

CCAMLR's approach to managing the krill fishery (2021).

Euphausia superba in Area 48

CCAMLR Secretariat

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The estimate of the standing stock of krill in Area 48 is based on the CCAMLR 2000 Krill Synoptic Survey of Area 48 (CCAMLR-2000 Survey) (Trathan et al., 2001). This estimate has been revised on the basis of methodological improvements in the processing and analysis of acoustic data (SC-CAMLR-XXIX, Annex 5, paragraphs 2.40 to 2.44).

In 2010, the Scientific Committee agreed that the best estimate of krill biomass during the CCAMLR-2000 Survey was 60.3 million tonnes. Based on the krill stock assessment model, CCAMLR agreed to the current precautionary catch limit for krill of 5.61 million tonnes per season (1 December to 30 November of the following year) in Subareas 48.1, 48.2, 48.3 and 48.4 combined. This catch limit was based on a B0 estimate of 60.3 million tonnes with a survey coefficient of variation (CV) of 12.8% and a fraction of the population referred to as *gamma* estimated using the generalised yield model (GYM) of 0.093.

CCAMLR sets precautionary catch limits for krill using a set of decision rules to determine what proportion of the stock can be fished while still achieving the objective of the Convention. To do this, the population of krill is projected forward in time using a population model to allow the effects of different catch levels to be simulated (Fig. 1). The distribution in blue shows the range of potential starting points for the simulations. For each projection, a starting point is chosen at random and the population is projected forward with the key parameters (such as recruitment, growth and mortality) drawn at random from plausible ranges to account for natural variability (and uncertainty in these parameters).

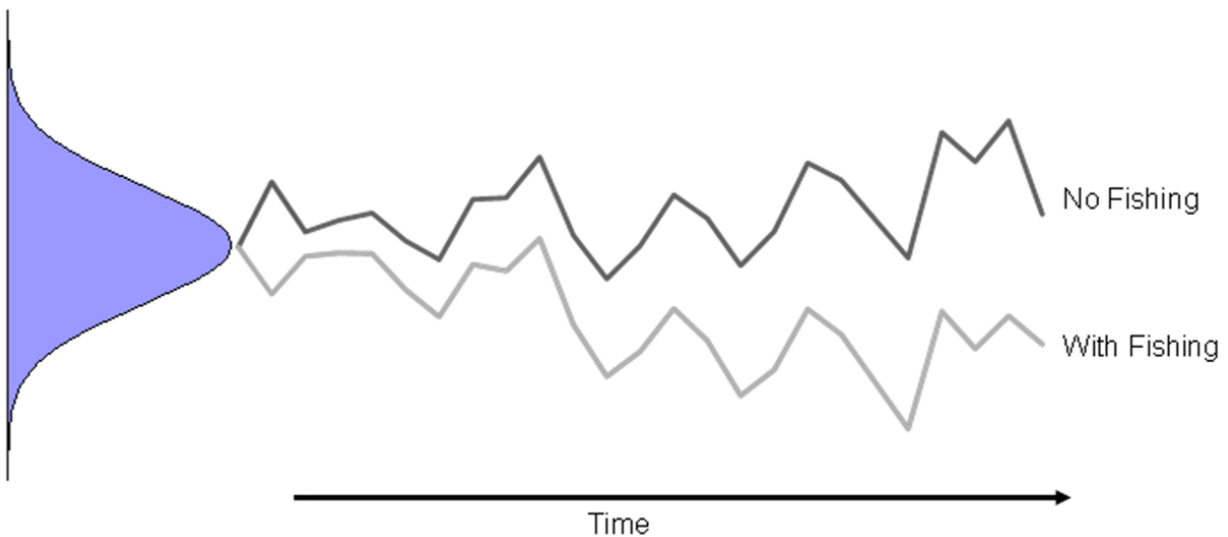


Figure 1. Schematic of krill population projection.

The actual catch limit for krill is set on the basis of a sustainable yield (*gamma*) that can be taken as a constant catch. This is estimated using the GYM. After repeatedly projecting the pre-exploitation population forward with different yield levels (*i.e.*, a different fraction of the starting population taken as a constant catch in each year of the projection), the following rules are used to determine the final estimate of yield:

1. Choose a yield, *gamma*₁, so that the probability of the spawning biomass dropping below 20% of its median pre-exploitation level over a 20-year harvesting period is 10%.
2. Choose a yield, *gamma*₂, so that the median escapement at the end of a 20 year period is 75% of the median pre-exploitation level.
3. Select the lower of *gamma*₁ and *gamma*₂ as the yield.

The actual catch limit is the level of yield selected in step 3, as that is a value of *gamma* that is consistent with both of the objectives, multiplied by the estimate of the stock size from a survey of that stock (see also Figure 2). In setting the 5.61 million tonne catch limit over such a large area, CCAMLR recognises that the fishery has the potential to be spatially restricted and has the potential for localised, potentially negative, ecosystem impacts. In recognition of this risk, CCAMLR introduced a trigger level of 620,000 tonnes above which the fishery cannot proceed until there is an agreed mechanism to distribute catches in a manner designed to avoid localised impacts. The trigger level was selected as it represented the combined maximum historic catches reported from each subarea (although at no point in the history of the krill fishery has a catch as high as 620,000 tonnes been taken in one year). The trigger level has been subdivided such that catches in any one season may not exceed 25% of the trigger level (155,000 tonnes) in Subarea 48.1 and 45% (279,000 tonnes) in Subareas 48.2 and 48.3 (Conservation Measure 51-07) (for schematic, see Figure 3). In 2003, CCAMLR agreed to the definition of a suite of small-scale management units (SSMUs) in Area 48 that are based on the distribution of krill, krill-predators and the fishery, however, there has been no agreement yet on the allocation of catches at this scale.

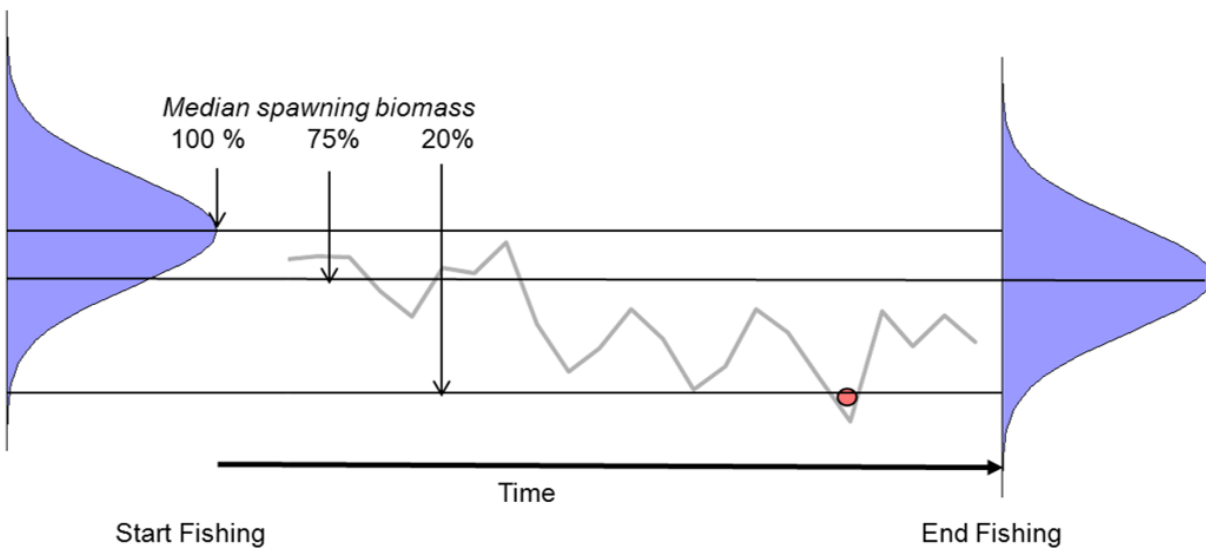


Figure 2. Schematic of krill population projection showing the decision rule information.

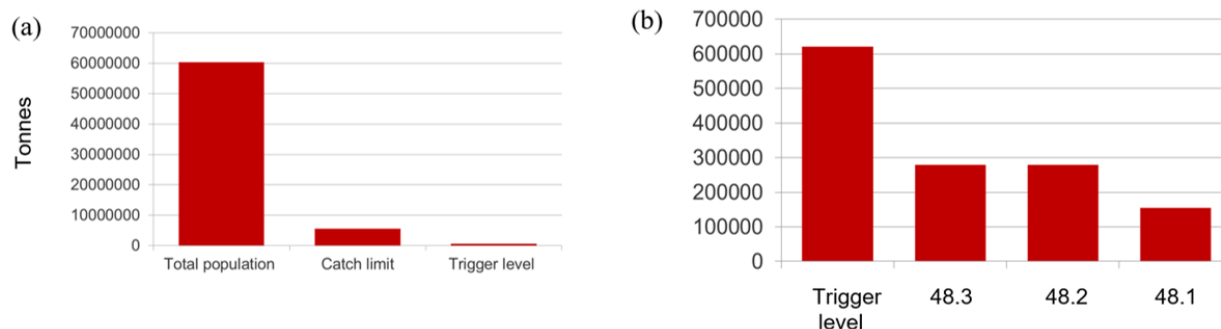


Figure 3. Schematic of (a) the total population size of krill and associated catch limit and trigger level in Area 48, and (b) and the trigger levels in Subareas 48.1, 48.2 and 48.3.

The current trigger level is not linked to the assessment of krill biomass and so in 2010, although the precautionary catch limit was amended, the trigger level was not changed at that time. Additionally, in discussions related to the use of the GYM, WG-EMM considered in 2008 the application of the current three-stage decision rule used by CCAMLR to determine the precautionary catch limit for krill and noted that for stocks such as krill that experience high interannual variability in abundance, the probability with which the biomass may fall below 20% of the initial biomass may be greater than 0.1 even in the absence of fishing (SC-CAMLR-XXVII, Annex 4, paragraph 2.62). This would result in sustainable yield (*gamma*₁) being equal to 0 and hence a modification of this part of the decision rule may be required to ensure that the objectives in Article II of the CAMLR Convention can still be met. Given also the potential impact of climate change on recruitment variability, the Working Group agreed that both the recruitment variability and the specification of the current decision rule relating to the maintenance of stable recruitment should be further investigated (SC CAMLR-XXIX, Annex 6, paragraph 2.78).

Recent developments

In recent years, international collaborations have focused on revising the krill management approach. The approach will include three components (SC-CAMLR-40, Annex 8 Fig. 1):

- Update of acoustic-derived biomass estimates (*e.g.*, [Krafft et. al, 2021](#)),
- Update of the GYM (now recoded in R, in the [Grym](#) package),
- Development of a risk assessment framework to distribute catch limits spatially (*e.g.*, [WG-FSA-2021/16](#)).

The revision of the krill management approach will involve efforts from all Working Groups of the Scientific Committee, which has developed an ambitious list of tasks (SC-CAMLR-40, paragraph 3.24).

Additional Resources

- Fishery Summary: [pdf](#), [html](#)
- Fishery Report: [pdf](#), [html](#)
- Species Description: [pdf](#), [html](#)
- [Fisheries Documents Browser](#)