11.2 Icelandic Waters ecoregion – fisheries overview

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Key signals

- Fisheries management measures for major stocks (e.g. cod, haddock, saithe, and herring) have resulted in decreased fishing pressure – close to or at F_{MSY} or HR_{MSY} – and increased SSBs for the past two decades.
- There has been an overall reduction in fishing effort since 1991 for all fisheries, except those using handlines where it has increased. The decrease in trawl effort is likely to have reduced pressure on benthic habitats.
- Three pelagic fisheries have seen increased effort and landings due to changes in migration patterns which have been linked to prey availability, oceanographic conditions, and stock abundance: a blue whiting fishery, which started in the late 1990s, the fishery of Atlantic mackerel which commenced in mid-2000, and the Norwegian spring-spawning herring fishery which recommenced at the turn of the century.
- Fishing grounds of several other species (e.g. haddock, anglerfish, ling, lemon sole, and witch) have extended to the northern part of the ecoregion due to species redistribution as a result of increased water temperature.
- Several species, including Atlantic halibut, spotted wolfish, Norway lobster, and northern shrimp, have shown substantial decreases in stock sizes associated with reasons such as high fishing pressure and reduced stock productivity. The directed fisheries for Atlantic halibut and Norway lobster are currently prohibited.
- Most of the demersal species are caught in mixed fisheries. The degree of mixing depends on the main target – for example, most cod are caught in fisheries targeting cod. Several species that are subjected to TACs are mainly taken as bycatch, including spotted wolffish, Atlantic halibut, Norway redfish, and anglerfish. Pelagic fisheries are highly targeted with little bycatch of other species.
- Legislation to recommence hunting of fin and minke whales was passed in 2009. However, catches are not made every year.
- The highest cumulative multiannual bycatch rate of protected, endangered and threatened species was recorded in set gillnets. At species level, the highest seabird bycatch rates were observed for guillemot and common eider, and highest marine mammal bycatch rates for harbour porpoise and harbour seal.
- The summer feeding grounds of capelin have moved out from the Icelandic Waters ecoregion to the Greenland Sea ecoregion. While this does not directly affect the Icelandic capelin fishery which occurs in the winter it may indirectly impact the distribution and growth of predator stocks on which other fisheries depend.

Supporting data used in the Icelandic Waters overview is accessible at https://doi.org/10.17895/ices.advice.21487635

Introduction

The Icelandic Waters ecoregion covers the shelf and the waters surrounding Iceland and is equivalent to the Icelandic Exclusive Economic Zone (EEZ; Figure 1). The region is located at the junction of the Mid-Atlantic Ridge and the Greenland–Scotland Ridge, just south of the Arctic Circle. The ocean and coastal shelves are heavily influenced by oceanic inputs where water masses of different origins mix; further details can be found in the ecosystem overview for Icelandic waters (ICES, 2022a).

The fisheries within the ecoregion catch more than 40 stocks of fish and marine invertebrates. The main demersal species include cod (cod.27.5a), haddock (had.27.5a), saithe (pok.27.5a), golden redfish (reg.27.561214), Greenland halibut (ghl.27.561214), Atlantic wolffish (caa.27.5a), plaice (ple.27.5a), tusk (usk.27.5a14), and ling (lin.27.5a). The main pelagic species are capelin (cap.27.2a514)and summer-spawning herring (her.27.5a), as well as widely distributed species such as Norwegian spring-spawning (NSS) herring (her.27.1-24a514a), blue whiting (whb.27.1-91214), and mackerel (mac.27.nea). Norway lobster, northern shrimp, and sea cucumber are the main invertebrate stocks that are exploited in Icelandic waters.

The fisheries for most stocks in this ecoregion are managed by the Icelandic Government, while fisheries of some shared stocks are subject to international negotiation through the North-East Atlantic Fisheries Commission (NEAFC) or by coastal state agreements (between Iceland, Greenland, the Faroe Islands, and Norway).

All of the Icelandic Waters ecoregion lies within FAO Major Fishing Area 27; the prefix “27” in the ICES statistical area codes is therefore omitted in the following text. This overview covers ICES Division 5.a and parts of divisions 2.a, 5.b, 12.a, 14.a, and 14.b, and provides:

- a short description of each of the national commercial fishing fleets in the ecoregion, including their fishing gears, and spatial and temporal patterns of activity. At present fisheries for diadromous species such as salmon is not included;
- a summary of the status of the fisheries resources and the level of exploitation relative to agreed objectives and reference points;
- a description of mixed-fisheries interactions in the ecosystem, and
- an evaluation of the effects of fishing gear on the ecosystem in terms of the seabed and on the bycatch of protected, endangered, and threatened species.

The scientific names of all species are included in Table A2 in the Annex.

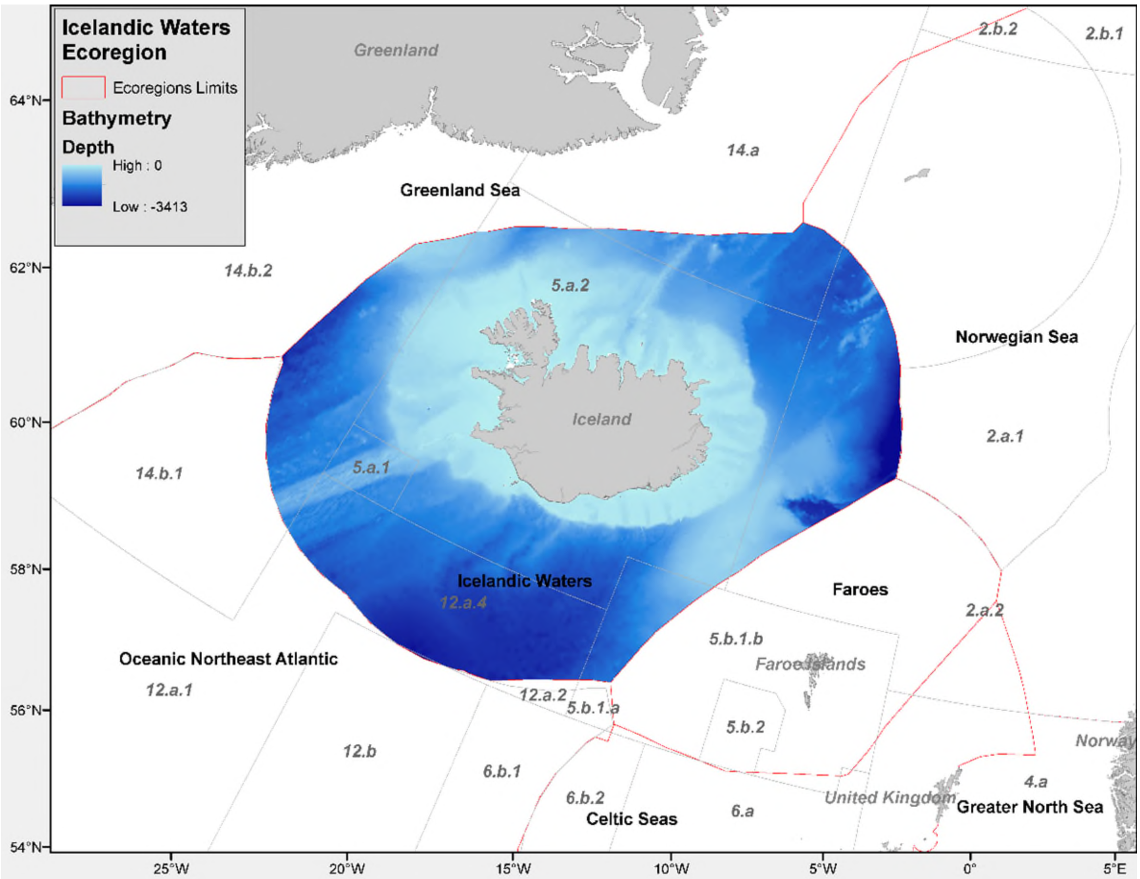


Figure 1 The Icelandic Waters ecoregion limits, ICES areas, adjacent ecoregions, and depth gradient.

Catches over time

Who is fishing

The majority of fishing in the Icelandic Waters ecoregion is performed by vessels from Iceland. Vessels from Norway, Greenland, and the Faroe Islands are also allowed to fish within the 200-nautical mile Icelandic EEZ through coastal state and bilateral agreements. Since its establishment in 1978, the EEZ has excluded foreign vessels not subject to those agreements (Figure 2). Around 1750 vessels operate in Icelandic waters. The following paragraphs highlight features of the fleets and fisheries of the different countries that operate within the Icelandic EEZ.

Iceland

Currently, the Icelandic fleet consists of around 1550 vessels of various sizes and types and has decreased by approximately 430 vessels since 1999 (Figure 3). The official statistics separate the fleet into three main categories: Bottom trawlers, decked vessels, and undecked vessels.

About 40 bottom trawlers (30–90 m in overall length [LOA] and with a volume of between 200 and 2000 gross tonnes [GT]) operate in Icelandic waters; these vessels are almost exclusively engaged in demersal fisheries, mainly fishing for cod, haddock, saithe, redfish, and Greenland halibut. The number of bottom trawlers has decreased by more than half since 1999 (Figure 3).

Decked vessels include several different types and size ranges, from those with 10 GT to over 4500 GT. This is by far the most diverse category, as it ranges from small boats to large vessels and includes specialized demersal seiners, small bottom trawlers, dredgers, longliners, and purse seiners. About 20 pelagic vessels (60–90 m LOA) fish for capelin, herring, mackerel, and blue whiting using pelagic trawls and purse-seines. Roughly 40 demersal seiners (10–45 m LOA) operate in Icelandic waters, fishing for cod, haddock, Atlantic wolffish, plaice, and other flatfish species. The number of intermediatesized vessels (mostly 10–50 m LOA) using static gear – i.e. longline and gillnet, or small otter trawls – fishing for Norway lobster, northern shrimp, cod, and haddock is around 650.

Approximately 820 undecked vessels, fishing mainly for cod and lumpfish, participated in the fishery 2018–2021; this number has decreased by more than 300 since 1999. Undecked vessels cover numerous vessels < 10 m in LOA and up to 10 GT in volume, although most in this category are less than 6 GT (Figure 3). Many of these small vessels are technologically advanced and driven by powerful engines. These vessels mainly operate in inshore areas or close to shore.

Two large vessels (50 m LOA) participate in the fin whale hunt, whereas three–five small vessels (undecked, < 10 m LOA) participate in the minke whale hunt.

Faroe Islands

Through a coastal state agreement, the Faroe Islands have a quota of the Iceland–Greenland–Jan Mayen capelin stock, which they are allowed to fish within the Icelandic EEZ. From 2015 to 2018 and in 2021, between four and six pelagic vessels using pelagic trawls were directed to capelin. No capelin fishery was conducted in Icelandic waters in 2019 or 2020. There is a bilateral agreement (revised annually) between Iceland and the Faroe Islands allowing Faroese longliners to fish for demersal species in the Icelandic EEZ and pelagic vessels to fish for NSS herring (since 2018). Since 2011, around 15 of these longliners have operated in Icelandic waters, fishing mainly cod, haddock, ling, and tusk. In 2021, 14 Faroese pelagic vessels using pelagic trawls fished for NSS herring in the Icelandic waters ecoregion.

Greenland

Through a coastal state agreement, Greenland has a quota of the Iceland–Greenland–Jan Mayen capelin stock, which it is allowed to fish within the Icelandic EEZ. From 2015 to 2018 and in 2021, between one and three pelagic vessels, using pelagic trawls and purse-seines, operated in Icelandic waters. No capelin fishery was conducted in Icelandic waters in 2019 or 2020.

Norway

Through a coastal state agreement, Norway has a quota of the Iceland–Greenland–Jan Mayen capelin stock, which it is allowed to fish within the Icelandic EEZ. From 2015 to 2018 and in 2021, between 46 and 67 pelagic vessels, using pelagic trawls and purse-seines, operated in Icelandic waters. No capelin fishery was conducted in Icelandic waters in 2019 or 2020. There is a bilateral agreement between Iceland and Norway for two Norwegian longliners to catch demersal fish, mainly ling and tusk.

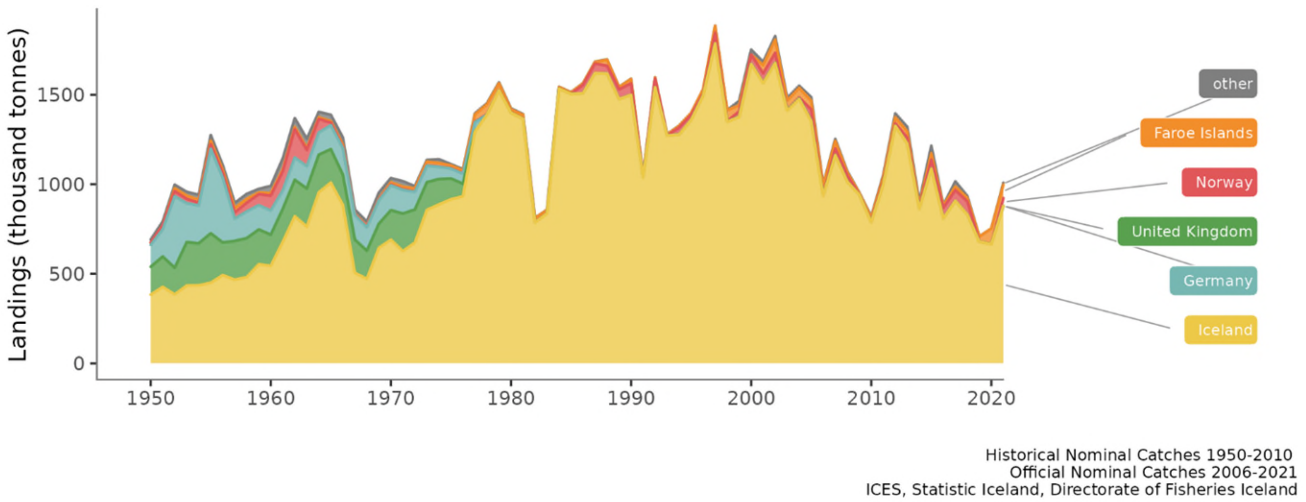


Figure 2 Landings (thousand tonnes) from the Icelandic Waters ecoregion 1950–2021, by country. The five countries with the highest landings are displayed separately, while the remaining countries are aggregated and displayed as "other".

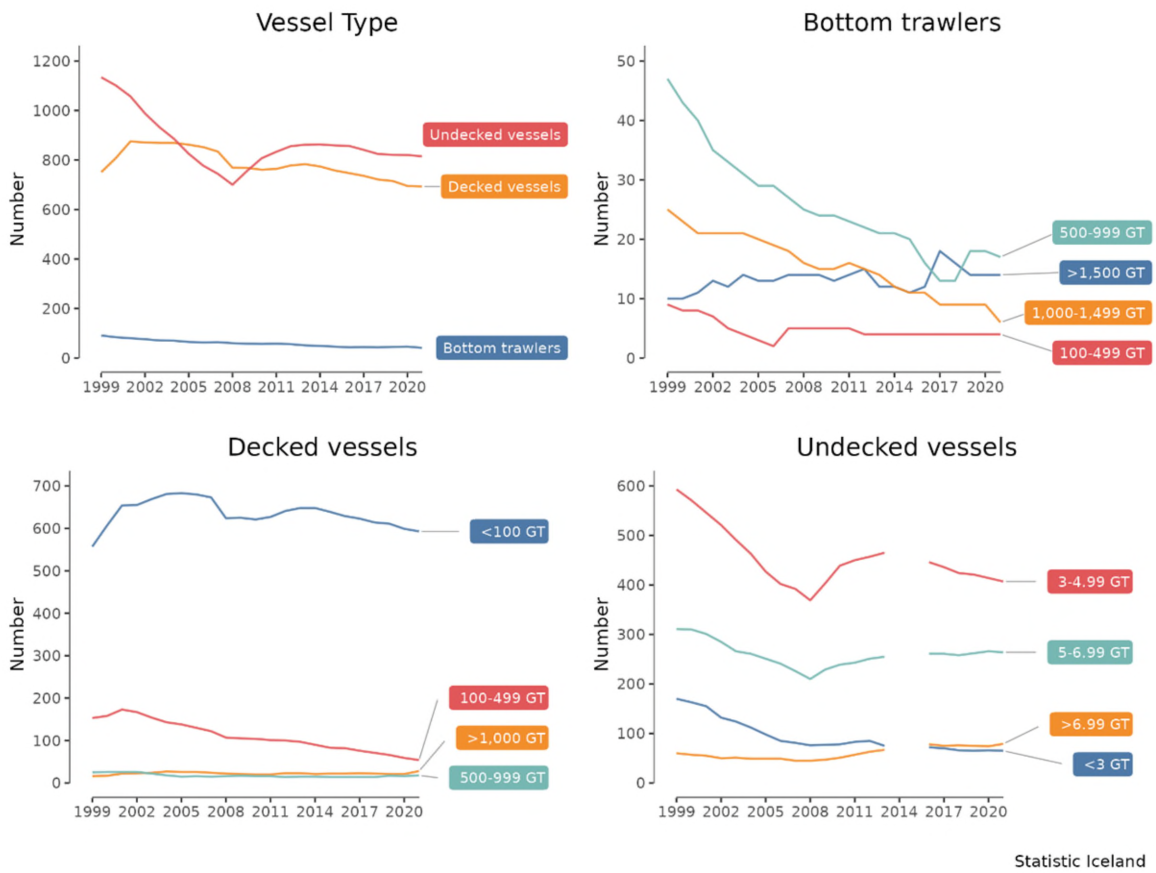


Figure 3 Number of Icelandic fishing vessels 1999–2021 by vessel type and size groups (gross tonnages [GT]). Decked vessels do not include bottom trawlers. Note that the data for the number of undecked vessels by size group in 2014 and 2015 are not available.

Landings

Fisheries within the Icelandic Waters ecoregion catch a wide range of species, including those considered to be demersal, benthic, pelagic, widely distributed, and deep-water. The principal species targeted in the commercial fisheries are cod, haddock, saithe, golden redfish, beaked redfish, Greenland halibut, capelin, herring (Icelandic summer-spawning herring and Norwegian spring-spawning herring), mackerel, and blue whiting. The fisheries for cod, haddock, saithe, and redfish species use mainly demersal trawls, longlines, and gillnets; herring, capelin, mackerel, and blue whiting are mainly caught by pelagic trawls and purse-seines. Other target species that have local economic importance include plaice, lemon sole, ling, tusk, Atlantic wolfish, lumpfish, northern shrimp, Norway lobster*,* and a newly developed fishery for one species of sea cucumber.

An increasing proportion of the landings of haddock, anglerfish, ling, tusk, witch, and lemon sole is now occurring along the northern shelf of Iceland and is considered to be a result of increased temperature and ecosystem changes (see Icelandic Waters ecosystem overview [ICES, 2022a]).

Total landings from Icelandic waters doubled from 750 000 tonnes in the early 1950s to about 1.5 million tonnes in the late 1960s (Figure 2). This was due to increased herring catches; with the collapse of the Norwegian spring-spawning and the two local Icelandic herring stocks in the late 1960s, total landings fell to a similar level to the early 1950s and consisted of mainly demersal species. Total landings increased again from the early 1970s to the mid-2000s, when they peaked at about 1.8 million tonnes. This increase was driven by the exploitation of pelagic species previously not fished in the Icelandic Waters ecoregion: a capelin fishery starting in the early 1970s, a blue whiting fishery starting in the late 1990s, and mackerel fishing beginning in the mid-2000s (Figure 4). Total demersal landings decreased in the same period, until the mid-1990s, due mainly to decreased landings of cod (Figure 4). From the mid-2000s to 2020, total landings decreased to around 750 000 tonnes, mainly because of the decreased capelin fishery. In 2021, the total landings increased due to the increased capelin fishery and were about 1 million tonnes.

Pelagic fisheries, using pelagic trawl and purse-seines, generally account for the largest proportion of the total landings; these are followed by the demersal trawl and seine fisheries, and then by the longline and gillnet fisheries (Figure 5).

Demersal species
Cod is the demersal species with the highest landings (Figure 7). Landings of cod peaked in 1954 with 546 000 tonnes. Annual landings decreased with fluctuation to their lowest in 2008 when 146 000 tonnes were landed but were on average about 265 000 tonnes in 2018–2021. The highest annual landings of haddock in recent decades were about 100 000 tonnes in 2005–2006, but the level has since then decreased to 40–60 000 tonnes (Figure 7). Annual catches of saithe and golden redfish have been relatively stable for the past two decades, but annual landings of beaked redfish have decreased substantially (Figure 7). Annual landings of other demersal species, such as Atlantic wolffish, ling, blue ling (bli.27.5a14), tusk and lumpfish, have fluctuated during but have in general decreased in the past decade (Figure 8).

Pelagic species
In 1950–1967 only herring (Norwegian spring-spawning stock and Icelandic summer- and spring-spawning stocks) was fished within the Icelandic Waters ecoregion (Figure 9). When the herring stocks collapsed in the late 1960s fishing for capelin started. Capelin landings in 1977–2003 were between 800 000 and 1100 000 tonnes but were on average about 360 000 tonnes in 2003–2018. No capelin fishery was conducted in 2019 or 2020, but landings in 2021 were about 200 000 tonnes. Since the turn of the century, the relative importance of capelin has decreased, while the relative importance of blue whiting, Norwegian spring-spawning herring, and mackerel has increased (Figure 9).

Flatfish species
Greenland halibut is the benthic species with the highest landings from the Icelandic Waters ecoregion (Figure 10). Annual landings of the species peaked in 1989 when about 59 000 tonnes were landed, but in 2004–2021 landings were between 10 000 and 18 000 tonnes. The flatfish species with the next highest landings is plaice with annual landings of 5 000–8 000 tonnes (Figure 10). Landings of other flatfish species are small compared to Greenland halibut and plaice. In 1990–2005, a fishery occurred for dab and long rough dab, but very little is now landed of either of these species. Landings of Atlantic halibut have decreased from 6600 tonnes in 1951 to less than 150 tonnes since 2012 when the directed fishery for the species was prohibited.

Invertebrates
Crustacean fisheries (Norway lobster and northern shrimp) have decreased substantially since the early 1990s, mainly owing to decreased landings of northern shrimp, but also because of the drastic decline of the Norway lobster fishery in recent years. The directed fishery for Norway lobster was prohibited in 2021. Since 2009, few mollusc shellfish fisheries have been conducted after the Iceland scallop stock collapsed in 2003, and there has been a decreased fishery for whelk. In 2008, the fishery for sea cucumber started with gradually increasing catches that peaked in 2018 and 2019.

Marine mammals
Around 200 minke whales were landed annually between 1973 and 1986 until the moratorium on all commercial whaling was declared by the International Whaling Commission (IWC; Figure 11). Commercial whaling for minke whales was resumed in 2007, annual landings have varied but with a decreasing trend. The landings on minke whales peaked in 2009 with 81 animals, but only 6 animals in 2018. There was no whaling for minke whales in 2019–2021. Annual landings of fin whales were 150–300 animals between 1948 and 1985 (Figure 11). After resuming commercial whaling for fin whales in 2009, the landings have been on average 140 animals per year when there has been whaling. There was no whaling for fin whales during 2011–2012, 2016–2017, and 2019–2021.

Traditional seal hunting in the last century were mainly on seal puppies of both harbour and grey seals, but adult seals were also harvested. In 1962-1987 annual catch were 3000-7000 seals, mostly harbour seal. From 1987 seal hunting gradually decreased and seal hunting in the Icelandic water ecoregion have been prohibited by law since 2019. In 2002-2021 annual recorded catch (including bycatch) were between 1000 and 2000 animals (see Bycatch section for further details).

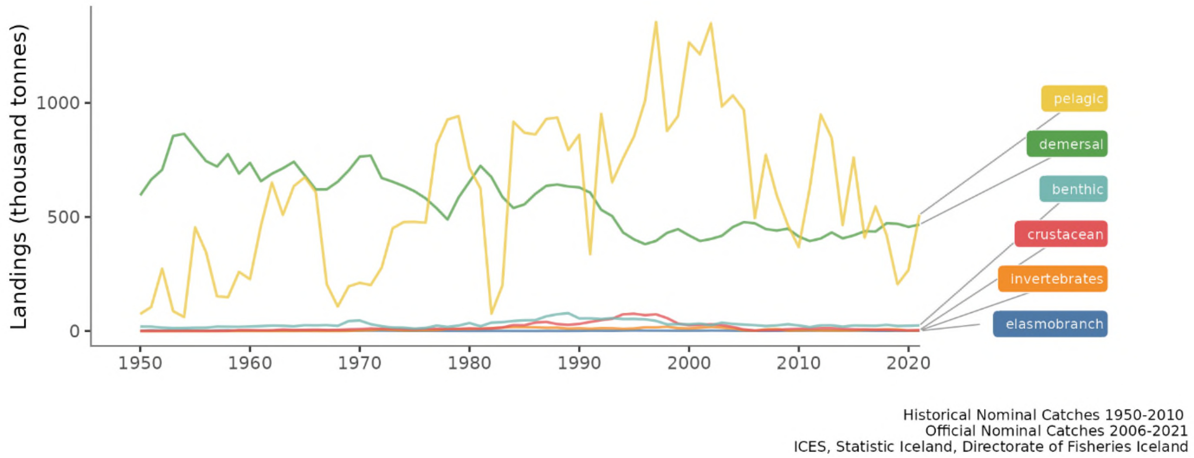


Figure 4 Landings (thousand tonnes) from the Iceland Waters ecoregion 1950–2021, by fish category. Table A2 details which species belong to each fish category.

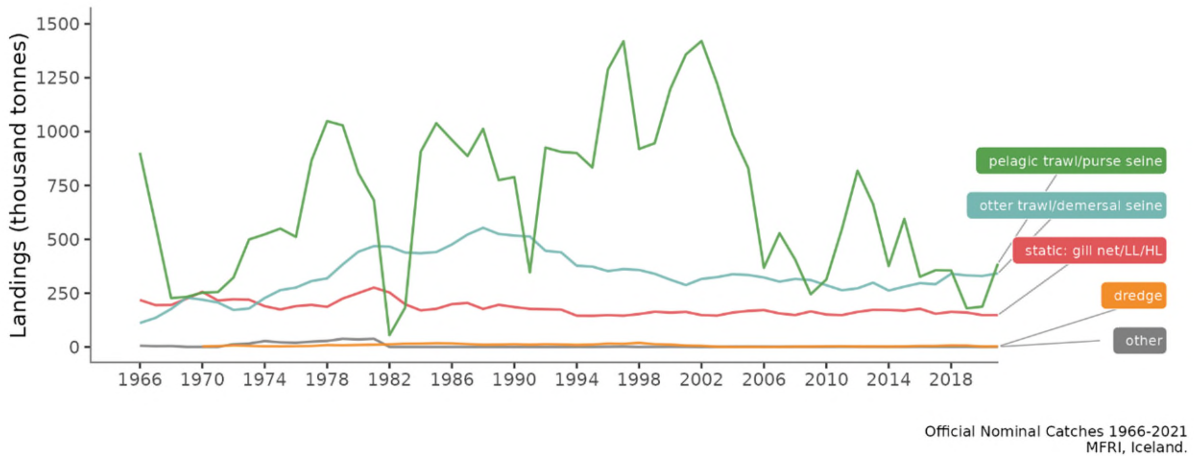


Figure 5 Landings (thousand tonnes) of the Icelandic fleet from the Icelandic Waters ecoregion 1966–2021, by gear type (LL = longline; HL = handline). See table A3 for description of the gear types.

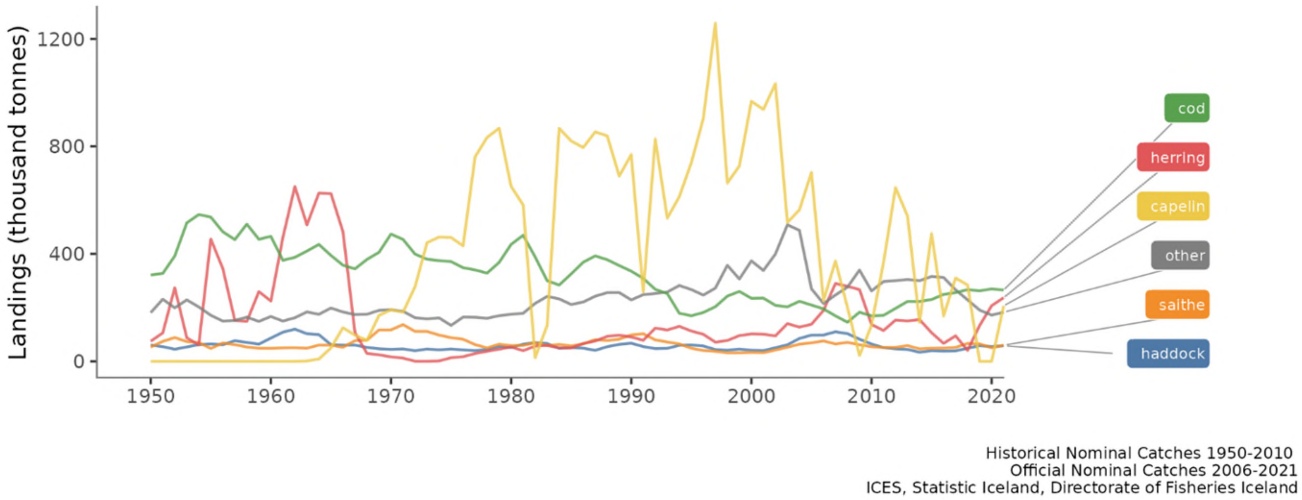


Figure 6 Landings (thousand tonnes) from the Icelandic Waters ecoregion 1950–2021 by species. The five species with the highest landings are displayed separately; the remaining species are aggregated and labelled as “other”.

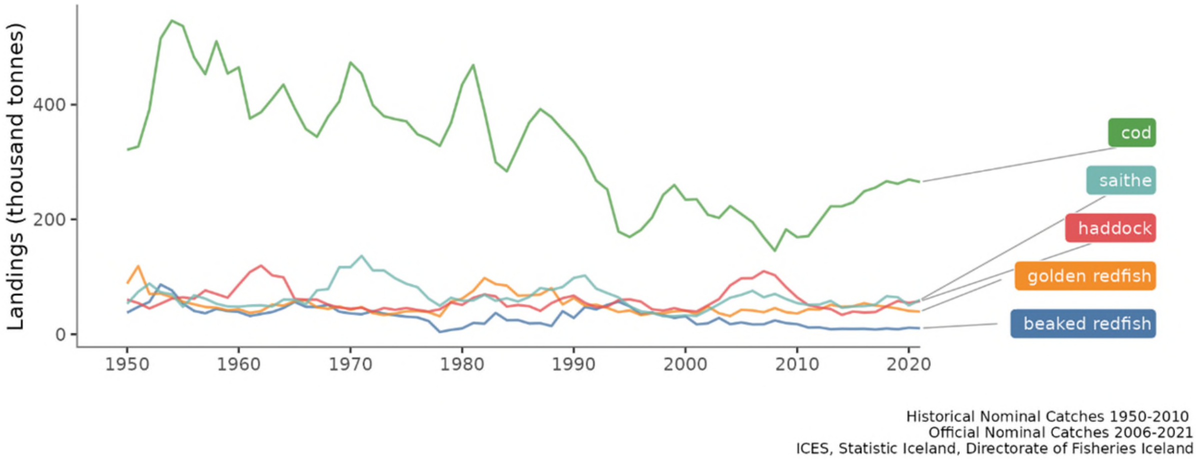


Figure 7 Landings (thousand tonnes) of demersal species from the Icelandic Waters ecoregion 1950–2021 divided by five species with the highest cumulative landings in the time-series.

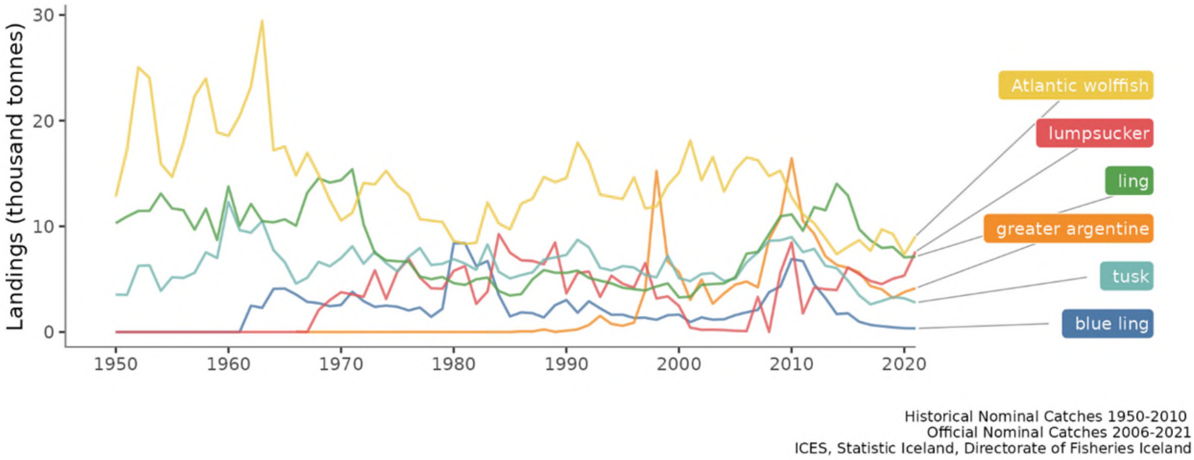


Figure 8 Landings (thousand tonnes) of six demersal species from the Icelandic Waters ecoregion 1950–2021.

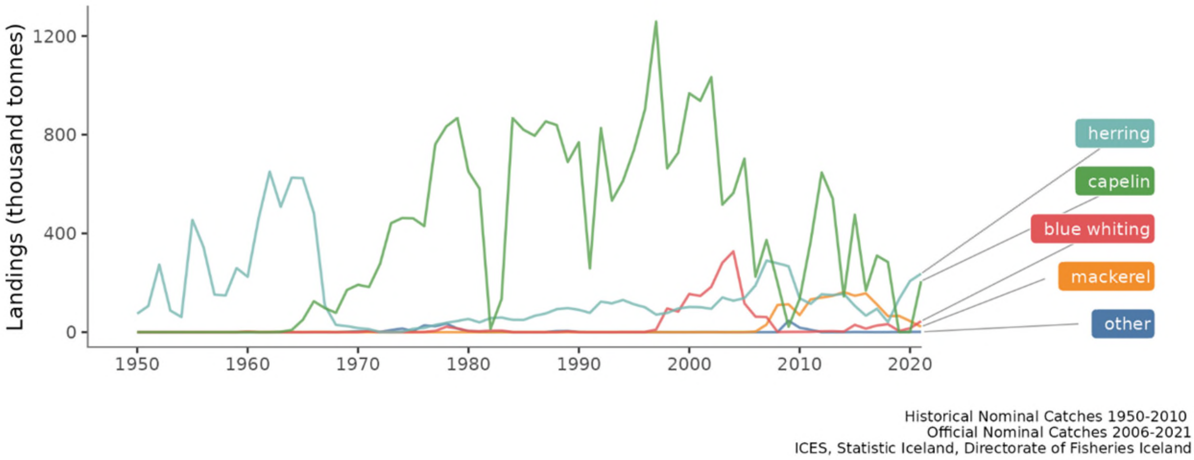


Figure 9 Landings (thousand tonnes) of four pelagic species from the Icelandic Waters ecoregion 1950–2021. The total landings of other species (Norway pout and Mueller's pearlside) are labelled as "other".

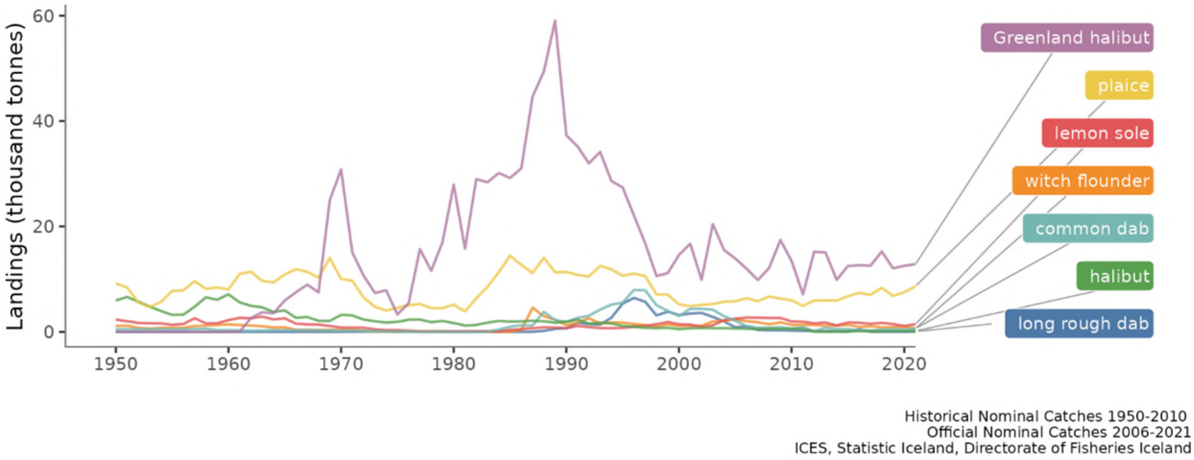


Figure 10 Landings (thousand tonnes) of seven flatfish species from the Icelandic Waters ecoregion 1950–2021.

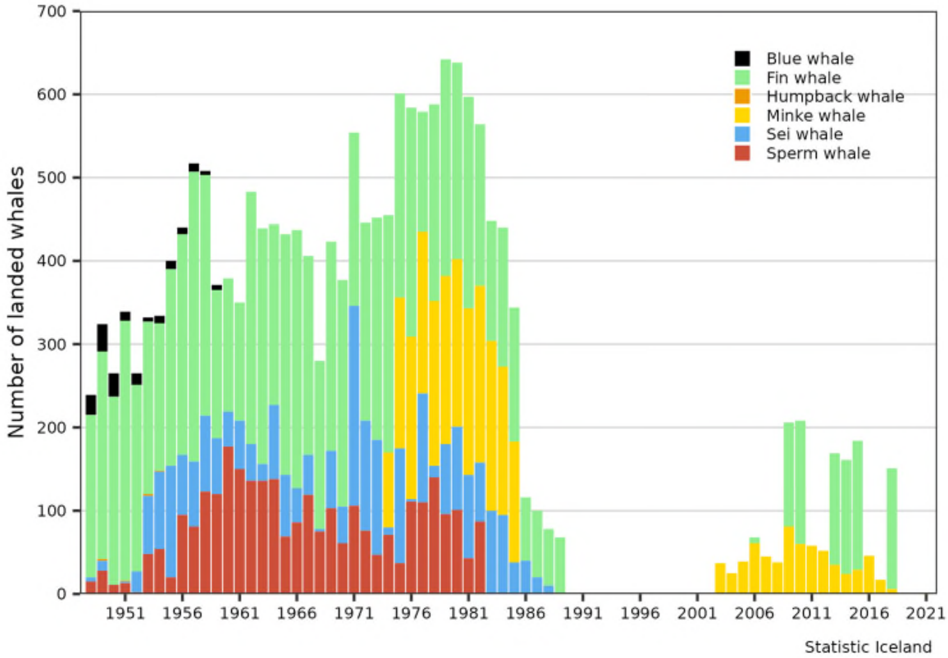


Figure 11 Number of whales landed in Icelandic Waters ecoregion 1948–2021 divided by six species. No whales were landed in the periods of 1990–2002 or 2019–2021.

Discards

Discarding is banned for species within the individual transferable quota (ITQ) system that are subject to total allowable catches (TACs). Fishing vessels are therefore required by law to land all catches of those species. Species that have low or no commercial value and are not restricted by a TAC can be discarded. Estimates of discards-based scientific sampling for cod and haddock are available for the period 2001–2018. Annual discards of cod are estimated to range from 0.05 to 2.62% of the total catch in tonnes during this period. The discard rate of haddock during the same period is estimated to range from 0.01 to 4.75%.

Description of the fisheries

Fisheries within the Icelandic Waters ecoregion use a variety of fishing gears to catch a wide range of species, including those considered to be demersal, benthic, pelagic, widely distributed, and deep-water. The bulk of the fisheries, both pelagic and demersal, occur at depths less than 500 m. There has been an overall reduction in fishing effort since 1991

(Figure 12) for all fisheries, except those using handlines where it has increased. The spatial distribution of the average fishing effort 2018–2021 by gear type is depicted in Figure 13.

Bottom-trawl

Bottom trawls account for the majority of the fishing effort in the Icelandic Waters ecoregion (Figure 12). The species composition of the catch depends on the area and depth fished as well as the gear design, including the codend mesh size. Bottom-trawl effort is highest on the continental shelf edge, particularly west and northwest of Iceland (Figure 13), targeting cod, saithe, and golden redfish (Figure 15) and using a mesh size of 135 mm in the codend. Otter trawling is banned within 12 nautical miles, although there are some exceptions, like the inshore northern shrimp fishery. Since 1996, the bottom-trawl effort has decreased substantially (Figure 14). There is also a substantial bottom-trawl fishery for haddock on the continental shelf around Iceland; it is in shallower waters, however, than the fishery targeting cod (Figure 15). In deeper waters (500–1000 m) on the shelf edge, the main target species are Greenland halibut (in the north and east), demersal beaked redfish (mainly southwest and west; reb.27.5a14), and greater silver smelt (south and southwest; aru.27.5a14) (Figure 15).

Lobster trawlers using smaller mesh bottom trawls (70–100 mm) primarily target Norway lobster in areas south and southwest of Iceland (Figure 13). Lobster trawl effort has decreased substantially since 1996 (Figure 14) and in 2019-2021 the only monitoring fishery has been allowed due to poor state of the stock.

The shrimp fishery, which uses specialized shrimp trawl with mesh size ~40 mm in the codend, is mainly conducted north of Iceland (Figure 13). Shrimp trawl effort declined rapidly from 1998 to 2005 and has since then been low (Figure 14). The reason for this is the collapse of five of eight inshore shrimp stocks as well as the substantial decrease in effort towards deep-water northern shrimp, which is the largest stock.

Demersal seine

Demersal seine fisheries operate mainly on soft bottoms close to land to west and south of Iceland (Figure 13); they target various flatfish species such as plaice and lemon sole, but also cod, haddock, and Atlantic wolffish (Figure 15). Demersal seine effort has decreased by more than half during the period 1991–2021 (Figure 14).

Static gear (gillnet, longline, and handline)

Gillnet fisheries operate mainly in shallow waters (Figure 13) and are directed at cod during its migration to the main spawning grounds south and west of Iceland in the first and second quarter. There is also a gillnet fishery that targets lumpfish conducted in very shallow areas in fjords north and west of Iceland. Gillnet fisheries conducted in deeper areas target Greenland halibut and anglerfish (Figure 13). Total gillnet effort has decreased by more than half in 2021 from a peak in 2004, mainly because of the decreased gillnet fishery for cod and saithe (Figure 14). In the most recent three years, gillnet effort targeting Greenland halibut has increased considerably on the continental slope in the northern and eastern part of the ecoregion (Figure 15).

Longline and handline effort increased from 2000 to 2010 and although it has decreased since then, it still remains high (Figure 14). These fisheries mainly operate in shallow waters, targeting cod and haddock (Figure 15). Longline fisheries in deeper waters target cod, tusk, ling, and blue ling.

Pelagic trawl and seine

The Icelandic fleet targeting the pelagic fish stocks in the ecoregion (two stocks of herring as well as capelin, mackerel, and blue whiting) consists of large vessels that can operate with both pelagic trawls and purse-seines. Since 2005, the majority of the pelagic fish stocks have been taken with large pelagic trawls, whereas the purse-seine fishery has declined to very low levels (Figure 14). Since 2011, the effort with pelagic trawls has decreased by more than 80%, mainly because of decreased catches of capelin but also because of the decreased mackerel and blue whiting fishery in the Icelandic Waters ecoregion in recent years (Figure 14). In 2007–2021, between 7% and 24% of the total Norwegian spring-spawning herring catch, between 4% and 18% of the total mackerel catch, and between < 1% and 7% of the total blue whiting catch was taken in the ecoregion.

Catches of the pelagic fishery vary both spatially and temporally (Figure 16). Capelin is mainly caught from January to March during its spawning migration along the southern and western coasts of Iceland. In some years, capelin has also been caught northeast of Iceland (Figure 16). The fishery for the Icelandic summer-spawning herring takes place on overwintering areas, mainly west and south of Iceland in autumn and winter (quarters three and four). The Norwegian spring-spawning herring stock fishery occurs at the feeding grounds east of Iceland from August to November. Mackerel is caught during its summer feeding migration (post-spawning) in the western, eastern, and southern parts of the ecoregion. The majority of the blue whiting catches taken in the ecoregion are taken southeast of Iceland, but the fishing season varies between years.

Part of the pelagic fishery for deep pelagic beaked redfish (reb.2127.dp) extended into the Icelandic EEZ, where only Icelandic vessels can operate, until 2019 (Figure 13). The proportion of deep pelagic beaked redfish that is caught within the Icelandic EEZ varies from year to year but in 2009–2018 was on average 11% of the total catch. Iceland has not fished from this stock since 2019.

Dredges

Dredge fisheries operate in shallow waters, both inshore and offshore, along the western and eastern coasts of Iceland (Figure 13). The most significant dredge fishery is the one that started in 2008 on sea cucumber. Other species caught in dredge fisheries are sea urchin, Iceland scallop, and ocean quahog; effort towards these species, however, has been low in recent years.

Whaling

Icelandic minke whaling targets the whales at their feeding grounds, located to the west of Iceland. Since 2009, fin whaling has predominantly taken place off the continental shelf west of Iceland, but in 2014 and 2015 moved further south and east. For both fin and minke whaling, 90 mm and 50 mm harpoon cannons are used, respectively.

Recreational

In Icelandic waters, marine recreational fisheries can be divided into the marine angling tourism sector and local marine recreational fisheries (subsistence fishery). These fisheries are exempt from ITQ fisheries management. Fishing licences are required in the angling tourist sector. The target species is mainly cod, but haddock is also caught, especially in the local marine recreational fishery. Catch statistic are, however, unavailable.

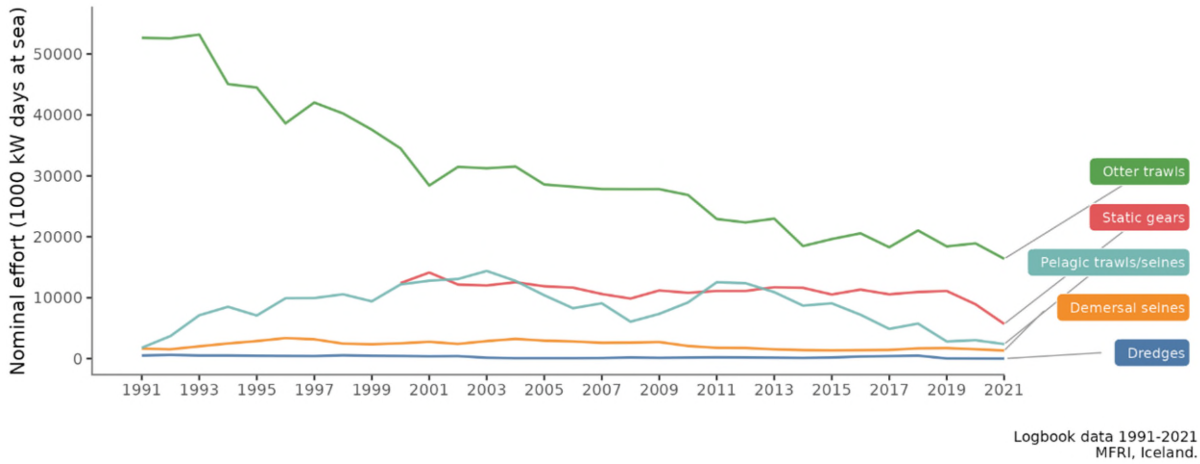


Figure 12 Fishing effort (thousand kW days-at-sea) in the Icelandic Waters ecoregion in 1991–2021, by gear type.

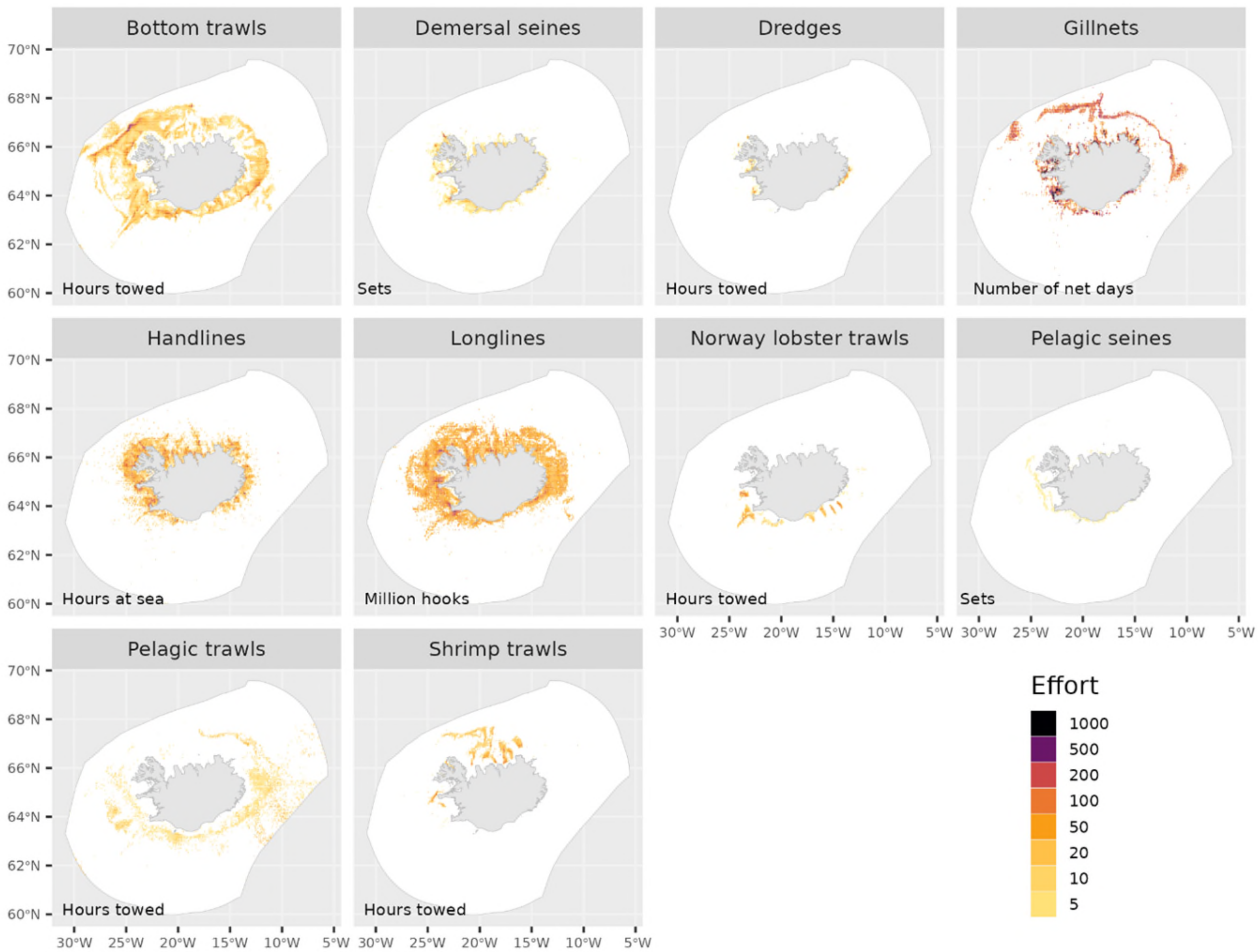


Figure 13 Spatial distribution of average annual fishing effort in the Icelandic Waters ecoregion from 2018 to 2021, by gear type. Based on logbook data from all Icelandic vessels.

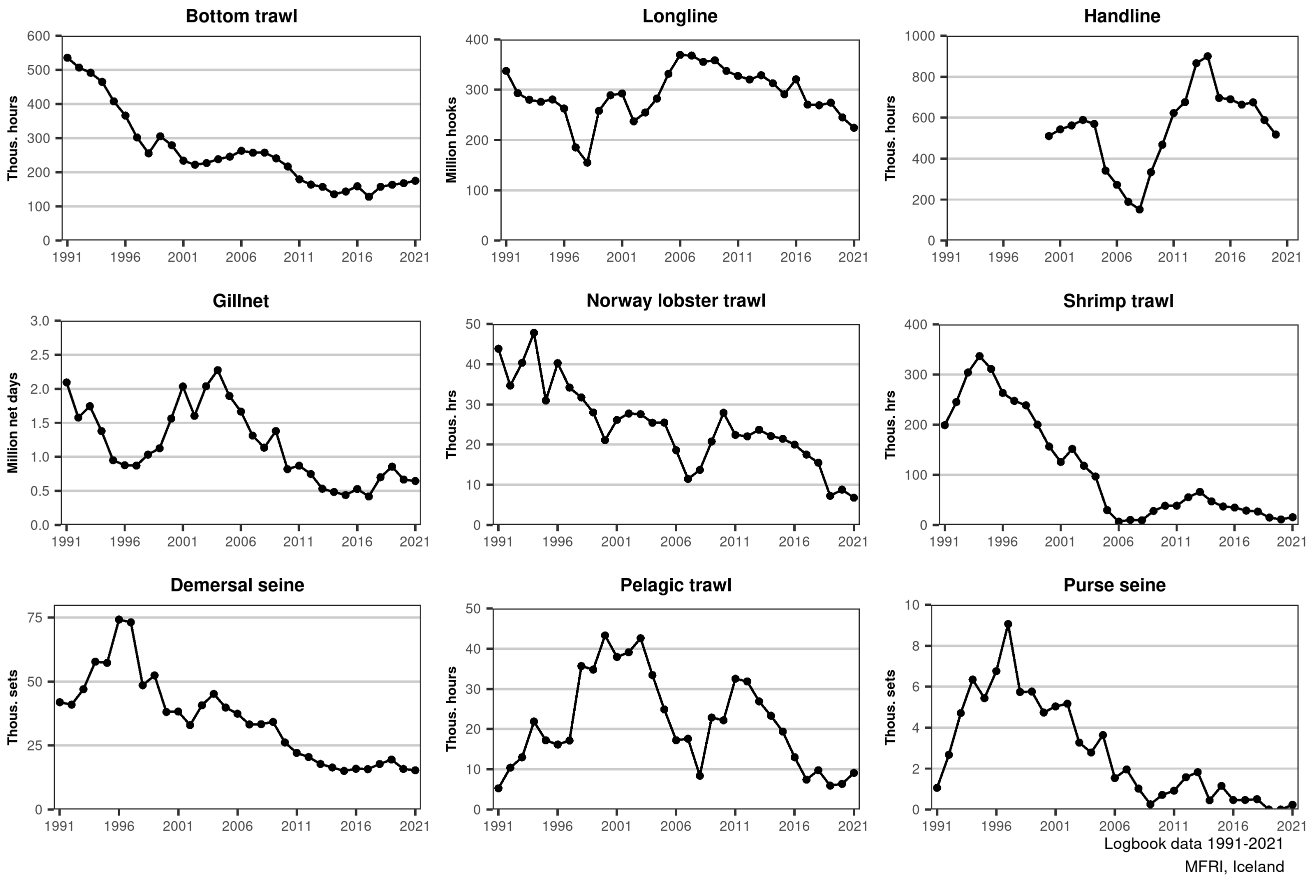


Figure 14 Fishing effort in the Icelandic Waters ecoregion in 1991–2021, by gear type. Data on handlines effort are only available for 2000–2020. Note that the units and scales on the *y*-axes are gear specific.

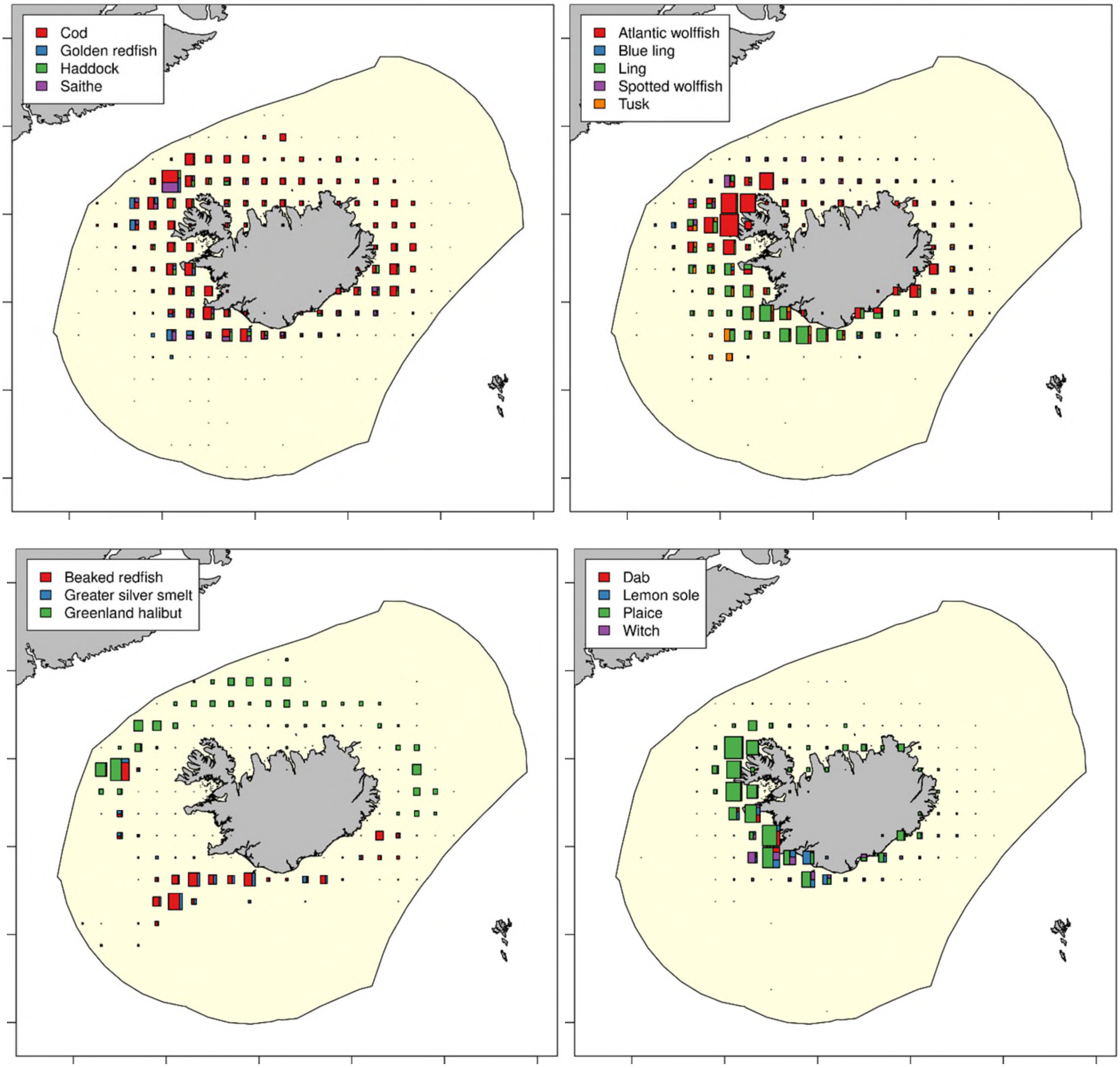


Figure 15 Spatial distribution of catches for demersal and benthic species in the Icelandic Waters ecoregion. Catches (tonnes) are represented proportionally within each panel but not between panels. Based on logbook data from all Icelandic vessels, 2017–2021.

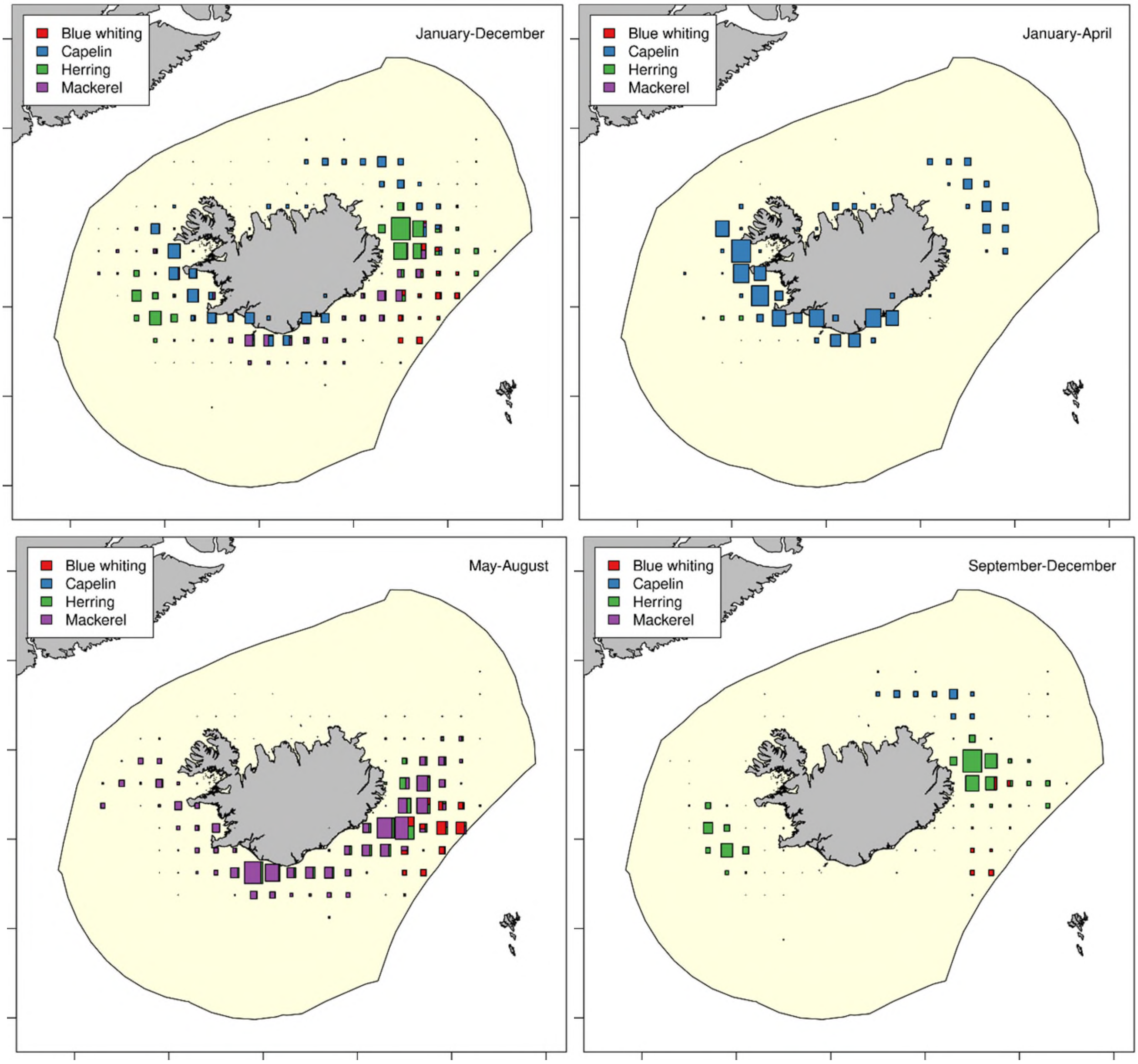


Figure 16 Spatial distribution of catches for four pelagic species in the Icelandic Waters ecoregion. The panels show the catches for the whole year (upper-left panel) and then by four-month periods (January–April, May–August, and September–December). Catches (tonnes) are represented proportionally within each panel, but not between panels. Based on logbook data from all Icelandic vessels, 2017–2021.

Fisheries management

Fisheries management within the Icelandic EEZ is under Icelandic legislation. The Ministry of Industries and Innovation is responsible for the management of Icelandic fisheries and for the implementation of relevant legislation. The Ministry issues regulations for commercial fishing for each fishing year, including an allocation of TAC for each of the stocks subject to such limitations. The fisheries for some shared stocks are subject to international negotiation through managed based on agreements by NEAFC and by coastal states. Fisheries advice is provided by the Marine and Freshwater Institute of Iceland (MFRI) and by ICES.

A system of vessel quotas was introduced in 1984. An individual transferable quota (ITQ) system was established for the fisheries in 1990, and they were subject to vessel catch quotas. Since the 2006/2007 fishing season, all vessels have operated under the TAC system. Individual vessel owners have substantial flexibility in exchanging quota in this system, both between vessels within individual companies and between different companies. The latter can be done via either a temporary or permanent transfer of quota.

Some flexibility is also allowed by individual vessels with regard to transfer of quota among species, with the exception of cod and Greenland halibut. These measures, which are accounted for more or less instantaneously, are likely to result in a weaker incentive to discard and misreport than can be expected if individual vessels are restricted by strict quota measures alone. They may, however, also result in fishing pressures of individual species that differ from that intended under single-species TAC allocation.

With some exceptions, it is required by law to land all catches. Consequently, no minimum landing size is in force. To prevent fishing of small fish, various measures such as mesh-size regulations and the closure of fishing areas are in place. Support measures to the general system of management include real-time area closures: A short-term (usually two weeks) immediate closure system has been in force since 1976, with the objective of protecting juvenile fish. In 2018, 97 areas were closed, but since then the number of closed areas has decreased substantially due to changes in national regulations. Only six areas were closed in 2021. Longer-term closures can be established if needed, thus directing the fleet to other areas. The Directorate of Fisheries and the Coast Guard supervise these closures. There are also seasonal area closures, where the major spawning grounds of cod, Atlantic wolffish, plaice, and blue ling are closed during the main spawning season.

There are also designated protected areas, and these areas are closed for fisheries that may affect relevant habitats and species (Figure 17). There are ten small areas southeast of Iceland that are closed for all fishing to protect cold-water corals. A large area west of Iceland is closed for otter and pelagic trawling to protect juvenile golden redfish. In 2019, three areas southeast of Iceland were closed for otter trawling to protect Norway lobster.

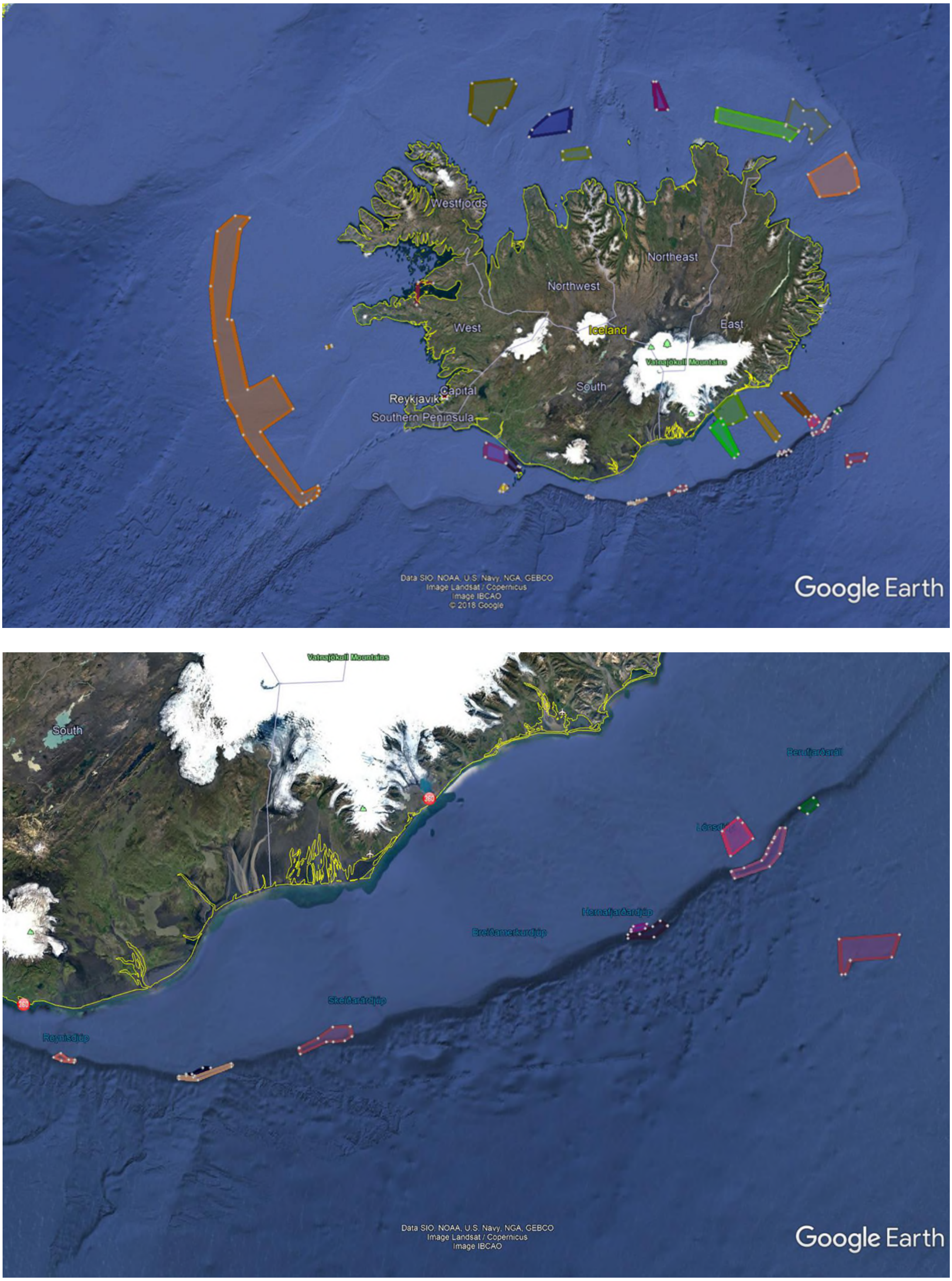


Figure 17 Top: permanently closed areas for otter trawling. Bottom: permanently closed areas for all fishing to protect cold-water corals.

Management plans have been implemented for cod, haddock, saithe, ling, tusk, golden redfish, plaice, Atlantic wolffish, capelin, and Icelandic summer-spawning herring. These provide harvest control rules (HCRs) and safeguards to ensure that stocks remain within safe biological limits. Before adoption, these plans were evaluated by ICES to ensure they were precautionary and in many cases conform to ICES MSY approach.

Directed fisheries of Atlantic halibut, basking shark, spiny dogfish, and porbeagle are prohibited, and all live specimens must be returned to the sea.

Management of whaling is based on the advice from MFRI and is built on assessments on stock size undertaken by the scientific committees of the North Atlantic Marine Mammal Commission (NAMMCO) and the International Whaling Commission (IWC).

Status of the fishery resources

Note that updates to the figures using data from the stock assessment graphs (SAG) include only advice published before 10 October 2022. Therefore, cap.27.2a514 refers to the advice current at this time (the advice applicable for 2022).

Eighteen stocks in the ecoregion are analytically assessed by ICES and were evaluated against harvest rate (HR), maximum sustainable yield (MSY), and precautionary approach (PA) reference points. The status of these stocks has also been assessed relative to safe biological limits, i.e., $F < F_{pa}$ and $SSB > B_{pa}$ with the exception of capelin, which is assessed and managed on the basis of acoustic measurements and escapement strategy. For stock-specific information, see Table A1 in the Annex.

The most recent status of these stocks relative to safe biological limits is presented in figures 18 and 19. The mean spawning-stock biomass (SSB) of all stocks is above $B_{trigger}$, except for deep pelagic beaked redfish. While biomass ratios are currently in a desirable condition for many of these stocks, 13 stocks in the ecoregion have current fishing mortality rates above F_{MSY} or HR_{MSY} – cod, haddock, saithe, tusk, ling, blue ling, golden redfish, deep pelagic beaked redfish, Atlantic wolffish, Norwegian spring-spawning herring, mackerel, and blue whiting.

The stock status relative to F_{MSY} or HR_{MSY} and MSY $B_{trigger}$ are shown in Figure 20. For the five gadoid stocks, all are above MSY $B_{trigger}$ but are fished above HR_{MSY}. Saithe and ling are two to three times MSY $B_{trigger}$, but other gadoids species are one to almost two times MSY $B_{trigger}$. Greenland halibut, plaice, Atlantic wolfish, and greater silver smelt are above MSY $B_{trigger}$ and, with the exception of Atlantic wolfish, fished below F_{MSY}. Golden redfish is now close to MSY $B_{trigger}$ and fished above F_{MSY}. The deep pelagic beaked redfish has the worst status, as its SSB is below MSY $B_{trigger}$, and is it fished at a level more than 12 times higher than F_{MSY}. The SSB of all four pelagic stocks with analytical assessment (Icelandic spring-spawning herring, Norwegian spring-spawning herring, mackerel, and blue whiting) is above MSY $B_{trigger}$, but these stocks are fished above F_{MSY} or HR_{MSY} (Figure 20).

The mean fishing mortality for demersal and benthic fish stock groups has shown a declining trend since the mid-1990s (Figure 21). Fishing pressures of other species show the same trend and are currently at low values (Figure 21), except for deep pelagic beaked redfish (not shown). Trends in biomass of gadoids show biomass indices that are two to three times higher than their lowest observed value. The biomass levels of three flatfish species – plaice, lemon sole, and witch – are currently around two times higher than the lowest observed value. The biomass of Atlantic wolffish is currently about two times higher than the lowest observed value, whereas the biomass index of spotted wolffish has decreased and is at its lowest level in the time-series.

Temporal trends in F and HR, and spawning-stock biomass (SSB) relative to MSY reference points, are shown in Figure 21. Also shown is F_{proxy} relative to target F_{proxy} and a biomass index for stocks where reference points have not been defined. For most demersal and benthic stocks, marked improvements in stock status have occurred since 2000; in many cases, fishing mortality ratios have declined below target reference points. Since 2000, the SSB and biomass ratios have shown an increasing trend, and the mean values are now in most cases above reference points. For the four pelagic stocks fished in the ecoregion, the last five–ten years have seen a decreasing trend in SSB ratios and at the same time an increase in mortality ratios. Note that although the mean fishing mortality and biomass ratios are in a desirable condition, this does not imply that all stocks are in such a condition.

A few species have been critically impacted by the fishery in the ecoregion. One of these species is Atlantic halibut. The biomass survey index for Atlantic halibut decreased between 1985 and 1995 and has since then remained at a low level. Additional management measures – a mandatory release of viable halibut and a landing ban – were introduced in 2012. Spotted wolffish is another species where the biomass is currently at its lowest observed level. Both of these species are currently bycaught in fisheries directed at other species.

Stocks of invertebrates in the ecoregion show a declining trend in biomass and in some cases are at their lowest observed level. For some of the stocks, however, no reliable biomass estimates are available. Trends in biomass of northern shrimp stocks show a considerable decrease in indices of all nine stocks since the mid-1980s. Out of eight inshore shrimp stocks, five have collapsed to a very low level. The size of the three other inshore stocks is currently about 30% of the highest value but above biomass reference points; a limited fishery is therefore allowed. The offshore northern shrimp stock (the largest stock) has decreased by half since the mid-1980s but is currently 40% above biomass reference points. Norway lobster is considered to be at a critically low level. Its fishable biomass has decreased so substantially since 2009 that only a monitoring fishery is allowed in 2021. There is limited information on stock status of common whelk, sea urchin, and ocean quahog, but fisheries for these stocks have declined considerably in recent years. The Iceland scallop stock, in the main fishing area west of Iceland, collapsed in the early 2000s, and no commercial fishery has been allowed since 2003. The collapse is linked to poor recruitment, combined with intensified fishing and high natural mortality due to protozoan infestation. A new fishery for sea cucumber developed to the west and east of Iceland, but little is known about stock status for this species.

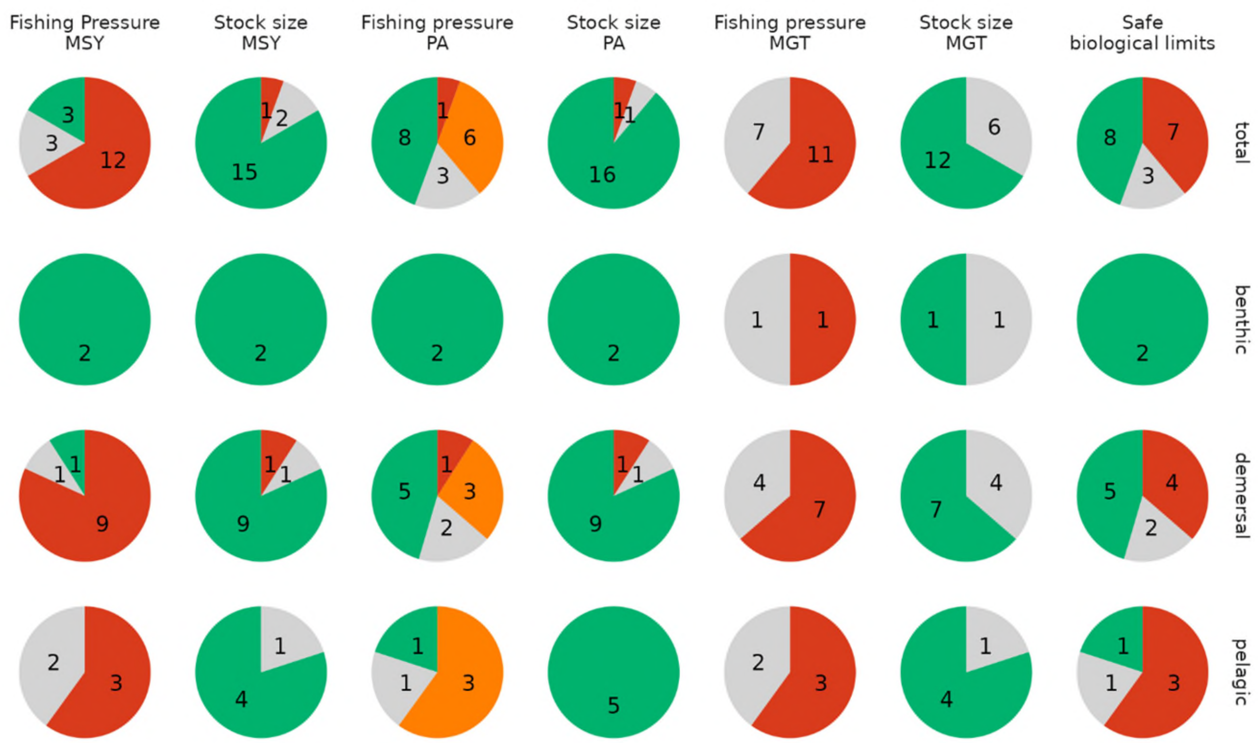


Figure 18 Status summary of Icelandic Waters ecoregion stocks, assessed by ICES, relative to ICES maximum sustainable yield (MSY) approach, precautionary approach (PA), and management (MGT) reference point. For the MSY approach: green represents a stock that is fished at or below F_{MSY} or whose size is equal to or greater than MSY $B_{trigger}$; red represents a stock that is fished above F_{MSY} or whose size is lower than MSY $B_{trigger}$. For the PA: green represents a stock that is fished at or below F_{pa} or whose size is equal to or greater than B_{pa}; orange represents a stock that is fished between F_{pa} and F_{lim} or whose size is between B_{lim} and B_{pa}; red represents a stock that is fished above F_{lim} or whose size is lower than B_{lim}. For MGT; green represents a stock that is fished at or below HR_{MSY} or F_{MGT} where the size is equal to or greater than MSY $B_{trigger}$. Stocks with a fishing mortality below or at F_{pa} and a 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. Grey represents unknown reference points. For stock-specific information, see Table A1 in the Annex.

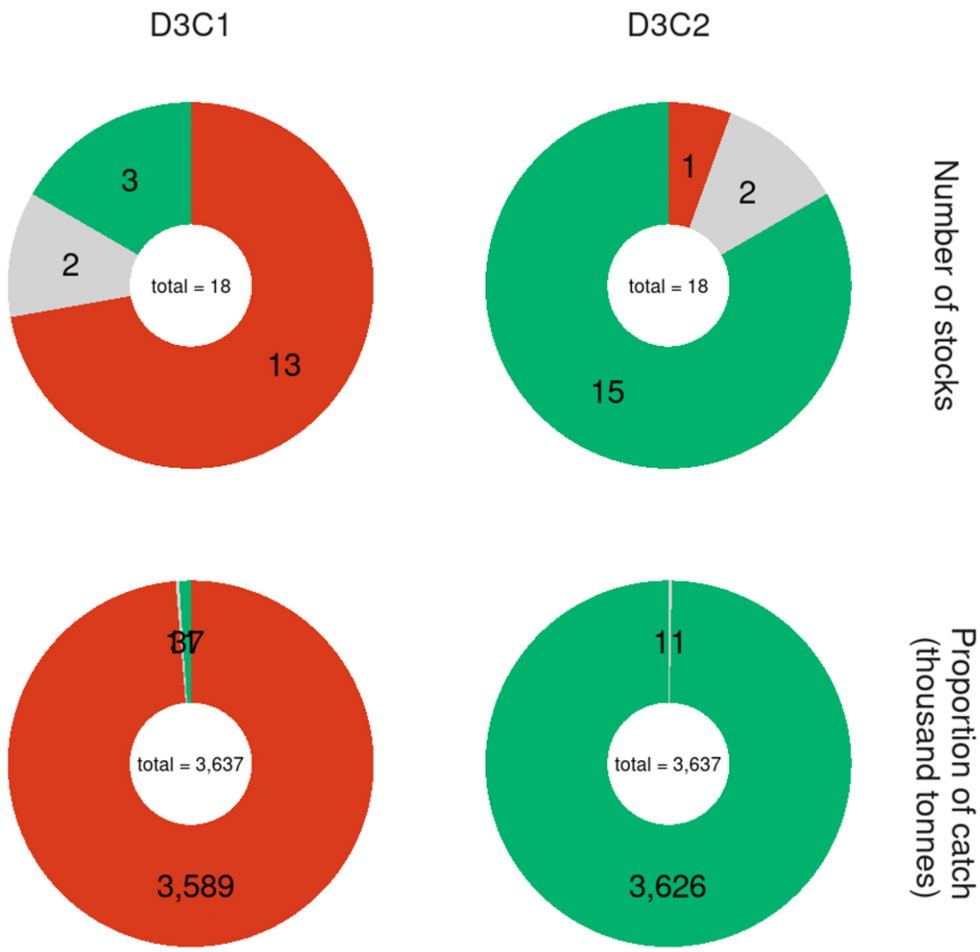
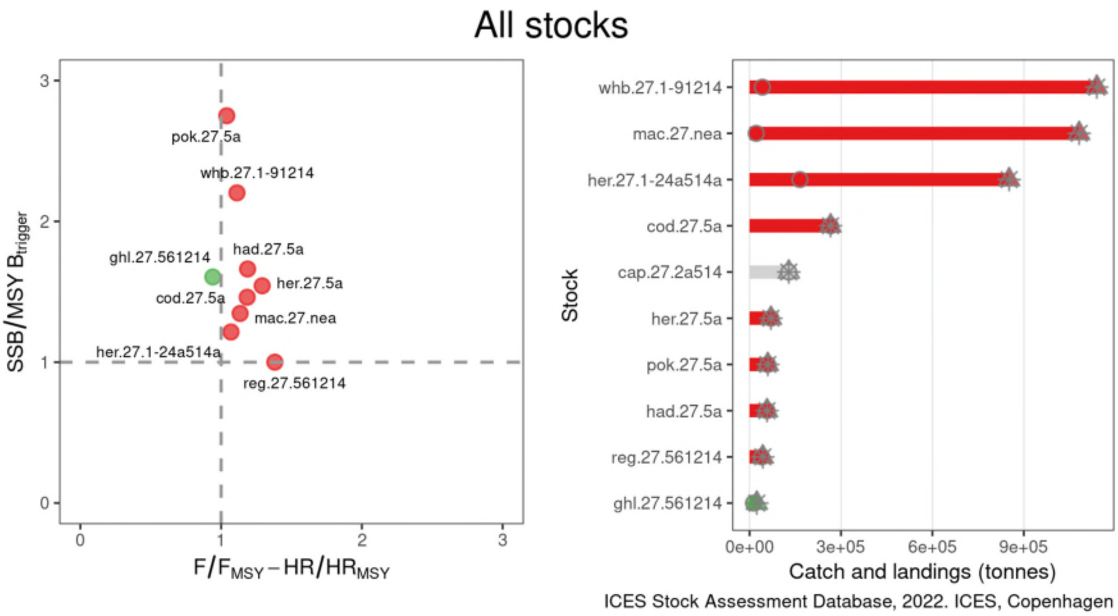
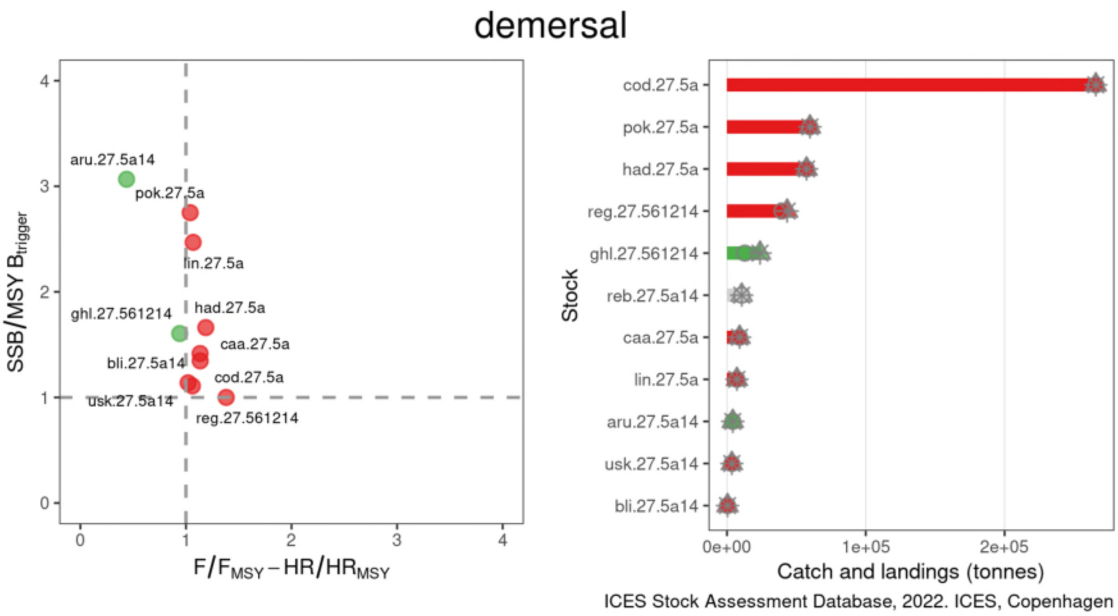


Figure 19 Status summary of Icelandic Waters ecoregion stocks, assessed by ICES in 2021 and 2022, relative to the EU Marine Strategy Framework Directive (MSFD) good environmental status (GES) assessment criteria of fishing mortality rate (D3C1) and stock reproductive capacity (D3C2). Green represents either the proportion of stocks fished below F_{MSY} or whose size is greater than MSY $B_{trigger}$, for criteria D3C1 and D3C2 respectively. Red represents either the proportion of stocks fished above F_{MSY} or those whose size is lower than MSY $B_{trigger}$, for criteria D3C1 and D3C2 respectively. Grey represents the proportion of stocks lacking MSY reference points. For stock-specific information, see Table A1 in the Annex. Note MSDF compliance plots are included for comparative purposes across other ecoregions even though the MSFD is not part of the fishery management in this ecoregion.


All stocks
SSB/MSY B_trigger
F/F_MSY – HR/HR_MSY
pok.27.5a
whb.27.1-91214
had.27.5a
ghl.27.561214
her.27.5a
cod.27.5a
mac.27.nea
her.27.1-24a514a
reg.27.561214
Stock
cap.27.2a514
Catch and landings (tonnes)
ICES Stock Assessment Database, 2022. ICES, Copenhagen


demersal
SSB/MSY B_trigger
F/F_MSY – HR/HR_MSY
aru.27.5a14
pok.27.5a
lin.27.5a
had.27.5a
ghl.27.561214
caa.27.5a
bli.27.5a14
cod.27.5a
usk.27.5a14
reg.27.561214
reb.27.5a14
Stock
Catch and landings (tonnes)
ICES Stock Assessment Database, 2022. ICES, Copenhagen

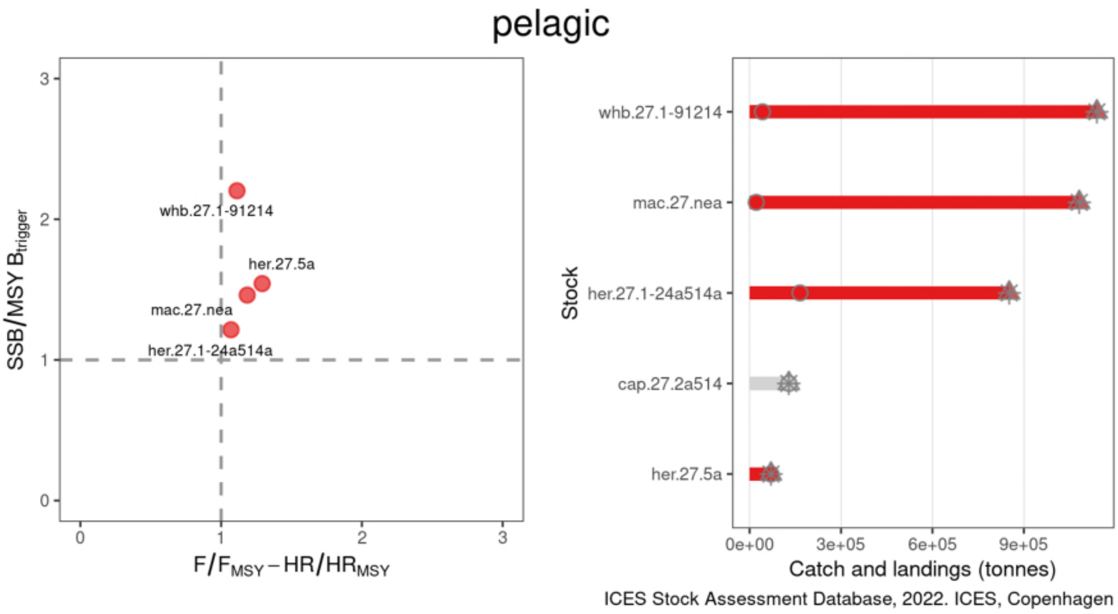
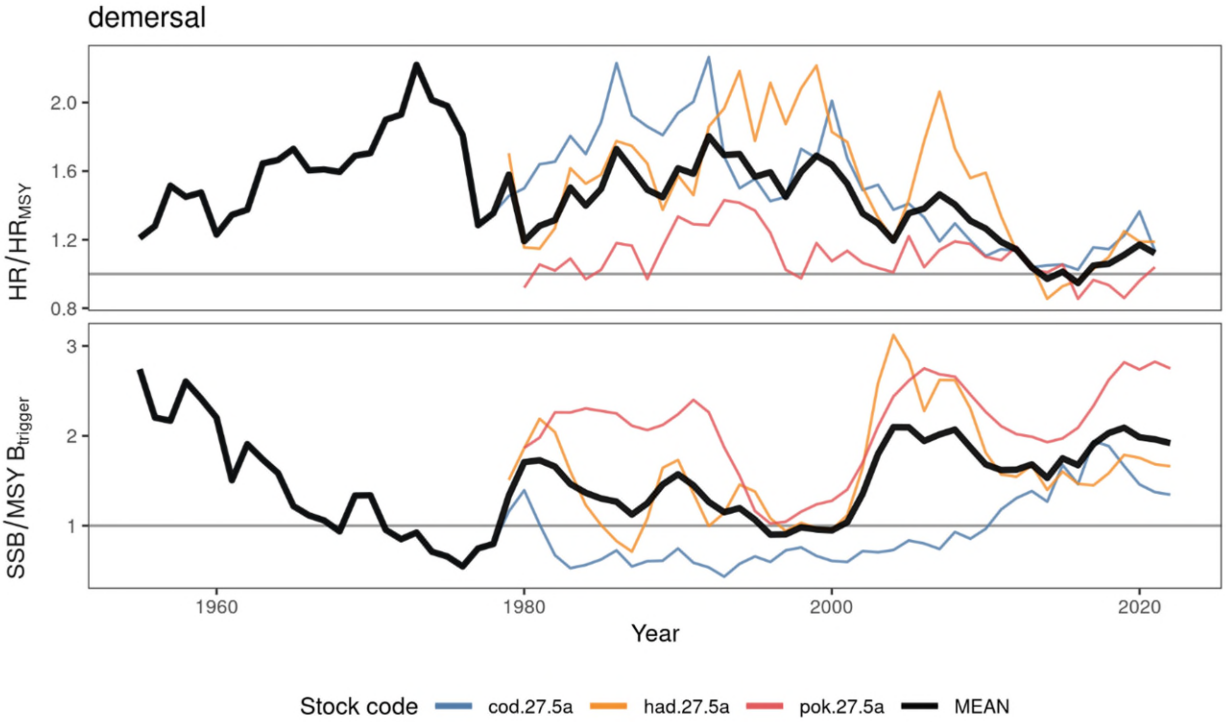
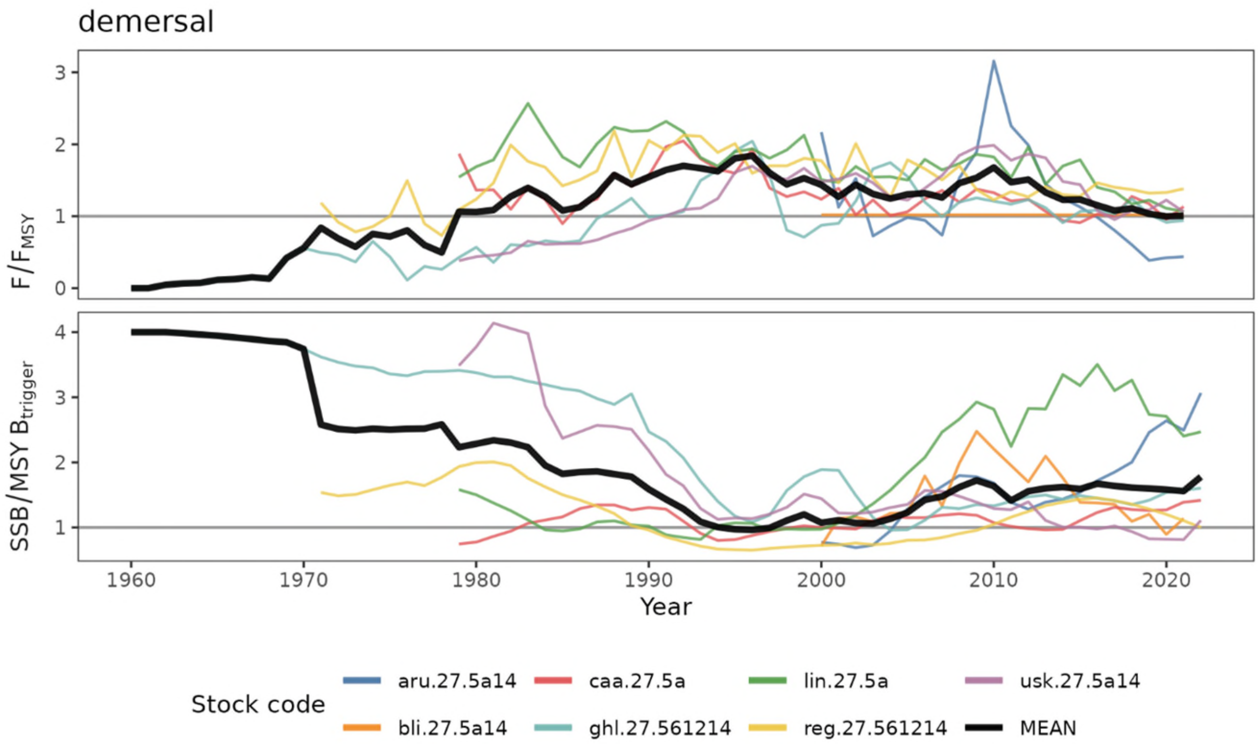
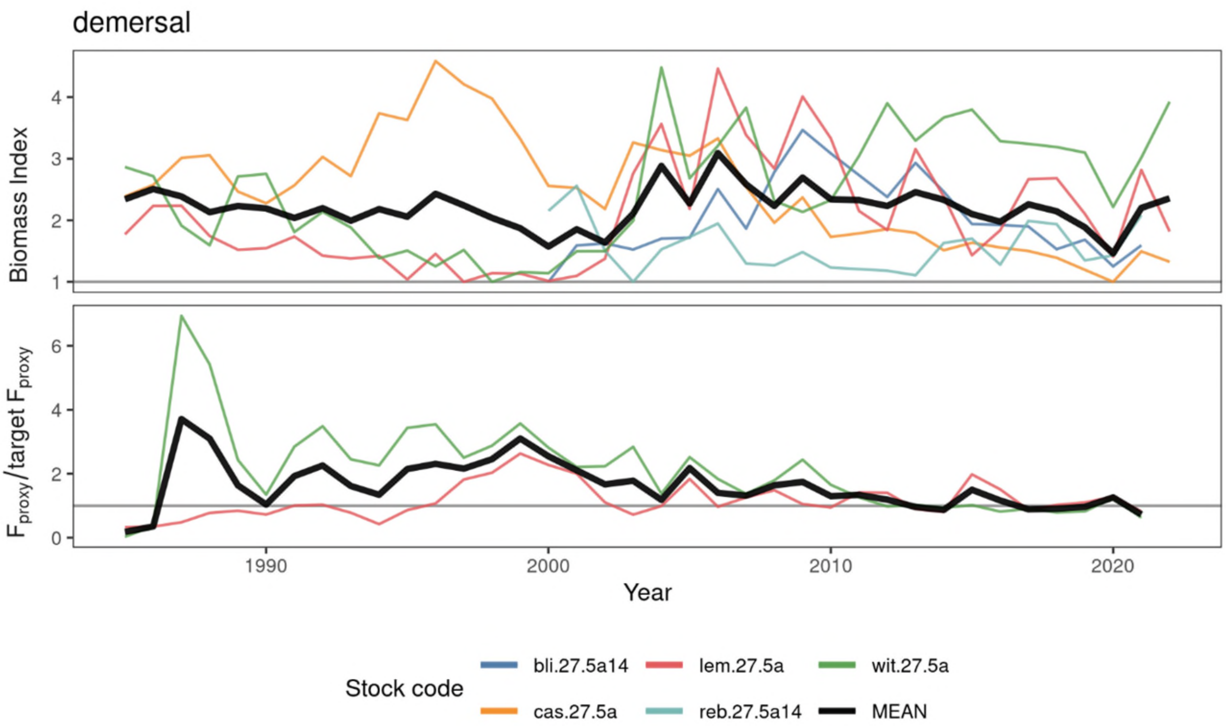
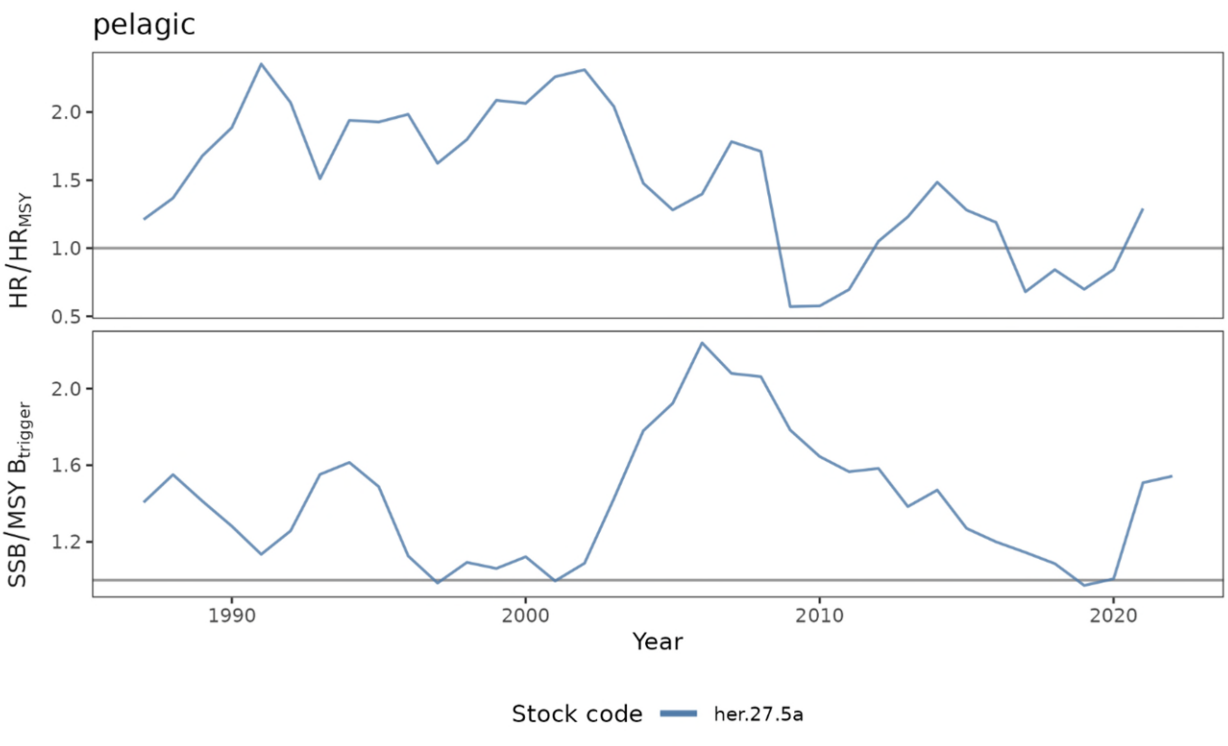


Figure 20 Status of Icelandic Waters ecoregion stocks assessed by ICES, relative to the joint distribution of exploitation (HR/HR_{MSY} and F/F_{MSY}) and stock size ($SSB/MSY\ B_{trigger}$) [left panel, by individual stocks] and catches (triangles)/landings (stars)/landings from Icelandic Waters ecoregion (circles) from these stocks in 2021 [right panel]. The left panel only includes stocks for which MSY reference points have been defined (MSY where available). Stocks in green are exploited at or below HR_{MSY} and F_{MSY}, while their sizes are also at or above MSY $B_{trigger}$. Stocks in red are either exploited above HR_{MSY} and F_{MSY} or their sizes are below MSY $B_{trigger}$, or both. "All stocks" refers to the ten stocks with the highest catch and landings across fisheries guilds in 2021. Note that reb.2127.dp is not included in the figure, as F/F_{MSY} is above 10. For full stock names, see Table A1 in the Annex. Note that Greenland halibut and plaice are considered demersal species.


demersal
HR/HR$_{MSY}$
SSB/MSY B$_{trigger}$
Year
Stock code
cod.27.5a
had.27.5a
pok.27.5a
MEAN


demersal
F/F$_{MSY}$
SSB/MSY B$_{trigger}$
Year
Stock code
aru.27.5a14
caa.27.5a
lin.27.5a
usk.27.5a14
bli.27.5a14
ghl.27.561214
reg.27.561214
MEAN


demersal
Biomass Index
F_{proxy}/target F_{proxy}
Year
Stock code
bli.27.5a14
lem.27.5a
wit.27.5a
cas.27.5a
reb.27.5a14
MEAN


pelagic
HR/HR_{MSY}
SSB/MSY $B_{trigger}$
Year
Stock code
her.27.5a

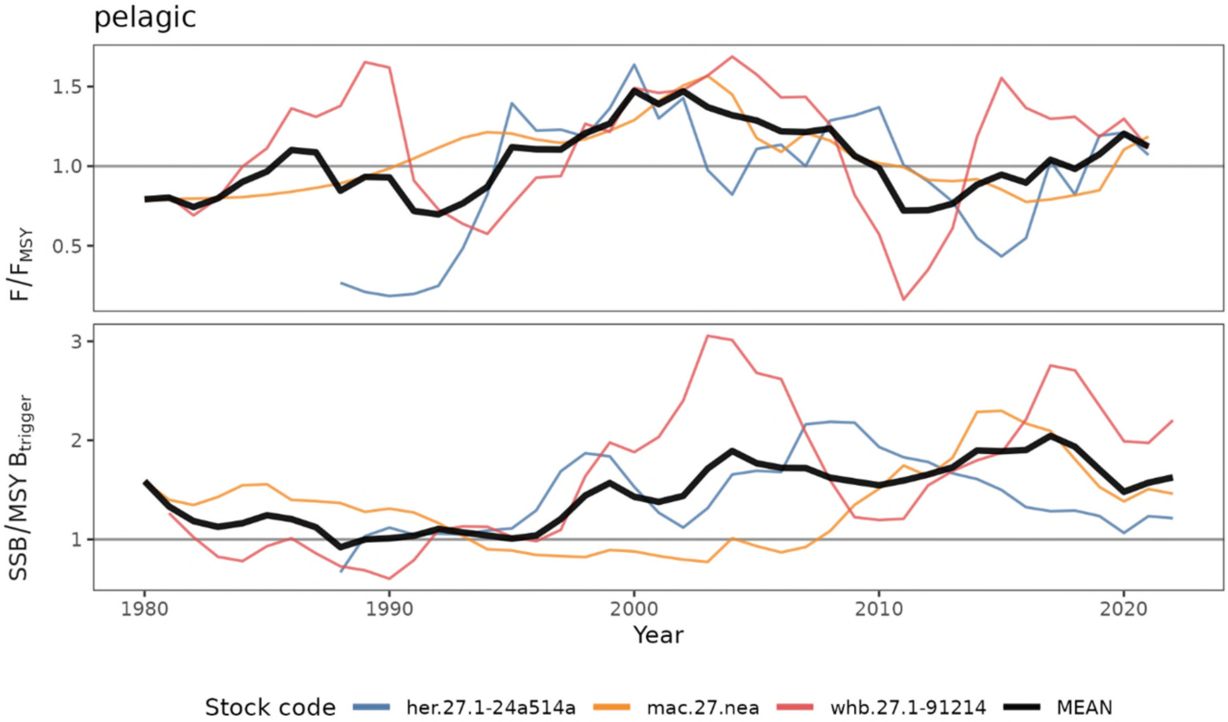


Figure 21 Temporal trends in HR/HR$_{MSY}$, F/F$_{MSY}$, and SSB/MSY B$_{trigger}$ for Icelandic Waters ecoregion demersal and pelagic fish stocks. Also shown is F$_{proxy}$/target F$_{proxy}$ and biomass indices for stocks that do not have analytical assessment and are not assessed by ICES (cas.27.5a, lem.27.5a, and wit.27.5a). Note that reb.2127.dp is not included in the figure, as F/F$_{MSY}$ is above 10. For full stock names, see Table A1 in the Annex.

Mixed fisheries

ICES has not been requested to provide mixed-fisheries scenarios for this ecoregion. This section gives a brief overview of the mixed fisheries and important bycatch.

Fishing gear operations that harvest multiple types of fish simultaneously are defined as mixed fisheries. However, some gears are more selective than others. For example, pelagic trawling and purse-seining typically catch only one species with lower quantities of bycatch; demersal trawling, bottom-seining, and longlining normally catch several species simultaneously. These operations are reported to MFRI via logbooks, in which catches of every species landed from each haul are recorded.

The average catches for 2019–2021 are aggregated to the following key description of fishing activity gear and target assemblage. (This is hereafter referred to as a 'métier'; see Table A3 in the Annex for métier definitions.)

Fifteen demersal TAC species dominate the landings (mean annual landings > 1000 tonnes; panel a in Figure 22), using nine métiers (panel b in Figure 22). Cod, for example, is the main species landed by the demersal fisheries and is caught in most métiers to a varying extent, except in the gillnet fishery for Greenland halibut (panel b in Figure 22). As another example, northern shrimp is only caught in the otter trawl fishery directed at that species.

Figure 23 demonstrates the catch composition of the six most important demersal target species caught in the otter trawl fisheries. For example, haddock, saithe, and golden redfish are often taken as bycatch in the otter trawl fishery for cod. There are mixed saithe and golden redfish fisheries, where proportions of the two species depend on the spatio-temporal operation of each of the fisheries. This leads to two different métiers, as shown in Figure 23 (OTB-DEF-POK and OTB-DEF-REG).

Figure 24 illustrates species composition by individual hauls. Most of the cod is caught in hauls where it constitutes over 50% of the total catch. As another example, haddock is more frequently caught in fisheries directed at other species such as cod. Several species that are subjected to TAC are mainly taken as bycatch, meaning that most of their annual catch is taken in fishing operations where they form less than 50% of the haul catch. These species include spotted wolffish, Atlantic halibut, Norway redfish, whiting, blue ling, ling, tusk, witch, dab, anglerfish, and common skate. Species where mean annual catch is less than 50 tonnes are taken exclusively as bycatch (not shown).

There is no bycatch reported in the fishery targeting capelin. Mixed fisheries in pelagic fisheries, targeting one of herring, mackerel, or blue whiting are relatively low. In the mackerel fishery, herring (Icelandic summer-spawning and Norwegian spring-spawning combined) bycatch has varied between 5% and 14% during the last ten years (2011–2021). Mackerel bycatch during this period in the Norwegian spring-spawning herring fishery varied between 1% and 12%. In the blue whiting and Icelandic summer-spawning herring fisheries little bycatch (< 2%) was recorded.

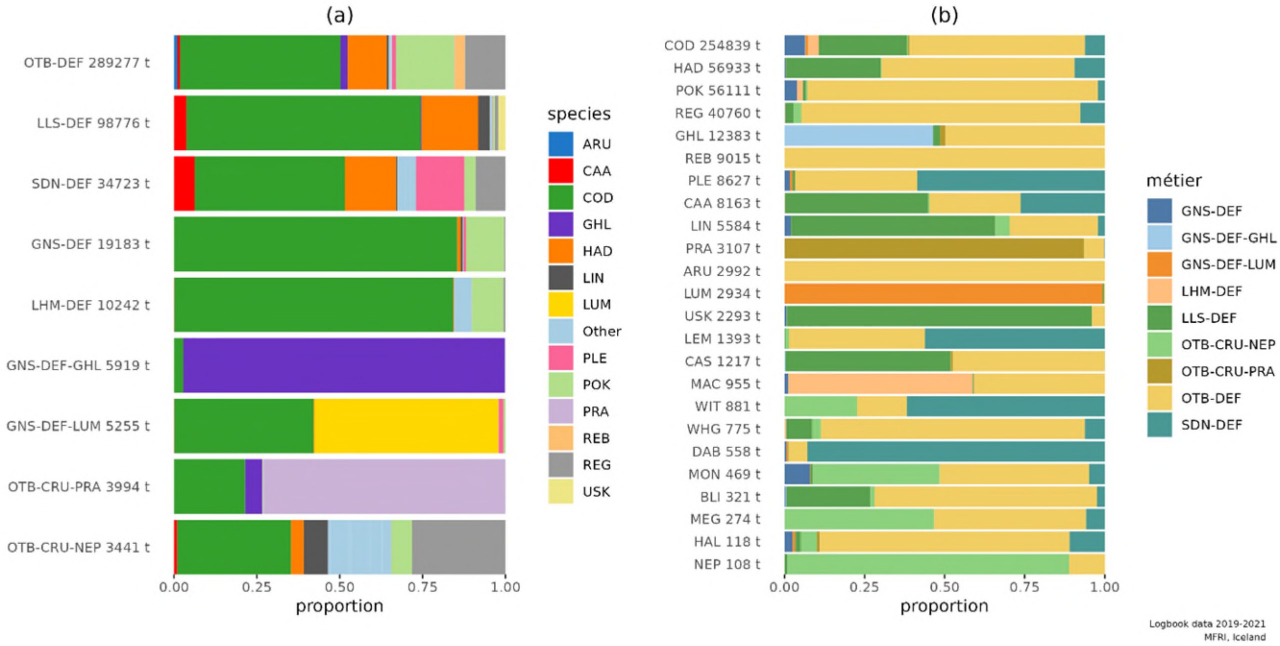


Figure 22 Description of technical interactions of demersal TAC species in the Icelandic Waters ecoregion. The left panel (a) shows the species composition of the main demersal métiers (catch > 99 tonnes) of the Icelandic fleet operating in Icelandic waters. The label incorporates métier and mean annual (2019–2021) catch in tonnes; species with mean annual catch < 2000 t are aggregated and labelled as "other" The right panel (b) shows the proportion of the catch of each species accounted for by the different demersal métiers. The label includes the mean annual landings (2019–2021). See Table A2 in the Annex for species definitions and Table A3 for métier definitions. Data were obtained from logbooks of the Icelandic fleet.

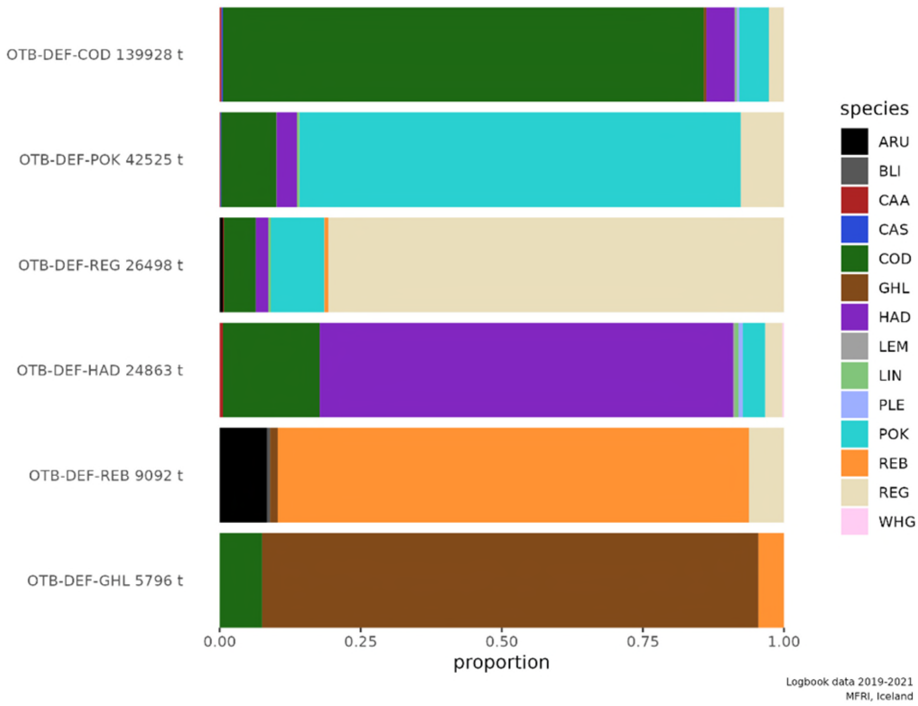


Figure 23 Description of technical interactions of demersal TAC species in the Icelandic Waters ecoregion caught with otter trawls. The panel shows the species composition of catches by demersal métiers (landings > 99 tonnes). The criteria for the division into métiers are that a given species was more than 50% of the total catch in a single haul (data obtained from logbooks). The label incorporates métier and mean annual (2019–2021) landings in tonnes. See Table A2 in the Annex for species definitions and Table A3 for métier definitions.

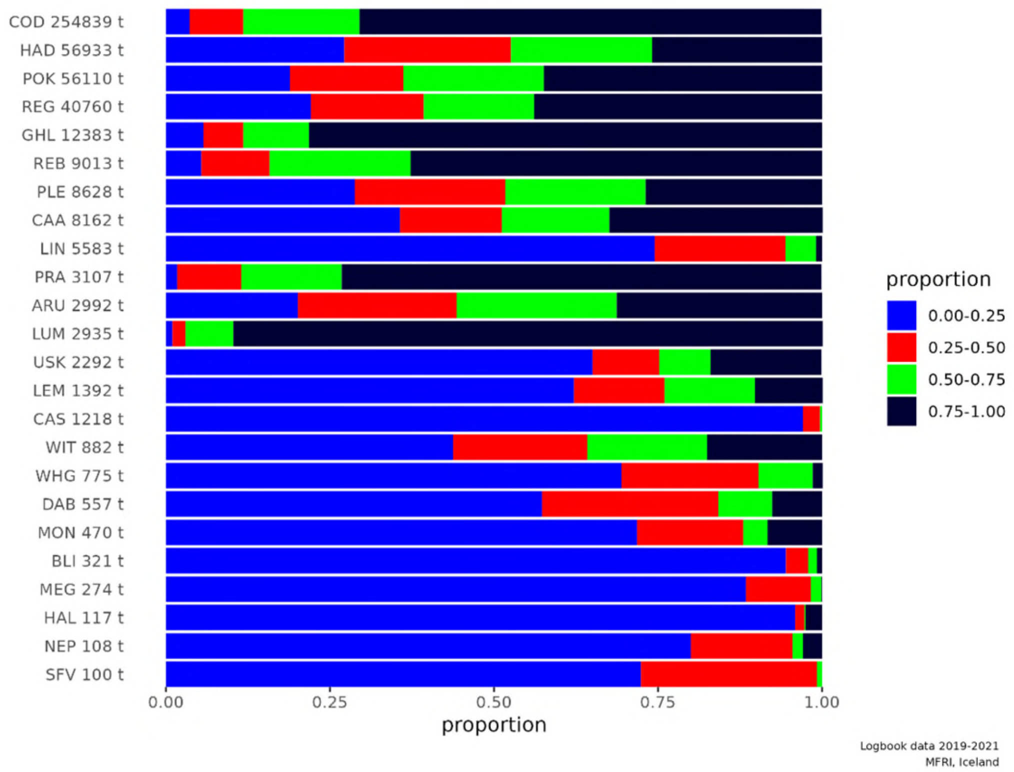


Figure 24 Description of technical interactions of demersal species in the Icelandic Waters ecoregion caught with bottom trawls, demersal seines, and static gears (all gears combined). The panel shows the proportion of a species out of the total catch in a single haul or set (0–0.25: ≤ 25% of the total catch of a species, 0.25–0.50: 25–50%, 0.50–0.75: 50–75%, and 0.75–1.00: ≥75%). The label includes the mean annual catch (2019–2021). See Table A2 in the Annex for species definitions.

Interactions between fisheries and the ecosystem

The fish species of commercial value in the Icelandic Waters ecoregion are clearly a significant part of the marine foodweb; they interact in various ways, including through predation and food competition. Generally, even if the pathways of the foodweb in the ecoregion are to some degree known, they are still poorly quantified. Consumption of fish by some predators has been estimated, but predation mortality has not been quantified; it is not, therefore, directly included other than within the general natural mortality estimates in the assessments of fish stocks in Icelandic waters.

Capelin is a key forage species in the ecoregion and is an important energy transfer within the ecosystem. Capelin feeds mainly on copepods and euphausiids, and it is one of the most important prey for several predators, e.g. cod, haddock, saithe, Greenland halibut, seabirds, and marine mammals. Other important prey species are shrimp and two sandeel species.

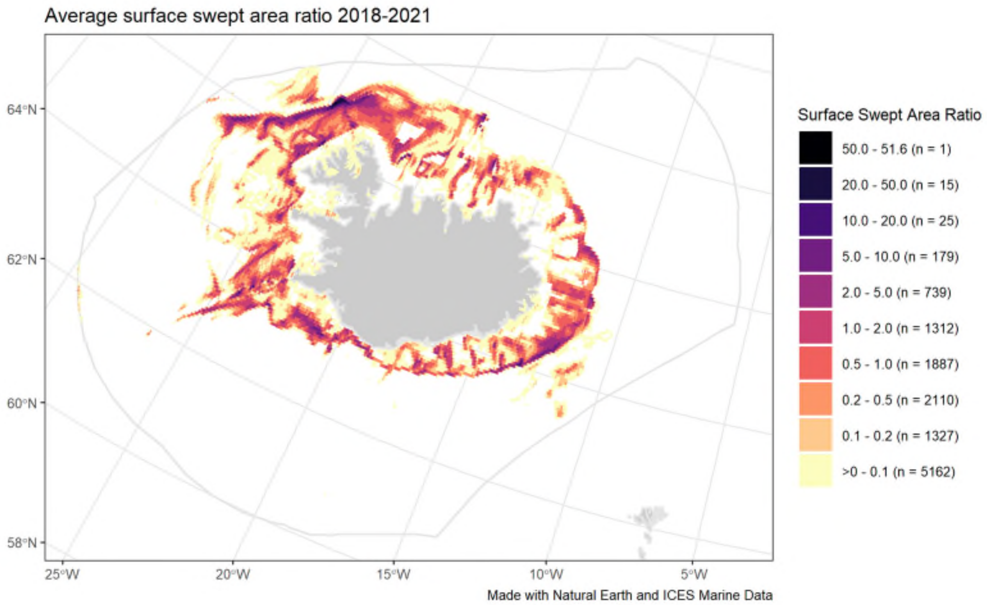
With more emphasis on sustainability, the precautionary approach, and rebuilding of fish stocks, fishing mortality has been reduced for many stocks in the ecoregion. This can alter the ratio between natural and fishing mortality. Natural mortality from predation can occur from other fish, seabirds, and marine mammals.

Effects of fisheries on the ecosystem

There are multiple effects on the fisheries ecosystems; two different effects are described in this section: (1) physical disturbance of benthic habitats by mobile bottom-contacting fishing gear; and (2) fisheries bycatch of protected, endangered, and threatened species.

Physical disturbance of benthic habitats by mobile bottom-contacting fishing gear

The main abrasive impact in the Icelandic Waters ecoregion is caused by mobile bottom-contacting fishing gears, mainly otter trawls targeting demersal fish, shrimp, and Norway lobster. Other mobile bottom-contacting fishing gears are demersal seines and dredges. Abrasion may affect the surface (top 2 cm of sediments) or the subsurface (> 2 cm), and affect fragile three-dimensional biogenic habitats in particular (e.g. sponge aggregations, coral gardens, and coral reefs). Most effects occur between 200 and 500 m depth ranges, while the effects on soft substrata in shallow waters have been shown to be minor. Other effects involve overturning boulders, scouring the seabed, and the direct removal of and/or damage to epifaunal organisms. The extent, magnitude, and effects of mobile bottom-contacting fishing gear on the seabed and benthic habitats vary geographically across the ecoregion (Figure 25). Some areas are subjected to very high fishing pressure when comparedwith other ecoregions.



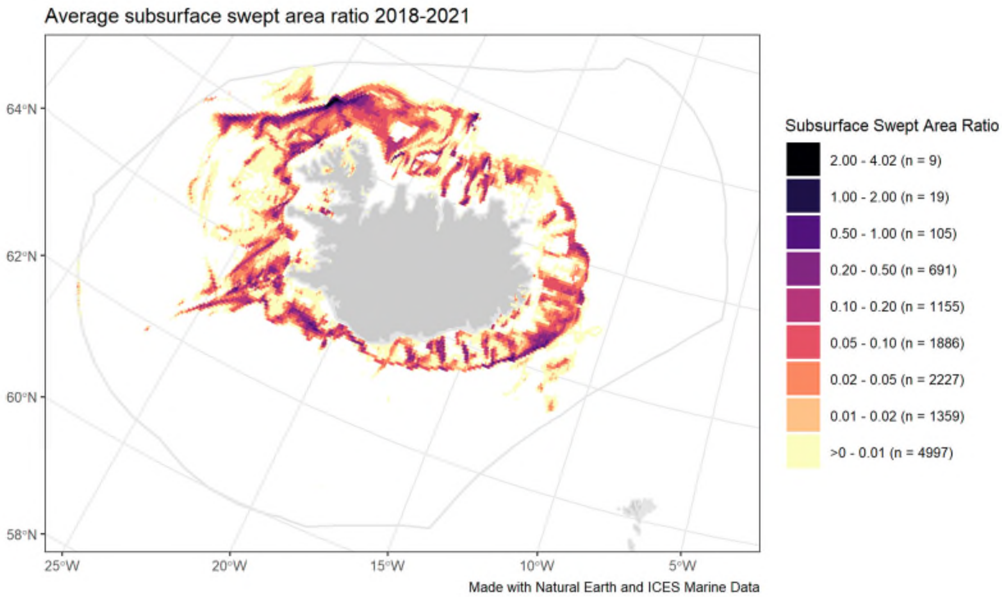


Figure 25 Average annual surface (top 2 cm of sediments; left) and subsurface (> 2 cm; right) disturbance by mobile bottom-contacting fishing gear (bottom otter trawls, demersal seines, beam trawls) in the Icelandic Waters ecoregion between 2015 and 2018, expressed as average swept-area ratios (SAR).

Bycatch of protected, endangered, and threatened species

All fisheries have the potential to catch protected, endangered, or threatened species such as seabirds and marine mammals as non-targeted bycatch.

Data submitted to ICES through annual data calls indicated that between 2017–2021 one ICES Member Country had fisheries operating in the Icelandic Waters ecoregion (ICES, 2022b). During the same period approximately 2800 monitoring days were undertaken by at-sea observers for a variety of static and mobile gears on vessels ranging from under 15 m to over 40 m. Bycatch data collection in the ecoregion is carried out within multipurpose catch/bycatch programs and to a lesser extent through specific research projects.

Bycatch records in 2021

In 2021, 49 marine mammals from five species were recorded as bycatch, all of which were reported from passive net fisheries (Table 1). Two hundred and ninety-seven seabirds from ten species were recorded as bycatch mainly in passive net fisheries. Approximately 10 600 specimens of fish of bycatch relevance were recorded mostly from bottom-trawl fisheries. No turtles were reported as bycatch

Table 1 The five most frequently reported marine mammal, seabird, fish and turtle species in the Icelandic Waters ecoregion in2021, based on data submitted through ICES data call and held in the bycatch database of ICES Working Group on Bycatch of Protected Species (WGBYC).

Marine mammals		Seabirds	
Species	Number reported	Species	Number reported
Harbour porpoise	36	Guillemot	279
Harbour seal	7	Northern fulmar	4
Grey seal	2	Black guillemot	3
White-beaked dolphin	2	Common eider	3
Harp seal	2	European shag	2
Fish		**Turtles**	
Species	Number reported	Species	Number reported
Blackbelly rosefish/bluemouth rockfish	5181	None reported	0
Rabbit fish	1590		
Black dogfish	1152		
Esmark's eelpout	630		
Great lanternshark	485		

Multiannual bycatch rates

The highest cumulative bycatch rate (pooled data 2017–2021) for marine mammals was recorded in set gillnets (GNS). A low overall rate was recorded in bottom otter trawls (OTB; Figure 26). At species level, the highest marine mammal bycatch rates were observed for harbour porpoise and harbour seal in set gillnets. Lower bycatch rates were observed for harp seal, white-beaked dolphin, and grey seal in set gillnets and harp seal in bottom otter trawls.

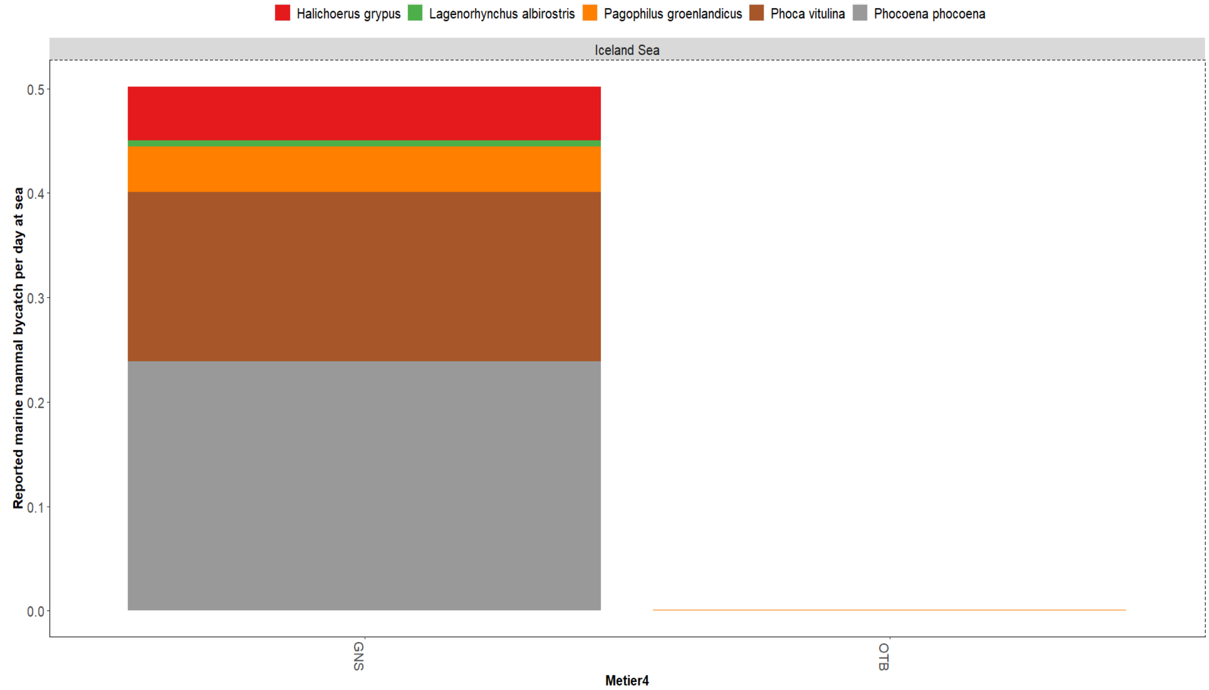


Figure 26 Reported marine mammal bycatch rates in the Icelandic Waters ecoregion 2017–2021 by métier level 4[1]. GNS = set gillnets, OTB = bottom otter trawls

The highest cumulative bycatch rate (pooled data 2017–2021) for seabirds was recorded in set gillnets (GNS), with lower overall rates recorded in set longlines (LLS) and midwater otter trawls (OTM). At species level, the highest seabird bycatch rates were observed for guillemot and common eider in set gillnets and northern fulmar in set longlines (Figure 27). Lower bycatch rates were observed for black guillemot and northern fulmar in set gillnets, herring gull in set longlines, and guillemot in midwater otter trawls.

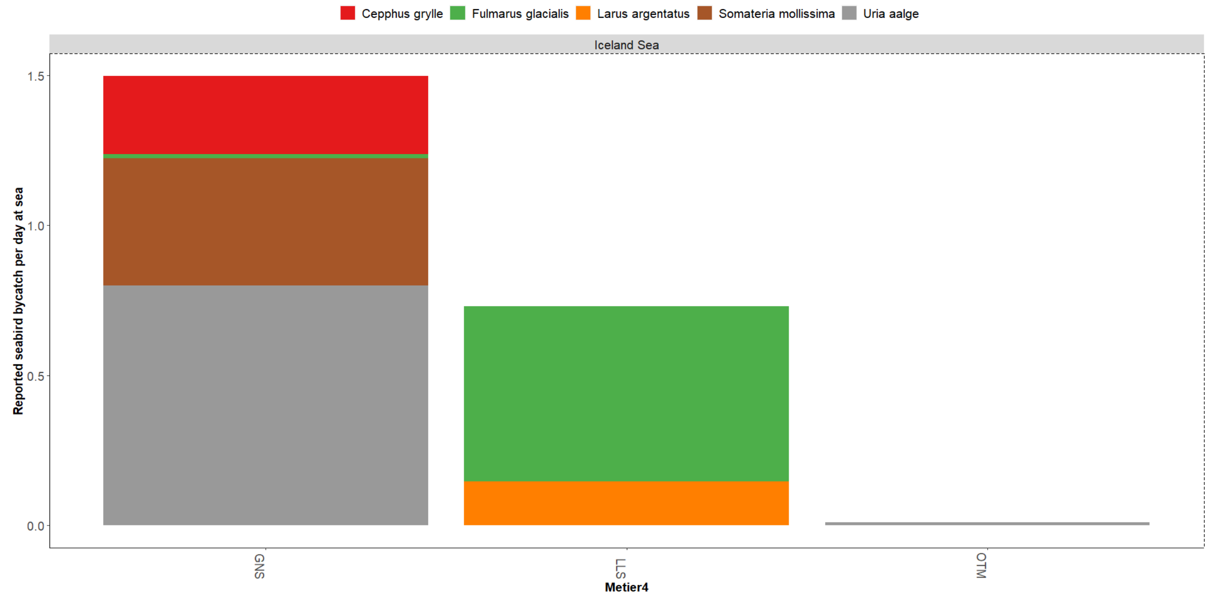


Figure 27 Reported seabird bycatch rates in the Icelandic Waters ecoregion 2017–2021 by métier level 4. GNS = set gillnets, LLS = longlines, OTM = midwater otter trawls.

[1] A full description of métiers can be found at https://vocab.ices.dk/?ref=1498

Fishing effort

Annual reported fishing effort (2019–2021) for métiers with recorded bycatch is shown in Figure 28. The highest fishing effort was reported for bottom otter trawls (OTB) and set longlines (LLS). Lower effort was reported for set gillnets and midwater otter trawls (OTM). Reported set gillnet effort, which is associated with the highest bycatch rates for mammals and seabirds, declined by approximately 50% in 2021. The three-year trend for the other métiers presented in Figure 28 are more stable. Métiers with low recorded bycatch rates but high fishing effort can result in high total bycatch estimates.

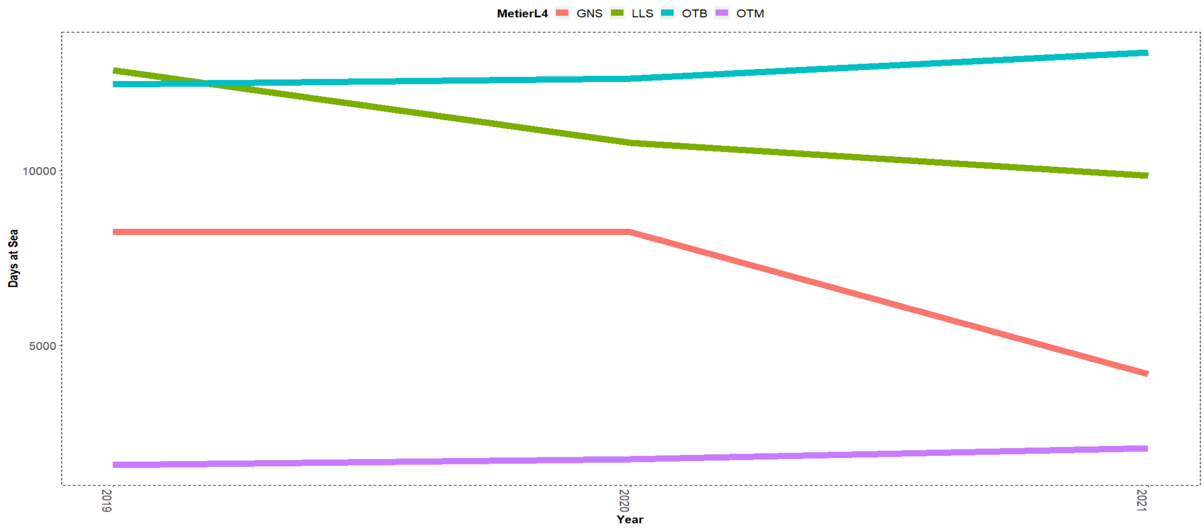


Figure 28 Fishing effort in days-at sea (DaS) by year (2019–2021) for the level 4 métiers with reported bycatch in the Icelandic Waters ecoregion. Fishing effort data prior to 2019 are not presented due to possible reporting inconsistencies. GNS = set gillnets, LLS = longlines, OTB = bottom otter trawls, OTM = midwater otter trawls.

Additional information

Harbour porpoise is the most common marine mammal bycatch. The annual estimate of bycatch of this species has decreased from 7300 animals in 2003, to 2000 animals in 2018. The annual estimated bycatch of harbour porpoise (2009–2017) ranged from 0.5–6.0% of the estimated abundance of the species from the most recent aerial survey of Icelandic coastal waters in 2007.

Harbour seal is mainly taken as bycatch in lumpfish and cod gillnet fisheries. Annual bycatch was estimated at 900–1800 animals which represents 9–19% of the current abundance estimates of the species in Icelandic waters. Bycatch levels of harbour seals is largely dependent on the fishing effort for lumpfish.

Grey seal is mainly caught as bycatch in the lumpfish gillnet fishery. Annual bycatch was estimated at 500–1500 animals, which represents approximately 8–24% of the current abundance estimates of the species in Icelandic waters.

Harp seal, ringed seal, and bearded seal are also bycaught in the lumpfish fishery, but to a lesser extent than harbour and grey seal. Bycatch was estimated at around 240 harp seals, 50 ringed seals, and 30 bearded seals annually.

The combined population abundance of the two cormorant species (great cormorant and European shag) in Icelandic waters is estimated at around 16 000 birds per year, and annual bycatch in the lumpfish fishery was estimated at 900 birds, or 6% of the estimated stock size. The population abundance of black guillemot in Icelandic waters was estimated at between 20 000 and 40 000 birds. The annual bycatch of black guillemot in the lumpfish fishery in 2014–2018 was estimated at 1653 birds, or 4–8% of estimated abundance.

Several species listed on the OSPAR list of threatened and declining species are known bycatch species in Icelandic fisheries. These species are leafscale gulper shark, basking shark, porbeagle shark, spiny dogfish, and common skate.

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Annex

Table A1 Status summary of ten Icelandic Waters ecoregion stocks accessed by ICES in 2021 and 2022 relative to maximum sustainable yield (MSY), and management (MGT) reference points, and ICES precautionary approach (PA). For MSY and MGT: green represents a stock that is fished below F_{MSY} or F_{MGT} or whose size is greater than MSY $B_{trigger}$ or MGT $B_{trigger}$; red represents a stock that is fished above F_{MSY} or F_{MGT} or whose size is lower than MSY $B_{trigger}$ or MGT $B_{trigger}$. For PA: green represents a stock that is fished below F_{pa} or whose size is greater than B_{pa}; yellow represents a stock that is fished between F_{pa} and F_{lim} or whose size is between B_{lim} and B_{pa}; red represents a stock that is fished above F_{lim} or whose size is less than B_{lim}. Stocks with a fishing mortality below or at F_{pa} and a size above B_{pa} are defined as being inside safe biological limits. Grey represents stocks for which reference points are unknown. MSFD = EU Marine Strategy Framework Directive; D3C1 = MSFD indicator for fishing mortality; D3C2 = MSFD indicator for spawning-stock biomass; SBL = safe biological limits; GES = good environmental status. Stock codes contain a hyperlink for the most recent ICES advice. cap.27.2a514 refers to the advice current at this time (the advice applicable for 2022).

Stock	Stock description	Data category	Fisheries guild	Assessment year	Advice category	Reference points	Fishing pressure	Stock size	D3C1	D3C2	SBL	GES
aru.27.5a14	Greater silver smelt in Subarea 14 and Division 5.a	1	Demersal	2022	MSY	MSY	✔	✔	✔	✔	✔	✔
						PA	✔	✔	✔	✔		
bli.27.5a14	Blue ling in Subarea 14 and Division 5.a	3.2	Demersal	2022	MSY	MSY	✘	✔	✘	✔	?	✘
						PA	?	?	?	?		
caa.27.5a	Atlantic wolffish in Division 5.a	1	Demersal	2022	MP	MGT	✘	✔	✘	✔	✘	✘
						PA	O	✔	O	✔		
cap.27.2a514	Capelin in subareas 5 and 14 and Division 2.a west of 5°W	1.8	Pelagic	2022	MP	MSY	?	?	?	?	?	?
						PA	?	✔	?	✔		
cod.27.5a	Cod in Division 5.a	1	Demersal	2022	MP	MGT	✘	✔	✘	✔	✔	✘
						PA	✔	✔	✔	✔		
ghl.27.561214	Greenland halibut in subareas 5, 6, 12, and 14	1	Demersal	2022	MSY	MSY	✔	✔	✔	✔	✔	✔
						PA	✔	✔	✔	✔		
had.27.5a	Haddock in Division 5.a	1	Demersal	2022	MP	MGT	✘	✔	✘	✔	✘	✘
						PA	O	✔	O	✔		

Stock	Stock description	Data category	Fisheries guild	Assessment year	Advice category	Reference points	Fishing pressure	Stock size	D3C1	D3C2	SBL	GES
her.27.5a	Herring in Division 5.a, summer-spawning herring	1	Pelagic	2022	MP	MGT	✗	✓	✗	✓	✗	✗
						PA	O	✓	O	✓		
her.27.1-24a514a	Herring in subareas 1, 2, and 5, and in divisions 4.a and 14.a	1	Pelagic	2022	MSY	MSY	✗	✓	✗	✓	✗	✗
						PA	O	✓	O	✓		
lin.27.5a	Ling in Division 5.a	1	Demersal	2022	MP	MGT	✗	✓	✗	✓	✓	✗
						PA	✓	✓	✓	✓		
mac.27.nea	Mackerel in subareas 1–8 and 14, and in Division 9.a	1	Pelagic	2022	MSY	MSY	✗	✓	✗	✓	✓	✗
						PA	✓	✓	✓	✓		
ple.27.5a	Capelin in subareas 5 and 14 and Division 2.a west of 5°W	1	Demersal	2022	MP	MGT	✗	✓	✗	✓	✓	✗
						PA	✓	✓	✓	✓		
pok.27.5a	Saithe in Division 5.a	1	Demersal	2022	MP	MGT	✗	✓	✗	✓	✓	✗
						PA	✓	✓	✓	✓		
reb.2127.dp	Beaked redfish in ICES subareas 5, 12, and 14 (deep pelagic stock)	1	Demersal	2021	MP	MSY	✗	✗	✗	✗	✗	✗
						PA	✗	✗	✗	✗		
reb.2127.sp	Beaked redfish in ICES subareas 5, 12, and 14 (shallow pelagic stock)	3.3	Demersal	2021	PA	MSY	?	?	?	?	?	?
						PA	?	?	?	?		
reb.2127.dp	Beaked redfish in ICES Division 5a and Subarea 14 (Icelandic slope stock)	3.2	Demersal	2022	PA	MSY	?	?	?	?	?	?
						PA	?	?	?	?		
reg.27.561214		1	Demersal	2022	MP	MSY	✗	✓	✗	✓	✓	✗

Stock	Stock description	Data category	Fisheries guild	Assessment year	Advice category	Reference points	Fishing pressure	Stock size	D3C1	D3C2	SBL	GES
	Golden redfish in subareas 5, 6, 12, and 14					PA	✓	✓	✓	✓		
usk.27.5a14	Tusk in Subarea 14 and Division 5.a	1	Demersal	2022	MP	MGT	✗	✓	✗	✓	✗	✗
						PA	o	✓	o	✓		
whb.27.1– 91214	Blue whiting in subareas 1–9, 12, and 14	1	Pelagic	2022	MP	MSY	✗	✓	✗	✓	✗	✗
						PA	o	✓	o	✓		

Table A2 Scientific names of species.

Common name	Scientific name	Species code	Assemblage	Assemblage code
Anglerfish	*Lophius piscatorius*	MON	Demersal fish	DEF
Atlantic cod	*Gadus morhua*	COD	Demersal fish	DEF
Atlantic halibut	*Hippoglossus hippoglossus*	HAL	Benthic	BEN
Atlantic wolffish	*Anarhichas lupus*	CAA	Demersal fish	DEF
Basking shark	*Cetorhinus maximus*	BSK	Elasmobranch	
Beaked redfish	*Sebastes mentella*	REB	Demersal fish	DEF
Bearded seal	*Erignathus barbatus*			
Black dogfish	*Centroscyllium fabricii*		Elasmobranch	
Black guillemot	*Cepphus grylle*			
Blackbelly rosefish	*Blackbelly rosefish*		Demersal fish	DEF
Blue ling	*Molva dypterygia*	BLI	Demersal fish	DEF
Blue whiting	*Micromesistius poutassou*	WHB	Small pelagic fish	SPF
Capelin	*Mallotus villosus*	CAP	Small pelagic fish	SPF
Common eider	*Somateria mollissima*			
Common murre	*Uria aalge*			
Common skate	*Dipturus batis*	RJB	Elasmobranch	
Common whelk	*Buccinum undatum*	UHE	Molluscs and invertebrates	MOL
Dab	*Limanda limanda*	DAB	Benthic	BEN
Esmark's eelpout	*Lycodes esmarkii*		Demarsal fish	DEF
European shag	*Phalacrocorax aristotelis*			
Fin whale	*Balaenoptera physalus*		Whaling	
Golden redfish	*Sebastes norvegicus*	REG	Demersal fish	DEF
Great cormorant	*Phalacrocorax carbo*			
Great lanternshark	*Etmopterus princeps*		Elasmobranch	
Greater silver smelt	*Argentina silus*	ARU	Demersal fish	DEF
Greenland halibut	*Reinhardtius hippoglossoides*	GHL	Demersal fish	DEF
Grey seal	*Halichoerus grypus*			
Guillemot	*Uria aalge*			
Haddock	*Melanogrammus aeglefinus*	HAD	Demersal fish	DEF
Harbour porpoise	*Phocoena phocoena*			
Harbour seal	*Phoca vitulina*			
Harp seal	*Pagophilus groenlandicus*			
Herring	*Clupea harengus*	HER	Small pelagic fish	SPF
Herring gull	*Larus argentatus*			
Iceland scallop	*Chlamys islandica*	ISC	Molluscs and invertebrates	MOL
Leafscale gulper shark	*Centrophorus squamosus*	GUQ	Elasmobranch	
Lemon sole	*Microstomus kitt*	LEM	Benthic	BEN
Ling	*Molva molva*	LIN	Demersal fish	DEF
Long rough dab	*Hippoglossoides platessoides*	PLA	Benthic	BEN
Lumpfish	*Cyclopterus lumpus*	LUM	Demersal fish	DEF
Mackerel	*Scomber scombrus*	MAC	Small pelagic fish	SPF
Minke whale	*Balaenoptera acutorostrata*		Whaling	
Northern fulmar	*Fulmarus glacialis*			
Northern gannet	*Morus bassanus*			
Northern shrimp	*Pandalus borealis*	PRA	Crustaceans	CRU
Norway lobster	*Nephrops norvegicus*	NEP	Crustaceans	CRU
Norway redfish	*Sebastes viviparus*	SFV	Demersal fish	DEF
Ocean quahog	*Arctica islandica*	CLQ	Molluscs and invertebrates	MOL
Plaice	*Pleuronectes platessa*	PLE	Benthic	BEN
Porbeagle	*Lamna nasus*	POR	Elasmobranch	
Ringed seal	*Pusa hispida*			
Saithe	*Pollachius virens*	POK	Demersal fish	DEF
Lesser sandeel	*Ammodytes marinus*		Benthic	
Small sandeel	*Ammodytes tobianus*		Benthic	

Common name	Scientific name	Species code	Assemblage	Assemblage code
Sea cucumber	*Cucumaria frondosa*	KHG	Molluscs and invertebrates	MOL
Sea urchin	*Strongylocentrotus droebachiensis*	UYD	Molluscs and invertebrates	MOL
Spiny dogfish	*Squalus acanthias*	DGS	Elasmobranch	DEF
Spotted wolffish	*Anarhichas minor*	CAS	Demersal fish	DEF
Tusk	*Brosme brosme*	USK	Demersal fish	DEF
Witch flounder	*Glyptocephalus cynoglossus*	WIT	Benthic	BEN
White-beaked dolphin	*Lagenorhynchus albirostris*			
Whiting	*Merlangius merlangus*	WHG	Demersal fish	DEF

Table A3 Métier definitions.

Gear type	Target assemblage	Métier label
Dredges	Molluscs and invertebrates other than Norway shrimp and Norway lobster	DBR_MOL
Gillnets	Demersal fish, other than Greenland halibut and lumpfish	GNS_DEF
	Greenland halibut	GNS_DEF_GHL
	Lumpfish	GNS_DEF_LUM
Handlines (mechanized)	Demersal fish	LHM_DEF
Longlines	Demersal fish	LLS_DEF
Otter trawls	Crustaceans – Northern shrimp	OTB_CRU_PRA
	Crustaceans – Norway lobster	OTB_CRU_NEP
	Demersal fish	OTB_DEF
Pelagic trawls	Small pelagic fish	OTM_SPF
Purse-seines	Small pelagic fish	PS_SPF
Demersal seines	Demersal fish	SDN_DEF