

Appendix 1: Executive summary from IESSNS survey report 2021 (ICES. 2021. Working Group on Widely Distributed Stocks (WGWISE). ICES Scientific Reports. 3:95. 874 pp. <http://doi.org/10.17895/ices.pub.8298>).

The International Ecosystem Summer Survey in the Nordic Seas (IESSNS) was performed within approximately 5 weeks from June 30th to August 3rd in 2021 using five vessels from Norway (2), Iceland (1), Faroe Islands (1) and Denmark (1). The main objective is to provide annual age-segregated abundance index, with an uncertainty estimate, for northeast Atlantic mackerel (*Scomber scombrus*). The index is used as a tuning series in stock assessment according to conclusions from the 2017 and 2019 ICES mackerel benchmarks. A standardised pelagic swept area trawl method is used to obtain the abundance index and to study the spatial distribution of mackerel in relation to other abundant pelagic fish stocks and to environmental factors in the Nordic Seas, as has been done annually since 2010. Another aim is to construct a new time series for blue whiting (*Micromesistius poutassou*) abundance index and for Norwegian spring-spawning herring (NSSH) (*Clupea harengus*) abundance index. This is obtained by utilizing standardized acoustic methods to estimate their abundance in combination with biological trawling on acoustic registrations. The time series for blue whiting and NSSH now consists of six years (2016-2021).

The survey coverage area included in calculations of the mackerel index was 2.2 million km² in 2021, which is 24% smaller coverage compared to 2020. Survey coverage was reduced in the western area as Greenlandic waters, Iceland basin (south of latitude 62°45') and the Reykjanes ridge (south of latitude 62°45') were not surveyed in 2021. Furthermore, 0.29 million km² was surveyed in the North Sea in July 2021 but those stations are excluded from the mackerel index calculations.

The total swept-area mackerel index in 2021 was 5.15 million tonnes in biomass and 12.2 billion in numbers, a decreased by 58% for biomass and 54% for abundance compared to 2020. Reduced survey coverage in the western area did not contribute to the observed decline as the zero mackerel boundary was established north, west, and south of Iceland. In 2021, the most abundant year classes were 2019, 2016, 2014, 2017 and 2012, respectively. The cohort internal consistency was slightly reduced compared to last year, particularly for ages 5-8 years.

Mackerel was distributed mostly in the central and northern Norwegian Sea, with low densities and limited distribution in Icelandic waters. Mackerel distribution in the North Sea was similar to 2020, but the biomass nearly doubled compared to 2020. Zero boundaries of the summer distribution of mackerel were found in most parts of the survey area, except towards northwest in the Norwegian Sea, southward boundaries in the North Sea and west of the British Isles.

The total number of Norwegian spring-spawning herring (NSSH) recorded during IESSNS 2021 was 19.6 billion and the total biomass index was 5.91 million tonnes, which are similar results to 2020. The 2016 year-class (5year olds) dominated in the stock and contributed to 54% and 59% to the total biomass and total abundance, respectively, whereas the 2013 year-class (8-year olds) contributed 13% and 11% to the total biomass and total abundance, respectively. The 2016 year-class is considered fully recruited to the spawning stock in 2021, and also fully recruited to the survey area. The survey is considered to contain the whole adult part of the NSSH stock during the 2021 IESSNS.

The total biomass of blue whiting registered during IESSNS 2021 was 2.2 million tonnes, which is a 22% increase compared to 2020. Stock abundance (ages 1+) was estimated to 26.2 billion compared to 16.5 billion in 2020. The 2020 year-class dominate the estimate in 2021 and contributed 51% and 69% to the total biomass and abundance, respectively.

As in previous years, there was overlap in the spatio-temporal distribution of mackerel and herring. This overlap occurred between mackerel and North Sea herring in major parts of the North Sea and partly in the southernmost part of the Norwegian Sea. There were also some overlapping distributions of mackerel and Norwegian spring-spawning herring (NSSH) in the western, north-western and north-eastern part of the Norwegian Sea.

Other fish species also monitored are lumpfish (*Cyclopterus lumpus*) and Atlantic salmon (*Salmo salar*). Lumpfish was caught at 78% of surface trawl stations distributed across the surveyed area from southwestern part of Iceland, central part of North Sea to southwestern part of the Svalbard. Abundance was greater north of latitude 72°N compared to southern areas. A total of 35 North Atlantic salmon were caught in 25 stations both in coastal and offshore areas from 60°N to 76°N in the upper 30 m of the water column. The salmon ranged from 0.089 kg to 6.5 kg in weight, dominated by postsmolt weighing 89-425 grams and 1 sea-winter individuals (grilse) weighing 1.9-2.4 kg.

Satellite measurements of the sea surface temperature (SST) showed that the central and eastern part of the Norwegian Sea were roughly on same level as average for July 1990-2009. SST was 1-3 °C warmer than the long-term average in the Iceland Sea and the Greenland Sea. The North Sea SST was 1-2 °C warmer than long term average. CTD measurements from the central part of the Norwegian Sea indicated more stratification in the surface layer than in 2020.

Average zooplankton biomass in the Norwegian Sea has been relatively stable since 2013. There was, however, a small decrease in 2021 compared to last year, especially in the central and southern areas. A small increase was observed in the Iceland region compared to last year.