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9.2 Greater North Sea Ecoregion – Fisheries overview

Executive summary

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.

Introduction

The Greater North Sea ecoregion includes the North Sea, English Channel, Skagerrak, and Kattegat. The Greater North Sea is a relatively shallow sea on the European continental shelf, with the exception of the Norwegian Trench that extends parallel to the Norwegian shoreline, from Oslo to north of Bergen. Pelagic species (primarily herring and mackerel) account for a significant portion of the total commercial fish landings in the region. Landings of benthic and demersal finfish species (primarily haddock, sandeel, flatfish, and cod) are also significant.

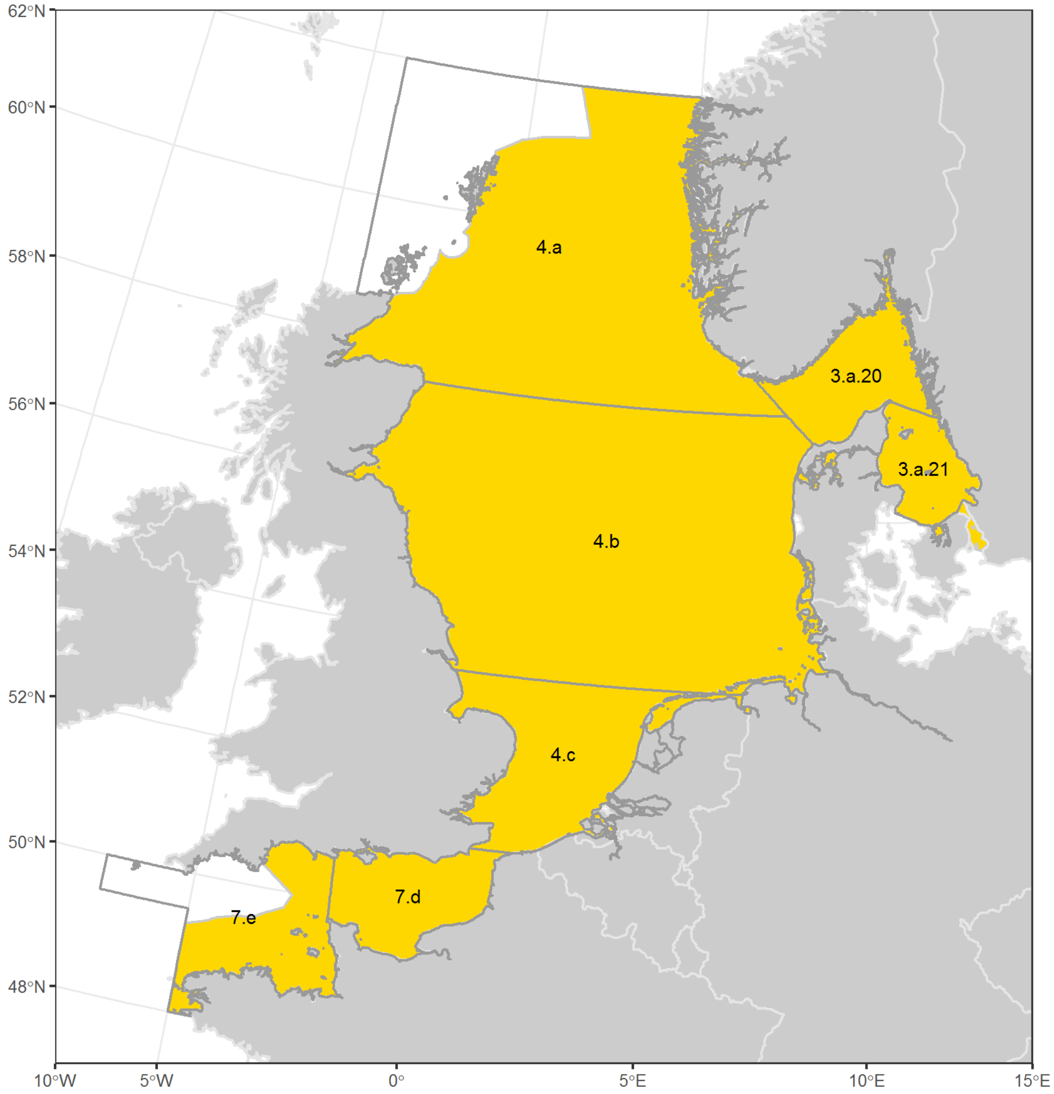


Figure 1 The Greater North Sea ecoregion (in yellow) as defined by ICES. The relevant ICES statistical areas are shown.

All of the Greater North Sea ecoregion lies within the FAO Major Fishing Area 27; the prefix "27" in the ICES statistical area codes is therefore omitted in the following. This overview, which covers ICES Division 3.a, most of divisions 4.a, 4.b, 4.c, 7.d, and part of 7.e as well as Subdivision 3.b.23, provides:

- a short description of each of the national fishing fleets in the ecoregion, including their commercial and recreational fisheries, and fishing gears and fishing patterns;
- a summary of the status of the resources and the level of exploitation relative to agreed objectives and reference points;
- an examination of mixed-fisheries considerations of relevance to the management of the fisheries; and
- an evaluation of impacts of fishing gear on the ecosystem in terms of physical contact on subsurface and bottom habitats, and on the bycatch of protected species.

The overview does not include the fisheries in the western English Channel (Division 7.e) and in the Sound (south of Subdivision 3.a.21).

Who is fishing

Around 6600 vessels from nine nations operate in the Greater North Sea, with the largest numbers coming from UK, Norway, Denmark, the Netherlands, and France. Total landings peaked in the early 1970s and have since declined. The proportion caught by each country of the total annual landings has varied over time (Figure 2). Since 2003, total fishing effort has declined (Figure 3). Profitability of many of the commercial fleets has increased in recent years due to the improved status of many fish stocks, reduced fleet sizes, lower fuel prices, and more efficient fishing gears. The following country paragraphs highlight features of the fleets and fisheries of each country and are not exhaustive descriptions.

Belgium

The Belgian fishing fleet is composed of about 75 vessels, primarily beam trawlers both above and below 24 m in length. Few vessels are smaller than 12 m. Most of the catch is demersal species; sole is the dominant species in value, and plaice the dominant species in volume. Other important species include lemon sole, turbot, anglerfish, rays, cod, shrimp, and scallops.

Denmark

The Danish fleet comprises 1400 vessels, of which 600 vessels operate in the Greater North Sea demersal fisheries. Smaller vessels (< 12 m) constitute the greatest proportion of the fleet, but account for less than 5% of the Danish fisheries catch value. The most important demersal fisheries target cod, plaice, saithe, northern shrimp, and *Nephrops* using bottom trawls and seines. The most important industrial and pelagic fisheries are prosecuted by around 30 large vessels (>40 m) and around 200 smaller (12–40 m) vessels; these fisheries target herring and mackerel for human consumption, and sandeel, sprat, and Norway pout for reduction purposes (i.e. fish meal and oils).

France

The French fleet in the North Sea is composed of more than 600 vessels. The demersal fisheries operate mainly in the eastern English Channel and southern North Sea and catch a variety of finfish and shellfish species. The largest fleet segments are gill- and trammel netters (10–18 m) targeting sole, demersal trawlers (12–24 m) catching a great diversity of fish and cephalopod species, and dredgers catching scallops. Smaller boats operate different gears throughout the year and target different species assemblages. There is also a fleet of six large demersal trawlers (>40 m) that target saithe in the northern North Sea and to the west of Scotland. The pelagic fishery is prosecuted by three active vessels catching herring, mackerel, and horse-mackerel.

Germany

The German North Sea fishing fleet comprises more than 200 vessels. Beam trawlers constitute the largest fleet component (around 180 vessels, 12–24 m) and target brown shrimp in the southern North Sea. Six large demersal trawlers (>40 m) target saithe in the northern North Sea (and in waters to the north of the North Sea). Several mid-sized otter trawlers and beam trawlers (24-40 m) target saithe, cod, sole, and plaice. Less than 10 vessels (mainly >40 m) operate in the North Sea pelagic and industrial fisheries that primarily target herring, but also catch horse mackerel, mackerel, sprat, and sandeel.

Netherlands

The Dutch fleet in the Greater North Sea consists of about 500 vessels. The main demersal fleet is the beam trawl fleet (275 vessels, of which 85 are >24 m and 190 are < 24 m) that operates in the southern and central North Sea, targeting sole (dominant in value) and plaice (dominant in volume) as well as other flatfish species. Many of these beam trawlers now use pulse trawls. Most of the smaller beam trawlers ("Eurocutters") seasonally target shrimp or flatfish. Pelagic freezer trawlers (7 vessels, >60 m) target pelagic species, mainly herring, mackerel, and horse mackerel.

Norway

The Norwegian North Sea fleet is composed of about 1585 vessels. 85% of these catch demersal species, including fish, crustaceans, cephalopods, and elasmobranchs, and 30% catch pelagic species, including herring, blue whiting, mackerel, and sprat. Approximately 60% of the fleet targeting demersal species are small vessels (< 10 m) that operate near the Norwegian coast using traps, pots, and gillnets, catching crabs, squid, and several fish species. Medium-sized vessels (10–24 m) mainly target *Nephrops* and crabs using pots and traps, shrimp using trawls, and cod, saithe, ling, and monkfish using gillnets. The industrial fleet (5 vessels of 24–40 m; 25 vessels >40 m) target Norway pout and sandeel for reduction purposes. The offshore fleet (>40 m) is predominantly otter trawlers, but also includes seiners and longliners. Larger vessels (>24 m) account for most of the landings of saithe, ling, cod, tusk, hake, haddock, herring, blue whiting, mackerel, and sprat.

Sweden

The Swedish fleet in the Greater North Sea comprises more than 500 vessels. The demersal fleet is highly diversified, catching several species in the Kattegat and Skagerrak, mainly *Nephrops*, northern shrimp, cod, witch, flounder, and saithe. The passive gear fleet is composed of around 400 vessels, of which 100 vessels (30 vessels of 10–18 m, 70 vessels < 10 m) target *Nephrops*. The 16 vessels in the pelagic fleet target sprat, herring, and sandeel.

UK (England)

The English fleet in the Greater North Sea has more than 1120 vessels. Medium-size demersal trawlers (80 vessels, 18–24 m and 24–40 m) primarily target *Nephrops*, cod, and whiting. The small vessel (< 10 m) fleet (around 1000 active vessels) operates in the eastern English Channel and coastal North Sea and catches a diversity of fish and shellfish species. Medium and large beam trawlers (about 40 vessels) account for the major share of the plaice landings. Three vessels (>50 m) operate in the pelagic fishery targeting mackerel, herring, and horse mackerel.

UK (Scotland)

The Scottish North Sea fleet comprises around 1000 vessels. More than 120 demersal trawlers (almost all >10 m) fish for mixed gadoids (cod, haddock, whiting, saithe, and hake,) and for groundfish such as anglerfish and megrim. A fleet of 116 trawlers fish mainly for *Nephrops* in the North Sea: 37 of these vessels (< 10 m) operate on the inshore grounds, while 79 (>10 m) operate over various offshore grounds. Pot or creel fishing is prosecuted by over 500 vessels (mostly < 10 m) targeting lobsters and various crab species on harder inshore grounds. Scallop fishing is carried out by around 70 dredgers (mostly >10 m). Limited amounts of longlining and gill netting are also conducted by Scottish vessels. Significant catches of pelagic species are harvested by 20 large vessels, primarily using pelagic trawls.

The Faroe Islands also fish in the Greater North Sea, but ICES does not have information on this fleet.

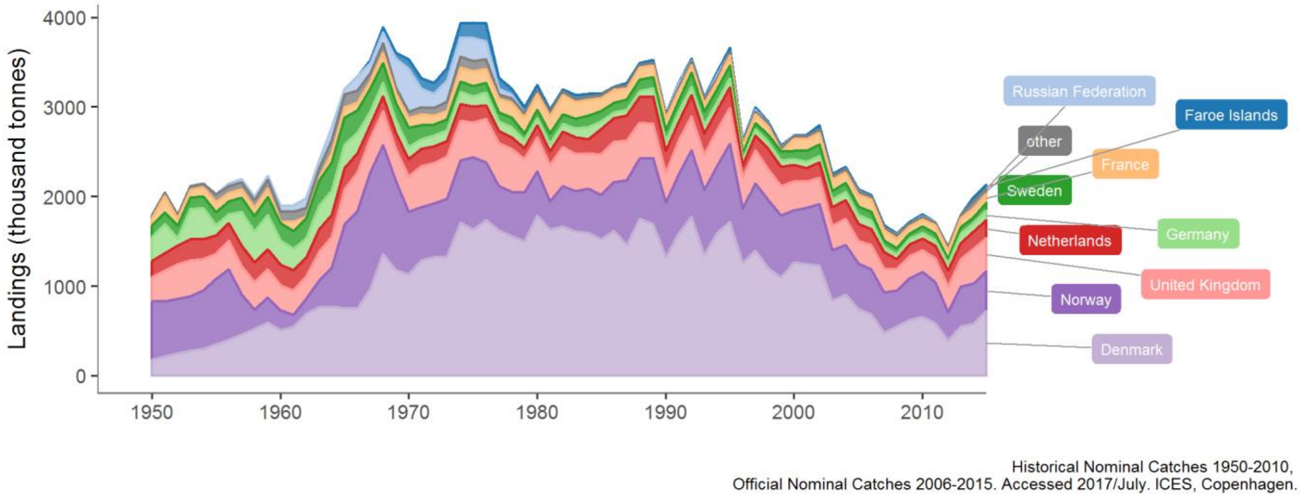


Figure 2 Landings (thousand tonnes) from the Greater North Sea in 1950–2015, by country. The nine countries having the highest landings are displayed separately and the remaining countries are aggregated and displayed as “other”.

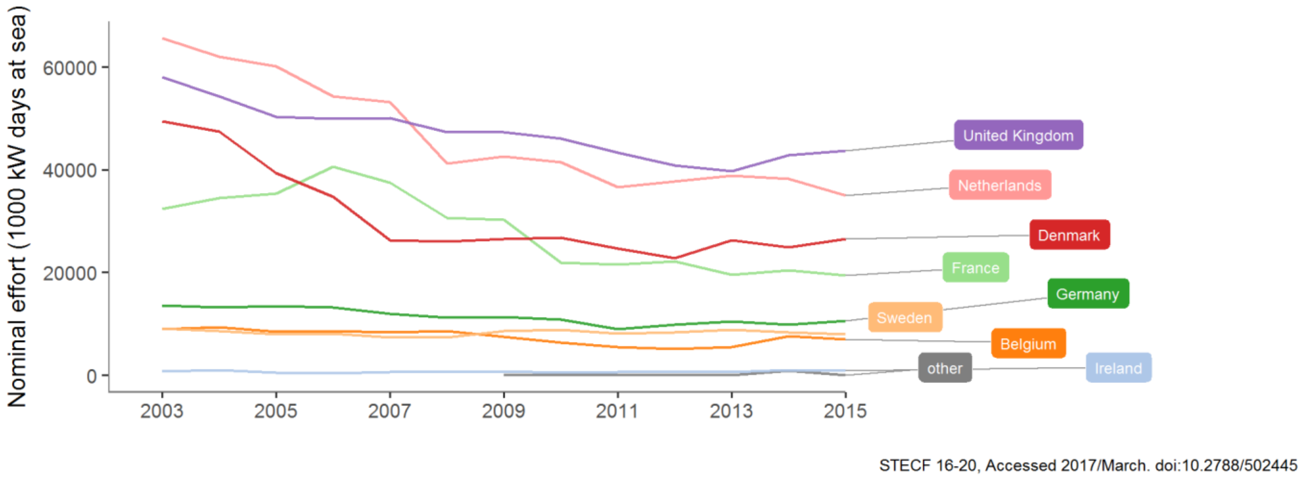


Figure 3 Greater North Sea fishing effort (thousand kW days at sea) in 2003–2015, by EU nation.

Catches over time

Species caught in the fisheries are either landed or discarded. Landings and discards are considered separately below. Data on landings have been collected consistently for many years, whereas information on discards have only been collected consistently in the most recent years.

Landings

Fisheries in the Greater North Sea catch a large diversity of species. These have been categorized into species that are pelagic, demersal, benthic (e.g. flatfish), crustaceans, and elasmobranchs.

Total landings from the Greater North Sea varied between 2 and 3 million tonnes during the 1950s, then rose to between 3 and 4 million tonnes from the late 1960s to the mid-1990s (Figure 2). High catches of both pelagic species (mackerel and herring) and demersal species (cod and haddock) accounted for the increase in total landings in the late 1960s (Figures 4 and 5). Total landings declined after 1995 to a low of 1.4 million tonnes in 2012. This decline is attributed to overfishing and decreased productivity of important stocks such as cod and herring, but also to the successful reduction of fishing mortality to more sustainable levels after 2000.

Since 2003, the pelagic fisheries using pelagic trawl and purse seines have accounted for the largest proportion of the total landings, followed by the demersal and benthic fisheries (Figure 6). Overall landings increased slightly from 2011 after a rise in herring landings and again, most recently (in 2015), from increased catches of anchovy, sardine, and hake.

Recreational fisheries in the North Sea target a wide range of species, but few of these fisheries are monitored or evaluated. Recreational catches of seabass and salmon (including freshwater for the latter) are significant and are included in ICES assessment of these species. In contrast, the recreational fisheries of elasmobranchs is not widely monitored; however, the recreational harvest of these species (mainly dogfish and several species of skates and rays) appears to be negligible.

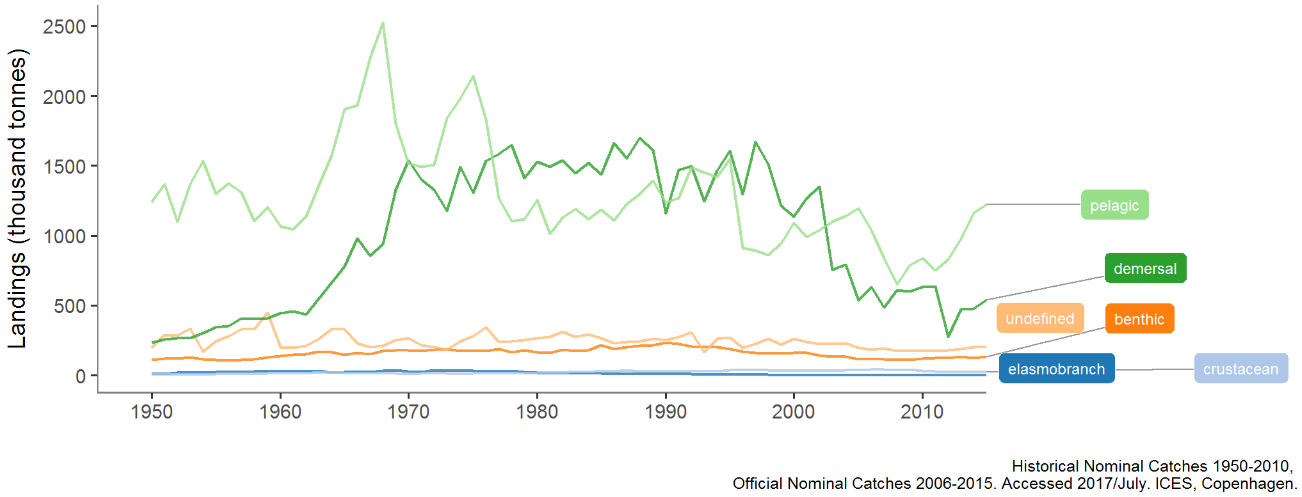


Figure 4 Landings (thousand tonnes) from the Greater North Sea in 1950–2015, by fish category. Table 1 in the Annex details which species belong to each fish category.

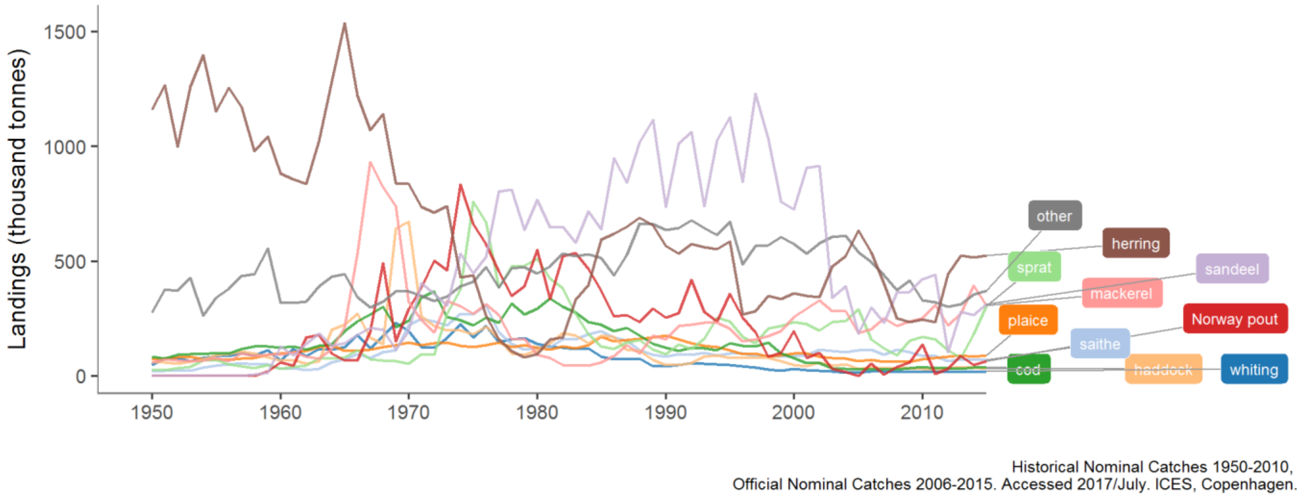


Figure 5 Landings (thousand tonnes) from the Greater North Sea in 1950–2015, by species . The ten species having the highest landings are displayed separately; the remaining species are aggregated and labelled as “other”.

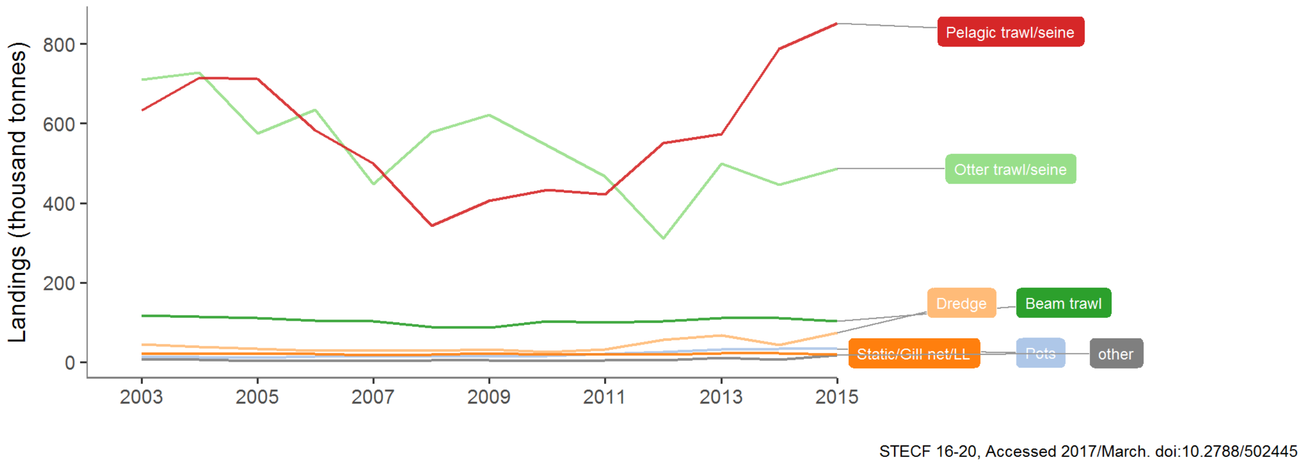


Figure 6 Commercial landings (thousand tonnes) from the Greater North Sea in 2003–2015, by gear type (LL = longline).

Discards

Discard data have been collected for some North Sea fisheries since the mid-1970s. Since 2000, discard data from North Sea commercial fisheries have been collected from various observer programmes implemented under the EU Data Collection Framework (DCF). However, complete discard data are only available from 2012 onwards. In 2012–2015, discard rates of demersal and crustacean species remained constant (7–10% and 15–20%, respectively, of the total catch of these species), while discards of benthic species declined sharply between 2014 and 2015 (40% to 25%). Discard rates of pelagic species were close to zero during 2012–2015 (Figure 7).

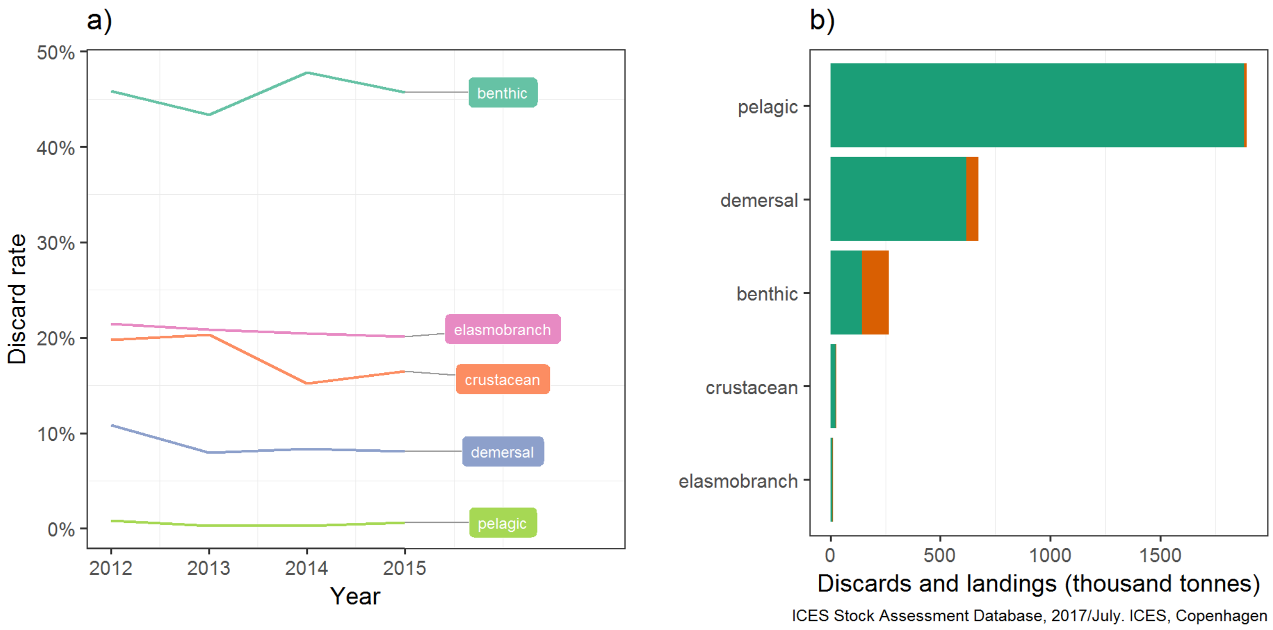


Figure 7 Left panel (a): Discard rates in 2012–2015 by fish category, shown as percentages (%) of the total annual catch in that category. Right panel (b): Landings (green) and discards (orange) in 2015 by fish category (in thousand tonnes). (Note that not all stock catches are disaggregated between landings and discards. In cases where discard data are unavailable for a given year, the discard rate in that year was assumed to be same as in the previous year.)

Description of the fisheries

Fishery resources in the Greater North Sea ecoregion are harvested using of a variety of fishing gears.

Otter trawl and beam trawls are the main gears used in the region's demersal fisheries, and pelagic trawls and seines are the primary gears used in the pelagic fisheries.

Demersal fishing effort has declined since 2003, while pelagic trawl and seine effort, after a decline, has increased again in recent years (Figure 8).

The spatial distribution of fishing effort by gear type is depicted in Figure 9. The maps show the distribution of effort by vessels >12 m having vessel monitoring systems (VMS). Fishing effort by vessels < 12 m may be significant, especially in inshore areas. However, these vessels are not required to have VMS and ICES does not have information on the spatial distribution of their effort; they are therefore not included in Figure 9.

Bottom otter trawl and seine fisheries

Otter trawls are the most common gear types in the Greater North Sea and are used intensively in most parts of the region, including the Skagerrak and the English Channel. Otter trawls typically catch gadoids, other groundfish, plaice, and

Nephrops; however, the species composition of the catch depends on the area and depth fished and the gear design, including codend mesh size. The mixed nature of most of the bottom fisheries and the spatial and temporal heterogeneity of target species challenge the simultaneous achievement of individual stock maximum sustainable yield (MSY) objectives, as well as the limitation of unwanted catches.

In the northern North Sea and the Skagerrak, otter trawls operate primarily with mesh sizes greater than 100 mm and target haddock, cod, whiting, anglerfish, megrim, and plaice, with economically important bycatches of *Nephrops* and some flatfish species. Some vessels target saithe in deeper waters in the north of the region. Otter trawlers using smaller mesh otter trawls (70–100 mm) primarily target *Nephrops* in soft mud areas. The proportion of *Nephrops* landings from mesh sizes greater than 100 mm has recently been increasing.

In the southern North Sea and the eastern English Channel, the otter trawl fleet operates with mesh sizes less than 100 mm, catching a varied mix of fish and shellfish species (including cephalopods) and, in muddy areas, *Nephrops*.

Bottom seine fisheries operate mainly in the Skagerrak, central North Sea, and in the eastern English Channel, with limited effort in the northern North Sea. Mesh sizes and targeted species are similar to the otter trawl fisheries in these areas.

Beam trawl fisheries

Beam trawl fisheries operate in the shallow parts of the southern and central North Sea, with particularly intense activity off the southeast coast of England. The most important species for beam trawlers are sole and plaice in terms of value and volume, respectively, and other flatfish species (e.g. turbot and brill). Because a relative small codend mesh size (80 mm) in used in beam trawls targeting flatfish, significant quantities of fish below minimum sizes are caught, resulting in high discard rates. Most small beam trawlers (< 24 m) target brown shrimp in the southern North Sea and coastal areas using a 20–25 mm codend mesh size.

Part of the beam trawl fleet is changing its fishing practices, shifting from conventional beam trawl to electric pulse trawl to reduce fuel costs, seabed impacts, and unwanted catches.

Static gear fisheries (gillnet and longline)

Gillnet fisheries primarily operate in the shallower areas of the southern North Sea, the eastern English Channel, and in the Skagerrak. Small and medium-sized boats target flatfish and demersal fish, depending on the gear used. Gillnet fisheries conducted in deeper areas also target anglerfish. Discard rates in gillnet fisheries with larger mesh sizes (>100 mm) are generally low; however, bycatch of marine mammals and seabirds occurs. Gillnet fisheries with smaller mesh sizes (90 mm) usually target sole, and may have considerable discard rates of dab.

Longline fisheries operate mostly in the northern North Sea and target saithe, cod, haddock, ling, and tusk.

Pelagic trawl and pelagic seine fisheries

Pelagic trawl and seine fisheries operate throughout most parts of the North Sea, except in the eastern portion of the central North Sea. The small-meshed (< 32 mm codend) pelagic trawl fishery is prosecuted mainly by vessels >40 m and targets sandeel, Norway pout, sprat, and blue whiting for reduction purposes. The pelagic trawl fishery for human consumption is operated by refrigerated seawater trawlers (>40 m) and freezer trawlers (>60 m) and targets herring, mackerel, and horse mackerel. Some blue whiting is taken by these vessels in the northern North Sea.

Dredge fisheries

Significant dredge fisheries for scallops occur in inshore areas along the east coasts of Scotland and England and throughout the English Channel. These fisheries primarily occur on sand and gravel substrates and are affected by exclusion zones that protect sensitive habitats in some areas. Dredges are also used to harvest blue mussels in the nearshore southern and eastern North Sea.

Pot fisheries

Static gear pot fisheries, mainly for edible crab, lobster, and whelk operate in the inshore areas of several countries bordering the North Sea. Most of the vessels are small (< 10 m).

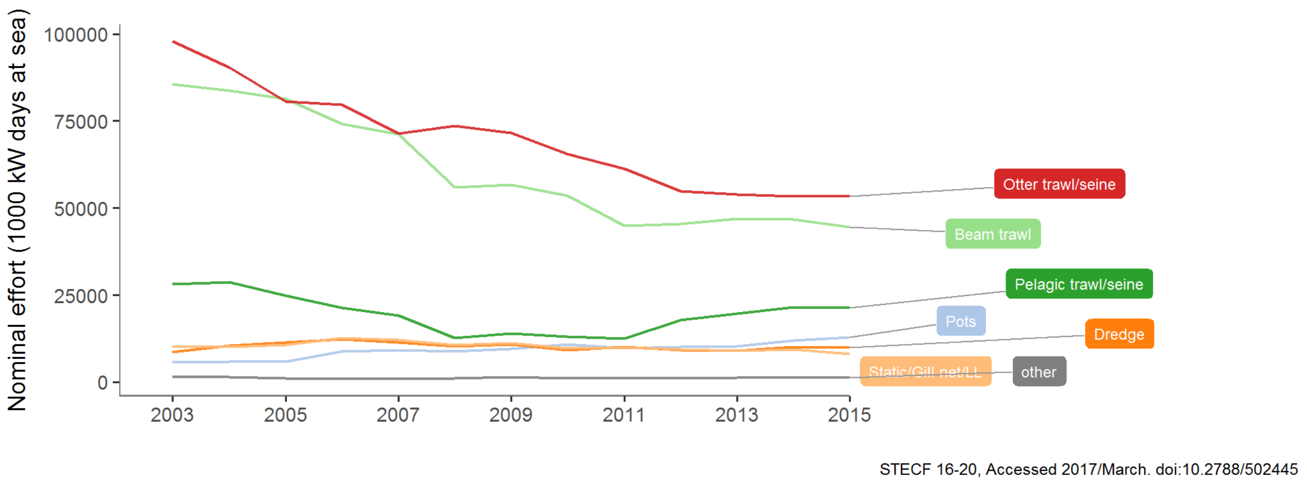


Figure 8 Greater North Sea fishing effort (thousand kW days at sea) in 2003–2015, by gear type (LL = longlines).

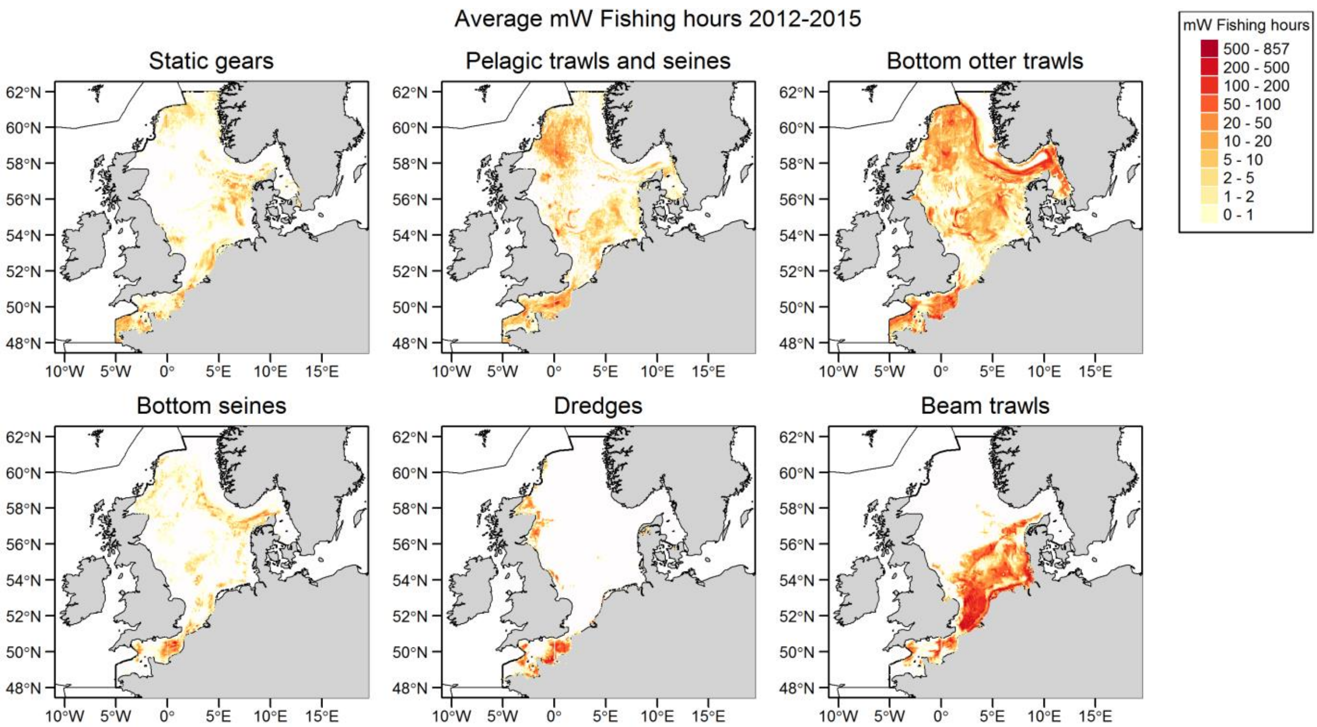


Figure 9 Spatial distribution of average annual fishing effort (mW fishing hours) in the Greater North Sea during 2012–2015, by gear type. Fishing effort data are only shown for vessels >12 m having vessel monitoring systems (VMS).

Fisheries management

Fisheries management in the Greater North Sea is conducted partly under the EU Common Fisheries Policy (CFP) and partly under Norway legislation. Within EU waters, management is conducted in accordance with the CFP and catching opportunities for stocks under EU competency are agreed during meetings of the Council of Ministers. Under the CFP's regionalization policy, proposals on certain issues (for example discard plans) are made by the North Sea Regional Fisheries Group (Scheveningen Group). National authorities manage activities in coastal waters (i.e. within 12 nautical miles). In

Norwegian waters, management of fishing activities in both offshore and inshore waters is conducted in accordance with Norwegian fisheries policy. For North Sea stocks shared between the EU and Norway (cod, haddock, whiting, saithe, herring, plaice, northern shrimp, and sprat), the EU–Norway agreements are based on an annual negotiation process agreeing on catch opportunities and the sharing of these. For more widely distributed stocks that occur in the North Sea (for example mackerel), management is discussed in coastal state consultations.

The North Atlantic Salmon Conservation Organization (NASCO) has managerial responsibility for the fisheries of salmon. Management of fisheries for large pelagic fish (e.g. tunas, etc.) is undertaken by the International Commission for the Conservation of Atlantic Tunas (ICCAT).

Collective fisheries advice, particularly on the state of stocks and on catch forecasts, is provided by the International Council for the Exploration of the Sea (ICES). Within EU waters, the European Commission's Scientific Technical and Economic Committee for Fisheries (STECF) provides broader advice that also covers technical and economic issues. Furthermore, the North Sea and Pelagic Advisory Councils also provide input to the management process.

Management plans

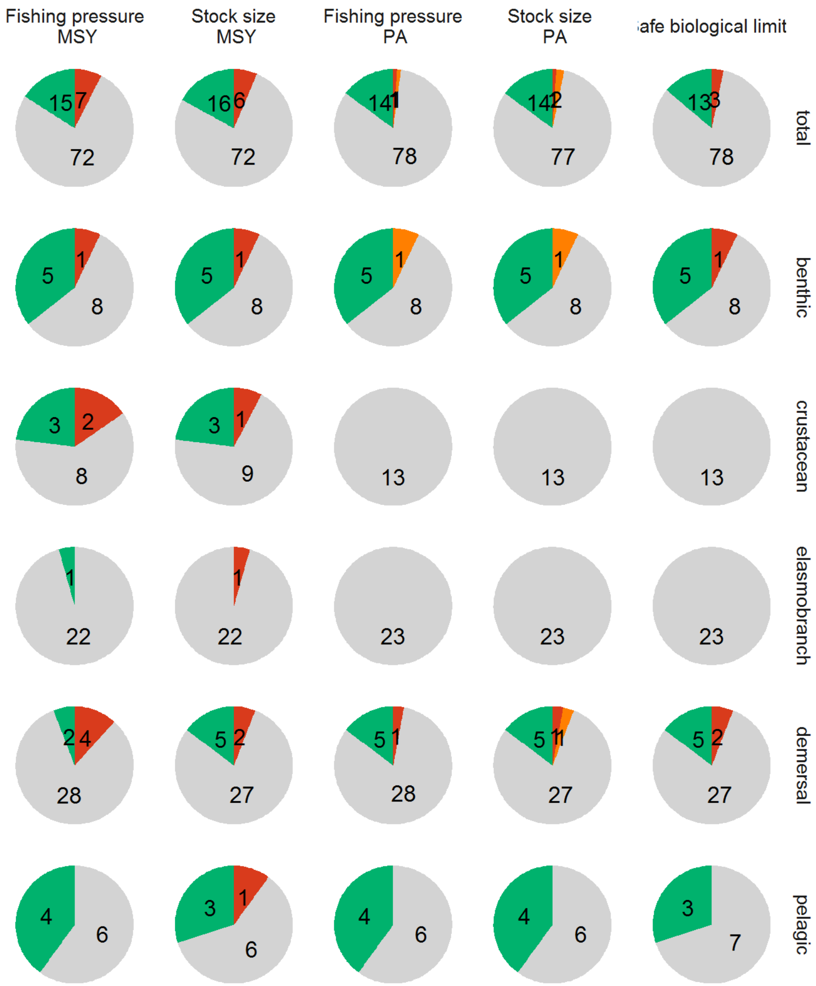
A number of management plans have been implemented for North Sea fisheries. Separate plans covering cod, haddock, whiting, saithe, and herring were established as joint management plans between the EU and Norway. These variously provide harvest control rules, safeguards to ensure that stocks remain within safe biological limits, and annual TAC change constraints. Before adoption, these plans were evaluated by ICES to ensure they were precautionary in nature. A similar approach was established by the EU for management plans for North Sea plaice and sole.

Changes have occurred recently in the assessments of several North Sea stocks covered by management plans, including revisions to reference points and adjustments in stock boundaries. These changes imply a need to re-evaluate the existing management plans to ensure that they remain precautionary. As a consequence, ICES advice for these stocks has been provided in accord with its MSY approach. The exception is herring and sole, for which management plan advice was continued in 2016.

Under the EU CFP, a new multi-annual plan (MAP) approach is currently being developed for the North Sea. This seeks to apply a mixed-fisheries approach that accounts for technical interactions (see section below) and recognises that simultaneous achievement of stock-specific MSYs across all stocks harvested in mixed fisheries is likely not possible. The North Sea MAP is expected to be implemented in 2018. Norway is also developing new fishery management plans for North Sea stocks in its waters.

Status of the fishery resources

Fisheries exploitation and spawning stock sizes of North Sea stocks have been evaluated against MSY and precautionary approach (PA) reference points, and the most recent status of these stocks has is presented relative to safe biological limits (Figures 10 and 11). Most of the North Sea stocks (15 of 27) that are analytically assessed are exploited at rates at or below F_{MSY}. Overall, fishing mortality (F) for shellfish, demersal, and pelagic fish stocks has substantially declined since the late 1990s (Figure 12). Spawning-stock biomass for most of these stocks has increased since 2000 and is above or close to their individual biomass reference points. However, several North Sea stocks have current fishing mortality rates above F_{MSY} (e.g., cod, whiting, haddock, mackerel, and blue whiting). For stock-specific information, see Annex 1.



ICES Stock Assessment Database, 2017/July. ICES, Copenhagen

Figure 10 Status summary of Greater North Sea stocks relative to ICES maximum sustainable yield (MSY) approach and precautionary approach (PA). Grey represents unknown reference points. *For the MSY approach*: green represents a stock that is fished at or below F_{MSY} while the stock size is equal to or greater than MSY $B_{trigger}$; red represents a stock status that is fished above F_{MSY} or the stock size is lower than MSY $B_{trigger}$. *For the PA*: green represents a stock that is fished at or below F_{pa} while the stock size is equal to or greater than B_{pa}; orange represents a stock that is fished between F_{pa} and F_{lim} or has a stock size between B_{lim} and B_{pa}; red represents a stock that is fished above F_{lim} or has a stock size lower than B_{lim}. Stocks having a fishing mortality below or at F_{pa} and a stock size at or above B_{pa} are defined as being inside safe biological limits. If this condition is not fulfilled the stock is defined as being outside safe biological limits. For stock-specific information, see Table 1 in the Annex.

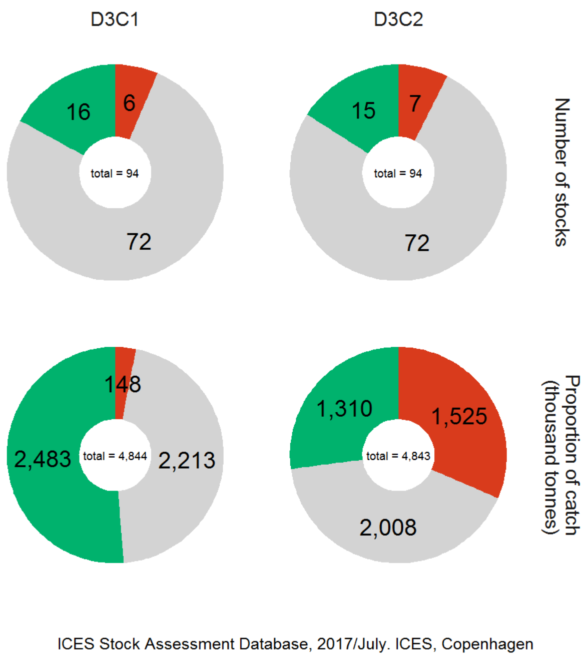
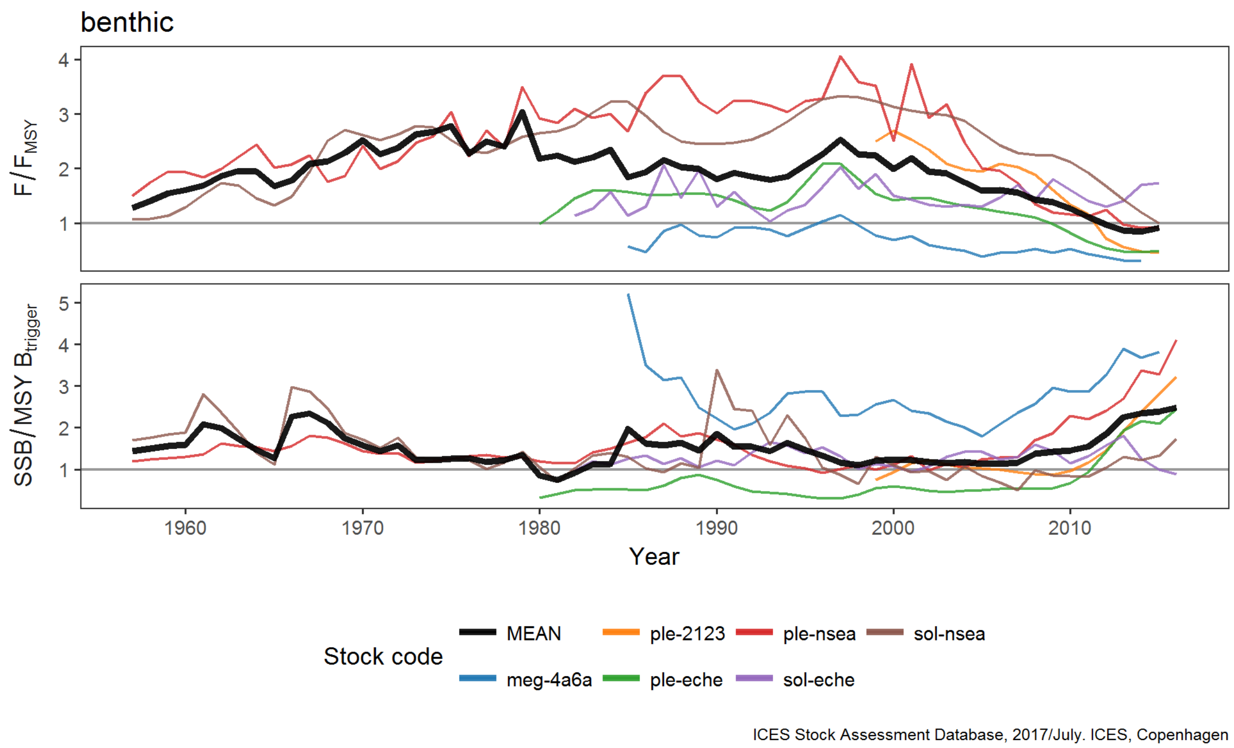
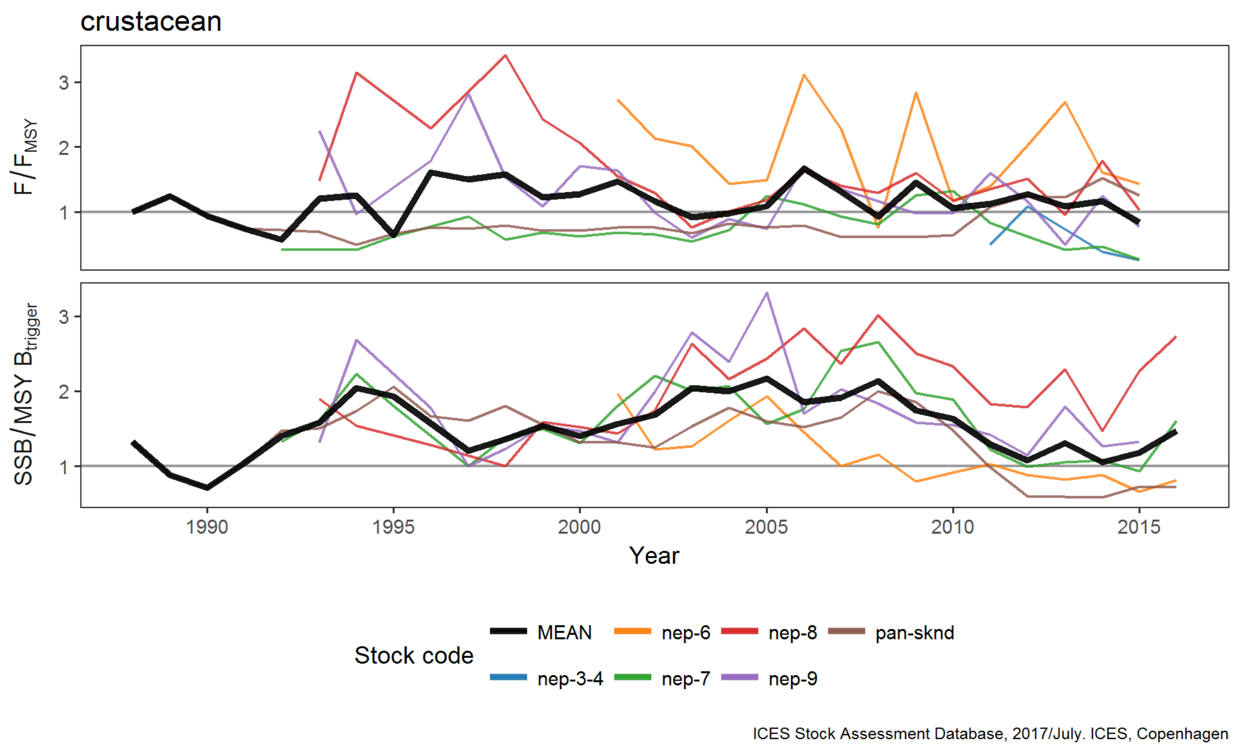


Figure 11 Status summary of Greater North Sea stocks in 2016 relative to the Marine Strategy Framework Directive (MSFD) good environmental status (GES) assessment criteria of fishing pressure (D3C1) and stock reproductive capacity (D3C2). Green represents the proportion of stocks fished below F_{MSY} or where stock size is greater than MSY $B_{trigger}$, for criteria D3C1 and D3C2. Red represents the proportion of stocks fished above F_{MSY} or where stock size is lower than MSY $B_{trigger}$ for criteria D3C1 and D3C2. Grey represents the proportion of stocks lacking MSY reference points. For stock-specific information, see Table A in Annex 1.

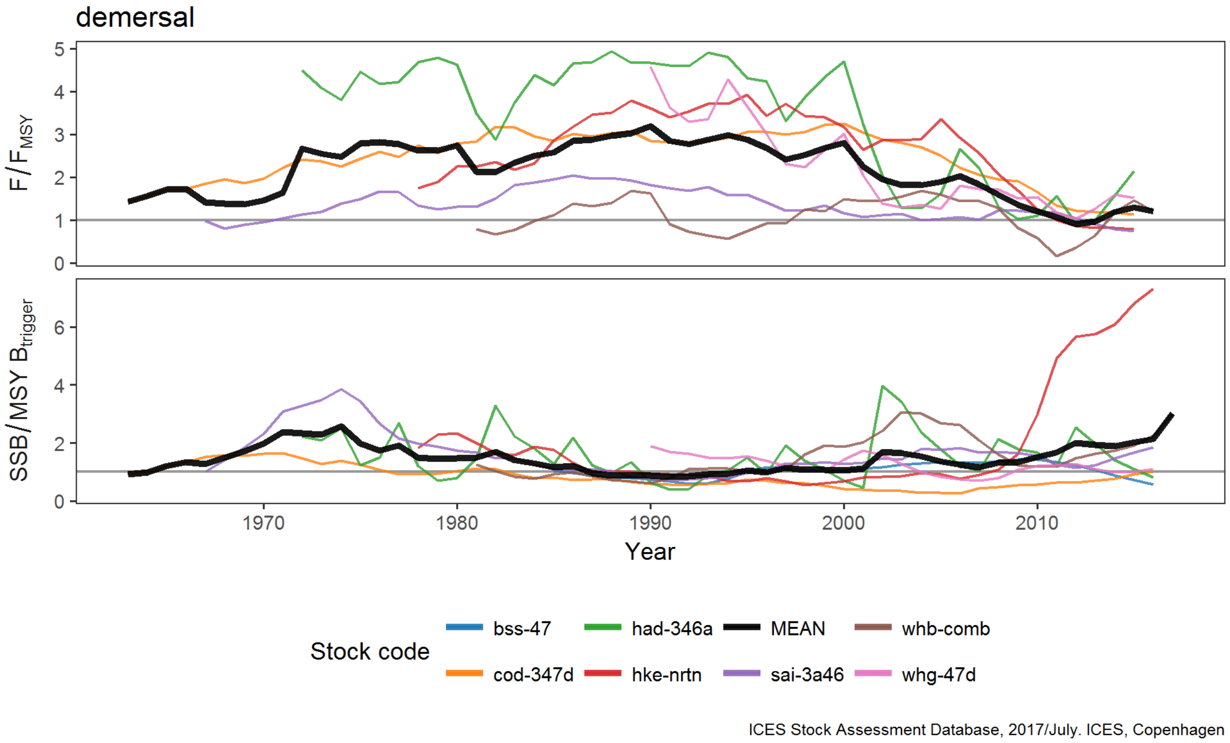
Temporal trends (1960 onwards) in F and spawning-stock biomass (SSB) relative to MSY reference points are shown in Figures 12 and 13 for North Sea benthic, crustacean, demersal, and pelagic stocks. For most benthic and demersal stocks, marked improvements in stock status have occurred since 2000 as F has been reduced. Similar, but less dramatic, changes are also evident for pelagic species. For crustaceans, annual changes in stock status have been more variable and there is a less obvious trend in F reductions. Many of the stocks in the benthic, demersal, and pelagic categories that exhibit the highest landings also exhibit good stock status (Figure 13).



benthic
F/F_MSY
SSB/MSY B_trigger
Year
Stock code
MEAN
ple-2123
ple-nsea
sol-nsea
meg-4a6a
ple-eche
sol-eche
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen



crustacean
F/F_MSY
SSB/MSY B_trigger
Year
Stock code
MEAN
nep-6
nep-8
pan-sknd
nep-3-4
nep-7
nep-9
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen



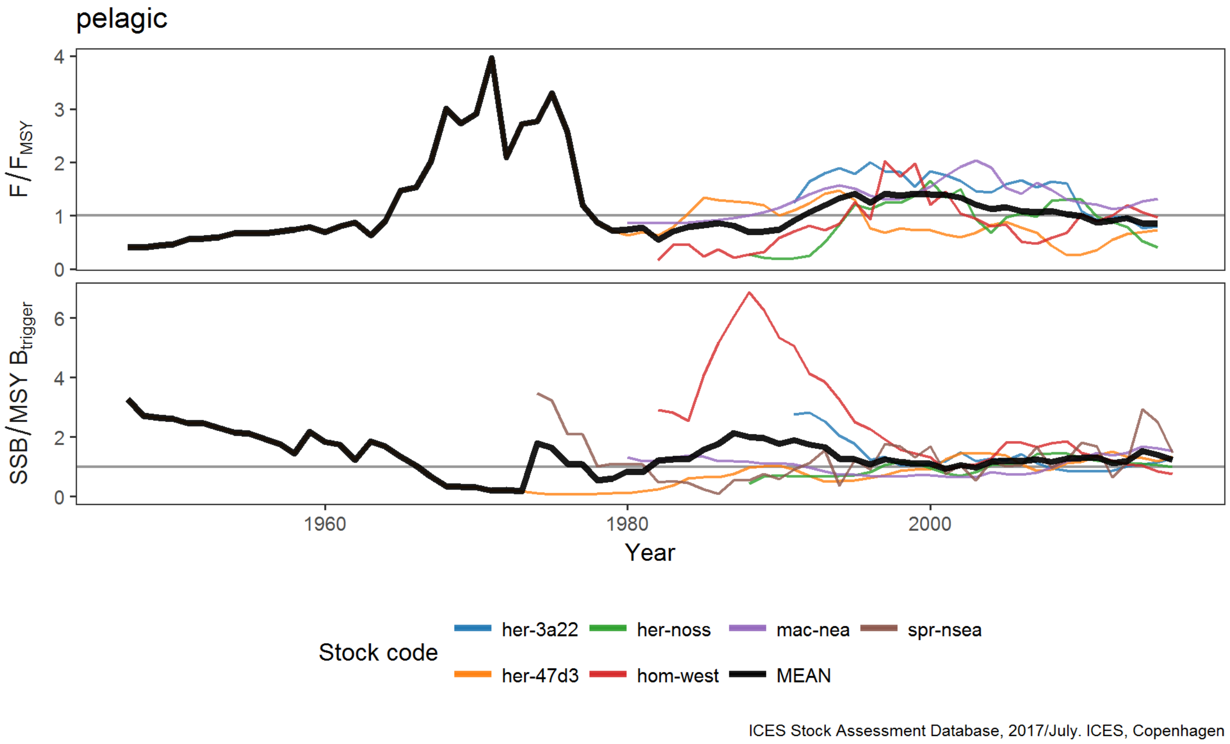
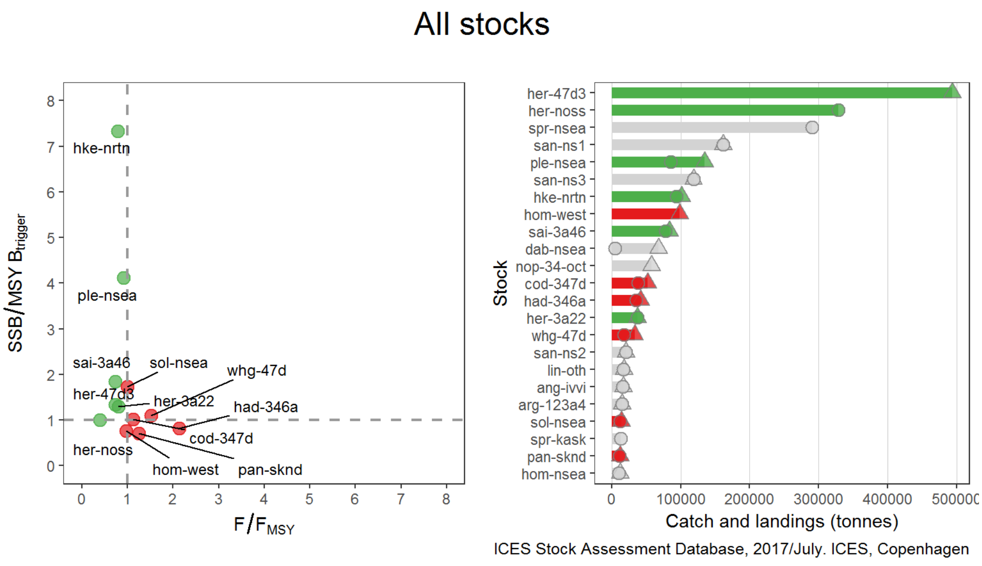
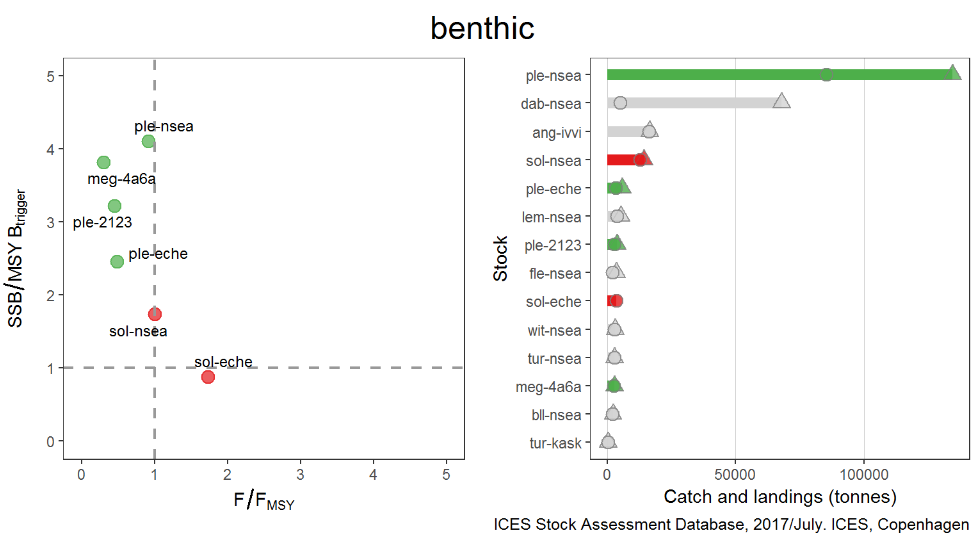
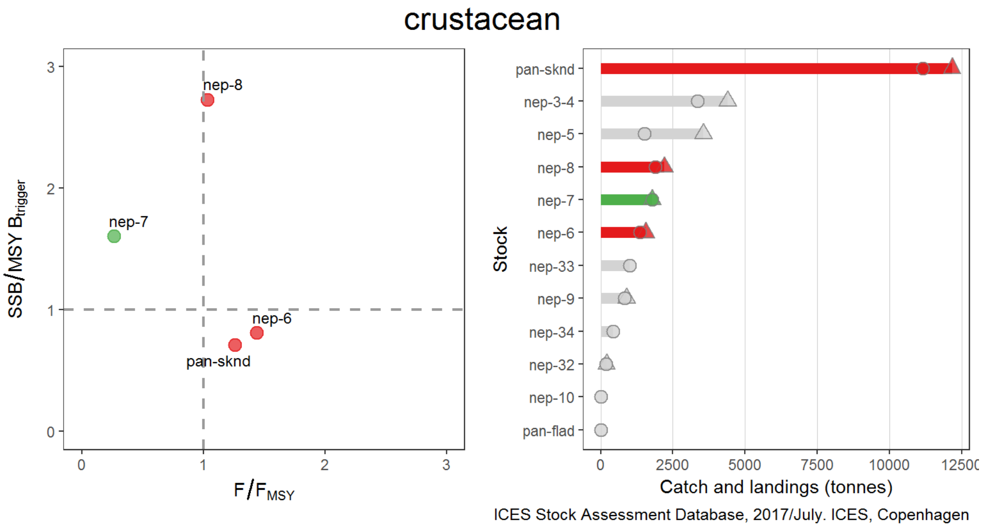
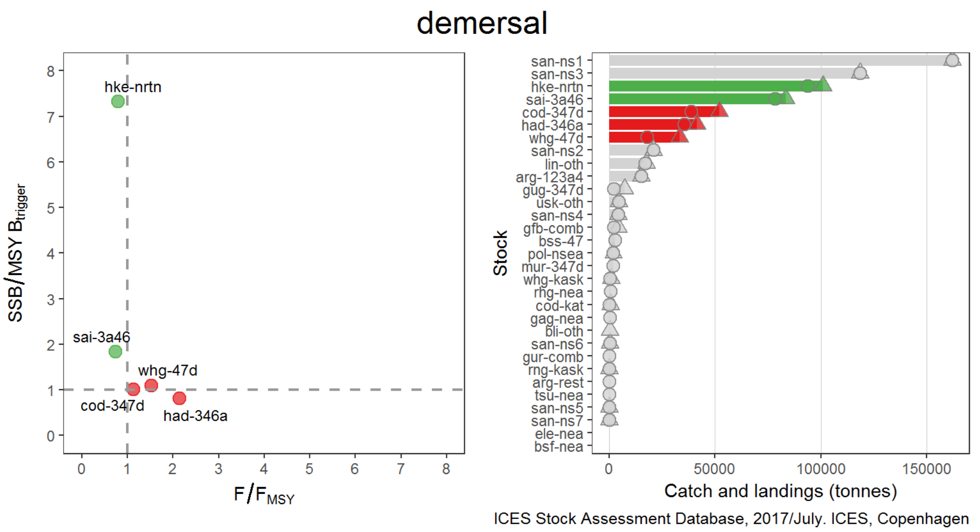


Figure 12 Temporal trends in F/F_{MSY} and SSB/MSY $B_{trigger}$ for North Sea benthic, crustacean, demersal, and pelagic stocks. Only stocks with defined MSY reference points are considered. For full stock names, see Table A in Annex 1.


All stocks
SSB/MSY Btrigger
F/FMSY
hke-nrtn
ple-nsea
sai-3a46
sol-nsea
whg-47d
her-47d3
her-3a22
had-346a
cod-347d
her-noss
hom-west
pan-sknd
Stock
her-47d3
her-noss
spr-nsea
san-ns1
ple-nsea
san-ns3
hke-nrtn
hom-west
sai-3a46
dab-nsea
nop-34-oct
cod-347d
had-346a
her-3a22
whg-47d
san-ns2
lin-oth
ang-ivvi
arg-123a4
sol-nsea
spr-kask
pan-sknd
hom-nsea
Catch and landings (tonnes)
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen


benthic
SSB/MSY Btrigger
F/FMSY
ple-nsea
meg-4a6a
ple-2123
ple-eche
sol-nsea
sol-eche
Stock
ple-nsea
dab-nsea
ang-ivvi
sol-nsea
ple-eche
lem-nsea
ple-2123
fle-nsea
sol-eche
wit-nsea
tur-nsea
meg-4a6a
bll-nsea
tur-kask
Catch and landings (tonnes)
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen


crustacean
SSB/MSY $B_{trigger}$
F/F_{MSY}
nep-8
nep-7
nep-6
pan-sknd
Stock
pan-sknd
nep-3-4
nep-5
nep-8
nep-7
nep-6
nep-33
nep-9
nep-34
nep-32
nep-10
pan-flad
Catch and landings (tonnes)
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen


demersal
SSB/MSY $B_{trigger}$
F/F_{MSY}
hke-nrtn
sai-3a46
whg-47d
cod-347d
had-346a
Stock
san-ns1
san-ns3
hke-nrtn
sai-3a46
cod-347d
had-346a
whg-47d
san-ns2
lin-oth
arg-123a4
gug-347d
usk-oth
san-ns4
gfb-comb
bss-47
pol-nsea
mur-347d
whg-kask
rng-nea
cod-kat
gag-nea
bli-oth
san-ns6
gur-comb
rng-kask
arg-rest
tsu-nea
san-ns5
san-ns7
ele-nea
bsf-nea
Catch and landings (tonnes)
ICES Stock Assessment Database, 2017/July. ICES, Copenhagen

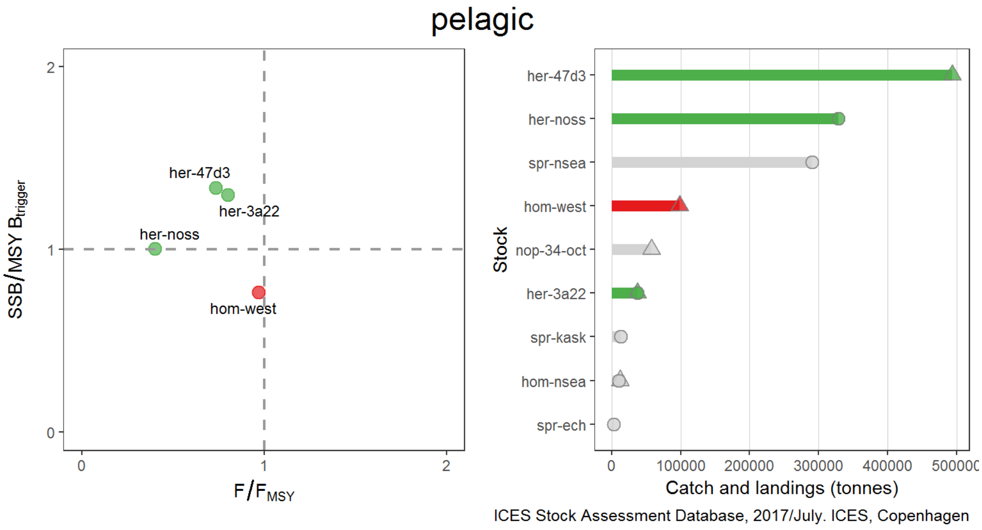


Figure 13 Status of North Sea stocks relative to the joint distribution of exploitation (F/F_{MSY}) and stock size (SSB/ MSY $B_{trigger}$) [left panels, by individual stocks] and catches (triangles) / landings (circles) from these stocks in 2015 [right panels]. The left panels only include stocks for which MSY reference points have been defined (MSY where available). Stocks in green are exploited at or below F_{MSY} while the stock size is also at or above MSY $B_{trigger}$. Stocks in red are either exploited above F_{MSY} or the stock size is below MSY $B_{trigger}$, or both. Stocks in grey have unknown/undefined status in relation to reference points. For full stock names, see Table A in Annex 1. Note: for clarity, only stocks with catches greater than 10 000 tonnes are shown in the "all stocks" panel.

Several of the stocks such as North Sea sprat, sandeels, and Norway pout are stocks of short-lived species that experience high natural mortality. The ICES MSY approach for these stocks is aimed at achieving a high probability of having a minimum biomass left to spawn the following year so that the stock is capable of producing MSY. For catch advice, ICES uses a different approach than for longer-lived species and defines a biomass reference point, MSY $B_{escapement}$, which is the biomass that should remain after the fishery has taken place. For some short-lived stocks, an F reference point, F_{cap}, is also used to limit exploitation when biomass is high as large biomasses are often estimated with greater uncertainty.

For some short-lived species, assessments are so sensitive to incoming recruitment that the amount of biomass in excess of the target escapement cannot be reliably estimated until data are available on the incoming year class. In such cases, the ICES catch advice is often provided just prior to, or at the beginning of the fishing season.

A consequence of this approach is that the reference points for short-lived stocks cannot be readily compared and dealt with in the same way as those for longer-lived stocks. In Figure 13, this is reflected in the short-lived species being assigned a 'grey' colouration. However, this does not mean that little is known about these stocks, that they are not being managed effectively, or that they are incapable of producing MSY.

Mixed fisheries

Many fishing gears catch more than one species, so 'technical interactions' between stocks occur when multiple stocks are captured in the same gear during fishing operations. Because these interactions may vary in time and space (e.g. interactions can differ between day and night, occur at different times of the year, and among different areas), it would be ideal if these could be identified at very small temporal and spatial scales. However, as most fisheries data are aggregated based on species, gear, mesh size range, ICES square, and calendar quarter, subtle interactions may be missed.

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 statistical rectangle and 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 14). In this figure, rows represent the share of each species A that was caught in fisheries where species B accounted for at least 5% of the total landing of the fisheries. For example, 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 columns illustrate the degree of mixing and can be used to identify the main fisheries (target fisheries) and the degree of mixing in these fisheries. 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*. This shows that the plaice fishery is a central fishery in the North Sea with a high degree of mixing. 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 this fisheries were also low. This confirms that there is no or very limited target lemon sole fishery.

Technical interactions in North Sea pelagic fisheries are relatively low. For example, in the Danish small-mesh fishery targeting sprat, herring bycatch has varied between 4% and 16% during the last ten years (2007–2016).

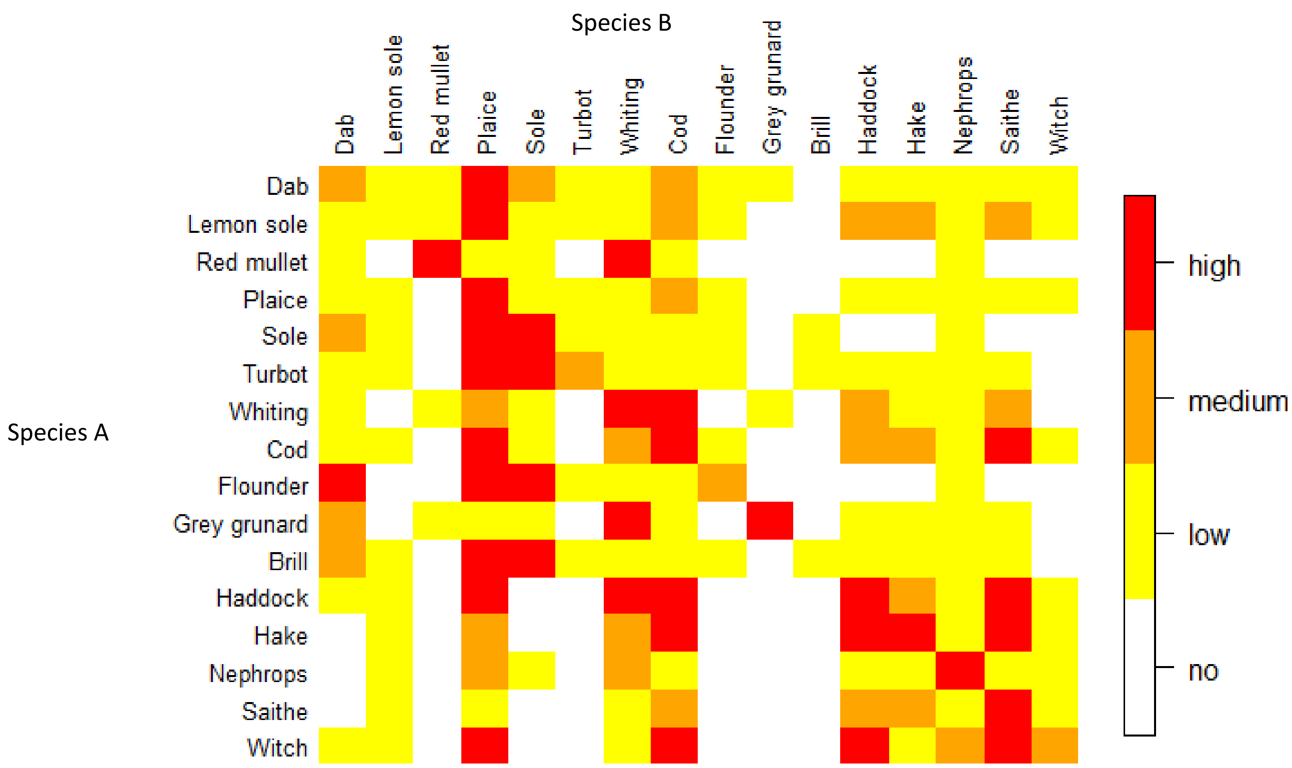


Figure 14 Technical interactions amongst Greater North Sea demersal stocks. The rows of the figure illustrate the fisheries where the species A was caught. Red cells indicate the species B with which species A are frequently caught. Orange cells indicate medium interactions and yellow cells indicate weak interactions. The column shows the degree of mixing in fisheries where species B account for at least 5% of the total landings. For A more detailed explained of the figure is provided in the text.

Mixed-fisheries advice

Due to technical interactions, single-species stock advice cannot fully describe the consequences of mixed-species fisheries. ICES, however, has developed a method to take these interactions into account when assessing the impact of single-stock advice. These mixed-fisheries considerations are based on the single-stock assessments, combined with knowledge of the consequences of technical interactions on species composition in catches in the North Sea fisheries.

ICES has also developed a series of possible scenarios of the consequences of a set of fishing opportunities that consider these interactions (Table 1). Each of these scenarios provides different likely outcomes on the fish stocks. Managers may consider taking these into account in deciding upon fishing opportunities.

Table 1 Scenarios currently developed to assess the impact of interactions in North Sea mixed fisheries (from ICES 2017a).

	Scenarios
Max	**"Maximum":** For each fleet, fishing effort in 2018 stops when all stock shares* of that fleet have been caught up. This option causes overfishing of the single-stock advice possibilities of most stocks.
Min	**"Minimum":** For each fleet, fishing effort in 2018 stops when the most limiting of the stock shares of that fleet has been caught up. This option is the most precautionary option, causing underutilization of the single-stock advice possibilities of other stocks. This scenario can highlight some potential "choke species" issues.
Sq_E	**"*Status quo* effort":** The effort of each fleet in 2017 and 2018 is set equal to the effort in the most recently recorded year for which landings and discard data are available (2016).
Val	**"Value":** A simple scenario accounting for the economic importance of each stock for each fleet. The effort by fleet is equal to the average of the efforts required to catch the fleet's stock shares of each of the stocks, weighted by the historical catch value of that stock (see example further below). This option causes overfishing of some stocks and underutilization of others.
HAD	**"Haddock MSY approach":** All fleets set their effort in 2017 and 2018 corresponding to their haddock stock share, regardless of other catches. (There are differences in the haddock catches between this scenario and the single-stock advice because of the slightly different forecast methods used.)
POK**	**"Saithe MSY approach":** All fleets set their effort in 2017 and 2018 corresponding to their saithe stock share, regardless of other catches (There are differences in the saithe catches between this scenario and the single-stock advice because of the slightly different forecast methods used.)

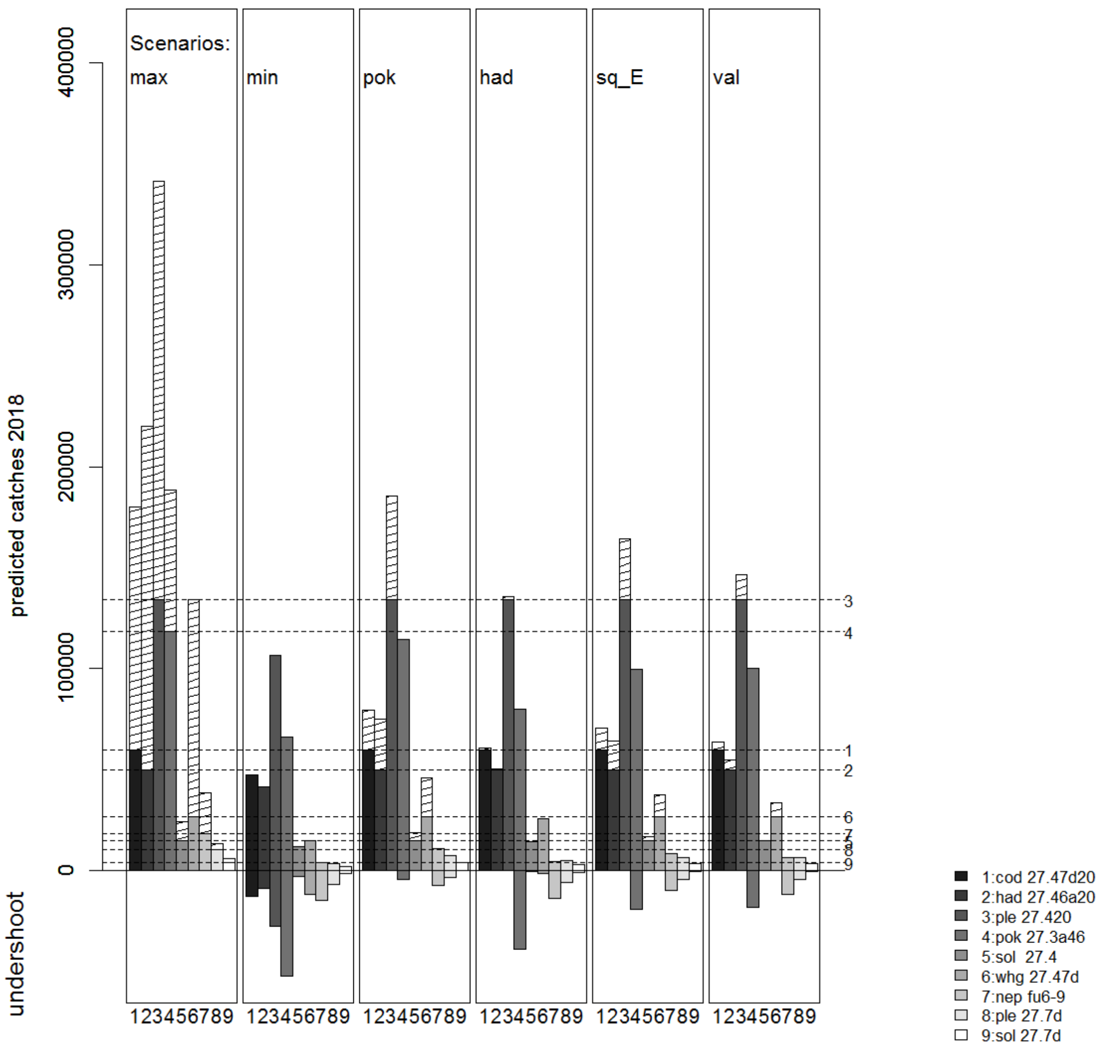


Figure 15 North Sea mixed-fisheries projections (from ICES 2017a). Estimates of potential catches (in tonnes) by stock and by scenario. Horizontal lines correspond to the single-stock catch advice for 2018. Bars below the value of zero show undershoot (compared to single-stock advice) where catches are predicted to be lower when applying the scenario. Hatched columns represent catches that overshoot the single-stock advice.

Multispecies considerations

Fish species are part of the marine foodweb and interact in various ways, including through predation and competition. Natural mortality is becoming more significant in the North Sea because fishing mortality has been markedly reduced on many stocks. Hence, natural processes are now having a relatively greater effect on the dynamics of these stocks. Predation mortality can occur from other fish, seabirds, and marine mammals. The abundance of larger fish and some mammal species has been increasing in the North Sea, while seabird populations have broadly decreased. Consumption of fish by these predators has been modelled and for several North Sea stocks (cod, haddock, whiting, sprat, sandeel, and herring), predation mortality is now directly included in the assessments of these stocks. This ensures that temporal changes in natural mortality are explicitly accounted for in these assessments, as well as in the setting of stock-specific reference points.

The modelling results indicate that the yields of many North Sea stocks are strongly affected by the abundance of cod, saithe, and mackerel, which are the main predator fish species. Changes in fishing mortality on these species therefore influences the abundance and yield of other fish stocks. Indirect predation effects are also important. For example, reduced fisheries exploitation on cod increases cod biomass, which not only leads to reductions in SSB and yields of whiting and haddock (direct predation effect) but also to increases in SSB and yield of herring, sandeel, Norway pout, and sprat. The SSB increases for these prey species are due to the reduction in predation pressure from whiting and haddock, which more than compensates for the increase in direct predation from a larger cod stock (indirect effect).

According to model simulations, it is not possible for all stocks to be simultaneously maintained above precautionary single-species biomass reference points. Whiting is the most extreme example of this. Small whiting are subjected to high predation by grey gurnard, and a strong recovery of the cod stock (another significant predator of whiting) increases the probability that the whiting stock will decline below its precautionary biomass reference point.

Any potential target multispecies F_{MSY} depends on management objectives and SSB constraints. No single maximum sustainable yield solution exists in a multispecies context, and policy choices (i.e. trade-offs) have to be made. However, model simulations show that fishing mortalities leading to close-to-maximum average yield (e.g. at least 95% of MSY) and which have a low probability of causing stocks to decline below B_{lim} can be estimated in a multispecies context. The simulations show that in the long term, cod and saithe could be fished at slightly higher Fs to limit predation pressure on their prey, thereby maintaining high SSB and yields of these prey species. In the case of cod, this would also avoid too much loss in cod yield due to cannibalism. The target F_{MSY} depends on managers defining agreed constraints and acceptable risk levels. ICES multispecies simulations of identified scenarios can be used to evaluate the possible consequences of different policy decisions.

Effects of fisheries on the ecosystem

Two different effects of fisheries on the ecosystem are described in this section: (1) Physical disturbance of benthic habitats by bottom trawl fishing gear; and (2) fisheries bycatch of protected, endangered, and threatened species.

The extent, magnitude, and impact of mobile bottom-contacting fishing gear on the seabed and benthic habitats varies geographically across the North Sea (Figure 16). These maps are calculated in terms of a swept area ratio. Swept area is calculated as hours fished × average fishing speed × gear width. Values for each of these factors were derived from VMS data and other sources. The swept area ratio is calculated for all 0.05 × 0.05 degree grid cells in the North Sea and is the sum of the swept area divided by the area of each grid cell. The resultant values indicate the theoretical number of times the entire grid cell area would have been swept if effort was evenly distributed within each cell. The swept area ratio is separately calculated for surface and subsurface contact. Different gear types interact with the seabed in different ways and thus exert different levels of physical disturbance, in terms of the substrate areas affected and the penetration depth. Surface abrasion is defined as the damage to seabed surface features; subsurface abrasion as the penetration and/or disturbance of the substrate beneath the seabed surface. For further information on these effects, see the Greater North Sea ecosystem overview (ICES, 2016).

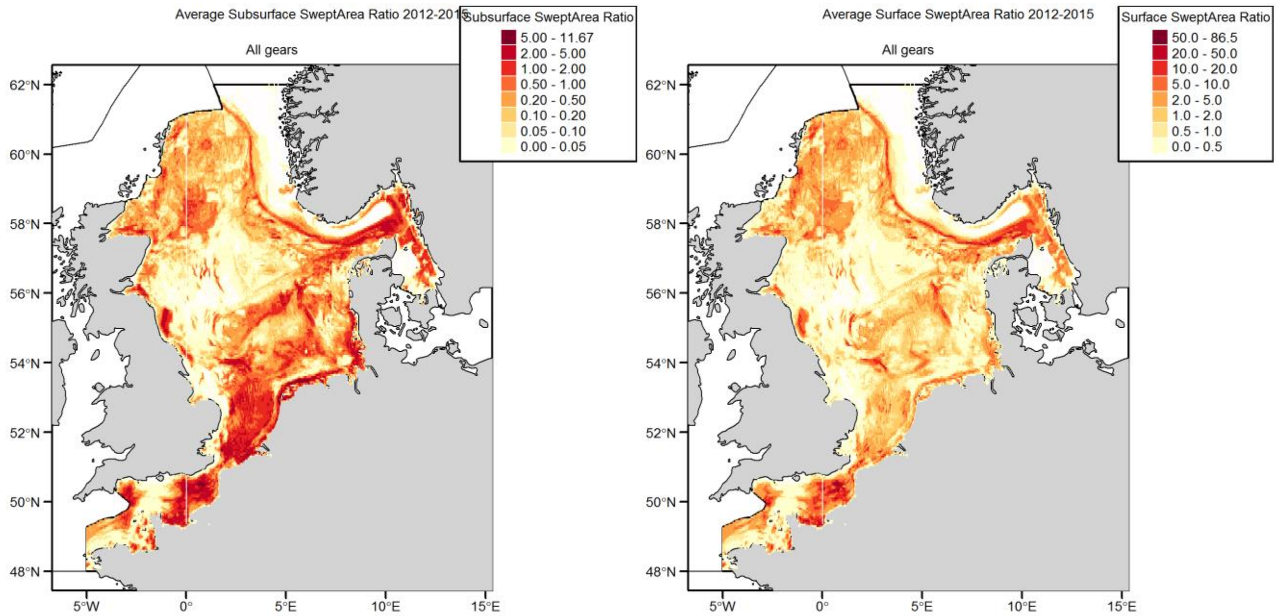


Figure 16 Average annual subsurface (left) and surface (right) disturbance by mobile bottom contacting fishing gear (otter trawls, beam trawls, dredges, and demersal seines) in the Greater North Sea during 2012–2015, expressed as average swept area ratios (SAR).

Some fisheries have the potential to take protected, endangered, or threatened species (i.e., seabirds and marine mammals) as non-targeted bycatch. Recording of the catch of these species has been undertaken in a few North Sea fisheries, where there is perceived particular risk of such bycatch. A recent EU-funded project (fishPi project, 2016) analysed risk from various gears to seabirds and marine mammals and determined that observations were most needed in fisheries using set gillnets, trammelnets, driftnets, and bottom trawls.

Based on patchy observer information with an unknown amount of bias, ICES has advised that bycatch of common dolphins in the western English Channel (the far southwestern part of the Greater North Sea) may be unsustainable in population terms, while the bycatch of harbour porpoise in the Greater North Sea is below assumed unsustainable levels. No recent assessment has been made of bird bycatch in the Greater North Sea; there was some evidence of large bycatches of seabirds in coastal gillnets in the past, but the fisheries with high bycatch have either been closed or have subsequently managed to reduce their bycatch risk.

Eight species of elasmobranchs that occur in the Greater North Sea are listed on OSPAR's list of threatened and declining species. Some of these are rare (e.g. basking shark, angel shark) and seldom caught in fisheries. Other species (e.g. spotted ray, thornback ray) are harvested in some targeted fisheries. Most often, elasmobranchs are taken as incidental bycatch and then discarded (Figure 7), particularly when there is a zero TAC for a species.

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Annex

Supporting data used in the Greater North Sea Fisheries overview is archived at ICES 2017b.

The following annex table is a status summary of the Greater North Sea stocks in 2016.

Table A Status summary of Greater North Sea stocks in 2016 relative to maximum sustainable yield (MSY) and the ICES precautionary approach (PA). Grey represents unknown reference points. For MSY: green represents a stock that is fished below F_{MSY} or the stock size is above MSY $B_{trigger}$; red represents a stock that is fished above F_{MSY} or the stock size is lower than MSY $B_{trigger}$. For PA: green represents a stock that is fished below F_{pa} or the stock size is above B_{pa}; yellow represents a stock that is fished between F_{pa} and F_{lim} or the stock size is between B_{lim} and B_{pa}; red represents a stock that is fished above F_{lim} or the stock size is below B_{lim}. Stocks having a fishing mortality rate at or below F_{pa} and a stock size above B_{pa} are defined as being inside safe biological limits. Grey represents stocks for which reference points are unknown.

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
agn-nea	Angel shark (*Squatina squatina*) in the Northeast Atlantic	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
ang-ivvi	Anglerfish (*Lophius piscatorius* and *Lophius budegassa*) in subareas 4 and 6, and in Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
arg-123a4	Greater silver smelt (*Argentina silus*) in subareas 1, 2, and 4, and in Division 3.a (Northeast Arctic, North Sea, Skagerrak and Kattegat)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
arg-rest	Greater silver smelt (*Argentina silus*) in subareas 7–10 and 12, and in Division 6.b (other areas)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
bli-oth	Blue ling (*Molva dypterygia*) in subareas 1, 2, 8, 9, and 12, and in divisions 3.a and 4.a (other areas)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
bll-nsea	Brill (*Scophthalmus rhombus*) in Subarea 4 and in divisions 3.a and 7.d–e (North Sea, Skagerrak and Kattegat, English Channel)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
bsf-nea	Black scabbardfish (*Aphanopus carbo*) in subareas 1, 2, 4, 6–8, 10, and 14, and in divisions 3.a, 5.a–b, 9.a, and 12.b (Northeast Atlantic)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
bsk-nea	Basking shark (*Cetorhinus maximus*) in the Northeast Atlantic	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
bss-47	Seabass (*Dicentrarchus labrax*) in divisions 4.b–c, 6.a, and 7.d–h (central and southern North Sea, Irish Sea, English Channel, Bristol Channel, Celtic Sea)	demersal	PA	1	✗	?	?	?	?	o	o	✗	?	?	✗	✗
cod-347d	Cod (*Gadus morhua*) in Subarea 4 and in divisions 7.d and 3.a West (North Sea, eastern English Channel, Skagerrak)	demersal	MSY	1	✓	✗	✗	✗	?	✗	✗	✓	?	✗	✓	✗
cod-kat	Cod (*Gadus morhua*) in Division 3.a East (Kattegat)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
dab-nsea	Dab (*Limanda limanda*) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
dgs-nea	Spurdog (*Squalus acanthias*) in the Northeast Atlantic	elasmobranch	MSY	1	?	✓	✓	✓	?	✗	✗	✗	?	✓	✗	✗
ele-nea	European eel (*Anguilla anguilla*) throughout its natural range	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
fle-nsea	Flounder (*Platichthys flesus*) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
gag-nea	Tope (*Galeorhinus galeus*) in the Northeast Atlantic	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
gfb-comb	Greater forkbeard (*Phycis blennoides*) in the Northeast Atlantic	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
gug-347d	Grey gurnard (*Eutrigla gurnardus*) in Subarea 4 and in divisions 7.d and 3.a (North Sea, eastern English Channel, Skagerrak and Kattegat)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
gur-comb	Red gurnard (*Chelidonichthys cuculus*) in subareas 3, 4, 5, 6, 7, and 8 (Northeast Atlantic)	demersal	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
had-346a	Haddock (*Melanogrammus aeglefinus*) in Subarea 4 and in divisions 6.a and 3.a West (North Sea, West of Scotland, Skagerrak)	demersal	MSY	1	✗	✓	✗	✗	?	✓	✓	✗	?	✗	✗	✗
her-3a22	Herring (*Clupea harengus*) in subdivisions 20–24 (spring spawners) (Skagerrak, Kattegat, and western Baltic)	pelagic	MSY	1	✓	✓	✓	✓	?	✓	✓	✓	?	✓	✓	✓
her-47d3	Herring (*Clupea harengus*) in Subarea 4 and in divisions 3.a and 7.d (autumn spawners) (North Sea, Skagerrak and Kattegat, eastern English Channel)	pelagic	MSY	1	✓	✓	✓	✓	?	✓	✓	?	?	✓	?	?
her-noss	Herring (*Clupea harengus*) in subareas 1, 2, and 5, and in divisions 4.a and 14.a (Northeast Atlantic) (Norwegian spring-spawning herring)	pelagic	MSY	1	✓	✓	✓	✓	?	✓	✓	✓	?	✓	✓	✓
hke-nrtn	Hake (*Merluccius merluccius*) in subareas 4, 6, and 7, and in divisions 3.a and 8.a–b,d (Northern stock) (Greater North Sea, Celtic Seas, northern Bay of Biscay)	demersal	MSY	1	✓	✓	✓	✓	?	✓	✓	✓	?	✓	✓	✓
hom-nsea	Horse mackerel (*Trachurus trachurus*) in divisions 3.a, 4.b–c, and 7.d (Skagerrak and Kattegat, southern and central North Sea, eastern English Channel)	pelagic	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
hom-west	Horse mackerel (*Trachurus trachurus*) in Subarea 8 and in divisions 2.a, 4.a, 5.b, 6.a, and 7.a–c,e–k (Northeast Atlantic)	pelagic	MSY	1	?	✗	✗	✓	?	✓	✗	✗	?	✓	✗	✗
lem-nsea	Lemon sole (*Microstomus kitt*) in Subarea 4 and in divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
lin-oth	Ling (*Molva molva*) in subareas 6–9, 12, and 14, and in divisions 3.a and 4.a (other areas)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
mac-nea	Mackerel (*Scomber scombrus*) in subareas 1–7 and 14, and in divisions 8.a–e and 9.a (Northeast Atlantic)	pelagic	MSY	1	?	?	?	?	?	?	?	?	?	?	?	?

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
meg-4a6a	Megrim (*Lepidorhombus* spp.) in divisions 4.a and 6.a (northern North Sea, West of Scotland)	benthic	MSY	1	✓	✓	✓	?	?	✓	✓	?	?	✓	✓	✓
mur-347d	Striped red mullet (*Mullus surmuletus*) in Subarea 4 and in divisions 7.d and 3.a (North Sea, eastern English Channel, Skagerrak and Kattegat)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
mur-west	Striped red mullet (*Mullus surmuletus*) in subareas 6 and 8, and in divisions 7.a–c,e–k and 9.a (North Sea, Bay of Biscay, southern Celtic Seas, Atlantic Iberian Waters)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
nep-10	Norway lobster (*Nephrops norvegicus*) in Division 4.a, FU 10 (northern North Sea, Noup)	crustacean	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
nep-3-4	Norway lobster (*Nephrops norvegicus*) in Division 3.a (Skagerrak and Kattegat)	crustacean	MSY	1	?	✓	✓	✓	?	?	?	?	?	✓	?	?
nep-32	Norway lobster (*Nephrops norvegicus*) in Division 4.a, FU 32 (northern North Sea, Norway Deep)	crustacean	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
nep-33	Norway lobster (*Nephrops norvegicus*) in Division 4.b, FU 33 (central North Sea, Horn's Reef)	crustacean	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
nep-34	Norway lobster (*Nephrops norvegicus*) in Division 4.b, FU 34 (central North Sea, Devil's Hole)	crustacean	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
nep-5	Norway lobster (*Nephrops norvegicus*) in divisions 4.b–c, FU 5 (central and southern North Sea, Botney Gut–Silver Pit)	crustacean	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
nep-6	Norway lobster (*Nephrops norvegicus*) in Division 4.b, FU 6 (central North Sea, Farn Deeps)	crustacean	MSY	1	?	✗	✗	✗	?	✗	✗	✗	?	✗	✗	✗
nep-7	Norway lobster (*Nephrops norvegicus*) in Division 4.a, FU 7 (northern North Sea, Fladen Ground)	crustacean	MSY	1	?	✓	✓	✓	?	✓	✗	✓	?	✓	✓	✓
nep-8	Norway lobster (*Nephrops norvegicus*) in Division 4.b, FU 8 (central North Sea, Firth of Forth)	crustacean	MSY	1	?	✓	✗	✗	?	✓	✓	✓	?	✗	✓	✗
nep-9	Norway lobster (*Nephrops norvegicus*) in Division 4.b, FU 9 (central North Sea, Moray Firth)	crustacean	MSY	1	?	✓	✗	✓	?	✓	✓	?	?	✓	?	?
nep-oth-4	Norway lobster (*Nephrops norvegicus*) in Division 4, outside the Functional Units (North Sea)	crustacean	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
nop-34-oct	Norway pout (*Trisopterus esmarkii*) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	pelagic	MSY	1	?	?	?	?	?	?	?	?	?	?	?	?
pan-flad	Northern shrimp (*Pandalus borealis*) in Division 4.a (northern North Sea, Fladen Ground)	crustacean	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
pan-sknd	Northern shrimp (*Pandalus borealis*) in divisions 3.a and 4.a East (Skagerrak, northern North Sea in the Norwegian Deep)	crustacean	MSY	1	?	✗	✗	?	?	✗	✓	?	?	?	?	?

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
ple-2123	Plaice (*Pleuronectes platessa*) in subdivisions 21–23 (Kattegat, Belt Sea, Sound)	benthic	MSY	1	✔	✔	✔	✔	?	✔	✔	✔	?	✔	✔	✔
ple-eche	Plaice (*Pleuronectes platessa*) in Division 7.d (eastern English Channel)	benthic	MSY	1	✔	✔	✔	✔	?	✔	✔	✔	?	✔	✔	✔
ple-nsea	Plaice (*Pleuronectes platessa*) in Subarea 4 (North Sea) and Division 3.a (Skagerrak)	benthic	MSY	1	✔	✔	✔	✔	?	✔	✔	✔	?	✔	✔	✔
pol-celt	Pollack (*Pollachius pollachius*) in subareas 6–7 (Celtic Seas and the English Channel)	demersal	PA	4	?	?	?	?	?	?	?	?	?	?	?	?
pol-nsea	Pollack (*Pollachius pollachius*) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
por-nea	Porbeagle (*Lamna nasus*) in the Northeast Atlantic	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
raj-347d	Other skates and rays in Subarea 4, and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
rhg-nea	Roughhead grenadier (*Macrourus berglax*) in the Northeast Atlantic	demersal	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
rja-nea	White skate (*Rostroraja alba*) in the Northeast Atlantic	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
rjb-34	Common skate (*Dipturus batis*-complex) in Subarea 4 and Division 3.a (North Sea, Skagerrak and Kattegat)	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
rjc-347d	Thornback ray (*Raja clavata*) in Subarea 4 and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
rje-ech	Small-eyed ray (*Raja microocellata*) in divisions 7.d–e (English Channel)	elasmobranch	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
rjf-celt	Shagreen ray (*Leucoraja fullonica*) in subareas 6–7 (West of Scotland, southern Celtic Seas, English Channel)	elasmobranch	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
rjh-4avi	Blonde ray (*Raja brachyura*) in subarea 6 and Division 4.a (North Sea and West of Scotland)	elasmobranch	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
rjh-4c7d	Blonde ray (*Raja brachyura*) in divisions 4.c and 7.d (southern North Sea and eastern English Channel)	elasmobranch	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
rji-celt	Sandy ray (*Leucoraja circularis*) in subareas 6–7 (West of Scotland, southern Celtic Seas, English Channel)	elasmobranch	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
rjm-347d	Spotted ray (*Raja montagui*) in Subarea 4, and in divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and eastern English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
rjn-34	Cuckoo ray (*Leucoraja naevus*) in Subarea 4 and divisions 3.a (North Sea, Skagerrak and Kattegat)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
rjn-678abd	Cuckoo ray (*Leucoraja naevus*) in subareas 6–7 (West of Scotland, southern Celtic Seas, and western English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
rjr-234	Starry ray (*Amblyraja radiata*) in subareas 2 and 4, and in Division 3.a (Norwegian Sea, North Sea, Skagerrak and Kattegat)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
rju-ech	Undulate ray (*Raja undulata*) in divisions 7.d–e (English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
rng-kask	Roundnose grenadier (*Coryphaenoides rupestris*) in Division 3.a (Skagerrak and Kattegat)	demersal	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
sai-3a46	Saithe (*Pollachius virens*) in Subarea 4 and 5, and in Division 3.a (North Sea, Rockall and West of Scotland, Skagerrak and Kattegat)	demersal	MSY	1	✓	✓	✓	✓	?	✓	✓	✓	?	✓	✓	✓
san-ns1	Sandeel (*Ammodytes* spp.) in divisions 4.b–c, SA 1 (central and southern North Sea, Dogger Bank)	demersal	MSY	1	?	?	?	?	?	?	?	?	?	?	?	?
san-ns2	Sandeel (*Ammodytes* spp.) in divisions 4.b–c, SA 2 (central and southern North Sea)	demersal	MSY	1	?	?	?	?	?	?	?	?	?	?	?	?
san-ns3	Sandeel (*Ammodytes* spp.) in divisions 3.a and 4.a–b, SA 3 (Skagerrak and Kattegat, northern and central North Sea)	demersal	MSY	1	?	?	?	?	?	?	?	?	?	?	?	?
san-ns4	Sandeel (*Ammodytes* spp.) in divisions 4.a–b, SA 4 (northern and central North Sea)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
san-ns5	Sandeel (*Ammodytes* spp.) in Division 4.a, SA 5 (northern North Sea, Viking and Bergen Banks)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
san-ns6	Sandeel (*Ammodytes* spp.) in Division 3.a East, SA 6 (Kattegat)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
san-ns7	Sandeel (*Ammodytes* spp.) in Division 4.a, SA 7 (northern North Sea, Shetland)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
sck-nea	Kitefin shark (*Dalatias licha*) in the Northeast Atlantic	elasmobranch	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
sho-celt	Black-mouth dogfish (*Galeus melastomus*) in subareas 6 and 7 (West of Scotland, southern Celtic Seas, and English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
sol-eche	Sole (*Solea solea*) in Division 7.d (eastern English Channel)	benthic	MSY	1	✗	✗	✗	✗	?	✓	✓	✗	?	✗	✗	✗
sol-nsea	Sole (*Solea solea*) in Subarea 4 (North Sea)	benthic	MSY	1	✓	✗	✗	✓	?	✓	✓	✓	?	✓	✓	✓
spr-ech	Sprat (*Sprattus sprattus*) in divisions 7.d,e (English Channel)	pelagic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
spr-kask	Sprat (*Sprattus sprattus*) in Division 3.a (Skagerrak and Kattegat)	pelagic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?

Stock code	Stock name	Fish category	Reference point	Data category	SBL	Fishing pressure				Stock size				MSFD descriptor		
					SBL	2013	2014	2015	2016	2014	2015	2016	2017	D3C1	D3C2	GES
spr-nsea	Sprat (*Sprattus sprattus*) in Subarea 4 (North Sea)	pelagic	MSY	1	?	?	?	?	?	✓	✓	✓	?	?	✓	?
syc-347d	Lesser-spotted dogfish (*Scyliorhinus canicula*) in Subarea 4, and in divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
syt-celt	Greater-spotted dogfish (*Scyliorhinus stellaris*) in subareas 6 and 7 (West of Scotland, southern Celtic Sea and the English Channel)	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
trk-nea	Smooth-hound (*Mustelus* spp.) in the Northeast Atlantic	elasmobranch	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
tsu-nea	Roughsnout grenadier (*Trachyrincus scabrus*) in the Northeast Atlantic	demersal	PA	6	?	?	?	?	?	?	?	?	?	?	?	?
tur-kask	Turbot (*Scophthalmus maximus*) in Division 3.a (Skagerrak and Kattegat)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
tur-nsea	Turbot (*Scophthalmus maximus*) in Subarea 4 (North Sea)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
usk-oth	Tusk (*Brosme brosme*) in subareas 4 and 7–9, and in divisions 3.a, 5.b, 6.a, and 12.b (Northeast Atlantic)	demersal	PA	3	?	?	?	?	?	?	?	?	?	?	?	?
whb-comb	Blue whiting (*Micromesistius poutassou*) in subareas 1–9, 12, and 14 (Northeast Atlantic)	demersal	MSY	1	✓	?	✗	✗	✗	?	✓	✓	✓	✗	✓	✗
whg-47d	Whiting (*Merlangius merlangus*) in Subarea 4 and Division 7.d (North Sea and eastern English Channel)	demersal	MSY	1	✓	✗	✗	✗	?	✗	✓	✓	?	✗	✓	✗
whg-kask	Whiting (*Merlangius merlangus*) in Division 3.a (Skagerrak and Kattegat)	demersal	PA	5	?	?	?	?	?	?	?	?	?	?	?	?
wit-nsea	Witch (*Glyptocephalus cynoglossus*) in Subarea 4 and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, eastern English Channel)	benthic	PA	3	?	?	?	?	?	?	?	?	?	?	?	?