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

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Dab (*Limanda limanda*) in subdivisions 22–32 (Baltic Sea)
Working Group:	WGBFAS
Last benchmarked:	2014 (WKBALFLAT; ICES, 2014).
Last updated:	April 2016
Last updated by:	WGBFAS 2016/ Rainer Oeberst
Main modifications:	Added data call requirements for the stock.

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. Some commercial landings of dab were reported also in SD 25, 27 and 28 (Florin, 2005; ICES, 2010). The eastern border of its occurrence is not clearly described. Single specimens are caught only occasionally in the Polish EEZ (unpublished data, E. Gosz) as well as in SD 26–32 (Plikšs and Aleksejevs, 1998; Ojaveer *et al.*, 2003).

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 al-

ways 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.

Further, the spatial distributions 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 2 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 22–32 is currently treated as a single stock.

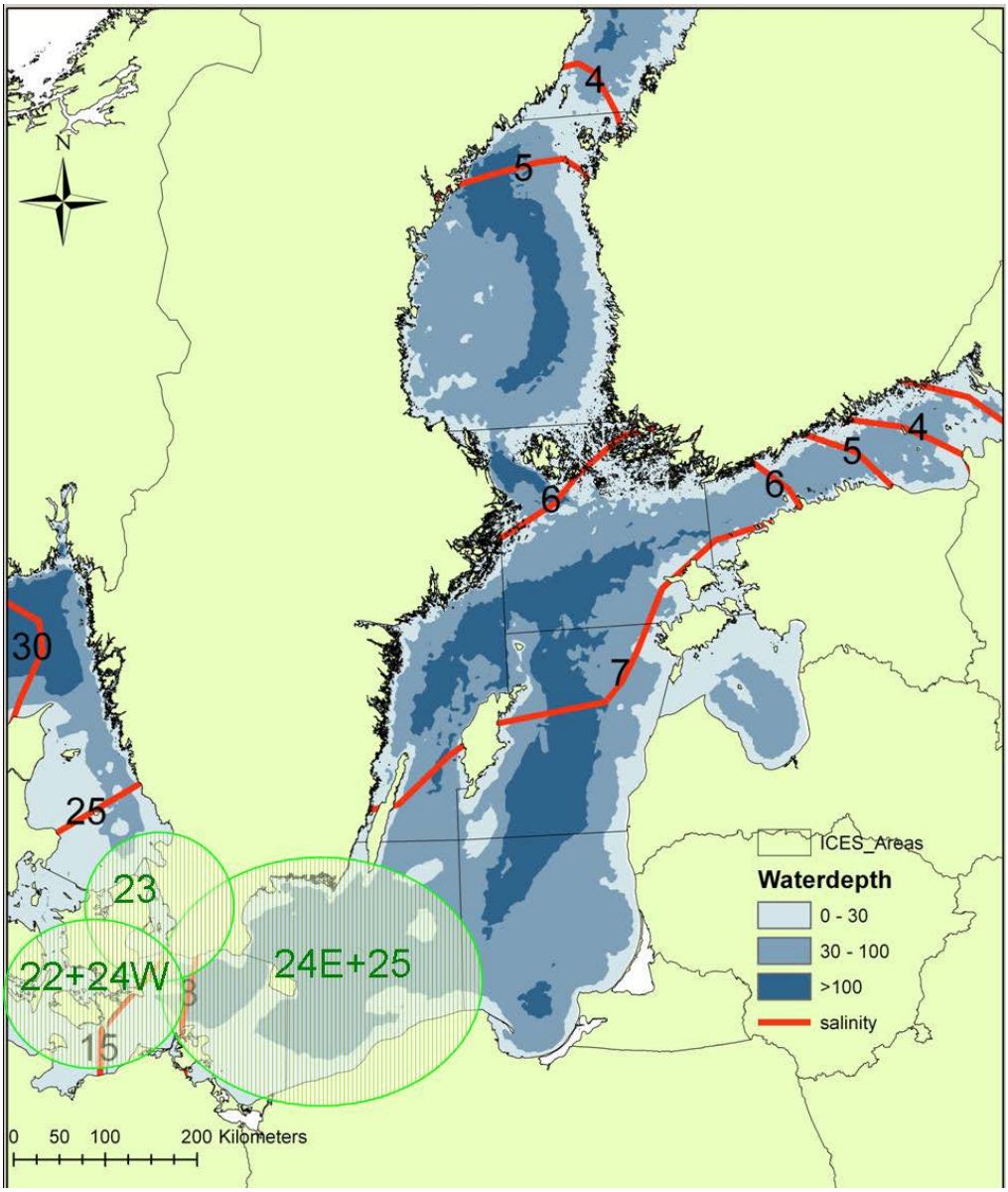

Figure 1: Approximate location of three identified stocks of dab in the Baltic Sea by WKFLABA (2010). Numbers within circles refer to ICES subdivisions.

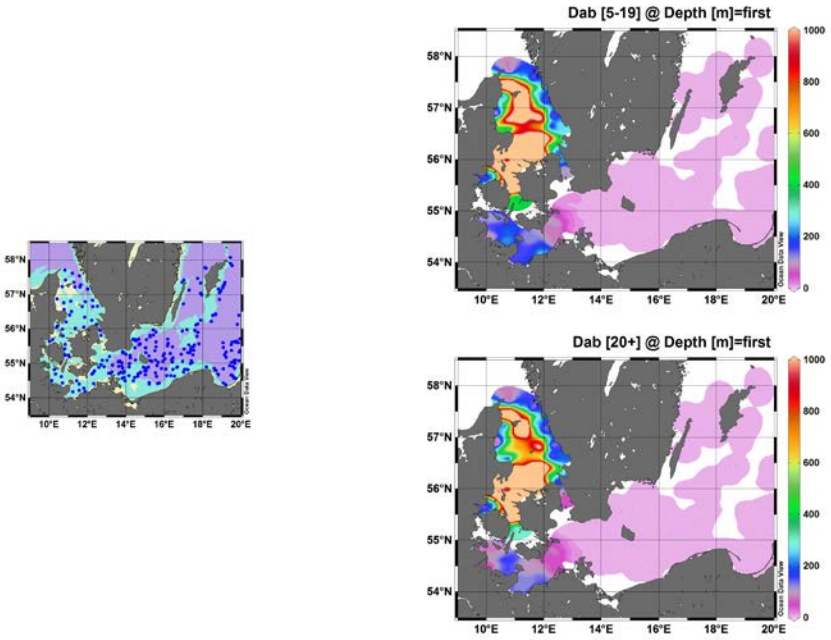

Figure 2: Position of fishing stations (left panel) and spatial distribution of dab < 20 cm (right upper panel) and dab ≥ 20 cm (right lower panel) during BITS in quarter 1 in 2003.

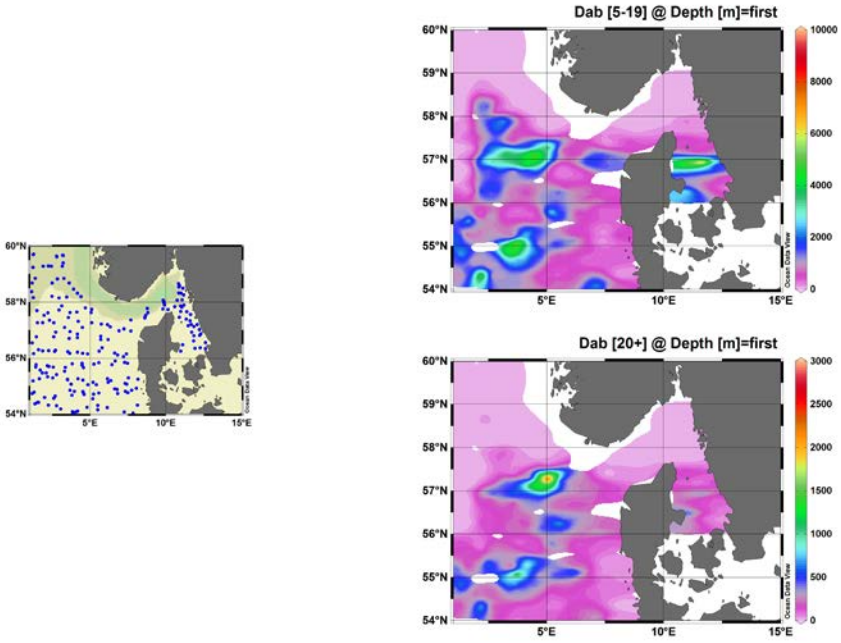

Figure 3: Position of fishing stations (left panel) and spatial distribution of dab < 20 cm (right upper panel) and dab ≥ 20 cm (right lower panel) during IBTS in quarter 1 in 2013.

A.2. Fishery

Dab is captured as by-catch of the cod, plaice and flounder fisheries and is mainly landed in SD 22 (Figure 4).The landings of Sweden in SD 22–30 are of minor importance. Danish and German landings in SD 22 amount to more than 1000 tonnes yearly and represent 47% and 36% respectively of total landings in the Baltic Sea during 2007–2009 (data from ICES, 2010). A significant amount of landings from SD 24, around 100 tonnes, is removed yearly by the two same dominant countries, and landings are reported to a lesser extent by Sweden in SD 25, 27 and 28 (Florin, 2005, ICES, 2010).

After a level at about 2000–3000 t between 1981 and 1997 landings decreased to 715 t in 2002 followed by fluctuating landings around 1 250 t with increasing proportions of landings in SD 25. Estimates of the amount of discards in 2011 and 2012 showed that in some periods similar (or even higher) amounts of dab were discarded than landed. It was agreed that both discarded and landed dab should be taken into account for describing the total removal of dab from the stock by the fishery because the survival rate of discarded dab is very low (Mieske and Oeberst, 2014).

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.

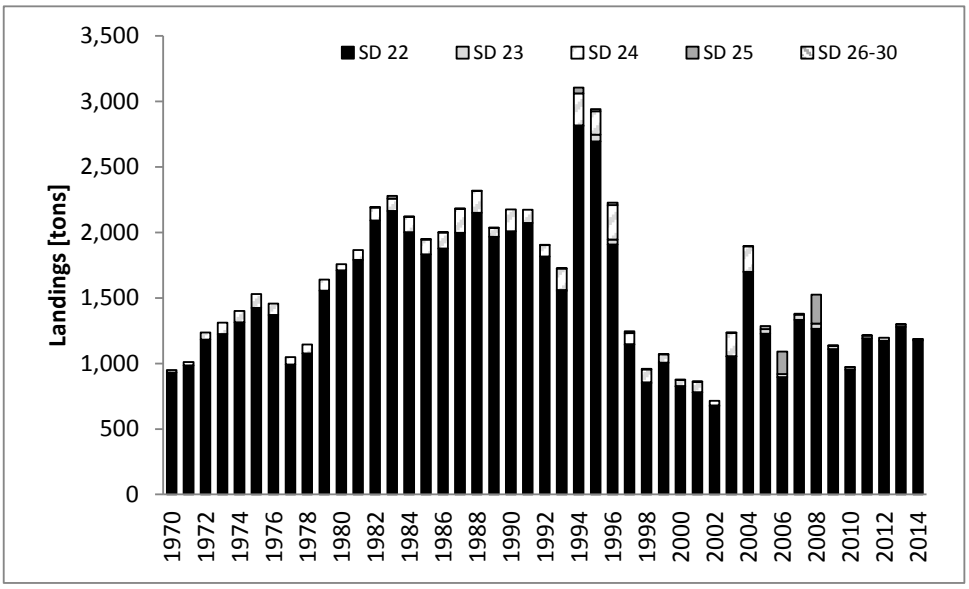

Figure 4: Landings of dab (tons) by ICES Subdivisions from 1970–2012

B. Data

B.1. Commercial catch

Landings by country and ICES Subdivisions are available from 1970 onwards. Estimates of discards were reported by countries from 2000 onwards. However, estimates were not available for all years, quarters and fisheries. The complex and unpredictable discard behaviour makes it very difficult to model the amount of the discard and makes the estimation of the discards very dependent on a proper sampling scheme. Unfortunately, the discard sampling is far from optimal because many strata are not sampled (Oeberst, 2014 c). Consequently, the discard from those strata have to be estimated based on data from other strata where sampling has taken place in order to get an estimate of the total discard of the stock.

Analyses during WKBALFLAT suggested that procedures to estimate discards provide a poor basis for the assessment. Therefore, discard estimates are currently considered too uncertain to be used for advice purposes. Both long-term and short-term solutions were developed by WKBALFLAT (ICES, 2014) to improve the discard estimates in the future. Until then, only landings advice can be provided. During WGBFAS in 2015 it was agreed that estimates of discards for the years 2012–2014 can be used to give catch advice based on the development of BITS indices.

B.2. Biological

Length frequencies of landings and discards are available but have not been reported for all years, quarters, fisheries and countries throughout the time series (Oeberst, 2014 c). Age data are available from Germany from 2008 onwards and from Denmark from 2010 onwards. Age data were not available from Sweden. Exploratory analyses to derive catch in number by age group based on length frequencies have been carried out using different slicing methods. However, the estimates were considered uncertain due to large differences between results from the different slicing methods and from those based on age readings. Resolving age reading inconsistencies between Germany and Denmark is needed in order to obtain a solid basis for validation of the results from slicing methods in the future.

Mean weight at age and the proportions of spawners by age group are available for 2008 to 2012 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

Advice was 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.

H. Other Issues

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.

I. Data call

Following information have to be uploaded to Intercatch (IC) and to accessions@ices.dk (AC) according to the data call of ICES

REQUIRED DATA	COUNTRIES	SUBMITTED TO
Landings (quantity)	All	IC
Discards (quantity)	All	IC & AC
Effort	All	IC & AC
Age comp landings	DE & DK	IC
Age comp discards	DE & DK	IC
Mean weight at age in the landings	DE & DK	IC
Mean weight at age in the discards	DE & DK	IC

J. References

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