Stock Annex: Flounder (*Platichtys flesus*) in Subdivisions 26 and 28 (East of Gotland, Gulf of Gdansk)

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Flounder (*Platichtys flesus*) in Subdivisions 26 and 28 (East of Gotland, Gulf of Gdansk)
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A. General

A.1. Stock definition

There are two sympatric flounder populations in the Baltic Sea, which differ in their spawning habitat and egg characteristics (Nissling *et al*., 2002; Nissling and Dahlman, 2010). Demersal spawners produce small and heavy eggs which develop at the bottom of shallow banks and coastal areas in the northern part of the Baltic Proper. Successful reproduction occurs down to 5-7 psu. Pelagic spawners spawn at 70–130 m depth, and their eggs are neutrally buoyant at 10-20 psu and require oxygen concentrations of 1–2ml/l for development (Vitins, 1980; Nissling *et al*., 2002; Ustups et al, 2013).

In SD 28 both spawner types exist; however, during spawning they are separated, with pelagic spawners in the deeper areas and flounder with demersal eggs spawning in coastal areas.

Flounder in the following ICES SD are allocated to the demersal stock: 27, 29-32. There is a spatial overlap between the demersal and pelagic ecotypes, especially in SD 28 but the proportions of mixing are unknown. However, since landings in SD 28-2 are relatively large compared to the other SDs of the demersal stock, and to avoid the dynamics in the demersal unit being driven by the flounders in SD 28-2 (containing a mixture of the two ecotypes) it was decided that flounders in SD 28-2 would be allocated to the pelagic ecotype. Flounder in the Gulf of Riga, SD 28-1, most probably are of the demersal ecotype (coastal spawning). However, since historical fisheries data for flounder currently provided by countries are not divided into sub units of SD 28 it was decided to allocate the Gulf of Riga (SD 28-1) into the pelagic unit as well. The density of flounder in Gulf of Riga is low, therefore the impact of allocating this subunit, considered to be of the demersal ecotype, to the pelagic ecotype is believed to be minimal.

During favourable hydrological conditions, flounder with pelagic eggs may occur also in SD 29 and even spread into SD 32 during spawning season (ICES, 2010; Grauman, 1981). Furthermore, during feeding migration flounder from the open Baltic Sea may

enter the Gulf of Finland (Mikelsaar, 1958). The extent of this is unknown and therefore SD 29 and 32 are assumed to belong to the stock with demersal eggs.

The flounder in SD 24 and 25 are differentiated from flounder in SD 26 and 28 based on separate spawning areas (Figure 1), trends in survey cpue, and tagging data that indicate no dispersal between these areas (Cieglewicz, 1963; Otterlind, 1967; Vitins, 1976). This needs further examination to determine whether a more consistent assessment with lower uncertainty is obtained when merging the two units.

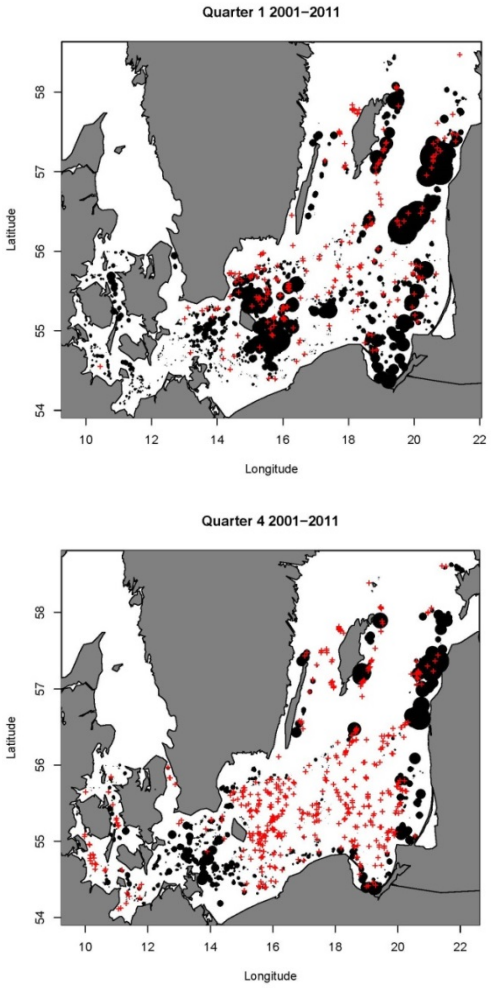

Figure 1. Average relative distribution of flounder biomass in BITS survey in Quarter 1 (spawning time) and quarter 4 from years 2001-2011. Bubble size is proportional to biomass, red crosses mean zero catch.

A.2. Fishery

Flounder landings in SD 26 and 28 up to 2012 fluctuated between 2000- to 5000 tonnes. The major part (86 % in 1996-2013) of the landings belonged to SD 26.

The main fishing countries in Subdivision 26 are Russia (56% of landings from long term average from 1996-2013), Poland (24%) and Lithuania (16%). The landings in SD 26 started to increase in the 1990s and for the last 15-20 years have been between 3000 and 3500 tonnes. In the last years the Polish fishery was mainly a gillnet fishery along the coast whereas the Russian and Lithuanian landings were by-catches mainly in a

bottom trawl fishery for cod. The main fishing countries in Subdivision 28 are Latvia (71%) and Estonia (12 %). Landings in the last years have continued to decrease due to decreasing fishing effort. Fishing activity is mainly determined by the cod fishery (quota availability, area of fishing) and and has shown a general trend of decrease in size. The small scale fishery in the coastal zone is a significant part of the landings in Subdivision 28.

The highest landings recorded, 6455 tonnes, in SD28, were in 1975. Later, in beginning of 1980's after the strong decrease of flounder stock, a specific ban of the flounder fishery was introduced for couple of years.

A.3. Ecosystem aspects

Recruitment success can fluctuate depending on hydrological conditions on the spawning grounds (Nissling *et al*., 2002). However some results suggest that recruitment may be regulated in a post-settlement stage, probably in the shallow coastal nursery areas (Ustups *et al*., 2013).

B. Data

B.1. Commercial catch

The catch from commercial fisheries includes a landed and a discarded fraction.

Landings data are available from Poland, Latvia, Lithuania, Estonia, Finland, Russia, Germany, Denmark and Sweden from 2000 onwards in the ICES database InterCatch. Landings are provided by Subdivision, quarter and fishing gear (i.e. active and passive). Landings from 1973 to 1999 are reported in previous WGBFAS reports (ICES, 2012a, 2013) and available in Excel sheets by countries and Subdivisions as part of the data call in preparation for the WKBALFLAT 2014 (ICES, 2014).

The discard ratios in both subdivisions differ between countries, fleets, vessels and even individual hauls of the same vessel and trip. Therefore, a common discard ratio cannot be applied across all countries. As the discards are not readily reported, there is poor data coverage within *strata* (defined by year, SD, country and fleet type: active or passive).

The quality of the estimations of discards is highly uncertain (ICES, 2014). The main problem is the very high records of flounder discards, which exceed the landings and sometimes are even 100% of the catch. When no discard data are available for a particular stratum and there were no landings of flounder assigned, the discard was set as nonexistent, which is not necessarily true. This leads to an underestimation of discards, and therefore the current discards estimates should not be used in the provision of advice.

A survival-rate (i.e. 50% survival in Q1 and Q4 and 10% survival in Q2 and Q3) was applied to the discarded fraction of the catch. These numbers represent the lower limits among the relatively wide range of survival rates obtained from several studies conducted in the Baltic Sea (see e.g. Revil, 2012; Herrmann *et al*., 2013; Broadhurst *et al*., 2006 and the WKBALFLAT Working document 2.1)

Given the uncertainties with the current estimates of discards, it was decided at WKBALFLAT that only landings advice should be provided for the flounder stock in

SD 26,28, until further work is done on a more appropriate calculation of the discards raising procedure (see below) (ICES, 2014).

To enable catch advice, the following improvements are needed;

Documentation of discards is needed, where did the samples come from, and what have the countries extrapolated . In general, only data from sampled strata should be provided, with extra information/advice on how to fill the gaps of unsampled strata (e.g. if zero landings of flounder, should the discards be estimated based on cod landing, etc.);

A common approach to calculating and raising discards for bycatch species, in particular when there are zero landings should be established;

To be able to use InterCatch for discard compilation, discards ratios should be available to borrow across years or neighbouring flounder stocks;

To be able to use InterCatch for discard compilation, it needs to be possible to use other discard raising factors than presently available, for example cod landings. Another option would be to add an additional column for total landings on a trip.

B.3. Surveys

The Baltic International Trawl Survey (BITS) covers the area of the flounder stock in 26 and 28. The survey is conducted twice a year (1st and 4th quarter) by the member-states having a fishery in this area. Survey-design and gear are standardized. International Baltic International Trawl Survey (BITS) was established in 2001 and is coordinated by the ICES WGBIFS

Around 300 fishing stations are planned for BITS-Q1 and about 240 fishing stations for BITS-Q4, in the entire Baltic Sea each year. The mean cpue values were estimated according to the procedures given in the BITS manual. Catch per unit of effort (number per hour) from BITS-Q1 and BITS-Q4 were used to calculate an index representing flounder abundance by numbers. Data were compiled from ICES DATRAS output format "cpue_per_length_per_haul". Averages were weighted first by fished depth stratum areas 8 (10-19m), 9 (20-39m), 10 (40-59m), 11 (60-79m), 12 (80-99m), 13 (90-119m), 14 (120-200m) and second by fished subdivision areas. Hauls with 0 fish per hour were included. All fish with length < 20cm were excluded from the calculations due to sampling design, because flounder nurseries areas are located in shallow coastal areas which are not covered in the BITS surveys.

B.4. Commercial cpue

Commercial cpue is available from Russia. The Russian cpue series refer to two types of bottom trawling vessels: the MRTR and MRTK. MRTRs vessels specialize in bottom trawl fishing, while the MRTK vessels, except bottom trawl fishing, can fish pelagic species. Both types of vessels cover 88-97% of the total Russian flounder catch in Subdivision 26. Under the current fishing regulation in the Russian Federation, to monitor the catch, a ship owner should provide the SSD. The information includes: kind of activity (commercial fishing, transition into the operations area, anchorage), daily catch and catch range. The data obtained from all vessels are combined into an electronic database. Number of vessel days by vessel type is estimated by taking into account the kind of activity; it includes only those days when the vessel performed commercial fishing. Average flounder cpue for MRTR and

MRTK vessels was calculated as flounder catch in tonnes divided by the number of commercial fishing vessel-days by vessel type.

B.5. Other relevant data

During WKBALFLAT (ICES, 2014), possibilities for age/length based analytical assessment were explored.

Length-distributions from commercial catches in the time-period from 2000 onwards are available for SD 26 from Latvia, Poland, Russia and Lithuania and for SD 28 from Latvia and Estonia (the time-ranges available depends on the country).

Age-data are considered to be applicable only when the ageing was conducted using recommended methods (slicing and staining or breaking and burning techniques) as recommended by WKARFLO (ICES, 2007, 2008) and WKFLABA (ICES, 2010). Von-Bertalanffy parameters were estimated based on age-data from the survey.

Because the estimated parameters didn't fit to the slicing method (L_{inf} in Bertalanfy growth equation was significantly lower than observed in the commercial samples), other von-Bertalanffy parameters from the literature were used (Froese and Sampang, 2013). Detailed description of the slicing method is available in the WKBALFLAT 2014 report (ICES, 2014).

It is important to highlight that due to time constraints, only some of the statistical slicing model settings were tested. If the statistical slicing method should be used in the future, then development and validation of this approach is encouraged. Further, sex-ratios should be available at least in a pilot study to determine whether it has an influence on the assessment or both sexes can be combined in future assessments.

C. Assessment: data and method

Category 3: Stocks for which survey-based assessments indicate trends (ICES DLS approach, ICES, 2012b).

Model used: Data Limited Stock Category 3.2. Stock trend model based on scientific surveys

Model Options and input data types and characteristics:

Stock trends are estimated using the Biomass Index from BITS-Q1 and BITS-Q4 surveys. The index is calculated by length-classes, and covers the period from 2001 onwards.

The Biomass-Index is a product of the calculated cpue by length and average-weight per length-class. The catch per unit of effort (number/hour) uses only fish ≥ 20 cm from both surveys and data is extracted from the ICES DATRAS database. The values are averaged from all (incl. 0 catch) daytime hauls weighted by depth stratum area. Weight at length was estimated as an average weight at length for data from 1991-2013, separately for 1st and 4th quarter for sub-divisions 26+28. Next, to these data, a weight-length relationships of the form $w=aL^b$ was fitted, where a and b are parameters. Parameters obtained for SDs 26+28 were: a=0.0154 and b=2.91 for 1st quarter and a=0.0158 and b=2.90 for 4th quarter.

The combined biomass index is calculated using the geometric mean of 1st and 4th quarter biomass indices. The Biomass-Index is calculated for each year. For advice, the

relative change in the average biomass index in the last two years is compared to the average of the three years before (DLS method 3.2.0).

H. Other Issues

Further developments of additional exploratory analytical assessments presented at WKBALFLAT (ICES, 2014) (production model and age based SAM) are recommended. However, before transitioning to a new stock assessment model, the discard estimates should be re-calculated.

It is recommended that also other countries (not only Poland) should re-age their historical age data using recommended ageing methodology for this species in the Baltic Sea.

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