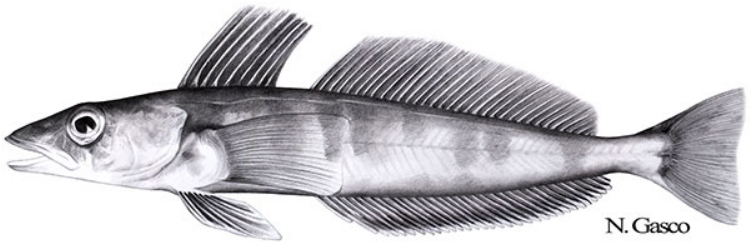
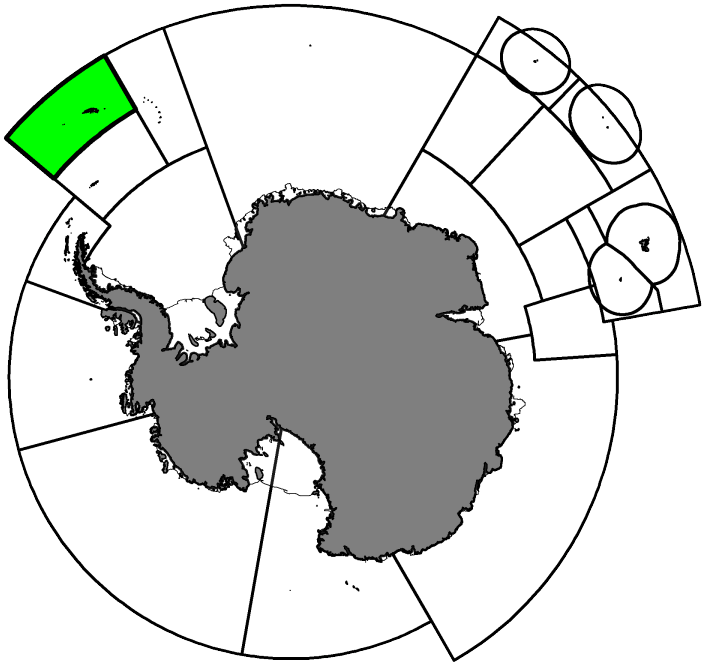
Stock Annex 2024: *Champsocephalus gunnari* in Subarea 48.3

CCAMLR Secretariat

20 December 2024



Mackerel icefish, *Champsocephalus gunnari* Lönnberg, 1905.



Map of the management areas within the CAMLR Convention Area. The region discussed in this report is shaded in green. Coastlines and ice shelves: UK Polar Data Centre/BAS and Natural Earth. Projection: EPSG 6932.

Stock Annex for the mackerel icefish (*Champsocephalus gunnari*) fishery in Subarea 48.3

Jessica Marsh and Tim Earl

Overview

Fishing for mackerel icefish (*Champsocephalus gunnari*, hereafter, icefish) began in Subarea 48.3 in the late 1970's. Following a peak in catches in the early 1980's and concerns about a depletion of stocks, CCAMLR closed the fishery in the early 1990's. The fishery was reopened in 1995 with precautionary catch limits in place. Since 2018, there has been no commercial fishing for icefish.

Since 2012, catch limits for the fishery have been set biennially. Catch limits are estimated using a length-based method (Edwards et al. 2010a; Earl, 2017; WG-FSA 2017 §3.4) applied to icefish abundance and biometric data collected as part of the UK demersal fish trawl survey.

Data

Catch data

The catch data are provided in the Fishery Report.

Biological parameters

Existing values for growth parameters, maturity status and natural mortality are used in the assessment. Growth parameters are assumed as, $L_\infty = 55.7, K = -0.17, t_0 = 0.58$, following CCAMLR (2010) in Edwards et al. (2010a). Natural mortality is assumed to be $0.71y^{-1}$ following Edwards et al. (2010a) and all fish are assumed to be mature by the end of the projection period.

Length-weight relationships are re-estimated using the most recent survey data to obtain estimates of the relevant parameters, a and b by fitting the relationship, $W = aL^b$, where W is the weight (g) and L is the length (mm) of individual icefish recorded in the survey.

Survey data

The UK demersal fish trawl surveys in Subarea 48.3 have taken place on an approximately biennial basis since the late 1980s, and typically take place during January-February. The surveys provide an estimate of the standing stock and length structure of the icefish population. The survey is undertaken in five area strata around the islands and the adjacent seamounts (Figure 1). Within each area strata, two depth strata (100-200 m and > 200 – 350 m) are surveyed following a random stratified design. For each haul in the survey, the total weight of icefish caught was recorded. Full biological information is taken from 30 representative samples, and the lengths of the

remaining fish (or a subsample for large catches) are recorded. Full details of the survey are provided in survey reports submitted to WG-FSA (e.g. Collins et al. 2021).

The survey data are bootstrapped in accordance with the method used in Mitchell and Martin (2011). The weightings used in the bootstraps are based on the number of hauls by stratum and the fishable area within each stratum. A correction factor of 1.241 is applied to the UK survey data following comparative studies with the Russian survey in 2002 (WG-FSA 2002 § 5.103 – 5.111).

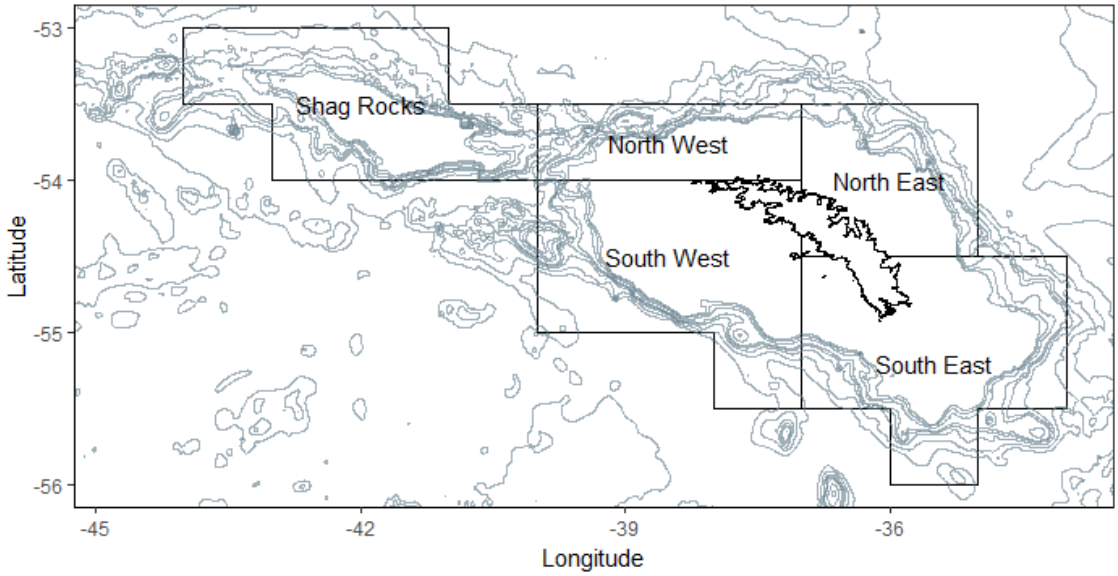


Figure 1. The five area strata used in the UK demersal fish trawl survey.

The length distribution data from individual hauls has been combined using a weighted average since 2010, as described in Edwards et al. (2010a), and revised in 2017 (Earl, 2017) and endorsed by WG-FSA-17 (§3.4).

Assessment methods

CCAMLR has agreed that, for icefish in Subarea 48.3, future catch limit advice should be given in accordance with the CCAMLR Decision Rules (WG-FSA 2010 §.5.164), as implemented by the length-based projection method described in Edwards et al. (2010a), with minor changes agreed in 2017 (Earl, 2017, WG-FSA 2017 §3.4). This method estimates vulnerable biomass using a bootstrap of survey densities, and then projects the population forwards.

The biomass is estimated using the weighting of de la Mare and Williams (1996),

$$D_{i,j} = d_{i,j} \frac{A_j}{\Sigma_k A_k} \times \frac{\Sigma_k n_k}{n_j}$$

where $D_{i,j}$ is the re-scaled density for haul i in stratum j, $d_{i,j}$ is the original density estimate for that haul, A_j and n_j are the area and number of hauls in stratum j, respectively, and A_k and $n_k$are the area and number of hauls in k strata, respectively.

Length frequencies from the survey are weighted by strata, to get a combined population length frequency. The growth parameters are used to create a transition matrix of the proportion of fish in each length class that move to each larger length class in each model timestep. Each season is split into two seasons; season 1 includes natural mortality and growth prior to the survey. The survey, and then catch, occur at the start of season 2, followed by the remaining growth and natural mortality. Fishing following the survey is assumed to use all the TAC remaining in the year. Fishing in the two projection years occurs at a constant harvest rate, estimated according to the decision rule. The assessment is implemented as an R markdown report, included as an annex to each assessment.

Decision Rule

The CCAMLR agreed Decision Rule for icefish calculates a Catch Limit that leaves on average 75% of the stock biomass that would be expected after two seasons if there were no fishing. To be conservative, the lower 5 percentile of survey biomass is used as the starting point for this projection, and no recruitment is assumed.

Studies of the application of the Decision Rule to icefish have demonstrated that the length-based approach provides robust, precautionary estimates of catch limits (Hillary et al., 2009, Hillary et al., 2010, Edwards et al., 2010a, Edwards et al., 2010b, Darby et al., 2013a). CCAMLR WG-SAM (2013 §.4.33) noted that the biomass projections upon which the catch advice is based are consistent with the objectives of the CCAMLR Convention Article II and that the rule generates future levels of exploitation that are considered precautionary.

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Additional Resources

- Fishery Summary: pdf, html
- Fishery Report: pdf, html
- Species Description: pdf, html
- Stock Assessment Report: pdf
- Fisheries Documents Browser