

UK Biodiversity Indicators 2019

This document supports
D1a. Fish size classes in the North Sea

Fiche

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D1. Biodiversity and ecosystem services

a. Fish size classes in the North Sea

Type: State / Benefit Indicator

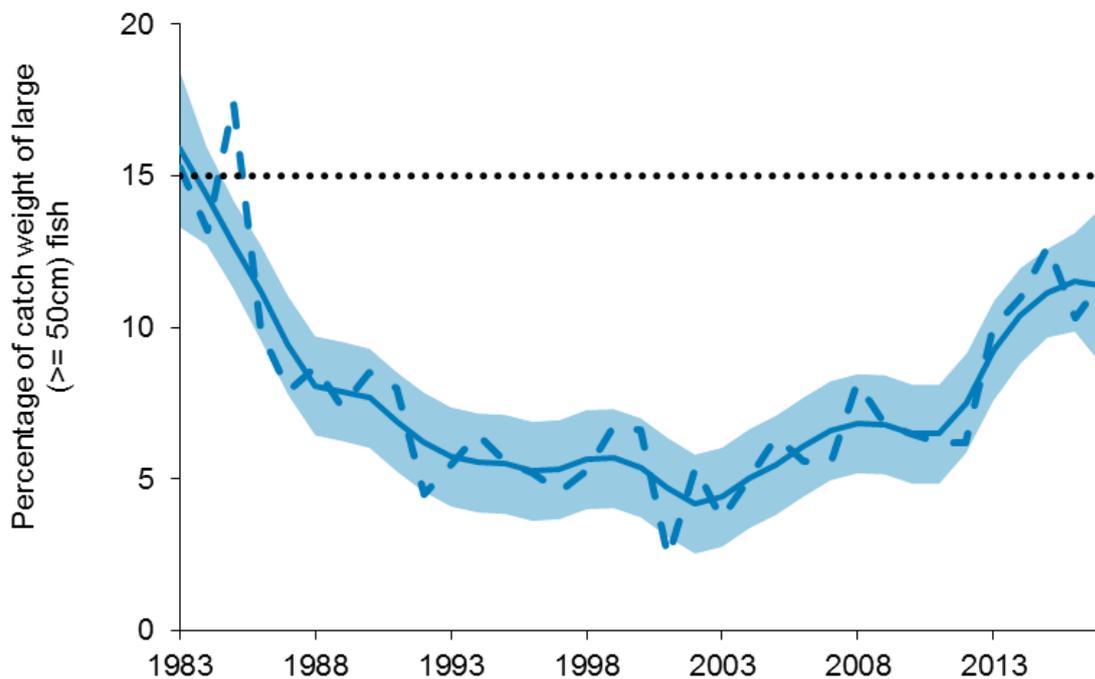
Since the previous publication additional data have been provided for the North Sea, Celtic sea, Irish Sea and Scottish Continental Shelf. The entire dataset has been revised, and updated to include all available years. The assessment value thresholds are specific to time periods and therefore change with any updates.

In 2017, large fish in the North Sea survey made up 12% of the weight of the fish community. This is approaching the value of 15% recorded in 1983 and shows a noticeable increase from a low of 2% in 2001. While there was a clear decline in the indicator from 1983 to 2001, there has been recovery since, and this pace of recovery accelerated after 2012.

Indicator Description

The indicator shows changes in the proportion, by weight, of large individuals equal to or over 50cm in length in demersal (bottom-dwelling) fish populations in the North Sea. Changes in the size structure of fish populations and communities reflect changes in the state of the fish community. Fluctuations in values between years are expected given inter-annual fluctuations in the distribution and abundance of North Sea fish populations and sampling variation.

Figure D1ai. Percentage of large fish (equal to or larger than 50cm), by weight, in the North Sea, 1983 to 2017



Note: The line graph shows the unsmoothed trend (dashed line) and a LOESS smoothed trend (solid line) with the shaded area showing the 95 per cent confidence intervals around the smoothed trend. The horizontal dashed line shows the assessment. LOESS is a non-parametric regression method; it may be understood as standing for "LOcal regrESSion".

Source: Centre for Environment, Fisheries and Aquaculture Science; Marine Scotland.

Assessment of change in the proportion of large fish, by weight			
	Long term	Short term	Latest year
North Sea	 1983–2017	 2012–2017	Increased (2017)

Note: The long-term and short-term assessments have been made by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) by fitting a LOESS smoothed trend to the index (see the note under Figure D1ai).

Indicator description

The indicator shows changes in the proportion, by weight, of large individuals equal to or over 50cm in length in demersal fish populations in the North Sea. The indicator is based on standardised trawls from international scientific surveys conducted annually. During the 1980s, large fish in the North Sea fish community included cod (*Gadus morhua*), ling (*Molva molva*), haddock (*Melanogrammus aeglefinus*), saithe (*Pollachius virens*), anglerfish (*Lophius piscatorius*) and rays (*Batoidea*). Recently, lesser spotted dogfish (*Scylliorhinus canicula*), hake (*Merluccius merluccius*) and smoothhounds (*Mustelus* spp.) have also formed a substantial part of the large fish catches in the North Sea.

The measure for the North Sea is used as the main indicator because it is based on the largest dataset that includes an assessment target period (early 1980s), and it is supported by publications, and therefore provides the most reliable indicator of change.

Figure D1ai presents the LOESS smoothed trend that is used to assess both long-term and short-term trends in the proportion of large individuals in North Sea fish populations.

Relevance

Change in the relative abundance of large fishes is likely to affect marine ecosystems in several ways. Fewer large fish will reduce the amount of predation on smaller prey species and allow increases in their abundance and biomass. In turn, this will affect the structure and stability of the ecosystem. The indicator responds to fishing impacts on the fish community because larger fish are more likely to be caught by trawls, and because larger species of fish are more likely to decline in number for a given rate of fishing (Engelhard *et al.* 2015; Greenstreet *et al.* 2011, 2012). When fish communities are more heavily fished the proportion of large fish is expected to fall, and when fishing is reduced the proportion of large fish is expected to rise, albeit with a multi-year delay. Some variation in the proportion of large fish will be driven by environmental variation and, in the long-term, increases in temperature may lead to decreased body-size of demersal fish in the North Sea (Queirós *et al.* 2018). However, in the short term (over periods of a few years) environmental effects on this indicator are expected to be relatively small in relation to fishing effects.

Background

The indicator is compiled using methods based on those developed by the International Council for the Exploration of the Sea (ICES) for the analysis of International Bottom Trawl Survey data (ICES, 2007), and further developed for the OSPAR Intermediate Assessment 2017, and since updated (Greenstreet and Moriarty, 2017; Moriarty *et al.* 2017). Data on fish length are taken from the North Sea during the first quarter of each year. All fish are measured as part of the survey.

To compile the indicator, the proportions of fish greater than or equal to 50cm are estimated by weight. The technical paper that accompanies this indicator outlines the background to the development of the Large Fish Index (LFI). The method involves additional averaging of catch densities across hauls within ICES rectangles, prior to summation of the large and

total fish components for the LFI ratio calculation. In addition, corrections have been made to the underlying data as part of an ongoing process to improve quality control. For these reasons, absolute values of the indicator differ slightly from those reported in previous years.

The background to this indicator previously included information from sub-divisional assessments within the North Sea, but current assessments are only available at regional sea level (Figure D1aii and D1aiii). From the previous extensive OSPAR assessment, 3 otter trawl surveys were selected to provide the key data for each regional sea area, considering the length of the time-series, spatial coverage and quality of data. These surveys are: the Scottish otter trawl survey in Quarter 1 for the Scottish Continental Shelf, the Northern Irish otter trawl survey in Quarter 1 for the Irish Sea and the northern part of the French otter trawl survey in quarter 4 for the Celtic Sea. Key findings for these areas are as follows:

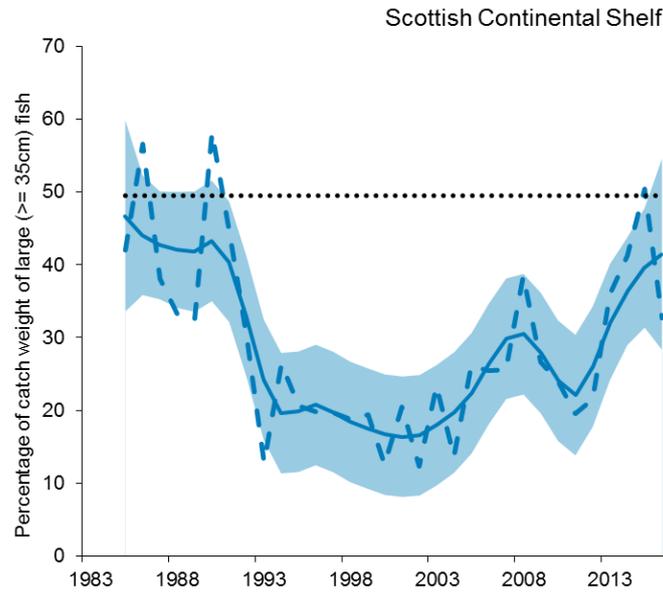
Scottish Continental Shelf. In 2016, large fish (≥ 35 cm) made up approximately 33% of the weight of the surveyed demersal fish community. This was lower than the 42% observed in 1985 and lower than the 50% target, but there are signs of recovery in the data. While there was a clear decline in the indicator during the 1990s to 12% in 2002, the smoothed trend has shown increases with fluctuations since that time.

Irish Sea. In 2016, large fish (≥ 45 cm) made up approximately 10% of the weight of the surveyed demersal fish community. This was higher than the 7% in 1992, but lower than the high in 2014 of 17%. Although recovery was prominent until 2014, a subsequent fall was observed in 2015 and 2016. This fall is due to a rapid increase in the biomass of small fish, predominately whiting *Merlangius merlangus* that do not contribute to the large fish component. The surveyed biomass of large fish has, in fact, continued to increase since 2014 but at a slower rate than the biomass of small fish.

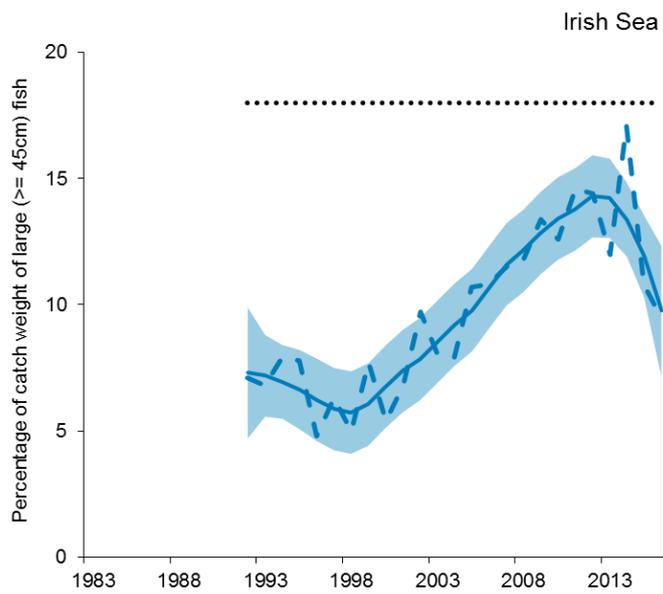
Celtic Sea. In 2016, large fish (≥ 40 cm) made up approximately 19% of the weight of the surveyed demersal fish community. This was slightly higher than the 16% recorded in 1997 but below the target of 46%, and lower than the 36% recorded in 2006. Although the long-term smoothed trend has been largely stable there was a fluctuation to higher values in the mid-2000s.

Figure D1aii. Proportion of large fish (survey specific threshold for “large” size), by weight, in the Scottish Continental Shelf, Irish Sea and Celtic Sea

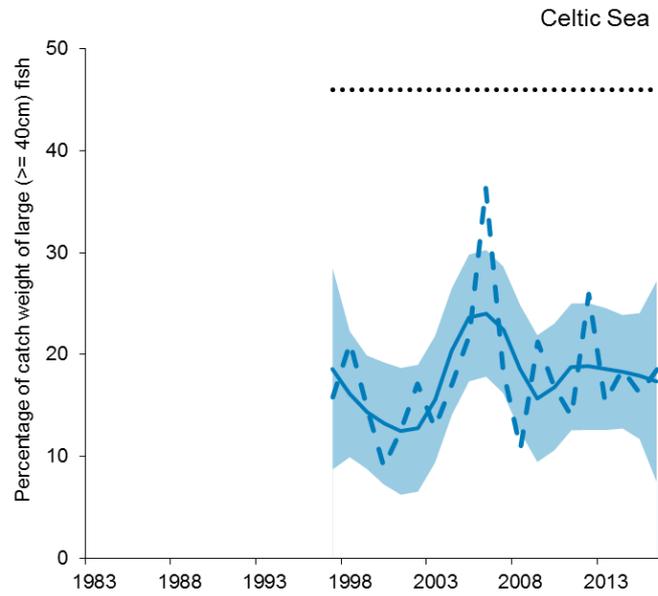
Scottish Continental Shelf, 1985 to 2016



Irish Sea, 1992 to 2016



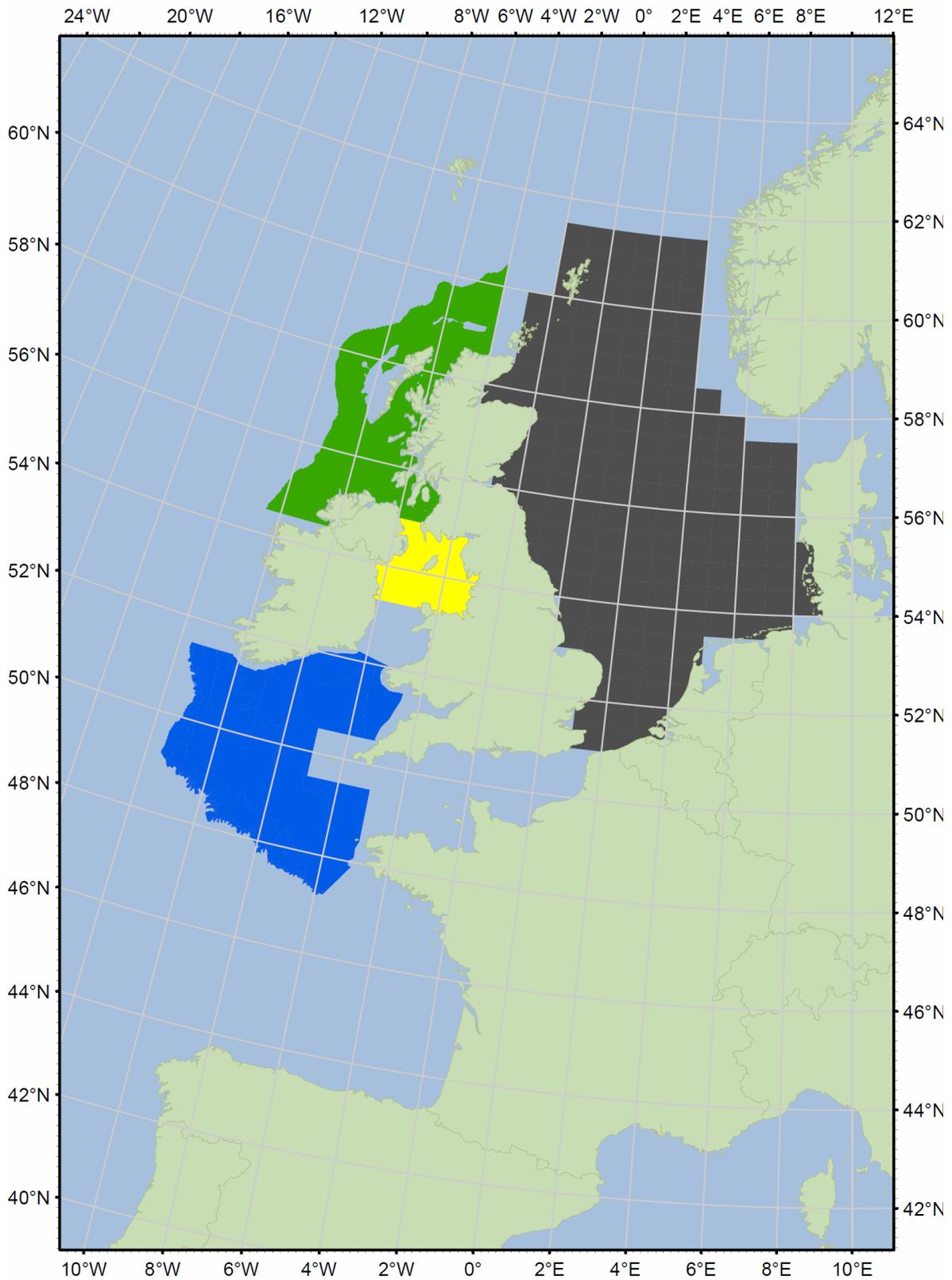
Celtic Sea, 1997 to 2016



Note: The line graphs show the unsmoothed trend (dashed line) and a LOESS smoothed trend (solid line) with the shaded area showing the 95 per cent confidence intervals around the smoothed trend. The horizontal dashed line shows the assessment thresholds from OSPAR (2017).

Source: Centre for Environment, Fisheries and Aquaculture Science; Marine Scotland.

Figure D1aiii. Areas surveyed to generate the fish size class indicator for the seas around the UK: North Sea - dark grey, Scottish Continental Shelf – dark green, Irish Sea – yellow and Celtic Sea – dark blue



Source: Centre for Environment, Fisheries and Aquaculture Science.

Goals and targets

Aichi Targets for which this is a primary indicator

Strategic Goal B. Reduce the direct pressures on biodiversity and promote sustainable use.



Target 6: By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Strategic Goal D. Enhance the benefits to all from biodiversity and ecosystems.



Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Aichi Targets for which this is a relevant indicator

Strategic Goal A. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.



Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal D. Enhance the benefits to all from biodiversity and ecosystems.



Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Web links for further information

Reference	Title	Website
OSPAR Intermediate Assessment 2017	Proportion of Large Fish (Large Fish Index)	https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/fish-and-food-webs/proportion-large-fish-large-fish-index/
Defra Science	Cotter <i>et al.</i> 2008. Development of a Marine Trophic Index for UK waters	http://randd.defra.gov.uk/Document.aspx?Document=WC0604_7255_FRP.pdf (PDF, 1.36Mb)

Reference	Title	Website
	and recommendations for further indicator development	
International Council for the Exploration of the Sea	ICES home page	http://www.ices.dk/Pages/default.aspx

References

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<https://doi.org/10.1111/faf.12278>

Full details of this indicator, including a datasheet are available at: jncc.gov.uk/ukbi-D1a and <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/biodiversity-status/fish-and-food-webs/proportion-large-fish-large-fish-index/>

Last updated: September 2019

Latest data: Proportion of large fish by weight in the North Sea – 2017

Proportion of large fish by weight in the Scottish Continental Shelf – 2016

D1a. Fish size classes in the North Sea

Proportion of large fish by weight in the Irish Sea – 2016

Proportion of large fish by weight in the Celtic Sea – 2016