Trends in Scottish Fish Stocks 2018

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Summary

This paper 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 generally increasing abundances and declining levels of exploitation.

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; in particular those that are of importance to the Shetland fishing fleet.

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 vessels, and research vessel surveys.

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

The time periods over which data are available vary between stocks and area. For some species (such as cod or plaice) long-time series are available, stretching back to the 1960s or 1950s. For others (such as monks or megrim) the available time series are much shorter.

* The latest ICES Advice is available online at:

www.ices.dk/community/advisory-process/Pages/Latest-advice.aspx

Two parameters are commonly used to reflect the state of a fish stock and the level of exploitation to which it is subject:

The **Spawning Stock Biomass** (**SSB**) is the estimated biomass (weight) of sexually mature fish in a stock and is commonly used as a measure of the size of the stock.

The **Fishing Mortality Rate (*F*)** is an index of the proportion of a fish stock that is removed (caught) each year and provides measure of the level of exploitation of the stock. *F* is measured on a logarithmic scale; thus 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 and lasting into the early 1970s – for reasons that are still unclear – there was an unprecedented increase in the abundances of some gadoid species (such as cod, haddock, saithe, whiting and Norway pout) in the North Sea, with five to six-fold increases in their biomasses[*].

The available time-series of abundance of some of the gadoid fish stocks start around the time of gadoid outburst or shortly afterwards, 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)

Cod

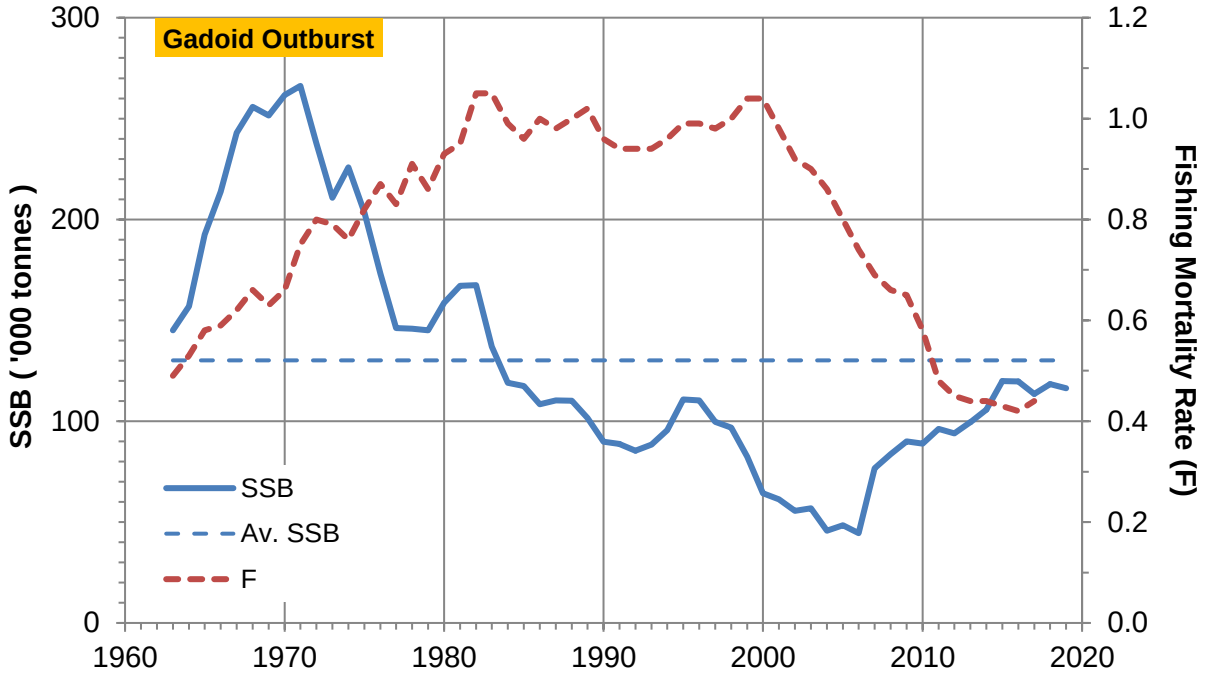

Figure 1 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of North Sea cod from 1963 to 2018 (2017 for *F*) and the projected SSB in 2019. The horizontal dashed line shows the long-term average SSB over the whole period (ICES Data; see p. 2.) (In the 1960s and 1970s the abundance of cod was enhanced by the 'gadoid outburst' - see p. 3.)

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-2000s. From a low in 2006 the SSB increased relatively rapidly and for the last few years has remained stable just below the long-term average.

The SSB of cod in the North Sea since 2015 has been larger than at any time in the last 30 years (since the early 1980s).

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 2017. The value of *F* has remained relatively constant over the last few years and lower than at any time for at least 50 years.

Haddock

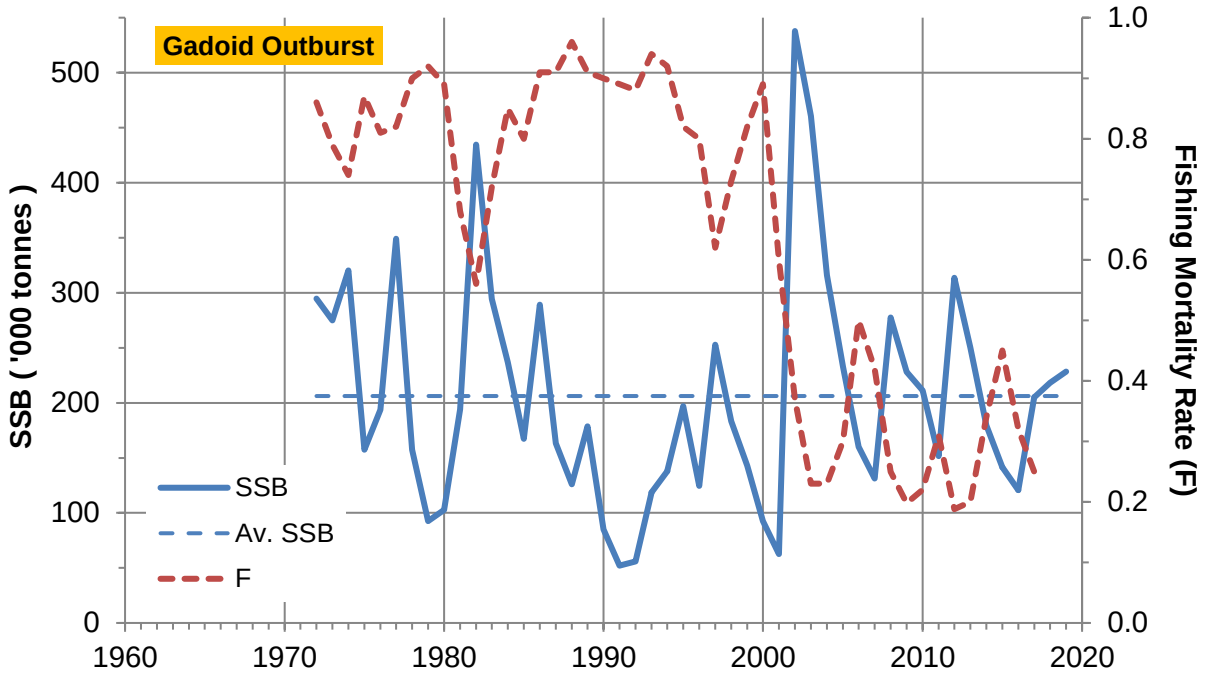

Figure 2 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of the combined North Sea and West of Scotland haddock stock from 1972 to 2018 (2017 for *F*) and the projected SSB in 2019. The horizontal dashed line shows the long-term average SSB over the whole period. (ICES Data; see p. 2.) (In the 1960s and 1970s the abundance of haddock was enhanced by the 'gadoid outburst' - see p. 3.)

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 has experienced very large fluctuations over the last 45 years (reflecting the biology of the species) and in 2018 was just above the long-term average.

The fishing mortality rate (*F*) for haddock remained generally relatively high until 2000, after which it fell sharply. Since the mid-2000s it has fluctuated, mirroring the fluctuations in biomass and in 2017 was at a relatively low level.

Saithe

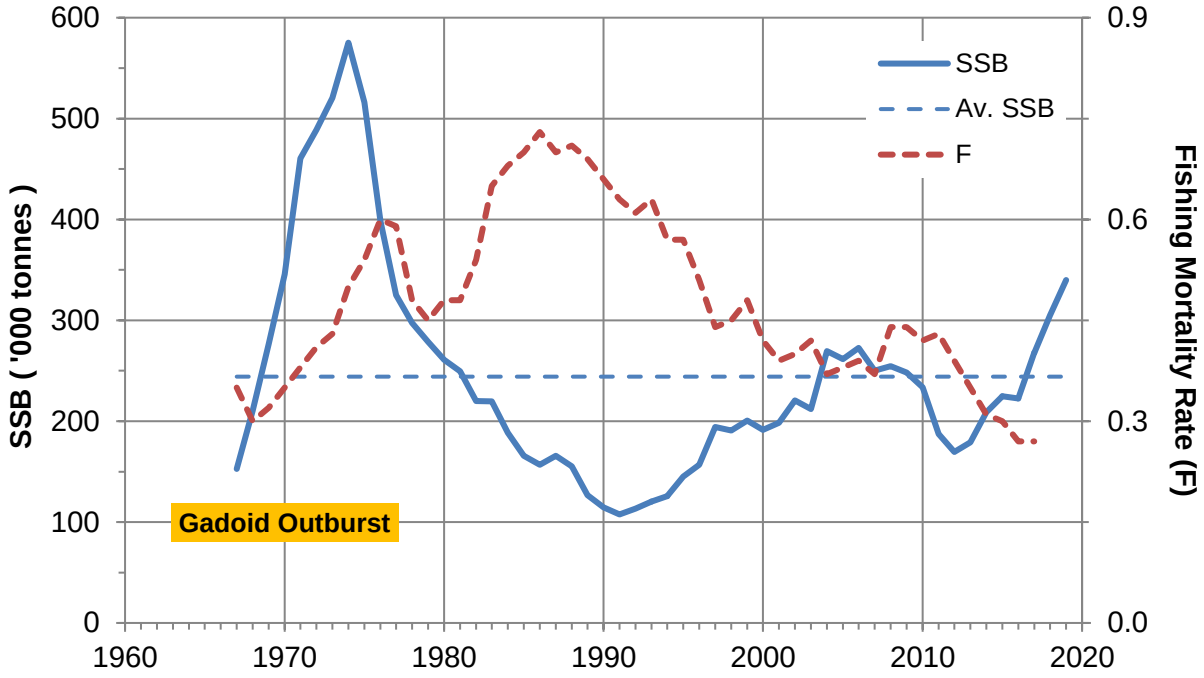

Figure 3 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of the North Sea and West of Scotland saithe stock from 1967 to 2017 (2016 for *F*) and the projected SSB in 2019. The horizontal dashed line shows the long-term average SSB over the whole period. (In the 1960s and 1970s the abundance 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 about 1990. Since then it has generally increased, albeit with some fluctuations. The SSB of saithe is now well above the long-term average and higher than at any time since the end of the gadoid outburst.

The fishing mortality rate (*F*) for saithe has generally declined over the last 30 years, having increased during the gadoid outburst. It is now at its lowest level in the last 50 years.

Whiting

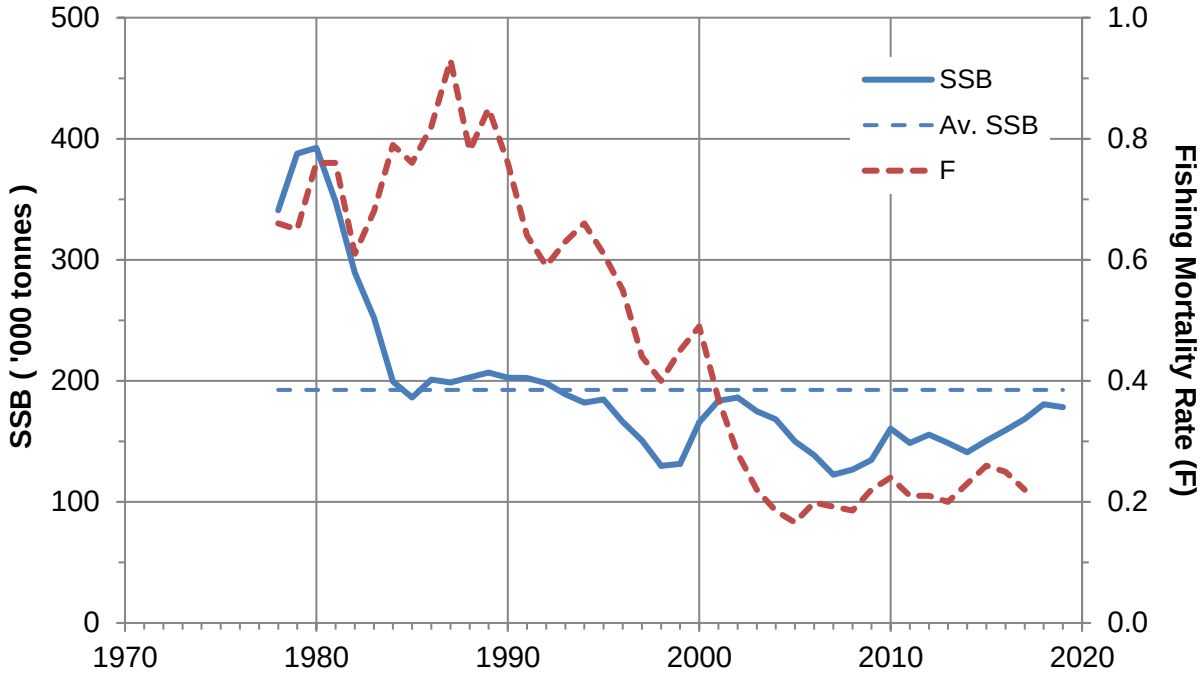

Figure 4 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of North Sea whiting from 1978 to 2018 (2017 for *F*) and the projected SSB in 2019. The horizontal dashed line shows the long-term average SSB over the whole period. (ICES Data; see p. 2.)

Having declined from a peak in 1980 the spawning stock biomass (SSB) of whiting in the North Sea has remained about the same size over the last 30 years, albeit with some large fluctuations, and is current close to the long-term average.

The fishing mortality rate (*F*) for whiting in the North Sea also generally declined after the late-1980s, and has remained fairly stable at a relatively low level over the last decade.

Plaice

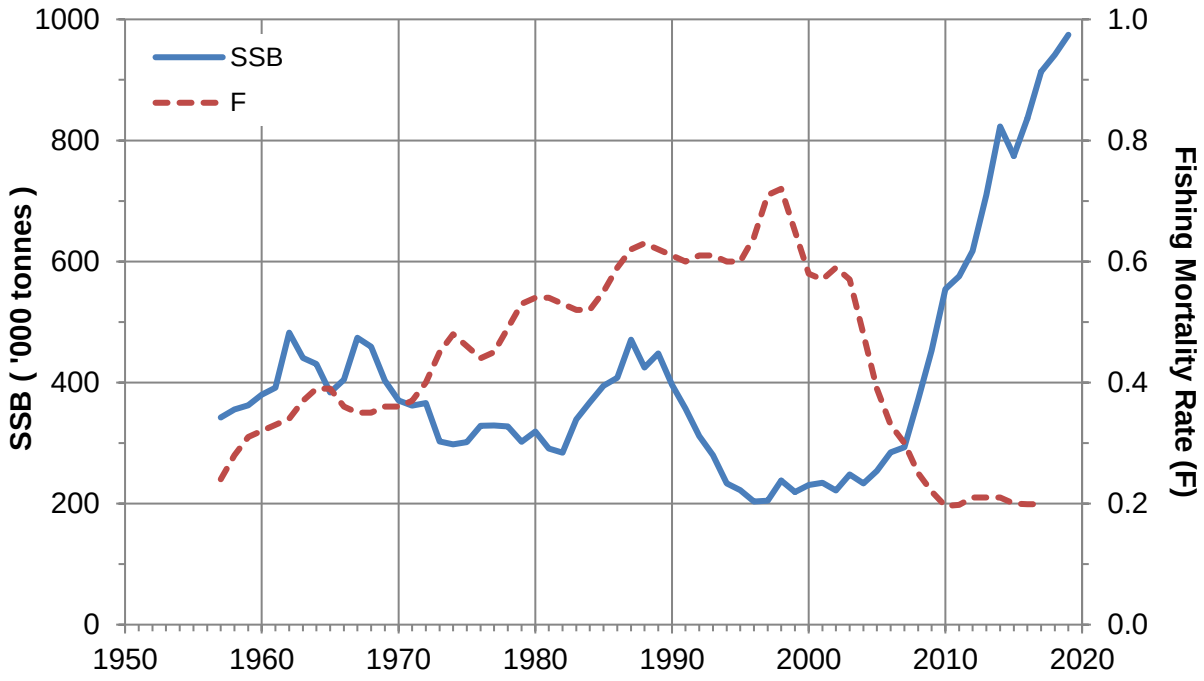

Figure 5 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of North Sea plaice from 1957 to 2018 (2017 for *F*) and the projected SSB in 2019. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of plaice in the North Sea remained relatively stable from the late 1950s until the mid-2000s, albeit with some large fluctuations. Since then it has increased dramatically, quadrupling between 2004 and 2018. The SSB over the last decade has been larger than at any time since at least 1957.

The fishing mortality rate (*F*) for plaice in the North Sea generally increased until the late 1990s, after which it fell rapidly. Since 2010 it has remained relatively stable at its lowest level for more than 50 years.

Common (Dover) Sole

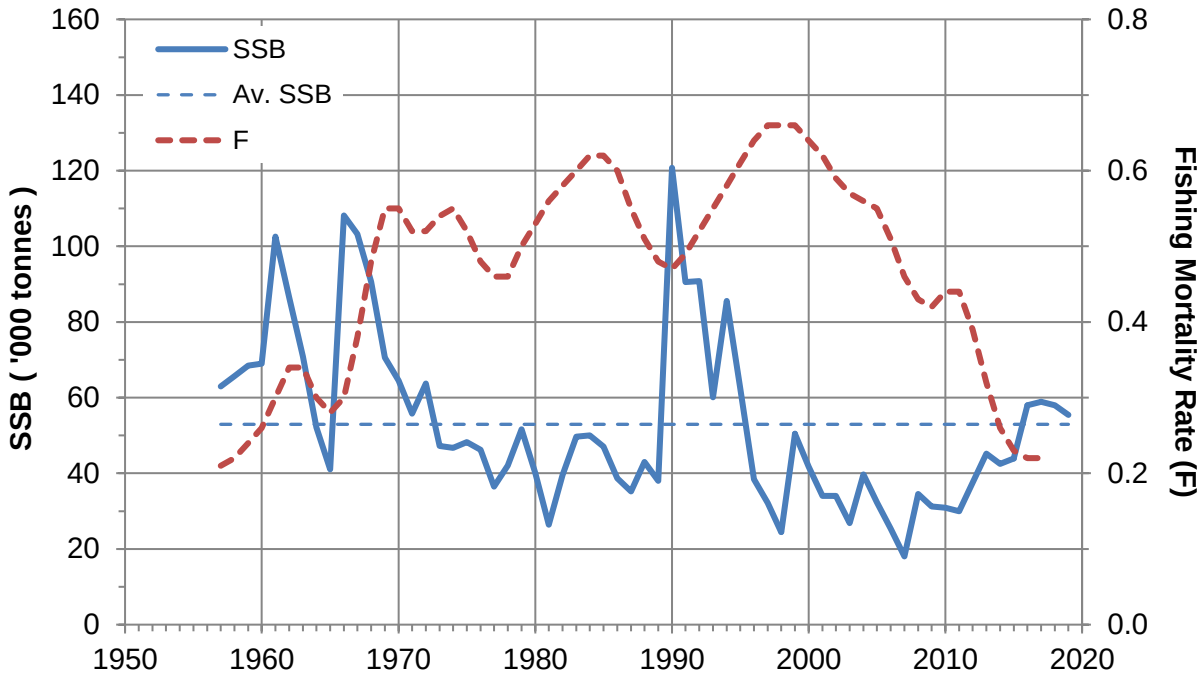

Figure 6 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of North Sea common sole from 1957 to 2018 (2017 for *F*) and the projected SSB in 2019. The horizontal dashed line shows the long-term average SSB over the whole period. (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of common sole in the North Sea has remained relatively stable over the last 60 years, albeit with some very large fluctuations. The SSB is currently above the long-term average over the last 60 years.

The fishing mortality rate (*F*) for common sole in the North Sea generally increased, though with large fluctuations, from the 1960s through the 1990s. It fell steeply thereafter, declining by 70% between 1997 and 2016. The value of *F* in 2015 was less than one-third of that in 1997 and lower than at any time since 1957.

Monks (Anglerfish)

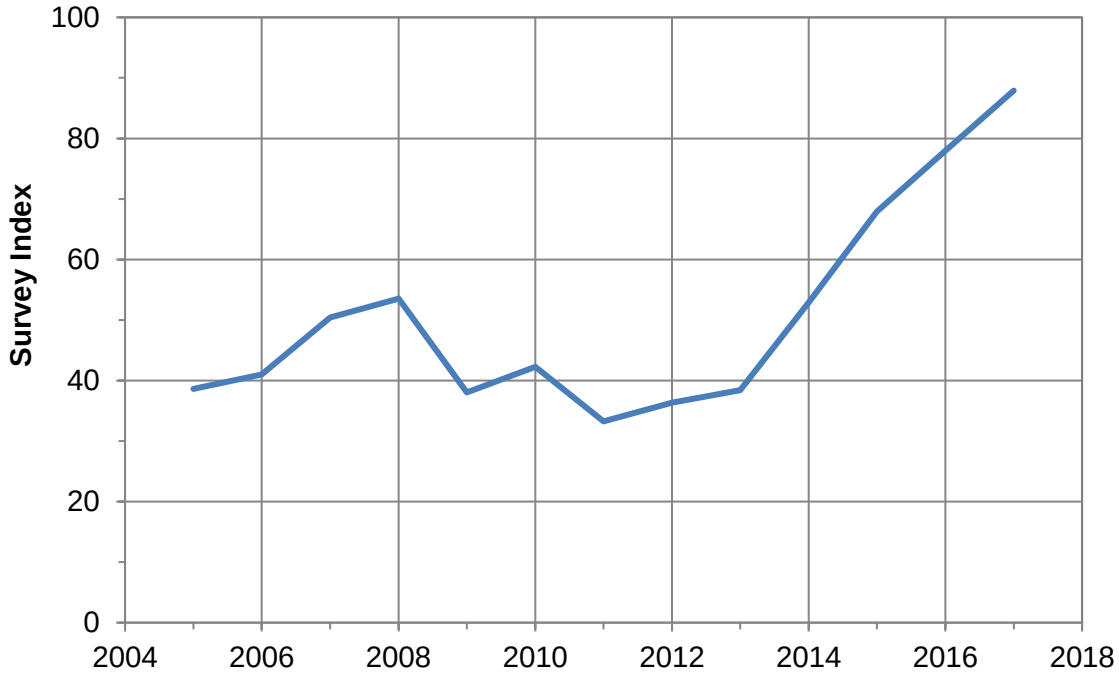

Figure 7 The abundance index (survey index) for Northern Shelf monks from 2005 to 2017. (No estimates of fishing mortality rate are available for monks.) (ICES Data; see p. 2.)

Data for monks in 2017 have not yet been published.

For the Northern Shelf monk stock an index of abundance is available for the period from 2005 to 2016, providing a much shorter time-series than for other species. Over this period the size of the stock has fluctuated, but has increased since 2011. According to the survey index the stock more than doubled in size since 2011 and 2017.

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

Megrim

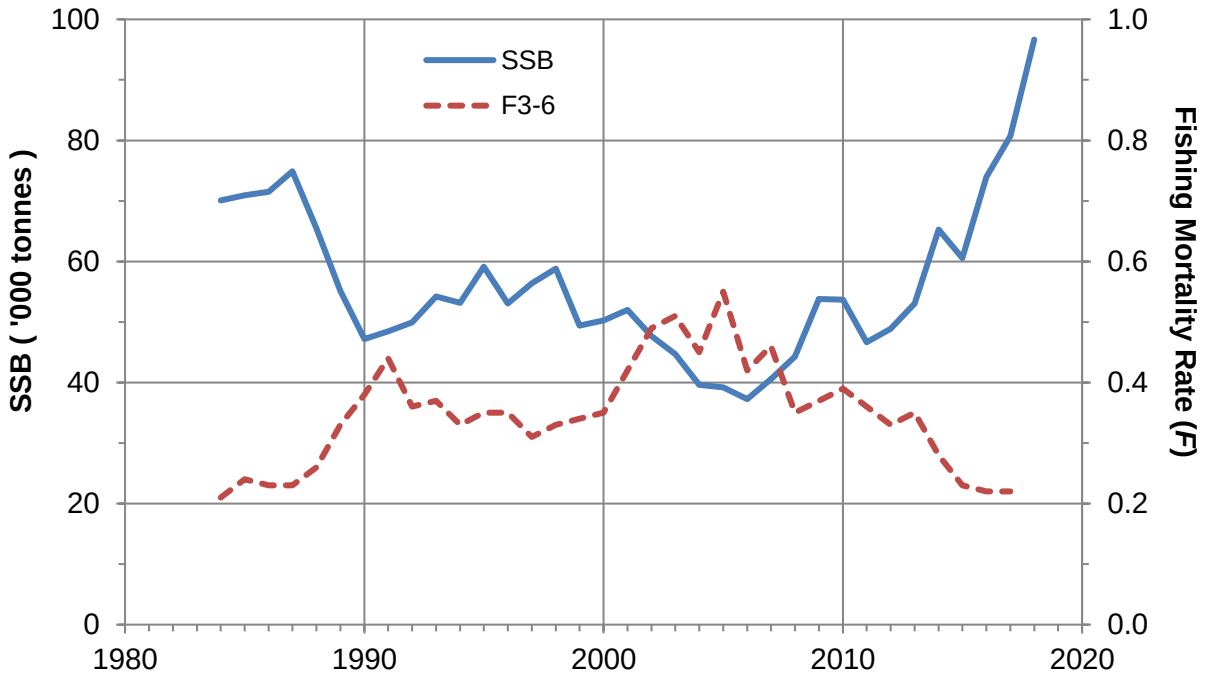

Figure 8 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of the North Sea and West of Scotland megrim stock from 1985 to 2018 (2017 for *F*). (ICES Data; see p. 2.)

The spawning stock biomass (SSB) of megrim in the North Sea and West of Scotland areas megrim stock declined during the late 1980s, remained fairly stable through the 1990s to the mid-2000s, and has increased substantially since then. The SSB in 2018 is double the average in the 1990s and 2000s.

The fishing mortality rate (*F*) for megrim in the North Sea and West of Scotland areas generally increased until the mid-2000s but has declined since then. *F* in 2017 was less than half the peak in 2005.

Hake

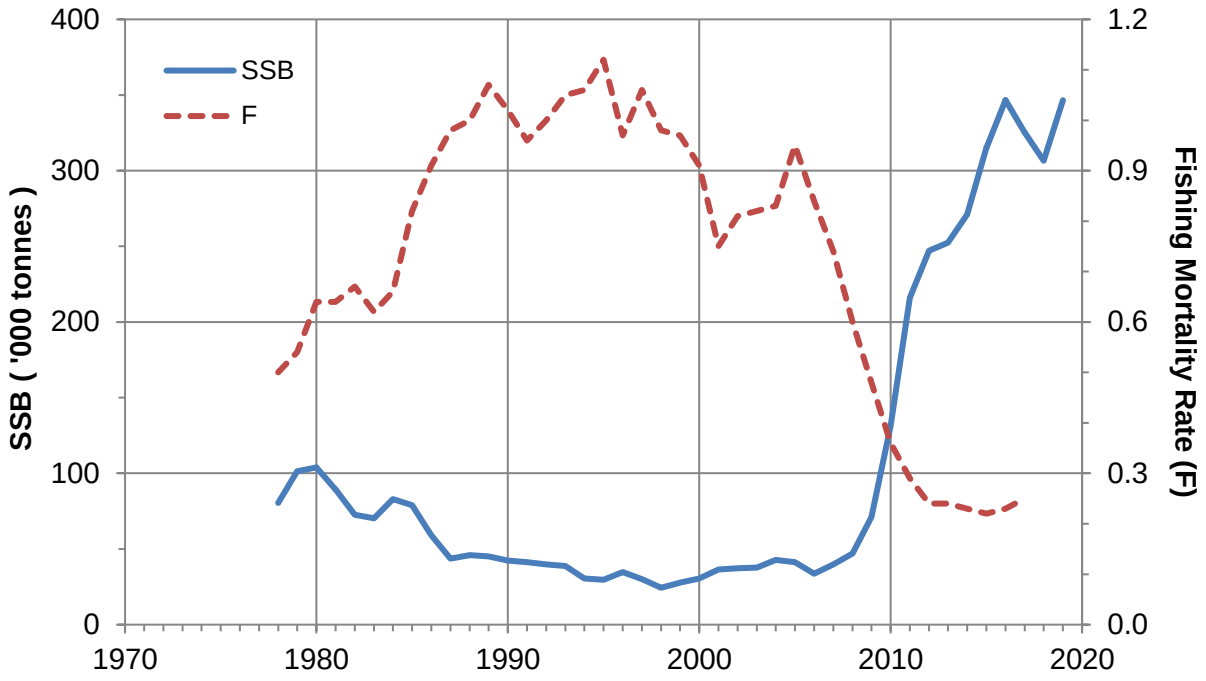

Figure 9 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of the northern hake stock* from 1978 to 2018 (2017 for *F*) and the projected SSB in 2019. (ICES Data; see p. 2.)

Following a 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. The SSB increased almost 10-fold between 2006 and 2016.

Despite a small decrease in size in 2017 and 2018 the SSB remains almost six times larger than the average prior to 2005.

The fishing mortality rate (*F*) for the northern hake stock rose during the 1980s but has generally declined since then, especially after 2005. Despite a slight increase the value of *F* in 2017 was remained about one quarter of that in 2005, and over the last few years has been lower than at any time in the last 40 years.

* The 'northern' hake stock covers an area that includes the North Sea and West of Scotland areas, as well as the areas around Rockall, to the west and south of Ireland and into the northern Bay of Biscay.

Ling

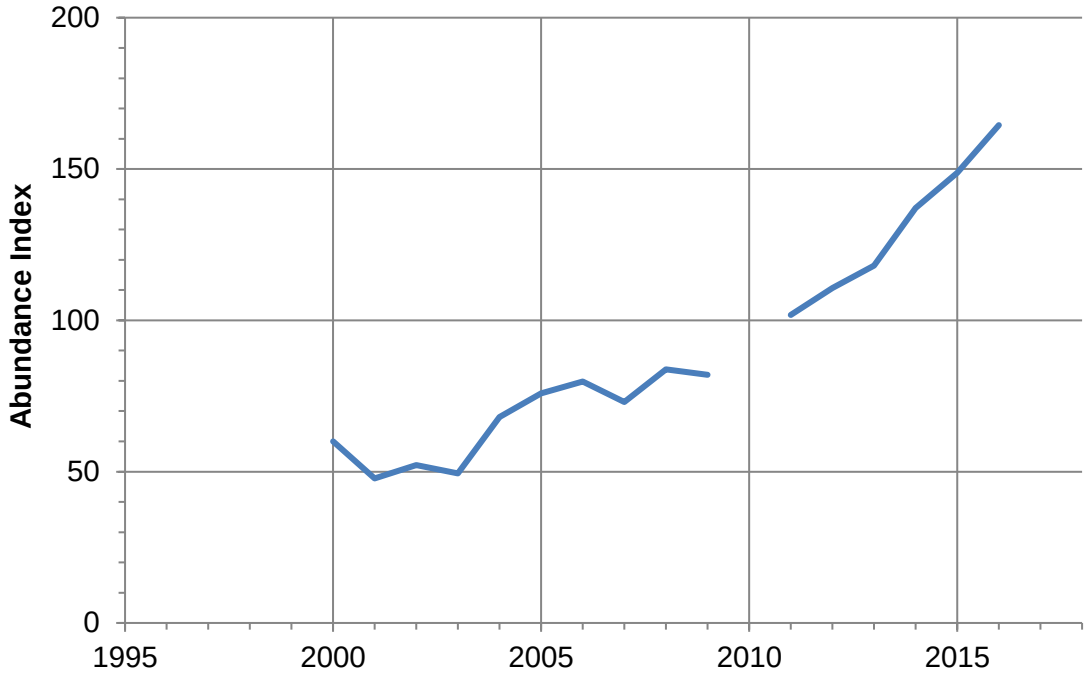

Figure 10 Index of the abundance of the North-East Atlantic ling stock* from 2000 to 2016. (No estimates of fishing mortality rate are available for ling.) (ICES Data; see p. 2.)

Data for ling in 2017 have not yet been published.

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 Norwegian ling-line fishing vessels.

This index indicates that the size of the ling stock has increased steadily over the last 13 years, more than tripling in size between 2003 and 2016.

* 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).

Aggregate Whitefish Biomass

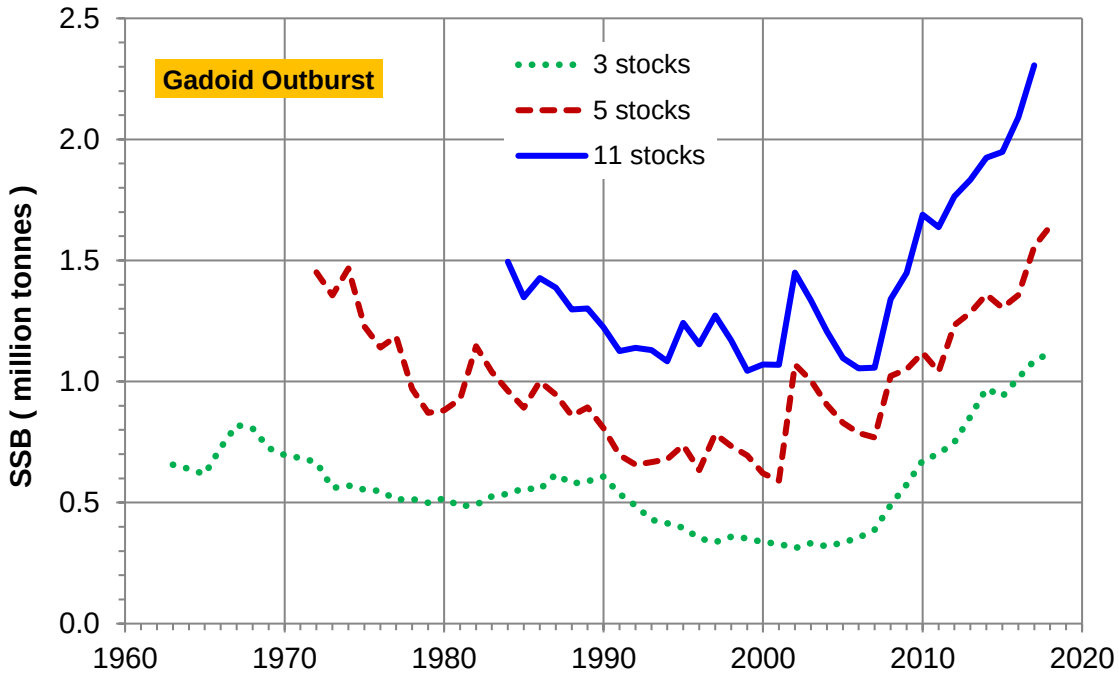

Figure 11 The total combined spawning stock biomasses (SSB) of three, five and 11 fish stocks for which long-term time-series are available (see table below for stocks). (Based on analysis of ICES Data; see p. 2.)

	3 stocks 1963-2018	**5 stocks** 1972-2018	**11 stocks** 1984-2017
NS Cod	X	X	X
NS Plaice	X	X	X
NS Pout			X
NS Dover Sole	X	X	X
NS Whiting			X
WoS Cod			X
WoS Whiting			X
NS & WoS Haddock		X	X
NS & WoS Megrim			X
NS & WoS Saithe		X	X
Hake			X

The combined spawning stock biomasses (SSBs) of multiple fish stocks show consistent patterns: a general decrease to about the late 1990s; and a more rapid and substantial increase since then.

The total SSBs of three, five and 11 fish stocks have all more than doubled since 2000 (increases of 232%, 164% and 115%, respectively). For all three groups of stocks the total SSBs are now larger than at any time during the available time series; that is, for more than 50, 40 or 30 years, respectively.

Aggregate Whitefish Fishing Mortality Rate

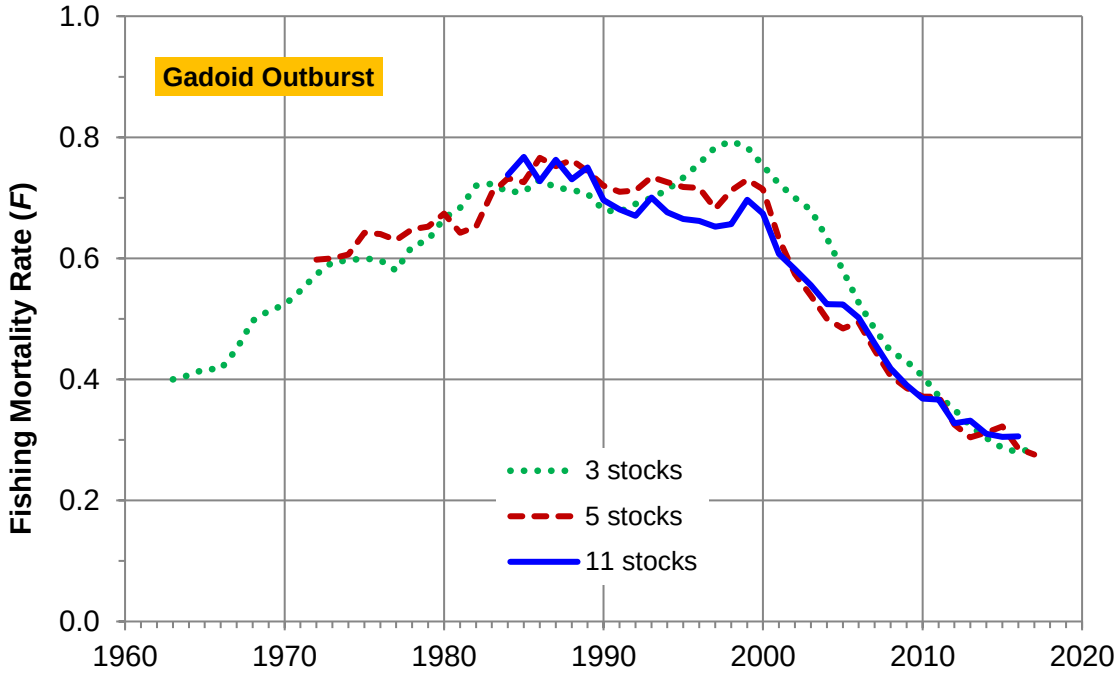

Figure 12 The overall average fishing mortality rate (*F*) of three, five and 11 fish stocks for which long-term time-series are available (see table below for stocks). (Based on analysis of ICES Data; see p. 2.)

	3 stocks 1963-2018	**5 stocks** 1972-2018	**11 stocks** 1984-2017
NS Cod	X	X	X
NS Plaice	X	X	X
NS Pout			X
NS Dover Sole	X	X	X
NS Whiting			X
WoS Cod			X
WoS Whiting			X
NS & WoS Haddock		X	X
NS & WoS Megrim			X
NS & WoS Saithe		X	X
Hake			X

The overall average fishing mortality rates (*F*) of multiple fish stocks show consistent patterns: a general increase to about the mid-1980s; relative stability or a slow decline to the late 1990s; and a rapid and substantial decline since then.

The average fishing mortality rates of three, five and 11 fish stocks have all more than halved since 1999 (declines of 63%, 62% and 56%, respectively). For all three groups of stocks the average fishing mortality rate after 2010 was less than half that in the 1990s, and lower than at any time during the available time series; that is, for more than 50, 40 or 30 years, respectively.

Herring

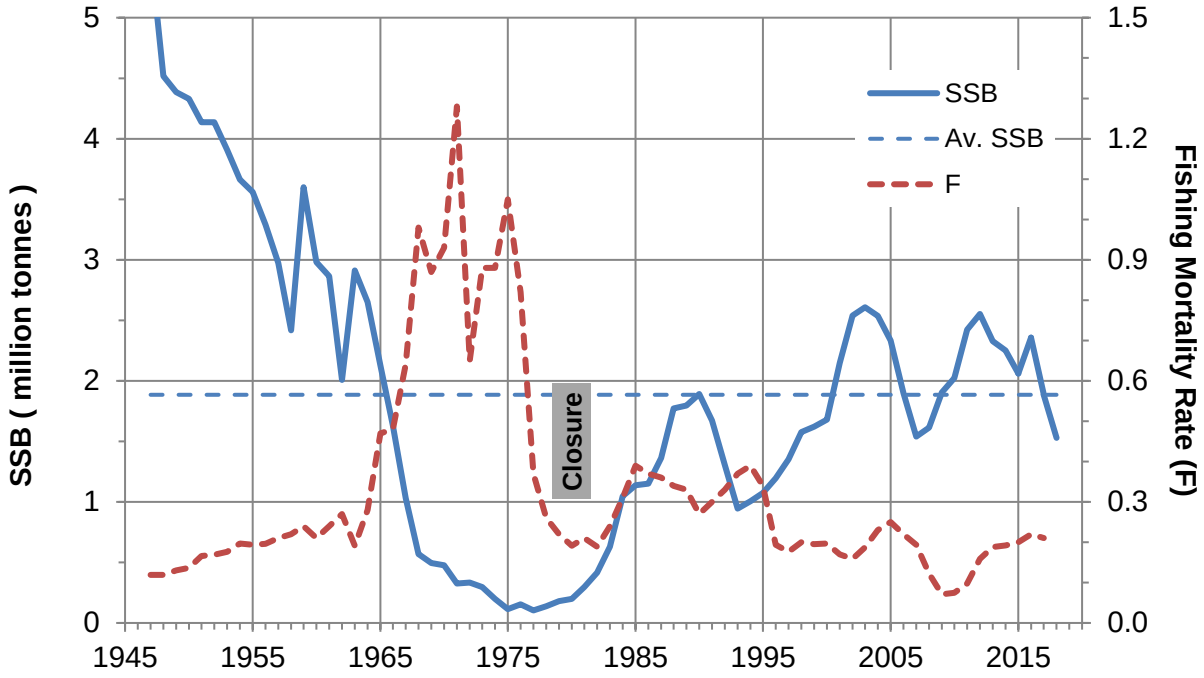

Figure 13 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of North Sea herring from 1947 to 2018 (2017 for *F*). The horizontal dashed line shows the long-term average SSB over the whole period. (The North Sea herring fishery was closed from 1977 to 1983.) (ICES Data; see p. 2.)

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. Since the mid-1970s the stock has generally increased in size, albeit with large fluctuations.

The SSB of North Sea herring has declined somewhat in the last few years but remains close to its long-term average size.

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. Although the value of *F* has increased in the last few years it remains about half what was in 1994.

Mackerel

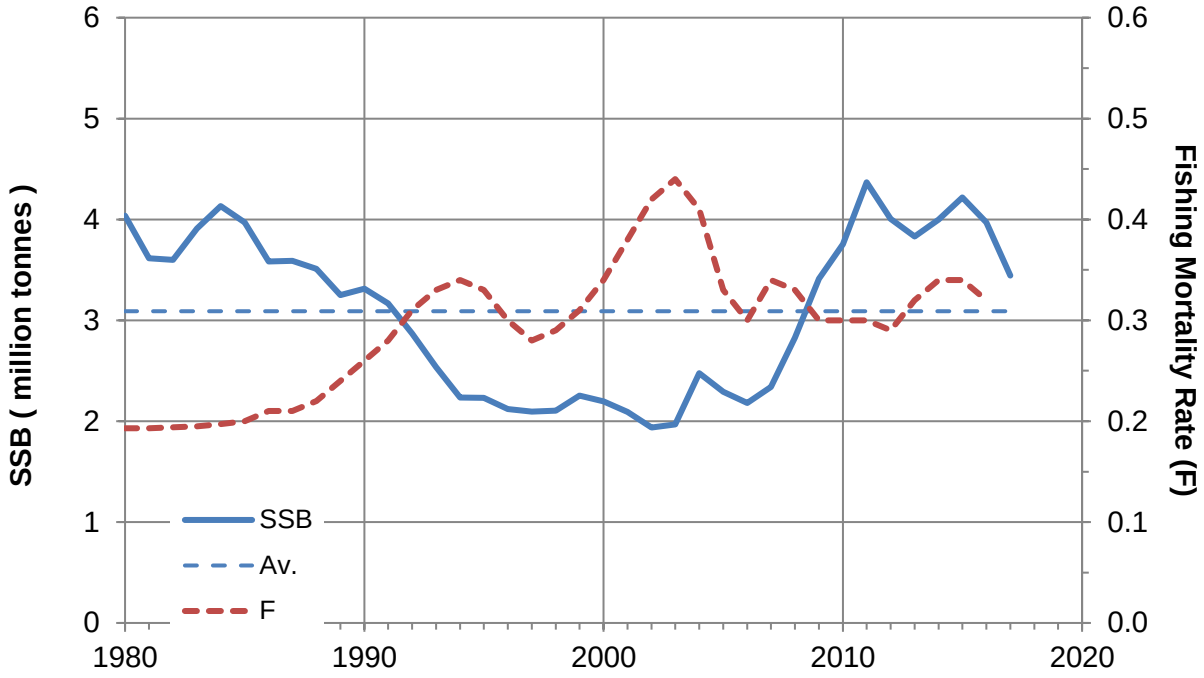

Figure 14 The spawning stock biomass (SSB) and fishing mortality rate (*F*) of the North-East Atlantic mackerel stock* from 1980 to 2017 (2016 for *F*). The horizontal dashed line shows the long-term average SSB over the whole period. (ICES Data; see p. 2.)

Data for mackerel in 2018 have not yet been published.

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 couple of years the mackerel SSB remains above its long-term average size.

The fishing mortality rate (*F*) for the North-East Atlantic mackerel stock generally increased prior to about 2003, but has declined rapidly after that and has remained relatively stable over the last decade.

* 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 mid-2000s, again by substantial amounts in some cases.

Although the sizes of some stocks (such as cod and haddock) remain below levels seen in the past, those of others (such as plaice and hake) are at historic highs. (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 have increased dramatically over the last two decades (Figure 11) and are now at record high levels. Over much the same period the overall average levels of fishing mortality across multiple stocks have fallen substantially to record-low levels (Figure 12).

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).

The overall picture of whitefish stocks provided by these data is of generally increasing stock sizes and decreasing (and relatively low) fishing mortality rates. These data also suggest that 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).