessment working groups (ICES, 2023).

1.2 Quality assurance

CVO is certified to ISO 9001:2015 (certificate number: 268632-2018-AQ-NLD-RvA). This certificate is valid until December 15th, 2024. The certification was issued by DNV Business Assurance B.V

2 Methods

2.1 Discard self-sampling programme

2.1.1 Reference fleet

A reference fleet with protocol-instructed fishers collected discard samples according to a predefined schedule during their regular commercial operations. The participants in the reference fleet are recruited by actively approaching vessels and through the fishers organisations while taking the composition of the entire Dutch demersal active fleet, based on gear, mesh size and landing harbour, into account. Prior to sampling, fishers were provided with all necessary equipment (labels, plastic sampling bags, sealing cable ties, markers, and sampling sheets) and written instructions. Additionally, WMR staff visited the crew in port regularly to evaluate and, when necessary, to reinstruct the sampling protocol. The fishermen receive a fixed compensation for each trip they have sampled. While the project commenced in 2022 with a reference fleet consisting of 22 commercial vessels, in the end 17 vessels did indeed participate in the self-sampling.

2.1.2 Sampling and data collection procedures

Annually approximately 160 trips need to be sampled. These trips were randomly divided over the reference fleet and any refusals of randomly assigned trips were recorded.

Operational and catch data are collected each time the fishing gear is deployed (each 'haul') during a fishing trip. With each haul the following information was registered: vessel position (at start and end); haul duration; depth; weather conditions; and the volumes of catches and landings. The total volume of discards of each haul was calculated by subtracting the retained amount of catch, which was recorded by the fishermen, from the total catch which was estimated by the skipper/crew. Within a trip, a sample consisting of two boxes of discards (one box equals approx. 40 kg), was taken by the crew from two separate hauls. This resulted in a total of approx. 160 kg of discards per trip. These boxes were filled by scooping discards at regular intervals from the end of the processing conveyer belt. Crew members collected the discard samples while other crew members sorted the commercial catch. The discard samples were stored in large plastic bags, which were sealed off using a cable tie, labelled and cool-stored until the vessel returns to the port. Back at port, the discard samples were collected by WMR staff and taken to the laboratory for analysis.

Numbers at length were recorded for all fish species, Norway lobster *(Nephrops norvegicus,* hereafter termed *Nephrops*) and edible crab (*Cancer pagurus)*. Numbers without length measurements were recorded for all remaining (benthos) species. Standard data management software was used to enter and subsequently audit all data before the data were stored in the centralised WMR Frisbe database.

2.1.3 Metier classification

All sampled trips were assigned to their respective metiers based on level 6 for the metier classification as defined by the European Union (EU) decision (2016/1251, Table 2) after the trip was executed (Table 1).

Within the Dutch beam trawl metier (TBB_DEF 70-99 mm), a distinction is made based on the vessel's engine power. Due to national regulations, only vessels with an engine power of ≤300 hp (so called "Eurocutters") are allowed to fish in a marine protected area ("plaice box") and the Dutch 12-mile zone.
To reflect this spatial difference of the fleet -which also has implications on their discarding pattern- in the following analysis, summaries of the discard data are presented separately for Eurocutters (termed TBB_DEF_70-99mm_S300hp) and the remaining part of the beam trawl fleet (termed TBB_DEF_70-99mm_G300hp; Table 1). The total number of samples per metier depends on the fleet composition of the reference fleet.

2.2 Raising procedures

See Figure 1 for a flow-chart of the raising procedure. Numbers (at length) were registered for all (fish) species for each sample. The numbers (at length) in the samples were multiplied with the volume ratio between discard sample and total discards to estimate total numbers (at length) within each haul. Whenever a species was very abundant within the sample, a sub-sample of this species was counted. When subsampling was conducted, the numbers (at length) were multiplied with the sub-sample fraction to estimate total numbers (at length) within the sample.

Next, length/weight-relationships[1] were applied to convert numbers at length to weight for all fish species. Both numbers (fish and benthos) and weights (fish) for the two sampled hauls in each trip were summed. These numbers and weights were then standardized into discards per unit effort rates (expressed in number/hour and kg/hour) by dividing them by the deployment duration (i.e. fishing time). Total numbers and weights per fishing trip were calculated by multiplying the standardized rates with the total duration of all hauls together. It is assumed that the species composition in the sampled hauls is representative of the sampled trip and have similar variance.

2.3 Fleet effort

The fleet effort was calculated using the WMR VISSTAT database containing the official Dutch logbook information. In this database, the date and time of port departure and arrival, and other vessel characteristics (such as gear type, engine power, mesh size) are registered for all Dutch fishing vessels over 12 metres. Time between departure and arrival was multiplied by the engine power of each vessel, resulting in a measure of fishing effort expressed as kWdays. The ratio between fleet effort and sampling effort (i.e. the fishing effort of the sampled trips expressed as kWdays) has been used as an auxiliary variable to estimate total discards by species for the Dutch demersal fleet by metier. Since 2011, total discard data from the reference fleet have been used in several ICES Working Groups for the assessment of stocks in the North Sea, such as plaice, cod, sole, whiting, turbot, brill and *Nephrops* (ICES, 2023). Furthermore, the data is also sent to the STECF Expert Working Group on Fisheries Dependent Information (STECF, 2023).

The fleet effort by ICES rectangle, metier and quarter has been extracted from the WMR VISSTAT database and plotted together with the sampled trawls in order to visually inspect the overlap between the sampled trips and the fleet in time and space.

[1] The L/W relationships for plaice (*Pleuronectus platessa)*, sole (*Solea solea*), turbot (*Scophthalmus maxima*), brill (*Scophthalmus rhombus*) and thickbacksole (*Microchirus variegatus*) are based on WMR data. For all other species these relations are based on literature.

3 Results

3.1 Data selection

In total, 145 trips were sampled in 2022. Trips that were not sampled according to the sampling protocol and/or trips for which essential information was missing were considered invalid and excluded from the analysis. This resulted in 138 valid trips. All sampled trips (Table 2b) were assigned to their respective metiers post-sampling, based on gear type, mesh size and species composition. Sampling was conducted on board of vessels from eight different metiers; beam trawlers with 80 mm mesh size (engine power > 300 hp and engine power ≤ 300 hp), 100-119 and ≥120 mm mesh size, and otter trawlers with 32-69 mm mesh size (cephalopod fisheries), 70-99 mm mesh size (targeting *Nephrops* or mixed crustaceans and demersal species) and 100-119 mesh size. It should be noted that for some metiers the results are based on a small number of trips (Table 2b). These results can therefore only be used as an indication for discard patterns, and not as exact estimates.

A visual inspection on whether the collected sampled trips follow the distribution of the fleet through space and time gave a first indication on representativeness of the sampled data for the entire fleet. The results show that sampling effort of the most-intensely sampled metiers (i.e. TBB_DEF_70-99, OTB_CRU_70-99) indeed follows the fleet through space and time. However, for the less frequently sampled metiers this not always appears to be the case; for example for OTB_DEF_100-119 in quarter 3 (Figure 3).

3.2 TBB_DEF_70-99_G300hp

The large (>300 hp, often >35m LOA) beam trawlers, make up the majority of the Dutch demersal fishing fleet effort, with a total fleet effort of 17237258 kWdays in 2022 (Table 2a, figure 2). 83 trips were sampled for this metier, which coincides with a sampling coverage of 4.5% (Tables 2b, 3). Sampling was highest in quarter 4 (Table 2b). Figure 3 shows the distribution of total fleet effort by year and corresponding positions of sampled trawls.

Sole (*Solea solea*) and plaice (*Pleuronectes platessa*) are the most abundant species in the landings. Turbot (*Scophthalmus maximus*), dab (*Limanda limanda*) and brill (*Scophthalmus rhombus*), and various other species make up the rest of the landings (Table 4).

Plaice and dab are the most frequently discarded fish species within this fleet (Tables 4,5,8). Plaice is discarded because it is undersized (Figure 4) and dab is discarded because of its low commercial value. Since 2018, an increase in the estimated discard percentage of plaice is visible (Table 10a) which is caused by a decline in plaice landings in this time period.

Most other fish species that are discarded include the bentho-pelagic oriented species whiting (*Merlangius merlangus*) for which no individual quota is available for the demersal fleet (Table 8). Also smaller flatfishes (e.g. solenette (*Buglossidium luteum*), scaldfish (*Arnoglossus laterna*), undersized sole and other demersal species (e.g. common dragonet (*Callionymus lyra*), grey gurnard (*Eutrigla gurnardus*) are encountered frequently in the discards (Table 8). The majority of the benthos discards consisted of echinoderm (sand sea star (*Astropecten irregularis*), serpent star (*Ophiura ophiura*), sea potato (*Echinocardium cordatum*), common starfish (*Asterias rubens*), crustaceans (swimming crab (*Liocarcinus* sp.), green sea urchin (*Psammechinus miliaris*) and the masked crab (*Corystes cassivelaunus*) (Table 9).

3.3 TBB_DEF_70-99_S300hp

Eurocutters (<300hp) are allowed to fish in the Dutch 12-mile zone and the plaice box (Beare et al., 2013). This is reflected in the distribution of the fleet effort and the sampling locations (Figure 3). In quarters 3 and 4 the

effort was substantially lower than in the first two quarters of 2022 (Table 2a, Figure 2). Target species may differ in time and between vessels.

Two trips were sampled in quarter 1 for this metier, which coincides with a sampling coverage of 0.5% (Tables 2b, 3). Therefore, presented information of discards for this metier is only indicative. Plaice and sole are the most frequently observed landed species (Table 4). Dab, turbot and brill make up the rest of the landings. Dab and undersized plaice are the most frequently observed discarded species (Tables 4, 5, 8, Figure 4). Most other discarded fish species include common dragonet and undersized sole (Table 8). The three most abundant observed discarded benthic species include common starfish, serpent sea star and swimming crab (Table 9).

3.4 TBB_DEF_100-119

The large beam trawlers (>300 hp) fishing with a mesh size of 100-119mm target plaice in the Northern North Sea (Figure 3). The large mesh sized beam trawler metier is a seasonal fishery, with highest fleet effort in quarters 3 and 4 (Table 2a, Figure 2). Two trips were sampled for this metier in quarters 1 and 2, which coincides with a sampling coverage of 2.2% (Tables 2b, 3).

Plaice is the most frequently observed landed species (Table 4). Dab and undersized plaice are the most frequently observed discard fish species (Tables 4, 5, 8 and Figure 4). However, the observed discard estimate for plaice is lower than the small mesh sized beam trawlers; 49% of plaice catch discarded in TBB_DEF_100-119 *vs*. 85% of plaice catch discarded in TBB_DEF_70-99_G300hp (Table 4). The observed discarded benthic species are dominated by sand sea star, followed by swimming crab and common starfish (Table 9).

3.5 TBB_DEF_>=120

The fleet effort of the large beam trawlers (>300hp) with fishing with a mesh size of 120mm has increased substantially since 2011. TBB_DEF_>=120 is a seasonal fishery, with peaking fleet effort in spring and summer (quarters 2 and 3) (Table 2a, Figure 2). The majority of the effort is concentrated in the Northern North Sea (Figure 3). In winter, effort is reduced (Table 2a). Two trips were sampled for this metier in quarters 1 and 3, which coincides with a sampling coverage of 0.8% (Tables 2b, 3).

Plaice is the most frequently observed landed species within this metier (Table 4). Undersized plaice and dab are the most frequently observed discarded fish species (Tables 4, 5, 8, Figure 4). The observed discarded benthic species are dominated by sand sea star, followed by flying crab (*Liocarcinus holsatus*) and masked crab (Table 9).

3.6 OTB_DEF_32-69

The ottertrawl fishery targeting cephalopods is an upcoming fisheries, with peaking fleet effort in quarter 4 (Table 2a, Figure 2). The effort is concentrated in the Southern North Sea (Figure 3). Two trips were sampled for his metier in quarter 4, which coincides with a sampling coverage of 1.2 % (Tables 2b, 3).

This metier is predominantly targeting cephalopods. The most frequently observed landed species are European squid and common cuttlefish (Table 4). Herring (*Clupea harengus*) was the most frequently observed discarded fish species, followed by striped red mullet (*Mullus surmuletus*) and horse mackerel (*Trachurus trachurus*) (Tables 4, 5, 8). Benthic species were observed in low numbers in comparison with the other sampled metiers (Table 9).

3.7 OTB_CRU_70-99

Even though otter trawlers fishing with small mesh size (OTB_70-99) operate with similar gear, the target species may differ. To discriminate between the different fisheries, the metiers are classified (post sampling) based on landing data per trip. If *Nephrops* from otter-trawl gears (OTB/OTT) composes more than 30% of the landings in a trip, this trip is classified as a crustacean (OTB_CRU) targeting metier. If *Nephrops* composes less than 30% and > 0% of landings in a trip, the trip is classified as a mixed crustacean and demersal fish (OTB_MCD) targeting metier. If no *Nephrops* is landed, the trip is classified as a demersal fish (OTB_DEF) targeting metier. It should be noted that this results in a knowledge deficiency of the initial purpose of the fishing trip (which is probably linked to fishing location), as an unsuccessful trip for *Nephrops* will be classified as OTB_MCD or OTB_DEF and the other way round.

Nephrops occur in specific habitats, which to some extent is reflected in the distribution of the total effort of this metier (Figure 3). OTB_CRU_70-99 shows a peak in the fleet effort in Q2 and Q3 (Table 2a, Figure 2). Thirty-six trips were sampled for this metier, which coincides with a sampling coverage of 6.15% (Tables 2b, 3).

This metier lands most *Nephrops* of the sampled demersal metiers (Table 4). Plaice and turbot also comprise a large part of the landings (Table 4). Brill and various other species make up the rest of the landings (Table 4). Dab is the most frequently discarded fish species, followed by undersized plaice, whiting and grey gurnard (Tables 4, 5, 8, Figure 4). *Nephrops* is the most frequently discarded benthic species. Furthermore, the common starfish and sand sea star belong to the most frequently discarded benthic species (Table 9).

3.8 OTB_MCD_70-99

OTB_MCD_70-99 shows a peak in fleet effort in Q1 (Table 2a, Figure 2). The distribution of the total effort of this metier is similar to that of OTB_CRU_70-99 (Figure 3). Four trips were sampled for this metier, resulting in a sampling coverage of 5.4% (Tables 2b, 3). Plaice is the most frequently landed species within this metier, followed by *Nephrops* (Table 4). Turbot, dab, brill and various other species make up the rest of the landings (Table 4). Dab is the most frequently discarded fish species, followed by undersized plaice and grey gurnard (Tables 4, 5, 8, Figure 4). The common starfish, sea potato and sand sea star area the most frequently discarded benthic species (Table 9).

3.9 OTB_DEF_100-119

OTB_DEF_100-119 shows a peak in fleet effort in Q3 (Table 2a, Figure 2). Seven trips were sampled for this metier, resulting in a sampling coverage of 6.1% (Tables 2b, 3). This metier targets plaice, at the Dogger Bank (Table 4, Figure 3), resulting in plaice being the most frequently landed species within this metier (Table 4). Herring (*Clupea harengus)* is the most frequently discarded fish species, followed by dab, mackerel (*Scomber scombrus*) and undersized plaice (Tables 4, 5, 8 and Figure 4). The pelagic species herring and mackerel were discarded in a single trip. Common starfish is the most frequently discarded benthic species. The observed benthos discards numbers within this metier are substantially lower than observed in the other sampled metiers (Table 9).

4 Discussion

Discard patterns are quite similar between the seven sampled bottom trawling metiers; dab and undersized plaice are the most frequently discarded species. The majority of the benthic, non-fish, discards within the beam trawl and otter trawl metiers consisted of echinoderms and crustaceans.

In 2022 numerous vessels participating in the reference fleet discontinued fishing for longer periods of the year due to high fuel prices and bad weather. Consequently, the planned number of 160 trips could not be reached in 2022.

While specific recruitment criteria (i.e. geartype, mesh size and landing harbour) are used when selecting vessels for the reference fleet, the actual metier that is assigned after sampling may differ as the choice of geartype and/or mesh size of a vessel may change. For example, while several eurocutters targeting flatfish (TBB_DEF_70-99_S300hp) were included in the 2022 reference fleet, most vessels decided, just as in 2021, to target shrimp throughout the entire year. As a result, only two trips of eurocutters targeting flatfish were sampled in 2022. To a certain extent, this is also reflected in the fleet effort of this metier which was considerably lower, especially in quarters 3 and 4 (Table 2a), in comparison with previous years.

From 2017 onwards the flyshoot fishery has not been part of the reference fleet (Verkempynck et al., 2018). As discarding patterns of the flyshoot fishery differ from the bottom-trawl fishery (Verkempynck et al., 2018), and the flyshoot fishery represents ~3-4% of the total Dutch demersal fleet effort (Van Overzee et al., 2019), efforts have been and will continue being made to reintroduce this fishery in the monitoring programme. A consortium of WMR, Good Fish, and Cornelis Vrolijk/Jaczon conducted a monitoring project of the Dutch flyshoot fishery where observer trips were carried out in the period 2021-2023 to obtain, amongst others, discard data from the Dutch flyshoot fishery (Van der Pol et al., 2023).

To verify the accuracy and objectivity of the self-sampling programme, every year, 10 observer trips (i.e. observer programme) are planned to be carried out on board of fishing vessels that participate in the programme. Analysis on the relationship between the catches of both the observer and the self-sampling programme for the period 2011-2018 have been carried out and results show that catches (in numbers) in co-sampled hauls (i.e. hauls sampled by both the observer programme and self-sampling programme) of the more abundant species do not significantly differ between the two programmes. While the time period of these analyses is somewhat outdated, there is no indication that behaviour has changed. In addition, a comparison of all sampled hauls collected within the observer and self-sampling programme onboard the large beam trawlers (metier=TBB_DEF_70-99_G300hp) in the period 2018-2021 shows variations in the observed discards by year and species (Van Overzee & Chen, 2023).

Ideally, all sampled trips are randomly selected from the Dutch demersal active fleet when sampling its discards, and all refusal rates are recorded. In practice, such a random approach will increase the time and effort to collate the discard data enormously. The use of a reference fleet is a practically desirable alternative option, though it is important that this reference fleet mirrors the Dutch demersal active fleet with respect to their overall discarding patterns. Since 2018, the sampled trips have randomly been divided over the reference fleet and any refusals are recorded. Figure 3 shows that for the less frequently sampled metiers, sampling effort does not always follow fleet effort in time and space. In order to solve this issue, an increase in sampling intensity is needed, and, consequently, an extension of the reference fleet for these metiers would be necessary. As the data collection under the DCF is based on end-user needs (both in quantitative as qualitative aspects), the end-user should, ideally in consultation with the data provider, flag and argue when sampling intensity should be increased in time and space.

For the demersal fisheries the landing obligation has been phased in over a number of years, starting in 2016 and full implementation in January 2019. It is clear that as discarding will continue under various forms of exemptions (high survivability, *de minimis*, prohibited species), a discards monitoring programme remains necessary under the landing obligation. Furthermore, additional monitoring of Below Minimum Size (BMS) landings needs to be captured in the sampling programme. From 2016 onwards, BMS sampling has been included as a separate catch fraction in the sampling protocol of the discards monitoring programme. BMS has been collected and registered irregularly in the self-sampling trips since the phasing in of the landing obligation. The collected information of the BMS catch fraction is not reported here, as it is considered incomplete and therefore may be interpreted wrongly.

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Tables and Figures

Table 1: List of Dutch bottom-trawl metiers sampled in 2022. Note that not all metiers are sampled for discards each year. Classification according to European Union (EU) definitions (2019/910 Table 2) requiring information about gear type (i.e. demersal beamtrawl – TBB; otter trawl - OTB/OTT), target species assemblage (i.e. demersal fish - DEF, mixed crustaceans and demersal fish – MCD; level 5) and mesh size ranges (in mm; level 6).

Level 4 **Gear type**	**Level 5** **Target assemblage**	**Level 6** **Mesh size**
TBB (> 300 hp)*	DEF	70-99 **
TBB (≤ 300 hp)*	DEF	70-99 **
TBB	DEF	100-119
TBB	DEF	>=120
OTB***	DEF	32-69
OTB***	CRU	70-99
OTB***	MCD	70-99
OTB***	DEF	100-119

* Note that the TBB metier is further subdivided on a national level in the Netherlands based on engine size (horse power, hp): vessels with ≤ 300hp engine power are so-called "Eurocutters".

** Note, that due to regulation vessels within this metier do not fish with a mesh size < 80 mm.

*** In this report, all OTB should be read as OTB/OTT/QUA, as in logbook in the Netherlands data bottom otter (OTB), otter twin trawl (OTT), and quadrig (QUA) gear can be used interchangeably.

Table 2a. Total effort by sampled metier (in kWdays) and quarter for the sampled metiers in **2022.**

Metier	2022 Q1	Q2	Q3	Q4	Total
OTB_CRU_70-99_0_0	57232	221450	302233	92311	673226
OTB_DEF_100-119_0_0	9035	67850	94484	14510	185878
OTB_MCD_70-99_0_0	57663	29439	8238	26583	121923
OTB_DEF_32-69_0_0	9538			73778	83316
TBB_DEF_>=120_0_0	328957	909459	494913	177220	1910548
TBB_DEF_100-119_0_0	21881	128038	264446	135153	549517
TBB_DEF_70-99_0_0_G300hp	4036221	2304965	3157765	3175504	12674454
TBB_DEF_70-99_0_0_S300hp	95935	118882	1049	290	216156
Total	4616460	3780082	4323126	3695349	16415018

Table 2b. Summary of the number of valid self-sampled trips per metier for **2022** by quarter.

Metier	2022 Q1	Q2	Q3	Q4	Total
OTB_CRU_70-99_0_0	3	11	16	6	36
OTB_DEF_100-119_0_0		4	2	1	7
OTB_MCD_70-99_0_0	1	1	1	1	4
OTB_DEF_32-69_0_0				2	2
TBB_DEF_>=120_0_0		2			2
TBB_DEF_100-119_0_0	1		1		2
TBB_DEF_70-99_0_0_G300hp	16	11	21	35	83
TBB_DEF_70-99_0_0_S300hp	2				2
Total	23	29	41	45	138

Table 3. Sampling and fleet effort (in kWdays) of sampled metiers, and sampling coverage (% of kWdays) per self-sampled metier for **2022**.

Metier	Sampling effort (kWdays)	Fleet effort (kWdays)	Sampling coverage kWdays (%)
OTB_CRU_70-99_0_0	414216	673226	61.5
OTB_DEF_100-119_0_0	11407	185878	6.14
OTB_MCD_70-99_0_0	6551	121923	5.37
OTB_DEF_32-69_0_0	1007	83316	1.21
TBB_DEF_>=120_0_0	14925	1910548	0.78
TBB_DEF_100-119_0_0	12228	549516	2.23
TBB_DEF_70-99_0_0_G300hp	572443	12674454	4.52
TBB_DEF_70-99_0_0_S300hp	981	216156	0.45

Table 4. Average weight (in kg) per hour of discarded (D) and landed (L) commercially-important target species and corresponding discards percentage (%D): dab (DAB), plaice (PLE), sole (SOL), brill (BLL), turbot (TUR), cod (COD), whiting (WHG), *Nephrops* (NEP), common cuttlefish (CTC), European squid (SQR) and cephalopods (CEP) by metier for **2022**. N= number of sampled trips, na= not available (No length-weight key was used on CTC, SQR and CEP data).

		BLL			COD			DAB			NEP			PLE		
Metier	**N**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**
OTB_CRU_70-99_0_0	36	0	0.47	0%	0.37	0.25	60%	84.24	0.52	99%	16.26	30.83	35%	32.87	15.63	68%
OTB_DEF_100-119_0_0	7	0.16	1.03	13%	0.16	0	100%	28.16	1.67	94%	0.5	3.04	14%	14.24	48.8	23%
OTB_MCD_70-99_0_0	4	0	2.44	0%	1.11	0.89	56%	64.44	2.7	96%	1.81	5.3	25%	48.21	27.21	64%
OTB_DEF_32-69_0_0	2	0	0		0	0		4.87	0	100%	0	0		3.26	0	100%
TBB_DEF_>=120_0_0	2	0	2.11	0%	0.3	0	100%	14.11	7.41	66%	0	0.12	0%	70.73	111.8	39%
TBB_DEF_100-119_0_0	2	0	0.07	0%	0	0		52.02	3.74	93%	0	0		157.12	160.3	49%
TBB_DEF_70-99_0_0_G300hp	83	0.04	0.96	4%	0.11	0.05	69%	78.06	2.05	97%	0.05	0.02	71%	119.87	21.3	85%
TBB_DEF_70-99_0_0_S300hp	2	0	0.18	0%	0	0		68.62	2.69	96%	0	0		70.99	18.69	79%

Table 4. Continued.

		SOL			TUR			WHG			CTC			SQR		
Metier	**N**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**	**D**	**L**	**%D**
OTB_CRU_70-99_0_0	36	0.02	0.35	5%	0.09	2.25	4%	13.68	0.07	99%	0	0		0	0	
OTB_DEF_100-119_0_0	7	0	0.05	0%	1.23	6.75	15%	0.51	0	100%	0	0.79	0%	0	36.38	0%
OTB_MCD_70-99_0_0	4	0	0.2	0%	0.15	9.34	2%	13.2	0.36	97%	0	0		0	0	
OTB_DEF_32-69_0_0	2	0.35	0	100%	0	0		3.86	0	100%	na	6.21		0	86.79	0%
TBB_DEF_>=120_0_0	2	0	0		0	2.86	0%	2.55	0	100%	0	0		0	0	
TBB_DEF_100-119_0_0	2	0	0		0	1.18	0%	0.11	0	100%	0	0		0	0	
TBB_DEF_70-99_0_0_G300hp	83	2.84	23.39	11%	0.2	3.95	5%	10.46	0.02	100%	na	0.15		na	0	
TBB_DEF_70-99_0_0_S300hp	2	1.24	7.7	14%	0	0.05	0%	0.51	0	100%	0	0		0	0	

Table 4. Continued.

Metier	N	CEP		
		D	L	D
OTB_CRU_70-99_0_0	36	0	0	
OTB_DEF_100-119_0_0	7	0	0	
OTB_MCD_70-99_0_0	4	0	0	
OTB_DEF_32-69_0_0	2	0	83.79	0%
TBB_DEF_>=120_0_0	2	0	0	
TBB_DEF_100-119_0_0	2	0	0	
TBB_DEF_70-99_0_0_G300hp	83	0	0	
TBB_DEF_70-99_0_0_S300hp	2	0	0	

Table 5. Average number per hour of discarded (commercially-important target species: dab (DAB), plaice (PLE), sole (SOL), brill (BLL), turbot (TUR), cod (COD), whiting (WHG), *Nephrops* (NEP), common cuttlefish (CTC), European squid (SQR) and cephalopods (CEP) by metier for **2022**. N= number of sampled trips.

Metier	N	BLL	COD	DAB	NEP	PLE	SOL	TUR	WHG	CTC	SQR	CEP
OTB_CRU_70-99_0_0	36	0	2.62	1316.26	786.2	317.93	0.13	0.33	202.95	0	0	0
OTB_DEF_100-119_0_0	7	0.72	0.93	332.84	20.03	103.21	0	4.17	7.86	0	0	0
OTB_MCD_70-99_0_0	4	0	4.82	900.85	76.04	423.58	0	0.97	125.69	0	0	0
OTB_DEF_32-69_0_0	2	0	0	43.64	0	33.5	4.47	0	27.06	8.05	0	0
TBB_DEF_>=120_0_0	2	0	3.2	140.1	0	667.19	0	0	25.13	0	0	0
TBB_DEF_100-119_0_0	2	0	0	663.48	0	1388.85	0	0	1.68	0	0	0
TBB_DEF_70-99_0_0_G300hp	83	0.28	0.81	1575.55	2.08	1644.83	33.88	1.1	157	2.96	0.24	0
TBB_DEF_70-99_0_0_S300hp	2	0	0	1234.33	0	837.49	22.76	0	8.48	0	0	0

Table 6. Average weight (kg) per hour of discarded (Dis) and landed (Lan) commercially-important target species: dab (DAB), plaice (PLE), sole (SOL), brill (BLL), turbot (TUR), cod (COD), whiting (WHG), *Nephrops* (NEP), common cuttlefish (CTC), European squid (SQR) and cephalopods (CEP) by metier for **2022**. N= number of sampled trips, na= not available (No length-weight key was used on CTC, SQR and CEP data).

Metier	Q	N	Dis BLL	Lan BLL	Dis COD	Lan COD	Dis DAB	Lan DAB	Dis NEP	Lan NEP	Dis PLE	Lan PLE	Dis SOL	Lan SOL	Dis TUR	Lan TUR	Dis WHG	Lan WHG
OTB_CRU_70-99_0_0	1	3	0	0.09	0.3	0.77	44.8	0.55	20	20.44	44.03	26.01	0	0.02	0	0.8	5.21	0.11
OTB_MCD_70-99_0_0	1	1	0	0.2	0.43	0.49	79.73	3.15	4.31	8.52	71.34	17.47	0	0.11	0	2.15	4.23	0.23
TBB_DEF_100-119_0_0	1	1	0	0	0	0	84.43	3.13	0	0	253.84	165.33	0	0	0	0	0	0
TBB_DEF_70-99_0_0_G300hp	1	16	0.04	1.42	0.42	0	86.91	3.01	0.02	0	85.97	12.27	2.9	26.99	0.19	1.81	18.52	0
TBB_DEF_70-99_0_0_S300hp	1	2	0	0.18	0	0	68.62	2.69	0	0	70.99	18.69	1.24	7.7	0	0.05	0.51	0
OTB_CRU_70-99_0_0	2	11	0	0.56	0.64	0.12	92.54	0.59	8.91	17.63	44.6	12.71	0.04	0.34	0.25	3.34	15.87	0.09
OTB_DEF_100-119_0_0	2	4	0	0.52	0.2	0	19.12	1.9	0.86	2.73	7.82	61.11	0	0	0.01	6.61	0.87	0
OTB_MCD_70-99_0_0	2	1	0	3.65	2.89	0	110.13	0	0	0	46.42	16.84	0	0	0.35	16.02	0.34	0
TBB_DEF_>=120_0_0	2	2	0	2.11	0.3	0	14.11	7.41	0	0.12	70.73	111.8	0	0	0	2.86	2.55	0
TBB_DEF_70-99_0_0_G300hp	2	11	0.17	0.31	0.03	0	141.95	3.16	0	0.11	74.52	8.7	4.5	23.68	0	1.5	6.97	0
OTB_CRU_70-99_0_0	3	16	0	0.48	0.03	0.03	82.12	0.55	21.73	39.38	23.07	6.22	0.01	0.44	0.02	1.83	15.7	0.03
OTB_DEF_100-119_0_0	3	2	0.56	2.55	0.17	0	60.3	2.02	0.04	5.19	34.2	48.58	0	0.19	4.27	10.42	0.04	0
OTB_MCD_70-99_0_0	3	1	0	5.26	0	0	60.79	7.43	0.08	0	19.92	43.2	0	0	0.24	15.31	0.05	0
TBB_DEF_100-119_0_0	3	1	0	0.14	0	0	19.61	4.35	0	0	60.4	155.27	0	0	0	2.37	0.22	0
TBB_DEF_70-99_0_0_G300hp	3	21	0	1.05	0.04	0.01	119.64	2.2	0	0.01	132.71	26.12	2.52	19.94	0.43	4.85	4.94	0
OTB_CRU_70-99_0_0	4	6	0	0.42	0.83	0.8	94.36	0.25	13.28	32.25	31.91	39.59	0	0.02	0	1.81	8.5	0.16
OTB_DEF_100-119_0_0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTB_MCD_70-99_0_0	4	1	0	0.64	1.13	3.08	7.11	0.22	2.86	12.68	55.17	31.34	0	0.7	0	3.89	48.2	1.22
OTB_DEF_32-69_0_0	4	2	0	0	0	0	4.87	0	0	0	3.26	0	0.35	0	0	0	3.86	0
TBB_DEF_70-99_0_0_G300hp	4	35	0.01	0.9	0.03	0.12	28.99	1.18	0.11	0	141.92	26.49	2.49	23.72	0.14	5.16	11.18	0.06

Table 6 Continued.

Metier	Q	N	Dis CTC	Lan CTC	Dis SQR	Lan SQR	Dis CEP	Lan CEP
OTB_CRU_70-99_0_0	1	3	0	0	0	0	0	0
OTB_MCD_70-99_0_0	1	1	0	0	0	0	0	0
TBB_DEF_100-119_0_0	1	1	0	0	0	0	0	0
TBB_DEF_70-99_0_0_G300hp	1	16	na	0	0	0	0	0
TBB_DEF_70-99_0_0_S300hp	1	2	0	0	0	0	0	0
OTB_CRU_70-99_0_0	2	11	0	0	0	0	0	0
OTB_DEF_100-119_0_0	2	4	0	0	0	0	0	0
OTB_MCD_70-99_0_0	2	1	0	0	0	0	0	0
TBB_DEF_>=120_0_0	2	2	0	0	0	0	0	0
TBB_DEF_70-99_0_0_G300hp	2	11	0	0	0	0	0	0
OTB_CRU_70-99_0_0	3	16	0	0	0	0	0	0
OTB_DEF_100-119_0_0	3	2	0	0	0	0	0	0
OTB_MCD_70-99_0_0	3	1	0	0	0	0	0	0
TBB_DEF_100-119_0_0	3	1	0	0	0	0	0	0
TBB_DEF_70-99_0_0_G300hp	3	21	na	0	na	0	0	0
OTB_CRU_70-99_0_0	4	6	0	0	0	0	0	0
OTB_DEF_100-119_0_0	4	1	0	5.55	0	254.65	0	0
OTB_MCD_70-99_0_0	4	1	0	0	0	0	0	0
OTB_DEF_32-69_0_0	4	2	na	6.21	0	86.79	0	83.79
TBB_DEF_70-99_0_0_G300hp	4	35	na	0.36	na	0	0	0

Table 7. Average number per hour of discarded (Dis) commercially-important target species: dab (DAB), plaice (PLE), sole (SOL), brill (BLL), turbot (TUR), cod (COD), whiting (WHG) and *Nephrops* (NEP), common cuttlefish (CTC), European squid (SQR) and cephalopods (CEP) by metier and quarter (Q) in **2022**. N= number of sampled trips.

Metier	Q	N	BLL	COD	DAB	NEP	PLE	SOL	TUR	WHG	CTC	SQR	CEP
OTB_CRU_70-99_0_0	1	3	0	4.65	641.43	967.41	447.64	0	0	59.24	0	0	0
OTB_MCD_70-99_0_0	1	1	0	4.52	1138.12	196	674.09	0	0	61.01	0	0	0
TBB_DEF_100-119_0_0	1	1	0	0	1042.12	0	2261.53	0	0	0	0	0	0
TBB_DEF_70-99_0_0_G300hp	1	16	0.26	3.25	1815.13	0.45	1196.44	35.35	0.82	224.6	0.41	0	0
TBB_DEF_70-99_0_0_S300hp	1	2	0	0	1234.33	0	837.49	22.76	0	8.48	0	0	0
OTB_CRU_70-99_0_0	2	11	0	5.13	1539.69	451.32	408.59	0.3	0.98	234.69	0	0	0
OTB_DEF_100-119_0_0	2	4	0	1.28	233.65	34.64	59.18	0	0.03	12.85	0	0	0
OTB_MCD_70-99_0_0	2	1	0	10.28	1475.17	0	348.68	0	2.7	5.39	0	0	0
TBB_DEF_>=120_0_0	2	2	0	3.2	140.1	0	667.19	0	0	25.13	0	0	0
TBB_DEF_70-99_0_0_G300hp	2	11	1.49	0.2	2804.4	0	1157.45	50.06	0	66.5	0	0	0
OTB_CRU_70-99_0_0	3	16	0	0.2	1296.97	1064.68	247.02	0.09	0.08	248.88	0	0	0
OTB_DEF_100-119_0_0	3	2	2.52	0.7	697.64	0.84	242.87	0	14.54	1.82	0	0	0
OTB_MCD_70-99_0_0	3	1	0	0	892.53	2.32	212.41	0	1.2	2.32	0	0	0
TBB_DEF_100-119_0_0	3	1	0	0	284.84	0	516.16	0	0	3.37	0	0	0
TBB_DEF_70-99_0_0_G300hp	3	21	0	0.14	2517.58	0.16	1836.7	28.55	2.77	65.28	0.5	0.02	0
OTB_CRU_70-99_0_0	4	6	0	3.45	1295.47	566.93	275.94	0	0	94.13	0	0	0
OTB_DEF_100-119_0_0	4	1	0	0	0	0	0	0	0	0	0	0	0
OTB_MCD_70-99_0_0	4	1	0	4.48	97.58	105.85	459.15	0	0	434.02	0	0	0
OTB_DEF_32-69_0_0	4	2	0	0	43.64	0	33.5	4.47	0	27.06	8.05	0	0
TBB_DEF_70-99_0_0_G300hp	4	35	0.07	0.29	514.6	4.62	1887.85	31.32	0.58	209.56	6.52	0.56	0

Table 8. Average number of discarded fish species per hour in Dutch demersal fisheries by metier in **2022**.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Agonus cataphractus	1.21	0	0.71	0.89	0.47	1.2	5.96	1.8
Amblyraja radiata	2.62	0.21	1.46	0	0.47	5.17	0.4	0
Ammodytes	0	0	0	0	6.79	43.77	7.53	0
Anarhichas lupus	0	0	0	1.45	0	0	0	0
Arnoglossus laterna	19.15	0.44	9.14	0	4.17	24.97	104.63	2.51
Belone belone	0	0	0	0	0	0	0.04	0
Buglossidium luteum	7.13	0.54	6.54	0	8.98	27.95	71.15	0
Callionymus lyra	32.73	3.75	40.19	66.57	10.98	24.9	51.69	32.95
Callionymus maculatus	0	0	0	0	0	0	0.09	0
Callionymus reticulatus	0	0	0	0	0	0	0.73	0
Chelidonichthys cuculus	0	0	0	0	0	0	0.08	0
Chelidonichthys lucerna	2.39	6.04	17.13	16.75	0	0	24.31	0
Ciliata mustela	0.04	0	0	0	0	0	0.04	0
Ciliata septentrionalis	0	0	0	0.46	0	0	0	0
Clupea harengus	0.55	642.53	1.26	3073.68	0	0	0.85	0
Congridae	0	0	0	1.03	0	0	0	0
Cyclopterus lumpus	0	0.02	0	0	0	0	0	0
Dicentrarchus labrax	0	0	0	0	0	0	0.05	0
Echiichthys vipera	0	0	0	0	0	0	38.4	0
Enchelyopus cimbrius	3.8	0	0.35	0	0	0	2.43	0
Engraulis encrasicolus	0	0	0	0	0	0	0.02	0
Entelurus aequoreus	0	0	0	0	0	0	0.07	0
Eutrigla gurnardus	115.02	42.45	251.01	3.86	89.42	76.71	48.25	0
Gadus morhua	2.62	0.93	4.82	0	3.2	0	0.81	0
Glyptocephalus cynoglossus	0.74	0	0.81	0	0	0	0	0
Hippocampus hippocampus	0	0	0	0	0	0	0.16	0
Hippoglossoides platessoides	8.16	1.95	2.26	0	0	1.22	0.08	0
Hyperoplus lanceolatus	0	0	0	0.42	5.03	0	2.96	0

Table 8. Continued.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Limanda limanda	1316.26	332.84	900.85	43.64	140.1	663.48	1575.55	1234.33
Lophius piscatorius	0.1	0	0	0	1.37	0	0.03	0
Melanogrammus aeglefinus	51.14	0.18	36.65	0	9.87	0	1.3	0
Merlangius merlangus	202.95	7.86	125.69	27.06	25.13	1.68	157	8.48
Microstomus kitt	7.46	2.01	10.64	80.47	1.34	15.1	5.14	4.53
Molva molva	0.03	0	0	0	0	0	0	0
Mullus surmuletus	0.87	0.58	0.78	748.23	0	0	5.89	0
Mustelus	0.2	0	0	0	0	0	0.61	0
Myoxocephalus scorpius	0.31	0.31	0.67	0	0	0	5.07	13.51
Pegusa lascaris	0	0	0	0	0	0	0.03	0
Phrynorhombus norvegicus	0.72	0.24	0.91	0	0	0	0.1	0
Platichthys flesus	0.06	0	0	0	0	0	1.01	8.51
Pleuronectes platessa	317.93	103.21	423.58	33.50	667.19	1388.85	1644.83	837.49
Pomatoschistus minutus	0.05	0	0	0	0	0	0.6	0
Pomatoschistus sp.	0	0	0	0	0	0	0.27	0
Raja	0	0	0	0	0	0	0.19	0
Raja brachyura	0.08	0.17	0	0	0	0	1.1	0
Raja clavata	0.64	4.85	2.61	0	0	0	6.71	0
Raja montagui	1.04	0.56	1.49	0	0	0	7.89	0
Scomber scombrus	0.09	141.53	0	41.67	0	0	0.07	0
Scomberesox saurus	0	0	0	0	0	0	0.14	0
Scophthalmus maximus	0.33	4.17	0.97	0	0	0	1.1	0
Scophthalmus rhombus	0	0.72	0	0	0	0	0.28	0
Scyliorhinidae	0	0	0	0	0	0	0.21	0
Scyliorhinus canicula	4.18	2.33	2.71	0.46	0	0	13.89	0
Solea solea	0.13	0	0	4.47	0	0	33.88	22.76
Sprattus sprattus	0.13	0	0	0	0	0	1.74	0

Table 8. Continued.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Squalus acanthias	0.02	0	0	0	0	0	0	0
Syngnathus acus	0	0	0	0	0	0	0.07	1.13
Taurulus bubalis	0	0	0	0	0	0	0.1	0
Trachinus draco	0	0	0	0	0	0	0.3	0
Trachurus trachurus	0	7.36	0	302.82	0	0	0.69	0
Trisopterus esmarkii	0.1	0	0	0	0	0	0	0
Trisopterus luscus	0	0	0.2	18.73	0	0	1.35	0
Trisopterus minutus	0.07	0	0.23	44.34	0	0	0.06	0
Zeus faber	0	0	0.14	0	0	0	0.04	0

Table 9. Average numbers per hour of discarded benthos species in Dutch demersal fisheries by metier in **2022**.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Abra prismatica	0	0	0	0	0	0	3.22	0
Acanthocardia echinata	0.93	0	0.2	0	0	0.91	40.58	1.21
Adamsia palliata	0	0	0	0	0	0	1.26	0
Aequipecten opercularis	0.72	0.03	0.4	25.50	0.5	0	2.26	0
Alcyonidium diaphanum	0	0.7	0	0	0	2.74	30.57	0
Alcyonium digitatum	0.61	0.31	6.98	0.42	68.12	2.21	3.44	0
Alitta virens	0.07	0.21	0	0	0	0	0.16	0
Alloteuthis subulata	2.26	0.07	0.38	0	0	0	4.1	0
Angulus fabula	0	0	0	0	0	0	0.02	0
Anthozoa	0.14	0	0.67	0	0	0	1.63	16.91
Aphrodita aculeata	88.91	6.34	158.01	0	0	49.12	55.14	0
Arctica islandica	0.21	0	0.71	0	2.26	0	1.27	0
Ascidiella scabra	0	0	0	0	0	0	1.66	0
Asterias rubens	428.82	150.26	1061.89	1.70	95.73	453	1558.31	2929.77
Astropecten irregularis	370.86	26.18	324.64	0	915	2397.57	7402.1	0
Atelecyclus rotundatus	0.04	0	0	0.42	0	0	0.31	0
Atelecyclus undecimdentatus	0.02	0	0	0	0	0	0.01	0
Bryozoa	0	0	0	0	0	0	0	0
Buccinum undatum	1	0.12	0.2	0.42	0	2.4	22.23	0
Cancer pagurus	4.68	0.62	1.76	0.42	5.04	0.38	2.72	0
Carcinus maenas	0.03	0	0	0	0	0	0	34.78
Chamelea striatula	0.04	0	0	0	0	0	5.62	0
Ciona intestinalis	0	0	0	0	0	0	0.68	0
Colus gracilis	0.22	0	0	0	0	0	0	0
Corbula gibba	0.08	0	0	0	0	0	0	0
Corystes cassivelaunus	4.19	1.84	27.28	0	147.32	67.42	633.15	0
Crangon crangon	0.15	0	0	0	0	0	2.17	0
Crassostrea gigas	0	0	0	0	0	0	0	1.13

Table 9. Continued.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Crepidula fornicata	0.47	0	0	0	0	0	4.09	55.88
Cyanea	0	0.02	0	0	0	0	0	0
Diogenes pugilator	0	0	0	0	0	0	0.06	0
Donax vittatus	0	0	0	0	0	0	0.96	0
Dosinia	0	0	0.55	0	0.5	1.22	0.16	0
Dosinia exoleta	0	0	0	0	0	0	0.23	0
Echinocardium cordatum	55.85	23.68	712.66	0	5.43	159.93	1658.86	17.87
Ectopleura larynx	0	0	0	0	0	0	2.14	0
Electra pilosa	0	0	0	0	0	0	0	0
Ensis	0	0	0	0	0	0	0.89	0
Ensis leei	0	0	0	0	0	0	0	16.18
Euspira catena	0	0	0	0	0	0	20.22	10.79
Euspira nitida	0	0	0	0	0	0	0.05	0
Flustra foliacea	0.17	0.04	0	0	0	1.22	6.41	0
Fucus vesiculosus	0.01	0	0	0	0	0	0	0
Gari fervensis	0	0	0	0	0	0	0.53	0
Glycymeris glycymeris	0	0	0	0	0	0	0.55	0
Goneplax rhomboides	32.68	0.48	3.45	0	0	0.91	215.43	0
Halecium halecinum	0	0	0	0	0	0	0.13	0
Halichondria panicea	0.9	0.38	1.22	0	1.36	22.72	1.73	0
Holothuroidea	0.34	0	0	0	0	0	0.12	0
Hyas araneus	0.05	0	0	0	0	0	0.05	0
Hyas coarctatus	0.11	0	0	0	0	0	0.22	0
Idotea	0	0	0	0	0	0	0.13	0
Idotea balthica	3.82	0	0	0	0	0	1.51	0
Inachus dorsettensis	0	0	0	0	0	0	0.41	0
Laevicardium crassum	0	0	0	0.46	0.45	0	4.13	0

Table 9. Continued.

Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Liocarcinus marmoreus	0	0	0	3.51	16.93	0	14.4	2.73
Liocarcinus navigator	0	0	0	0	0	0	0	173.73
Lithodes maja	0.03	0	0	0	0	0	0	0
Loligo	0.01	0	0	0	0	0	0.12	0
Loligo forbesii	0.25	0	0.34	16.31	0	0.77	0.55	0
Loligo vulgaris	0	0	0	0	0	0	0.24	0
Luidia sarsii	1.29	0.84	6.39	0	4.72	25.19	27.98	0
Lutraria lutraria	0	0	0	0	0	0	0.29	2.17
Macomangulus tenuis	0	0	0	0	0	0	0.11	0
Macropodia rostrata	0	0	0	0	0	0	2.27	0.3
Macropodia tenuirostris	0.03	0	0	0.42	0	0	0.13	0
Mactra stultorum	0.06	0	0	0	0	3.66	12.27	0
Maja squinado	0	0	0	0	0	0	0.43	0
Metridium dianthus	0	0	0	0	0	0	0.34	0
Musculus	0	0	0	0	0	0	0.16	0
Mya arenaria	0.03	0	0	0	0	0	0.18	0
Mya truncata	0.1	0	0	0	0	0	0	1.46
Mysia undata	0	0	0	0	0	0	0.03	0
Mytilus edulis	1.31	0.17	0	0	0	0	48.15	16.54
Nassarius	0	0	0	0	0	0	0.01	0
Nassarius reticulatus	0	0	0	0	0	0	2.47	28.14
Necora puber	0.46	0	0.82	2.21	0	0	5.8	27.59
Nemertesia	0	0	0	0	0	0	0.88	0
Nemertesia antennina	0	0	0	0	0	0	0.05	0
Nephrops norvegicus	786.2	20.03	76.04	0	0	0	2.08	0
Neptunea antiqua	1.41	0.06	0	0	0	0.91	0	0
Nudibranchia	0	0	0	0	0	0	0.02	0

Table 9. Continued.

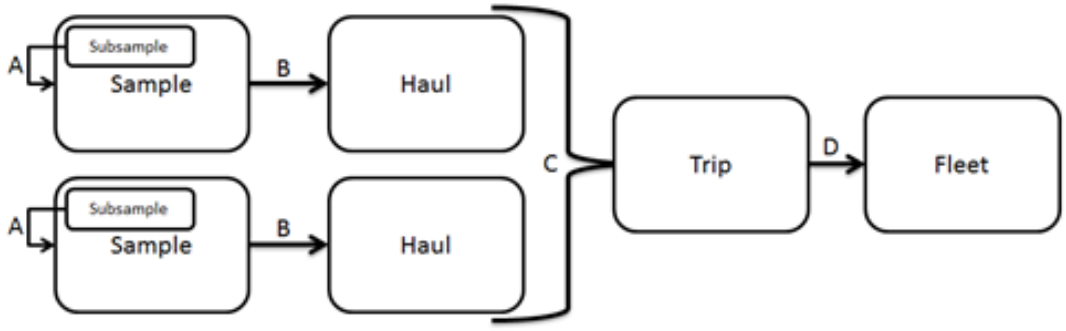
Scientific name	OTB_CRU_70-99	OTB_DEF_100-119	OTB_MCD_70-99	OTB_DEF_32-69	TBB_DEF_>=120	TBB_DEF_100-119	TBB_DEF_70-99_G300hp	TBB_DEF_70-99_S300hp
Octopus vulgaris	0	0	0	0	0	0	0.03	0
Ophiothrix fragilis	0.61	0.09	0	0	0	5.95	1.25	0
Ophiura albida	0.15	0	0	0	0	0	2.32	1.46
Ophiura ophiura	5.07	0.1	7.2	0	0.95	2.74	3418.5	955.47
Pagurus bernhardus	89.4	4.99	27.61	1.45	23.69	92.9	217.01	3.7
Pagurus prideaux	0	0	0	0	0	0	1.01	0
Pilumnus hirtellus	0	0	0	0	0	0	0.06	0
Pinnotheres pisum	0	0	0	0	0	0	0.04	0
Pontaster	0	0	0	0	0	3.64	0	0
Psammechinus miliaris	0.43	0	0	10.78	0	0	919.38	81.15
Sabellaria alveolata	0	0	0	0	0	0	7.31	0
Sagartia troglodytes	0	0	0	0	0	0	0.06	0
Sepia officinalis	0	0	0	8.05	0	0	2.96	0
Sepiola atlantica	0.03	0	0	0	0	0	0	0
Solen marginatus	0	0.14	0	0	0.93	0	0.48	0
Spatangus purpureus	0	0	0	0	0	0	0.33	0
Spisula elliptica	0	0	0	0	0	0	0.19	0
Spisula solida	0	0	0	0	0	0	8.93	0
Spisula subtruncata	0	0	0	0	0	0	4.31	2.81
Tubularia	0	0	0	0	0	0	0.04	0
Tubularia indivisa	0	0	0	0	0	0	0.08	0
Upogebia deltaura	0.02	0	0	0	0	0	0	0
Venerupis corrugata	0	0	0	0	0	0	0	7.04

Table 10a. Average weights (kg) and numbers per hour of landed (L) and discarded (D) plaice (PLE) and sole (SOL) in the beam trawl fisheries (TBB_DEF_70-99_>221kW) between 1976 and 2022. Nm, not measured; n/a, not available. (Before 2009, data is based on observer trips. 2009 and onwards is based on self-sampling trips.)

Year/		PLE Numbers			Weight			SOL Numbers			Weight		
Period	**N trips**	**L**	**D**	**%D**	**L**	**D**	**%D**	**L**	**D**	**%D**	**L**	**D**	**%D**
1976-1979	21	253	185	42%	108	28	20%	116	8	6%	32	1	4%
1980-1983	24	309	418	57%	99	51	34%	85	24	22%	19	3	15%
1989-1990	6	392	330	46%	104	46	30%	286	83	22%	48	12	20%
1999	3	145	181	55%	42	18	29%	112	16	13%	32	2	5%
2000	12	194	601	76%	50	47	48%	90	25	22%	22	2	10%
2001	4	364	1184	76%	84	89	51%	82	17	17%	17	1	6%
2002	6	263	868	77%	69	71	51%	126	38	23%	18	3	13%
2003	9	196	945	83%	52	70	57%	95	32	25%	20	3	14%
2004	8	158	792	83%	42	57	57%	175	69	28%	31	7	17%
2005	8	143	710	83%	47	51	52%	99	29	23%	20	2	11%
2006	9	166	997	86%	57	67	54%	64	26	29%	16	2	13%
2007	10	214	700	77%	67	57	46%	94	27	23%	22	2	10%
2008	10	169	902	84%	61	69	53%	95	16	16%	23	1	6%
2009	48	189	917	83%	61	76	55%	113	34	23%	25	3	11%
2010	74	201	872	81%	82	68	45%	132	42	24%	22	4	14%
2011	67	Nm	921	n/a	72	85	54%	Nm	50	n/a	23	5	18%
2012	61	Nm	934	n/a	90	87	49%	Nm	72	n/a	29	6	17%
2013	57	Nm	1189	n/a	81	106	57%	Nm	52	n/a	35	5	13%
2014	84	Nm	1191	n/a	81	104	56%	Nm	64	n/a	33	5	14%
2015	69	Nm	1057	n/a	65	95	59%	Nm	51	n/a	36	4	11%
2016	81	Nm	1061	n/a	74	99	57%	Nm	37	n/a	34	3	8%
2017	89	Nm	1035	n/a	65	92	59%	Nm	42	n/a	31	3	9%
2018	102	Nm	995	n/a	45	91	67%	Nm	35	n/a	25	3	11%
2019	91	Nm	953	n/a	34	75	69%	Nm	73	n/a	24	5	18%
2020	103	Nm	1097	n/a	25	87	78%	Nm	49	n/a	29	4	11%
2021	124	Nm	1228	n/a	26	109	81%	Nm	39	n/a	24	3	12%
2022	83	Nm	1645	n/a	21	120	85%	Nm	34	n/a	23	3	11%

Table 10b. Average weights (kg) and numbers per hour of landed (L) and discarded (D) dab (DAB) and whiting (WHG) in the beam trawl fisheries (TBB_DEF_70-99_>221kW) between 1976 and 2022. Nm, not measured; n/a, not available. (Before 2009, data is based on observer trips. 2009 and onwards is based on self-sampling trips.)

Year/		DAB Numbers			Weight			WHG Numbers			Weight		
Period	N trips	L	D	%D	L	D	%D	L	D	%D	L	D	%D
1976-1979	21	12	917	99%	4	65	95%	10	34	78%	3	5	62%
1980-1983	24	31	796	96%	7	60	90%	21	89	81%	5	11	69%
1989-1990	6	15	2147	99%	2	123	98%	5	122	96%	1	17	95%
1999	3	112	1411	93%	13	106	89%	Nm	77	n/a	<1	10	93%
2000	12	28	951	97%	6	49	89%	Nm	117	n/a	2	9	85%
2001	4	125	2268	95%	12	97	89%	Nm	69	n/a	1	9	86%
2002	6	92	934	91%	11	57	84%	14	104	88%	1	7	85%
2003	9	60	1166	95%	8	64	89%	2	40	96%	<1	3	86%
2004	8	54	1037	95%	7	51	87%	0	46	100%	<1	2	92%
2005	8	25	492	95%	6	52	90%	3	18	85%	<1	2	85%
2006	9	46	2335	98%	9	79	90%	Nm	36	n/a	<1	3	74%
2007	10	81	1196	94%	12	62	83%	0	10	100%	<1	3	87%
2008	10	51	905	95%	8	49	87%	0	15	100%	<1	3	93%
2009	48	31	1221	98%	33	62	65%	Nm	58	n/a	<1	5	89%
2010	74	48	1178	96%	10	65	87%	Nm	70	n/a	1	5	82%
2011	67	Nm	1350	n/a	12	74	86%	Nm	54	n/a	3	4	57%
2012	61	Nm	1106	n/a	8	63	89%	Nm	73	n/a	2	6	75%
2013	57	Nm	1543	n/a	8	84	91%	Nm	42	n/a	1	3	75%
2014	84	Nm	1508	n/a	5	79	94%	Nm	79	n/a	1	4	88%
2015	69	Nm	1212	n/a	4	59	94%	Nm	73	n/a	<1	4	95%
2016	81	Nm	1481	n/a	7	73	92%	Nm	61	n/a	<1	4	90%
2017	89	Nm	814	n/a	2	42	95%	Nm	73	n/a	<1	5	92%
2018	102	Nm	783	n/a	3	47	94%	Nm	82	n/a	<1	7	99%
2019	91	Nm	733	n/a	2	40	96%	Nm	133	n/a	<1	8	100%
2020	103	Nm	1022	n/a	1	54	97%	Nm	114	n/a	<1	6	99%
2021	124	Nm	1352	n/a	2	71	97%	Nm	136	n/a	<1	9	100%
2022	83	Nm	1576	n/a	2	78	97%	Nm	157	n/a	<1	10	100%



A: $number\ in\ subsample * subsample\ fraction$

B: $number\ in\ sample * \frac{Volume\ of\ (total\ catch\ of\ haul - total\ landings\ in\ haul)}{volume\ of\ discard\ sample}$

C: $sum\ of\ numbers\ in\ both\ samples * \frac{Total\ duration\ all\ hauls\ of\ the\ trip}{Duration\ both\ sampled\ hauls}$

D: $number\ per\ trip * \frac{effort\ (kWDays)\ national\ fleet\ (per\ métier)}{effort\ (kWDays)\ sampled\ trips\ (per\ métier)}$

Figure 1. Flowchart of the raising process

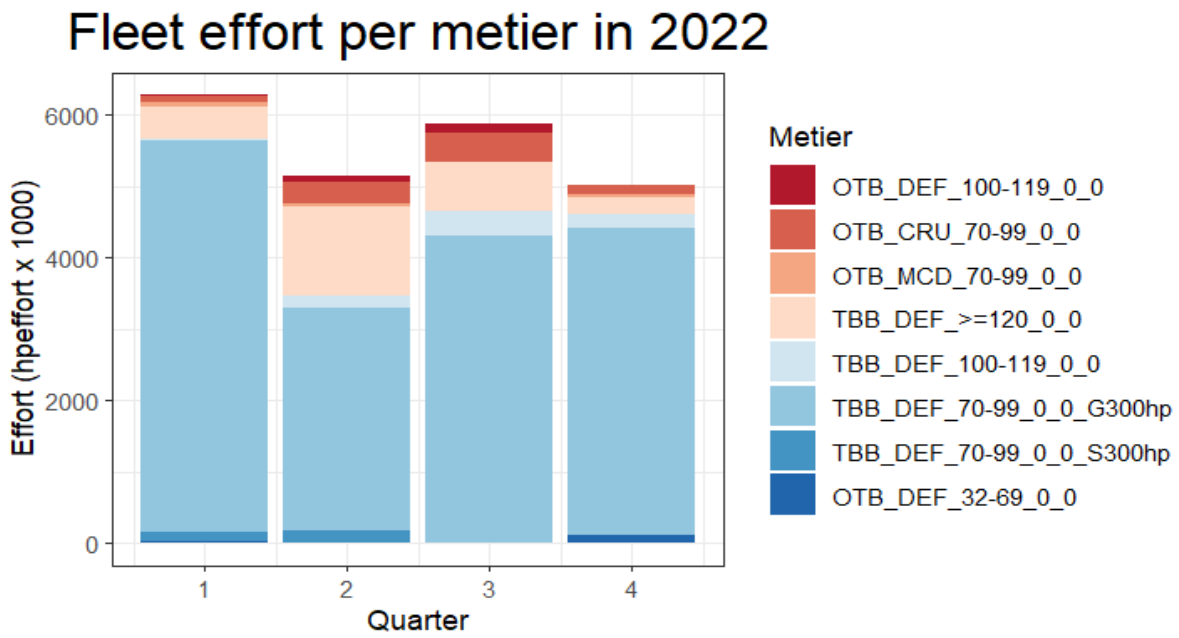


Figure 2. Effort of the Dutch Demersal fleet (in kW*days x 1000) in **2022** per quarter and metier

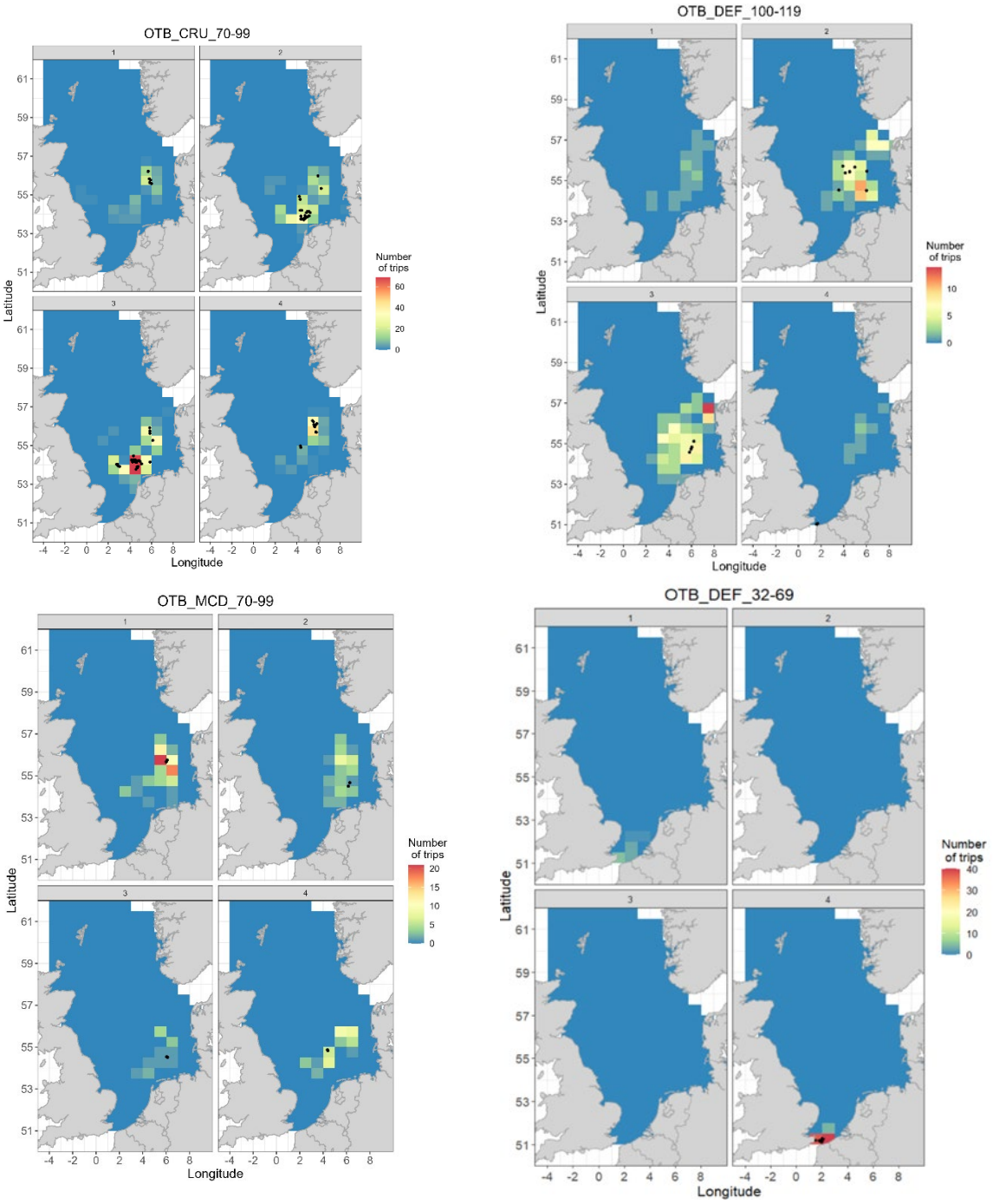


Figure 3. Distribution of total effort (expressed in number of trips at sea, shaded colours per ICES rectangle) and positions of sampled trawls (black dots) for the sampled demersal metiers in **2022** by quarter.

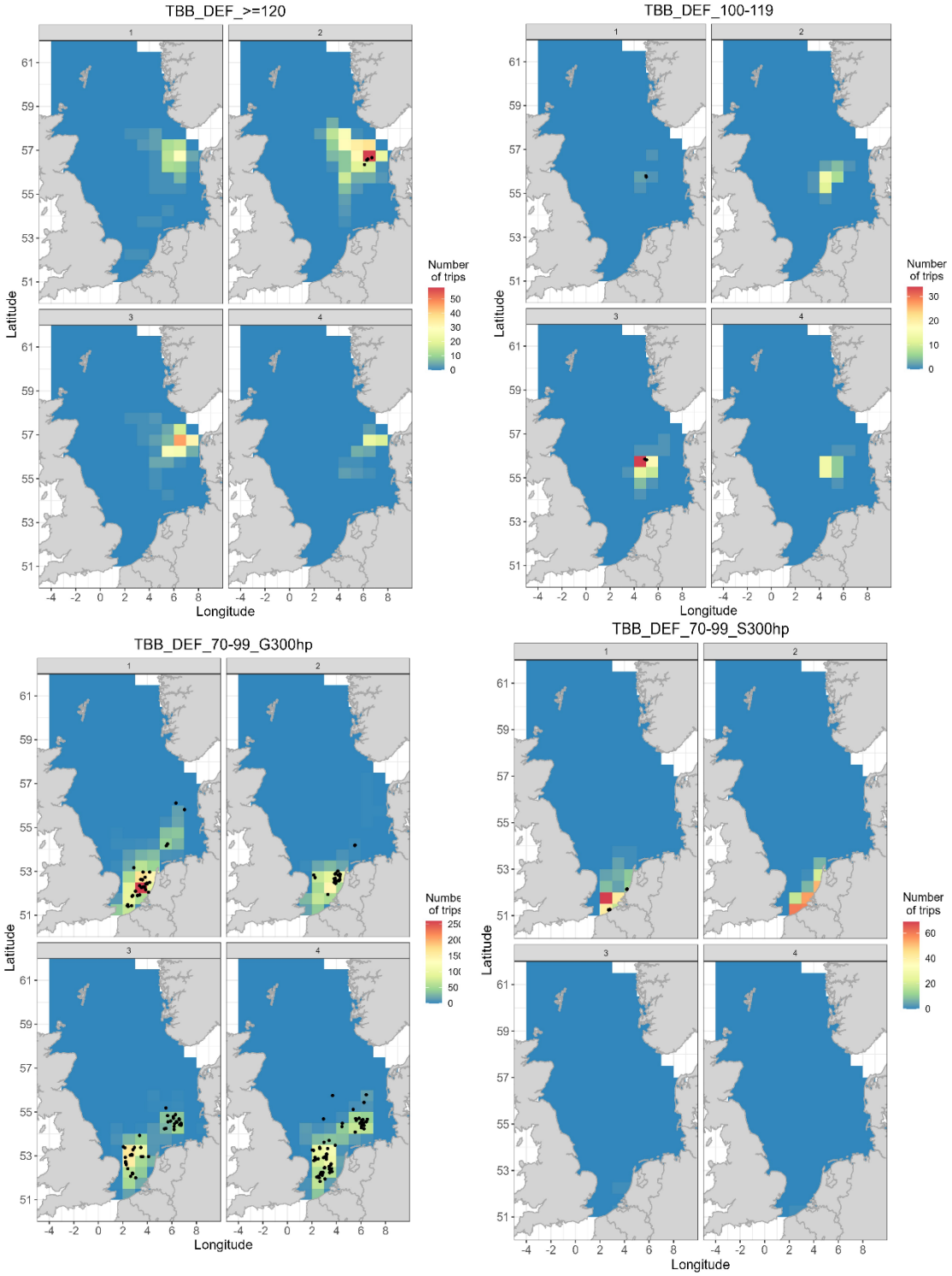


Figure 3. Continued. NB: Distribution of total effort for TBB_DEF_70-99_S300hp (expressed in number of trips at sea, shaded colours per ICES rectangle) too low to be visible for quarters 3 (2 trips) and 4 (1 trip)

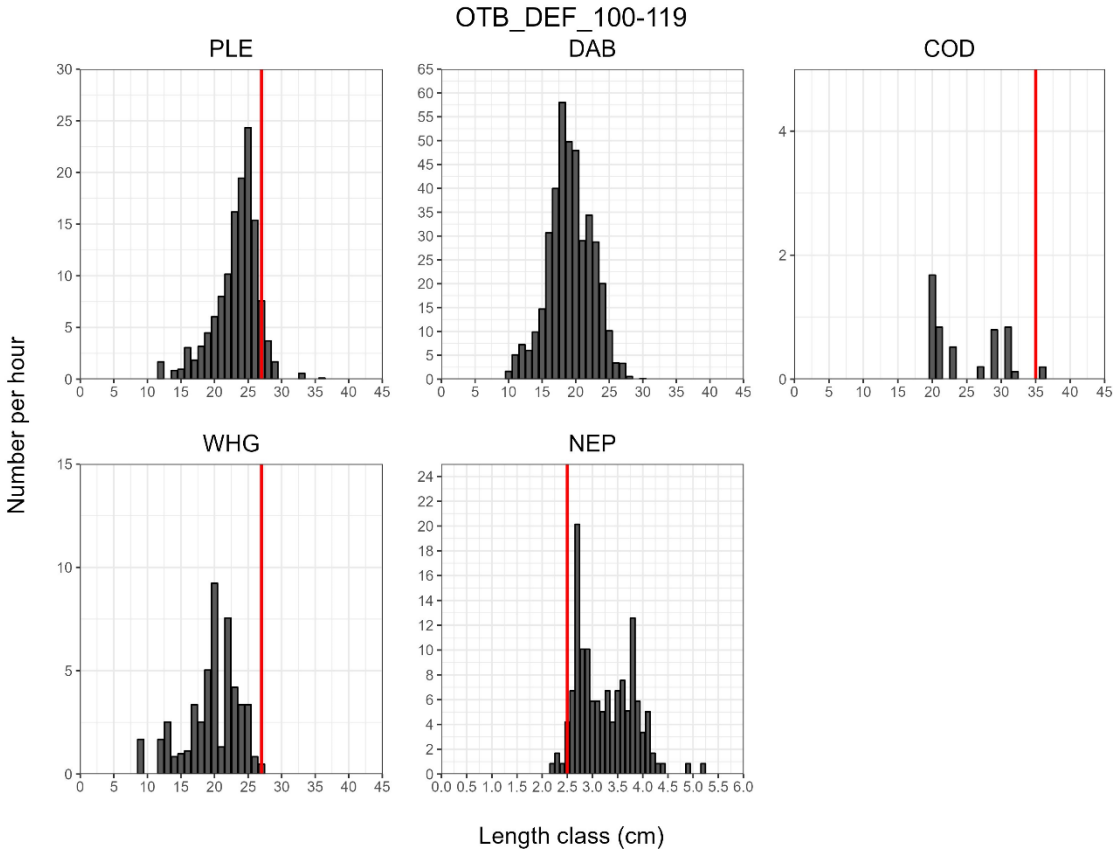


Figure 4. Number per hour discarded per length class (cm) for several discarded species for the sampled demersal metiers in **2022** (red line = Minimum Landing Size).

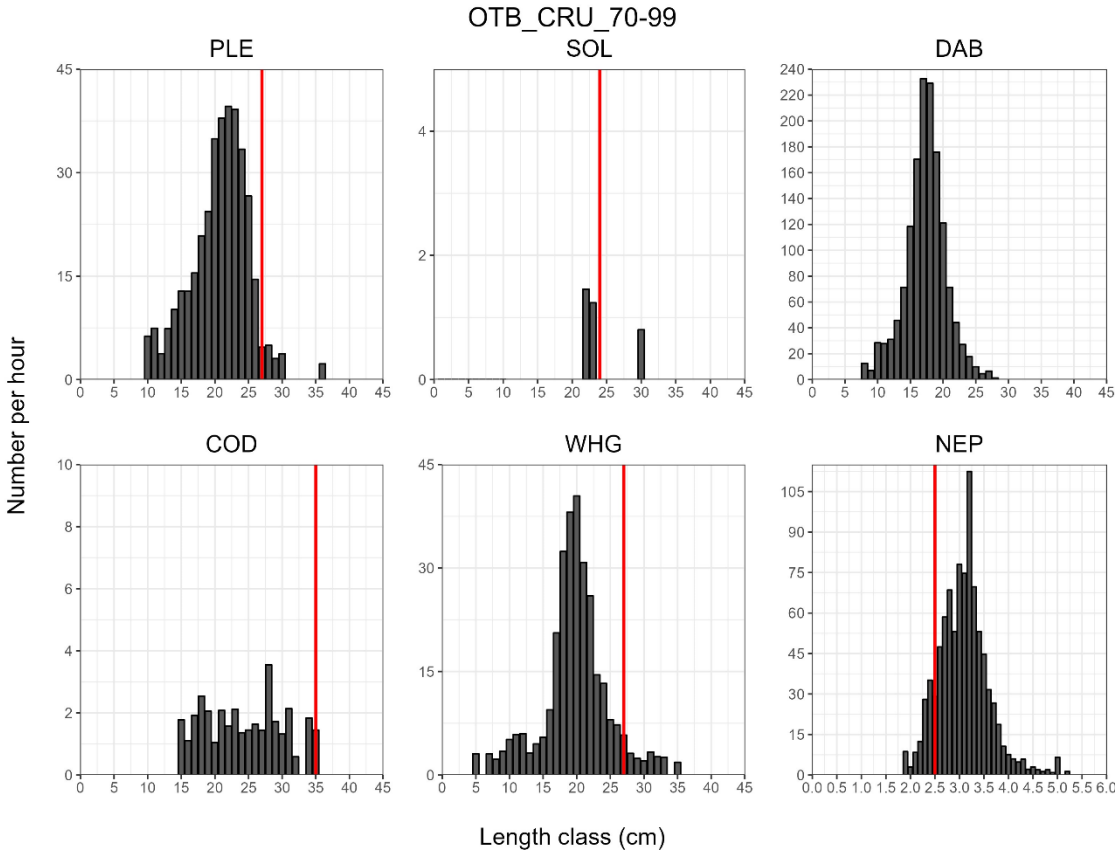


Figure 4. Continued.

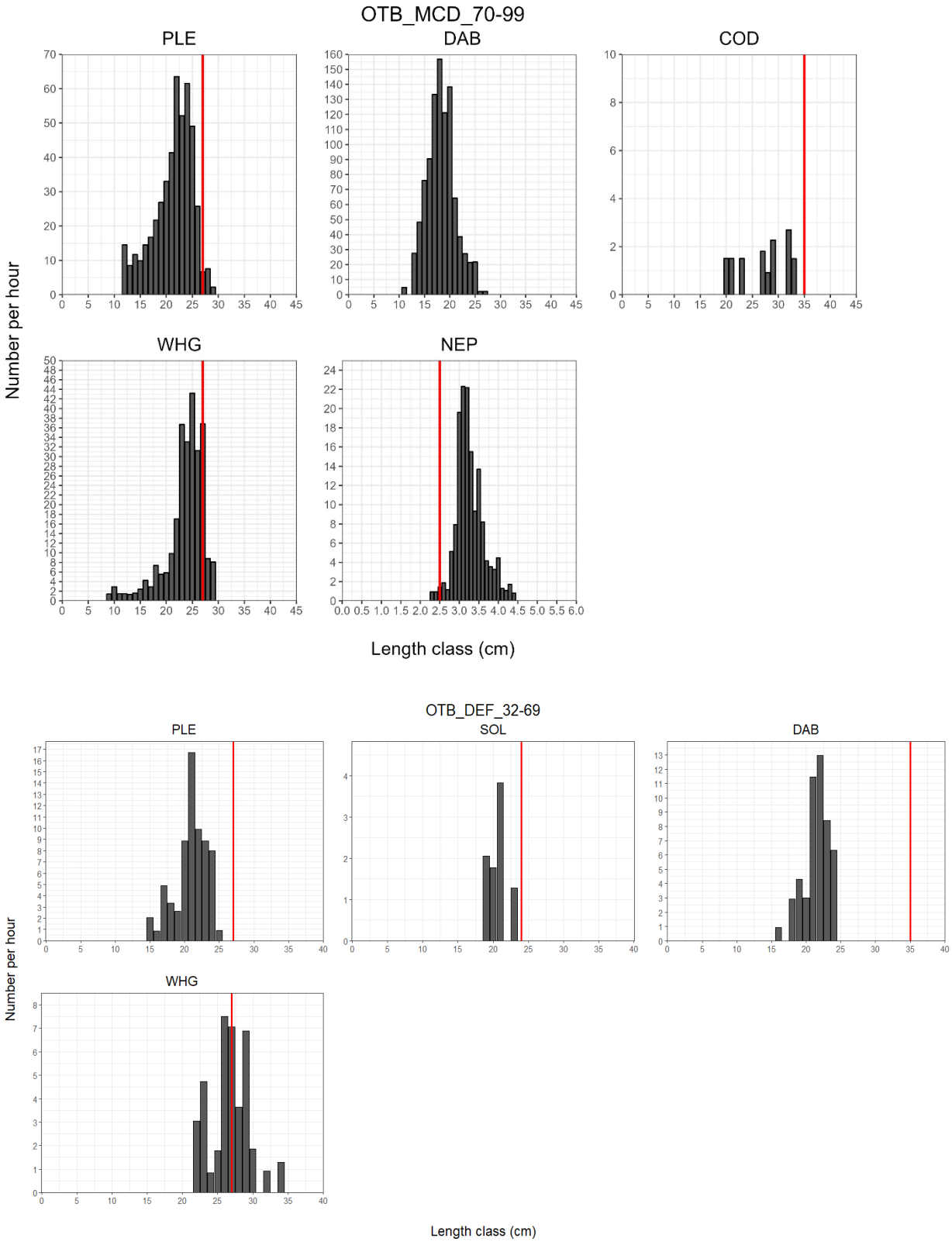


Figure 4. Continued.

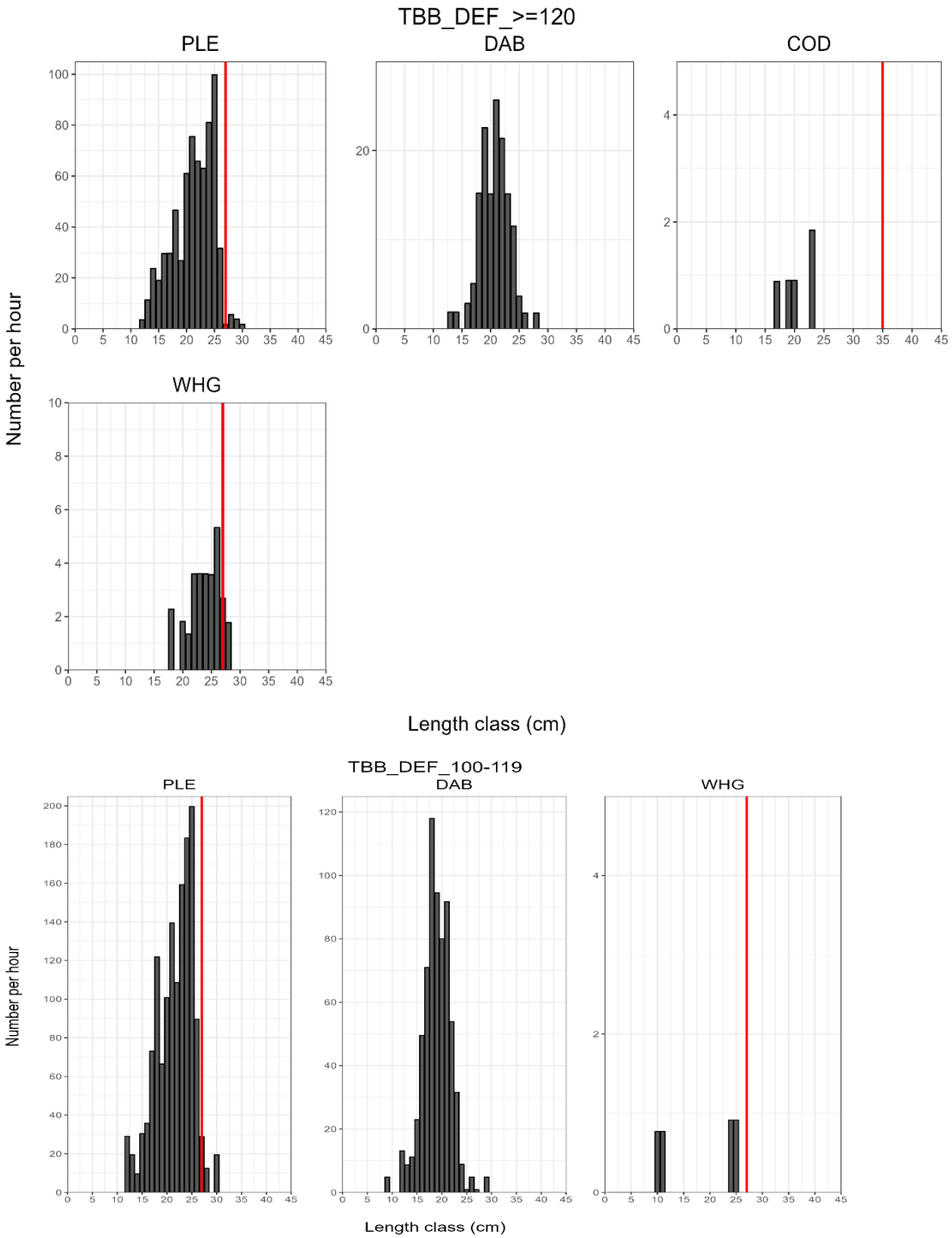


Figure 4. Continued.

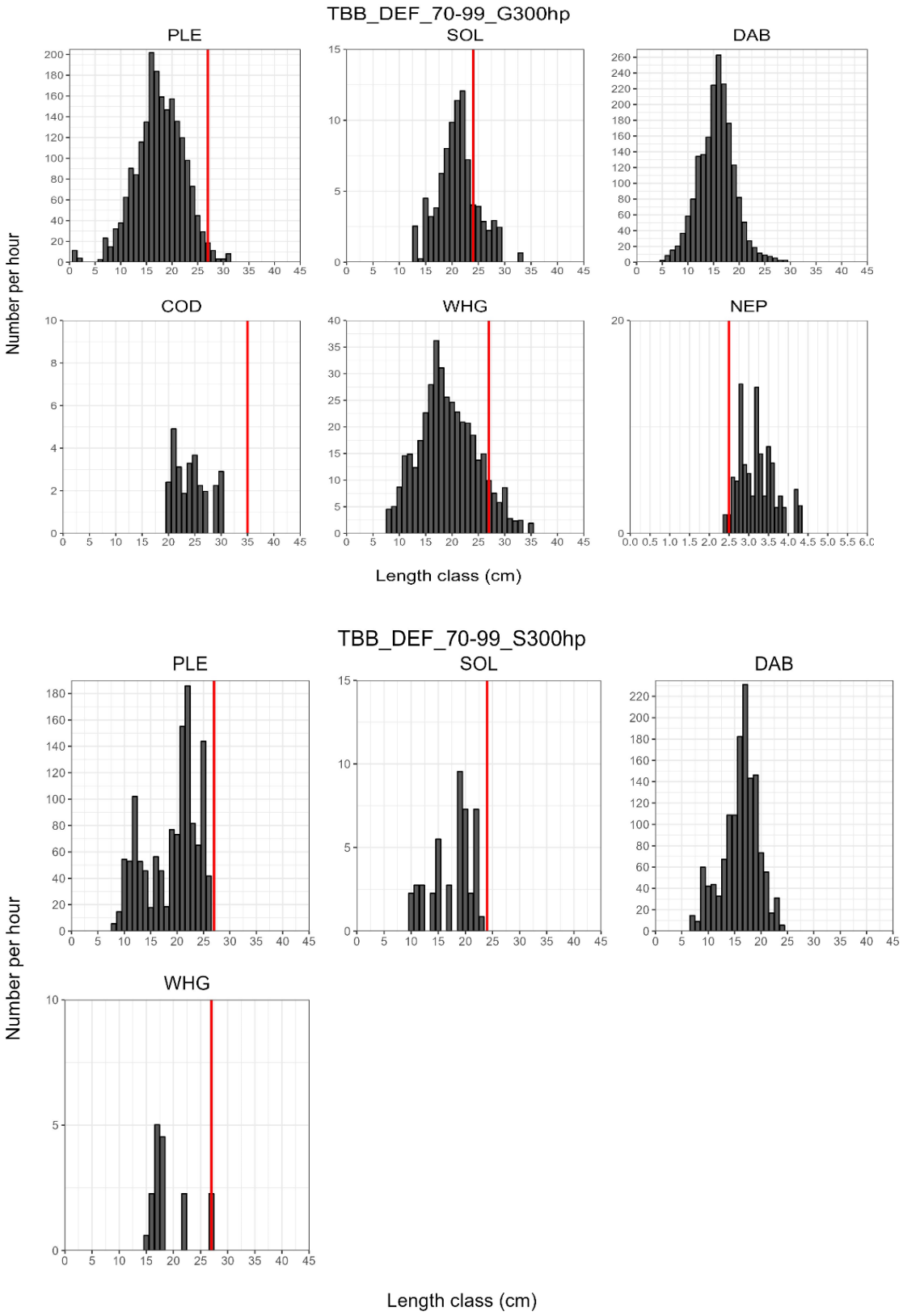


Figure 4. Continued.

Justification

CVO Report: 24.014
Project number: 4311213033.

The quality of this report has been peer reviewed by a colleague scientist and the head of CVO.

Approved by:	Karolina Molla Gazi MSc Researcher
Signature:	DocuSigned by: Karolina Molla Gazi CB4B4281711D493...
Date:	11 April 2024

Approved by:	Ing. S.W. Verver Head Centre for Fisheries Research
Signature:	DocuSigned by: Sieto Verver 59D037FEFE924D5...
Date:	11 April 2024