Stock Annex: Dab (*Limanda limanda*) in subdivisions 22–32 (Baltic Sea)

Stock specific documentation of standard assessment procedures used by ICES.

Stock	dab.27.2232
Working Group:	Baltic Fisheries Assessment Working Group (WGBFAS)
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A. General

A.1. Stock definition

Dab is distributed mainly in the western part of the Baltic Sea. Landings are mainly taken in SD 22, with smaller proportions in SD 24 and SD 25. The eastern border of its distribution is not clearly described. Single specimens are caught only occasionally in the Polish EEZ as well as in SD 26–32 (Plikšs and Aleksejevs, 1998; Ojaveer *et al.*, 2003).

Spatial distribution data of dab based on BITS in quarter 1 and quarter 4 suggest that dab in SD 21 is connected to SD 22 - SD 32 (Oeberst, 2014a). Figure 1 shows the spatial distribution of dab during BITS in quarter 1 in 2003. The density of dab in the Arkona Sea and Bornholm Sea is very low also after the major inflow in January 2003. The stock separation between Skagerrak and SD 21 is supported by the spatial distribution of dab during IBTS in quarter 1 and 3. cpue values of dab are very low in the Skagerrak during quarter 1 (Oeberst, 2014b). High cpue values were observed in the deeper area of the North Sea and in the southern part of the Kattegat as illustrated in Figure 3 for IBTS in quarter 1 in 2013. In quarter 4 dab was also observed in the shallow waters of the Danish coast of the North Sea and with low densities around Skagen (southern part of Skagerrak).

Therefore, it is possible that the dab in SD 21–32 should be considered as one stock. Further work is needed to validate this hypothesis, however, that was not possible to conduct as part of WKBALFLAT (ICES, 2014). Thus, dab in SD 21 and SD 22–32 are currently treated as separate stocks.

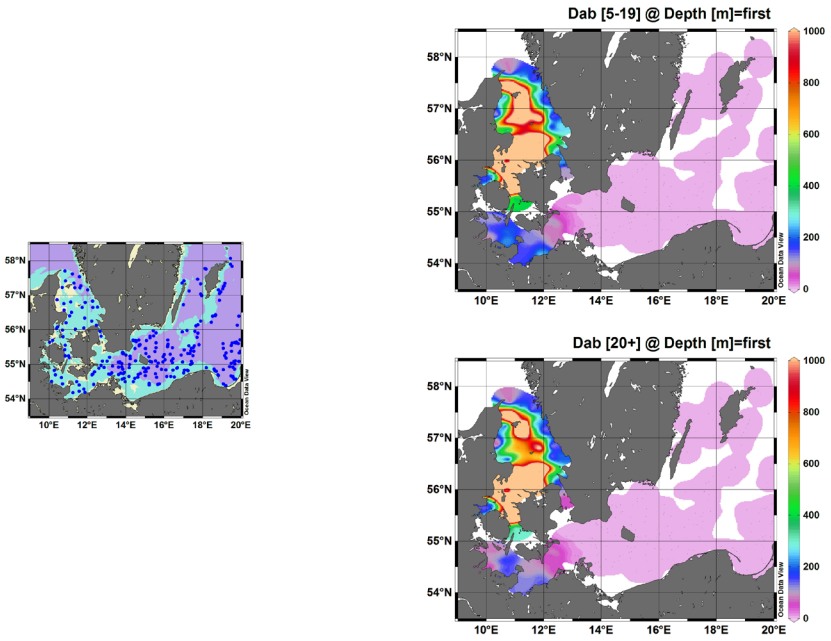

Figure 1: Position of fishing stations (left panel) and spatial distribution of dab < 20 cm (right upper panel) and dab ≥ 20 cm (right lower panel) during BITS in quarter 1 in 2003.

A.2. Fishery

Dab is captured as by-catch in the cod fishery and in a mixed-flatfish fishery with plaice and flounder. The main fishing grounds are in SD 22 and to a minor extend in SD 24; Denmark and Germany are the main fishing countries. The landings of Sweden in SD 22–30 are of minor importance.

Minimum mesh opening size for dab is 120 mm and minimum landing size of dab is 25 cm. There is no seasonal protection of dab.

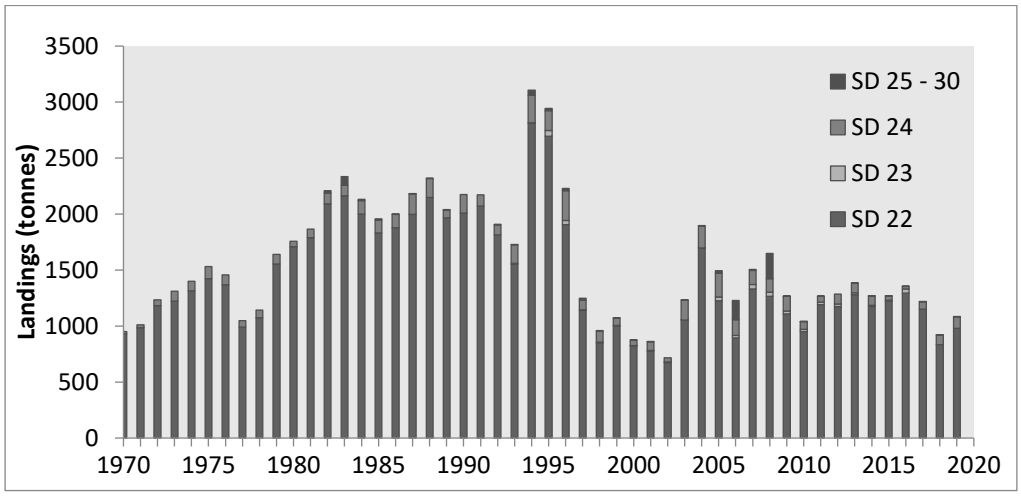

Figure 4: Landings of dab (tons) by ICES Subdivisions from 1970 - 2019

B. Data

B.1. Commercial catch

Landings by country and ICES Subdivisions are available from 1970 onwards. Total landings of dab were around 1000 t between 1970 and 1978 and fluctuated around 2000 t between 1979 and 1996 (Table 8.2.1). During the years 1994 to 1996 the total landings of dab were over-reported due to bycatch misreporting in the cod fishery. Less than 1000 t were landed in 1997 and from 1999 to 2002. Since 2003 landings fluctuated around 1300 t with a maximum of 1894 t in 2004. Landings varied between 941 t (2018) and 1648 t (2008) without a trend since then.

The largest amount of dab landings are reported by Denmark (subdivisions 22 and 24) and Germany (mainly in Subdivision 22, Figure 8.2.1). The German and Danish landings of dab are mostly bycatches of the directed cod fishery and the target of a mixed flatfish fisheries.

1.1.1.1 Discard

Sampling intensity and the quality of the discard data has increased steadily since the last benchmark in 2014, as the national data submitters gave more estimation. Reliable estimates of discards are available from Denmark and Germany since 2012. Estimations before 2012 are based on very few observations and considered unreliable, as the amount of discarded fish can vary greatly between trips. Since 2018, the discard ratio is considered reliable and a catch advice is given for the species. Subdivision 22 (the Belt) shows a very good sampling coverage that allows reasonable discard estimations.. Subdivision 23 (Sound) is sampled less; only a few biological samples are available. Before 2006, sampling intensity was too low to give a reasonable estimation, especially in the passive segment, where almost no data are available.

B.2. Biological

Parameters such as catch volume, discard volume, discard length and age distribution, length distribution and fishing effort are available from the commercial fishery. Data on catch at age in numbers, weight at age in the catch, catch per unit of effort are available by quarter and subdivision from the Baltic International Trawl Survey (BITS) since 2001Mean weight at age and the proportions of spawners by age group are available for since 2008 based on BITS. Age samples were not available before 2008. Collection of otoliths for age determination has intensified since 2011.

B.3. Surveys (BITS in quarter 1 and 4)

National bottom trawl surveys were conducted in the Baltic Sea between 1978 and 2000 in quarter 1 and quarter 4. However, large parts of ICES SD 22 were not covered by the surveys. Baltic International Trawl Survey (BITS) was established in 2001 and was coordinated by WGBIFS. A new survey design was applied and randomly selected stations taken from the Tow Database. Small and larger versions of standard gear (TVS and TVL), which were adapted to the different sizes of research vessels, are used and conversion factors were estimated based in inter-calibration experiments to transfer the catch per unit effort data of TVS into units of TVL. A constant conversion factor of 1.4 is used to transfer the cpue values of dab captured by TVS into units of TVL.

The mesh size in the cod end of the standard gears is 10 mm suggesting that the catchability of dab larger than 11 cm is not influenced by the cod end mesh size if it is assumed that the selectivity characteristics of dab and flounder are comparable (Oeberst, 2007). Around 300 fishing stations are planned for quarter 1 BITS and about 240 fishing stations for quarter 4 BITS, in the entire Baltic Sea each year. Hauls which were realized between 10 m and 19 m (BITS stratum 8) in SD 22–24 were taken into account. The mean cpue values were estimated according the procedures given in the BITS manual. The minimum observed length of dab during BITS was 4 cm and the maximum length was 40 cm. Truncation of length range for the stock assessment is not supported by the length distributions observed during BITS. Dab was mainly observed west of 12°E, but, dab was also captured east of 15 °E in quarter 1 of many years (max 18 ° 33' E in 2008). Highest cpue values were observed between 10 m and 30 m depth.

C. Assessment: data and method

The stock is assessed based on the method 3.2.0 of the ICES DLS approach (ICES, 2012). Geometric mean of the biomass index of quarter 1 and 4 was calculated as proxy for the spawning stock biomass. Only dab of length ≥ 15 cm were taken into account because on average more than 50% of dab > 14 cm of both sexes were maturing during quarter 1 with high fluctuations from year to year. Length frequencies of BITS were combined with annually weight-length relationship to estimate biomass indices.

Advice is estimated based on recent landings/catch and the relation between the average of the biomass index of the two last years and the average of the three preceding years. Advice on dab is given every two years. In 2018 the advice based on landings has been changed to advice based on catches which includes landings and estimated discards.

A precautionary truncation has to be applied to the advice if the status of the stock is below the proxy reference point. The proxy is a result of a length-based indicator method.

Reference points

The stock status is evaluated by calculating length based indicators applying the LBI method developed by WKLIFE V (2015). CANUM and WECA of commercial catches are taken from InterCatch. Biological parameters were calculated using survey data from DATRAS:

- L_{inf}: average of 2002–2018, both quarter and sexes → L_{inf} = 35.61 cm
- L_{mat}: average of 2002–2018, quarter 1 only, females only → L_{mat} = 18 cm

The results of LBI shows the stock status of dab.27.22-32 compared to possible reference points. The F_{MSY} proxy ($L_{F=M}$) is used as proxy reference point to evaluate the stock status.

H. Other Issues

H.1. Historical overview of stock separation and stock definition studies

Several analyses have been conducted to define the dab stock in the Baltic Sea. Temming (1989) separated dab in the Belt Sea area (SD 22 and western part of SD 24, south of Mön) from dab in the Bornholm area (SD 25) based on tags and meristic

investigations by Nissling *et al*. (2002) suggest two stocks of dab, one in SD 23 and western part of SD 24, and the second in the eastern part of SD 24 and SD 25 based on salinity requirements for egg development and neutral buoyancy of eggs.

Genetic analyses related to dab and direct comparisons between SD 23 and 22 are not available. Nevertheless, it is suggested that three stocks in the Baltic Sea (Fig 1, ICES, 2010) exist: one stock in Belt Sea SD 22 + 24W, one stock in Öresund SD 23 and one joint stock in Arkona and Bornholm basin (SD 24E + 25) based on the data above (Temming, 1989; Nissling *et al.*, 2002; ICES, 2010). The boundary in SD 24 for the split into two stocks is still unclear. WKFLABA concluded that the Öresund stock should be merged with the Belt Sea stock, but, merging stocks that have independent dynamics can be considered a more severe error from a stock conservation point of view, than to erroneously divide a homogenous stock in two separate assessment units (c.f. Laikre *et al.*, 2005; ICES, 2010). Hence WKFLABA proposed the separation of dab into three stocks in the Baltic (ICES, 2010).

Descriptions of the spatial distribution patterns of dab are available from the international coordinated **B**altic **I**nternational **T**rawl **S**urvey (BITS) in SD 21–28 in quarter 1 and 4 and the **I**nternational **B**ottom **T**rawl **S**urvey (IBTS) which covers the North Sea, the Skagerrak and the Kattegat in quarter 1 and quarter 4. Hydrographical data, especially salinity and oxygen content in SD 24 and SD 25 are available from BITS and from standard stations of the Institute of Baltic Sea Research-Warnemünde in the near bottom layer in spring. Salinity was only in some years (2003, 2005 and 2007) above 17.8 psu where ~ 1% of dab eggs will obtain neutral buoyancy, but it was always lower than the required mean salinity of neutral buoyancy (Nissling *et al.*, 2002). Thus, poor hydrographical conditions in the pre-spawning and spawning period in combination with the very low cpue values in SD 24 and SD 25 in quarter 1 between 2001 and 2013 do not support the hypothesis of WKFLABA (2010) that there is currently a self-reproducing dab stock in SD 24W and 25. Based on these observations, WKBALFLAT decided to treat the area SD 22–32 as combined.

H.1. Historical overview of previous assessment methods

To provide advice, the dab in SD 22–32 should be assessed with a Survey-based trend model (as suggested for data limited stock following the DLS Guidance Report, 2012). However, continued developments towards an analytical assessment (e.g. SAM) should be ensured. The data quality currently doesn't allow the results of the analytical assessment to be used for advice, and different issues, such as discards and deriving age structure based on length measurements need to be improved (as described above). Further development in these calculation procedures and analyses is strongly encouraged to be carried out in parallel with survey-based trend analyses, to allow for a possible transition to analytical methods in the future.

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