2 Overview

This Section was updated in October 2021

2.1 Introduction

The demersal fisheries in the North Sea can be categorised as a) human consumption fisheries, and b) industrial fisheries which land the majority of their catch for reduction purposes. Demersal human consumption fisheries usually either target a mixture of roundfish species (cod, haddock, whiting), a mixture of flatfish species (plaice and sole) with a bycatch of roundfish and other flatfish (e.g., turbot, brill, dab), or *Nephrops* with a bycatch of roundfish and flatfish. A fishery directed at saithe with some bycatch of hake and other roundfish exists along the shelf edge.

The industrial fisheries which used to dominate the North Sea catch in weight have become much less prominent. Human consumption landings have steadily declined over the last 30 years, with an intermediate high in the early 1980s. The landings of the industrial fisheries show the largest annual variations, resulting from variable recruitment and the short life span of the main target species. The total demersal landings from the Greater North Sea peaked above 1.5 million tonnes in the 1980s, showed a strong decline from the mid to late 1990s, and is now below 500 000 tonnes. Main North Sea stocks targeted in the fisheries for industrial purposes are sandeel, Norway pout, and sprat.

(http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2020/2020/FisheriesOverview_GreaterNorthSea_2020.pdf).

For some stocks, the North Sea assessment area may also cover other regions adjacent to ICES Subarea 4. Thus, combined category 1 assessments are made for cod including Division 7.d and Subdivision 20 (i.e. Skagerrak), haddock including Division 6.a and Subdivision 20, whiting including Division 7.d, saithe including Subarea 6 and Division 3.a, plaice including Subdivision 20, witch including Divisions 3.a and 7.d, and Norway pout including Division 3.a. The state of *Nephrops* stocks are evaluated on the basis of discrete Functional Units (FU) on which estimates of appropriate removals are based. However, quota management for *Nephrops* is still carried out at the Subarea and Division level.

The analysis of biological interactions (predator-prey relationships) among species has been a central theme in ICES over the last 30 years, primarily for the Baltic Sea and the North Sea. The 2011, 2014, 2017 and 2020 North Sea key run performed by the multispecies group WGSAM represents the current state of the art in terms of multispecies assessment, with the dynamic estimation of predation mortality. This has led to the publication of the first multispecies advice by ICES in 2013
(http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2013/2013/mult-NS.pdf).

The single-stock assessments and advice presented in this report are not produced by the multispecies assessment model, but time-varying values of natural mortalities estimated by multispecies assessments for cod, haddock and whiting are incorporated in the assessments of these species. Natural mortalities taking into account multi-species interactions as estimated in specific research is also included in the single stock assessment for Norway pout being similar to the multi-species assessment values. Flatfish are not part of the current multispecies assessment and more work is needed to incorporate information on flatfish in the multispecies advice.

Gear types vary between fisheries. Human consumption fisheries use otter trawls, pair trawls, *Nephrops* trawls, seines, gill nets, or beam trawls, while industrial fisheries use small meshed

otter trawls which in most cases are equipped with selective panels to reduce by-catches. Trends in reported effort in the major fleets fishing in the North Sea are described annually by the ICES WG on Mixed Fisheries Advice for the North Sea (ICES WGMIXFISH 2020), which meets straight after the WGNSSK. Both WGs share a joint data call issued by ICES for fulfilling the data needs of both groups (Annex 8).

The data distinguish between two basic concepts, the Fleet (or fleet segment), and the Métier. Their definition has evolved with time, but the most recent official definitions are those from the EC's Data Collection Framework (DCF, Reg. (EC) No 949/2008), which we adopt here*:*

- A **Fleet** segment is a group of vessels with the same length class and predominant fishing gear during the year. Vessels may have different fishing activities during the reference period, but might be classified in only one fleet segment.
- A **Métier** is a group of fishing operations targeting a similar (assemblage of) species, using similar gear, during the same period of the year and/or within the same area and which are characterized by a similar exploitation pattern.

Fleets and métiers were defined to match with the available economic data and the former cod long term management plan. In 2013 and 2014, WGMIXFISH included new stocks in its analyses (plaice and sole in the Eastern Channel as full analytical stocks; hake in the North Sea and plaice in Skagerrak as additional "LPUE" stocks as well as turbot, see WGMIXFISH 2013 and 2014 report). Plaice in the Subdivision 20 has been merged with plaice in Subarea 4 in 2015. Mixed-fisheries considerations are based on the single-stock assessments, combined with information on the average catch composition and fishing effort of the demersal fleets and fisheries in the Greater North Sea catching cod (cod.27.47d20), haddock (had.27.46a20), whiting (whg.27.47d), saithe (pok.27.3a46), plaice (ple.27.420 and ple.27.7d), sole (sol.27.4 and sol.27.7d), and Norway lobster *Nephrops norvegicus* (functional units [FUs] 5–10, 32, 33, 34, and 4outFU). In the absence of specific mixed-fisheries management objectives, ICES does not advise on unique mixed-fisheries catch opportunities for the individual stocks but develops scenarios that might show potential discrepancies in the single stock advices in a mixed fisheries context.
In 2017, WGMIXFISH introduced a new scenario, the 'range' scenario taking advantage of the F_{MSY} ranges to reduce the potential inconsistencies in the single species advice. More effort will be put in the future in the inclusion of other stocks without analytical assessment and/or mostly distributed in other areas (i.e. hake) because many of them are important bycatch species and are potential "choke species" once under the landing obligation.

ICES WGMIXFISH also produces a number of figures describing main trends in effort, catches and landings by fleet and stock.

Overall nominal effort (kW-days) by EU demersal trawls regulated in the former cod management (TR1, TR2, TR3, GN1, GT1, LL1, BT1, BT2) in the North Sea, Skagerrak, and Eastern Channel has been substantially reduced since the implementation of the two successive effort management plans in 2004 and 2008 (-30% between 2004 and 2014, −12% between 2008 and 2014). Following the introduction of days-at-sea regulations in 2003, there was a substantial switch from the larger mesh (>100 mm, TR1) gear to the smaller mesh (70–99 mm, TR2) gear. Subsequently, effort by TR1 has been relatively stable, whereas effort in TR2 and in small-mesh beam trawl (80–120 mm, BT2) has shown a pronounced decline (Figure 2.1.1), and effort in gill and trammel net fisheries (not shown in Figure 2.1.1) has increased. An update of Figure 2.1.1 is not yet available, but there are indications of a general increase in TR1 effort since 2016.

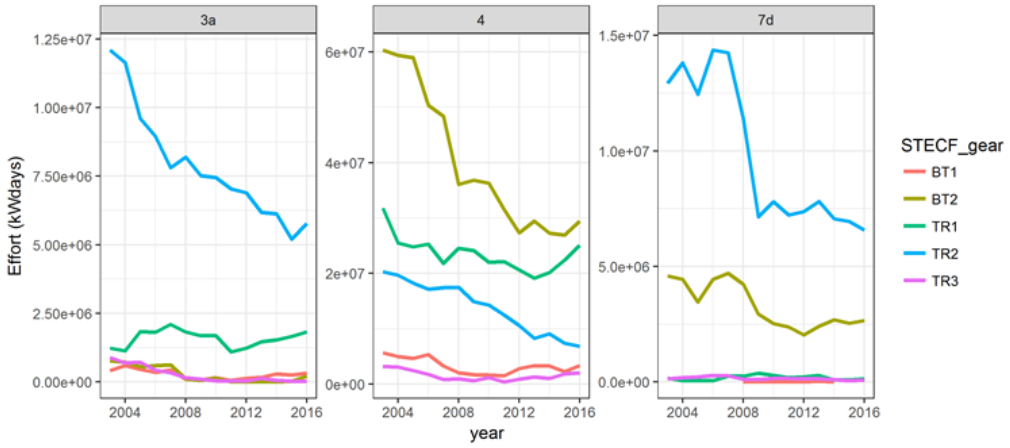

Figure 2.1.1. Trends in fishing effort for different STECF fishing gear groups in ICES Division 3.a, ICES Subarea 4 and ICES Division 7.d for the period 2003–2016 (STECF, 2017b). Regulated gears: BT1 are beam trawls with mesh sizes ≥ 120 mm. BT2 are beam trawls with mesh sizes ≥ 80 mm and < 120 mm. TR1 are bottom trawl and seines with mesh sizes ≥ 100 mm. TR2 are bottom trawl and seines with mesh sizes ≥ 70 mm and < 100 mm. TR3 are bottom trawl and seines with mesh sizes ≥ 16 mm and < 32 mm.

ICES has evaluated technical interactions between species captured together in demersal fisheries by examining their co-occurrence in the landings at the scale of gear/mesh size range/ICES square/calendar quarter (hereafter referred to as 'strata'). The percentage of landings of species A, where species B is also landed and constitutes more than 5% of the total landings in that stratum, has been computed for each pair of species. Cases in which species B accounts for less than 5% of the total landings in a stratum were ignored.

To illustrate the extent of the technical interactions between pairs of species, a qualitative scale was applied to each interaction (Figure 2.1.2). In this figure, rows represent the share of each species A that was caught in fisheries where the B species (columns) accounted for at least 5% of the total landing of the fisheries. A high proportion of the catches of lemon sole was for example taken in fisheries where plaice landings where at least 5% of the total landings. The amounts of lemon sole caught in fisheries where cod, haddock, hake or saithe accounted for at least 5% of the total landings were medium. The amount of lemon sole caught in fisheries where lemon sole constituted 5% or more of the total landings were low, indicating that there is no (or very limited) target lemon sole fishery.

The vertical bars illustrate the degree of mixing. Fisheries where plaice (species B) constitute 5% or more of the total landings account for a high share (red cells) of the total landings of dab, lemon sole, plaice, sole, turbot, flounder, brill, haddock, and which, and a medium share (orange cells) of the landings of whiting, hake and *Nephrops*. The lemon sole column shows that the landings of lemon sole in fisheries where the species constituted 5% or more of the total landing were low and the relative landings of other species in these fisheries were also low. The columns can be used to identify the main fisheries (target fisheries) and the degree of mixing in these fisheries.

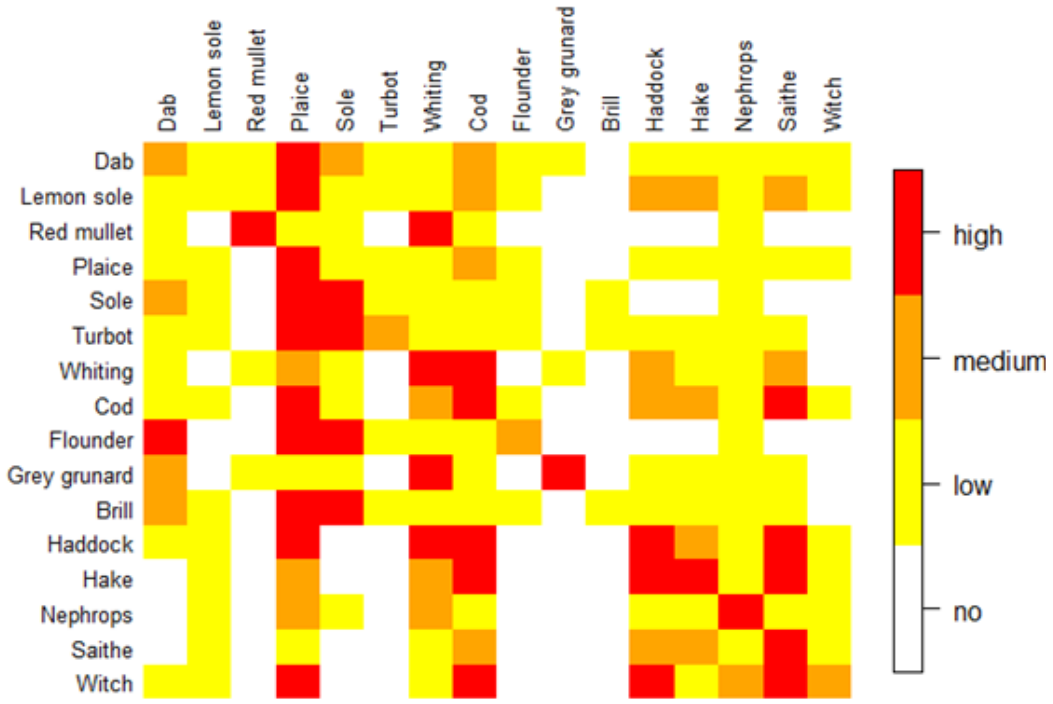

Figure 2.1.2. Technical interactions amongst North Sea demersal stocks (averaged over the years 2014–2015). Horizontal lines of the figure represent the target species of the fishery (species A) for which the interaction with species in each column (species B) was assessed. Red cells indicate that the species are frequently caught together. Orange cells indicate medium interactions and yellow cells indicate weak interactions. For example, haddock sometimes occur in catches in the whiting fishery (a 'medium' interaction) but whiting often occur in catches in the haddock fishery (a 'high' interaction).

2.2 Main management regulations

The near collapse of the North Sea cod stock in the beginning of the 2000s led to the introduction of effort restrictions alongside TACs as a management measure within EU fisheries. There has also been an increasing use of single-species multiannual management plans, partly in relation to cod recovery, but also more generally. With the implementation of the landing obligation in 2016 mixed fisheries, EU multiannual plans have been developed and are now available for North Sea demersal stocks (Regulation (EU) 2018/973) and for stocks fished in western waters (Regulation (EU) 2019/472).

The management frameworks can be summarised as such:

2.2.1 Landing obligation

Fisheries in Norwegian waters have been subject to a landing obligation for cod and haddock from 1987 and for most species since 2009. A landing obligation for EU fisheries on demersal species in the North Sea was implemented from 2016 in a phased approach with all quota stocks subject to the landing obligation from 2019 onwards. Detailed definitions of the landing obligation can be found in Article 15 of regulation 1380/2013. Discard plans have been agreed for 2018 in the North Sea (Subarea 4, Division 3.a and Union waters of Division 2.a; Table 2.2.1.1; Regulation (EU) 2018/45) and in Union and international waters of Subarea 6 and Division 5.b (Table 2.2.1.2; Regulation (EU) 2018/46), and in Division 7.d (Table 2.2.1.3; Regulation (EU) 2018/46), defining for which species, gear and mesh size combinations the landing obligation applies. These have been updated for 2019–2021 (Regulation (EU) 2018/2035 and Regulation (EU) 2018/34) to reflect that all demersal quota stocks are now subject to landings obligations, but also

to detail survivability and *de minimis* exemptions and specific technical measures. In 2019, new updates were published for 2020–2021 (Regulation (EU) 2019/2238 and Regulation (EU) 2019/2239), to modify in part the details of survivability and *de minimis* exemptions and specific technical measures.

Table 2.2.1.1. Fisheries under the landing obligation in Subarea 4, Division 3.a and Union waters of Division 2.a (from Commission delegated regulation (EU) 2018/45).

Fishing gear (1) (2)	Mesh size	Species subject to the landing obligation
Trawls: OTB, OTT, OT, PTB, PT, TBN, TBS, OTM, PTM, TMS, TM, TX, SDN, SSC, SPR, TB, SX, SV	≥ 100 mm	All catches of cod, common sole, haddock, plaice, saithe, Northern prawn, and Norway lobster and whiting.
Trawls: OTB, OTT, OT, PTB, PT, TBN, TBS, OTM, PTM, TMS, TM, TX, SDN, SSC, SPR, TB, SX, SV	70-99 mm	All catches of cod (3), common sole, haddock, saithe, Northern prawn, and Norway lobster and whiting.
Trawls: OTB, OTT, OT, PTB, PT, TBN, TBS, OTM, PTM, TMS, TM, TX, SDN, SSC, SPR, TB, SX, SV	32-69 mm	All catches of cod, common sole, haddock, plaice, saithe, Northern prawn, and Norway lobster and whiting.
Beam trawls: TBB	≥ 120 mm	All catches of cod, common sole, haddock, plaice, saithe, Northern prawn, and Norway lobster and whiting.
Beam trawls: TBB	80-119 mm	All catches of cod, common sole, haddock, saithe, Northern prawn, and Norway lobster and whiting.
Gillnets, trammel nets and entangling nets: GN, GNS, GND, GNC, GTN, GTR, GEN, GNF		All catches of cod (3), common sole, haddock, saithe, Northern prawn, and Norway lobster and whiting.
Hooks and lines: LLS, LLD, LL, LTL, LX, LHP, LHM		All catches of cod, common sole, haddock, hake, plaice, saithe, Northern prawn, and Norway lobster and whiting.
Traps: FPO, FIX, FYK, FPN		All catches of cod, common sole, haddock, plaice, saithe, Northern prawn, and Norway lobster and whiting.

(1) Gear codes used in this Table refer to those codes in Annex XI to Commission Implementing Regulation (EU) No 404/2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy (OJ L 112, 30.4.2011, p. 1).
(2) For the vessels whose LOA is less than 10 metres, gear codes used in this table refer to the codes from the FAO gear classification.
(3) The landing obligation for cod shall not apply in ICES subdivision IIIaS.

Table 2.2.1.2. Fisheries under the landing obligation in Union and international waters of Subarea 6 and Division 5.b (from Commission delegated regulation (EU) 2018/46).

Fishery	Gear Code	Fishing gear description	Mesh Size	Species to be landed
Cod (*Gadus morhua*), Haddock (*Melanogrammus aeglefinus*), Whiting (*Merlangius merlangus*) and Saithe (*Pollachius virens*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls & Seines	All	All catches of haddock and by-catches of sole, plaice and megrims where total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 5 % of the following gadoids: cod, haddock, whiting and saithe combined
Norway lobster (*Nephrops norvegicus*)	OTB, SSC, OTT, PTB, SDN, SPR, FPO, TBN, TB, TBS, OTM, PTM, SX, SV, FIX, OT, PT, TX	Trawls, Seines, Pots, Traps & Creels	All	All catches of Norway lobster and by-catches of haddock, sole, plaice and megrim where the total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 5 % of Norway lobster.
Saithe (*Pollachius virens*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls	≥ 100 mm	All catches of saithe where the total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 50 % of saithe.
Black scabbardfish (*Aphanopus carbo*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls & Seines	≥ 100 mm	All catches of black scabbardfish where total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 20 % of black scabbardfish.
Blue ling (*Molva dypterygia*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls & Seines	≥ 100 mm	All catches of blue ling where total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 20 % of blue ling.
Grenadiers (*Coryphaeides rupestris, Macrourus berglax*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls & Seines	≥ 100 mm	All catches of grenadiers where total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 20 % of grenadiers.

(*) Vessels listed as subject to the landing obligation in this fishery in accordance with Commission Delegated Regulation (EU) 2016/2375 remain on the list indicated in Article 4 of this Regulation despite the change in the reference period and continue being subject to the landing obligation in this fishery.

Table 2.2.1.3. Fisheries under the landing obligation in Division 7.d (from Commission delegated regulation (EU) 2018/46).

Fishery	Gear Code	Fishing gear	Mesh Size	Species to be landed
Common Sole (*Solea solea*)	TBB	All Beam trawls	All	All catches of common sole
Common Sole (*Solea solea*)	OTT, OTB, TBS, TBN, TB, PTB, OT, PT, TX	Trawls	< 100 mm	All catches of common sole

Fishery	Gear Code	Fishing gear	Mesh Size	Species to be landed
Common Sole (*Solea solea*)	GNS, GN, GND, GNC, GTN, GTR, GEN	All Trammel nets & Gill nets	All	All catches of common sole
Cod (*Gadus morhua*), Haddock (*Melanogrammus aeglefinus*), Whiting (*Merlangius merlangus*) and Saithe (*Pollachius virens*)	OTB, SSC, OTT, PTB, SDN, SPR, TBN, TBS, OTM, PTM, TB, SX, SV, OT, PT, TX	Trawls and Seines	All	All catches of whiting, where total landings per vessel of all species in 2015 and 2016 (*) consisted of more than 10 % of the following gadoids: cod, haddock, whiting and saithe combined

(*) Vessels listed as subject to the landing obligation in this fishery in accordance with Commission Delegated Regulation (EU) 2016/2375 remain on the list indicated in Article 4 of this Regulation despite the change in the reference period and continue being subject to the landing obligation in this fishery.

There is a high probability that the implementation of the EU landing obligation with its complex definitions, exemptions and rules (e.g. *de minimis*, high survival, 9% inter-species flexibility) has implications for the quality of monitoring of the catches and the quality of assessments of the stock status and exploitation rate. *De minimis* exemptions and the 9% inter-species flexibility rule may have serious implications for stocks dependent on the interpretation of the respective paragraphs in the regulation (STECF, 2014a, b). The possibility of using up to 9% of the quota of a target species for bycatch of any other species constitutes a major factor for uncertainty in future management because it is not possible to predict what will happen, at least in the first few years.

The data provided to ICES does not include information that would allow ICES to evaluate the impact or take account of the complex survivability and *de minimis* exemptions. For example, no information was provided on the use of netgrid selectivity devices, which were part of survivability exemptions for *Nephrops* in 2018, and *de minimis* information is not reported to ICES. Furthermore, there was no evidence presented to the Working Group that the introduction of the landing obligation had caused any change to discarding practices for the *Nephrops* and other fisheries since 2016.

For sole and haddock, several *de minimis* exemptions have been agreed. The default ICES assumption is that the same exploitation patterns as observed in recent years will continue and former discards are now called unwanted catch. How much of this unwanted catch will be landed in the future (catch category BMS) and how much will still be discarded is speculation. Given that stocks are impacted by the total F independent of how the total catch is split up (at least under the assumption of no survival of discards), the results of forecasts are robust to assumptions regarding which fraction of the total catch will be landed. In contrast, the landing obligation will mean a serious change and therefore exploitation patterns of fleets will most likely change in the future. Predicting these changes is impossible at the current stage, which leads to an increased uncertainty in short term forecasts until more information becomes available.

It would be expected that under the EU Landing Obligation fish caught under the minimum conservation reference size (MCRS) would be landed and recorded as BMS landings in log books rather than discarded as happened before the Landing Obligation. The log book records of BMS landings would then be reported to ICES. However, low BMS values may be seen if the fish caught below MCRS are either not landed, not recorded in log books, not reported to ICES, reported to ICES incorrectly, or a mixture of any of these. For all stocks where BMS landings were reported to ICES since 2016, these values were either zero or very low, substantially lower than the estimated discards.

2.2.2 Effort limitations

For vessels registered in EU member states, effort restrictions in terms of days at sea were introduced in 2003 and subsequently revised annually. Initially days at sea allowances were defined by calendar month. From 2006, the limit was defined on an annual basis. The maximum number of days a fishing vessel could be absent from port varied according to gear type, mesh size (where applicable) and region. A complex system of 'special conditions' (SPECONs) developed upon request from the Member States, whereby vessels could qualify for extra days at sea if special conditions (specified in the Annexes) were met. Increasingly detailed micromanagement took place until 2008 (Ulrich *et al.*, 2012).

In 2008, the system was radically redesigned. From 2009, a total effort limit (measured in kW days) was set and divided up between the various nation's fleet effort categories. The baselines assigned in 2009 were based on track record per fleet effort category averaged over 2004–2006 or 2005–2007 depending on national preference, and the effort ceilings were updated in 2010. After some reductions based on the cod management plan to support the recovery of the cod stock, an

effort roll-over for the maximum allowable fishing effort was decided for 2013–2016 (Table 2.2.2.1). The effort management regime, which formed part of the long-term management plan for North Sea cod, has been revoked from 2017 onwards. The effort management regime for plaice and sole continued to apply in 2018 while the second stage of the management plan (Council Regulation (EC) 676/2007) was still in place; the maximum allowable fishing effort applied to beam trawls of mesh larger than or equal to 80 mm (BT1 and BT2) in Subarea 4 is shown in Table 2.2.2.2 for different countries. The effort management regime for plaice and sole has now also been revoked (from 2019 onwards) with the implementation of the EU MAP for sole (Regulation (EU) 2018/973).

The grouping of fishing gear concerned are: Bottom trawls, Danish seines and similar gear, excluding beam trawls of mesh size: TR1 (≥ 100 mm), TR2 (≤ 70 and < 100 mm), TR3 (≤ 16 and < 32 mm); Beam trawl of mesh size: BT1 (≥ 120 mm), BT2 (≤ 80 and < 120 mm); Gill nets excluding trammel nets: GN; Trammel nets: GT and Longlines: LL.

Table 2.2.2.1. Maximum allowable fishing effort in kilo watt days in 2013–2016 for: Skagerrak, that part of Division 3.a not covered by the Skagerrak, and the Kattegat; Subarea 4 and EU waters of Division 2.a; Division 7.d. Note for 2016, TR1 and TR2 were combined.

Regulated gear	BE	DK	DE	ES	FR	IE	NL	SE	UK
TR1	895	3 385 928	954 390	1 409	1 505 354	157	257 266	172 064	6 185 460
TR2	193 676	2 841 906	357 193	0	6 496 811	10 976	748 027	604 071	5 037 332
TR3	0	2 545 009	257	0	101 316	0	36 617	1 024	8 482
BT1	1 427 574	1 157 265	29 271	0	0	0	999 808	0	1 739 759
BT2	5 401 395	79 212	1 375 400	0	1 202 818	0	28 307 876	0	6 116 437
GN	163 531	2 307 977	224 484	0	342 579	0	438 664	74 925	546 303
GT	0	224 124	467	0	4 338 315	0	0	48 968	14 004
LL	0	56 312	0	245	125 141	0	0	110 468	134 880

Table 2.2.2.2. Maximum allowable fishing effort in kilowatt days in 2018 for Subarea 4.

Regulated gear	BE	DK	DE	NL	UK
BT1 + BT2	5 693 620	1 432 092	1 972 158	39 475 162	10 568 178

The STECF and ICES WGMIXFISH has performed annual monitoring of deployed effort trends since 2002. In addition, a more detailed overview and analyses of the various measures implemented in the frame of the cod recovery plan can be found in the 2011 joint STECF/ICES evaluation of this plan (ICES WKROUNDMP 2011, Kraak *et al.*, 2013).

2.2.3 Stock-based management plans

Cod, haddock, whiting, saithe, plaice and sole have previously been subject to multiannual management strategies (the latter two, being EU strategies, not EU-Norway agreements). These plans all consist of harvest rules to derive annual TACs depending on the state of the stock relative to biomass reference points and target fishing mortalities. The harvest rules also impose constraints on the annual percentage change in TAC. These plans have been discussed, evaluated and adopted on a stock-by-stock basis, involving different timing, procedures, stakeholders and sci-

entists involved, disregarding mixed-fisheries interactions (ICES WGMIXFISH, 2012). The technical basis of the individual management plans is detailed in the relevant stock section. All of these plans are no longer used as basis of advice and to set TACs for a variety of reasons, including benchmarks that have revised perceptions and reference points and the extension of stock areas, rendering these plans outdated.

With the new CFP, the demand for mixed fisheries management plans covering all species caught in a fishery is increasing. EU multiannual management plans (EU MAPs) are now available for demersal stocks in the North Sea (Regulation (EU) 2018/973), and demersal and deep-sea stocks in Western Waters (Regulation (EU) 2019/472), which cover stocks within WGNSSK. These have been used as the basis for advice for North Sea sole, and Eastern English Channel plaice and sole for 2019; they have not been used for shared stocks in the North Sea (cod, haddock, whiting, saithe and plaice) because Norway has not agreed to the EU MAP. Instead, the EU and Norway have jointly proposed alternative, single-species plans for these shared stocks, which ICES have evaluated (ICES-WKNSMSE 2019). With the implementation of the landing obligation from 2016 onwards for the North Sea demersal fisheries, problems caused by the management of mixed fisheries with single species plans will become more evident.

2.2.4 Additional technical measures

The national management measures with regard to the implementation of the available quota in the fisheries differ between species and countries. The industrial fisheries are subject to regulations for the bycatches of other species (e.g. herring, whiting, haddock, cod) including maximum by-catch rates and technical measures on selective panels to reduce by-catch. Technical measures relevant to each stock are listed in each stock section, along with additional management measures, e.g., real time closures or Fully Documented Fisheries (FDF).

2.2.4.1 Minimum landing size/Minimum conservation reference size

"Undersized marine organisms must not be retained on board or be transhipped, landed, transported, stored, sold, displayed or offered for sale, but must be discarded immediately to the sea" (EC 850/98)). After the implementation of the landing obligation minimum landing sizes have been transformed into Minimum Conservation Reference Sizes (MCRS) that apply from 2016 onwards. The current MCRS can be found in Table 2.2.4.1. Individuals below MCRS have to be landed but are not allowed to be sold for human consumption.

Table 2.2.4.1. Current MCRS.

Species	MCRS region 1–5	MCRS Skagerrak and Kattegat
Cod	35 cm	30 cm
Haddock	30 cm	27 cm
Saithe	35 cm	30 cm
Pollack	30 cm	–
Whiting	27 cm	23 cm
Sole	24 cm	24 cm
Plaice	27 cm	27 cm
Nephrops	85 mm (25 mm)	105 mm (32 mm)

2.2.5 Minimum mesh size

Regulations on mesh sizes are more complex than those on landing sizes, as they differ depending on gears used, target species and fishing areas. Many other accompanying measures are implemented simultaneously with mesh sizes. They include regulations on gear dimensions (e.g. number of meshes on the circumference), square-mesh panels, and netting material. The most relevant mesh size regulations of EC No 2056/2001 are presented below.

Towed nets excluding beam trawls

Since January 2002, the minimum mesh size for towed nets fishing for human consumption demersal species in the North Sea is 120 mm. There are however many derogations to this general rule, and the most important are given below:

- ***Nephrops* fishing.** It is possible to use a mesh size in range 70–99 mm, provided catches retained on board consist of at least 30% of *Nephrops*. However, the net needs to be equipped with an 80 mm square-mesh panel if a mesh size of 70–99 mm is to be used in the North Sea and if a mesh size of 90 mm is to be used in the Skagerrak and Kattegat the codend has to be square meshed.
- **Saithe fishing.** It is possible to use a mesh size range of 110–119 mm, provided catches consist of at least 70% of saithe and less than 3% of cod. This exception however does not apply to Norwegian waters, where the minimum mesh size for all human consumption fishing is 120 mm. Since January 2002 Norwegian trawlers (human consumption) have had a minimum mesh size of 120 mm in EU-waters. However, since August 2004 they have been allowed to use down to 110 mm mesh size in EU-waters (but minimum mesh size is still 120 mm in Norwegian waters).
- **Fishing for other stocks.** It is possible to use a mesh size range of 100–119 mm, provided the net is equipped with a square-mesh panel of at least 90 mm mesh size and the catch composition retained on board consists of no more than 3% of cod.
- **2002 exemption.** In 2002 only, it was possible to use a mesh size range of 110–119 mm, provided catches retained on board consist of at least 50% of a mixture of haddock, whiting, plaice sole, lemon sole, skates and anglerfish, and no more than 25% of cod.

Beam trawls

- **Northern North Sea.** It is prohibited to use any beam trawl of mesh size range 32 to 119 mm in that part of ICES Subarea 4 to the north of 56° 00' N. However, it is permitted to use any beam trawl of mesh size range 100 to 119 mm within the area enclosed by the east coast of the United Kingdom between 55° 00' N and 56° 00' N and by straight lines sequentially joining the following geographical coordinates: a point on the east coast of the United Kingdom at 55° 00' N, 55° 00' N 05° 00' E, 56° 00' N 05° 00' E, a point on the east coast of the United Kingdom at 56° 00' N, provided that the catches taken within this area with such a fishing gear and retained on board consist of no more than 5% of cod.
- **Southern North Sea.** It is possible to fish for sole south of 56° N with 80–99 mm meshes in the cod end, provided that at least 40% of the catch is sole, and no more than 5% of the catch is composed of cod, haddock and saithe.

Combined nets

It is prohibited to simultaneously carry on board beam trawls of more than two of the mesh size ranges 32 to 99 mm, 100 to 119 mm and equal to or greater than 120 mm.

Fixed gears

The minimum mesh size of fixed gears is of 140 mm when targeting cod, which is when the proportion of cod catches retained exceeds 30% of total catches.

2.2.5.1 Closed areas

Twelve mile zone

Beam trawling is not allowed in a 12 nm wide zone along the British coast, except for vessel having an engine power not exceeding 221 kW and an overall length of 24 m maximum. In the 12 mile zone extending from the French coast at 51°N to Hirtshals in Denmark, trawling is not allowed to vessels over 8 m overall length. However, otter trawling is allowed to vessels of maximum 221 kW and 24 m overall length, provided that catches of plaice and sole do not exceed 5% of the total catch. Beam trawling is only allowed to vessels included in a list that has been drawn up for the purposes. The number of vessels on this list is bound to a maximum, but the vessels on it may be replaced by other ones, provided that their engine power does not exceed 221 kW and their overall length is 24 m maximum. Vessels on the list are allowed to fish within the twelve miles zone with beam trawls having an aggregate width of 9 m maximum. To this rule there is a further derogation for vessels having shrimping as their main occupation. Such vessels may be included in annually revised second list and are allowed to use beam trawls exceeding 9 m total width.

Plaice box

To reduce the discarding of plaice in the nursery grounds along the continental coast of the North Sea, an area between 53°N and 57°N has been closed to fishing for trawlers with engine power of more than 221 kw (300 hp) in the second and third quarter since 1989, and for the whole year since 1995. Beare *et al.* (2013) conducted a thorough analysis of the potential effect of the plaice box on the stock of plaice, and concluded that no significant effect, neither positive nor negative, could be related to the implementation of the plaice box.

Sandeel box

In the light of studies linking low sandeel availability to poor breeding success of kittiwake, ICES advised in 2000 for a closure of the sandeel fisheries in the Firth of Forth area east of Scotland. All commercial fishing was excluded, except for a maximum of 10 boat days in each of May and June for stock monitoring purposes. The closure was initially designated to last for three years but has been repeatedly extended and remains in force. The level of effort of the monitoring fishery was increased in 2006.

Norway pout box

The Norway pout fishery intensified in the northern North Sea during the 1960s and 1970s, and the concerns raised here about bycatch of juvenile cod, whiting, haddock, and saithe led to the establishment of the "Norway pout box" closed management area along the Scottish coast to protect juvenile gadoids in particular. In 1977, the UK government decided to establish this area of closure to the small-mesh trawl fishery along the eastern Scottish coast in the northern North Sea (Bigné *et al.*, 2019). Since then, the small-mesh trawl fishery is completely forbidden in this area, with the declared aim of protecting juveniles of larger gadoid species (i.e. cod, haddock, and whiting).

Natura 2000

To protect habitats, several Natura 2000 areas have been defined. It is still under negotiation which fisheries will be prohibited in these areas exactly. It is likely that for each of these areas different rules will apply.

Unilateral management

In addition to the EU-wide statutory regulations, some countries impose additional management schemes on their fleets. One example of this is the Scottish Conservation Credits scheme which

encompasses technical regulation and temporary spatial closures in return for derogation from some EU effort controls. This scheme, and others are described in the stock sections to which they pertain.

2.3 Ecosystem Overviews

General observations

WGNSSK welcomes the ecosystem overview available for the North Sea. It is a well-organized description of the ecosystem and highlights changes observed during the last decades. However, WGNSSK discussed the overviews and has some suggestions how to improve the next generation of overviews.

Some minor comments and suggestions for corrections:

On page 3, the following is stated: "The seabird population showed an overall increasing trend until 2000, after which it declined. Recent changes in fisheries management policy (e.g. reduction in effort and the landing obligation) will likely affect seabirds as well as other parts of the ecosystem". The second sentence is very general and does not contain enough information to be truly useful for scientists or decisions makers and no link/reference is provided to aid the reader finding more information. Similar examples can be found throughout the document.

A further issue is the description of the state of the ecosystem. In the absence of reference levels, conclusions on the current state of the ecosystem cannot be reached.

Figure 3 is central to the ecosystem overview. The figure shows the main human activities, pressures and how they are linked to ecosystem states. The figure provides a good summary; however, it is unclear how the strength of the lines linking activities, pressures and states has been derived. Neither is it described how the ranking was performed, nor is an indication provided on which stakeholder groups, and how many people, were involved in the analysis. This contradicts to some extent the ICES ambition to provide, as much as possible, transparent and objective advice. In addition, the thin line in the figure from selective extraction of species to food webs contradicts, at first sight, the sentences further down in the overview: "Fishing changes both community structure and food webs. The depletion of larger predatory species has likely perturbed the structure and functioning of the ecosystem".

Some of the figures in the current version are outdated. Longer time series are available for effort data, and the large fish indicator stops in 2011. Given the lower fishing mortality regime in recent years, it would be most interesting to see whether the large fish indicator has responded or not.

The word "crustaceans" should be replaced with *Nephrops* in Figure 5. Only four *Nephrops* assessments are available, and *Nephrops* constitutes only a small part of the crustacean biomass.

WGNSSK does not fully follow the rationale behind the sentence: "The proportional impact of recreational fishing is increasing as commercial operations are restrained" (page 6). Also, this sentence on recreational fishing seems a bit of context, when considering the rest of the paragraph.

No flatfish are in the figure showing the North Sea food web. This is questionable, since flatfish are highly abundant in the North Sea.

Ideas for the next version of ecosystem overviews:

1. Trends in the condition and productivity (e.g. weight, recruitment etc.). This could be important information for scientists and managers. For example, the current low productivity of many gadoids in the North Sea is not discussed in the document. Also, perhaps use biomass spectra time-series in combination with the large fish indicator.

2. Distribution of stocks and changes over time (incl. spawning and nursery areas) may become increasingly relevant as the number of areas closed to fishing increase (i.e. marine spatial planning and conservation issues). Also, how does it influence stock assessment models if parts of the stock is within "closed" areas.
3. Density dependence may become more important when stocks are recovering. This could have an impact on the appropriateness of current reference points.
4. Detailed information on changes in the North Sea food web over time, on descriptions of who eats whom.
5. A table highlighting which métiers/fisheries have the highest bycatch of a certain species could be an interesting addition for risk-based management approaches.
6. Discussions in the group revealed that the overview currently does not provide sufficient information on the effects and impacts of observed changes. In general, links are missing between trends in observations and the impact on particular stocks. Such links could be added (when information is available) either in the ecosystem overviews or as additional overview table.
7. A separation of natural fluctuations from impacts caused by anthropogenic pressures is recommended. Furthermore, time-series of relevant environmental variables (temperature, AMO, water flow etc.) could lead to a better understanding of past environmental regimes. Are maps of historic distributions of sea grass beds and rocky and biogenic reefs available?
8. Reports from STECF on the monitoring of the CFP provide useful information on general trends in fishing pressure and biomass of stocks in the greater North Sea. The report provides the full code used for the analyses. The work is based on ICES assessments and uses the assessment graph database. Therefore, it could be easily used for regular updates of ecosystem overviews as well.
9. The list of threatened and declining species according to OSPAR should be updated after discussions with OSPAR. It is debatable whether species like cod (at least at a whole North Sea level) and thornback and spotted ray still belongs to this list.
10. Approach stakeholders to learn about their main interests/needs in relation the an ecosystem overviews.

2.4 Fisheries Overviews

ICES has published a Fisheries Overview for the Greater North Sea Ecoregion (http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2020/2020/FisheriesOverview_GreaterNorthSea_2020.pdf). The Executive Summary is as follows:

This fisheries overview contains details of mixed fisheries considerations for North Sea demersal and Norway lobster stocks, and a description of the fisheries and their interactions within the ecoregion.

Mixed-fisheries considerations presents six example scenarios of fishing opportunities of eight fish stocks and ten Norway lobster stock units fished within the ecoregion: cod (cod.27.47d20), haddock (had.27.46a20), whiting (whg.27.47d), saithe (pok.27.3a46), plaice (ple.27.420 and ple.27.7d), sole (sol.27.4), turbot (tur 27.4), witch (wit.27.3a47d), and Norway lobster (functional units [FUs] 5–10, 32, 33, 34, and 4 outFU), taking into account the single-stock advice of those species. The most limiting total allowable catch (TAC) in 2020 will be the TAC for cod for particular fleets.

Around 6600 fishing vessels are active in the Greater North Sea. Total landings peaked in the 1970s at 4 million tonnes and have since declined to about 2 million tonnes. Total fishing effort has declined substantially since 2003. Pelagic fish landings are greater than demersal fish landings. Herring and mackerel, caught using pelagic trawls and seines, account for the largest portion of the pelagic landings, while sandeel and haddock, caught using otter trawls/seines, account for the largest fraction of the demersal landings. Catches are taken from more than 100 stocks. Discards are highest in the demersal and benthic

fisheries. The spatial distribution of fishing gear varies across the Greater North Sea. Static gear is used most frequently in the English Channel, the eastern part of the Southern Bight, the Danish banks, and in the waters east of Shetland. Bottom trawls are used throughout the North Sea, with lower use in the shallower southern North Sea where beam trawls are most commonly used. Pelagic gears are used throughout the North Sea.

In terms of tonnage of catch, most of the fish stocks harvested from the North Sea are being fished at levels consistent with achieving good environmental status (GES) under the EU's Marine Strategy Framework Directive; however, the reproductive capacity of the stocks has not generally reached this level. Almost all the fisheries in the North Sea catch more than one species; controlling fishing on one species therefore affects other species as well. ICES has developed a number of scenarios for fishing opportunities that take account of these technical interactions. Each of these scenarios results in different outcomes for the fish stocks. Managers may need to take these scenarios into account when deciding upon fishing opportunities. Furthermore, biological interactions occur between species (e.g. predation) and fishing on one stock may affect the population dynamics of another. Scenarios that take account of these various interactions have been identified by ICES and can be used to evaluate the possible consequences of policy decisions. The greatest physical disturbance of the seabed in the North Sea occurs by mobile bottom-contacting gear during fishery in the eastern English Channel, in nearshore areas in the southeastern North Sea, and in the central Skagerrak. Incidental bycatches of protected, endangered, and threatened species occur in several North Sea fisheries, and the bycatch of common dolphins in the western English Channel may be unsustainable in terms of population.

2.5 Human consumption fisheries

2.5.1 Data

Estimates of discarding rates provided by a number of countries through observer sampling programme were used in the assessments of various roundfish and flatfish as well as *Nephrops* FUs, to raise landings to catch (see also Section 01 on InterCatch). Discards could also be estimated for bycatch species (e.g., dab, flounder, lemon sole, witch, brill, and turbot). Finally, catch advice could be given for all WGNSSK stocks that require it.

In the EU, national sampling programs are defined and implemented as part of the Data Collection Framework (DCF). Other sampling programmes (e.g. industry self-sampling for discards and biological data) have been in place in recent years and the data are increasingly entering the assessment process in some instances (e.g., plaice in 4, haddock). In general, some discarding occurs in most human-consumption fisheries. As TACs have become more restrictive for some species (e.g. cod), an increase in discarding of marketable fish (i.e. over minimum landing size) has been observed. In 2013, a landing obligation has been agreed between the EU Parliament and the Council of Ministers, as one of the most important aspects of the reform of the Common Fishery Policy (CFP), and this is going to have fundamental implications for the demersal fisheries and associated data collection program (see above).

For a number of years there had been indications that substantial under-reporting of roundfish and flatfish landings is likely to have occurred. It is suspected to have been particularly strong for cod until 2006, and catches were expected to be larger than the TAC. Since the middle of the 2000s, the WG had used an assessment method for North Sea cod (Section 4) which estimated unallocated removals, potentially due to reporting problems, unrecorded discards, changes in natural mortality, or changes in survey catchability. In 2013, WGNSSK considered that the assumption of unallocated removals after 2006 could not be justified by any known factors (see also ICES WKCOD, 2011), and relaxed that assumption (from 2006 onwards) in the assessment.

Several research vessel survey indices are available for most species, and were used both to calibrate population estimates from catch-at-age analyses, and in exploratory analyses based on

survey data only. Commercial CPUE series were available for a number of fleets and stocks, but for various reasons only some of them could be used for assessment purposes (although they are presented and discussed). The use of commercial CPUE indices has been phased out where possible and of the ten category 1 assessments, only saithe, turbot in 4 and sole in 7.d include a commercial index.

Bycatches in the industrial fisheries were significant in the past for haddock, whiting and saithe, but these have reduced considerably in recent years.

2.5.2 Summary of stock status

The main impression in recent years is that fishing pressure has been reduced substantially for many North Sea stocks of roundfish and flatfish compared to the beginning of the century. All fish stocks with agreed reference points (Category 1 stocks) are above B_{lim}, apart from cod in 4, 7.d and 20. The SSBs of cod in 4, 7.d and 20, sole in 7.d and saithe in 3.a, 4 and 6 are below MSY $B_{trigger}$ at the beginning of 2021. Several North Sea stocks are exploited at or below F_{MSY} levels (haddock in 4, 6.a and 20, plaice in 4 and 20, plaice in 7.d, turbot in 4, whiting in 4 and 7.d); however, several others are being fished above F_{MSY} (cod in 4, 7.d and 20, saithe in 3.a, 4 and 6, sole in 4, sole in 7.d, and witch in 3.a, 4 and 7.d). An important feature is that recruitment still remains poor compared to historic average levels for most gadoids, although there are signs of a strong recruitment for haddock and whiting in 2019 and 2020. Recruitment in 2020 continues on a high level also for flatfish stock of turbot in 4.

All *Nephrops* stocks with agreed biomass reference points (Category 1 stocks, excluding nep.fu.3-4) are currently above MSY $B_{trigger}$, and all *Nephrops* stocks with defined F_{MSY} (Category 1 stocks) are being fished below F_{MSY} in 2020, apart from *Nephrops* in FU 6 (nep.fu.6).

WGNSSK is also responsible for the assessment of several data-limited species (Category 3+ stocks) that are mainly by catch in demersal fisheries (brill in 3.a, 4 and 7.d-e, lemon sole in 3.a, 4 and 7.d, dab in 3.a and 4, flounder in 3.a and 4, turbot in 3.a, whiting in 3.a), along with grey gurnard in 3.a, 4 and 7.d and striped red mullet in 3.a, 4 and 7.d. Biennial precautionary approach (PA) advice was provided in 2015 for the first time, and again in 2017, 2019 and 2021. Biennial advice is required on a different cycle for grey gurnard in 3.a, 4 and 7.d, and was not provided in 2021; instead, it was only necessary to determine whether the perception of the stocks has changed compared to 2020; because these perceptions have not changed, no reopening was needed for this stock. Triennial advice is now required for dab in 3.a and 4 (due in 2022) and pollack in 3.a and 4 (due in 2021).

Biennial PA advice was provided for data-limited *Nephrops* stocks (Category 4: FU 5, 10, 32, 33, 34) for the first time in 2016, subsequently in 2018 and 2020. However, this advice is updated whenever the results from a new UWTV survey becomes available and the re-opening protocol is triggered (e.g. FU 34 in 2018 and FU 33 in 2019). For *Nephrops* in 4 outside functional units biennial PA advice was produced for the first time in 2015; however, it did not make sense to have biennial advice for this unit (Category 5) misaligned with biennial advice for other data-limited *Nephrops* stocks (Category 4), so in order to achieve alignment, triennial PA advice was provided in 2017, with biennial PA advice given in 2020 (aligned with other data-limited *Nephrops* stocks). No advice is required for these stocks in 2021.

The summary of stock status is as follows:

1) *Nephrops*:

Category 1:

a) FU 3-4 (nep.fu.3-4): The stock size is considered to be stable. The estimated harvest rate for this stock is currently below F_{MSY}. No reference points for stock size have been defined for this stock.

b) FU 6 (nep.fu.6): The stock abundance has increased since 2015, and currently it is above MSY $B_{trigger}$. The harvest rate is above F_{MSY} in 2020.

c) FU 7 (nep.fu.7): The stock size has been above MSY $B_{trigger}$ for most of the time-series. The harvest rate has increased since 2017 but remains below F_{MSY}.

d) FU 8 (nep.fu.8): The stock size has been above MSY $B_{trigger}$ for the entire time-series. The harvest rate is varying, decreased in 2020 and is now below F_{MSY}.

e) FU 9 (nep.fu.9): The stock has been above MSY $B_{trigger}$ for the entire time-series. The harvest rate has fluctuated around F_{MSY} in recent years and is above F_{MSY} in 2019 but below F_{MSY} in 2020 (calculated using an interpolated value for abundance, no survey index in 2020).

Category 4:

f) FU 32 (nep.fu.32): The available data is non-conclusive with regard to stock status, in recent years landings have relatively low.

g) FU 33 (nep.fu.33): The state of this stock is unknown. Landings have been relatively stable since 2004, fluctuating without trend at around 1000 tonnes. The mean density of Norway lobster decreased 2017 to 2019. Advice was provided for this stock in 2019 (although it was not scheduled) because of the availability of data from a UWTV survey conducted in 2018.

h) FU 34 (nep.fu.34): The current state of the stock is unknown.

i) FU 5 (nep.fu.5): The status of this stock is uncertain. Assuming the density has been constant since 2012, the harvest rate in 2018 and 2019, corresponding to the total landings, has decreased and now below the MSY proxy reference point.

j) FU 10 (nep.fu.10): The current state of the stock is unknown.

Category 5:

k) out of FU (nep.27.4outFU): The current state of the stock is unknown.

2) Cod (cod.27.47d20): Fishing pressure has increased since 2016, and is below F_{lim} in 2020. Spawning-stock biomass has decreased since 2016 and is now below B_{lim}. Recruitment since 1998 remains poor. Currently, fishing pressure on the stock is above F_{MSY}, but below F_{pa} and F_{lim}; the spawning-stock size is below MSY $B_{trigger}$, B_{pa} and B_{lim}.

3) Haddock (had.27.46a20): Fishing pressure has declined since the beginning of the 2000s, but it has been above F_{MSY} for most of the entire time-series. Only since 2019, fishing pressure has been below F_{MSY}. Spawning-stock biomass has been above MSY $B_{trigger}$ in most of the years since 2002. Recruitment since 2000 has been low with occasional larger year classes. The 2019 and 2020 year-classes are estimated to be two of the largest since 2000. Currently, fishing pressure on the stock is below F_{MSY}, F_{pa} and F_{lim}, and spawning stock size is above MSY $B_{trigger}$, B_{pa} and B_{lim}.

4) Whiting (whg.27.47d): Spawning-stock biomass has fluctuated around MSY $B_{trigger}$ since the mid-1980s and has been above it since 2019. Fishing pressure has been below F_{MSY} since the early 2000s. Recruitment (R) has been fluctuating without trend, but the 2019

and 2020 year-classes are estimated to be the largest since 2002. Currently, fishing pressure on the stock is below F_{MSY}, F_{pa} and F_{lim}; spawning-stock size is above MSY $B_{trigger}$, B_{pa} and B_{lim}.

5) Saithe (pok.27.3a46): Spawning-stock biomass has fluctuated without trend and has been above MSY $B_{trigger}$ in 1996-2020. Fishing pressure has decreased and stabilized above F_{MSY} since 2000. Recruitment has shown an overall decreasing trend over time with lowest levels in the past 10 years. Currently, fishing pressure on the stock is above F_{MSY}, but below F_{pa} and F_{lim}; spawning-stock size is below MSY $B_{trigger}$ and B_{pa} but above B_{lim}.

6) Plaice (ple.27.420): The spawning-stock biomass is well above MSY $B_{trigger}$ and has markedly increased since 2008, following a substantial reduction in fishing pressure since 1999. After a strong recruitment in 2019, the recruitment in 2020 is estimated to be the average. Currently, fishing pressure on the stock is below F_{MSY}, F_{pa} and F_{lim}, and spawning-stock size is above MSY $B_{trigger}$, B_{pa} and B_{lim}.

7) Sole (sol.27.4): The spawning-stock biomass has fluctuated around B_{lim} since 2003, and has been estimated to be below MSY $B_{trigger}$ since 2000. In 2021, SSB is estimated to be above MSY $B_{trigger}$. Fishing pressure has declined since 1999 and is above F_{MSY} in 2020. Recruitment in 2019 is estimated to be one of the highest in the time series, while recruitment in 2020 is estimated to be relatively low. Currently, fishing pressure on the stock is above F_{MSY}, but below F_{pa} and F_{lim}, and spawning-stock size is below MSY $B_{trigger}$, B_{pa} and B_{lim}.

8) Sole (sol.27.7d): This stock was downgraded from Category 1 to Category 3 following the Interbenchmark in 2019 and Benchmark in 2020. Following the benchmark in 2021, the stock is again assessed as category 1. The spawning-stock biomass (SSB) has been fluctuating without trend and has been below MSY $B_{trigger}$ since 2014. Fishing pressure (F) has shown a decreasing trend since 2009 and has been above F_{MSY} throughout the time series. Recruitment has been fluctuating without trend. In 2019, the recruitment is estimated to be one of the highest in the time series. Currently, fishing pressure on the stock is above F_{MSY}, but below F_{pa} and F_{lim}, and spawning-stock size is below MSY $B_{trigger}$ and B_{pa}, but above B_{lim}.

9) Plaice (ple.27.7d): The spawning-stock biomass has increased rapidly from 2010 following a period of high recruitment between 2009 and 2019, and is now still well above the MSY $B_{trigger}$, despite a decline since 2016. Fishing pressure has declined since the early 2000s, with an increase in the recent years to slightly below F_{MSY}. Recruitment in 2019 is currently estimated to be highest in the time series, while recruitment in 2020 is estimated to be the lowest value in the time series. Currently, fishing pressure on the stock is below F_{MSY}, F_{pa} and F_{lim}, and spawning stock size is above MSY $B_{trigger}$, B_{pa} and B_{lim}.

10) Turbot (tur.27.4): Recruitment is variable without a trend. In 2019 and 2020 recruitment is estimated to be above average of the time series. Fishing pressure has decreased since the mid-1990s, and has been at or below F_{MSY} since 2012. The spawning-stock biomass has increased since 2005 and has been above MSY $B_{trigger}$ since 2013. This stock was upgraded to Category 1 from Category 3 following an inter-benchmark in 2018. Currently, fishing pressure on the stock is below F_{MSY}, F_{pa} and F_{lim}; spawning stock size is above MSY $B_{trigger}$, B_{pa} and B_{lim}.

11) Witch (wit.27.3a47d): Fishing pressure has been above F_{MSY} since the beginning of the time-series. Spawning-stock biomass that was below B_{lim} around 2010, has increased since then and is now above B_{lim} but below MSY $B_{trigger}$. Recruitment has increased in recent years and is currently at a medium level. This stock was upgraded to Category 1 from Category 3 following a benchmark during 2018. Fishing pressure on the stock is above F_{MSY} and at F_{pa}, but below F_{lim} in 2020, and spawning stock size is below MSY $B_{trigger}$ and B_{pa} and above B_{lim} in the beginning of 2021.

12) Category 3–6 finfish stocks: In 2021, new advice has been produced for bll.27.3a47de, lem.27.3a47d, fle.27.3a4, tur.27.3a (all Category 3 stocks) and mur.27.3a47d and pol.27.3a4 (Category 5). Advice was not provided for gug.27.3a47d, dab.27.3a4 and whg.27.3a (Category 3).

a) Brill (bll.27.3a47de): The biomass index has been gradually increasing over the time-series until 2015, and has then decreased. Currently, fishing pressure on the stock is below $F_{MSY\ proxy}$ and spawning stock size is above MSY $B_{trigger\ proxy}$.

b) Flounder (fle.27.3a4): The available survey information indicates no clear trend in stock biomass, while the stock indicator is at relatively low level in recent years. Currently, fishing pressure on the stock is below FMSY; no reference points for stock size have been defined for this stock.

c) Lemon sole (lem.27.3a47d): Total mortality has fluctuated without trend. Spawning-stock biomass increased from 2007 to 2012, and has remained stable since, albeit with a small decline in recent years. Recruitment has shown a mostly downwards trend since a peak in 2011, but in recent years an increase in recruitment is estimated, with high recruitment estimated for 2020. Currently, fishing pressure on the stock is below $F_{MSY\ proxy}$. No reference points for stock size have been defined for this stock.

d) Striped red mullet (mur.27.3a47d): The assessment was rejected in 2021 and the stock is now category 5. Currently, fishing pressure on the stock is above F_{MSY}; no reference points for stock size have been defined for this stock.

e) Pollack (pol.27.3a4): ICES cannot assess the stock and exploitation status relative to MSY and precautionary approach (PA) reference points because information to define reference points is not available.

f) Turbot (tur.27.3a): Catches peaked in the late 1970s and early 1990s and have been more stable in recent years. Relative exploitable biomass (B/Bmsy) declined towards 2000 with an increasing trend in recent years years. Relative fishing pressure (F/Fmsy) peaked in the late 1970s and early 1990s without a trend in more recent years. Currently, fishing pressure on the stock is below $F_{MSY\ proxy}$ and spawning stock size is above MSY $B_{trigger}$.

Industrial fisheries

The Norway Pout (nop.27.3a4) assessment was benchmarked in 2012 through an inter-benchmark protocol (IBPNPOUT), resulting in changes in biological parameters (growth, maturity and natural mortality), and again in 2016 (WKPOUT) during which the assessment model was changed, but the general perception of the stock hasn't changed substantially.

The stock size is highly variable from year to year, due to recruitment variability and a short life span. Spawning-stock biomass is estimated to have been fluctuating above B_{pa} for most of the time-series. Fishing mortality declined between 1985 and 1995 and has been fluctuating at a lower level since 1995. Recruitment in 2018, 2019 and 2020 was above the long-term average, but was estimated to be low in 2021. Currently, spawning stock size is above B_{pa} and B_{lim}; no reference points for fishing pressure or for MSY $B_{trigger}$ have been defined for this stock.

References

Beare, D., Rijnsdorp, A. D., Blæsbjerg, M., Damm, U., Egekvist, J., Fock, H., Verweij, M., 2013. Evaluating the effect of fishery closures: lessons learnt from the Plaice Box. Journal of Sea Research, 84, 49–60.

Bigné, M., Nielsen, J. R., and Bastardie, F. 2018. Opening of the Norway pout box: will it change the ecological impacts of the North Sea Norway pout fishery? – ICES Journal of Marine Science, 76: 136–152.

Kraak, Sarah B.; Bailey, Nick; Cardinale, Massimiliano; Darby, Chris; De Oliveira, José A.; Eero, Margit; Graham, Norman; Holmes, Steven; Jakobsen, Tore; Kempf, Alexander; Kirkegaard, Eskild; Powell, John; Scott, Robert D.; Simmonds, E. John; Ulrich, Clara; Vanhee, Willy; Vinther, Morten. 2013. Lessons for fisheries management from the EU cod recovery plan. Marine Policy. 37. 200–213.STECF 2017 – Fisheries Dependent -Information – Classic (STECF-17-09). Publications Office of the European Union, Luxembourg 2017, ISBN 978-92-79-67481-5, doi:10.2760/561459, JRC107598: 848 pp.

STECF 2014a. Landing Obligation in EU Fisheries - part 2 (STECF-14-01). ISBN 978-92-79-36219-4.

STECF 2014b. Landing Obligations in EU Fisheries - part 3 (STECF-14-06). ISBN 978-92-79-37840-9.

Ulrich, C., Wilson, D. C. K., Nielsen, J. R., Bastardie, F., Reeves, S. A., Andersen, B. S., & Eigaard, O. R., 2012. Challenges and opportunities for fleet and metier based approaches for fisheries management under the European Common Fishery Policy. Ocean & Coastal Management, 70, 38-47. DOI:10.1016/j.ocecoaman.2012.06.002