Stock Annex: Flounder (*Platichtys flesus*) in Subdivisions 27 and 29–32 (Northern Central and Northern Baltic Sea)

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Flounder (*Platichtys flesus*) in Subdivisions 27 and 29-32 (Northern Central and Northern Baltic Sea)
Working Group:	WGBFAS
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Last updated by:	Ann-Britt Florin

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 & Dahlman, 2010). Flounder with demersal eggs produce small and heavy eggs which develop at the bottom of shallow banks and coastal areas in the northern part of the Baltic Proper. Reproduction is successful at salinity levels down to 5-7 psu (Nissling et al 2002). Flounder with pelagic eggs spawn in areas that reach 70–130 m depth, and their eggs are neutrally buoyant at 10–20 psu salinity and require oxygen concentrations of 1–2ml/l for development (Nissling et al, 2002; Vitins, 1980; Ustups et al, 2013). There is also strong genetic evidence for separating these ecotypes into separate stocks (Florin & Höglund, 2008; Hemmer Hansen et al, 2007) with flounder with pelagic eggs distributed in the southern and the deeper eastern part of the Baltic Sea and flounder with the demersal egg type in the northern area.

In previous ICES/HELCOM workshops (WKFLABA, ICES, 2010; WKFLABA2, ICES, 2012a) several assessment units were defined within each ecotype of flounder based on evidence from life history characters and tagging. However, in the review by SIMWG (ICES 2012b) it was suggested to have one single stock of flounder with demersal eggs in the Baltic Sea and at the WKBALFLAT Data compilation workshop (26-28 November 2013) the same conclusion was made.
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 these in the other SDs of the demersal stock and to avoid the dynamics in the demersal unit to be very much driven by SD 28-2 (containing a mixture of the two ecotypes) it was decided that 28-2 was to be allocated to the pelagic unit. Furthermore since fisheries data for flounder currently are not divided into sub units of SD 28 it was not possible to include data from the Gulf of Riga SD 28-1 in the analyses of this stock. During favourable hydrological conditions flounder with pelagic eggs

may occur also in SD 29 and even spread into SD 32 during spawning season (Grauman, 1981; ICES, 2010). 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 & 32 are kept as belonging to the stock with demersal eggs.

A.2. Fishery

Landings of flounder in SD 27, 29-32 peaked at over 2000 tonnes in the early 1980s but have then declined to around 200 tonnes yearly. The fishery is dominated by Estonia who takes about 80% of the landings. Flounder is mainly fished in the Gulf of Finland (SD 32) and the Åland Sea (SD 29) by Estonian and Finnish fishery and to a lesser extent by Swedish fishery in SD 27. In the Gulf of Bothnia (SD30+31) less than 1 ton is taken yearly by the Finnish fishery. The fishery is almost exclusively using passive gears, dominated by gillnets but trap nets are also used. Fishery occurs all year round but is concentrated to the late summer and autumn (77% of the landings were made in Q3 and 17 % in Q4 in 2012).
Minimum legal landing size in SD27 is 21 cm and in SD 29S and 32 (south of the 59o30'N latitude) it is 18 cm. There are no length restrictions in SD 29N and in SD's 30 & 31. There is a fishing ban in place between the 15th February-15th of May in SD 27 and SD29 and between the 15th February-31st of May in SD 32. Minimum legal diagonal meshsize for passive gears is 110mm.

Discard

Discard in this fishery are presumably low butno estimates are available from Sweden and Estonia. According to Estonian fishery rule, discard is not allowed. In case of a bycacth of over 10 % of the catch in weight, fishing must be finished. However, conversations with fishers revealed that discard exists (T. Drevs pers. comm). During spawning time and immediately after spawning all the flounder, caught in the traps, is discarded. For example in Northewestern Hiiumaa SD 29 the discard of flounder during spawning time has been 2-3 t per trap. During the summer months small flounder is discarded in the traps with small mesh size.
In Finland, however, reporting of all catch is mandatory. Since there has not been any consequences on discarding it's likely that the fishermen report it. The legislation and practice has been in place all the period within the datacall (2000-2012). Reported discards in this stock by Finland were 155kg out of a total catch of 5 tonnes in 2012, corresponding to a discard rate of 3%. Survival of discard is unknown and depends on whether the discard takes place at sea or in the harbour.

Recreational fishery

Flounder is also caught to a great extent in the recreational fishery. Statistics from the Ministry of Environment in Estonia estimate that a yearly catch of more than 40 tonnes, representing 20% of the total catch, are made in the recreational fishery. Data available from 2005-2012. (http://www.envir.ee/orb.aw/class=file/action=preview/id=1197601/Harrastuspyygi+saagi+koondandmed+2005-2012++17.04.2013.pdf).
The recreational catch is estimated by reports of fishers with fishing permits. On the basis of fishing permitsit is possible to differentiate between the different gears used: entangling net, longline consisting of up to 100 hooks, hoopnet, dragnet, crayfish dipnet and trap. For flounder fishing, gillnets are mainly used. The recreational fishers, who use one or several simple hand linesw; spinning reel; troll; pulling device; fly hook; bottom line (tonka, krunda); trimmer and harpoon gun; and up to five-prong

harpoon for underwater fishing, have no responsibility to report their catch (http://www.envir.ee/1181039).

In Finland annual recreational catches are estimated every second year by a mail survey (for a large sample of the households from the whole Finnish population) and assumed to be the same as the year before in the intermediate year. Recreational fishery is further described in the WKBALFLAT report (ICES, 2014). The bulk of the Finnish recreational flounder catch is taken from SD's 29-32 by gillnetters for household consumption, other fishing techniques used for flounder (such as angling) are of minor importance, comprising about 1 tonne annually. Recreational fishing data from 2000-onwards, showing a decrease over time from over 300 tonnes to less than 50 tonnes in 2012.

In Sweden national surveys of recreational fishery have been performed by Statistics Sweden and Swedish Board of Fisheries describing the situation between 2006 and 2010. The first study is described in Thörnqvist (2009). The study was performed in two steps, first a simple enquire was posted to a stratified sample of 10 000 Swedish citizens. The stratification was based on geography, age and sex to get a representative sample from all parts of Sweden. A second and more detailed enquire was sent to those that had reported that they had been fishing and included questions of fishing area, species caught, species thrown back, number of fishing days per gear type, (two types of gears: hand-held or bulk catching gears) etc. To ensure that the information gathered was representative of the fishing pattern, a drop- out analyses was performed by telephone interviews to avoid biased sampling. Using the Hansen-Hurwitz method (Hansen & Hurwiotz, 1943) mean and variation of total catches per species, gear type and geographic area was estimated. In 2006 it is estimated that 60 tonnes of flounder (± 42.5 tonnes) were caught in recreational fishery in SD 27, 28 and 29. This is the same magnitude as commercial fishery who landed 50 tonnes of flounder in 2006 in the same SDs. No recreational catches of flounder were reported from the Gulf of Bothnia (SD 30 & 31). It is possible that this is an underestimation of flounder catches since flounder might also have been reported as “other flatfishes” (140 tonnes, ±57 tonnes). The questionnaires asked specifically about plaice, flounder, turbot and “other flatfishes”. However the only “other flatfish” occurring regularly in the Baltic Proper is dab so “other flatfishes” probably includes all of the mentioned species. Figures from a survey in 2010 (data from SWAM, not published) merged all flatfishes together and estimated the total catch of flatfish in Baltic Proper to be 75 tonnes (±64 tonnes) compared to 50 tonnes of flounder landed in SD 27,28 & 29. No recreational catches were reported from Gulf of Bothnia.

Recreational fishery, tonnes						
	Estonia	Estonia	Finland	Finland	Finland	Finland
year	SD 29	SD 32	SD29	SD30	SD31	SD32
2000			187	30	1	156
2002			78	63		14
2004			64	3		12
2005	16	21				
2006	16	22	48	2		
2007	19	19				
2008	19	17	27	7		6
2009	14	15				
2010	22	22	9		1	1
2011	20	21				
2012	22	21	24	1		13

B. Data

B.1. Commercial catch

Total landings (CATON) are available for all three countries fishing on the stock (Estonia, Sweden and Finland) from 1980 onwards. The total landings also include recreational fishery from 1980-2008 for Estonia and from 1980-1999 for Finland. CANUM and WECA (using slicing or breaking and burning technique for otolith age reading as recommended by WKARFLO, ICES 2007 & 2008 and WKFLABA, ICES 2010) are available from Sweden from 2009 & 2010 in SD 27 and from Estonia from 2011-2012 in SD 29 and 32.

B.3. Surveys

The BITS survey is not representative for flounder with demersal eggs since during the Q1 survey this type of flounder are most probably on more shallow, coastal areas not covered by BITS and during the Q4 survey they are mixed with the flounder with pelagic eggs (WKFLABA, ICES 2010). Furthermore the BITS survey do not cover the northern parts of the Baltic Sea (SD 29-32) which is the main distribution area of flounder with demersal eggs.

Cpue are however available from national surveys for this stock. National gillnet surveys are performed by Estonia in Muuga bay near Tallinn (mesh size 40-60mm bar length) in SD 32 since 1993 and onwards and in Küdema bay in SD 29 since 2000 and onwards (mesh size 21.5, 30, 38, 50 and 60 mm bar length). In Muuga the survey is done weekly from May to October while in Küdema six fixed stations are fished during six nights in October/November at depths of 14-20 m. Gillnet surveys are also done since 1999 in different parts of the Gulf of Finland in Estonian waters (Pakri, Muuga, Ihasalu, Kaberneeme and Kolga bays) with mesh sizes 16, 22, 24, 30, 35, 40, 45, 50 and 60 mm (bar length). Gillnet surveys are also made by Sweden using the same gear as in Küdema at the same time of year (September/October) in two areas in the southern and the northern parts of SD 27, Kvädöfjärden (data from 1989 onwards) and Muskö (data from 1992 onwards) . In Kvädöfjärden six fixed stations are fished during six nights at 15-20m depth while in Muskö eight fixed stations are fished during six nights at 16-18m depth. CANUM from survey data (using the broken and burning technique for age reading) are available from Estonia in SD 29 (from 2000 and onwards) and SD

32 (from 2011 and onwards). From Sweden CANUM and WECA from survey data (using the slicing & staining technique for age reading) are available from Muskö in SD 27 (from 2002 and onwards).

B.4. Commercial cpue

Data on effort and cpue from the commercial fishery in Finland are available for several gears (gillnets and trap nets) in SD 29-32 from 1998 and onwards. The effort in cpue is given as gear days. For example gill net fishing with ten gill nets on five days equals 50 gill net days. The unit of catch is given as kg per gear and per fishing day. The unit of catch is calculated from observations deviating from zero (where flounder was landed).
From Estonia effort and cpue from the Danish seine fishery in SD 29 are available from 2009 and onwards (kg per haul), in addition effort data from the gillnet fishery in SD29 & 32 are available for the same time period.
Landings per unit effort from the Swedish commercial flounder gillnet fishery (gillnets ≥100mm diagonal mesh) in SD 27 is also available from 2000 and onwards. Effort is calculated as number of fishing hours from the daily logbooks for ships >10m. The unit of catch is calculated from observations deviating from zero (where flounder was landed).

C. Assessment: data and method

Category 3: Stocks for which survey-based assessments indicate trends (DLS approach, ICES, 2012c).
Model used: Data Limited Stock Category 3.2 Survey based index but no MSY trigger

Software used: Excel

Model Options chosen: Biomass index (kg/effort) from national gillnet surveys. Surveys are restricted to quarter 4. Within SD:s the arithetric mean is used if several surveys exists. Survey indices from different SD:s are then weighted by the total landings in the respective subdivision to calculate an overall biomass index for flounder in the whole area SD 27, 28:1, 29-32. The average index from the last two years is then compared with the average index from the three preceeding years, according to ICES DLS guidelines.

Input data types and characteristics:

Landings were taken from Intercatch for Sweden and Finland but for Estonia Intercatch data were mixed with commercial and recreational fishery and data was provided separately by the national data uploader. Characteristics of surveys used for biomass index is shown below.

Table 2. Description of the national surveys included in the assessment.

Type	Name	SD	Year range	Description
cpue (kg/effort) in survey	Muuga Bay	32	1993-2012	Gillnet survey (meshsize 40 & 60 mm bar length), fished from May-October, performed by Estonian Marine Institute, University of Tartu. Only data from October used in the assessment.
cpue (kg/effort) in survey	Küdema Bay	29	2000-2012	Gillnet survey, 6 fixed stations fished during 6 nights in October/November in depths 14-20m. (mesh size 21.5, 30, 38, 50 and 60 mm bar length), performed by Estonian Marine Institute, University of Tartu
cpue (kg/effort) in survey	Muskö	27	1992-2012	Gillnet survey, 8 fixed stations fished during 6 nights in September/October in depths 16-18m. (mesh size 21, 30, 38, 50 and 60 mm bar length), performed by Institute of Coastal Research, Department of Aquatic Resources, Swedish University of Agricultural Sciences,
cpue (kg/effort) in survey	Kvädöfjärden	27	1989-2012	Gillnet survey, 6 fixed stations fished during 6 nights in October in depths 15-20m. (mesh size 21, 30, 38, 50 and 60 mm bar length) performed by Institute of Coastal Research, Department of Aquatic Resources, Swedish University of Agricultural Sciences,

D. Short-Term Projection

Based on the change in survey index the suggested landings should be changed proportionally. In addition, a precautionary buffer may apply (20% reduction) if there are no data available showing a decrease in effort or that fishing mortality is low.

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