Annex Q – Stock Annexes for New Species

Stock Annex: European sea bass (*Dicentrarchus labrax*) in subarea VIIIa, VIIIb, VIIId (Bay of Biscay)

Stock specific documentation of standard assessment procedures used by ICES.

Stock	European sea bass (*Dicentrarchus labrax*) in subarea VIIIa,VIIIb, VIIId (Bay of Biscay)
Working Group:	WGBIE
Date:	May 2013
Revised by	Mickael Drogou, May 2013 (stock annex developed by IBPNEW 2012, retaining only information for BSS-8ab and WGNEW 2013)

A. General

Seabass for the 8ab area is considered in 2012 as data poor species, in category 5.2.0

A.1. Stock definition

Bass *Dicentrarchus labrax* is a widely distributed species in northeast Atlantic shelf waters with a range from southern Norway, through the North Sea, the Irish Sea, the Bay of Biscay, the Mediterranean and the Black Sea to North-west Africa. The species is at the northern limits of its range around the British Isles and southern Scandinavia.

Stock structure of sea bass in the Atlantic has been reviewed by WGNEW 2012 and IBP-NEW 2012 based on evidence from genetics studies, tagging studies, distribution of commercial catches and similarities in stock trends between areas, drawing also on extensive information contained in previous WGNEW and ICES SGBASS reports.

IBP-NEW considers that stock structure remains uncertain, and recommends further studies on seabass stock identity, using conventional and electronic tagging, genetics and other individual and population markers (e.g. otolith microchemistry and shape), together with data on spawning distribution, larval transport and VMS data for vessels tracking migrating bass shoals, to confirm and quantify the exchange rate of seabass between sea areas that could form management units for this stock. Such information is critical to support development of models to describe the spatial dynamic of the species under environmental drivers (eg. temperature and food). Such a modelling work is being carried out in France in the framework of a PhD study (R. Lopez).

The pragmatic view of IBP-NEW 2012 is to structure the baseline stock assessments into four units:

- <u>Assessment area 1</u>. Sea bass in ICES areas IVbc, VIId, VIIe,h and VIa,f&g (lack of clear genetic evidence; concentration of area IV bass fisheries in the southern North Sea; seasonal movements of bass across ICES Divisions). Relatively data-rich area with data on fishery landings and length/age composition; discards estimates and lengths; growth and maturity parameters; juvenile surveys, fishery LPUE trends.

- Assessment area 2. Sea bass in Biscay (ICES Sub area VIIIa,b). Available data are fishery landings, with length compositions from 2000; discards from 2009; some fishery LPUE.
- Assessment area 3. Sea bass in VIIIc and IXa (landings, effort)
- Assessment area 4. Sea bass in Irish coastal waters (VIa, VIIb, VIIj). Available data: Recreational fishery catch rates; no commercial fishery operating.

Fishery landings of sea bass are extremely small in Irish coastal waters of VIIa and VIIg and the stock assessment for assessment area 1will not reflect the sea bass populations around the Irish coast, which may be more strongly affiliated to the population in area 4 off southern, western and Northern Ireland.

A.2. Fishery

General description

Sea bass in the Bay of Biscay, are targeted by France (more than 90% of international landings) by line fisheries which take place mainly from July to October and by pelagic trawlers, nets and in a mixed bottom trawl fisheries from November to April on pre spawning and spawning grounds when seabass is aggregated (**Error! Reference source not found.**). In 2012 nets represent 31% of the landings of the area, lines (handlines+longlines) 29%, bottom trawl 20%, and pelagic trawl 9% (but It has to be note that pelagic trawlers were used from 2000 to 2008 to catch around 25% of the landings of the area decreasing to 9 (the pelagic fishery take place at present essentially in the Channel). In parallel a decrease of landings for liners is also observed from 2007.

In France, the market value seabass depends greatly on how its caught, giving added value to certain metiers as liners: according to auction, mean price of seabass sold by liners was 14.92€ per kg in 2009 compared with €5.99 per kg for pelagic trawl, 8.21€ per Kg for Bottom trawlers and 8.92€ per Kg for nets, reflecting differences in volume landed and fish condition.

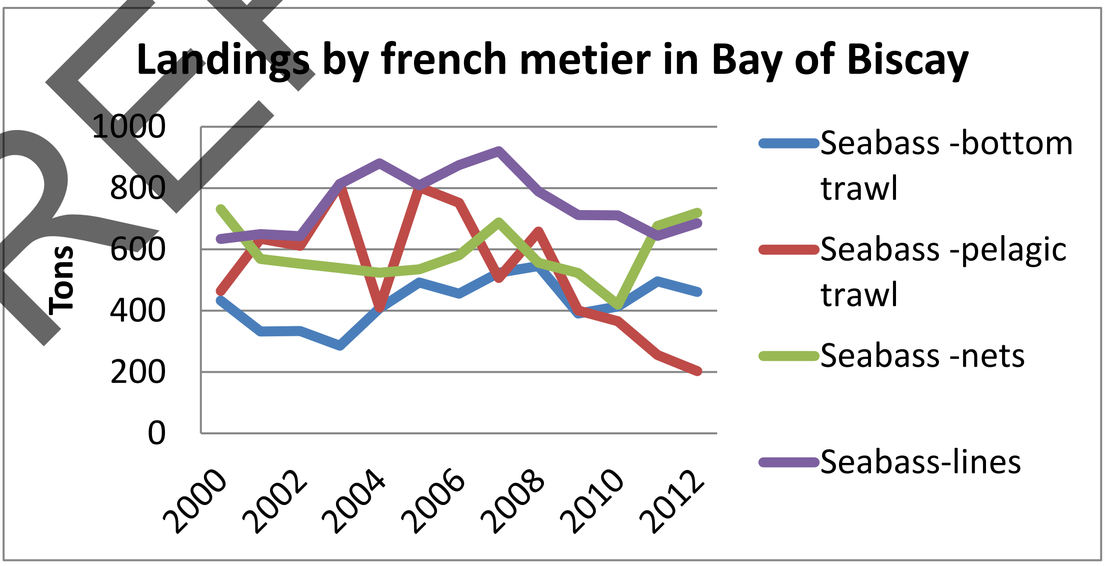

Figure 1 : landings by french fleet in the Bay of Biscay from 2000

Spain is responsible for around 10% of the catches, mainly with bottom otter trawlers. Discarding is thought to be low because of the high value of the fish; some discards could occurred due to individual quota limitations but are not quantified.. Spanish bass landings from Division VIIIa,b,d have increased to around 20 tons in the 90's to around 150 tons in the middle of the 2000's, then to 317 tons in 2011. Spanish commercial landings by gear type are shown in **Error! Reference source not found.**. UK landings from this area are very low, usually inferior to 5 tons per year. Recreational fisheries are an important part of the total removals but these are not accurately quantified

Seabass are a popular target for recreational fishing in Europe, particularly for angling in the UK, Ireland and France, and increasingly in parts of southern Norway, the Netherlands and Belgium. Relatively little historical data are available on recreational fisheries although several European countries are now carrying out surveys to meet the requirements of the EU Data Collection Framework and for other purposes (ICES WKSMRF 2009, PGRFS 2010 & 2011, WGRFS 2012; Herfault *et al*, 2010, Rocklin et al, 2012 in prep, Van der Hammen & De Graaf, 2012).

Fishery management regulations

Seabass are not subject to EU TACs and quotas. Commercial vessels catching bass within cod recovery zones are subject to days-at-sea limits according to gear, mesh and species composition. Under EU regulation, the MLS of bass in the Northeast Atlantic is 36 cm total length, and there is effectively a banned range for enmeshing nets of 70 - 89 mm stretched mesh in Regions 1 and 2 of Community waters[1]. A variety of national restrictions on commercial bass fishing are also in place. These include:

- a landings limit of 5 t/boat/week for all French trawlers landing bass;
- a licensing system from 2012 in France for commercial gears targeting sea bass.
- voluntary closed season from February to mid-March for long-line and hand-line bass fisheries in Brittany; France
- A minimum size landing of 42cm for recreationnal fisheries since 2013 in France.

Depending on country, measures affecting recreational fisheries include minimum landing sizes, restrictions on sale of catch, gear restrictions.

A.3. Ecosystem aspects

Temperature appears to be a major driver for bass production and distribution (Pawson, 1992). Reynolds *et al*. (2003) observed a positive relationship between annual seawater temperature during the development phases of eggs and larvae of sea bass and the timing and (possibly) abundance of post-larval recruitment to nursery areas. In addition, early growth is related to summer temperature and survival of 0-groups

[1] Region 1: All waters which lie to the north and west of a line running from a point at latitude 48 ºN, longitude 18 °W; thence due north to latitude 60 °N; thence due east to longitude 5 °W; thence due north to latitude 60 °30'N; thence due east to longitude 4 °W; thence due north to latitude 64 °N; thence due east to the coast of Norway.

Region 2: All waters situated north of latitude 48 °N, but excluding the waters in Region 1 and ICES Divisions IIIb, IIIc and IIId.

through the first winter is affected by body size (and fat reserves) and water temperature (Lancaster 1991; Pawson 1992). prolonged periods of temperatures below 5 - 6°C may lead to high levels of mortality in 0-groups in estuaries during cold winters. As a result, any SSB–recruit relationships may be obscured by temperature effects (Pawson *et al*., 2007a).

Recruitment of sea bass is highly variable, and the fisheries have often in the past been dominated by individual very strong year classes or have been negatively affected by periods of very poor recruitment. Expansion of sea bass populations in the North Sea in the 1990s coincided with a period of ocean warming as well as the growth of the very strong 1989 year class.

B. Data

B.1. Commercial catch

B1.1 Landings data

Data available

Landings series for use are available from three sources:

i) Official statistics recorded in the Fishstat database since around the mid 1980s.

ii) French landings for 2000-2012 from a separate analysis by Ifremer of logbook and auction data.

iii) Spanish landings for 2007-2011 from sale notes

French vessels take around 90% of the total annual landings in the area VIIIa and VIIIb with a a fishery including nets, bottom trawlers, pelagic trawlers (and also Danish seiners since 2010 in small proportion) who essentially operate during quarter 1 and 4 (prespawning and spawning season) and lines who operate essentially during quarter 3 and 4. Declines are observed in landings from 1984 to 1999 but are certainly due to poor statistics, which are more reliable since 2000.

Spanish bass landings from Division VIIIa,b,d have increased to around 20 tons in the 90's to around 150 tons in the middle of the 2000's, then to 317 tons in 2011. UK landings from this area are very low, usually inferior to 5 tons per year.

Quality of official landings data

The official landings data for sea bass available to WGNEW 2013 are subject to several uncertainties that can affect the accuracy of assessments:

- Incomplete reporting of landings in the 1970s and early 1980s when the fisheries were developing;
- Poor reporting accuracy for small vessels that do not supply EU logbooks.

From 1999 onwards, French landings data from FishStat are replaced by more accurate figures from a separate analysis of logbook and auction data carried out by Ifremer, in which landings have been correctly allocated to fishing ground. The time series for each component fishing ground therefore has a step change around 2000

B1.2 Discards estimates

French Data

Survey design and analysis

The French sampling schemes also utilise vessel-list sampling frames and random selection of vessels within strata defined by area and fleet sector. From the activity calendars of French vessels for year n-1, vessels are grouped by the métiers practiced. Thus, a vessel may belong to multiple groups if practicing several metiers in the period. If the metier has to be sampled in priority No. 1, the vessel to be boarded is chosen randomly within this group of vessels. The observer then chooses to go onboard for a trip. During the trip, the fishing operations corresponding to metier No. 1 are sampled. Optionally, if the vessel practices several metier during the trip, fishing operation of the metier No 2 will also be sampled if the metier No.2 is included in the annual sampling plan. If the metier is not part of the plan, it is requested to sample at least one fishing operation of this metier in the trip. (complete document on sampling protocol in French :http://sih.ifremer.fr/content/download/5587/40495/file/Manuel_OBSMER_V2_2_2012.pdf)

Data coverage and quality

France

Discards data are only available for French fleets from 2009 onwards. Length frequencies are available. Discarding of sea bass by commercial fisheries can occur where fishing takes place in areas with bass smaller than the minimum landing size (36cm in most European countries), and where mesh sizes <100mm are in use. For 2009, .discard are estimated to 44 tons, for 2010 44 tons, for,2011 20 tons and 2012 37 tons. Precision is low at current sampling rates weighting and raising of France discards estimates was carried out using COST tools, which have limited flexibility to match raising procedures to the sampling stratification, including where vessels are stratified by LOA. There is therefore a large potential for bias in the discards estimates. However discard rates are low in general in the fishery.

Spain

Observer data from Spanish vessels fishing in Areas VIII, have shown there was no seabass discard from 2003.

B1.3 Recreational catches

Recreational marine fishery surveys in Europe are still at an early stage in development (ICES WKSMRF 2009; PGRFS 2010 & 2011; WGRFS 2012). The following information was available to WGNEW 2012.

France

A study targeting sea bass was conducted between 2009 and 2011 in VIIIa, VIIIb, VIIe, VIIh, VIId, Ivc. Estimates of sea bass catches were obtained from a panel of 121 recreational fishermen recruited during a random digit dialling screening survey of 15 000 households in the targeted districts (Atlantic and Chanel). The estimated recreational catch of bass in the Bay of Biscay and in the Channel was 3,170t of which 2,350t was kept and 830t released. The precision of the the combined Biscay & Channel estimate is relatively low (CV =-26%; note that the figure of 51% given in IBP-NEW 2012 was incorrect). This makes the confidence interval at 95% of the average (3170t) to [1554t;4786t].

Increasing the panel from 121 to 210 fishermen would be expected to improve precision to 20% and increasing this panel to 500 would improve precision to 13%.

Around 60% of the recreational catch estimate was from Bay of Biscay. The main gears used, in order of total catch, were fishing rod with artificial lure, fishing rod with bait, hand line, long line, net and spear fishing. Approximately 80% of the recreational catch was taken by sea angling (rod and line or handline).

Spain

A recreational boat fishing survey was performed in the Basque Country to estimate the total catch of the target species of this fishery. Fishermen were asked about their catches in 2009, and 555 surveys were collected. Sea bass catch data were modeled with a two-step GLM, using type of boat and total boat length as covariables. The results were extrapolated to the total number of boats using an updated census. The estimated catch for seabass was in 2009 was 8183 Kg, with an associated standard error of 149 Kg. It is important to note that this estimation refers only to the fishing performed from boats. In order to estimate total recreational catches of sea bass, anglers fishing from coast and spear fishers need to be included in the survey. In 2012 a pilot study financed by the Data Collection Framework (DCF) was taking place in order to estimate total sea bass catches (taking into account all types of recreational fishing), and it is expected that the results if this study will increase significantly the estimated sea bass catch. Results were not available for WGNEW2013.

Quality of recreational catch estimates

Recreational catch estimates from surveys (numbers or tonnes caught per year) are not yet available as time series. The estimates for France are characterised by relatively poor precision. The 2012 ICES Working Group on Recreational Fisheries initiated the development of data quality indicators for recreational fishery survey estimates, however sources and potential magnitude of bias in available estimates were not provided to WGNEW 2013.

Scorecard on data quality

Data quality is evaluated in relation to precision (relative standard errors or proxies for effective sample size) and critical forms of bias (e.g. coverage of surveys; biases in fishery catch data, natural mortality rate). Where possible, sensitivity analyses are conducted to evaluate the effect of these biases on the assessment results. WGNEW 2012 (udated in WGNEW 2013, **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**) highlighted blocks of national data using traffic lights colours to indicate potential quality issues, but IBP-NEW 2012 and WGNEW 2013 did not have time to conduct the detailed evaluation of biases in data quality required by the ICES scorecard

B.2. Biological sampling

B2.1 Length and age compositions of landed and discarded fish in commercial fisheries.

Length and age compositions of sea bass landings were available to WGNEW & IBP-NEW 2012.

Length and age compositions of commercial landings

Length compositions of sea bass landings, are only available from sampling in France from 2000 in the Bay of Biscay, area VIIIa and VIIIb. Shorter time series of length compositions were supplied by Spain for Areas VIII for bottom trawlers in 2010 and 2011.

Effective sample sizes for length and age compositions

The effective sample size for annual estimates of length or age composition lie between the number of trips sampled and the number of fish measured or aged, due to cluster sampling effects. Effective sample sizes have not been computed yet for sampling data for seabass. In the meantime, numbers of fishing trips sampled for length or age could be used as an annual measure of relative precision of data sets

Sampling methods and analysis

France

The French sampling programme for length compositions of sea bass covers sampling at sea and on shore. Since 2009, both sampling types are first based on metiers composition and their relative importance per fishing harbours and month. Both are also designed to sample the whole catch following a concurrent sampling of species, potentially leading to low sea bass sample size. In order to complement this effort, specific sampling for sea bass at the market is added at times and harbours when higher landings are occurring, especially from metiers targeting sea bass. The sampling frame is based on the main harbours, gear types (or grouping of metiers) and month and is available to all samplers on a dedicated website. Real time follow-up of the plan, refusal rates and their reasons, time taken to sample, all this information is also available from the website, together with sampling protocol (in French :

http://sih.ifremer.fr/content/download/5587/40495/file/Manuel_OBSMER_V2_2_2012.pdf). Before 2009, only market specific sampling was in place, and the sampling plan was designed and followed by the stock coordinator. The French sampling programme for age compositions of sea bass is based on age-length keys with fixed allocation. For the VIIeh area, quarterly French landings at auctions are sampled in order to collect five scales (from 2000 to 2008) or three scales (from 2009) by length class (cm). For the VIIIab area the information is available only from 2010. For other areas the information is not available. All length samples are populated in a central data base (Harmonie) and regular extracts are available in the COST format. Raising the data to the population is done using COST tools and a special forum for discussing the outcomes of the analysis is held every year in March, in order to gather all stock coordinators and prepare the datasets for the assessment working groups.

Data coverage and quality

Sampling has been very variable between areas and gears, with greatest consistency between years in the neighbouring stock unit in VIIIa,b. There has been a general increase in numbers of trips sampled for length since 2009 (see assessment report).

The statistical design of fishery sampling schemes has undergone change in recent years in France, following recommendations from ICES workshops on sampling survey design, with a move towards more representative sampling across trips within fleet segments. This can result in sampling more trips that have small catches of bass, and is one reason for the increase in numbers of sampled trips with bass since 2009 in France which does not imply an increase of the proportion in numbers of fish measured per trip.

Length and age compositions

Length compositions are supplied by France since 2000 for VIIIab, disaggregated by seven gear types: bottom trawl, pelagic pair trawl, nets, handlines, longlines purseiners and danish seiners from 2012. French sampling rates for length compositions have been very variable between area, gear and year strata. Sampling has also been very variable between areas and gears, with greatest consistency between years in VIIIa,b. There has been a general increase in numbers of trips sampled for length since 2009. An attempt of building a catch at age matrix is proposed in WGNEW 2013 but should be discussed and analysed to conclude that the use or not. If such is the case, because of age validation (see below) a 9 or 10+ group should be adopted. The matrix has been built on the assumption that stock delimitation for seabass is still uncertain, and with scales sampling from 2000 to 2005 from coastal fisheries of Audierne (boundary between VIIIa and VIIeh), with sampling from 2006 and 2007 from in shore and off shore fisheries in VIIeh, and with sampling from 2008 to 2011 from the all Bay of Biscay.

Spanish landings of *Dicentrarchus labrax*, which is not a target species for any Spanish fleet, were not sampled for length structure before the implementation of concurrent sampling in 2009. Length information is scarce for most part of the Spanish metiers. For this reason length structure is presented only for bottom trawl activity in the Bay of Biscay in 2010 and 2011 where enough individuals have been sampled to allow an adequate extrapolation..

Accuracy and validation of age estimates

Age-reading consistency

Consistency in age reading of sea bass between four operators in Cefas and Ifremer was examined during a limited exchange of otolith and scale images between laboratories in 2011, organised by the ICES Planning Group on Commercial Catches, Discards and Biological Sampling (Mahé et al. 2012). A total of 155 fish of 17–74 cm was sampled on board French research vessels during two international surveys. The precision of ageing was similar for scales and otoliths. The coefficient of variation of age readings for individual fish was around 12% implying a standard deviation of +/- 1 year for a 10-year-old fish, with relatively few fish having identical readings by all four operators. However it was noted by the operators that photographic images were more difficult to evaluate than original age material, which was likely to have a negative effect on the consistency of ageing. These results provide no indication of the validity of ages, only the consistency between operators, and cannot indicate data quality in earlier years when different operators provided the age data. A more extensive age exchange is to be carried out in 2012.

Age validation

WGNEW was not aware of specific studies to validate absolute ages of seabass derived from otolith or scale readings. Strong and weak year classes can be followed clearly to over 20 years of age in UK sample data although it is not known to what extent the elevated numbers of sampled fish in immediately adjacent year classes is a true reflection of year class strength or a consequence of age errors discussed in the previous section. Year class tracking is less clear in the younger ages 3 – 5 although this will be affected by gear selectivity and changes in fish behaviour.

Sea bass show relatively broad length-at-age distributions, and it has been noted in French data (Laurec et al. 2012 WD to IBP-NEW) that the length-at-age distributions can have unusual patterns including some multiple modes that could indicate age errors. This will result in some smoothing of age data across neighbouring year classes. In the UK data, unusual patterns in length-at-age distributions for some younger ages appear related more to effects of minimum landing size on data from the fishery.

Inclusion of age error parameters in Stock Synthesis model

CV's for ageing error by age class can be input to Stock Synthesis. Based on the ICES sea bass scale exchange in 2002, the CVs of ~12% can be specified as increasing values per age class to give a standard error of ~1 year per age class.

Commercial discards

France

Discarding of sea bass by commercial fisheries can occur where fishing takes place in areas with bass smaller than the minimum landing size (36cm in most European countries), and where mesh sizes <100mm are in use. For 2009, .it's estimated to 44 tons, for 2010 44 tons, for,2011 20 tons and 2012 37 tons.

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Quality of discards estimates

Precision is low at current sampling rates weighting and raising of France discards estimates was carried out using COST tools, which have limited flexibility to match raising procedures to the sampling stratification, including where vessels are stratified by LOA. There is therefore a large potential for bias in the discards estimates. However discard rates are low in general in the fishery..

B2.2 Growth parameters

For area VIIIa,b no specific growth curve is available yet, especially because af the lack of information on youngest age which are needed to calibrate the growth curve. IBPNew 2012 discussed this section but because of the difference in environmental condition between the Channel and Bay of Biscay, further studies are needed to present a robust growth curve in this area.

Growth is relatively slow and the species is long-lived (up to 30 years of age). In the Channel, maturity is attained at 4 - 7 years, which is around 35 cm for males and 42 cm for females (Pawson and Pickett 1996). Nevertheless, although bass is an eurythermic species (registered tolerance from 5-33o C) maximal somatic growth occurs around 22-24oC (Vinagre et al. 2012), thus contributing to pronounced latitudinal gradients in length at age and daily growth rates. Values from Pawson and Picket could thus be revised downwards to the North area in the Bay of Biscay (and in Iberian waters).

B2.3 Maturity

Available data are from samples from all around the coast of England and Walesans are discussed in the IBPNew 2012 report. Nos specific data from The Bay of Biscay are available.

B2.4 Larval dispersal, nursery grounds and recruitment

Bass larvae resulting from offshore spawning move steadily inshore towards the coast as they grow and, when they reach a specific developmental stage at around 11 - 15 mm in length (at 30 - 50 days old), it is thought that they respond to an environmental cue and actively swim into estuarine nursery habitats (Jennings and Pawson, 1992). From June onwards, 0-group bass in excess of 15 mm long are found almost exclusively in creeks, estuaries, backwaters, and shallow bays all along the southeast, south, and west coasts of England and Wales, where they remain through their first and second years, after which they migrate to over-wintering areas in deeper water, returning to the larger estuaries in summer. Several studies indicate the existence of similar bass nursery areas in bays and estuaries on the French coasts of the Channel and Bay of Biscay and southern Ireland.

During the winter, juvenile bass move into deeper channels or into open water, and return in spring to the larger estuaries and shallow bays on the open coast, where they remain for the next 2-3 years.

On the south and west coasts of the UK, juvenile bass emigrate from these nursery areas at around 36 cm TL (age 3 - 6 years, depending on growth rate), often dispersing well outside the 'home' range, and not necessarily recruiting to their specific parent spawning stock (Pawson *et al.*, 1987; Pickett and Pawson., 2004). It appears that there is substantial mixing of bass at this stage throughout large parts of the populations' distribution range. When they reach 4 or 5 years of age their movements become more wide-ranging and they eventually adopt the adult feeding/spawning migration patterns (Pawson et al., 1994).

B2.5 Natural mortality M

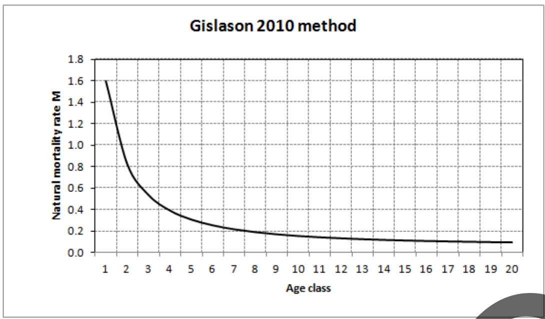
A variety of methods are given in the literature relating natural mortality rate M to life history parameters such as von Bertalanffy growth parameters k and Linf (asymptotic length), length or age at 50% maturity and apparent longevity particularly in an unexploited or very lightly exploited population. These methods were applied to the following sea bass life history parameters by Armstrong (2012):

There are no direct estimates of natural mortality available for Northeast Atlantic sea bass. Predation up to around age 4 will be in and near estuaries and bays. As with other fish species it is expected that M will be relatively high at the youngest ages, particularly given the slow growth rate in sea bass. For the benchmark assessment WGNEW 2012 proposes the compilation of life-history based inferences in the general value of M, based on maximum observed age, VB growth parameters, age at maturity and age of cohort biomass peak in relation to maturity. Age composition data from France since 2000 and the UK since 1985 indicate maximum recorded ages from 22 (French data) to 28 (UK data). The probability of encountering very old sea bass is partly a function of the interaction of year class strength and sampling rates, as well as mortality, however the occurrence of sea bass to almost 30 years of age suggests low rates of mortality.

The probability of encountering very old bass is partly a function of the interaction of year class strength and sampling rates, as well as mortality, however the occurrence of seabass to almost 30 years of age suggests low rates of mortality. The observed maximum age of 28 years in sea bass samples in the UK was recorded in the early 1980s, following a period of relatively low fishery landings. Age compositions of recreational fishery caught bass in southern Ireland, presented by stakeholders at IBP-NEW 2012, also show ages up to 26 years. This stock has been subject to a commercial fishery ban for many years.

Inferences on natural mortality rates are given below:

Source	Formulation	Combined sex M		
Hoenig 1983	variety of taxa ln(M) = 1.44-0.982*ln(tmax);	0.160		
	teleosts ln(M) = 1.46-1.01*ln(tmax)	**0.149**		
Alverson and Carney 1975	M = 3k/(exp(0.38*tmax*k)-1)	**0.161**		
Pauly 1980	M=exp(-0.0152+0.6543*ln(k)-0.279*ln(Linf,cm)+0.4634*lnT(oC))	0.196	temperature C	12
		0.211		14
		0.224		16
Ralston 1987	M=0.0189+2.06*k	**0.219**		
Beverton 1992	M=3k/(exp(*am* *k)-1) am = age at 50% maturity	0.369	female *am* ; comb sex k	
		0.614	male *am* , comb sex k	
Jensen (1997)	M=1.5K	**0.146**		
Gislason 2010	M = exp(0.55-1.61*Ln(L) + 1.44* Ln (Linf)+ Ln(K))			



Age class	Length	M
1	13.1	1.599
2	19.7	0.827
3	25.7	0.539
4	31.1	0.395
5	36.1	0.312
6	40.5	0.258
7	44.6	0.221
8	48.3	0.195
9	51.6	0.175
10	54.7	0.159
11	57.5	0.147
12	60.0	0.138
13	62.2	0.130
14	64.3	0.123
15	66.2	0.117
16	67.9	0.113
17	69.4	0.109
18	70.8	0.105
19	72.1	0.102
20	73.2	0.100

The inferred values of M, with the exception of the Beverton method, are in the range 0.15 – 0.22. The average of the Gislason estimates for ages 3 – 20 is 0.19.

A variety of methods are given in the literature relating natural mortality rate M to life history parameters such as von Bertalanffy growth parameters k and Linf (asymptotic length), length or age at 50% maturity and apparent longevity particularly in an unexploited or very lightly exploited population. The probability of encountering very old bass is partly a function of the interaction of year class strength and sampling rates, as well as mortality, however the occurrence of seabass to almost 30 years of age suggests low rates of mortality. The observed maximum age of 28 years in sea bass samples in the UK was recorded in the early 1980s, following a period of relatively low fishery landings. Age compositions of recreational fishery caught bass in southern Ireland, presented by stakeholders at IBP-NEW 2012, also show ages up to 26 years (Fig. B2-3). This stock has been subject to a commercial fishery ban for many years.

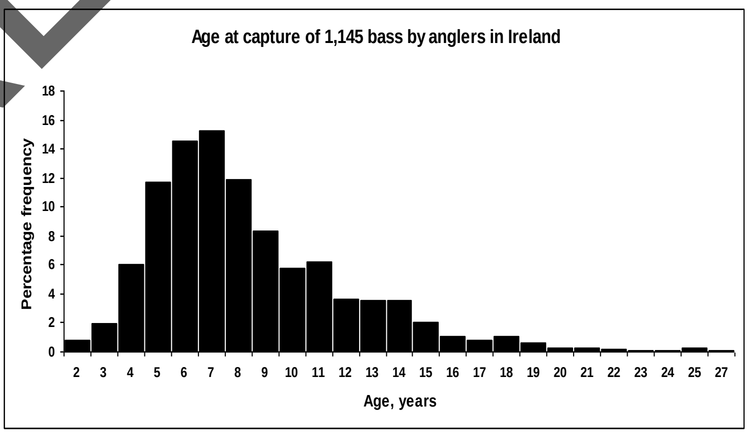


Fig. B2-3. Age composition of bass from samples collected from recreational catches in southern Ireland (data courtesy Ed Fahy, IBP-NEW 2012 meeting).

Inferences on sea bass natural mortality based on some life history models in the literature are given in IBP-NEW 2012 benchmark assessment section. The inferred values of M, with the exception of the Beverton method, are in the range 0.15 – 0.22 (Armstrong, 2012).

Hooking mortality, and mortality of discarded bass from commercial vessels

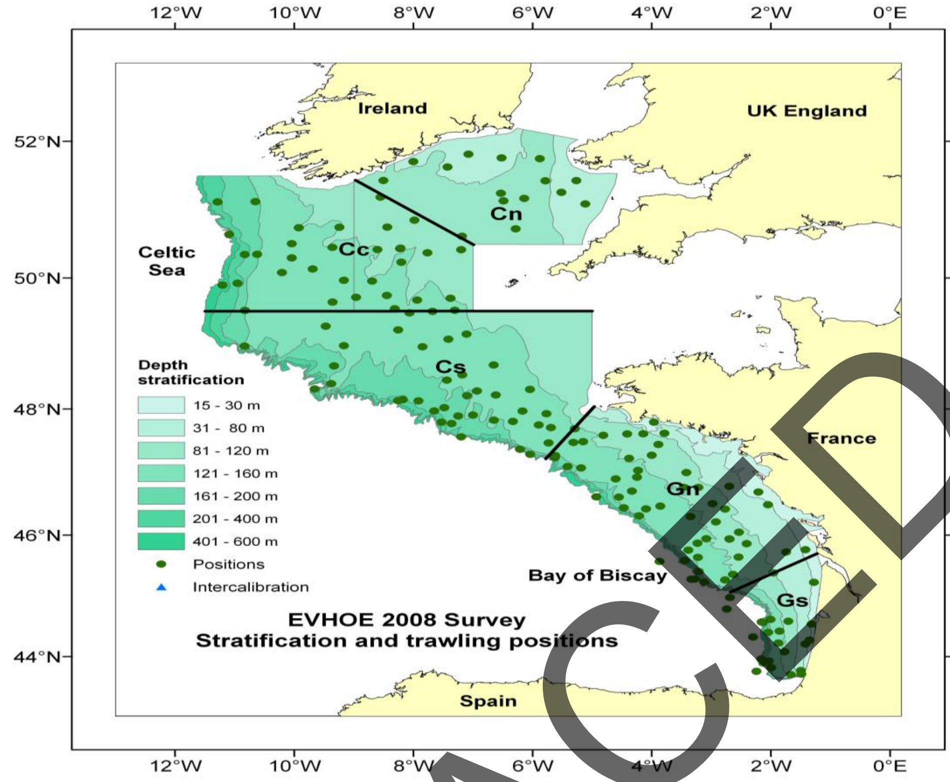
The NMFS in the US has in the past used an average hooking mortality of 9% for striped bass, estimated by Diodati and Richards 1996. Striped bass are very similar to European sea bass in terms of morphology, habitats and angling methods. A literature review of hooking mortality for a range of species compiled by the Massachusetts Division of Marine Fisheries included a total of 40 different experiments by 16 different authors where striped bass hooking mortality was estimated over two or more days (Gary A. Nelson, Massachusetts Division of Marine Fisheries, pers. comm.) The mean hooking mortality rate was 0.19 (standard deviation 0.19). Direct experiments are needed on European seabass to estimate hooking mortality for conditions and angling methods typical of European fisheries.

A fraction of sea bass discarded from commercial line vessels and netters may survive depending on the extent of injury or stress. This will affect the calculation of fishing mortality reference points that are conditional on selectivity patterns. Trawl-caught undersized bass are less likely to survive. Unfortunately no estimates of survival rates of commercial bass discards is available.

B.3. Surveys

France : Evhoe survey

Seabass are caught in small numbers in the French Evhoe trawl survey, which extends to the shelf edge in Subareas VII and VIII but also extends into coastal areas of the Bay of Biscay and the Celtic Sea where bass may be caught (cf the station map). Less than 10% of the stations have bass catches in most years. A mean of 0.5 seabass per trawl has been recorded from 1987. Abundance indices are calculated as stratified means.



.Fig. B 3-2. Station positions for French Evhoe bottom-trawl survey.

Spain

Information of Dicentrachus labrax catches in the series of research surveys conducted by the IEO since 1983 showed there are a very few seabass caught.

B.4. Commercial LPUE

France

IBP-NEW2012 evaluated a range of commercial fishery LPUE series for French and UK fleets operating in Areas IV and VII, including the LPUE trends for participants in the Cefas voluntary logbook scheme. A methodology on french bottom trawlers has been tested from auctions sales in area VII, IV and VIIIab : time series have been calculated for bottom trawlers <18m, which don't target seabass. French and UK (>10m) trawlers in areas IVb,c, VIId and VIIef could have been compared, and it shows very similar LPUE trends. With some exceptions (e.g. trawlers in VIId), UK >10m vessels tend to show different LPUE trends to 10m and under vessels. For the VIIIa and VIIIb, there is unlikely no possible comparison for the french results with other countries or other data set, and so will not be used at present.

Spain

LPUE data for Spanish fleets operating in ICES areas VI-VIII and landing into Basque Country ports were provided to WGNEW in 2005, and the best indicator of sea bass abundance trends (LPUE) in the period 1994 - 2004 was considered to be from vessels of the 'baka' otter trawl fleet working in Div. VIIIa,b,d and landing into the Basque port of Ondarroa. Data for later years were not available to WGNEW. Landings and effort data were provided to WGNEW by Spain, though not in the form of LPUE indices.

B.5. Other relevant data

None

C. Assessment: data and method

This chapter refers to the work done during IBPNew2012 for the Bay of Biscay Area

Length cohort analysis for Bay of Biscay

Little information on sea bass biology and data on exploitation are available for areas VIIIab: there are no growth parameter estimates, ALKs are only available for 2008-2010 and no abundance indices (either survey or commercial fishery based) are readily available. It is thus not possible to carry out an assessment comparable to the one developed for area IV and VII.

An exploratory analysis of the length frequency data was carried out using a length cohort analysis (Jones, 1984) applied to the pooled-gears length frequency distributions from French fleets fishing in the Bay of Biscay. The main difficulty with length-cohort analysis is that its application requires estimates or assumptions about the underlying growth rates (Linf and K), and the choice of input growth parameters can critically influence the results obtained (Jones, 1990). As no growth parameters estimates are readily available for Bay of Biscay sea bass, two sets of values were used for comparison : i) a set of estimates obtained from area IV and VII and used in the stock assessment described above (Linf=85cm and K=0.09) and ii) a set of parameters obtained during the IBP-NEW 2012 from fitting a VB growth model to length-age data collected in the Bay of Biscay in 2009 and 2010 (Linf=95cm and K=0.10). The estimates of F at length and N at initial length were then used to calculate equilibrium yield under a series of fishing mortality levels using a length based Thompson and Bell model.

Results clearly show the strong impact of assumptions on growth parameters on equilibrium yields which makes the use of this method very problematic with the limited biological knowledge available. Furthermore, this method relies on strong assumptions which may not be met in the case of seabass, namely that length composition data are sampled from a stock at equilibrium, with no variation in exploitation over time and no variation in year-class strength. This underlines, for this area, the critical need for data (biological and fishery related) to be able to carry out an analytical assessment of the stock, either as a separate stock or in a joint assessment with the more northern areas.

Inclusion of Bay of Biscay data in Stock Synthesis model

Runs 1A and 1B, the length only and age-length models for IVb,c and VIIa,d,e,f,g,h, were re-run to include a seventh fleet representing the French fleet in the Bay of Biscay. Length compositions for this fleet are provided for the years 2000 onwards. Tuning data for the Bay of Biscay are not included.

Inclusion of Bay of Biscay data scales up the SSB and recruitment compared with SS3 runs 1A and 1B. Although a trend of increasing F is shown, the rate of increase is lower than in IV&VII and terminal F is much lower.

A potential problem with this simple extension of the SS3 model is the possibility for different growth patterns in the warmer waters of the Bay of Biscay, affecting the fit of the length-based model. The absence of any age composition data precludes a direct evaluation of year class variations, and it is therefore not possible to evaluate how well the Solent and Thames recruit surveys match recruitment patterns in the Bay of Biscay population.

Conclusions regarding Bay of Biscay area (IBP New 2012)

Further analysis of growth rates are needed to allow any interpretation of length composition data for this area. Inclusion of Bay of Biscay data in the SS3 model assumes that there is a single biological stock, a hypothesis which can neither be confirmed or disproved with current knowledge. Relative abundance indices for pre-recruit and recruited sea bass are also needed for this area. IBP-NEW 2013 considers that no assessment can at present be performed for sea bass in the Bay of Biscay.

Implications of missing recreational catches in assessment model

Recreational catch estimates for sea bass are currently available for only 2010, and only for France and the Netherlands. Data for surveys in the UK in 2012 are not yet available. For France and Netherlands, the combined estimates of recreational fishery removals for 2010, including an assumed hooking mortality of 20% for released fish, is 1,115t:

	All Areas IV – VIII			Areas IV & VII only				
	kept	released	CV	Proportion in IV&VII	kept	released	hooking mortality for releases	total removed
France 2010	2350	830	0.51	0.4	940	332	20%	1006
Netherlands 2010	96	65	0.31	1	96	65	20%	109
Total								1115

These removals would represent 19% of a combined fishery removal of 5,850t in 2010 (1,115t recreational + 4,736 t commercial), although this percentage will be imprecise due to the large CVs for the recreational catch estimates (for France, the CV for areas IV and VII will be larger than 0.51 as only 40% of the catch estimate is for this area). The addition of recreational catches from the UK, Belgium and other countries would increase this percentage, but addition of commercial discards weights for all international fleets would reduce the percentage. Estimates of discards weights of sea bass in areas IV&VII in 2010 for UK trawls and nets, and French fleets, are around 200t. These figures exclude discards from other national fleets or UK fleets not sampled. Retained catches of sea bass by UK sea angers were estimated in the late 1980s and early 1990s to be around 400 t per year (Dunn et al 1989; Dunn and Potten 1994), although these estimates are of unknown accuracy. It is possible, therefore, that recreational fisheries could potentially account for around 20% of the fishing mortality in recent years. It is not possible to evaluate how the recreational fishing mortality rate may have altered over time, and how this would affect the fit of the model, including initial depletion rate. Further work is needed to consider how to handle recreational data (recent estimates and missing historical data) in assessments and advice for sea bass.

Short term projections

Short term projections were not carried out, although the scenario of increasing F, declining SSB and very poor recruitment since 2008 would lead to an expectation of further SSB decline. Procedures for carrying out trends-only projections should be developed at WGNEW 2013.

Appropriate Reference Points (MSY)

IBP-NEW 2012 was not in a position to develop MSY reference points for seabass based on the SS3 runs. Further work is needed at WGNEW 2013 to develop biological reference points.

Model used: Stock Synthesis 3 (SS3) (Methot, 2010)

Software used: Stock synthesis v3.23b (Methot, 2011)

The development of a seabass assessment model by IBP-NEW 2012 was built on experiences from application of the statistical, fleet-based separable model developed by Pawson et al (2007a) and updated by ICES WGNEW (Kupschus et al. 2008). The Pawson et al model was fitted only using UK age compositions for trawls, midwater trawls, nets and lines, separately for areas IVbc, VIId, VIIeh and VIIafg, and was intended mainly to estimate fleet selection patterns. Although it excluded any tuning data, the recruitment series for each sea area closely resembled the Solent survey indices and to an extent the shorter Thames series, and was able to provide coherent selection patterns by fleet.

The IBP-NEW 2012 assessment required a modelling framework capable of handling a mixture of age and length data for fisheries, including data for French fleets that had length composition data but no age composition data, and for which the length data were available only since the 2000s. The Stock Synthesis (SS) assessment model was chosen, primarily for its highly flexible statistical model framework allowing the building of simple to complex models using a mix of data compositions available. This model is written in ADMB (www.admb-project.org), is forward simulating and available at the NOAA toolbox: http://nft.nefsc.noaa.gov/SS3.html. For European sea bass a range of assessment models were built using Stock Synthesis 3 (SS3) version 3.29b to integrate the mix of fisheries and survey data available (fleet-based landings; landings age or length compositions and discards length compositions for variable combinations of fleets and years; three surveys providing recruitment indices) and biological information from recent research on growth rates, maturity and mortality.

Two basic model structures were explored, with the same specifications where possible:

1. Age and length model – Including age compositions for the four UK fleets and combined length compositions for the French fleets.
2. Length only model – Including only the length compositon data for all fishery fleets.

Input data

Years: 1985-2010

Model structure:

- Temporal unit: annual based data (landings, lpue, age-frequency and length-frequency)
- Spatial structure: One area
- Sex: Both sexes combined

Fleet definition:

Six fleets were defined as the gear for UK vessles, France and Other:

- UK trawl
- UK midwater trawl

- UK nets
- UK lines
- French fleets (combined)
- Other (Other countries and Other UK fleets combined)

Landed catches:

Annual landings in tonnes from 1985 to 2010 for the six fleets from ICES sub-divisions IVb and c, VIIa, d-h were used in the assessment.

Abundance indices:

Ten abundance indices were defined for each age up to 4 years for different areas and time period.

- Spring Solent survey in ICES sub-division VIId covering ages 2 to 4 for years 1985 to 2009
- Autumn Solent survey in ICES sub-division VIId covering ages 2 to 4 for years 1986 to 2009
- Autumn/Winter Thames survey ICES sub-division IVc covering ages 0 to 3 for years 1997 to 2009

Age composition of data for age-length model:

The age bins were set at 0 to 11 with a plus group for ages 12 and over. Age compositions for four fishing fleets were used. The available age data and their disaggregated level differ among fleets:

- UK trawl – Annual total numbers and mean weight in kilograms for 1985 to 2010 were used in the age-length model.
- UK midwater trawl – Annual total number and mean weight in kilograms for 1985 to 2010 were used in the age-length model. Gaps in the time-series were present, for years 1986, 1990, 1993, 1997 and 2006.
- UK nets - Annual total numbers and mean weight in kilograms for 1985 to 2010 were used in the age-length model.
- UK lines - Annual total numbers and mean weight in kilograms for 1985 to 2010 were used in the age-length model.

Length composition of data:

The length bin was set from 4 to 100 cm by 2 cm intervals. Length compositions for five fishing fleets were used. The available length data and their disaggregated level differ among fleets:

- UK trawl – Annual total numbers for 1985 to 2010 were used in the length only model.
- UK midwater trawl – Annual total numbers for 1985 to 2010 were used in the length only model.
- UK nets – Annual total numbers for 1985 to 2010 were used in the length only model.
- UK lines – Annual total numbers for 1985 to 2010 were used in the length only model.

- French all fleets combined – Annual total numbers for 2000 to 2010 were used in both the age-length and length only model.

Model assumptions and parameters

Characteristic	Settings
Starting year	1985
Ending year	2010
Equilibrium catch for starting year	Mean landings by fleet: 1980-1984
Number of areas	1
Number of seasons	1
Number of fishing fleets	6
Number of surveys (recruit surveys)	3 surveys, modelled as 10 single-age fleets at ages 0 – 4
Individual growth	Von Bertalanffy, parameters fixed, combined sex
Number of estimated parameters	48
Population characteristics	
Maximum age	30
Genders	1
Population length bins	4 - 100, 2 cm bins
Ages for summary total biomass	0 –12+
Data characteristics	
Data length bins (for length structured fleets)	14 – 94, 2 cm bins
Data age bins (for age structured fleets)	0 – 12+
Minimum age for growth model	0 [age 2 for age-length model]
Maximum age for growth model	30
Maturity	Logistic 2-parameter – females; L50 = 40.65cm
Fishery characteristics	
Fishery timing	-1 (whole year)
Fishing mortality method	Hybrid
Maximum F	2.9
Fleet 1: UK Trawl selectivity	Asymptotic
Fleet 2: UK Midwater trawl selectivity	Asymptotic
Fleet 3: UK Nets selectivity	Asymptotic (dome shaped forsensitivity run)
Fleet 4: UK Lines selectivity	Asymptotic
Fleet 5: Combined French fleet selectivity	Asymptotic
Survey characteristics	
Solent spring survey timing (yr)	0.42
Solent autumn survey timing (yr)	0.83
Thames survey timing (yr)	0.75
Catchabilities (all surveys)	Analytical solution
Survey selectivities	[all survey data entered as single ages; sel = 1]
Fixed biological characteristics	
Natural mortality	0.2
Beverton-Holt steepness	0.999

Recruitment variability (σR)	0.9
Weight-length coefficient	0.00001296
Weight-length exponent	2.969
Maturity inflection (L50%)	40.649 cm
Maturity slope	-0.33349
Length at age Amin	5.78 cm
Length at Amax	80.26 cm
Von Bertalanffy k	0.09699
Von Bertalanffy Linf	84.55 cm
Von Bertalanffy t0	-0.730 yr
Std. Deviation length at age (cm)	SD = 0.1166 * age + 3.5609

D. Other Issues

D.1. Historical overview of previous assessment methods

No previous methods for international data.

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