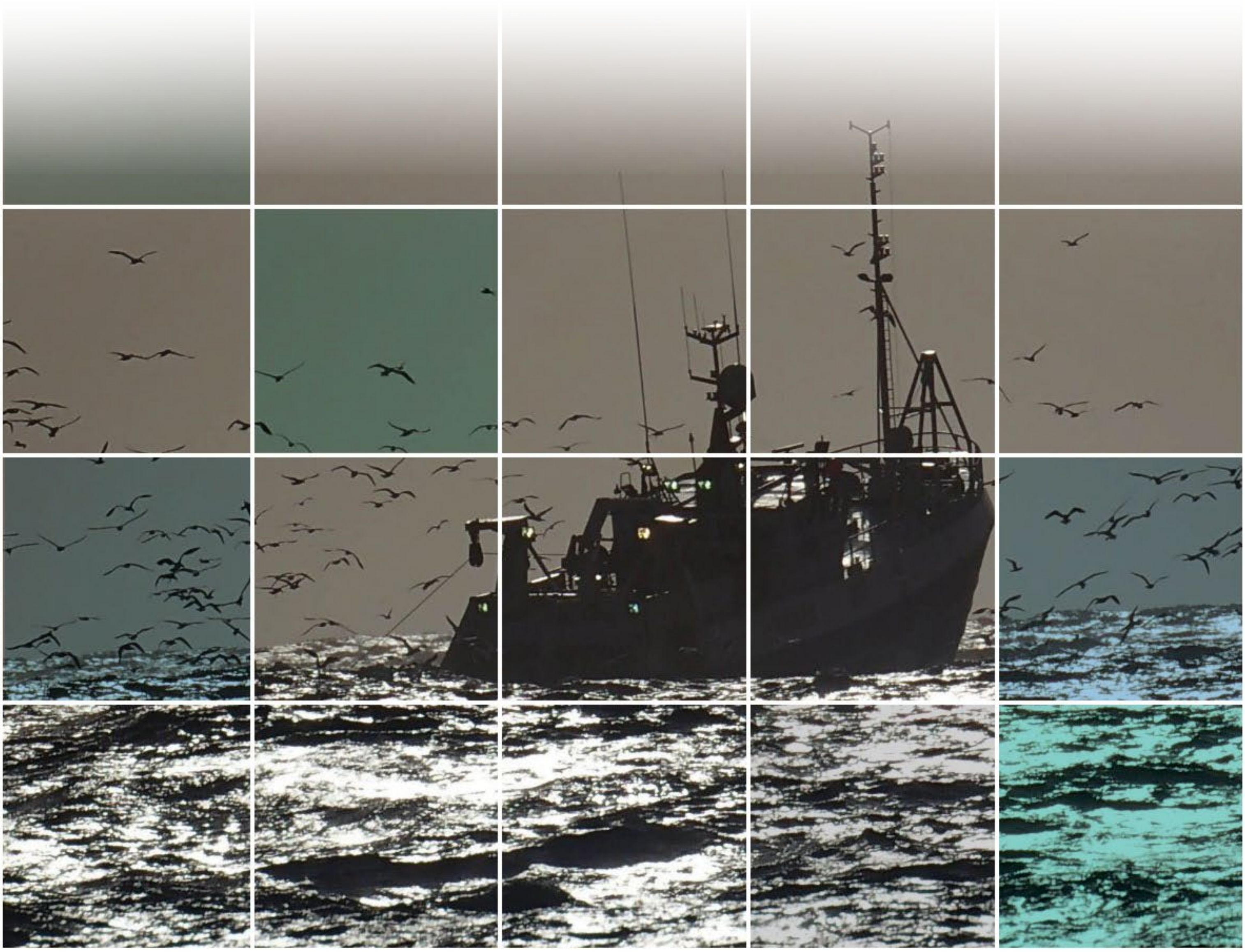
Trends in Scottish Fish Stocks 2022

Ian R. Napier

14th November 2022



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(ian.napier@uhi.ac.uk)

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www.shetland.uhi.ac.uk/research/statistics/reports

UHI Shetland
Port Arthur
Scalloway
Shetland ZE1 0UN
Tel: 01595 772000
Email: shetland@uhi.ac.uk
Web: www.shetland.ac.uk

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Summary

This report summarises the most recently published data from the International Council for the Exploration of the Sea (ICES) on the state of commercially important fish stocks in the waters around Scotland. These data reveal trends in the sizes of these fish stocks and in the levels of exploitation. This information informs the scientific advice that ICES provides on the future management of these fish stocks.

The general overall picture continues to be one of relatively high abundances, following increases over the last two decades, and of relatively low levels of exploitation following decreases over the same time period.

Introduction

Published data have been collated and summarized to provide an overview of trends in the size of, and in the levels of exploitation of, commercially important Scottish fish stocks, particularly those that are of importance to the Shetland fishing fleet.

This report was updated in November 2022 to include the latest information published in October and November 2022.

Data

Data were collated from the latest advice published by the International Council for the Exploration of the Sea (ICES)*. ICES is the inter-governmental organisation that coordinates and promotes marine research in the North-East Atlantic Ocean, including assessing the status of fish stocks and providing advice on their management. ICES stock assessments are based on the analysis of data from a variety of sources, including landings, fishermen's logbooks, scientific observers on-board fishing boats, and research vessel surveys.

Fish species are divided into separate stocks in different areas. For some species ICES assesses a stock separately in the North Sea (ICES Sub-Area IV) but for others a single stock is assessed covering the North Sea and West of Scotland (ICES Sub-Area VIa) together. A few stocks are assessed across larger areas.

The time periods over which data are available vary between stocks and areas. Long time-series, extending back to the 1960s or 1950s, are available for a few species

* The latest ICES Advice is available online at: www.ices.dk/advice/Pages/Latest-Advice.aspx

(such as cod and plaice) but for others (such as monks or megrim) the available time series are much shorter.

Two parameters are commonly used to reflect the size of fish stocks and the level of exploitation:

The **Spawning Stock Biomass** (**SSB**) is the estimated biomass (weight) of sexually mature fish in a stock.

The **Fishing Mortality Rate (*F*)** is an index of the proportion of a fish stock that is removed (caught) each year and provides a measure of the level of exploitation. F is measured on a logarithmic scale, such that a value of 1.0 ($F_{1.0}$) corresponds to 63% of the stock being removed each year, $F_{0.7}$ corresponds to 50% of the stock being removed and $F_{0.5}$ to 39%.

For some species (including monks and ling) ICES uses other indices to reflect the size and level of exploitation of stocks.

The Gadoid Outburst

Starting in the 1960s – for reasons that are still unclear – there was an unprecedented increase in the abundances of some gadoid species (such as cod, haddock, saithe and whiting) in the North Sea, with five to six-fold increases in their biomasses[*]. This 'gadoid outburst' lasted into the 1970s and, in some cases, the early 1980s.

The available time-series of abundance of some of the gadoid fish stocks start during or shortly after the gadoid outburst and may thus give a misleading impression of the 'normal' size of these stocks. It has been suggested that the declines in the abundances of these gadoid species from the 1970s to the early 1990s should be regarded as a return to 'normal' levels of abundance[*].

[*] Hislop, J.R.G. (1996). Changes in North Sea gadoid Stocks. *ICES Journal of Marine Science* 53: 1146-1156. (Available at: https://doi.org/10.1006/jmsc.1996.0140)

Cover picture courtesy of Shetland Fishermen.

Cod

North Sea

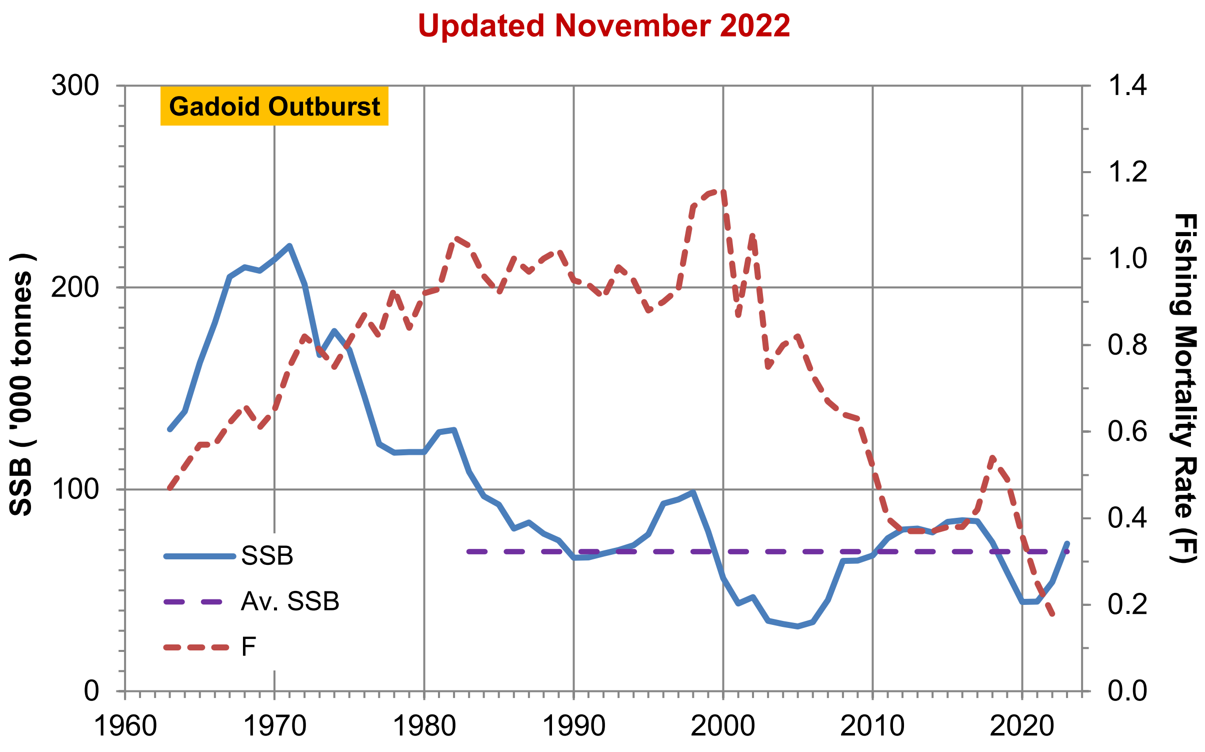

Figure 1 The spawning stock biomass (SSB) of North Sea cod from 1963 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1963 to 2021 with the projected *F* in 2022. The horizontal dashed line shows the average SSB over the last 40 years (1983 – 2022). In the 1960s and 1970s the abundance of cod was enhanced by the 'gadoid outburst' (see p. 3). (ICES Data; see p. 2.)

The abundance of cod in the North Sea peaked during the gadoid outburst in the 1960s and 1970s (see page 3). Following the outburst, the spawning stock biomass (SSB) generally declined until the mid-1980s, since when it has fluctuated.

Over the last 40 years (since the early-1980s) the abundance of North Sea cod has fluctuated around an average of about 69,000 tonnes. The SSB increased by 22% in 2022 and is predicted to increase by a further 35% in 2023 taking it above that long-term average.

The fishing mortality rate (*F*) increased during the period of the gadoid outburst and remained high during the 1980s and 1990s. After 2000 it fell rapidly, declining by two-thirds between 2000 and 2012. Although it increased around 2018, the fishing mortality has again fallen steeply since then and in 2021 was at its lowest ever recorded level with a further fall predicted in 2022.

Haddock

North Sea & W. of Scotland

Updated June 2022

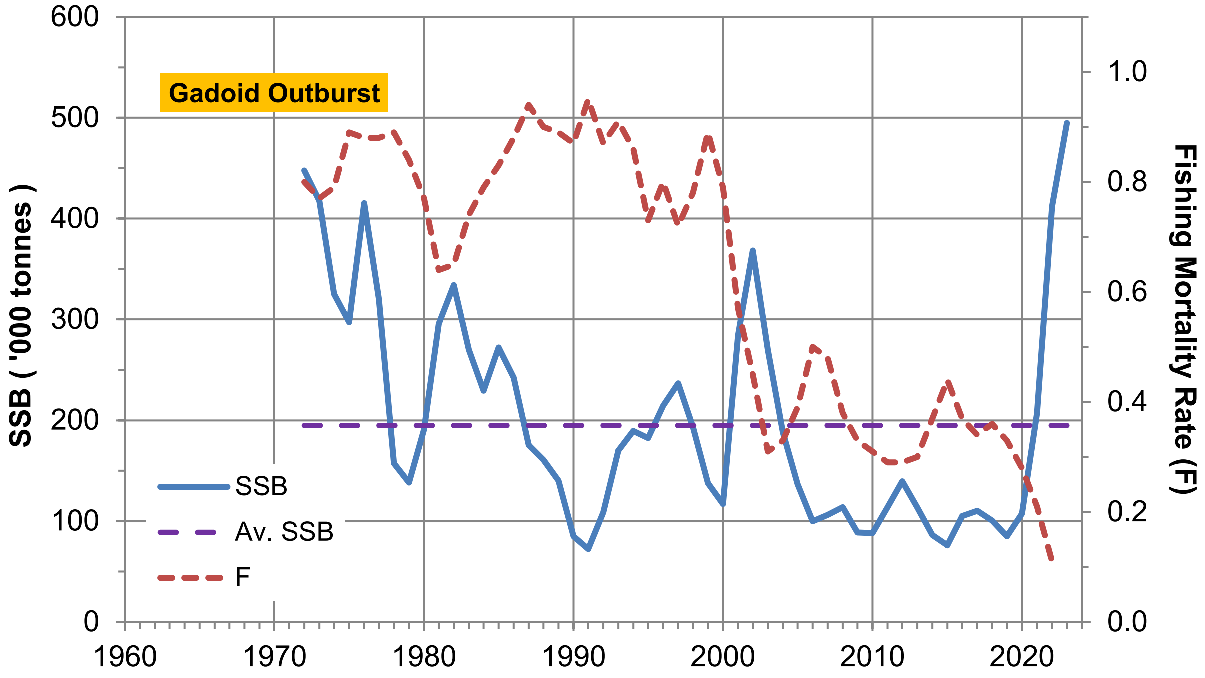

Figure 2 The spawning stock biomass (SSB) of the combined North Sea and West of Scotland haddock from 1972 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1972 to 2021 with the projected *F* in 2022. The horizontal dashed line shows the average SSB over the whole time-series (1972 – 2022). In the 1960s and 1970s the abundance of haddock was enhanced by the 'gadoid outburst' (see p. 3). (ICES Data; see p. 2.)

Since 2015 haddock in the North Sea and West of Scotland areas have been assessed as a single stock. The spawning stock biomass (SSB) of haddock is characterised by large fluctuations reflecting the biology of the species.

The SSB of haddock in 2022 is larger than at any time since 1973, having increased five-fold in the three years since 2019. A further substantial increase in the stock size is predicted in 2023 which will take the estimated stock size to a record high of almost half a million tonnes.

Cover picture courtesy of Shetland Fishermen.

The fishing mortality rate (*F*) for haddock remained generally relatively high until 2000, after which it fell sharply. It fluctuated during the 2000s and 2010s but has declined sharply again in the last few years to its lowest recorded level.

Saithe

North Sea & W. of Scotland

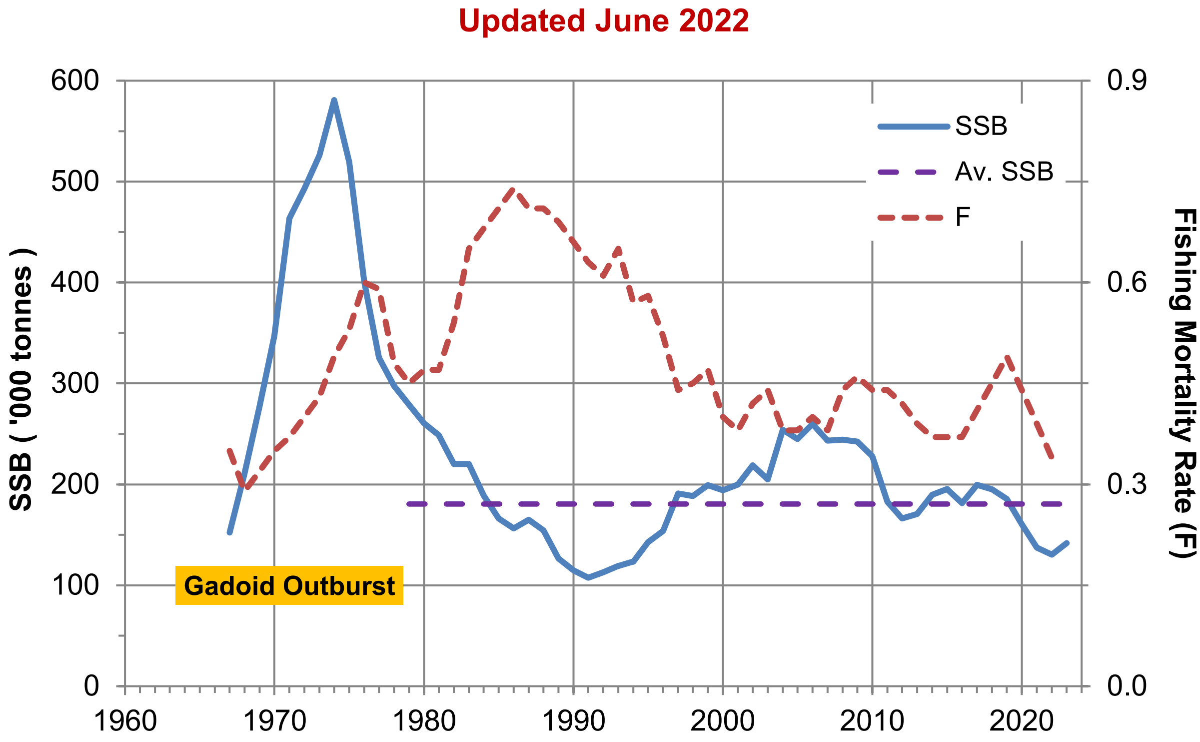

Figure 3 The spawning stock biomass (SSB) of the North Sea and West of Scotland saithe stock from 1967 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1963 to 2021 with the projected *F* in 2022. The horizontal dashed line shows the average SSB over the last 40 years (1983 – 2022). In the 1960s and 1970s the abundance of saithe was enhanced by the 'gadoid outburst' (see p. 3). (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of saithe in the North Sea and West of Scotland areas peaked during the gadoid outburst (see page 3), after which it declined to the mid-1980s. Since then, it has fluctuated about a long-term average. The stock size is predicted to increase by 9% in 2023.

The fishing mortality rate (*F*) for saithe generally declined after the mid-1980s and has fluctuated during the 2000s and 2010s. It has declined sharply in the last few years and is now at its lowest level for more than 50 years (since 1969).

Cover picture courtesy of Shetland Fishermen.

Whiting

North Sea

Updated June 2022

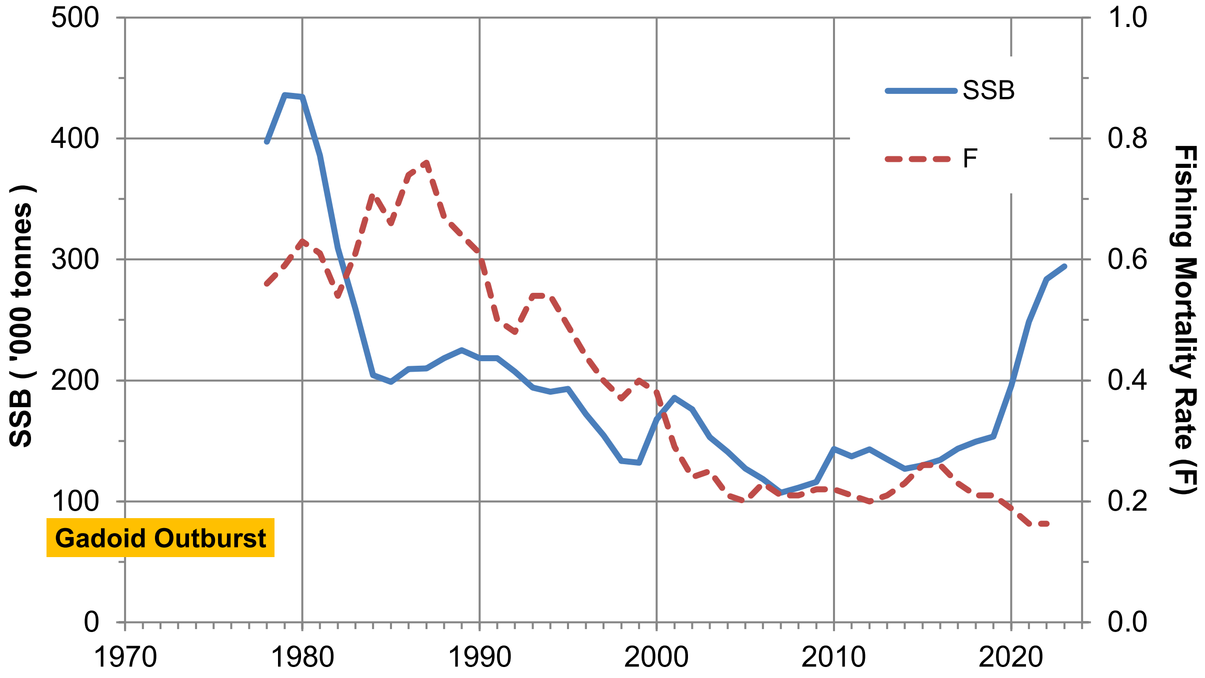

Figure 4 The spawning stock biomass (SSB) of North Sea whiting from 1978 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1978 to 2021 with the projected *F* in 2022. In the 1960s and 1970s the abundance of whiting was enhanced by the 'gadoid outburst' (see p. 3). (ICES Data; see p. 2.)

Having declined from a peak in 1980 (towards the end of the gadoid outburst), the spawning stock biomass (SSB) of whiting in the North Sea fluctuated but remained generally fairly stable over the last few decades.

However, the SSB of North Sea whiting has increased sharply in the last few years, doubling in size over the five years from 2017 to 2022. A further increase (of 4%) is predicted in 2023 which will take the stock close to 300,000 tonnes, its largest size for 40 years.

The fishing mortality rate (*F*) for whiting in the North Sea generally declined from the late-1980s to the mid-2000s. Following a period of relative stability, it has declined again in recent years to its lowest ever recorded level.

Plaice

North Sea

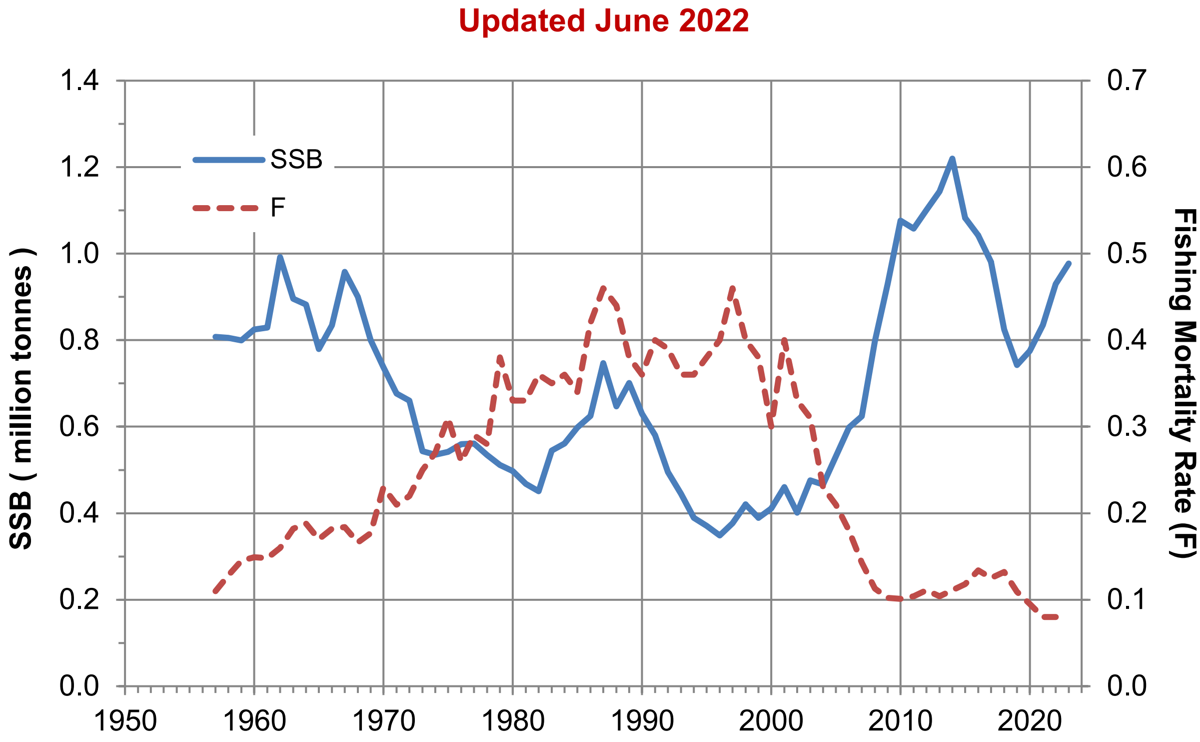

Figure 5 The spawning stock biomass (SSB) of North Sea plaice from 1957 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1957 to 2021 with the projected *F* in 2022. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of plaice in the North Sea generally declined from the late 1950s until the mid-1990s (plaice was not affected by the gadoid outburst). From the mid-2000s the SSB of plaice increased dramatically, more than doubling over the 10 years to 2014. Although it declined after 2014, the SSB of North Sea plaice has again increased substantially in recent years and a further 5% increase is predicted in 2023 which will take the stock close to one million tonnes.

The fishing mortality rate (*F*) for plaice in the North Sea generally increased until the late 1990s, after which it fell rapidly. After 2010 it remained relatively stable but is has declined again in recent years to its lowest ever recorded level.

Cover picture courtesy of Shetland Fishermen.

Common (Dover) Sole

North Sea

Updated June 2022

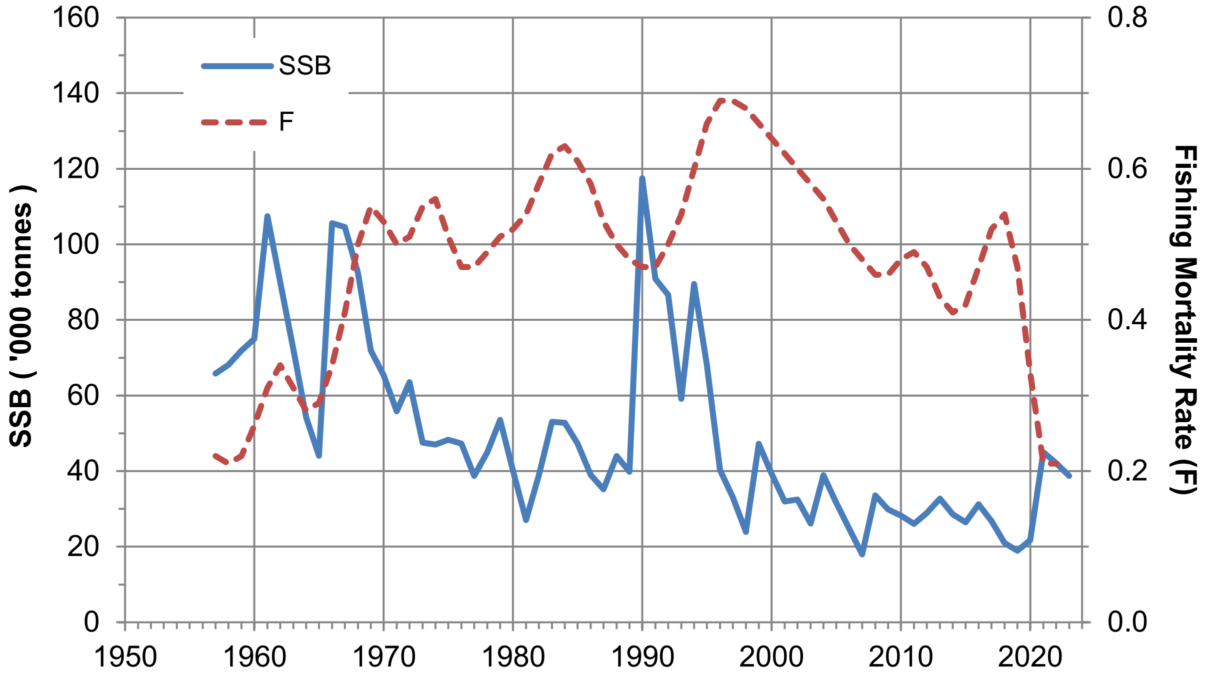

Figure 6 The spawning stock biomass (SSB) of North Sea common sole (Dover sole) from 1957 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1957 to 2021 with the projected *F* in 2022. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of common (Dover) sole in the North Sea has remained relatively stable over the last 60 years, albeit with some very large fluctuations. The SSB has remained fairly stable over the last two decades but there was a large increase in 2021 followed by a small fall in 2022.

The fishing mortality rate (*F*) for common sole in the North Sea generally increased from the 1960s through the 1990s, though with large fluctuations. It fell steeply thereafter, and there has been a very steep decline in *F* in the last few years to the lowest level seen since the late 1950s.

Monks (Anglerfish)

Northern

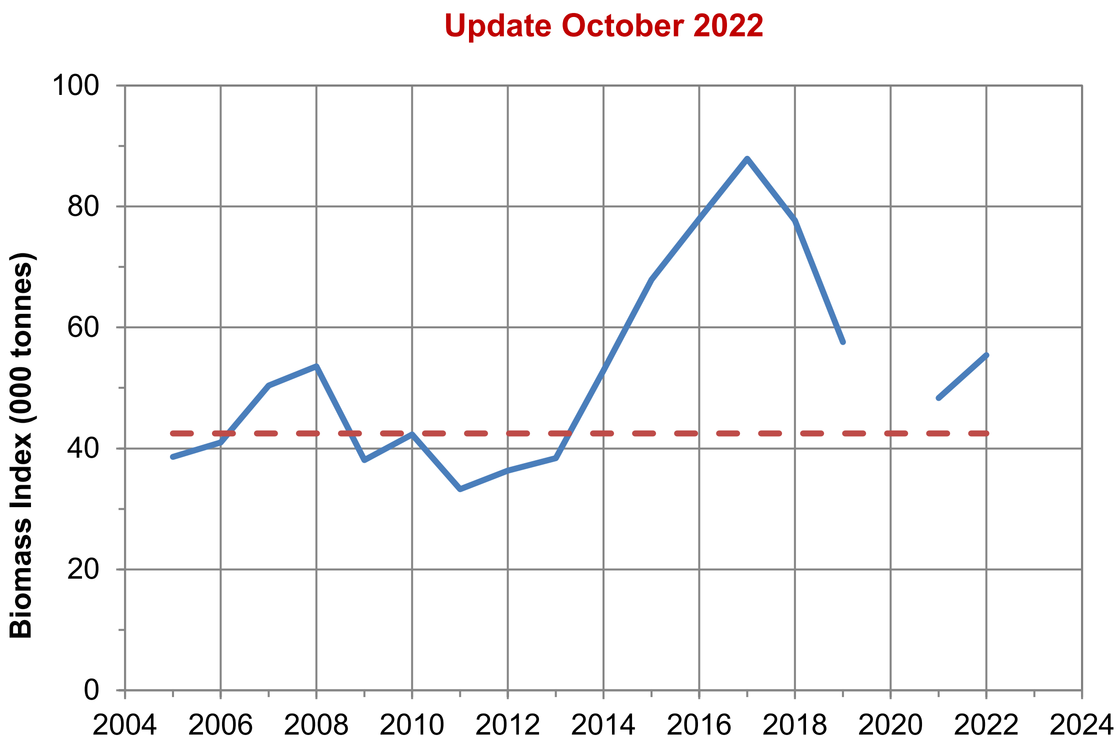

Figure 7 The abundance index (survey index) for Northern Shelf monks from 2005 to 2022 (there was no survey in 2020). The dashed line shows the average biomass index from 2005 to 2014. (No estimates of fishing mortality rate are available for monks.) (ICES Data; see p. 2.)

For the Northern Shelf monk stock an index of abundance is available only for the period from 2005 to 2022 (excluding 2020), providing a much shorter time-series than for other species.

The stock size remained fairly stable over the first 10 years of the survey before increasing substantially to a peak in 2017. The stock size declined in the following years but remains above the long-term average and increased by about 15% in 2022.

No prediction of the monk biomass index in 2023 is available.

No estimates of fishing mortality rate (*F*) are available for monks.

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Megrim

North Sea & W. of Scotland

Updated June 2022

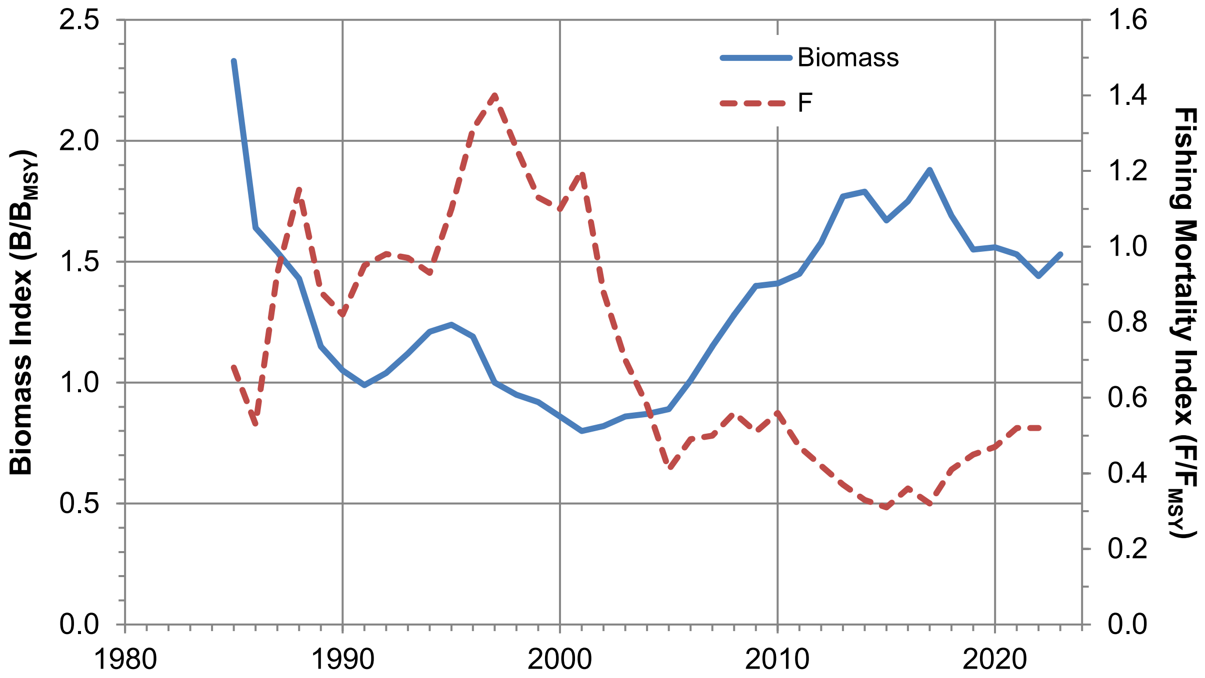

Figure 8 The index of the biomass index of the North Sea and West of Scotland megrim stock from 1985 to 2022 with the projected index in 2023, and the index of the fishing mortality rate (*F*) from 1985 to 2021 with the projected index in 2022. (ICES Data; see p. 2.)

The biomass of the North Sea and West of Scotland megrim stock declined during the late 1980s, remained fairly stable through the 1990s, and increased again during the 2000s. Since the early 2010s the biomass index has generally fluctuated around a relatively high level and it is predicted to increase by about 6% in 2023.

The fishing mortality rate (*F*) for megrim in the North Sea and West of Scotland areas generally increased until the mid-1990s but declined rapidly after that and has remained relatively low since the mid-2000s.

Hake

Northern

Updated June 2022

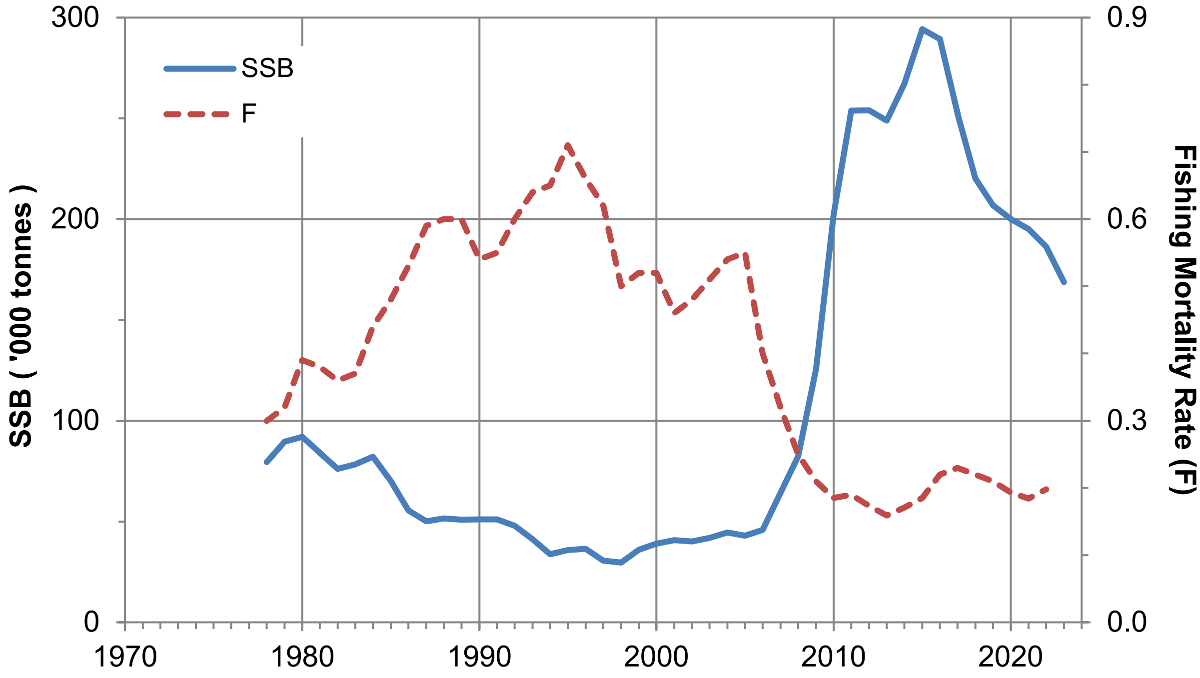

Figure 9 The spawning stock biomass (SSB) of the northern hake stock* from 1978 to 2022 with the projected SSB in 2023, and the fishing mortality rate (*F*) from 1978 to 2021 with the projected *F* in 2022. (ICES Data; see p. 2.)

Following a slight general decline during the 1980s and 1990s the spawning stock biomass (SSB) of the northern hake stock* increased rapidly and dramatically after the mid-2000s, increasing more than 6-fold between 2006 and 2015. The hake SSB has generally declined since the peak in the mid-2010s but remains relatively very large – more than three times the average size prior to 2005.

The fishing mortality rate (*F*) for the northern hake stock rose during the 1980s but declined rapidly after the mid-2000s and over the last decade has fluctuated at a relatively low level.

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* The ‘northern’ hake stock covers an area that extends from the northern Bay of Biscay to the west of Ireland and Scotland and to the North Sea.

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Ling

North-East Atlantic

Updated June 2021

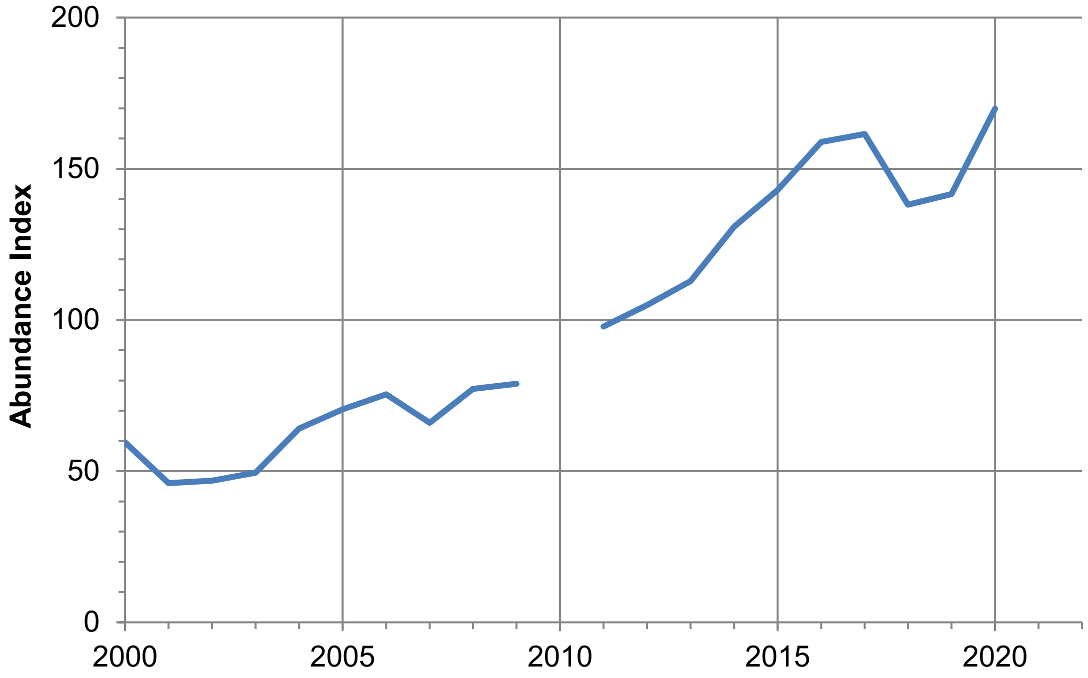

Figure 10 Index of the abundance of the North-East Atlantic ling stock* from 2000 to 2020. (No estimates of fishing mortality rate are available for ling.) (ICES Data; see p. 2.)

Updated information on ling is not expected until 2023.

The spawning stock biomass (SSB) and fishing mortality rate (*F*) of ling are not known directly. Instead, ICES uses an index of ling abundance based on the catch rate of ling by Norwegian long-line fishing boats.

This index indicates that the size of the ling stock has increased fairly consistently over the last 20 years, despite a dip in 2018 and 2019, and was at its highest ever level in 2020 (the last year for which it is available).

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* The North-East Atlantic ling stock covers an area that extends from southern Spain to the North Sea and West of Scotland areas and to the coast of Greenland (but not the Norwegian Sea or the waters around Iceland or Faroe).

Cover picture courtesy of Shetland Fishermen.

Overview - Whitefish

Abundance (SSB)

Of six whitefish stocks in the North Sea or North Sea and adjacent areas whose spawning stock biomasses (SSBs) are known, the abundances of four increased from 2021 to 2022 and the abundances of five are predicted to increase in 2023 (Table 1)

Overall, the total SSB of these six stocks increased by some 330,000 tonnes (20%) from 2021 to 2022 and is predicted to increase by a further 150,000 tonnes (8%) in 2023. That continues the general upward trend in the abundance of these stocks over the last two decades (see Figure 11, Figure 12). Since 2000 the total SSB of these six stocks has more than doubled. For those stocks for whom longer time series are available their total SSBs are now close to levels last seen in the 1960s or 1970s (Figure 11); that is, they are close to their highest levels for 50 or 60 years.

Table 1 The Spawning Stock Biomasses (000 tonnes) in 2021 and 2022 and the predicted biomass in 2023 of six stocks in the North Sea or North Sea and adjacent areas. The % changes in the SSBs from 2021 to 2022 and the predicted changes from 2022 to 2023 are also shown. (ICES Data; see p. 2.; NS & WoS = North Sea and West of Scotland.)

		SSB (000 tonnes)			% Change in SSB	
Species	**Stock**	**2021**	**2022**	**2023**	**2021-22**	**2022-23**
Cod	North Sea	44.3	54.1	73.0	22%	35%
Plaice	North Sea	834.8	930.2	977.5	11%	5%
Whiting	North Sea	248.4	283.6	294.2	14%	4%
Haddock	NS & WoS	207.2	412.1	494.8	99%	20%
Saithe	NS & WoS	137.5	130.5	141.8	-5%	9%
Hake	Northern	195.1	186.4	168.8	-4%	-9%
TOTAL		**1,826.1**	**2,196.0**	**2,220.5**	**20%**	**8%**

Aggregate Whitefish SSB

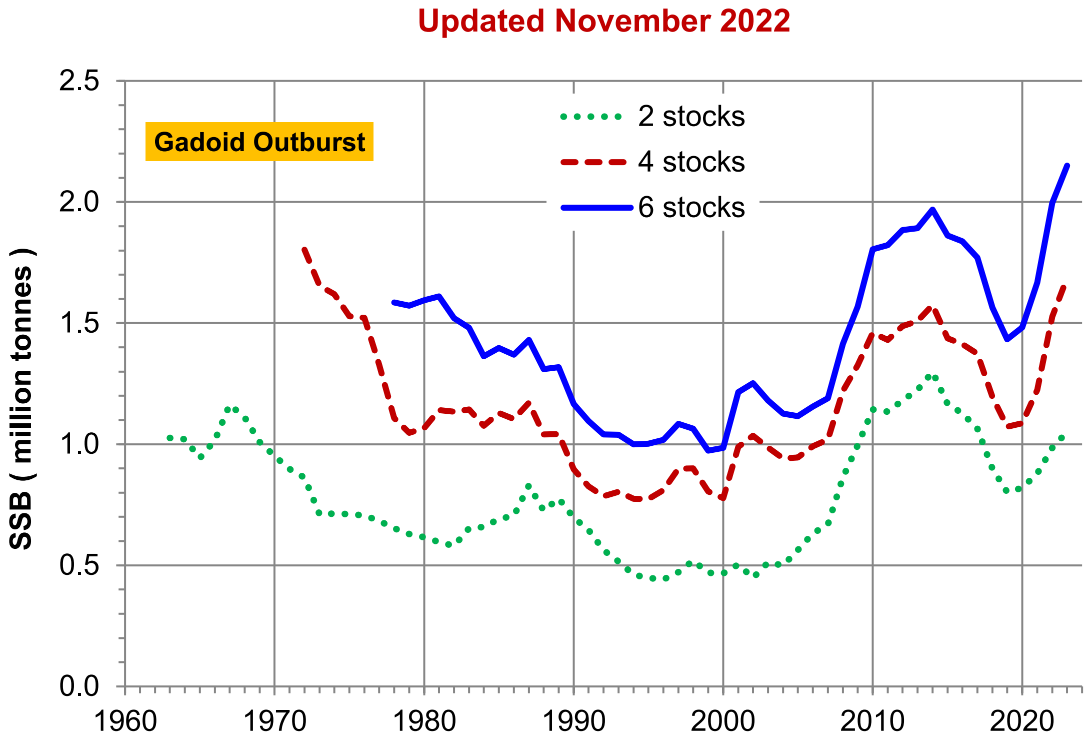

Figure 11 The total combined spawning stock biomasses (SSB) of two, four and six fish stocks for which long-term time-series are available with the predicted SSBs in 2023 (see table below for stocks). The dip in the abundances in the late 2010s was mainly due to a fall in the abundance of plaice. (Based on analysis of ICES Data; see p. 2.)

	2 stocks 1963-2023	**4 stocks** 1972-2023	**6 stocks** 1978-2023
NS Cod	X	X	X
NS Plaice	X	X	X
NS Whiting			X
NS & WoS Haddock		X	X
NS & WoS Saithe		X	X
Northern Hake			X

Cover picture courtesy of Shetland Fishermen.

Aggregate Whitefish SSB

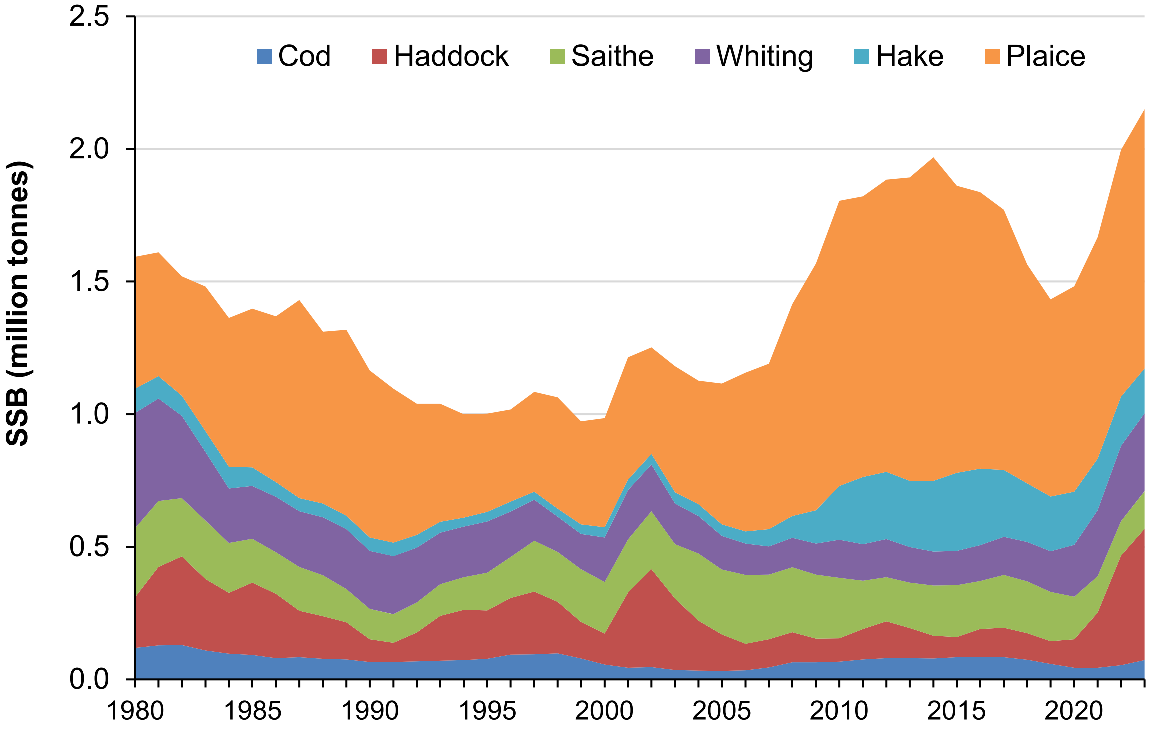

Figure 12 The estimated spawning stock biomasses (SSB) of North Sea cod, whiting and plaice; North Sea & West of Scotland haddock and saithe; and northern hake from 1980 to 2022 and the predicted total SSBs in 2023. (Based on analysis of ICES Data; see p. 2.)

Average Fishing Mortality Rate (*F*)

The fishing mortality rates (*F*) of all six of the fish stocks listed in Table 1 decreased from 2020 to 2021, indicating a reduction in fishing pressure (Table 2). The fishing mortality rates of all six stocks are predicted to have decreased further or remain unchanged in 2022.

Overall, the average fishing mortality rate across all six stocks decreased by 19% from 2020 to 2021 and it predicted to have decreased a further 18% in 2022.

Again, that continues the general downward trend in fishing mortality rates seen over the last 20 years. Since the late 1990s the average fishing mortality rates of these stocks has decreased by more than two-thirds (Figure 13) indicating a substantial reduction in fishing pressure. The average fishing mortality rates for these stocks, and for those for whom longer time-series are available are lower now than ever previously recorded.

Table 2 The fishing mortality rates (*F*) in 2020 and 2021 and the predicted *F*s in 2022 of six stocks in North Sea or North Sea and adjacent areas. The % changes in the *F*s from 2020 to 2021 and the predicted changes from 2021 to 2022 are also shown. (ICES Data; see p. 2.; NS & WoS = North Sea and West of Scotland.)

		Fishing Mortality Rate (*F*)			% Change in *F*	
Species	**Stock**	**2020**	**2021**	**2022**	**2020-21**	**2021-22**
Cod	North Sea	0.36	0.25	0.18	-31%	-28%
Plaice	North Sea	0.10	0.08	0.08	-16%	0%
Whiting	North Sea	0.19	0.16	0.16	-13%	0%
Haddock	NS & WoS	0.28	0.21	0.11	-25%	-47%
Saithe	NS & WoS	0.44	0.39	0.34	-11%	-13%
Hake	Northern	0.12	0.12	0.12	-6%	0%
TOTAL		**0.25**	**0.20**	**0.16**	**-19%**	**-18%**

Cover picture courtesy of Shetland Fishermen.

Average Fishing Mortality Rate (*F*)

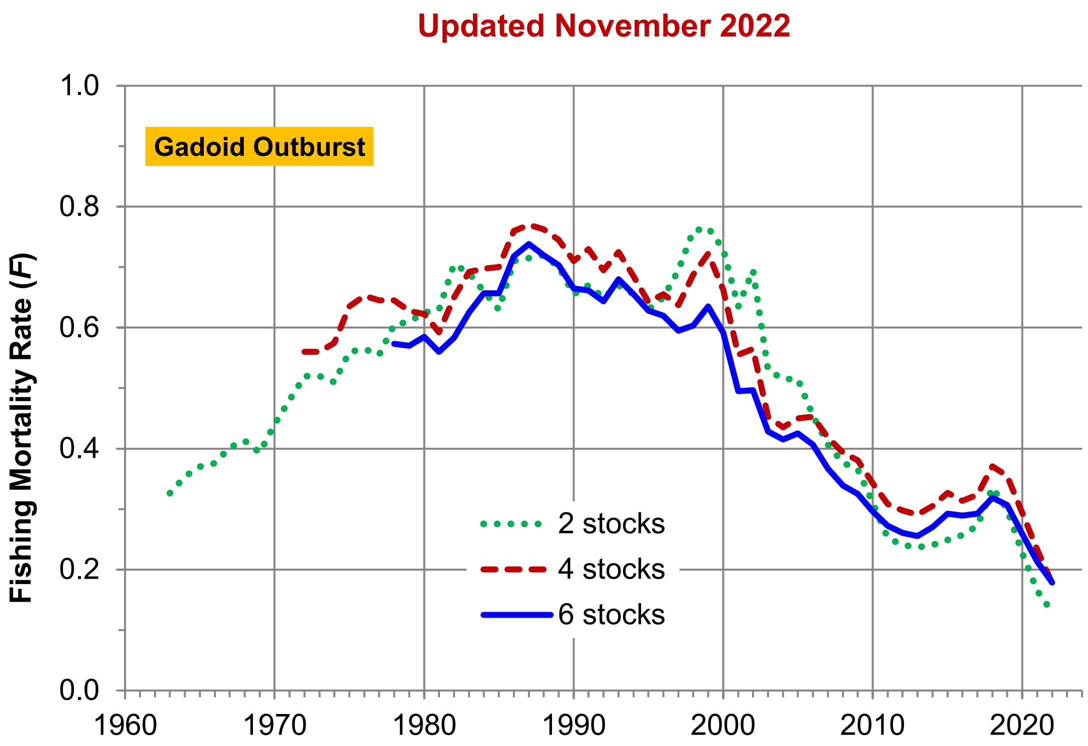

Figure 13 The overall average fishing mortality rate (*F*) of two, four and six fish stocks for which long-term time-series are available (see table below for stocks). (Based on analysis of ICES Data; see p. 2.)

	2 stocks 1963-2022	**4 stocks** 1972-2022	**6 stocks** 1978-2022
NS Cod	X	X	X
NS Plaice	X	X	X
NS Whiting			X
NS & WoS Haddock		X	X
NS & WoS Saithe		X	X
Northern Hake			X

Herring

North Sea

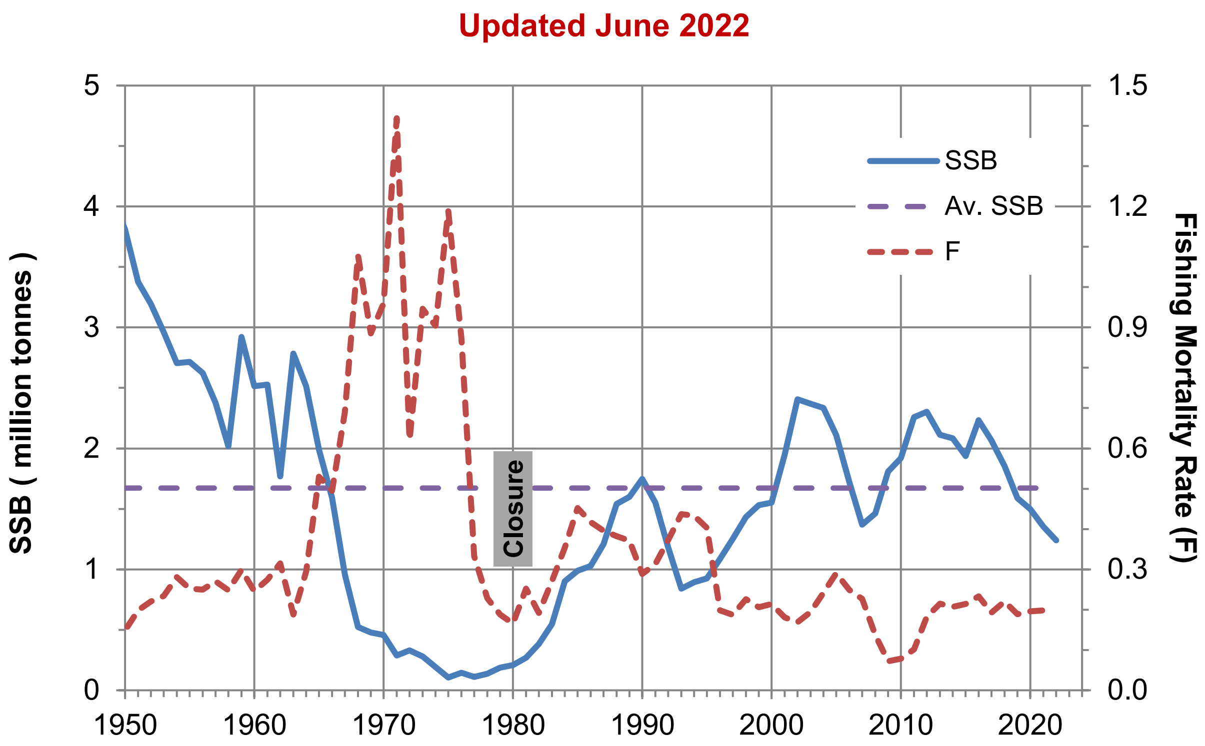

Figure 14 The spawning stock biomass (SSB) of North Sea herring from 1950 to 2022, and the fishing mortality rate (*F*) from 1950 to 2021. The horizontal dashed line shows the average SSB over the whole time period. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of herring in the North Sea generally declined from the mid-1940s until the mid-1970s, leading to the closure of the fishery from 1977 to 1983. Following a recovery, the biomass has generally fluctuated around the long-term average size since the fishery reopened and a small (8%) decrease was predicted in 2022.

The fishing mortality rate (*F*) for herring in the North Sea peaked in the early 1970s, before declining rapidly during the closure of the fishery. Since the fishery re-opened the fishing mortality rate has generally declined, especially since the mid-1990s, albeit with some large fluctuations.

Cover picture courtesy of Shetland Fishermen.

Mackerel

North-East Atlantic

Updated September 2022

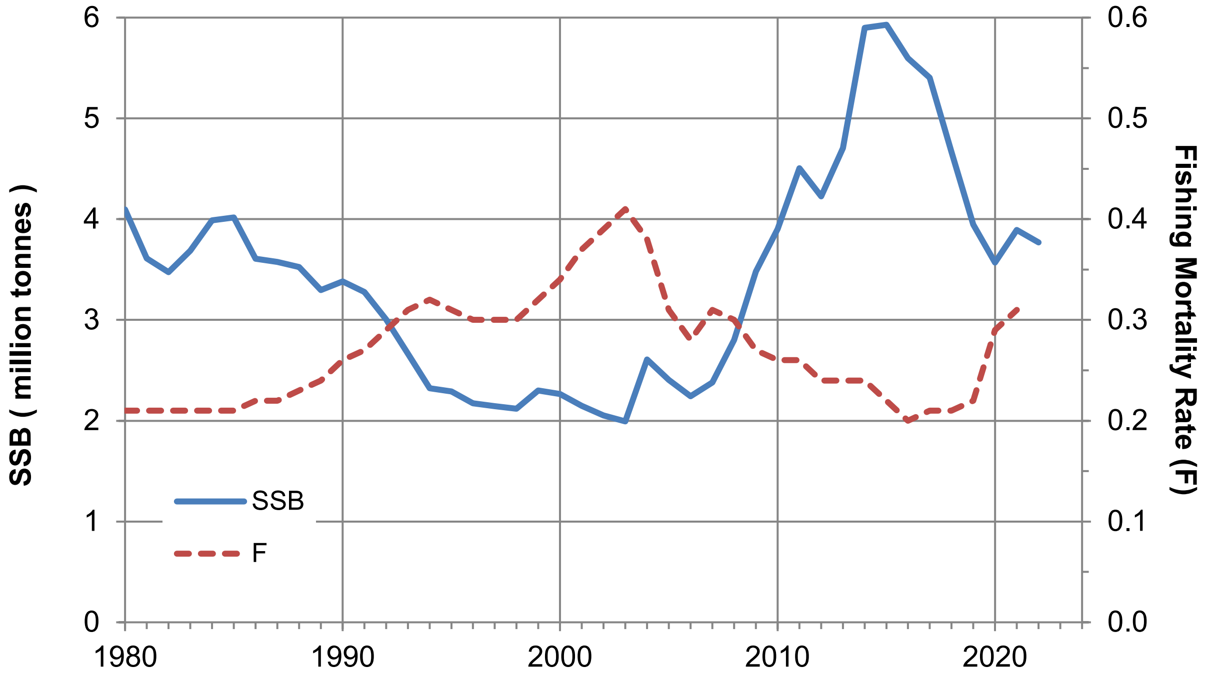

Figure 15 The spawning stock biomass (SSB) of the North-East Atlantic mackerel stock* from 1980 to 2022 and the fishing mortality rate (*F*) from 1980 to 2021. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of the North-East Atlantic mackerel stock* declined during the 1980s and early 1990s but increased rapidly after the mid- 2000s. Although there has been a decrease in the last few years the mackerel SSB remains similar to that in the 1980s.

The fishing mortality rate (*F*) for the North-East Atlantic mackerel stock generally increased prior to about 2003, but generally declined since then although it has risen in the last few years.

* The North-East Atlantic mackerel stock extends from the coasts of Portugal and Spain to the Norwegian Sea and Iceland, including the North Sea.

General Remarks

Two general trends are apparent from the whitefish data:

- The spawning stock biomasses (SSB) of most whitefish stocks have increased since the mid-2000s, in some cases by substantial amounts.
- The fishing mortality rates (*F*) of all the species have declined since the late 1990s, again by substantial amounts in some cases.

Although the sizes of some stocks (such as cod and saithe) remain below levels seen in the past, those of others (such as plaice and hake) are at relatively high levels in historic terms. (As is discussed on page 3, past abundances of some species were enhanced by the gadoid outburst).

It is notable that the aggregate whitefish spawning stock biomass has increased dramatically over the last two decades (Figure 11) and is now at a record high level. Over much the same period the average level of fishing mortality of whitefish stocks has fallen substantially to record-low levels (Figure 13).

Research carried out by ICES on the interactions between different fish species in the North Sea* has suggested that there are links between the abundances of different species of fish. In particular, increases in the abundance of cod and saithe may result in declines in the abundance of haddock and whiting (which they eat), but also to increases in the abundance of species such as herring, sandeels and pout (which haddock and whiting eat). This interaction implies that it is impossible for all fish stocks to be abundant at the same time.

The overall picture of whitefish stocks provided by these data is of relatively high levels of abundance and relatively low levels of fishing mortality. Focussing attention on a single species may give an incomplete impression of the general state of Scottish fish stocks.

* Anon. (2013). Multispecies considerations in the North Sea. *ICES Advice 2013*, Book 6, Section 6.3.1. (available online at: www.ices.dk/sites/pub/Publication%20Reports/Advice/2013/2013/mult-NS.pdf).

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