# Stock Annex: Plaice (*Pleuronectes platessa*) in Subdivisions 21, 22, and 23 (Kattegat, Belt Sea, Sound) ple-2123

Stock specific documentation of standard assessment procedures used by ICES.

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| **Stock:** | Plaice (*Pleuronectes platessa*) in Subdivisions 21, 22, and 23 (Kattegat, Belt Sea, Sound) ple-2123 |
| **Working Group:** | WGBFAS |
| **Created:** | February 2015 |
| **Authors:** | |
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| **Last updated:** | |
| **Last updated by**: | WGBFAS / Henrik Degel |

## A. General

### A.1. Stock definition

WKPESTO (ICES 2012a) suggested to recognize Kattegat together with the Belt area and Western Baltic (Sub-divisions 21, 22 and 23) as an independent stock. The stock was named PLE21-23. The suggestion was built on readily literature and information from historical tagging. The split between Skagerrak and Kattegat was rather well documented but the border to Sub-division 24 was less conclusive. The suggestion was confirmed by SIMWG (ICES 2012b). Based in new information (i.e. growth investigations, drift modelling of egg and larval movements and genetics), SIMWG (ICES 2012b) recommended to keep the stock definition as it was as these new information shows very little exchange between Kattegat and Skagerrak and did not provide conclusive evidence of extensive exchange between Subdivision 22 and 24. The WKPLE (ICES 2015) has endorsed this recommendation but recommends that the border between PLE21-23 and PLE24-32 is further investigated in the future.

Spawning

The spawning occurs between late February and late March in Kattegat waters mainly at depth between 30 and 40 meters (Nielsen et al., 2004). Ulmestrand (1992) showed that Kattegat were not significant spawning areas for plaice between 1990 and 1992. But Nielsen et al., (2004) observed the existence of two spawning areas in Kattegat, one in the North-Eastern part and another one, of greater importance in terms of production, in the southern part. Spawning in SD 22 is not described even though spawning takes place here.

### A.2. Fishery

#### A.2.1 General description

Plaice are seldom considered as a target species by the fishery, but caught as bycatch in mixed trawl fisheries targeting mainly cod or Nephrops. The biggest landings of plaice occur in 1st quarter SD 22 in connection with the cod fishery and in 3rd quarter in SD 21 in connection with the Nephrops fishery. Because plaice is considered as a

bycatch species, the discard pattern, as observed in the observer program, is very fluctuating dependent on the actual market conditions for plaice (price), the quota situation for cod and local or individual discard traditions. As a consequence the Danish discard raising is based on effort (trips).

Countries involved: Denmark, Germany and Sweden.

### A.2.2 Fishery management regulations

Implementation of a number of changes in the regulatory systems in the Kattegat between 2007 and 2008 as well as continuous reductions in the allowed days at sea to protect Kattegat cod have significantly changed the fishing patterns of the Danish and Swedish fleets.

Minimum mesh size is 90 mm for towed gears, and 100 mm for fixed gears. The minimum landing size is 27 cm. Danish fleets are prohibited to land females from January 15th to April 30th.

**Kattegat (SD 21)**

The fishery is dominated by Denmark, with Danish landings usually accounting for 80 to 90% of the total.

Since 1978, IIIa landings have declined from 27 000 to 9000 tonnes in the late nineties. In most years the combined TAC for the area has been largely higher than the actual landings estimates. (ICES, 2011). The TAC has been largely unrestrictive in the Kattegat (21% of TAC uptake in 2010).

Landings were previous taken year round with a predominance of the period from spring to autumn, and most catches (~80%) are linked to a targeted fishery, by Danish seiners, flatfish gillnetters. Plaice were also caught within mixed cod and Nephrops fishery by otter trawlers, and were as well landed as by-catch of other gillnet fisheries (Beyer et al., 2011). In recent years, the prices for plaice has decreased and plaice is now to a wide extent landed as bycatch from particularly the Nephrops and sole fishery.
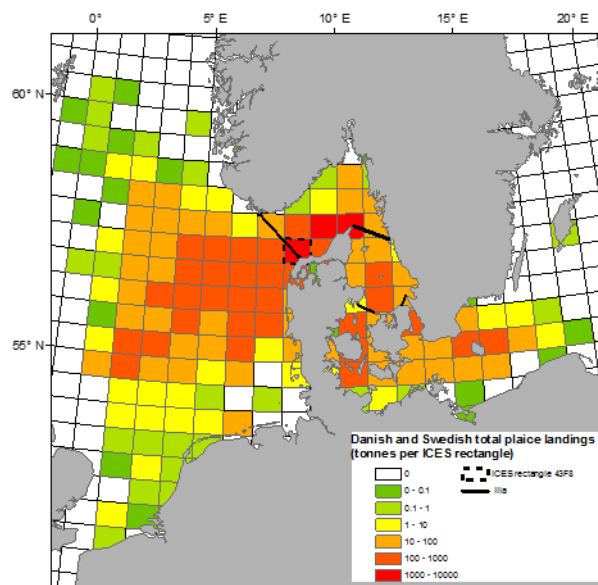


**Figure 3.7.1. Danish and Swedish plaice landings in 2009. By ICES rectangle, all vessels included.**

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### Belt (SD 23)

Trawl fishery is not allowed in the Belt and all landings are caught by gillnetters. The catches are insignificant compared to catches in SD 22.

### Western Baltic (SD 22)

Plaice are caught by trawlers and gillnetters mostly. The minimum landing size is 25 cm. Danish fleets are prohibited to land females from January 15th to April 30th. Plaice are often landed as bycatch from the cod fishery. SD 22 has within the last years become the area where most of catches come from.

## B. Data

### B.1. Commercial catch

#### B.1.1    Landings data

Landing statistics from Germany, Sweden and Denmark is available back to 1972. Landings decreased from around 15000 tons in the seventies to a rather stable level (2000 - 4000 tons) in the last thirty years. In recent years the landings from SD 21 has decreased (from 2000 t to 300 t) while the landings from SD 22 since mid-nineties has been stable/slightly increasing (around 1500 tons). The landings from SD 23 have all years been insignificant compared to the other areas (Table 5.1).

Denmark has in the whole period been dominating the catches with landing around 96% of the total landings in 1992 gradually decreasing to 76% in 2013 caused by the increasing landings by Germany (buying quotas from Sweden and Denmark).

The quality of the landing statistics is believed to be good as it builds on logbook/sales slip information and misreporting is not believed to be an issue because quota regulation never has been limiting the fishery, except for Germany in recent years. However, this not believed to have influenced the reliability of the landings significantly.

#### B.1.2    Discards estimates

Discard information have been compiled in InterCatch for the period 2002 to 2013 based on the EU data call in connection with the benchmark (Figure 5.1). It has not been possible to request pre-DCF-data in connection with the data call. The discard estimates is based on observer trips covering the important fisheries (otter trawl and Danish seines). The coverage I rather good as most significant strata (year, country, SD, quarter, fishery) are covered. The data is stratified on Active gears (trawls and seines) and Passive gears (gillnets). The Danish Discard raising is done outside InterCatch based on effort (number of trips) as no correlation between landed amount of plaice,

all species landed or fishing days and the amount of discard of plaice could be demonstrated (WD 4). The Swedish and German discard is based on tons of landings of plaice (method used by InterCatch). All burrowing of data for strata without or with insufficient sampling is done inside InterCatch.

Additional rules applied for discard estimation

All un-sampled passive gear discards strata are assumed to have zero discard.

Germany uses in 2010 and 2013 the fleet groups "All" and "MIS_MIS_0_0_0_HC" in SD21. In all cases where extrapolation has been made for fleet = "All" (2010) and "MIS_MIS_0_0_0_HC" (2013), the source has been a mix of all relevant sources (same SD, Q, catch category). Manual weighting has been used in order to put equal total weighting to Passive and Active. The fleets "All" and "MIS_MIS_0_0_0_HC" only constitute a very small percentage of the total stock catches in the two years.

Additional rules applied for allocation of biological information (landing and discard)

SWE 2005 SD23 Passive discard: no source data exists. DEN 2005 SD23 Active discard is used.

For SD23: SD21 has always been used as source data if needed

If more than one source is used for discard estimation, manual equal weight is used.

The total discard per year was estimated to 4000 tons in 2002 decreasing to around 1300 tons in 2004 already and then being more a less stable around that level the rest of the period up to 2013. The overall discard percentage (all SDs) has been app. 45% in all years (31-56%).

## B.2. Biological sampling

### B.2.1    Maturity

The maturity ogives per year (running mean of three years) are shown in figure 1. The mean ogive is shown in figure 2. The data are calculated from 1st quarter surveys of NS-IBTS and BITS.
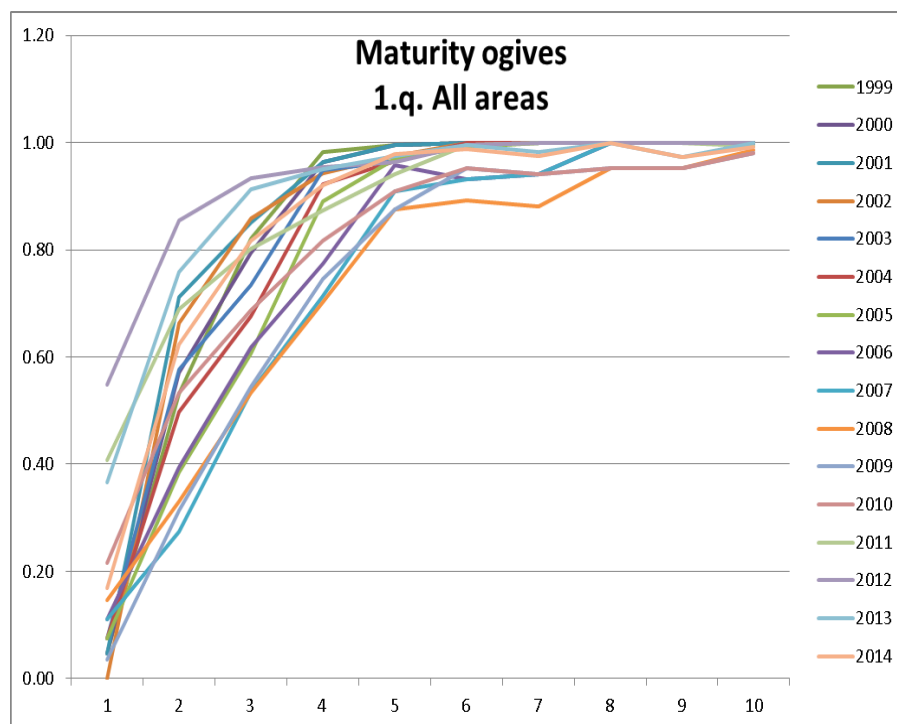
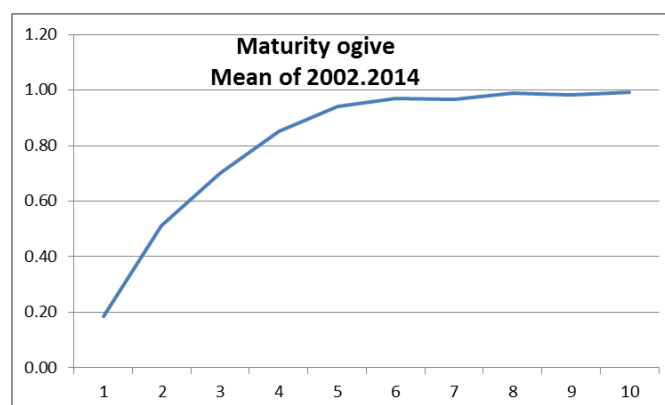Fig. 1    Mean weight in stock compared to values for North Sea plaice.



Fig. 2    Constant maturity ogive based on average of 2002-2014.

### B.2.2    Natural mortality

The natural mortality is in line with the North Sea plaice stock set to constant 0.1 for all age classes except age 1, which is set to 0.2. The reason for the low mortality is the lack of observed plaice in stomachs of potential predators.

### B.2.3    Length and age composition of landed and discarded fish in commercial fisheries

The mean weight in landings, discards and catches by age were extracted from Inter-Catch for each individual year. The stock mean weights by age were calculated from the two first quarter surveys for each individual year.  BITS data only exists for the period 2008 to 2014 and NS-IBTS only for the period 2003 to 2014. Therefore, the BITS series is extended backwards to 2003 based on the average of 2008 to 2012. The common mean weight in the stock is then calculated as the mean of the two surveys. The common series is finally extended backwards to 1999 based on the average of 2003 to 2007. Mean weight at age in the stock is given in figure 3. The fluctuating stock mean weights

of the older age classes is caused by the low number of individuals caught at the surveys and the extremely high variability in weight for these age classes. The constant mean weight is shown in figure 4 and compared with the North Sea
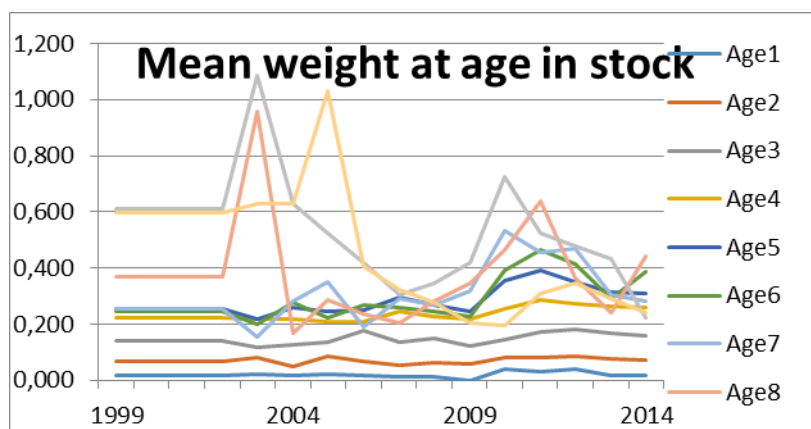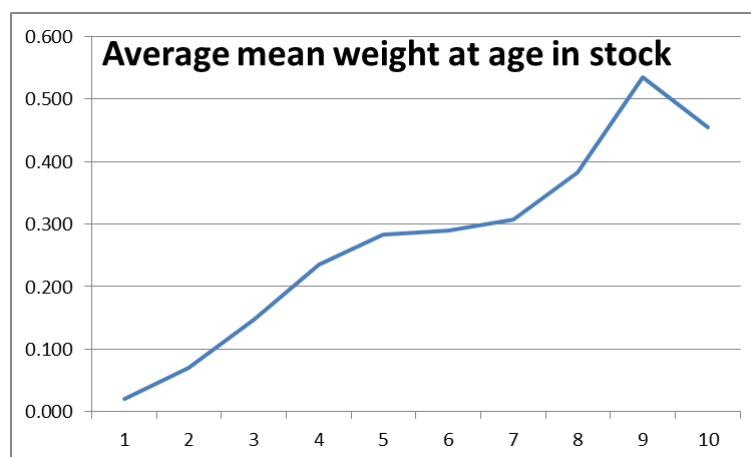


**Fig. 3**      **Mean weight at age in stock.**



**Fig. 4**      **Constant mean weight at age in stock (average of 2002-2014).**

## B.3. Surveys

All available survey series were recalculated previous to the WGPLE in order to cover only the stock area. This area is not a standard option in DATRAS and has to be done manually. Four surveys are available covering the stock area (SD21, SD22 and SD 23) or part of it.

### B.3.1     Survey data used

**NS-IBTS 1st quarter**. The data series includes all hauls from the survey in SD 21. All hauls carried out by Sweden using RV Argos (1991-2011) or RV Dana (2012-2014). The data series is available from 1991-2014. The survey mostly overs the eastern part of SD 21 (fig 5.2a). App.25 hauls per year.

**NS-IBTS 3rd quarter**. The data series includes all hauls from the survey in SD 21. All hauls carried out by Sweden using RV Argos (1998-2010) or RV Dana (2011-2014). The data series is available from 1998-2014. The survey mostly overs the eastern part of SD 21 (fig 5.2b). App.25 hauls per year.

**BITS 1st quarter**. The data series includes all hauls from the survey in SD 21, SD 22 and SD 23. All hauls carried out by Germany using RV Solea or by Denmark using RV Havfisken. The data series is available from 1998-2014 and covers the complete stock area. Standard gear introduced in 2000. CPUE for years before 2000 are adjusted to common standard. App. 55 hauls per year.

**BITS 4th quarter**. The data series includes all hauls from the survey in SD 21, SD 22 and SD 23. All hauls carried out by Germany using RV Solea or by Denmark using RV Havfisken. The data series is available from 1999-2014 and covers the complete stock area. Standard gear introduced in 2000. CPUE for years before 2000 are adjusted to common standard.  App. 55 hauls per year.

The two 1st quarter surveys and the two second-half-of-the-year surveys were combined using the smoothed GAM approach developed by Casper berg (#WD3b). Only the age up to 5 was included due to low numbers for age class 6 and 7 particularly in the start of the series.

## B.4. Commercial CPUE

No commercial CPUE is used in this assessment.

# C. Assessment methods and settings

## C.1. Choice of stock assess model

Model used: State bases Assessment Model (SAM)

Software used: stockassessment.org

## C.2. Model used of basis for advice

Within stockassessment.org; PLE2123_Benchnark_2015_aveMat_aveMWstock

Model options

Commercial catches

Age group 0 has been excluded in input because mean weights of age 0 is highly inconsistent and is seldom even in discards.

Age group 7 has been recalculated to be +group. This is done in the model script (input data still have age10 as +group)

Landings (tons) are available from all countries back to 1972 but not used in the assessments as SAM cannot use this information. Discards (CANUM, WECA) are only available back to 2002. Discards 1999-2001 are calculated as the plain average of 2002-2005 (5 years). Landing (CANUM and WECA) are available back to 1999.

Fbar= 3-5.

Tuning fleets

NS-IBTS 1st quarter and BITS 1st quarter combined by use of GAM-model (Berg et al. 2013).
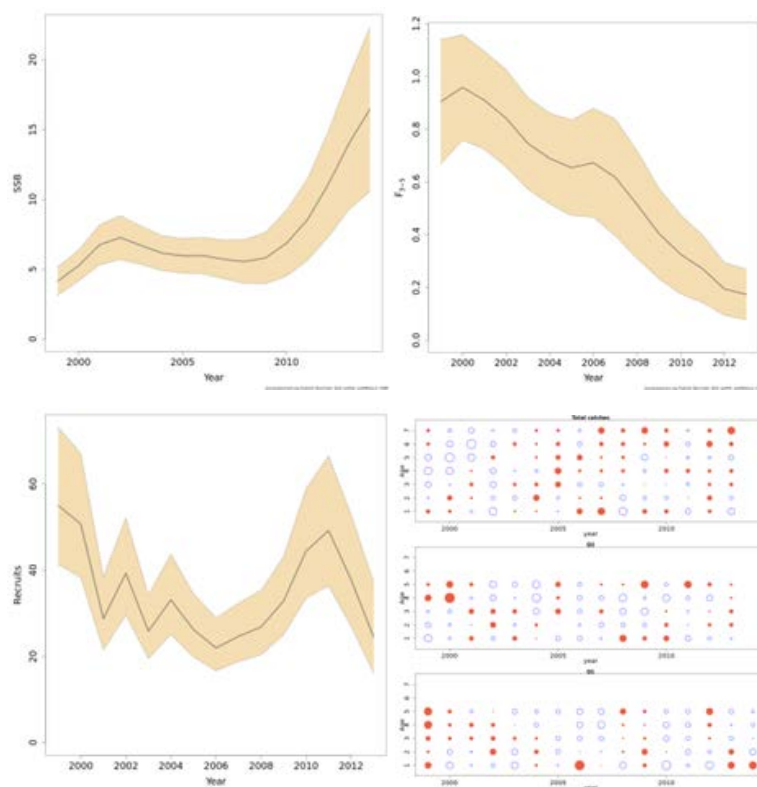
NS-IBTS 3rd quarter and BITS 4th quarter combined by use of GAM-model (Berg et al. 2013).

The tuning fleets include age class 1-5

Coupling of catchability of age 4-5 for both tuning fleets

Constant maturity and

Constant mean weight at age in stock



## C.3. Assessment model configuration

| Type | Name | Year range | Age range | Variable from year to year Yes/No |
|------|------|-----------|-----------|-----------------------------------|
| Caton | Catch in tonnes* | 2002-2014 | - | Yes |
| Canum | Catch at age in numbers | 2002-2014 | 1-7+ | Yes |
| Weca | Weight at age in the commercial catch | 2002-2014 | 1-7+ | Yes |
| West | Weight at age of the spawning stock at spawning time. | | | |
| Mprop | Proportion of natural mortality before spawning | 1999-2014 | 1-7+ | No |
| Fprop | Proportion of fishing mortality before spawning | 1999-2014 | 1-7+ | No |
| Matprop | Proportion mature at age | 1999-2014 | 1-7+ | No |
| Natmor | Natural mortality | 1999-2014 | 1-7+ | No |

**\*Catch part of Caton is 1999-2002**

## D. Short-term prediction

Model used:

Software used:                         MFDP1a

Initial stock size:                    Output from SAM 20014

Maturity:                              Mean of the whole time series

F and M before spawning:               0 for all age groups (output from SAM)

Weight at age in the stock:            Mean for the whole time series

Weight at age in the catch:            output from SAM

Exploitation pattern:

Intermediate year assumptions:  SQ

Stock recruitment model used:   Average of whole time series

Procedures used for splitting projected catches:

## E. Biological reference points

Fmsy=0.37

Fpa=0.67

Blim= 4077 (=Bloss)

Bpa=5553,

Btrigger=5553

## F. Other issues

### F.1 Biology of species

## I. References

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