Progressing towards responsible, science-based and highly precautionary krill fisheries management

Submitted by ASOC
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Abstract

Improving the management of the krill fishery is a key priority for ASOC. In this paper, we recommend several key actions that CCAMLR should take to ensure that management of the krill fishery remains highly precautionary and protects the needs of the full range of krill predators. Obtaining up to date krill biomass estimates, reviewing the CCAMLR Ecosystem Monitoring Program, reviewing decision-making frameworks in a workshop, implementing these approaches before the expiry of CM 51-07, and developing a better understanding of by-catch of other krill species are critical steps toward the development of a responsible science-based krill fishery.

Introduction

Antarctic krill (Euphausia superba) is a keystone species of the Antarctic ecosystem, providing the primary food source for a diverse group of predators including fish, penguins, seals, and whales (Hill et al. 2006). New evidence demonstrates that foraging areas of breeding penguins and fur seals and the krill fishery consistently overlap within parts of the Antarctic Peninsula region (Hinke et al. 2017). In addition, the management of the krill fishery has not assessed the needs and behaviour of baleen whales, which are the largest krill predators in the Antarctic (Weinstein et al, 2017).

The Antarctic Krill fishery is the largest in the Southern Ocean with a reported total catch of 260,174 metric tonnes (mt) in 2015/2016. Noting that CCAMLR’s current krill fisheries management scheme was setup as an interim measure and is not related to the status of the krill biomass, CCAMLR should move toward a functional ecosystem-based management system, based on robust science. Science-based management is increasingly important as the fishery has expanded in recent years. Before the end of the 2016/2017 season, the fishery again reached the portion of the trigger level set for Subarea 48.1, which has occurred 5 times since 2010. And for the first time since the fishing season 1994/1995 (Kock et al, 2007) the fishery operated outside of Area 48, with fishing conducted in Subarea 58.4 during the 2016/17 season. Consequently, WG-EMM-17 suggested that it would be appropriate to provide a separate report for krill fishing in East Antarctica in the future.

Nicol et al. (2012) noted, “CCAMLR will need to ensure that the fishery does not expand more rapidly than the organization’s ability to manage it.” Recent research demonstrates that climate-related inter-annual variability will influence krill growth and development (Murphy et al. 2017). It is now more critical than ever for CCAMLR to advance real science-based management of the krill fishery.

Obtaining up to date krill biomass estimates, reviewing the CCAMLR Ecosystem Monitoring Program, reviewing decision-making frameworks in a workshop, implementing these approaches before the expiry of CM 51-07, and developing a better understanding of by-catch of other krill species are critical steps toward the development of a responsible science-based krill fishery.

Krill Biomass in Area 48

Current management of the Antarctic krill fishery is based on an estimation of biomass in CCAMLR Area 48 using data from the CCAMLR 2000 Synoptic Survey.

Updating the krill biomass estimate should be top priority for CCAMLR as part of its precautionary approach and conservation mandate. This is particularly important since climate modelling suggests that krill populations will be impacted by climate change (Piñones and Fedorov 2016).

Thus, ASOC recommends the following approach:

- **Securing commitments from CCAMLR Members and the fishing industry to undertake krill biomass surveys.**

  Comprehensive spatial coverage for an updated biomass estimate is important as CCAMLR scientists have noted that there is a need to consider the population dynamics of the krill population in the area as a whole, given flux and migration. In that context, krill flux remains an important uncertainty.
Therefore, CCAMLR should commit to undertaking a new synoptic survey, or equivalent, in Area 48 augmented with data from CCAMLR Member surveys and efforts to advance krill biomass estimates from fishing vessel acoustic data. In order to make the best use possible of data from such surveys, using standardized survey procedures is critical. Alternatively, providing biomass updates more frequently could be achieved through surveys at the subarea scale, which are rotated between different subareas in different years.

- **Establishing a statistically robust method for incorporating data from various sources to ensure appropriate spatial coverage.**

In the absence of resources to conduct a basin wide survey, CCAMLR should develop a statistically robust plan which combines the design of local area surveys and the identification of key areas to be surveyed, which can then be pooled together to calculate a single regional biomass estimate. Data from sources like KRILLBASE (Atkinson et al, 2017), combined with fishery-dependent data, could be used as indices of change in biomass over time in an updated assessment.

- **Once comprehensive data have been collected in Area 48, CCAMLR should complete an updated biomass estimate.**

While the krill fishery is currently concentrated in Area 48, recent krill surveys have been conducted and are planned in the East Antarctic region (e.g. Kerguelen Axis program, Japanese commitment to a krill survey in Division 58.4.1 during the 2018/19 season (WG-EMM-17/05, etc.). So far, we have referred to details for Area 48, but our recommendations to updating krill biomass estimates can be generalized as appropriate if fishing effort increases in other CCAMLR areas.

### Expanding the scope of the CCAMLR Ecosystem Monitoring Program

The CCAMLR Ecosystem Monitoring Program (CEMP) keeps track of a set of indices set up to measure the effects of fishing on krill dependent species, including land-based predators such as seals and penguins. The program aims to detect and record significant changes in critical components of the ecosystem and to distinguish between changes due to commercial fishing and those due to environmental variability, including climate change.

The CEMP is a valuable data source for research and monitoring programs to evaluate the effectiveness of marine protected areas as well as monitoring the impacts of krill fishing on predators. CEMP data can be incorporated into krill fishery management frameworks such as risk assessment, experimental area closures, or FBM.

In a recent synthesis of methods to detect competition between seabirds and fisheries, Sydeman et al (2017) discuss advantages and limitations of a variety of predator response variables. They also emphasize selecting predator demographic response variables appropriate to the temporal and spatial scale of hypothesized fisheries effects.

Thus, ASOC recommends that:

- **CCAMLR should advance predator monitoring by undertaking a review of the current CCAMLR Ecosystem Monitoring Program (CEMP), to determine if it is sufficiently robust to inform CCAMLR’s management of the fishery. This update will also be useful for MPA monitoring.**

- **CCAMLR should also consider adding additional types and sources of data to the CEMP program.** Key data that could benefit CEMP include information on critical foraging habitats of marine mammals, especially baleen whales, predator foraging tracking data (to provide indices of overlap between predator foraging and krill catches) (Weinstein et al. 2017), and data on krill consumption by predators. Examples of useful external data sources include, but are not limited to, penguin demographics monitoring by cameras (such as through Penguin Lifelines), aerial or satellite image surveys, traditional counts (Oceanites), and seabird foraging data available through the Seabird Tracking Database.

### 3. Advancing decision-making frameworks

CCAMLR has committed to advancing krill decision-making frameworks and feedback management beyond Conservation Measure 51-07. Over the last two years, CCAMLR has received a variety of proposals from Australia, Norway, the U.S., and the U.K.
In 2015, Australia submitted plans (WG-EMM-15/36 and WG-EMM-15/55) based on a risk assessment approach serving as a step towards Feedback Management (FBM). The U.S. proposal (WG-EMM-15/04 and WG-EMM-15/33) focuses on adjusting catches midway within a given fishing season based on predator performance half way through the season. The UK and Norway proposal (WG-EMM-15/10) is centred around experimental fisheries closures, similar to the fisheries manipulation experiments being conducted off South Africa which are already showing the effects of fishing on predators (discussed in Sydeman et al. 2017).

That year, the Scientific Committee recognized that different parts of the Convention Area may need different approaches because of the nature of the ecosystem in different regions, as well as the different levels of data and monitoring capability currently available. WG-EMM agreed that a common framework would be desirable across the entire krill fishery and that achieving that common framework may take some time (SC 2015 – paragraph 2.127).

In 2016, papers elaborating on risk assessment methods for Area 48 were submitted to CCAMLR within the context of CM 51-07 renewal (WG-EMM-16/69, WG-FSA-16/47, and WG-FSA-16/48). In addition, per the request of WG-EMM, additional technical details for the U.S. proposal were submitted to the working group in 2016 (WG-EMM-16/45; 46; 47; 48). CCAMLR received additional proposals in 2016, including an effort regulation and “move-on rule” approach from Norway (SC-CCAMLR-XXXV/BG/29).

It was agreed at the WG-EMM-16 meeting that this risk-assessment approach could potentially be used to provide advice for future proposals that envision spatial subdivisions of catch limits in Area 48, including, for example, risk assessments across SSMUs within Subarea 48.1.

Of note, this risk assessment framework (presented in WG-EMM-16/69 within the context of CM 51-07 renewal) is becoming one of the approaches in the development of management procedures for the krill fishery and is now being proposed to be applied also to CCAMLR Divisions 58.4.1 and 58.4.2 (WG-EMM-17/20).

The risk assessment approach developed by Australia is a mathematical method to evaluate relative spatial risks associated with proposals to subdivide the trigger limit, or any other catch limit, among subareas, SSMUs, or other spatial units. It is based on the best scientific evidence available related to spatial patterns in the krill population, predator foraging and fishing operations. The result gives the proportion of the total catch that could be taken from each local area with negligible effects on predators. It should be noted that alternative risk assessment approaches are available within the Southern Ocean decision making framework, including the FOOSA model developed by Watters et al (2013), which is being updated to include climate change impacts (WG-EMM-16/53).

In the renewal of CM 51-07, CCAMLR confirmed its commitment to advancing decision-making frameworks towards FBM, stating, “The Scientific Committee shall provide advice to the Commission regarding progress towards the development of the risk assessment framework, feedback management and the spatial allocation of catch no later than the annual meeting in 2019,” and, “Methods such as a quantitative risk assessment framework will provide an initial scientific basis for determining the interim allocation of krill catches and that progress towards feedback management is intended to provide a long-term mechanism to further improve future management of krill, and the spatial allocation of krill catches” (CM 51-07, 2016).

As CCAMLR has not yet agreed to any particular approach for feedback management, it should capitalize on the five-year extension of CM 51-07 and devote time now to advancing consensus towards an appropriate and highly precautionary decision-making framework that can be scaled up across the Convention Area.

Due to the complex technical aspects of these approaches, it is crucial that scientific representatives, Commission representatives, and stakeholders understand the different approaches being designed. As stated by WG EMM 2015, the presentation of any approach needs to be accompanied by a simple and concise explanation that is accessible to a range of potential stakeholders that describes how this specific approach would be implemented.

CCAMLR Scientific Committee (2015) indicated that the development of FBM for the krill fishery and the decision rules should be advanced by holding a workshop in 2016 where to evaluate the various approaches and proposed decision rules (SC 2015 - paragraph 2.128). This workshop has not been organized yet.

Thus, ASOC recommends:
• CCAMLR to agree to a detailed work plan and timeline to develop and implement decision-making frameworks for the management of the krill fishery. An intersessional workshop with interested CCAMLR Members, observers and experts to advance technical discussions on this matter is recommended.

4. Understanding by-catch in the krill fishery

During the Third International Krill Symposium in June 2017, representatives of the krill fishing industry indicated that they do not report by-catch of crystal krill (Euphausia crystallorophias) that might be caught during their operations. By-catch reporting is a responsibility of the fishing industry, not scientific observers, and statistics available in the CCAMLR Statistical Bulletin indicate that catch of Euphausid krill in the Southern Ocean have been reported as Euphausia superba or Euphausia spp.

While the several other species of Southern Ocean krill are easily distinguishable from Antarctic krill, E. superba and E. crystallorophias are almost impossible to differentiate without the aid of a microscope. Since krill fishing operations concentrate in shallow coastal areas, which overlap with the preferred habitat of E. crystallorophias, there is concern that E. crystallorophias is being caught and landed as E. superba.

Uncertainty in which species are being fished undermines science-based fisheries management of Antarctic krill. Thus far in its management of the fishery, CCAMLR has assumed that only E. superba are being fished, not a mix of Euphausid species. CCAMLR should prioritize the evaluation of krill catches to confirm that only E. superba are present. Also, historical samples should be examined to gain new understanding on this particular issue.

Thus, ASOC recommends that

• CCAMLR develop requirements for evaluation of representative samples of the krill catch to assess the level of E. crystallorophias in the catch.

Summary of Recommendations

- CCAMLR should commit to a timeline and work program to update krill biomass and distribution estimates. This should include:
  • Securing commitments from CCAMLR members and industry to undertake needed local area or subarea surveys
  • Designing a statistically robust method for incorporating data from various sources to ensure appropriate spatial coverage
  • Once comprehensive data has been obtained, CCAMLR should update the Antarctic krill biomass assessment

- CCAMLR should advance predator monitoring by undertaking a review of the current CCAMLR Ecosystem Monitoring Program (CEMP), to determine if it is sufficiently robust to inform CCAMLR’s management of the fishery. This update will also be useful for MPA monitoring.

- CCAMLR should agree to a detailed work plan and timeline to develop and implement decision-making frameworks for the management of the krill fishery. An intersessional workshop with interested CCAMLR Members, observers and experts to advance technical discussions on this matter is recommended.

- CCAMLR should develop requirements for evaluation of representative samples of the krill catch to assess the level of E. crystallorophias in the catch.

References


