Stock Annex: Plaice (Pleuronectes platessa) in divisions 7h–k (Celtic Sea South, southwest of Ireland)

Stock	Plaice (Pleuronectes platessa) in divisions 7h–k (Celtic Sea South, southwest of Ireland); ple.27.7h–k
Working Group	WGCSE
Date	May 2021
Last revision	WGCSE 2021
Main modifications	New assessment method
Last benchmarked	WKWest 2021

A. General

Stock definition

To date no stock identification or tagging studies have been conducted on plaice in 7h–k. There is evidence in other areas to suggest that plaice is a highly mobile species, and therefore it is possible that plaice in 7h–k is an extension of larger adjoining populations, but tagging and genetic would need to be completed to determine this (ICES, 2021a).

A.2 Fishery

The TAC area specified for plaice in ICES divisions 7.h–k is consistent with the assessment area. This stock is on the south-western margins of the species distribution, which is reflected in the reported landings that show high landings in adjoining stock areas, 27.7.e and 27.7.fg (Figure A.1). Landings of plaice are similar in ICES divisions 7h and 7j, but are considered negligible in 7k. Plaice in 7j is typically targeted by the Irish otter trawl fleet, which operate on sandy grounds off the southwest of Ireland, close to shore and this species is a small, but valuable component of the landings in a mixed fishery. Whereas, plaice in 7h is mostly targeted by the beam trawl fleet, and some otter trawl, which operate close to the boundaries of other plaice stocks (ple.27.7.fg and ple.27.7.e)(Figure A.1).

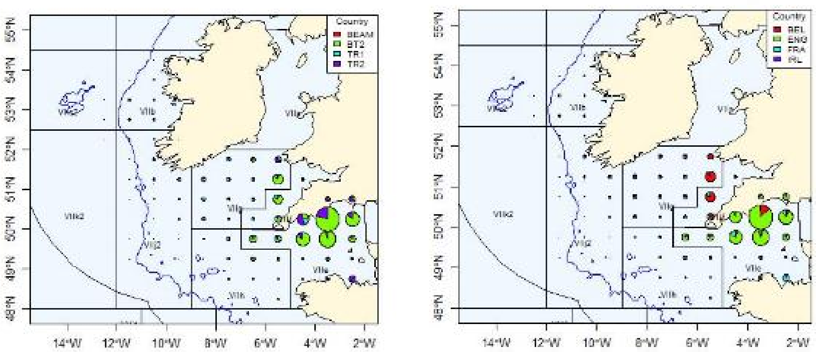

Figure A.1. The spatial distribution of plaice landings reported to the STECF fisheries dependant information data call in 2016 (the last data year available by statiticla rectangle), disaggregated by Member State (left) and gear (right). Note beam trawlers are described as beam and BT2, and otter trawlers are described as TR1 and TR2.

B. Data

B.1. Landings

Landings data are available for 7.h,j and k, through InterCacth from 2004 onwards. As this time-series does not capture the peak of the fishery, which occurred pre-2004, official landings were used to cover the years from 1995–2003. The benchmark group decided to cut the time-series at 1995 to avoid the inclusion of two very high peaks at the beginning of the time-series as they were unable to verify the validity of the early peaks, and dips, in the time-series (Figure B.1)(ICES 2021a). Where the two time-series overlap three is good concistancy (Figure B.1).

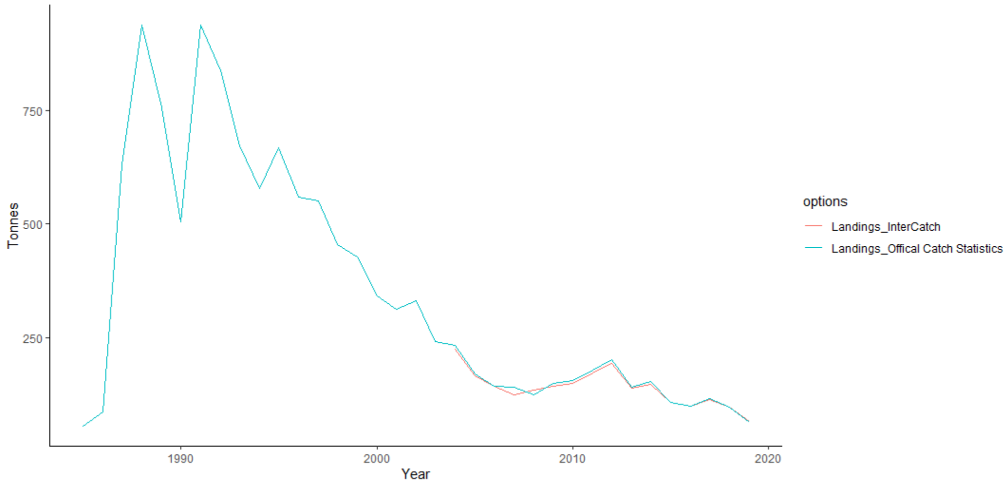

Figure B.1. Comparison of official landings statitics and those submitted to InterCatch.

B.2. Discards

Discard data are available for 7.h,j and k, through InterCacth from 2004 onwards. These rates are highly variable over time (Figure B.2.1), this variability is be driven by low or variable numbers samples. Therefore, in 2021 an average discard rate was calculated from the of the average discard rates of all years, resulting in 44% (Figure B.2.2) (ICES, 2021a,b). To ensure that any increase in future discarding is captured, future years will be calculated using an average of the preceding three years (ICES, 2021b).

Figure B.2.1. Plaice in divisions 7.h–k. raw variable discard rates avaible trhough InterCatch.

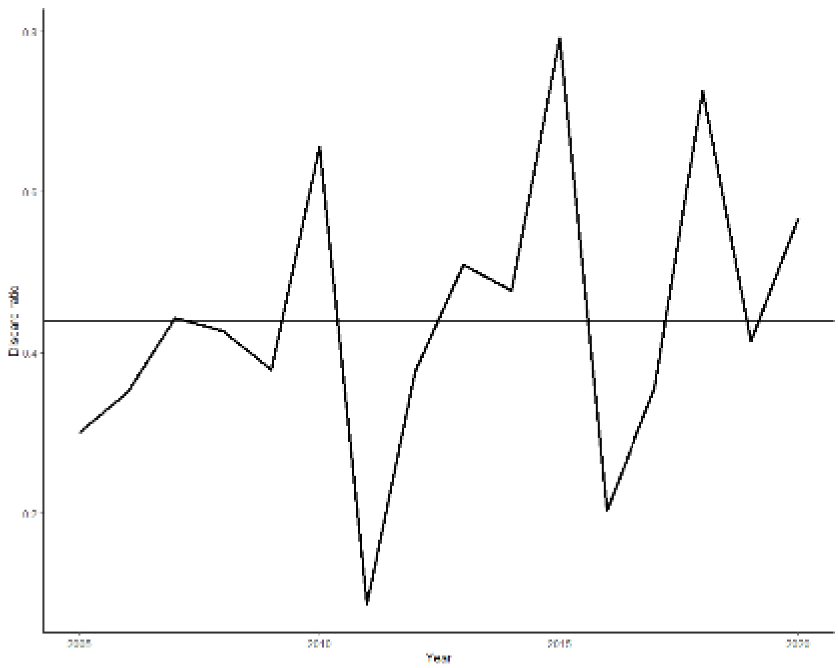

Figure B.2.2. Plaice in divisions 7.h–k. Annual average discard rate of 44% calaculate in 2021 (ICES, 2021b).

B.3. Biological sampling

A number of length-based parameters were required for the calculation of the new 'rfb' catch advice rule (ICES, 2020): mean length in observed catch ($\bar{L}_{y-1}$), the length at first capture relative to the target length ($L_{F=M}$), asymptotic length at which growth is zero (L_∞), length at first catch (length at 50% of mode) L_c. These values will be estimated annually. Below is an outline of how these biological parameters were estimated in 2021 (ICES, 2021 a,b).

The calculation of the 'rfb' catch advice rule requires the calculation of *f* which is the ratio of mean length ($\bar{L}_{y-1}$) in the observed catch that is above the length of the first capture relative to the target length ($L_{F=M}$). The mean length in the observed catch was calculated by plotting the landings and discards data submitted to InterCatch over all years (2004–2020). The length of the first capture relative to the target length ($L_{F=M}$) is calculated ($L_{F=M} = 0.75*L_c + 0.25*L_\infty$). Length at first catch (length at 50% of mode)(L_c) was calculated from the landings and discards data submitted to InterCatch. L_c was calculated for each year, but was found to be highly variable due to the variable and low sample number submitted for discards. Therefore a mean of the time-series, 234.4 mm, was estimated as the L_c of this stock (Figure B.3.1) and used in the calculation of rfb. Similarly, the mean length in observed catch ($\bar{L}_{y-1}$) was found to be was found to be highly variable due to the variable and low sample number submitted for discards. Therefore a mean of the time-series, 299.3 mm, was estimated as the $\bar{L}_{y-1}$ of this stock (Figure B.3.2) and used in the calculation of rfb.

L_∞ is calculated from the von Bertalanfy growth model. Samples available through DATRAS were used to calculate these length parameters. These samples were collected by three surveys, Irish ground fish survey (IGFS, 2004–2020), Irish anglerfish and megrim survey (IAMS, 2016–2020) and the French southern Atlantic bottom trawl survey (EVOHE, 2014–2020). Although none of these surveys are designed to capture the dynamics of this stock, they do provide the samples required to produce estimates of life-history parameters. Only samples from 7j (n= 1533) were used to calculate these parameters due to low sample size in 7h (n=13).

The FSA package in R (Ogle *et al*., 2020) was used to determine the starting values Ford-Walford (vbStarts{FSA}) and to fit a von Bertalanfy growth curve was fit to the survey data for all areas combined, by bootstrapping a nonlinear regression (nls{stats}(R Core, 2020)). Due to the uneven sample size it was not possible to determine if these growth parameters vary between ICES divisions 7j and 7h. However, we could estimate the growth parameters for the whole stock as linf = 463.64 mm (SD ± 21.26), K = 0.19 (SD± 0.03), t0 = -1.99 (SD± 0.30) (Figure B.3.3). Residuals of model fitted considered acceptable (Figure B.3.4).

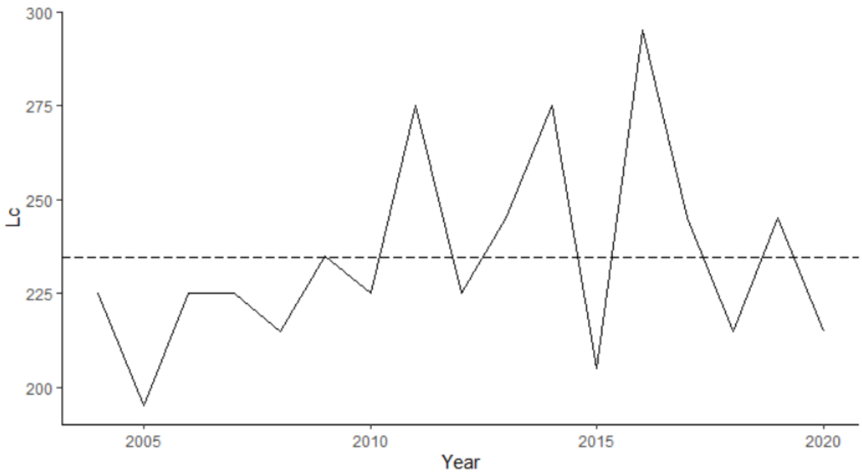

Figure B.3.1. Plaice in divisions 7.h–k. Length at first catch (length at 50% of mode) L_c.

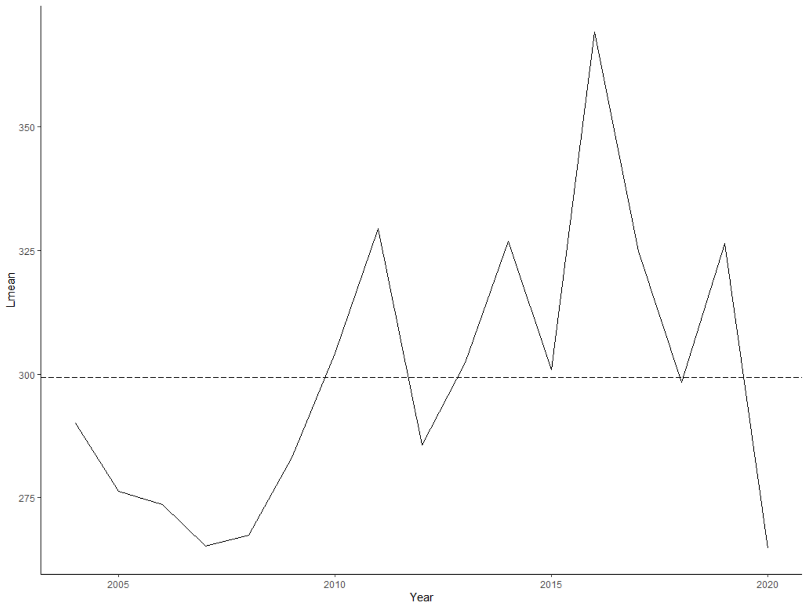

Figure B.3.2. Plaice in division 7.h–k. mean length in observed catch ($\bar{L}_{y-1}$).

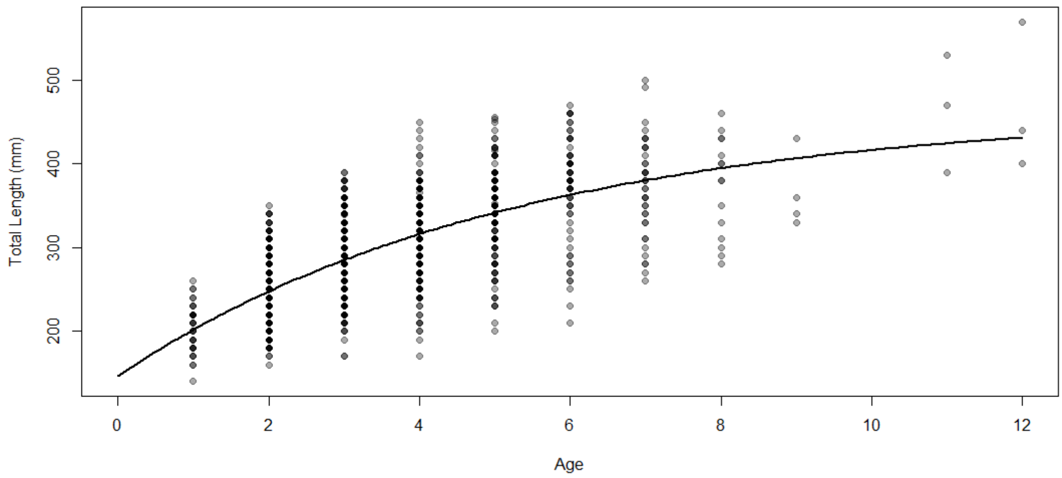

Figure B.3.3. Plaice in division 7.h–k. Length (mm) versus age (dots) with superimposed best-fit von Bertalanffy growth function (black line) of all plaice in ICES divisions 27.7h and 27.7j available in Datras. Years included: 2003–2020.

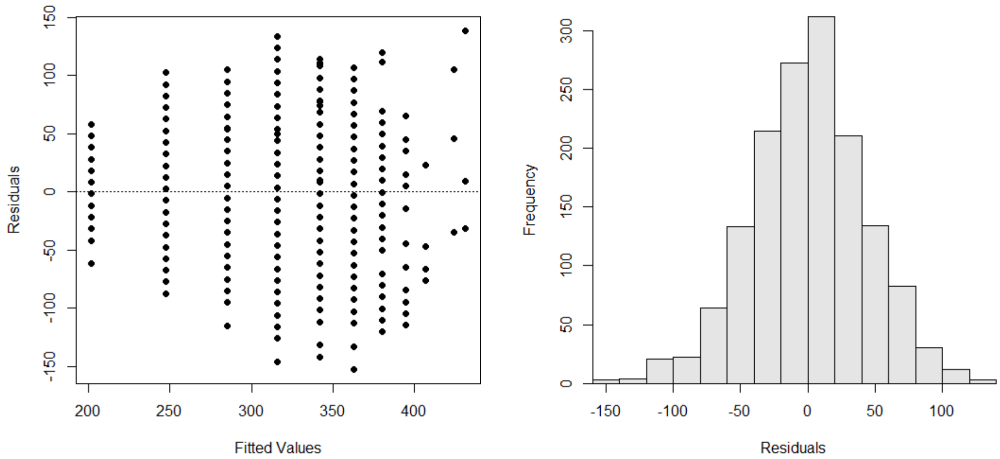

Figure B.3.4. Plaice in division 7.h–k. Residual plot (left) and histogram of residuals (right) of von Bertalanffy growth function (black line) on plaice in ICES divisions 27.7h and 27.7j available in Datras. Years included: 2003–2020.

B.4. Surveys

There is no directed survey for plaice in 7h–k, there fore a survey indice was produced by combining seven fisheries-independent surveys into a modelled biomass index based on a method developed by Dolder *et al*. (2018) using a Vector Autoregressive Spatiotemporal model in R (VAST, Thorson *et al*., 2016). This model implements a spatial delta-generalized linear mixed model (delta-GLMM) which is capable modelling univariate and multivariate spatiotem-poral species distributions, and is capable of dealing with zeros and a continuous positive distribution (Thorson, 2019).

The model was parametrised following the guidelines set out by Thorson *et al*. (2019). Haul level data from seven fisheries-independent surveys undertaken in the Celtic Sea (1997–2019) (Table B.4) was used. The coverage of these surveys varies in space and time, a full description of which can be found in Table B.4 and Figure B.4. The raw survey data were checked for quality (specifically, the estimated weights of the catch numbers-at-length were checked against the reported catch weights). For each valid haul, the catch weight, tow duration, tow position (midpoint), survey series and year were used as input values for the VAST model. The model was specified to have spatial autocorrelation but no temporal autocorrelation (i.e. years are independent). VAST can optionally estimate, and correct for, differences in catchability between the two survey series as there is a significant spatial overlap between the two surveys. The model first estimates the likelihood of occurrence and then the biomass using a gamma error distribution or the abundance using a lognormal error distribution. Historically none of these surveys were used to estimate abundances of plaice as individually they do not cover the full stock area, spatially/ temporally, and now of the surveys have been designed with this stock and species in mind. Vast offers a number of advantages over more traditional ways of estimat-ing abundances. It has an ability to deal with gaps in survey coverage, and an ability to account for differences in catchability between surveys or vessels, providing an objective way to com-bine multiple indices even when the gear is not standardised. The spatial domain was defined as 1000 knots, and implemented using k-means clustering to give knot positions proportional to sampling intensity (Thorson, 2019).

Table B.4. Summary of surveys used in to produce the VAST abundance index.

Survey	Years	Quarters	Gear	Sources
IGFS	2003–Current assessment year	4	Otter	DATRAS
IAMS	2003–Current assessment year	1	Otter & Beam	DATRAS
EVOHE	2003–Current assessment year	4	Otter	DATRAS
WGCFS	1997–2004	1,2,4	Otter	CEFAS
SWBEAM	2006–Current assessment year	1	Beam	DATRAS
SWIBTS	2003–2011	4	Otter	CEFAS

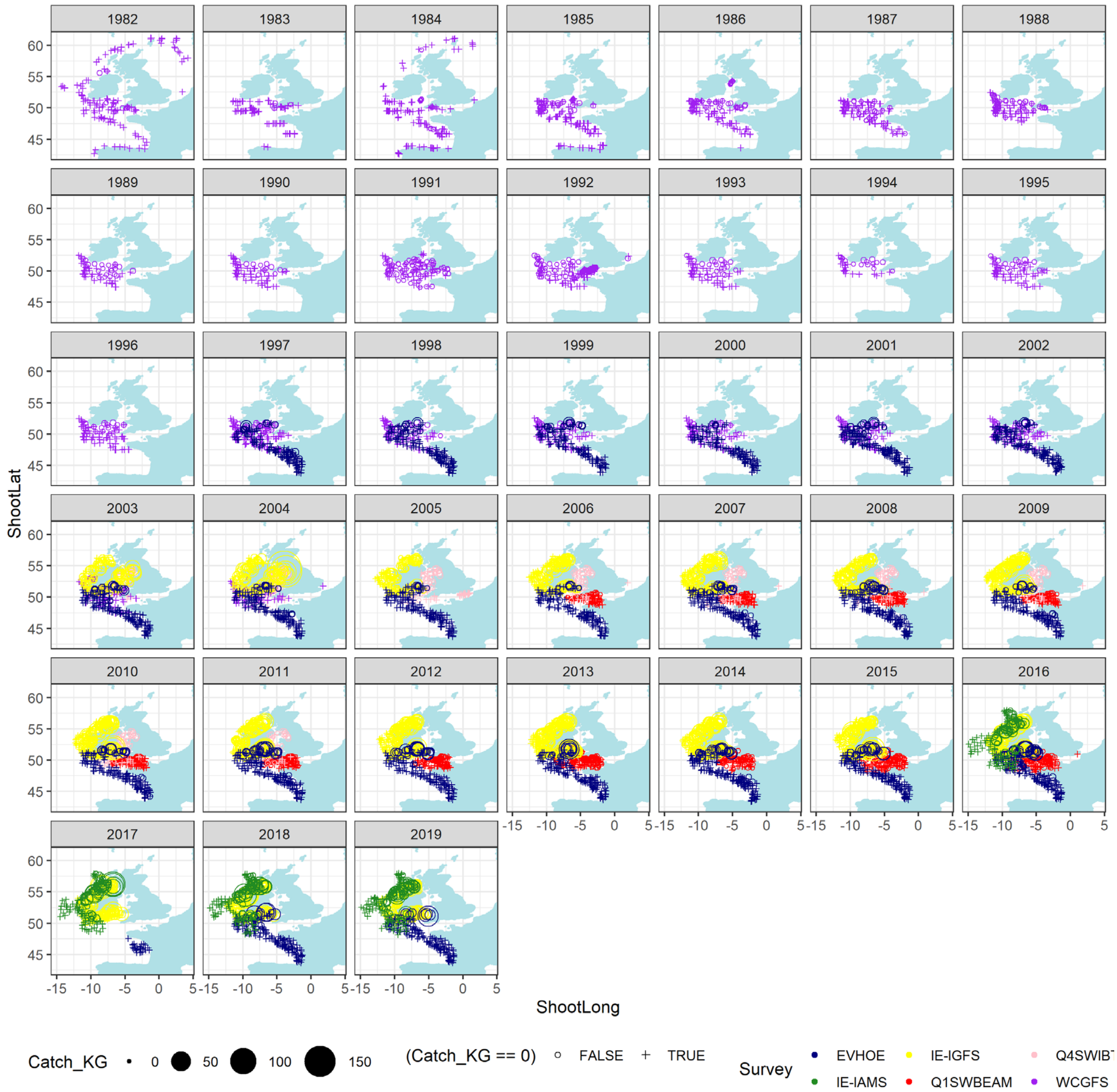

Figure B.4. Plaice in division 7.h–k. Survey numbers per haul by year. Each point represents haul with a positive count shown as a circle and a zero as a '+' symbol. Circle diameter is proportional to the count. Colours denote the surveys.

B.5. Commercial LPUE

No information.

B.6. Other relevant data

No information.

C. Assessment methods and settings

As a catygory 3 data-limited stock, catch advice can be derived from trends in the VAST derived biomass index. A Surplus Production Model in Continuous Time (SPiCT, Pedersen and Berg, 2017) was applied to estimate the status of the stock against MSY proxy reference points. The procedure and settings of the SPiCT analysis were investigated and decided during the benchmark (ICES, 2021). The model was paramterised with landing from 1995 onwards, discards from 2004, a biomass index from 1997 onwards (ICES, 2021a,b). Prioirs were set to account for uncertainty in the early years of the data set due to lack of disctads (stdevfacC= 3 from 1995 to 2004) (ICES, 2021a,b). The stock was assumed to be modeatly exploted at the beginging of the time-series, accounting for historically high levels of landings (bkfracC = 0.5) (ICES, 2021a,b). The production survey was fixed to a schefer (logn = log(2)) (ICES, 2021a,b). Finally, the survey time period was fixed to December the surveys were spread between quarter 4 and 1. The catch advice is set using the HCR 'rfb' (ICES, 2020).

D. Short-term prediction

Produced by SPiCT.

E. Medium-term prediction

None.

F. Long-term prediction

None.

G. Biological reference points

The table below summarises all known reference points for plaice in area 27.7h–k and their technical basis. No reference points are defined for this stock in terms of absolute values. SPiCT estimated values of the ratios F/F_{MSY} and B/B_{MSY} are used to estimate stock status relative to the proxy MSY reference points.

Framework	Reference point	Value	Technical basis
MSY approach	MSY $B_{trigger\ proxy}$	$\frac{B}{B_{MSY}} = 0.5$*	Estimated by SPiCT
	$F_{MSY\ proxy}$	$\frac{F}{F_{MSY}} = 1$*	Estimated by SPiCT
Precautionary approach	B_{lim}	Not defined	
	B_{pa}	Not defined	
	F_{lim}	Not relevant	
	F_{pa}	Not relevant	
Management plan	SSB_{MGT}	Not relevant applicable	
	F_{MGT}	Not relevant applicable	

*** No reference points are defined for this stock in terms of absolute values. The SPiCT-estimated values of the ratios F/F_{MSY} and B/B_{MSY} are used to estimate stock status relative to the proxy MSY reference points.**

H. References

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