EU request on immediate measures to safeguard eastern Baltic cod, on mixing with western Baltic cod and bycatches in different fisheries

Advice summary

ICES advice for eastern Baltic cod for 2020 confirms its poor stock status.

1a. *Extending the spawning closure period in 2019:* ICES advises that when total catches are constrained by TACs set at sustainable levels, closures do not contribute substantially to sustainable exploitation; closures can, however, be considered as a supplement in specific circumstances. Spawning closures in particular can have additional benefits for the stock that cannot be achieved by TAC alone (e.g. increased recruitment through undisturbed spawning), though these effects cannot be demonstrated or quantified for eastern Baltic cod.

If spawning closures are chosen to be applied as a supplementary management measure, closures covering most of the distribution area of the stock during its main spawning time is preferable to small area closures. For eastern Baltic cod, peak spawning is in May–August and most of the stock is distributed in ICES subdivisions (SDs) 25–26, and partly in SD 24. To be effective any spawning closures in 2019 would need to be implemented during those months.

1b. *Reducing the TAC in 2019*: Closing all fisheries on the eastern Baltic cod stock (zero catch) in the third (Q3) and fourth (Q4) quarters of the year in 2019 is estimated to result in only a 4% higher spawning-stock biomass in 2020 compared with no additional catch restrictions in 2019. The limited effect is because presently fishing mortality is estimated to be much lower compared to natural mortality and because over half of the catch is normally taken in the first half of the year. However, fishing at any level targets the remaining few commercial sized (≥ 35 cm) cod, thus further deteriorating the stock structure and reducing its reproductive potential.

1c. *Closing the recreational fishery :* Recreational catches of eastern Baltic cod in SDs 25–32 have been in the range of 465–763 tonnes in the last three years, based on preliminary data available. This constitutes about 2% of the total cod catch in SDs 25–32. Any measures introduced on the recreational fisheries are expected to have a small impact on the eastern Baltic cod stock.

2. *Specific measures in the mixing area:* The commercial catch from the eastern Baltic cod stock expected to be taken in the mixing area (SD 24) in Q3–Q4 in 2019 is relatively low. The scenario with continued fishing in the mixing area in Q3–Q4 in 2019 results in only 1% lower spawning-stock biomass of the eastern Baltic cod in 2020 compared to the scenario when the catches in the mixing area in Q3–Q4 in 2019 are set to zero. All recreational cod catches taken in SD 24 are considered to be from the western Baltic cod stock. Thus, measures on the recreational cod fishery in SD 24 are thought to have no effect on the eastern Baltic cod stock.

3. *Bycatch of eastern Baltic cod in non-target fisheries:* It is not possible to estimate the bycatch levels of eastern Baltic cod in other, non-cod targeting fisheries because catch data (i.e. landings + discards) are not readily available. To address this request the landings compositions in 2018 were analysed by métier (gear, target assemblage, mesh size range, and country). Most (53) of the 68 métiers active in the Baltic Sea in SDs 24–28 in 2018 had no or very low amounts of cod in their landings.

Most of the landings of eastern Baltic cod come from mixed demersal fisheries. Fifteen métiers were found to have significant landings of cod. Two of these métiers account for 82% of the total cod landings in SDs 24–28 in 2018 (bottom trawl with > 105 mm mesh size and a 120 mm Bacoma exit window, and gillnets with 110–156 mm mesh size). These métiers are considered to target cod. Cod constituted approximately 40–50% of their annual landings, the other species landed were mostly flatfish. A further four métiers target cod and contributed approximately 15% of the total annual landings (bottom trawls with > 115 mm mesh size and longlines).

The remaining nine métiers landed a variety of different species, and cod constituted varying proportions of their landings. However, the overall amounts of cod in these métiers were low (less than 1% of the total annual cod landings).

A detailed breakdown of this is given later in the section on métiers.

Request

The EC has asked ICES to address the following request:

Assuming that the ICES stock advice would confirm the current indications and the situation would hence require rapid action,

1) *ICES is requested to provide advice on effective measures for 2019 to safeguard eastern Baltic cod, and in particular on the options below:*
    a. *Extending the spawning closure period for commercial and recreational fishing of eastern Baltic cod in terms of time and/or geographic scope, whereby ICES is requested to advise on appropriate modalities*
    b. *Reducing the TAC for eastern Baltic cod, whereby ICES is requested to advise on the appropriate level*
    c. *Closing the recreational fishery of eastern Baltic cod, whereby ICES should advise on the appropriate period.*
2) *Should in such case specific measures be considered in 2019 for the area where eastern and western Baltic cod mix, and if so, which would ICES recommend? In case of option 1b and 1c,*
   should the TAC for western Baltic cod and the bag limit for recreational fishing be reduced and by how much so as to avoid the potentially harmful effects of a possible effort reallocation of the fishing effort to other areas?
3) *If ICES were to advise no or very low catches of eastern Baltic cod for 2020, ICES is asked to estimate the bycatch levels of eastern cod in other, non-cod targeting fisheries, where possible broken down by fishery and Member State – taking the 2019 measures and fisheries as the starting point for this estimation. In case ICES were to advise measures for 2019 to safeguard eastern Baltic cod, ICES is also asked to estimate the bycatch levels of eastern cod in other, non-cod targeting fisheries, where possible broken down by fishery and Member State – taking the 2019 measures and fisheries as the starting point for this estimation.*

Elaboration on the advice

The spawning-stock biomass (SSB) of the eastern Baltic cod has been declining since 2015 and is estimated to have been below B_{lim} in the last two years. The biomass of commercial sized cod (≥ 35 cm) is presently at the lowest level observed since the 1950s. Fishing mortality (F) has declined since 2012. The value estimated for 2018 is the lowest on record, and substantially lower than the estimated natural mortality (ICES, 2019).

The poor status of the eastern Baltic cod is largely driven by biological changes in the stock during the last decades. Growth, condition (weight at length), and size at maturation have substantially declined. These developments indicate that the stock is distressed and is expected to have reduced reproductive potential. Natural mortality has increased, and is estimated to be considerably higher than the fishing mortality in recent years. The size of the largest fish in the population has shown a decline since 1990.

At the present low productivity, the stock is estimated to remain below B_{lim} in the medium term (2024), even with no fishing. Furthermore, fishing at any level will target the remaining few commercial sized (≥ 35 cm) cod, thereby further deteriorating the stock structure and reducing its reproductive potential.

The low growth, poor condition, and high natural mortality of cod are related to changes in the ecosystem, which include: (i) Poor oxygen conditions that can affect cod directly by altering their metabolism and, combined with a shortage of benthic prey, may additionally affect the survival of offspring; (ii) Low availability of fish prey in the main distribution area of cod, as sprat and herring are more northerly distributed and have little overlap with cod; and (iii) High infestation with parasites, which is related to increased abundance of grey seals. These drivers are interrelated and the relative impact on the cod stock is unclear.

Basis of the advice

1.a Effectiveness of spawning closures for the eastern Baltic cod

ICES evaluated the effectiveness of spawning closures for the eastern Baltic cod in 2018 (ICES, 2018). Here the main findings from this evaluation are summarized. Further details can be found in ICES (2018) and in Eero *et al.* (2019).

Methods

The specific biological objectives for cod spawning closures in the eastern Baltic Sea addressed in this evaluation were (i) increased recruitment via undisturbed spawning, taking into account survival probability of the offspring; (ii) increased proportion of larger/older individuals in the stock, which may also increase recruitment; and (iii) reduced total catch.

It is recognized that reduced total catch should not be the main objective of spawning closures in the eastern Baltic Sea, when catches are regulated by TAC. Thus, the potential objective of reduced total catch was only included for completeness.

The realized effects of spawning closures (e.g. increased recruitment, increased proportion of large cod in the population) on a fish stock are generally very difficult to demonstrate or quantify. This is because a large number of factors and processes influence recruitment as well as size structure of the stock. Thus, it is not possible to separate out effects of the closures on eastern Baltic cod stock from other factors that are known to influence the stock at the same time.

For this reason, ICES evaluated potential effects of the closures. The key focus in this approach is on the overlap between the closure and the stock component it is intended to protect. If such an overlap is not present, this implies that the closure cannot be beneficial, but can possibly be counterproductive for the stock. If the overlap is present, the closure can potentially contribute to achieving a given objective. However, it can still not be verified that the closure actually has a positive effect on the eastern Baltic cod stock; similarly it cannot be verified that the closure has any negative effect on the stock.

The evaluated closures include:

i) the presently applied area closures in the three designated areas in the eastern Baltic Sea (1 May–31 October), as specified in the Baltic MAP (2016), and potential modifications to these (Figure 1);
ii) the seasonal closure (1 July–31 August in 2018; July only in 2019) in SDs 25–26 and potential expansion of this seasonal closure to SDs 27–32 and to SD 24.

ICES evaluated potential positive and negative effects of both area and seasonal closures. Potential positive effects were related to overlap between the closure and the stock component intended to be protected. Potential negative effects of the closures were generally associated with possible spatial and temporal effort reallocation.

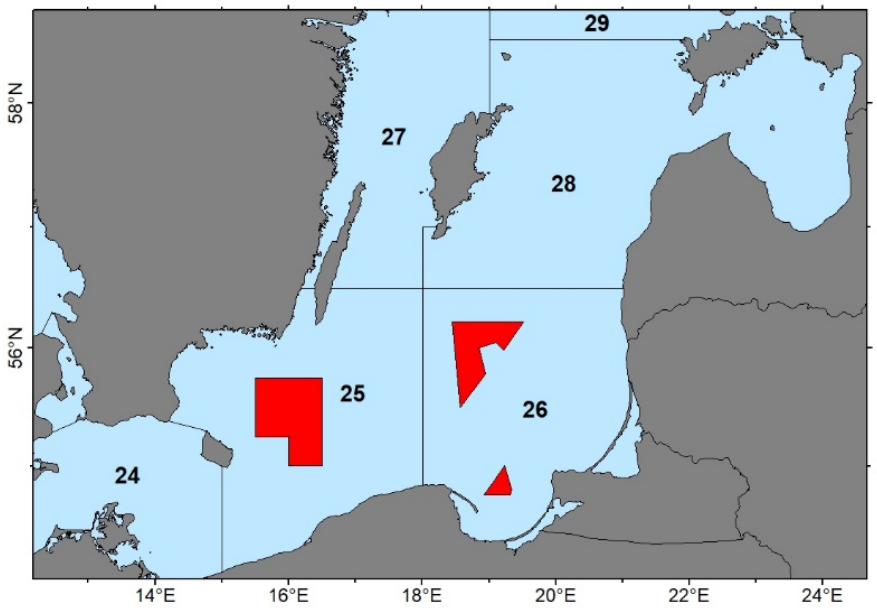

Figure 1 Area closures in the eastern Baltic Sea, enforced from 1 May to 31 October, as part of the Baltic MAP (EU, 2016).

The specific questions addressed by ICES for both the area and seasonal closures are shown in the table below.

Objectives	Criteria
Increased recruitment (via undisturbed spawning)	Is there an overlap between the closure and cod spawning activity, in time and space? Is there an overlap between the closure and spawners whose offspring has a higher probability of survival?
Increased proportion of larger cod	Is there an overlap between the closure and the abundance of large individuals of cod? Does the closure decrease the proportion of larger cod in fisheries catch?
Reduced total catch (F)	Is there an overlap between the closure and cod distribution? Could the same total amount of cod be caught regardless of the closure?

Results and conclusions on area closures

The existing area closure in the Bornholm Basin (1 May–31 October) has potentially both positive and negative effects for eastern Baltic cod. The potential negative effects are associated with effort reallocation to areas in the Bornholm Basin where spawners may produce eggs and larvae with a higher rate of survival, and to areas where larger individuals of eastern Baltic cod are relatively more abundant, at least in some years (i.e. in Subdivision 26). To eliminate these potential negative effects an extension of the closed area would need to include the area in the Bornholm Basin with water depths of 60 m or more, and additionally the entire SD 26. Further benefits to cod may be obtained by including the Slupsk Furrow, where cod spawning also takes place.

The current closure includes the period from May to October. Shortening the period of the closure to only cover the peak spawning (May–August) would not substantially reduce the potential benefits of the closure.

The present area closures in the Gdansk and Gotland basins have little potential to contribute to improving the stock status, given the present hydrographic conditions.

Results and conclusions on seasonal closures

The present seasonal closure (in July in 2019) in SDs 25–26 does not cover the period (June) when the most intensive spawning has been observed since 2010, and the closure may therefore cause increased disturbance of peak spawning in June due to effort reallocation. This potential negative effect can be eliminated by extending the period of the closure to include June.

Potential expansion of the closure to SDs 27–32 would have only minor potential benefits to the eastern Baltic cod stock, because cod abundance as well as catches are very low in this area.

A potential expansion of the closure to SD 24 may have some benefits to eastern Baltic cod recruitment due to undisturbed spawning, though the survival of eastern Baltic cod eggs spawned in this area is considered to be generally low. Quantitative analyses on the relative contribution of spawning in SD 24 to eastern Baltic cod recruitment are currently lacking. Similarly to SDs 25–26, a closure not covering June would potentially increase the disturbance of peak spawning (in June) due to effort reallocation. Thus, to avoid possible negative effects, if a closure in SD 24 is implemented, it should also cover June. Eastern and western Baltic cod are mixed in the entire SD 24. A summer closure in SD 24 may therefore have implications for western Baltic cod due to effort reallocation to SDs 22–23.

Overall conclusions

If spawning closures are chosen to be applied as a supplementary management measure, closures covering most of the distribution area of the stock during its main spawning time is preferable to small area closures. This is because small area closures cause fishing effort reallocation to other stock components, which risks the introduction of unintended negative effects via mechanisms that may not have been accounted for when designing the closure (Eero *et al.*, 2019). For eastern Baltic cod, most of the spawning takes place during May–August and the stock is mainly distributed in SDs 25–26. Part of the stock is also distributed in SD 24; however, the contribution of spawning in this area to overall recruitment of the eastern Baltic cod stock is unclear.

1.b Effect of a potential reduction of TAC in 2019 for the eastern Baltic cod

Methods

Total catch from the eastern Baltic cod stock in 2019 is assumed to be at 18 904 tonnes, if no additional fishing restrictions are implemented in 2019. This is based on the assumption that fishing mortality in 2019 stays at the same level as estimated for 2018, and it corresponds to a 12% lower catch in 2019 compared to 2018. This is considered to be the maximum likely catch level in 2019, given the declining biomass of the eastern Baltic cod. The catch at 18 904 tonnes was used as a starting point for the present analyses, exploring the effect of a possible reduction of catch/TAC in 2019 on stock development in short term.

If the TAC for 2019 were reduced, ICES assumes that this would only affect the cod catches in Q3 and Q4 in 2019. This is because the fishery in Q1 and likely also in Q2 have already taken place before such a measure could potentially be enforced in practise. Thus, in the short-term forecast scenarios with alternative catch levels for 2019, the catch for Q1–Q2 was kept as assumed in ICES latest stock assessment, and only the catches in Q3–Q4 were modified. The quarterly distribution of the assumed catches in 2019 was based on data from 2018 (67% in Q1–Q2 and 33% in Q3–Q4), which is similar to the average in the two previous years (2016–2017).

Short-term forecast scenarios

The short-term forecast scenarios conducted represent the maximum possible effect that could be obtained by reducing the TAC for 2019 from Q3 onwards, i.e. setting the catches to zero in the last two quarters of the year 2019. The two scenarios that were conducted differed in terms of whether the zero catch in Q3–Q4 applied for the entire eastern Baltic cod stock (including SD 24; ***Scenario 1***) or only for the eastern Baltic management area (SDs 25–32; ***Scenario 2***). These were compared with a run (***Scenario 0***) assuming no additional catch/TAC restrictions in 2019.

In ***Scenario 1***, total catch of the eastern Baltic stock in 2019 was reduced from 18 904 tonnes to 12 754 tonnes, which is the catch amount assumed to have been taken in Q1–Q2 (Table 1). This scenario corresponds to zero catch from the eastern Baltic cod stock in Q3–Q4 in 2019 (including SD 24).

In **Scenario 2**, zero catch in Q3–Q4 in 2019 was applied for SDs 25–32, but allowing for continued fishery in SD 24 with no further restrictions. Eastern Baltic cod is caught in SD 24 together with the western Baltic cod stock. Given that the TAC of 9515 tonnes established in the western Baltic management area (SDs 22–24) for 2019 will be taken, this is estimated to correspond to a catch of 3646 tonnes of the eastern Baltic cod in SD 24 in 2019.

In this scenario it is assumed that the geographical distribution of cod catches in the western Baltic management area in 2019 is the same as observed in 2016–2018 (52% in SD 24), implying that 4599 tonnes of the TAC of 9515 tonnes is expected to be taken in SDs 22–23 and 4916 tonnes in SD 24. Furthermore, the proportion of the eastern Baltic cod in the commercial cod catch in SD 24 is assumed to be the same as observed on average during 2016–2018 (74%). This results in a catch of 3646 tonnes of the eastern Baltic cod in SD 24, in 2019. About half of the annual commercial cod catch in SD 24 is expected to be taken in first two quarters of the year (based on 2018 data). This proportion could be higher in 2019, when no spawning closures in SD 22–24 have been implemented in the first quarter of the year. Thus, a maximum of 1823 tonnes (0.5 × 3646 tonnes) of eastern Baltic cod is expected to be taken in SD 24 in the second half of the year 2019. Thus, in ***Scenario 2***, 1823 tonnes of the eastern Baltic cod was assumed to be taken in Q3–Q4 in 2019, which corresponds to an annual catch of 14 577 tonnes of eastern Baltic cod in 2019 (Table 1).

This calculation considers the TAC to be the maximum commercial cod catch taken in SDs 22–24, not including discards that may occur in addition. Recreational fisheries in SD 24 are considered to target the western Baltic cod stock, as the recreational fishery largely takes place in near-shore areas, where the western Baltic cod dominate.

The catch assumptions for 2019 in the short-term forecast scenarios are summarized in the table below.

Table 1 Catch of the eastern Baltic cod stock in 2019 in short-term forecast scenarios.

Scenario	Total catch from the eastern Baltic cod stock in 2019	Basis
Scenario 0 : No action in 2019	18 904 tonnes	$F_{2019} = F_{2018}$
Scenario 1: No EB cod catch in Q3–Q4	12 754 tonnes	Catch in Q1–Q2, assuming the same quarterly distribution of catches (67% in Q1–Q2) as in 2018 (0.67 × 18 904 = 12 754 tonnes). Catch in Q3–Q4 is set to zero.
Scenario 2: No EB cod catch in Q3–Q4 in SDs 25–32, but EB cod catch in SD 24	14 577 tonnes	Catch in SDs 25–32 in Q3–Q4 is set to zero, allowing for continued fishery in SD 24. The expected catch amount of eastern Baltic cod in SD 24 is 1823 tonnes in Q3–Q4 (12 754 + 1823 = 14 577 tonnes).

In all these scenarios, the same assumptions were applied for recruitment (average of 2013–2017) and other biological parameters (latest estimates). The catch for 2020 was set to zero in all scenarios.

Results and conclusions

The results show little difference in estimated SSB in 2020 between the three scenarios (Table 2). Applying zero catch in Q3–Q4 for the entire eastern Baltic cod stock (*Scenario 1*) resulted in a 4% higher SSB compared to *Scenario 0*. Applying zero catch in Q3–Q4 only in SDs 25–32 resulted in a 3% higher SSB compared to *Scenario 0*.

TACs for the eastern Baltic cod have not been utilized since 2010 (in 2018, only 55% of the TAC was utilized). Therefore, a recommended reduction in TAC needs to be large enough to limit the landings in practice and have a measurable effect on the stock.

Even the zero catch in Q3–Q4 in 2019 makes only a little difference to the SSB because (i) the majority of the annual catch has already been taken in Q1–Q2, and (ii) fishing mortality at these catch levels is low compared to the estimated natural mortality. Fishing at any level targeting the remaining commercial sized (≥ 35 cm) cod further deteriorates the stock structure and reduces its reproductive potential.

ICES notes that in-year changes of fishing opportunities may unequally affect different countries or fleets.

Table 2 Results of the short-term forecast scenarios. Weights are in tonnes.

Scenario	Total catch (2019)	F (2019)	Total catch (2020)	F (2020)	SSB (2019)	SSB (2020)	SSB (2021)
Scenario 0	18904	0.21	0	0	66412	68942	77373
Scenario 1	12754	0.13	0	0	66353	71578	79122
Scenario 2	14577	0.15	0	0	66353	70773	78580

1.c Recreational fishery for the eastern Baltic cod

Recreational cod catches are mainly taken by charter vessels supporting a relevant recreational fishing tourism in some EU Member States, e.g. Poland and Denmark. For the purpose of this request several EU Member States provided information on recreational catches of cod in SDs 25–32 (Table 3). ICES has not evaluated the quality of these data, in stock assessment context. The total recreational catch amounts of the eastern Baltic cod have ranged between 465 tonnes and 763 tonnes in the last three years. These figures are considered to be a minimum estimate, since not all EU Member States were able to contribute with recreational fishery data (Table 3).

The available estimate of recreational catch constitutes approximately 2% of the total catch of eastern Baltic cod in SDs 25–32, in the last three years (Table 4). All recreational cod catches taken in SD 24 are considered to be from the western Baltic cod stock.

The level of recreational cod catch is presently low compared to commercial catch. However, a severe reduction of commercial fishing opportunities for cod in the eastern Baltic management area could lead to an increased importance of the recreational cod fishery. In terms of ecosystem impacts hook-and-line fisheries are generally considered to have low impacts on marine ecosystems compared to other fishing methods. There is presently no EU regulation for recreational cod fishery in SDs 25–32; however, some EU Member States may have implemented national regulations.

Table 3 The recreational cod catches (t) in the eastern Baltic management area (SD 25–32) reported by EU Member States.

Year	Denmark	Sweden	Germany	Poland	Lithuania	Latvia	Estonia	Total
2016	40	NA	0	695	26	1	1	763
2017	16	NA	0	442	16	1	0	475
2018	8	NA	0	400	56	0	0	465

Table 4 The total recreational cod catch compared to commercial catch in the eastern Baltic management area (SDs 25–32).

Year	Recreational catch (t)	Commercial catch (t)	Total (t)	Percentage of recreational catch from total (%)
2016	763	32591	33354	2.3
2017	475	28734	29209	1.6
2018	465	19010	19475	2.4

Conclusion

Recreational catches of eastern Baltic cod in SDs 25–32 have been in the range of 465 tonnes to 763 tonnes in the last three years, based on preliminary data available. This is around 2% of the total cod catch in SDs 25–32. Any measures introduced on the recreational fisheries are expected to have a small impact on the eastern Baltic cod stock.

2 Cod landings in different commercial fisheries

Methods

Data

The analyses presented here are based on landing data uploaded to the Regional Database (RDB) for the year 2018. The quality of this is dependent on the information recorded in logbooks and was not further evaluated by ICES. The data are available by métier, quarter, ICES Subdivision, EU Member State, and species. To analyse the cod bycatch, data on a fishing trip level should ideally be used to estimate the fractions of different species caught within a given fishing trip. This was,

however, not possible due to time constraints, as data on a trip level are presently not available in RDB. Therefore, the analyses presented here only show species compositions of landings at the levels of métier, quarter, SD, and EU Member State; They do not tell, however, to what extent these species are actually caught together in one single fishing operation.

Furthermore, the analyses presented here only include landing data, i.e. discards, though often substantial, are not included. This could have an effect on métiers where cod is not the target species.

Species compositions of total catch could also be analysed based on observer data; unfortunately, this was not possible within the time frame available for these analyses.

The landing data used here are for EU Member States only, i.e. Russian data are not included.

Definition of a métier

Métier is the term used in the EU Data Collection Framework (DCF) to define a somewhat homogeneous group of fishing actions which share 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 (Figure 2). 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 5.

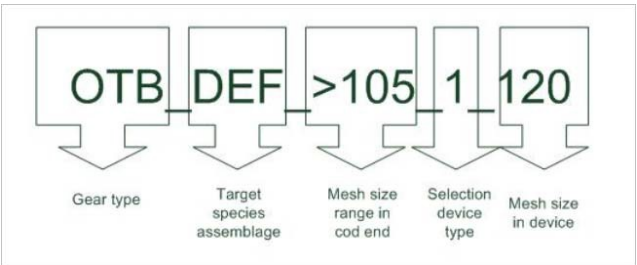

Figure 2 Example of a métier code: a bottom otter board trawl targeting demersal fish, having > 105 mm mesh size in the codend and a Bacoma exit window with 120 mm mesh size.

Table 5 Codes used for target species assemblage and selection device in the métier names.

Gear code	Gear
FPN	Fixed pound nets
FPO	Pots
FYK	Fykenet
GNS	Set gillnet
LLS	Longlines bottom
OTB	Otter trawl bottom
OTM	Otter trawl midwater
OTT	Otter twin trawl (midwater)
PTM	Pair trawl midwater
PTB	Pair trawl bottom
PS	Purse seine
SDN	Anchored seine
SSC	Flyshooter
Target species assemblage code	**Target species assemblage**
ANA	Anadromous species
CAT	Catadromous species
DEF	Demersal fish
SPF	Small pelagic species
CRU	Crustaceans
Selection device code	**Selection device**
1	Bacoma window
2	Fixed grid

Analyses

The analyses were conducted for métiers that had fished in ICES SDs 24–28, i.e. in the distribution area of the eastern Baltic cod. In the northern Baltic in SDs 29–32 cod abundance is very low, and less than 1% of the total annual landings of the eastern Baltic cod have been taken in these areas in the last decades. Therefore, the métiers fishing only in these northern SDs were not included in the analyses.

Altogether 68 métiers had fished in SDs 24–28 in 2018. A large number of these métiers (40) had landed no or very little cod (below 0.1% of the total cod landings in 2018), and cod constituted less than 5% of the total landings of these métiers (Table 6). An additional 13 métiers landed a similarly small fraction of the total cod landings (below 0.1% of the total cod landings in 2018), although cod constituted more than 5% of the landings of these métiers. This is due to generally low landings of these métiers (Table 7).

For the remaining 15 métiers (each contributing > 0.1% of the total cod landings), further analyses were conducted, and considered:

i) Species compositions of total annual landings and total amounts of cod landings;
ii) Species compositions by subdivisions and distribution of cod landings between subdivisions;
iii) Species compositions by quarter and distribution of cod landings between quarters;
iv) Species compositions by EU Member States and distributions of cod landings between the EU Member States.

3 Results and conclusions for métiers and species composition

Métiers with no or very low bycatch of cod

Cod catches are very low in ICES SDs 29–32, because of very low cod abundance in this area. Thus, cod bycatch from this area will not have a significant impact on eastern Baltic cod.

Furthermore, cod bycatch is very low for the métiers listed in Table 6, both in terms of the landed amount of cod and the fraction of cod in their landings.

For the métiers listed in Table 7, the amount of cod landings as well as total landings were low in 2018. However, as cod constituted a relatively high proportion of the landings of some of these métiers, cod bycatch could become an issue for these métiers if their effort were to increase.

The landings of the remaining 15 métiers that contributed most of the cod landings in SDs 24–28 in 2018 are analysed in further detail in the sections below.

Overall species composition and total cod landings of the selected métiers

The majority (approximately 70%) of the cod landings in SDs 24–28 were taken by trawlers with a BACOMA with a 120 mm escape window (OTB_DEF_>=105_1_120) or T90 (OTB_DEF_>=120_0_0) and 15% of the cod landings were taken by gillnetters with mesh sizes between 110 mm and 156 mm (GNS_DEF_110-156_0_0). These métiers are generally considered to target cod. Both of these two métiers also landed flatfish (mostly flounder and, to a lesser degree, plaice and turbot). Cod constituted about half of the annual landings for OTB_DEF_>=105_1_120, and less than half for GNS_DEF_110-156_0_0.

The other métiers in the top 15 in terms of the amount of cod landings each contributed less than 5% to the total cod landings (Figure 3). The landings of the next métiers in terms of their contribution to total cod landings (OTB_DEF_>=115_0_0, OTB_DEF_>=120_0_0, and OTT_DEF_>=105_1_120, all of which were used only by Sweden) consisted mostly of cod, with small amounts of other species. Also, most of the landings with longliners targeting demersal fish (LLS_DEF_0_0_0) were cod.

The other métiers had variable proportions of cod in their landings and landed a variety of species. Some of these métiers had a very low proportion of cod in their landings (e.g. pelagic trawls – OTM métiers fishing for sprat and herring). These

métiers were among the top 15 in terms of the amount of landed cod due to their overall high catch levels (Figure 3). However, it should be noted that 95% of the total cod landings were taken by the first five listed métiers, and the contribution of the other métiers to total cod landings was low (between 0.1 and 1%; Figure 3).

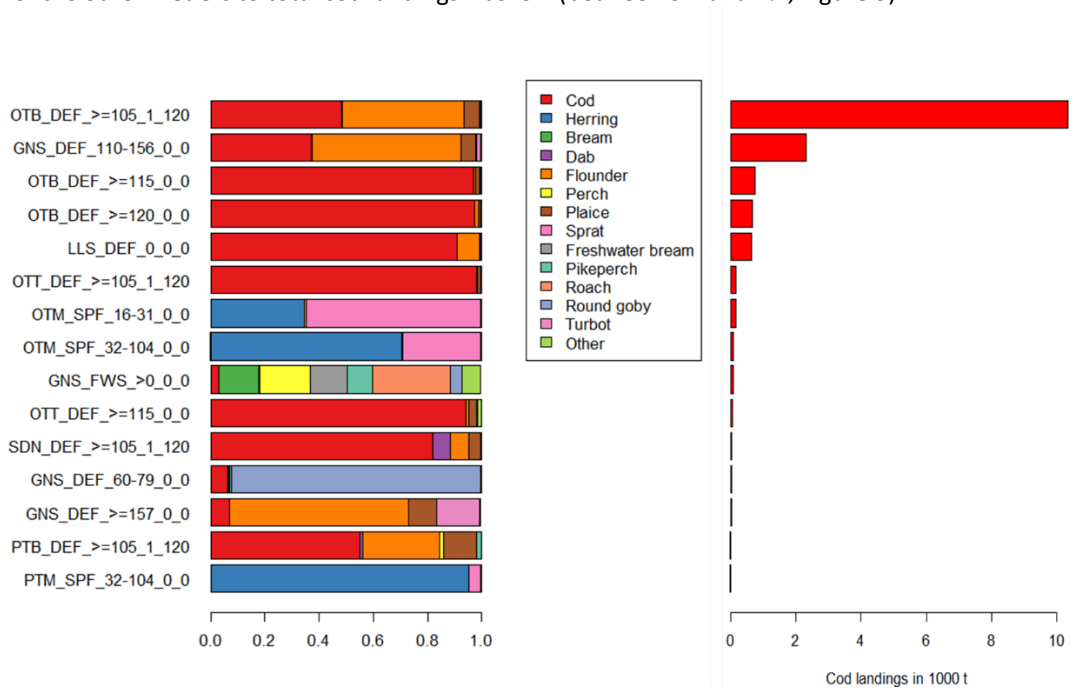

Figure 3 Left panel: Species composition of landings in SDs 24–28 in 2018, by métiers. Right panel: The amount of cod landings by the same métiers.

Species composition of landings of the selected métiers by subdivisions

Eastern Baltic cod is mostly caught in SDs 24–26. Most of the métiers that take a larger part of the cod landings operate in all three of these SDs. There are also métiers that have only been fishing in one or two SDs, but these have taken smaller fractions of the total cod landings (Figure 4).

Species compositions of the landings of a given métier were generally similar between SDs 24–26, though the proportions of the different species somewhat differed (Figure 5). In the first two métiers that take most of the cod landings (OTB_DEF_>=105_1_120 and GNS_DEF_110-156_0_0), the proportion of cod in the landings was highest in SD 26, while flatfishes contributed larger shares to the total landings in SDs 24 and 25. In SDs 25–26, it is mostly flounder, while plaice and other species occur in larger fractions in SD 24.

In the other métiers, where cod landings were generally much lower, the species compositions depended on the gear type, and were generally relatively similar between the SDs 24–26 (Figure 5).

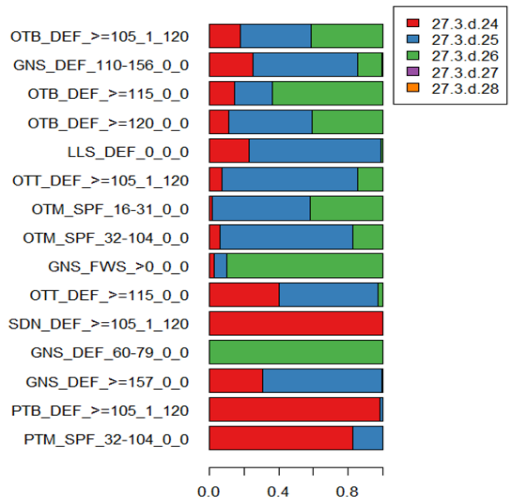

Figure 4 Distribution of cod landings between subdivisions, in 2018, by métiers. Metiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

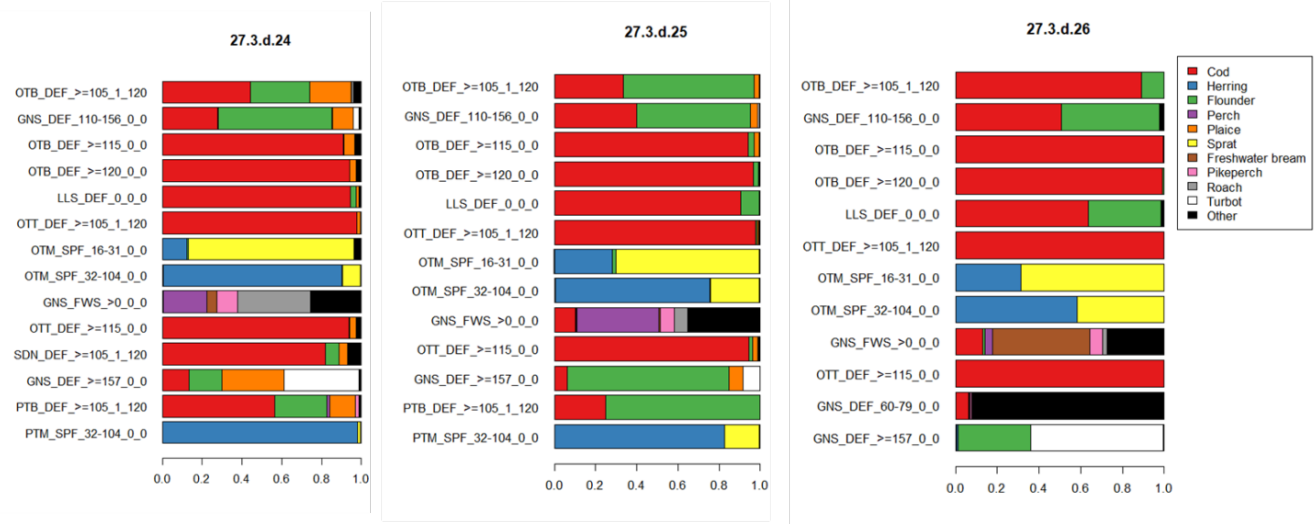

Figure 5 Species composition of landings in SDs 24–28 in 2018, by métier and subdivision. Note that not all métiers are present on all panels, as they have not been fishing in all subdivisions. Métiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

Species composition of landings of the selected métiers by quarter

Quarterly distribution of cod landings in SDs 24–28 in 2018, by métier, is shown in Figure 6. The most important métiers in terms of total cod landings generally had a larger share of their cod landings in Q1–Q2. Some of the other métiers with lower total cod landings landed cod mostly in Q4.

Species compositions of the landings of a given métier were generally similar between different quarters, though with some differences in the proportions of species in the landings (Figure 7). The two métiers with the highest cod landings (OTB_DEF_>=105_1_120 and GNS_DEF_110-156_0_0) had a relatively low proportion (less than 30% of total landings) of cod in their landings in Q1, where flounder dominated in the landings. In Q2, where a large part of the annual cod landings were taken, cod constituted at least half or more of the landings. For the other métiers with lower total cod landings, the proportion of cod in the landings was generally similar between quarters, if a métier had been fishing in all quarters. Some of the analysed métiers did not operate in all quarters of the year (Figures 6 and 7).

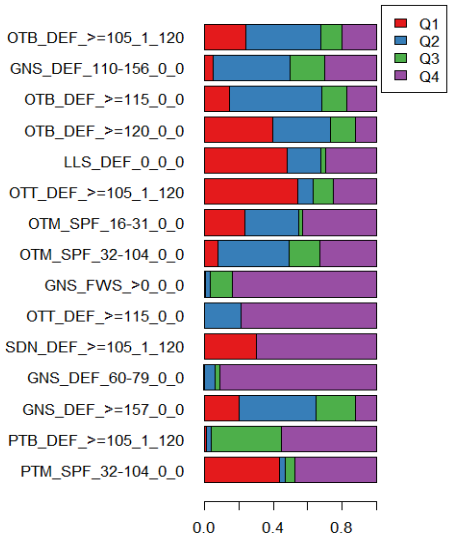

Figure 6 Distribution of cod landings in 2018 in SDs 24–28 between quarters, by métiers. Métiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

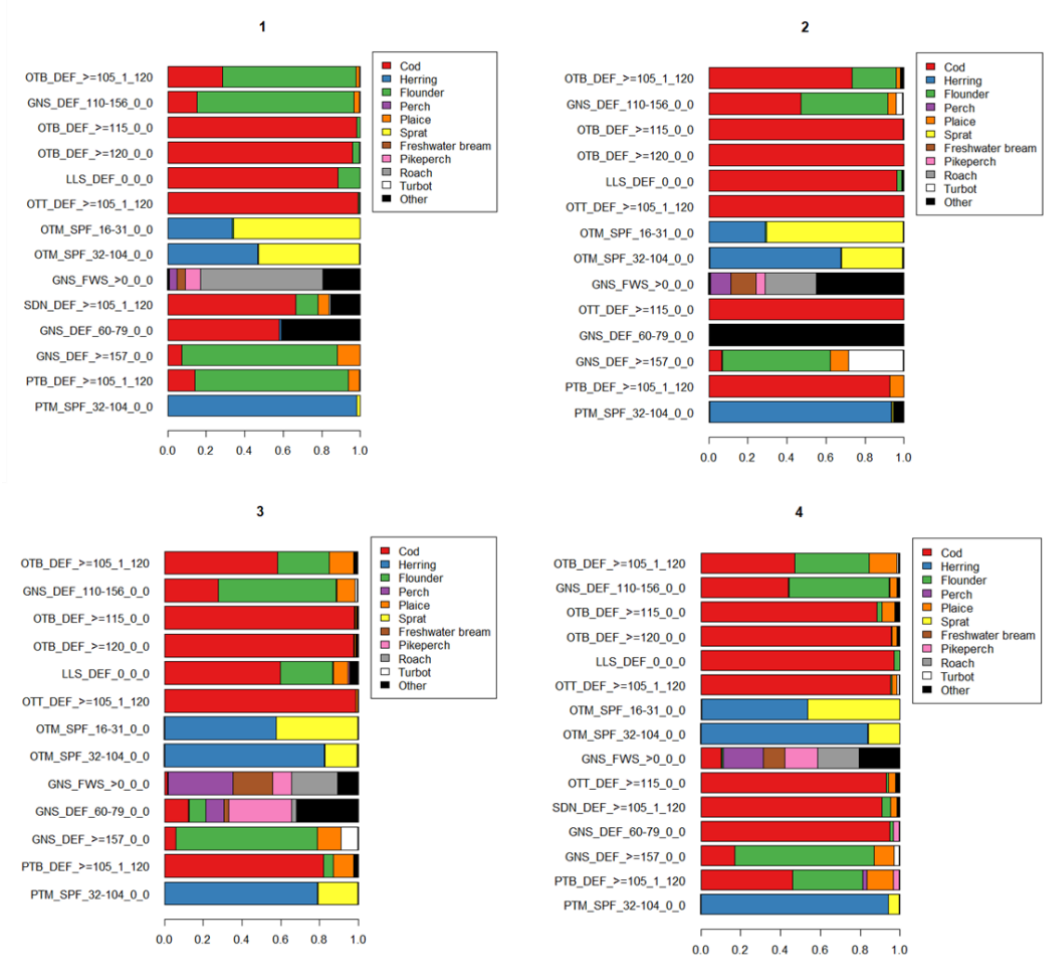

Figure 7 Species composition of landings in SDs 24–28 in 2018, by métier and quarter. Note that not all métiers are present on all panels, as they have not been fishing in all quarters. Métiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

Species composition of landings of the selected métiers by EU Member State

The two métiers taking most of the cod landings (OTB_DEF_>=105_1_120 and GNS_DEF_110-156_0_0) are used by most EU Member States participating in cod fisheries. However, there are also métiers that are only used by one country. For example, métiers OTB_DEF_>=115_0_0, OTB_DEF_>=120_0_0, and OTT_DEF_>=105_1_120 that altogether took 10% of the cod landings, were used exclusively by Sweden (Figure 8).

Consequently, in Sweden, where flatfish catches are mostly discarded, the main métiers contributing to the cod fishery landed mostly only cod (Figure 9). In other countries, the métiers landing cod additionally landed flatfish and some other species. The share of other species in the landings of the main cod métiers (OTB_DEF_>=105_1_120 and GNS_DEF_110-156_0_0) was highest in Poland and Germany (more than 50%). In Denmark, Latvia, and Lithuania, around 30% of the landings of the two main cod métiers (OTB_DEF_>=105_1_120 and GNS_DEF_110-156_0_0) consisted of species other than cod (mainly flatfish; Figure 9). In the other métiers with lower amounts of cod landings, cod constituted varying but mostly low proportions in all countries (Figure 9).

The differences in landing patterns between EU Member States of course reflect also the available quota shares for different species. Although there is no TAC for flounder, the different landing patterns can be connected to market prices. For example, Denmark and Sweden have less tradition for a flounder fishery than is seen in other Baltic countries.

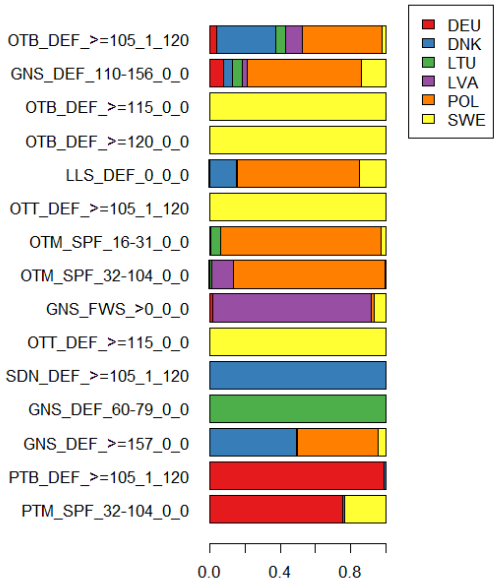

Figure 8 Distribution of cod landings in 2018 in SDs 24–28 between EU Member States, by métiers. Métiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

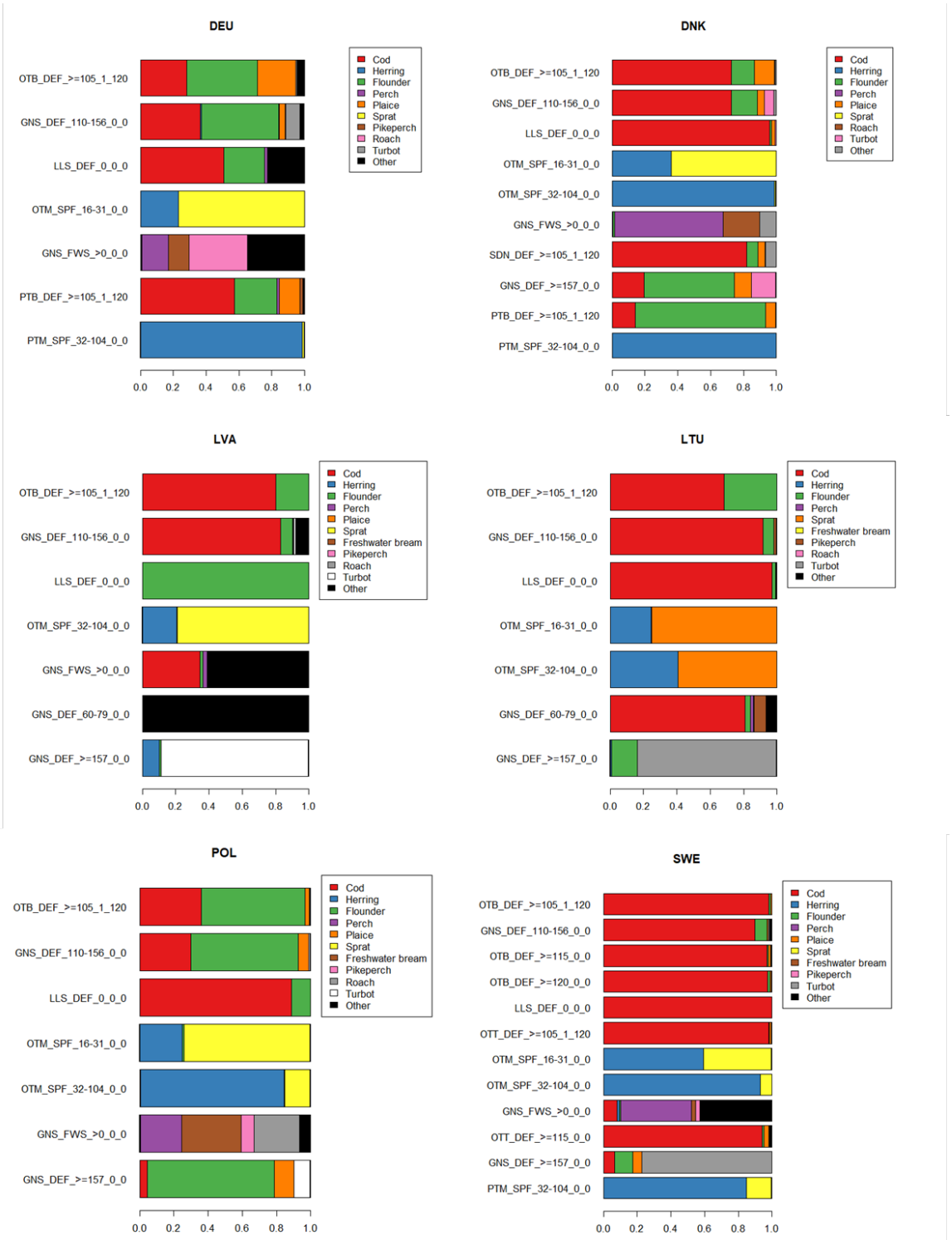

Figure 9 Species composition of landings in SDs 24–28 in 2018, by métier and EU Member State. Note that not all métiers are present on all panels, as they have not been used by all countries. Métiers are listed in the order of their contribution to total cod landings in SDs 24–28 in 2018.

Table 6 Métiers that contributed < 0.1% of the total cod landings in SDs 24–28 in 2018, with cod constituting < 5% of their landings.

Métier	Total landings of all species (kg)	Landings of cod (kg)	Proportion of cod in the total landings of all species	Proportion of total cod landings
GNS_SPF_32-109_0_0	3999011	7619	0.002	0.0005
OTM_DEF_<16_0_0	1261667	4788	0.004	0.0003
OTM_DEF_>=105_1_120	364598	4077	0.011	0.0003
FPN_SPF_>0_0_0	1645000	3456	0.002	0.0002
FPO_SPF_>0_0_0	1122361	2865	0.003	0.0002
OTB_FWS_>0_0_0	115525	2552	0.022	0.0002
PTM_SPF_16-31_0_0	16338819	2161	0.000	0.0001
OTB_SPF_32-104_0_0	124207	1368	0.011	0.0001
FPN_CAT_>0_0_0	95053	1219	0.013	0.0001
OTM_SPF_16-104_0_0	44567769	1135	0.000	0.0001
PTB_FWS_>0_0_0	16244	640	0.039	0.0000
PTM_DEF_<16_0_0	470359	379	0.001	0.0000
GNS_ANA_>=157_0_0	177191	270	0.002	0.0000
PTB_SPF_32-104_0_0	245298	224	0.001	0.0000
GNS_CAT_>0_0_0	58558	223	0.004	0.0000
LLD_ANA_0_0_0	205556	205	0.001	0.0000
OTB_SPF_16-104_0_0	3110710	170	0.000	0.0000
LLS_CAT_0_0_0	12428	141	0.011	0.0000
GNS_ANA_110-156_0_0	5063	88	0.017	0.0000
FYK_CAT_>0_0_0	33045	72	0.002	0.0000
OTB_SPF_16-31_0_0	3796464	57	0.000	0.0000
FPO_FWS_>0_0_0	2441076	50	0.000	0.0000
FPN_FWS_>0_0_0	147819	45	0.000	0.0000
LLS_FWS_0_0_0	3906	40	0.010	0.0000
OTB_DEF_90-104_0_0	2716	34	0.013	0.0000
GTR_SPF_32-109_0_0	21272	28	0.001	0.0000
FYK_FWS_>0_0_0	651	17	0.026	0.0000
FPO_ANA_>0_0_0	2928	0	0.000	0.0000
FPO_CAT_>0_0_0	13706	0	0.000	0.0000
GNS_CRU_>0_0_0	6699	0	0.000	0.0000
GNS_SPF_16-109_0_0	13403	0	0.000	0.0000
GTR_FWS_>0_0_0	279	0	0.000	0.0000
LLS_ANA_0_0_0	1286	0	0.000	0.0000
LLS_SPF_0_0_0	328	0	0.000	0.0000
PS_SPF_16-31_0_0	197761	0	0.000	0.0000
PS_SPF_32-104_0_0	125436	0	0.000	0.0000
PTB_SPF_>=105_1_120	6000	0	0.000	0.0000
PTB_SPF_16-31_0_0	59300	0	0.000	0.0000
SDN_DEF_>=105_1_110	73200	0	0.000	0.0000
SDN_SPF_32-104_0_0	6566	0	0.000	0.0000

Table 7 Métiers that contributed < 0.1% of the total cod landings in SDs 24–28 in 2018, but with cod constituting > 5% of their landings.

Métier	Total landings of all species (kg)	Landings of cod (kg)	Proportion of cod in the total landings of all species	Proportion of total cod landings
OTB_DEF_<16_0_0	120202	10204	0.08	0.0007
FPO_DEF_>0_0_0	12173	9400	0.77	0.0006
FPN_DEF_>0_0_0	18203	8937	0.49	0.0006
LHP_FIF_0_0_0	1990	1987	1.00	0.0001
MIS_MIS_0_0_0	1598	1582	0.99	0.0001
GTR_DEF_110-156_0_0	17649	1574	0.09	0.0001
GNS_DEF_90-109_0_0	2839	1503	0.53	0.0001
OTT_DEF_>=120_0_0	934	902	0.97	0.0001
GTR_DEF_>=157_0_0	1239	503	0.41	0.0000
SSC_DEF_>=105_1_120	483	431	0.89	0.0000
FPN_ANA_>0_0_0	212	72	0.34	0.0000
PTB_DEF_90-104_0_0	124	64	0.52	0.0000
GNS_SPF_110-156_0_0	108	18	0.17	0.0000

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