https://doi.org/10.17895/ices.pub.18622061

Bay of Biscay Mixed Fisheries Annex

Mixed Fisheries Annex

Regional specific documentation of standard assessment procedures used by ICES.

Eco-Region:	Bay of Biscay
Working Group:	Working Group on Mixed Fisheries Advice (WGMIXFISH-ADVICE)
Last updated:	October 2021
Last updated by:	Sonia Sánchez-Maroño and Dorleta García

A. General

A.1. Area definition

This mixed fisheries advice considers finfish species in ICES divisions 8.a-b and 8.d, and part of subdivisions 8.d.2 and 8.e.2. For Norway lobster (*Nephrops norvegicus*) in two functional units in divisions 8.a-b (Figure 1).

The species considered are part of the demersal mixed fisheries of the Bay of Biscay, and at present are anglerfish, hake, horse mackerel, mackerel, megrim, Norway lobster, pollack, smooth-hound, sole, blue whiting and whiting (Table 1).

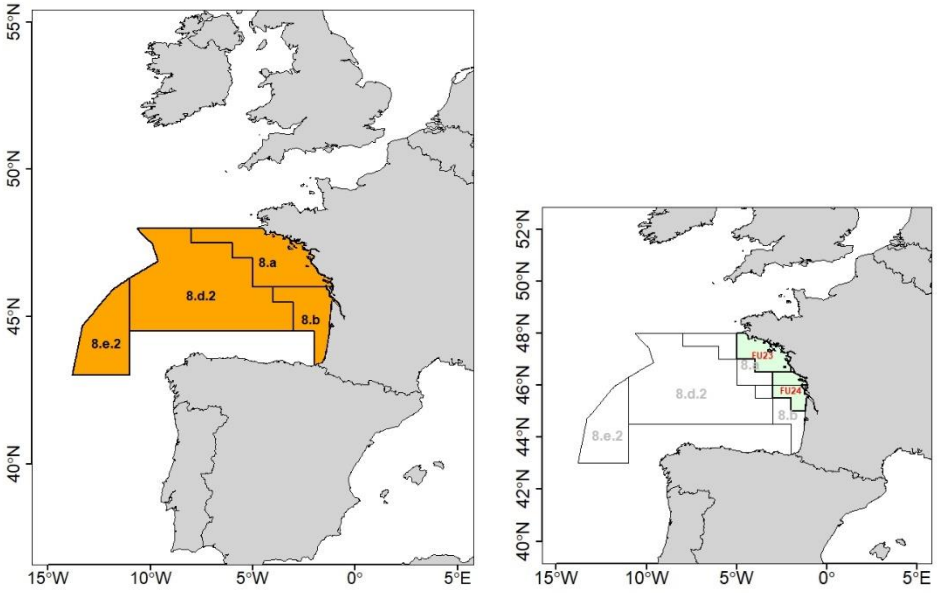

Figure 1. Area description for finfish advice and Norway lobster Functional Units (FU) in the Bay of Biscay region. Note: rectangles in Bay of Biscay region are included in FU23-24. However, it is very rare to have Norway lobster directed vessels out of the green area (due to the depth, as it is not yet the continental shelf).

Table 1. Finfish stocks

Species	ICES single stock advice area
Black-bellied anglerfish	Subarea 7 and divisions 8.a–b and 8.d (Celtic Seas, Bay of Biscay)
Hake	Subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d, Northern stock (Greater North Sea, Celtic Seas, and the northern Bay of Biscay)
Horse mackerel	Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k (Northeast Atlantic)
Mackerel	Subareas 1–8 and 14, and in Division 9.a (Northeast Atlantic and adjacent waters)
Megrim	Divisions 7.b–k, 8.a–b, and 8.d (west and southwest of Ireland, Bay of Biscay)
Whitie anglerfish (monkfish)	Subarea 7 and divisions 8.a–b and 8.d (Celtic Seas, Bay of Biscay)
Norway lobster	Divisions 8.a and 8.b, functional units 23–24 (northern and central Bay of Biscay)
Pollack	Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)
Smooth-hound	Subareas 1–10, 12, and 14 (Northeast Atlantic and adjacent waters)
Sole	Divisions 8.a–b (northern and central Bay of Biscay)
Blue whiting	Subareas 1–9, 12, and 14 (Northeast Atlantic and adjacent waters)
Whiting	Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)

* Species of interest for the Bay of Biscay, that have not included this year due to several issues.

Table 2. Norway lobster Functional Units (FU) in the Bay of Biscay.

FU no.	Name	ICES area	Statistical rectangles
23	Northern Bay of Biscay	8.a	24E5, 24E6, 24E7, 23E5, 23E6, 23E7, 22E6, 22E7, 22E8
24	Southern Bay of Biscay	8.b	21E7, 21E8, 20E7, 20E8, 19E8

Pelagic fisheries targeting anchovy and other pelagic species are not considered in a mixed fisheries advice context given the targeted nature of the fisheries for these species.

A.2. Fishery

More information on fisheries in the Bay of Biscay can be found in the Bay of Biscay and Iberian Coast Ecoregion – Fisheries overview.

The EU landing obligation was implemented from 1 January 2015 for several gears for pelagic stocks and from 1 January 2017 for demersal stocks.

Anglerfish in Subarea 7 and in divisions 8.a–b and 8.d

Both anglerfish species, white anglerfish (*Lophius piscatorius*) and black-bellied anglerfish (*Lophius budegassa*), are caught on the same grounds and by the same fleets and are usually not separated by species in the landings. Anglerfish is an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and Norway lobster. France contributes to most of the landings for the combined species in this area and

has done so since 1990. Since 2011, the landings of both species combined have been above the average of the time-series. Total Allowable Catch (TAC) is set for both species combined.

Hake in Subareas 4, 6, and 7, and in divisions 3.a, 8.a–b, and 8.d (Northern Stock)

Hake is caught in nearly all fisheries in Subareas 7, 8. and in some fisheries in Subareas 4, 6. In recent years. France accounted for the main part of the catches, followed by Spain and Scotland. Stock landings have been steadily increasing throughout the last decade, from 36 675 t in 2001 to 107 530 t in 2016, the highest value of the time-series. The 2017 landings saw a slight reduction down to 104 670 t with a corresponding drop in discarding. Discards were not available until 2002. From 2003 until 2010, discards were provided as a total in all the divisions and subareas where the northern hake is caught. In 2014, discards were allotted to specific divisions where the highest discarding occurs in divisions 4 and 7. A declining trend in total discards was observed since 2017. However, discarding in divisions 8.a, 8.b, and 8.d became the highest contributor to the 2017 total discards. In 2020, total discards were 3257 t. Historically, landings have been above the agreed TAC (2009-2015), and below it (2015-2020).

Horse mackerel in Subarea 8 and divisions 2.a, 4.a, 5.b, 6.a, 7.a–c, and 7.e–k

France, Germany and the Netherlands have a directed trawl fishery and Norway and France a directed purse-seine fishery for horse mackerel. Spain has directed as well as mixed trawl and purse-seine fisheries targeting horse mackerel. In earlier years most of the catches were used for meal and oil while in later years most of the catches have been used for human consumption.
The Dutch, Danish, Irish and German fleets operated mainly in the North and West of Ireland and the Western waters off Scotland. The French fleet were in the Bay of Biscay and West Scotland whereas the Norwegian fleet fished in the North-eastern part of the North Sea. The Spanish fleet operated mainly in waters of Cantabrian Sea and Bay of Biscay.

Mackerel in Subareas 1–8 and 14, and in Division 9.a

The total fleet can be considered to consist of the following components: freezer trawlers, purse seiners, pelagic trawlers, lines and jigging, and gillnets.
Freezer trawlers are commonly large vessels (up to 150 m) that usually operate a single mid-water pelagic trawl, although smaller vessels may also work as pair trawlers. These vessels are at sea for several weeks and sort and process the catch on board, storing the mackerel in frozen 20 kg blocks. The Dutch, German and the majority of the French and English fleets consist of these vessels which are owned and operated by a small number of Dutch companies. They fish in the North Sea, west of the UK and Ireland and also in the English Channel and further south along the western coast of France. The Russian summer fishery in Division 2.a is also prosecuted by freezer trawlers and partly the Icelandic fishery in Division 5.a and in some years in 14.b.
The majority of the Norwegian catch is taken by purse seiners, targeting mackerel overwintering close to the Norwegian coastline. The largest vessels (> 20 m) used refrigerated seawater (RSW), storing the catch in tanks containing RSW. Smaller purse seiners use ice to chill their catch which they take on prior to departure. A purse seine fleet is also the most important component of the Spanish fleet. They are numerous and target mackerel early in the year close to the northern Spanish coast. These are dry hold vessels, chilling the catch with ice. Denmark also has a purse seine fleet operating in the northern North Sea.

Pelagic trawlers vary in size from 20—100 m and operate both individually and as pairs. The largest of the pelagic trawlers use RSW tanks for storage. Iceland, Greenland, Faroes, Scotland and Ireland fish mackerel using pelagic trawlers. Scottish and Icelandic vessels mostly operate as single trawlers whereas Ireland and Faroese vessels tend to use pair trawls. Spain also has a significant trawler fleet which target mackerel with a demersal trawl in Subarea 8 and Division 9.a.N.
Norway and England have handline fleets operating inshore in the Skagerrak (Norway) and in Divisions 7.e/f (England) around the coast of Cornwall, where other fishing methods are not permitted. Spain also has a large artisanal handline fleet as do France and Portugal. A small proportion of the total catch reported by Scotland (Divisions 4.a and 4.b) and Iceland (Division 5.a) is taken by a handline fleet.
Gillnet fleets are operated by Norway and Spain.

Megrim in Divisions 7.b–k, 8.a–b, and 8.d

Lepidorhombus spp. in Divisions 7.b-k and 8.a, b, d are caught in a mixed demersal fishery with anglerfish, hake and Norway lobster. both as targeted species and as valuable bycatch. The two species are landed and recorded together in ports statistics. Information from landings was available for 2017 for *L. boscii* that provided a rough proportion for splitting the two species. Landings in recent years were relatively stable around 15 000 t. Since 2014, landings declined with no constant trend (average of around 12 000 t). Discarding of smaller megrim is substantial and also includes individuals above the minimum landing size of 20 cm. The discards were variable, between 885 t and 6300 t.

Norway lobster in ICES Divisions 8.a–b

There are two Functional Units (FU) in ICES Division 8.a-b: FU 23 (Bay of Biscay North) and FU 24 (Bay of Biscay South). Norway lobster in these FUs are exploited by French trawlers almost exclusively. Landings declined until 2000, from 5875 t in 1988 to 2849 t in 2000. After that year, they increased again to around 3421 t, staying above 3000 t until 2006. From 2007–2009, landings have been around 2800 t then increased to about 3200 t during the next 2 years. In 2012 and 2013, a reduction in the landings occurred (around 2200 t) followed by an increase to 3425 t in 2015. In 2020, total nominal landings reached 2273 t, close to the historically lowest level of its time-series in 2018 (2125 t).

A French regulation increased the minimum landing size in 2006 and several effort and gear selectivity regulations have also been put in place in recent years. The use of selective devices for trawlers targeting Norway lobster became compulsory in 2008. All these measures are expected to be contributing in various ways to the change of landings and discards patterns recently observed. In general, discard values after 2000 have been higher than in earlier years, although sampling only occurred on a regular basis from 2003, so information about discards is considerably weaker for the earlier period. Since 2017, the use of a discarding quick-chute system on-board has become compulsory. This measure has a direct impact on the survival rate of discards. The new survival rate of 50% was accepted to be used in the assessment and advice of the stock (ICES, 2021a).

Pollack in Subarea 8 and Division 9.a

Pollack is mainly caught by France (77%) and Spain (18%) by several types of gears; nets, lines and trawls. Most of the landings are from gillnets (53%) followed by the line (37%) fisheries. Since the early 2000s, the landings have been relatively stable between

around 1500 t and 2200 t. The recreational removals are unquantified but considered non-negligible.

Discards by Spanish netters indicate that the discards are considered negligible. Discards by French netters and liners are about 1.2% and 0.1% of their catches, respectively.

Whiting in Subarea 8 and Division 9.a

Whiting (*Merlangius merlangus*) are caught in mixed demersal fisheries primarily by France and Spain. Present fishery statistics are considered to be preliminary. Total landings in recent years have fluctuated around 2000 t. The 2016 landings (2502 t) are reported to be one of the highest of the time-series. In 2017, landings decreased to 1909 t. This was followed by further declines in succeeding years to a value of 1096 t in 2020, the lowest in its time-series when excluding the year 1999 (French landings data were not submitted). Whiting has never been recorded in Spanish discards and is negligible in Portuguese discards. However, there are indications that discarding occurs in the French fleet, recent available information suggests this is highly variable between fleets and for some considerable.

TAC for this stock is only set in Subarea 8. For Division 9.a the TAC is delegated to the Member States.

This species is at the southern extent of its range in the Bay of Biscay and Iberian Peninsula. It is not clear whether this is a separate stock from a biological point of view.

Smooth-hound in subareas 1–10, 12, and 14

Smooth-hounds are a seasonal bycatch in trawl, gillnet and longline fisheries. Though they are discarded in some fisheries, others land them as bycatch, depending on market demands. Some may also be landed to supply bait for pot fisheries.

Smooth-hounds are also a relatively important species for recreational sea anglers and charter boat fishing in several areas, with anglers and angling clubs often having catch-and-release protocols, particularly in the Celtic and North Sea ecoregions.

There are no specific management measures for smooth-hounds.

Sole in Divisions 8.a–b

Bay of Biscay sole is caught in ICES divisions 8.a and b. The fishery has two main components: one is a French gillnet fishery directed at sole (about two thirds of total catch) and the other one is a trawl fishery (French otter or twin trawlers and Belgian beam trawlers).

Blue whiting in subareas 1–9, 12, and 14 – to be included at some point in future

The main fisheries on blue whiting were targeting spawning and post-spawning fish. Most of the catches (89%) were taken in the first two quarters of the year and the largest part of this was taken along the slopes of the Western European shelf, in the Rockall Trough and in the deep trenches around the Faroes. Smaller quantities were taken in the Norwegian Trench and along the coast of Spain and Portugal.
The fishery in the latter half of the year was mainly east of the Faroes and in the central Norwegian Sea, with smaller amounts in the Norwegian Trench, along the slopes of the Western European shelf and along the coast of Portugal and Spain.

The multinational fleet targeting blue whiting in 2019 consisted of several types of vessels from 17 countries. The bulk of the catch is caught with large pelagic trawlers, some with capacity to process or freeze on board. The remainder is caught by RSW vessels.

A.3. Ecosystem aspects

These are described in the Bay of Biscay and Iberian Coast ecosystem overview in the ICES advisory report.

B. Data

The mixed fisheries assessment is based on catch and effort data that were compiled mostly on the basis of the data collected in annual ICES data calls and data collected by STECF for the evaluation of the effort regime. The data structured by fleets and métiers were used as inputs, together with single stock data and advice from several ICES working groups, in the integrated FLBEIA framework (García *et al*., 2017).

The assessment data for the different stocks is taken from the ICES Working Group for the Bay of Biscay and the Iberian Waters ecoregion (WGBIE: ICES, 2021a), from the Working Group on Elasmobranch Fishes (WGEF: ICES, 2021b), and from the Working Group on Widely Distributed Stocks (WGWIDE: ICES, 2021c).

C. Assessment methodology

Definitions

Two basic concepts are of primary importance when dealing with mixed-fisheries, the Fleet (or fleet segment), and the Métier. Their definition has evolved with time, but the most recent official definitions are those from the CEC's Data Collection Framework (DCF, Reg. (EC) No 949/2008), which we adopt here*:*

- ***A Fleet segment*** is a group of vessels with the same length class and predominant fishing gear during the year. Vessels may have different fishing activities during the reference period, but might be classified in only one fleet segment.
- ***A Métier*** is a group of fishing operations targeting a similar (assemblage of) species, using similar gear, during the same period of the year and/or within the same area and which are characterized by a similar exploitation pattern.

Model used:

FLBEIA

The FLBEIA simulation model is presented and described in García *et al*. (2017). The aim of this flexible and generic simulation model is to allow conducting Bio-Economic Impact Assessments of harvest control rule based on management strategies under a Management Strategy Evaluation (MSE) framework. The model provides functions that describe the different components of the system (i.e. stocks, fleets and management procedure). Given fishing opportunities available for each fleet (e.g. TACs by stock or effort allocation by fleet), the model estimates the potential future levels of effort for each fleet, based on fleet effort distribution and catchability by métier. Based on this effort level, landings and discards (i.e. catches) by fleet are estimated using standard forecasting procedures.

The selected function to simulate the behaviour of the fleet is the Simple Mixed Fisheries Behaviour model (SMFB), which is a simplified version of the behaviour of fleets that work in a mixed fisheries framework. The function is seasonal and assumes that effort share among metiers is given as input parameter. Catchability ($q_{f,mt,st}$) by fleet (*f*), métier (*mt*) and stock (*st*) can be estimated as a mean over the recent observed landings and discards. But the user can also select a specific value of *q*, in case of evidence of changes are expected to occur (e.g. significant technical creep, a change in selectivity due to a change in mesh size…).

For each season (*s*), fleet effort ($E_{f,s}$) is restricted by the seasonal landing or catch quotas of the stocks captured by the fleet and the landing obligation (LO) can also be included. The effort is is calculated following the subsequent steps:

1. Compare the overall seasonal quotas ($\sum_f Q_{f,s,st} \cdot TAC$), with the abundances of the stocks. If the ratio between the overall quota and the abundance ($B_{s,st}$) exceeds the seasonal catch threshold ($\gamma_{s,st}$), then the quota share is reduced in the same degree. That is,

$$\boldsymbol{Q'_{f,s,st}} = \begin{cases} \boldsymbol{Q_{fl,s,st}} & , \quad \boldsymbol{if} \ \dfrac{\sum_f \boldsymbol{Q_{f,s,st}} \cdot \boldsymbol{TAC}}{\boldsymbol{B_{s,st}}} \leq \boldsymbol{\gamma_{s,st}} \\ \boldsymbol{Q_{fls,st}} \cdot \dfrac{\boldsymbol{B_{s,st}} \cdot \boldsymbol{\gamma_{s,st}}}{\sum_f \boldsymbol{Q_{f,s,st}} \cdot \boldsymbol{TAC}} & , \quad \boldsymbol{if} \ \dfrac{\sum_f \boldsymbol{Q_{f,s,st}} \cdot \boldsymbol{TAC}}{\boldsymbol{B_{s,st}}} > \boldsymbol{\gamma_{s,st}} \end{cases} \quad \textbf{(1)}$$

2. According to the catch production function, Cobb-Douglas in this case, the efforts corresponding to the landing or catch quotas ($Q'_{f,s,st} \cdot TAC$) for individual stocks are calculated, $\{E_{f,s,st_1}, \dots, E_{f,s,st_n}\}$.
3. Based on the efforts calculated in the previous step, an unique effort ($\hat{E}_{f,s}$) is calculated, based on the following options:
    - *max*: the maximum among possible efforts
    $$\hat{E}_{f,s} = max_{j=1,\dots,n}\left(E_{f,s,st_j}\right)$$
    - *min*: the minimum among possible efforts
    $$\hat{E}_{f,s} = min_{j=1,\dots,n}\left(E_{f,s,st_j}\right)$$
    - *mean*: the mean of possible efforts
    $$\hat{E}_{f,s} = mean_{j=1,\dots,n}\left(E_{f,s,st_j}\right)$$
    - previous: the effort selected is the effort most similar to previous year effort in that season
    $$\hat{E}_{f,s} = \left\{E_{f,s,st}: \left|1 - \frac{E_{f,s,st}}{E_{f,y-1,s}}\right| = \min_{j=1,\dots,n}\left|1 - \frac{E_{f,s,st_j}}{E_{f,y-1,s}}\right|\right\}$$
    - *stock.name*: the effort corresponding to *stock.name* is selected
    $$\hat{E}_{f,s} = E_{f,s,stk.nam}$$

    If there is a LO, the option to calculate the simulated fleet effort will be the minimum among possible efforts instead of using the option chosen by the user.
4. When LO is applied, the new effort is calculated using exemptions and flexibilities (*de minimis*, year transfer and quota swap).
    - *de minimis*: The fleet is allowed to discard a percentage of the quota to increase the effort in order to catch other stocks.
    - *year transfer*: The fleet can borrow next year's quota to catch it in the current year.

- *quota swap*: A percentage of the quota of one stock can be transferred to the effort limiting stock, if the two stocks are in the same group. Where these groups are specified by the user.

5. The selected effort ($\hat{E}_{f,s}$) is compared with the capacitiy of the fleet ($K_{f,s}$), so that if the capacity is exceeded, the final effort ($E_{f,s}$) should be reduced.

$$\boldsymbol{E_{f,s}} = \begin{cases} \boldsymbol{K_{f,s}} & , \quad \boldsymbol{if\ K_{f,s} < \hat{E}_{f,s}} \\ \boldsymbol{\hat{E}_{f,s}} & , \quad \boldsymbol{if\ K_{f,s} \geq \hat{E}_{f,s}} \end{cases} \tag{2}$$

6. Finally, the catch corresponding to effort selected is calculated for each stock and compared with the corresponding quota. If the catch is not equal to the quota and the season is not the last one (ns), the seasonal quota shares of the rest of the seasons are reduced or increased proportionally to ther weight in the total share. The shares are changed in such a way that the resultant annual quota share is equal to the original one. In the case that the difference between actual catch and that corresponding to the quota exceeds the quota left over in the rest of the seasons, the quota in the rest of the seasons is cancelled (i.e. set to 0). Mathematically, for season i where $s \leq i \leq ns$:

$$\boldsymbol{Q''_{f,i,st}} = \mathbf{max}\left(\mathbf{0}, \boldsymbol{Q'_{f,i,st}} + \left(\boldsymbol{Q'_{f,s,st}} - \boldsymbol{Q''_{f,s,st}}\right) \cdot \frac{\boldsymbol{Q'_{f,i,st}}}{\sum_{j<s} \boldsymbol{Q'_{f,j,st}}}\right) \tag{2}$$

where Q' denotes the quota share obtained in the first step and Q'' the new quota share.

Software used:

The FLBEIA model has been coded as a method in R (R Development Core Team, 2021), as part of the FLR framework (Kell *et al.*, 2007; www.flr-project.org). Input data are in the form of FLFleetsExt and FLBiols objects inherited from the FLCore 2.6.15 package objects, and two forecast methods were used, stf() from the FLAssess (version 2.6.3) and fwd() from the Flash (version 2.5.11) packages. Both input parameterisation as well as the stock projections are made using FLBEIA functions and methods (version 1.15.6), that are flexible enough to allow covering different alternatives. Full transparency is assured as all the FLBEIA source code is available at GitHub (https://github.com/flr/FLBEIA). The code, software and versions are part of the ICES Transparent Assessment Frame-work (TAF) and can be fully reproduced from this repository (see https://github.com/ices-taf/2021_BoB_MixedFisheriesAdvice).

D. Short-Term Projection methodology

Model used: Overview of software used by WGBIE, WGEF and WGWIDE.

Stock	ICES code	Assessment	Forecast
Black-bellied anglerfish	ank.27.78abd	Survey trend (Category 3)	NA
Hake	hke.27.3a46-8abd	Length-based model (SS3)	SS3 (ad hoc R code)
Horse mackerel	hom.27.2a4a5b6a7a-ce-k8	Length- and age-based analytical assessment (SS3)	FLR STF
Mackerel	mac.27.nea	Age-based analytical model (SAM)	FLR STF
Megrim	meg.27.7b-k8abd	Bayesian statistical catch at age model	ad hoc R code
Whitie anglerfish (monkfish)	mon.27.78abd	Age-based analytical assessment (a4a)	FLR STF
Norway lobster (nephrops)	nep.fu.2324	UWTV survey (Category 1)	Ad-hoc (excel sheet)
Pollack	pol.27.89a	None (Category 5)	NA
Smooth-hound	sdv.27.nea	Survey trend (Category 3)	Ad-hoc (excel sheet)
Sole	sol.27.8ab	Age-based analytical assessment (FLXSA) with only landings	FLR STF (including discards)
Blue whiting	whb.27.1-91214	Age-based analytical assessment (SAM)	SAM forecast (deterministic version)
Whiting	whg.27.89a	None (Category 6)	NA

* Species of interest for the Bay of Biscay, that have not included this year due to several issues.

In the mixed-fisheries runs, all forecasts were done with the same FLR forecasts method (see section C).

For every scenario, the following output is generated per stock:

	Description	Landings	F mult	SSB
Baseline forecast for current year	Applying single species forecast assumptions to last year's data (current year – 1)*	Current yr	Current yr	1st Jan TAC yr
Baseline forecast for TAC year	Applying single species HCRs** to current year results*	TAC yr	TAC yr	1st Jan TAC yr + 1
Current year FLBEIA results	Applying FLBEIA to last year's data	Current yr	Current yr	1st Jan TAC yr
FLBEIA estimate of catches in TAC year	Applying FLBEIA on current year FLBEIA results	TAC yr	TAC yr	1st Jan TAC yr + 1
TAC advice results (incl mgt plans)	Applying single species HCRs** to current year FLBEIA results	TAC yr	TAC yr	1st Jan TAC yr + 1

*** For the Baseline runs, a forecast was run for each stock separately following the same settings as in the ICES single species forecast.**

**** Harvest Control Rules – either from single species management plans or with reference to the F_{MSY} transition approach. Where HCRs according to these approaches were not available values according to the precautionary approach were used.**

G. Biological Reference Points

The biological reference points that are used are the same values as referred to in the single stock advisory reports.

H. Other Issues

-

I. References

García, D., Sánchez, S., Prellezo, R., Urtizberea, A., and Andrés, M. 2017. FLBEIA: A simulation model to conduct Bio-Economic evaluation of fisheries management strategies. SoftwareX, 6: 141-147.

ICES. 2021a. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). ICES Scientific Reports. 3:48. 1101 pp. https://doi.org/10.17895/ices.pub.8212

ICES. 2021b. Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports. 3:59. 822 pp. https://doi.org/10.17895/ices.pub.8199

ICES. 2021c. Working Group on Widely Distributed Stocks (WGWIDE). ICES Scientific Reports. 3:95. 874 pp. http://doi.org/10.17895/ices.pub.8298Kell, L., T., Mosqueira, I., Grosjean, P., Fromentin, J-M., Garcia, D., Hillary, R., Jardim, E., Mardle, S., Pastoors, M. A., Poos, J. J., Scott, F., and R.D. Scott (2007) FLR: an open-source framework for the evaluation and development of management strategies. ICES Journal of Marine Science, 64: 640–646.

R Development Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org