Stock Annex – Sole in Division VIId

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Sole in Division VIId (Easter Channel)
Working Group:	ICES Working Group for the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)
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Revised by	Willy Vanhee (WKFLAT) updated at WGNSSK-2011

A. General

A.1 Stock definition

The sole in the eastern English Channel (VIId) are considered to be a separate stock from the larger North Sea stock to the east and the smaller geographically separate stock to the west in VIIe. There is some movement of juvenile sole from the North Sea into VIId (ICES CM 1989/G:21) and from VIId into the western Channel (VIIe) and into the North Sea. Adult sole appear to be largely isolated from other regions except during winter, when sole from the southern North Sea may enter the Channel temporarily (Pawson, 1995). The assessment does not take account of these stock movements.

A.2 Fishery

There is a directed fishery for sole by small inshore vessels using trammelnets and trawls, which fish mainly along the English and French coasts and possibly exploit different coastal populations. Sole represents the most important species for these vessels in terms of the annual value to the fishery. The fishery for sole by these boats occurs throughout the year with small peaks in landings in spring and autumn. There is also a directed fishery by English and Belgian beam trawlers who are able to direct effort to different ICES divisions. These vessels are able to fish for sole in winter before the fish move inshore and become accessible to the local fleets. In cold winters, sole are particularly vulnerable to the offshore beamers when they aggregate in localized areas of deeper water. Effort from the beam trawl fleet can change considerably depending on whether the fleet moves to other areas or directs effort at other species such as scallops and cuttlefish. In France, there are some few small beam trawlers operating inshore in a few local areas, and offshore trawlers fishing for mixed demersal species taking sole as a bycatch.

The minimum landing size for sole is 24 cm. Demersal gears permitted to catch sole are 80 mm for beam trawling and 90 mm for otter trawlers. Fixed nets are required to use 100 mm mesh since 2002 although an exemption to permit 90 mm has been in force since that time.

A.3 Ecosystem aspects

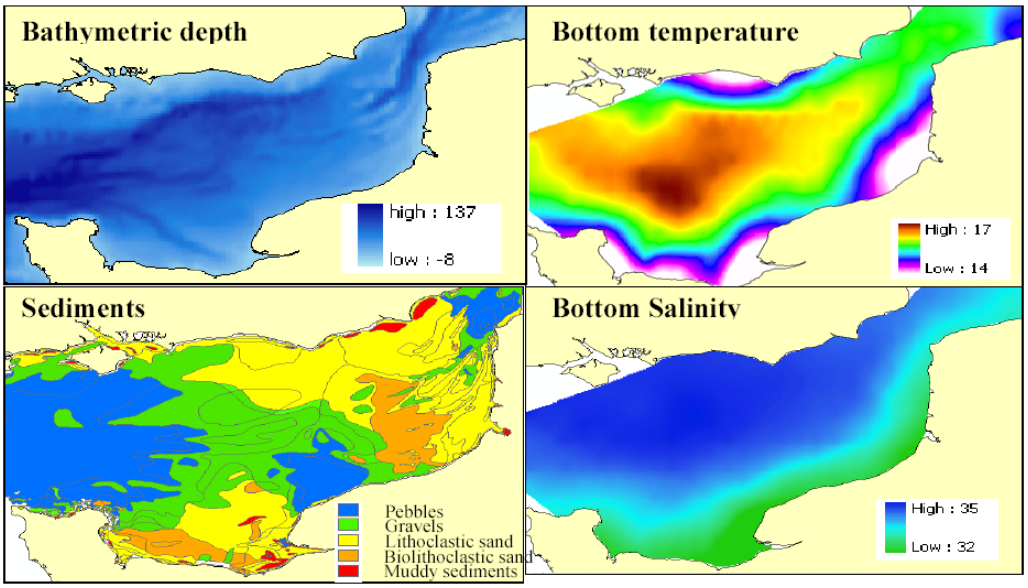


Figure 1. Eastern English Channel physical and hydrological features: Bathymetric depth and simplified sediment types representation. Survey bottom temperature and bottom salinity (averaged for 1997 to 2003) obtained by Kriging. (in Vaz *et al.*, 2004).

Biology: Adult sole feeds on worms, small molluscs and crustaceans. In the English Channel, reproduction occurs between February and April, mainly in the coastal areas of the Dover Strait and in large bays (Somme, Seine, Solent, Mont-Saint-Michel, Start and Lyme Bay). Pelagic eggs hatch after 5 to 11 days leading to larvae that are also pelagic and that will metamorphose into benthic fry after 1 or 2 weeks. Juveniles spend the first 2 or 3 years in coastal nurseries (bays and estuaries) where fast growth occurs (11 cm at 1 year old) before moving to deeper waters.

The spatial distribution of life stages of common sole demonstrates a particular pattern: larval distribution (on spawning grounds) and juvenile distribution (in nursery grounds) overlap. If larvae are found everywhere during spring, the potential habitat for stage 2 larvae is along the Flanders coast and near the Pays de Caux, to the central zone of the English Channel. Older larvae have a more coastal habitat preference, which can be explained by a retention phenomenon linked to estuaries.

Environment: A benthic species that lives on fine sand and muddy seabeds between 0 and 150 meters depth. It ranges from marine to brackish waters in temperatures between 8 and 24°C.

Geographical distribution: Eastern Atlantic, from southern Norway to Senegal, Mediterranean Sea including Sea of Marmara and Black Sea.

Vaz *et al.*, 2007 used multivariate and spatial analyses to identify and locate fish, cephalopod, and macrocrustacean species assemblages in the eastern English Channel from 1988 to 2004. Four sub-communities with varying diversity levels were identified in relation to depth, salinity, temperature, seabed shear stress, sediment type, and benthic community nature. One Group (class 4 in Figure 2 below) was a coastal heterogeneous community represented by pouting, poor cod, and sole and was classified as preferential for many flatfish and gadoids. It displayed the greatest diversity and was characterized by heterogeneous sediment type (from muds to coarse sands) and various associated benthic community types, as well as by coastal hydrology and

bathymetry. It was mostly near the coast, close to large river estuaries, and in areas subject to big salinity and temperature variations. Possibly resulting from this potentially heterogeneous environment (both in space and in time), this sub-community type was the most diverse.

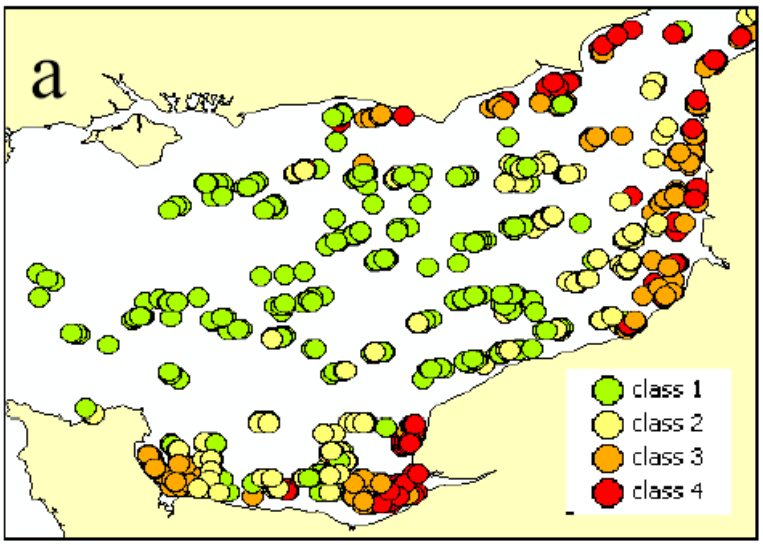


Figure 2. Spatial distribution of Fish Subcommunities in the Eastern Channel from 1988 to 2003. Observed assemblage type at each station, These illustrate the gradation from open sea community to coastal and estuarine communities (In Vaz *et al.*, 2004).

Community evolution over time: (From Vaz *et al.*, 2007). The community relationship with its environment was remarkably stable over the 17 y of observation. However, community structure changed significantly over time without any detectable trend, as did temperature and salinity. The community is so strongly structured by its environment that it may reflect interannual climate variations, although no patterns could be distinguished over the study period. The absence of any trend in the structure of the eastern English Channel fish community suggests that fishing pressure and selectivity have not altered greatly over the study period at least. However, the period considered here (1988–2004) may be insufficient to detect such a trend.

B. Data

B.1 Commercial catch

The landings are taken by three countries: France (50%), Belgium (30%) and England (20%). Age sampling for the period before 1980 was poor, but between 1981 and 1984 quarterly samples were provided by both Belgium and England. Since 1985, quarterly catch and weight-at-age compositions were available from Belgium, France, and England.

An initiative for undertaking combined sampling of VIId sole between France, Belgium and the UK has been agreed from January 2008. The result was a framework for the collection of age data in relation to an international ALK. The division VIId has been stratified in three geographical areas and the data collected in line with them for 2008.

It was the intention that these data would be used to provide the assessment advice in 2009. A limited otolith exchange was arranged between the laboratories involved,

specifically looking at VIId sole, in order to assess the likely quality of the ALK provided. The reason for restricting the exchange to those involved in the reading of VIId sole was so that any stock-specific issues could be addressed. The agreement achieved between institutes was 91% across all ages. Due to workload and shortage of manpower, further analysis and the use of a combined ALK was not established yet. If possible this combined ALK will be calculated and proposed for adoption by ACOM before the next assessment.

Belgium

Belgian commercial landings and effort information by quarter, area and gear are derived from logbooks.

Sampling for age and length occurs for the beam trawl fleet (main fleet operating in Belgium).

Quarterly sampling of landings takes place at the auctions of Zeebrügge and Oostende (main fishing ports in Belgium). Length is measured to the cm below. Samples are raised per market category to the catches of both harbours.

Quarterly otolith samples are taken throughout the length range of the landings (sexes separated). These are aged and combined to the quarterly level.

In 2003 a pilot study started on on-board sampling with respect to discarded and retained catch. Since 2004 it is part of the DCR.

France

French commercial landings in tonnes by quarter, area and gear are derived from logbooks for boats over 10m and from sales declaration forms for vessels under 10 m. These self declared productions are then linked to the auction sales in order to have a complete and precise trip description.

The collection of discard data has begun in 2003 within the EU Regulation 1639/2001. The first years of collection were incomplete in term of time and métier coverage. It is expected an increase of sampling effort from 2009 designed for the use of the information for assessment purpose, as required by ICES/ACOM.

The length measurements are done by market commercial categories and by quarter into the principal auctions of Grandcamp, Port-en-Bessin, Dieppe and Boulogne. Samplings from Grandcamp and Port-en-Bessin are used for raising catches from Cherbourg to Fecamp and samplings from Dieppe and Boulogne are used to raise the catches from Dieppe to Dunkerque.

Otoliths samples are taken by quarter throughout the length range of the landed catch for quarters 1 to 3 and from the October GFS survey in quarter 4. These are aged and combined to the quarterly level and the age–length key thus obtained is used to transform the quarterly length compositions. The lengths not sampled during one quarter are derived from the same year close quarter.

Weight, sex and maturity-at-length and -at-age are obtained from the fish sampled for the age–length keys.

England

English commercial landings in tonnes by quarter, area and gear are derived from the sales notes statistics for vessels under 12 m which do not complete logbooks. For those over 12 m (or >10 m fishing away for more than 24 h), data are taken from the

EC logbooks. Effort and gear information for the vessels <10 m is not routinely collected and is obtained by interview and by census. .No information is collected on discarding from vessels <10 m but it is known to be low. Discarding from vessels >10 m has been obtained since 2002 under the EU Data Collection Regulation and is also relatively low.

Length samples are combined and raised to monthly totals by port and gear group for each stock. Months and ports are then combined to give quarterly total length compositions by gear group; unsampled port landings are added in at this stage. Quarterly length compositions are added to give annual totals by gear. These are for reference only, as ALK conversion takes place at the international level. Age structure from otolith samples are combined to the quarterly level, and generally include all ports, gears and months. For sole the sex ratio from the randomly collected otolith samples are used to split the unsexed length composition into sex-separate length compositions. The quarterly separate age–length-keys are used to transform quarterly length compositions by gear group to quarterly age compositions. At this stage the age compositions by gear group are combined to give total quarterly age compositions.

A minimum of 24 length samples are collected per gear category per quarter. Age samples are collected by sexes separately and the target is 300 otoliths per sex per quarter. If this is not reached, the 1st and 2nd or 3rd and 4th quarters are combined.

Weight-at-age is derived from the length samples using the length/weight relationship W=aL^b, where a and b are reference condition factors for the stock.

The text table below shows which countries supply which kind of data:

Kind of data supplied quarterly

Country	Caton (catch-in-weight)	Canum (catch-at-age in numbers)	Weca (weight-at-age in the catch)	Matprop (proportion mature-by-age)	Length composition-in-catch
Belgium	x	x	x		x
England	x	x	x		x
France	x	x	x		x

Data are supplied as FISHBASE files containing quarterly numbers-at-age, weight-at-age, length-at-age and total landings. The files are aggregated by the stock coordinator to derive the input VPA files in the Lowestoft format. No SOP corrections are applied to the data because individual country SOPs are usually better than 95%. The quarterly data files by country can be found with the stock co-ordinator.

The resulting files (FAD data) can be found at ICES and with the stock co-ordinator, either in the IFAP system as SAS datasets or as ASCII files on the Lowestoft format, either under w:\acfm\nsskwg\2002\data\sol_eche or w:\ifapdata\eximport\nsskwg\sol_eche.

B.2 Biological

Natural mortality

Natural mortality is assumed constant over ages and years at 0.1.

Maturity

The maturity ogive used is knife-edged with sole regarded as fully mature at age 3 and older as in the North Sea.

Weight-at-age

Prior to 2001 WG, stock weights were calculated from a smoothed curve of the catch weights interpolated to the 1st January. Since the 2002 WG, second quarter catch weights were used as stock weights in order to be consistent with North Sea sole.

Proportion mortality before spawning

Both the proportion of natural mortality before spawning (Mprop) and the proportion of fishing mortality before spawning (Fprop) are set to 0.

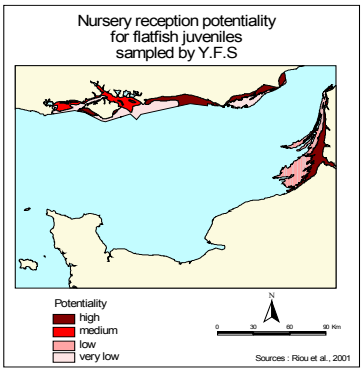
B.3 Surveys

A dedicated 4 m beam trawl survey for plaice and sole has been carried out by England using the RV Corystes since 1988. The survey covers the whole of VIId and is a depth stratified survey with most samples allocated to the shallower inshore stations where the abundance of sole is highest.

In addition, inshore small boat surveys using 2 m beam trawls are undertaken along the English coast and in a restricted area of the Baie de Somme on the French coast. In 2002, the English and French Young Fish Surveys were combined into an International Young Fish Survey. The dataset was revised for the full period back to 1981. The two surveys operate with the same gear (beam trawl) during the same period (September) in two different nursery areas. Previous analysis (Riou *et al.*, 2001) has demonstrated that asynchronous spawning occurs for flatfish in Division VIId. Therefore both surveys were combined based on weighting of the individual index with the area nursery surface sampled. Taking into account the low, medium, and high potential area of recruitment, the French YFS got a weight index of 55% and the English YFS of 45% (See table and figure below).

Nursery reception potential used for the combination of FR and UK YFS

Potentiality surface (Km^2)	South England	Bay of Somme
High	756	575.1
Medium	484.7	0
Low	30.5	953.1
Very low	993.3	21.3
Total	2264.5	1549.5
Total (Low–Med–High)	1271.2	1528.2



However, the UK component of the YFS was last conducted in 2006. In the absence of any update of the UK component of the YFS index the available time-series of the UK component should still be used in the assessment next to the French component of the YFS index. The lack of information from the UK YFS may impede the recruitment estimates and therefore the forecast.

B.4 Commercial cpue

Three commercial fleets have been used in tuning. The Belgian beam trawl fleet (BEL BT), the UK Beam Trawl fleet (UK BT) and a French otter trawl fleet (FR OT). The two beam trawl fleets carry out fishing directed towards sole but can switch effort between ICES areas. The UK BT cpue data are derived from trips where landings of sole from VIId exceeded 10% of the total demersal catch-by-weight on a trip basis.

The effort of the Belgian beam trawl fleet is corrected for horse power, based on a study carried out by IMARES and CEFAS in the mid 1990s (no reference available). The study calculated an effort correction for HP applicable to sole and plaice effort in the beam trawls fisheries. The corresponding equations for sole is P=0.000204 BHP^1.23.

This horsepower correction for the commercial Belgian beam trawl fleet should still be applied. However, if a new corrected effort series is available (based on Section 4.2.4.1 in ICES 2009) it should be used under condition that this is reviewed and approved by ICES.

No French commercial tuning data are available for the otter trawl and fixed nets. A first attempt to create an effort series for the French trammel nets has been presented but is not deemed sufficient. If a new effort series is produced this too should be used under condition that they are reviewed and approved by ICES.

B.5 Other relevant data

None.

C. Historical stock development

Model used: XSA

Software used: IFAP/Lowestoft VPA suite

Model Options chosen:

Tapered time weighting not applied

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 7

Survivor estimates shrunk towards the mean F of the final 5 years or the 5 oldest ages

S.E. of the mean to which the estimate are shrunk = 0.500

Since 2004-S.E. of the mean to which the estimate are shrunk = 2.000

Minimum standard error for population estimates derived from each fleet = 0.300

Prior weighting not applied

Input data types and characteristics:

Catch data available for 1982–present year. However, there were no French age compositions before 1986 and large catchability residuals were observed in the commercial data before 1986. In the final analyses only data from 1986–present are used in tuning.

Type	Name	Year range	Age range	Variable from year to year Yes/No
Caton	Catch in tonnes	1982–last data year	2–11+	Yes
Canum	Catch-at-age in numbers	1982–last data year	2–11+	Yes
Weca	Weight-at-age in the commercial catch	1982–last data year	2–11+	Yes
West	Weight-at-age of the spawning stock at spawning time.	19682–last data year	2–11+	Yes-assumed to be the same as weight-at-age in the Q2 catch
Mprop	Proportion of natural mortality before spawning	1982–last data year	2–11+	No-set to 0 for all ages in all years
Fprop	Proportion of fishing mortality before spawning	1982–last data year	2–11+	No-set to 0 for all ages in all years
Matprop	Proportion mature-at-age	1982–last data year	2–11+	No-the same ogive for all years
Natmor	Natural mortality	1982–last data year	2–11+	No-set to 0.2 for all ages in all years

Tuning data:

Type	Name	Year range	Age range
Tuning fleet 1	Belgian commercial BT	1986–last data year	2–10
Tuning fleet 2	English commercial BT	1986–last data year	2–10
Tuning fleet 3	English BT survey	1988–last data year	1–6
Tuning fleet 4	UK YFS	1987–2006	1–1
Tuning fleet 5	French YFS	1987–last data year	1–1

D. Short-term projection

Model used: Age structured

Software used: MFDP

Initial stock size is taken from the XSA for age 3 and older and from RCT3 for age 2, if appropriate. Otherwise the XSA value for age 2 is used. The long-term geometric mean recruitment is used for age 1 in all projection years.

Since 2004 initial stock size for age 2 was taken from XSA.

Natural mortality: Set to 0.1 for all ages in all years

Maturity: The same ogive as in the assessment is used for all years

F and M before spawning: Set to 0 for all ages in all years

Weight-at-age in the stock: Average weight over the last three years

Weight-at-age in the catch: Average weight over the three last years

Exploitation pattern: Average of the three last years, scaled to the level of Fbar (3-8) in the last year

Intermediate year assumptions: F status quo

Stock recruitment model used: None, the long-term geometric mean recruitment-at-age 1 is used

Procedures used for splitting projected catches: Not relevant

E. Medium-term projections

Not performed for this stock.

In the past an age structured model was used (WGMTERMc software). Medium-term projections were carried out with settings as in short-term projection except for the weights in the catch and in the stock which are averaged over the last 10 years. Since 2005 medium-term projections have not been done for this stock.

F. Long-term projections, yield-per-recruit

Not performed for this stock.

In the past an age structured model was used (WGMTERMc software). Medium-term projections were carried out with settings as in short-term projection except for the weights in the catch and in the stock which are averaged over the last 10 years. Since 2005 medium-term projections have not been done for this stock.

G. Biological reference points

	Type	Value	Technical basis
Precautionary approach	Blim	Not defined	Poor biological basis for definition
	Bpa	8000 t	Lowest observed biomass at which there is no indication of impaired recruitment. Smoothed Bloss
	Flim	0.55	Floss, but poorly defined; analogy to North Sea and setting of 1.4 Fpa = 0.55. This is a fishing mortality at or above which the stock has displayed continued decline.
	Fpa	0.40	Between Fmed and 5th percentile of Floss; SSB>Bpa and probability (SSBmt<Bpa), 10%: 0.4.
MSY approach	MSY $B_{trigger}$	8000 t	Bpa
	F_{MSY}	0.29	Stochastic simulations assuming smooth hockey stick relationship

(unchanged since 1998)

H. Other issues

None.

I. References

CEFAS 1999. PA software users guide. The Centre for Environment, Fisheries and Aquaculture Science, CEFAS, Lowestoft, United Kingdom, 22 April 1999.

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