

Stock Annex: Black-bellied anglerfish (*Lophius budegassa*) in divisions 7.b–k, 8.a,b,d (west and southwest of Ireland, Bay of Biscay)

Stock-specific documentation of standard assessment procedures used by ICES

Stock	Black anglerfish_ank.27.78abd
Working group	Working Group on Bay of Biscay and Iberian Waters Ecoregion (WGBIE)
Last updated	May 2018
Revised by	WGBIE
Timeline of revisions	February 2018: WKAngler May 2018: WGBIE
Main modifications	Feb 2018: New stock annex, previously only a combined annex for the two <i>Lophius</i> species in the area was available. May 2018: Minor additions
Last Benchmarked	WKAngler, 2018

A. General

A.1 Stock definition

ICES considers black anglerfish in areas 27.7 and 27.8abd to be a stock for assessment purposes. However, there is evidence of considerable potential for long-distance migration and it is not clear whether this stock definition is appropriate. Because there is currently insufficient information to change the stock boundaries, the current stock definition remains unchanged (except the inclusion of area 27.7a in 2018).

The TACs are set separately for areas 27.7 and 27.8 but for the two species of anglerfish combined (*L. piscatorius* and *L. budegassa*).

A.2 Fishery

A.2.1 General description

Both species of anglerfish (*L. piscatorius* and *L. budegassa*) are taken in a mixed fishery, mainly with hake, megrim and *Nephrops*.

The fishery for anglerfish developed in the late 1960s and landings quickly reached around 25 thousand tonnes (for both *Lophius* species combined). Since then, landings have fluctuated between 20 and 40 thousand tonnes per year.

France takes the vast majority of the landings; followed by Spain, the UK and Ireland. Minor landings have been recorded for Belgium, Germany and Portugal.

A.3 Ecosystem aspects

Black anglerfish occur throughout the Northeast Atlantic and in the Mediterranean and Black sea. They are most abundant at depths of 200–500 m. Juveniles are mainly found offshore in the western Celtic Sea and sometimes in the Bay of Biscay.

Anglerfish are ambush predators who feed opportunistically on passing prey, that are attracted using a fleshy lure on the *illicium*. The diet is dominated by fish and, to a lesser extent, cephalopods. Small gadoids have a relatively high importance in their diet (Power *et al.*, unpublished).

There are no reports of predators that specifically target anglerfish in European waters (Thangstad *et al.*, 2006). Indirect predation by seals of netted fish is common though, and seals may prey directly on anglerfish as well. Anglerfish remains were found in one stranded sperm whale in the Netherlands (Santos *et al.*, 2002). In Faroese waters, juvenile anglerfish remains have been found in the stomachs of large cod (Thangstad *et al.*, 2006).

B. Data

B.1 Commercial catch

B.1.1 Landings data

Landings are generally reported for the two species combined (*L. piscatorius* and *L. budegassa*). The combined landings are split into species at national level, based on the species composition in the sampling data. Some countries use annual proportions of the two species; others estimate proportions by fleet, port and/or quarter. Spain catches the largest proportion of *L. budegassa* (around 50%) while the UK catches the smallest proportion (around 5% *L. budegassa*).

Some countries applied minor corrections for underreported landings.

In recent years landings data have been reported by quarter, ICES division and métier level 6. While the logbook data can be reported at this level of disaggregation, the sampling programmes are unable to support estimates for such a large number of strata (four quarters, 13 divisions, ~20 métiers). Therefore, the number of samples in each stratum is generally low, and aggregation of these data tends to result in imprecise estimates. The landings length distributions of the period covered by the latest data call (2002–2016) appear to be poorer at tracking cohorts than the data obtained from the period before that (1986–2001) when each country produced national estimates based on the stratification of their sampling programme.

The large number of métiers was reduced to a small number of gear groups (level 4 métiers):

- OTB_DEF (otter trawls targeting demersal fish)
- OTB_CRU (otter trawls targeting *Nephrops*)
- GNS_DEF (gillnets targeting demersal fish)
- TBB_DEF (beam trawls targeting demersal fish)
- MIS_MIS (miscellaneous or unknown métiers)

The catches are dominated by OTB_DEF (consistently around 80%); OTB_CRU take about 10%; GNS_DEF take around 5% of the catches; TBB_DEF around 5%.

For landings strata that have no sampling data, the length–frequency distributions are imputed from samples of the same country, quarter and year, if available, otherwise from the combined sample data from all countries in the relevant quarter and year.

French landings

France takes nearly 50% of the landings of this stock. The sample sizes are generally between ten and 50 trips per stratum for the dominant strata. Overall, less than half the landings have sample data associated with them, resulting in considerable imputations.

Spanish landings

Spain takes around 40% of the landings. Spanish sample sizes are generally low (<10 trips), even for strata that dominate the overall landings. However, most of the landings have sample data associated with them, so there is virtually no imputation required.

UK (England) landings

The UK generally takes less than 5% of the landings. The sample sizes vary considerably from year-to-year and between strata, however England has very few strata that contribute more than 1% to the total estimate. Slightly more than half of the landings have associated sample data, resulting in considerable imputations.

Irish landings

Ireland takes 5–10% of the landings. Irish sample sizes are generally low (<10 trips) but Ireland has very few strata that contribute more than 1% to the total estimate. About two-thirds of the landings have associated sample data, resulting in a moderate amount of imputations.

Other landings

The remainder of the landings are mainly from Belgium, Scotland. They contribute very little to the overall landings.

B.1.2 Discards estimates

Discarding in this stock is quite variable and in the order of 10–25% by weight. For landings strata with missing discards, the discard volume was estimated using the proportions of the catch that were discarded for similar strata using the following hierarchy:

1. If discard data were available for the same country, gear group and year, these discard proportions were applied to the landings of the strata with missing discards;
2. If discard data were only available for the same gear group and year, these discard proportions were applied;
3. If discard data were only available for the year, these discard proportions were applied.

The correlation between landings and discards is quite poor, however no alternative method is available and the overall contribution of discards to the catch is relatively small.

French discards

The sample sizes of the French discard estimates are relatively high (10–20 trips). However, most landings strata did not have associated discard estimates, which

resulted in considerable imputations, making the overall discard estimates very uncertain.

Spanish discards

The Spanish discard estimates generally have a high sample size, the reason for this appears to be that all Spanish sampling data were combined and subsequently split out across the strata. This is likely to provide a more precise and accurate estimate than the French approach.

UK (England) discards

English sample sizes for discards are variable but generally >10 trips for the most significant strata.

Irish discards

Irish sample sizes were relatively low and data were estimated on an annual basis and subsequently divided across the strata based on the proportion of landings in each stratum. As anglerfish grow quickly during their first few years, the quarterly length distributions will be inaccurate.

Other discards

Belgium provided discard estimates for 2013 only.

B.1.3 Recreational catches

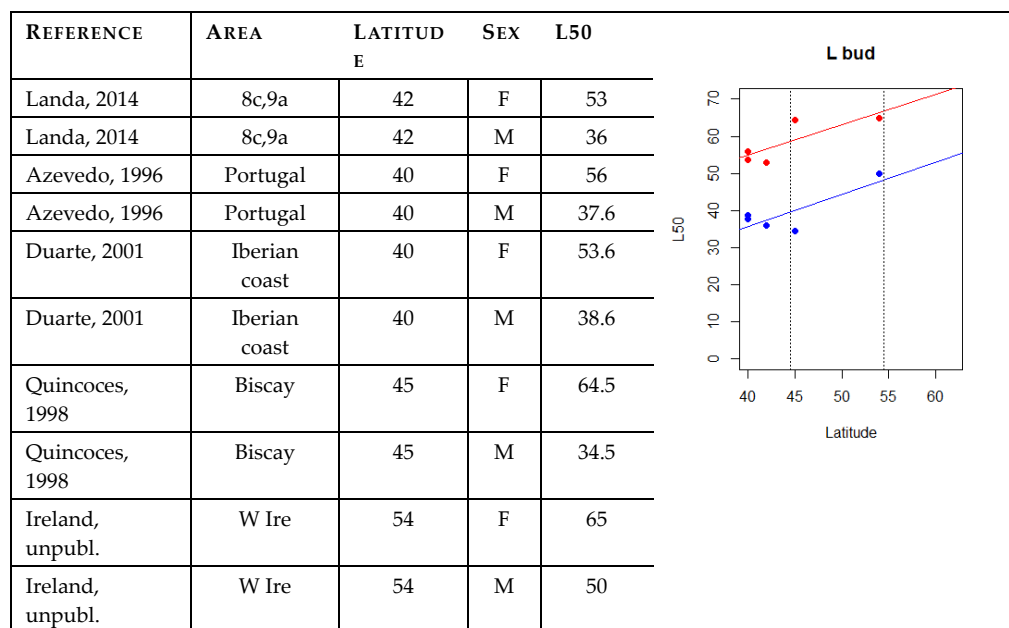
Recreational catches are assumed to be zero.

B.2 Biological sampling

B.2.1 Maturity

Spawning females are very rarely observed, which makes it difficult to estimate maturity. Based on estimates from the literature and sampling data from Ireland, the mean length-at-first maturity was estimated to be around 65 cm for females.

Figure and Table B.1. Estimates of L50 (mean length at first maturity) of *L. budegassa* at various latitudes from the literature and unpublished data. The dotted lines indicate the extent of the stock area (27.7,8abd; 44.5–54.5 degrees North).



B.2.2 Natural mortality

WKAnglerfish estimated natural mortality to be between 0.2 and 0.4

B.2.3 Growth

Based on tagging data and length-frequency analyses, WKAnglerfish estimated that the growth parameters are likely in the following range:

	LINF	K	T0
Slow growth	119.8	0.1186	0
Medium growth	175	0.078	0
High growth	250	0.0525	0

B.2.4 Length-weight

WKAnglerfish estimated the length-weight parameters for this stock to be: $a = 0.0195$ and $b = 2.93$

B.3 Surveys

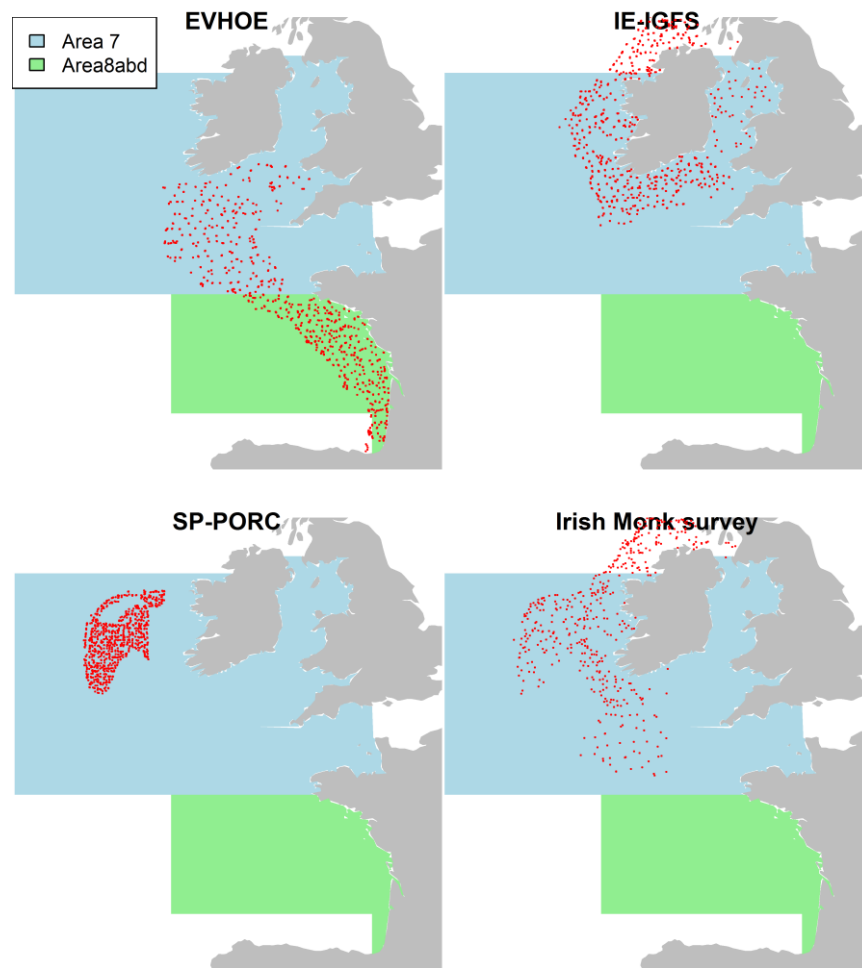


Figure B1. Spatial coverage of the available surveys. Red points indicate trawl positions; the full time-series is plotted so the number of trawl positions is not an indication of the annual number of trawls completed. The blue area represents 27.7 and the green area is 27.8abd.

B.3.1 Western IBTS Q4 EVHOE and IGFS surveys (France/Ireland)

The Irish IBTS Q4 groundfish survey (IGFS) covers areas 27.7bgjk. The French EVHOE survey covers areas 27.7j8ab. Both surveys are coordinated and largely standardised under WGIBTS and both use a GOV trawl. Together the two surveys cover the majority of the stock area up to depths of 200–300 m. This is where most of the young fish occur. Older fish migrate to deeper waters, and may not be fully available to these surveys.

WKAnglerfish 2018 decided to use a combined Irish/French biomass index as the basis for the advice, using the 3/2 rule.

WKAnglerfish did not specify how the two surveys should be combined, but a similar approach could be taken to that applied to white anglerfish: weighting their average catches by the area covered by each survey series (IGFS gets a weight of 45% and EVHOE 55%).

The combined index of catch weights per hour fished can be calculated for the years 2003 onwards. An index of catch numbers-at-length per hour fished should also be made available to the working group for auxiliary information.

B.3.2 Western IBTS Q4 Porcupine Survey (Spain)

The Spanish Groundfish Survey in the Porcupine bank (SP-Porc) covers ICES divisions 27.7c,k and a small portion of 27.7b corresponding to the Porcupine Bank and the adjacent area in western Irish waters, covering depths between 180 and 800 m.

This survey catches very few black anglerfish and no index is provided.

B.3.3 Irish Anglerfish and Megrim Survey (Ireland)

Irish anglerfish survey data in area 27.7 are available for the years 2007, 2008 (under the acronym SIAMISS), 2016 onwards (IAMS). These surveys were designed to estimate the biomass of anglerfish and they cover a significant part of the stock in all depths up to 1000 m.

The survey index consists of catch numbers-at-length per swept-area.

This index is made available to the working group for auxiliary information.

B.4 Commercial cpue

WKAnglerfish (2018) rejected the use of commercial cpue data due to concerns about changes in efficiency, targeting behaviour, quota restrictions, technical measures, discarding and compliance. However, trends in effort, landings and lpue or cpue may be used by the assessment working group as auxiliary information.

B.5 Other relevant data

Official landings data are available for the combined *Lophius* species since 1903. While the historic data cannot be separated into the two species and may suffer from inaccurate reporting, they provide useful insights in the development of the fisheries during before the period covered by the assessment.

C Assessment methods and settings

No assessment.

D Short-term prediction

No forecast.

E Biological reference points

Fmsy proxy was estimated using the the ICES Technical Guidelines for setting reference points for stocks in category 3 and 4 (ICES, 2018) and using code from https://github.com/ices-tools-dev/ICES_MSX. The analysis is documented in in Working document “WD Reference points for black anglerfish in 27abd” to WGBIE 2018.

The life-history parameters were as follows:

PARAMETER	VALUE
Linf	175
K	0.078
T0	0
M	0.3
a	0.0195
b	2.93
maxage	10
Lc	36

The catch length distributions of the years 2003–17 were used. No overall effort time-series is available but a proxy for effort was calculated from the ratio of catches to total stock biomass of white anglerfish in the same area. This stock has a full analytical assessment and the two species are caught in the same fishery. This is therefore considered to provide an adequate proxy for the fishing effort for black anglerfish.

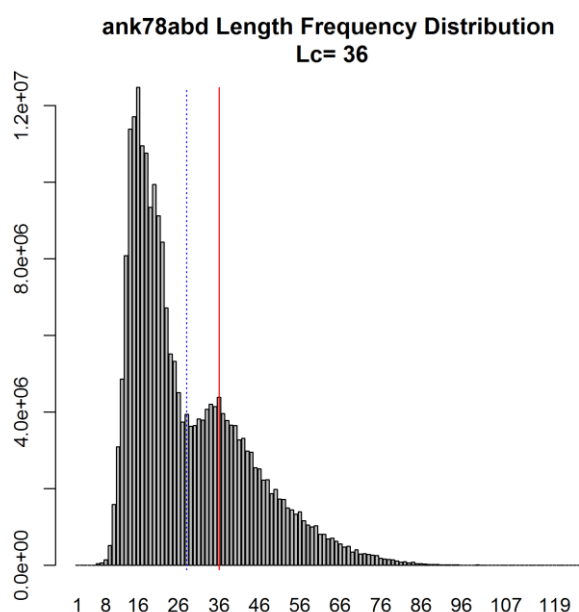


Figure F1. Total length distribution. The fish in the first mode are mainly 0-group and are not fully selected. The second mode is at 36cm at which length the fish are likely to be fully vulnerable to the fishery.

Figure F1 shows the length frequency distribution of the catches for all years combined. The second mode in the length distribution is at 36cm. At this length the fish are likely to be fully vulnerable to the fisher; this value was chosen for L_c .

The length at full selection (L_c) was used in an equilibrium yield-per-recruit analysis, together with the parameters listed above. Figure F2 shows the yield curve and F_{01} is estimated at 0.23. The mean-length Z analysis with effort indicated that in the most recent year F was below $F_{MSYproxy}$.

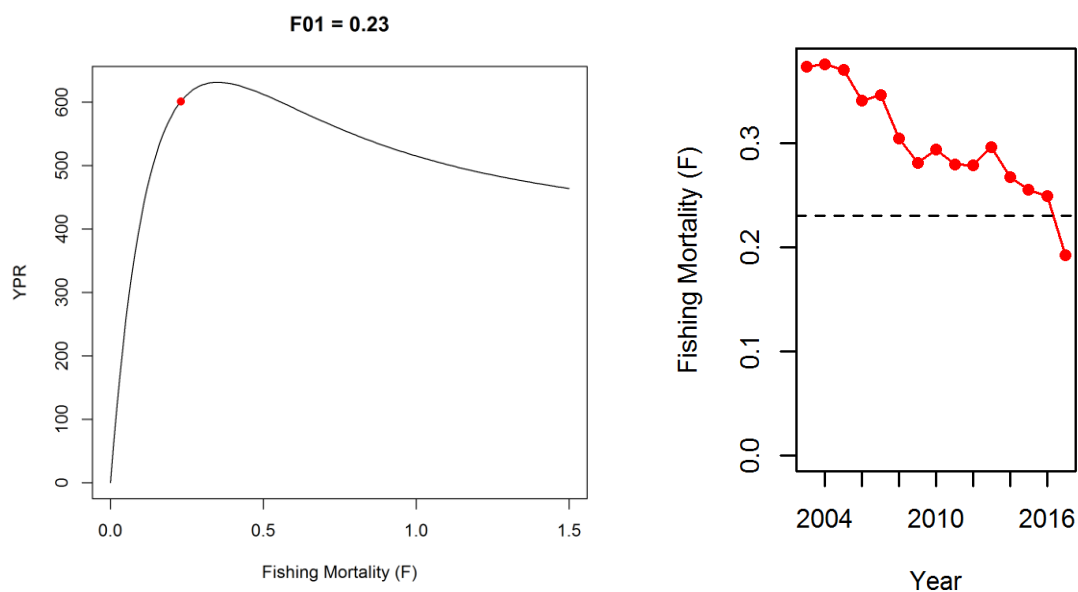


Figure F2. YPR analysis (left) and length-based Z (with effort) estimate of fishing mortality (right), the dashed line is F_{01} .

F Other issues

F.1 Biology of species

- Growth and possibly natural mortality is different for males and females.
- As older fish migrate to deeper water, they may be less available to the fishing industry.

F.2 Stock assessment–historic overview

YEAR (Y)	2000(?)–2007	2008–2017	2018–
Model	XSA	None – survey trends	None – survey trends
Software	vpa.exe/ FLXSA		
Catch data	1986–		
Age data	2–14+		
Fleets	FR-FU04 - commercial	FR-EVHOE	Combined FR-EVHOE and
	FR-FU14 – commercial	IE_IGFS (2016,17 only)	IE_IGFS biomass index
	SP-VIGOTR7 – commercial	SP-PORC (2016,17 only)	
	SP-BAKON7 – commercial		
	SP-BAKON8 – commercial		
	FR-EVHOE – survey		

F.3 Current fisheries

See Section A1.

F.4 Management and advice

The TACs are set separately for areas 27.7 and 27.8 but for the two species of anglerfish combined (*L. piscatorius* and *L. budegassa*).

F.5 Others

None.

G References

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