CCAMLR

Commission for the Conservation of Antarctic Marine Living Resources
Commission pour la conservation de la faune et la flore marines de l'Antarctique
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Moving forward, not backward, with krill fishery management

Submitted by ASOC

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Abstract

2021 is a critical year for the management of the Antarctic krill fishery, which is expanding even as climate impacts on krill habitat increase. CCAMLR must continue its efforts to complete the agreed krill work plan and develop a new science-based CM to replace 51-07 as soon as possible, but meanwhile must prevent a situation this year in which 51-07 lapses completely. ASOC therefore recommends that:

- SC-CAMLR completes the krill work plan agreed in 2019 —including the biomass estimate, stock assessment, and risk assessment, and CCAMLR subsequently agrees on a new, improved conservation measure replacing CM 51-07.
- CCAMLR renews CM 51-07 if a new CM cannot be agreed this year, so that the SC can complete the agreed krill work plan and formulate a new CM.
- CCAMLR avoids the complete lapse of CM 51-07 as reversion to management under CM 51-01 alone would be irresponsible given that the combined impacts on the ecosystem of climate change and concentrated fishing are already of concern.

Introduction

The krill-based ecosystem in the Antarctic continues to experience the impacts of climate change and concentrated fishing. These impacts are projected to increase in the future. CCAMLR adopted krill Conservation Measure (CM) 51-07 in 2009 as an interim measure to avoid localized depletion due to concentrated fishing. Renewed several times, CM 51-07 will expire in 2021 if consensus is not reached to renew or replace it. Since CM 51-07 went into effect, the fishery has become increasingly concentrated and grown significantly, and the impacts of climate change in the area where the fishery operates have become better known. CCAMLR committed in 2019 to complete a scientific krill work plan by 2021 which should lead to the development of a new science-based CM to replace 51-07. It is critical that CCAMLR moves forward with a new measure this year; however, if agreement on a new measure cannot be met, CM 51-07 must be renewed to allow progress on the krill management work plan to continue.

Changes to the krill-based ecosystem

Recent evidence highlights that krill dependent predators are negatively affected by the combined impacts of climate change and concentrated fishing. An empirical analysis published in the Nature journal *Scientific Reports,* reviewed over 30 years of monitoring data and found that climate change and concentrated fishing (which reduces local food availability to predators) are having, and will continue to have, negative impacts on penguin colonies at two sites in the South Shetland Islands adjacent to some of the most important krill fishing areas in Subarea 48.1 - the Bransfield Strait and Drake Passage (Watters et al 2020). Other researchers have found that for chinstrap (*Pygoscelis antarcticus*) and gentoo (*P. papua*) penguin populations breeding along the Western Antarctic Peninsula between 1980 and 2017, the combination of high catch rates during years with poor climate conditions has a negative impact on population size the following year (Krüger et al. 2020).

The ongoing recovery of cetacean populations in the Southern Ocean (Zerbini et al. 2019) also has implications for whether the management of the krill fishery is sufficiently precautionary. CCAMLR scientists believe that management of the krill fishery would be more precautionary if consumption by whales were explicitly considered in management (Trathan et al. 2021; Watters et al. 2020).

The recent Special Report on the Ocean and Cryosphere in a Changing Climate from the United Nations (IPCC SROCC) notes that climate change is transforming the Antarctic in lasting and fundamental ways (IPCC 2019).

Furthermore, the Intergovernmental Panel on Climate Change 6th Assessment report has identified that "*Warming, ocean acidification, reduced seasonal sea ice extent and continued loss of multi-year sea ice are projected to impact polar marine ecosystems through direct and indirect effects on habitats, populations and their viability. In the Southern Ocean, the habitat of Antarctic krill, a key prey species for penguins, seals, and whales, is projected to contract southwards."*

These projections are of particular concern given krill are highly concentrated in the SW Atlantic sector, the area of the Southern Ocean most impacted by climate change so far (Klein et al. 2018), and where most krill fishing operations currently take place. Krill, particularly in the larval and juvenile life stages, are reliant on sea ice, which is diminishing around the Antarctic Peninsula due to warming temperatures (Michon Scott 2020) and consequentially the distribution of krill is contracting southwards (Atkinson et al. 2019). It is estimated that sea ice extent able to support krill in the SW Atlantic sector will reduce by 20% by 2100 (Hill et al. 2019) and the amount of suitable habitat available to krill will decrease by 30% during the same period (Sylvester et al. 2021). Studies have also shown that krill recruitment has significantly declined over the last 40 years (Atkinson et al. 2019) and that female condition is linked to recruitment success, both of which are expected to be negatively impacted by a warming climate (Steinke et al. 2021).

Ocean acidification (and potentially ocean warming and freshening too) is projected to have a significant impact on Antarctic krill recruitment. The deep waters of the Southern Ocean, where krill eggs sink and hatch, have concentrations of CO_2 higher than surface waters – concentrations which are not suitable for the hatching of embryos and could lead to the collapse of the krill population by 2300 based on current emissions trajectories (Kawaguchi et al. 2013).

CCAMLR's considerations of these impacts of climate change and predator needs in managing the krill fishery are currently inadequate and need to be taken into account.

The krill fishery then and now

Since the time Conservation Measure 51-07 was first implemented in 2009 there has been significant change and growth in the krill fishery. During the 2008/2009 season, although krill fishing operations were increasing, the total annual catch was only 123,948 tonnes[1]. Acknowledgement of climate change combined with a start of localized fishing triggered the creation of CM 51-07 that year.

The catch of krill in the 2019/20 season was the largest catch ever reported in Area 48 and the highest total catch of krill in CCAMLR since the 1990s, reaching 450,781 tonnes (CCAMLR 2021). The duration in which it was caught was also much shorter than over the previous five years - 69 days rather than 130 days. For 2019/2020, the annual catch has doubled in just five years since 2015 and represents an increase of 365 percent over the 2008/2009 season.

Between 2010 and 2021, the majority of catches within CCAMLR Subareas 48.1, 48.2, and 48.3 have been taken from single CCAMLR small scale management units (SSMUs). In Subarea 48.1 most catches were concentrated in the Bransfield Strait West SSMU off the Antarctic Peninsula, in Subarea 48.2 in the South Orkney West SSMU, and in the South Georgia East SSMU in Subarea 48.3 CCAMLR 2019). These targeted SSMUs account for a large percentage of the annual catch. Concentration of krill catches in certain

[1]Catches reported until October 2009 when CM 51-07 was agreed

hotspots and at certain times of the year is concerning and does not reflect the precautionary approach as defined in the CAMLR Convention, particularly in the context of climate change.
For the fishing season (2021/22), five Members notified their intention to fish for krill with a total of 13 vessels (Fishery Notifications 2021/22, CCAMLR Secretariat 2021). In September 2021, seasonal catches in Area 48 reached 338,511 tonnes as of September 9. The fishery in Subarea 48.1 was closed (on June 4th, 2021) prior to the end of the fishing season due to the catch reaching the seasonal limit for that subarea, which represents the ninth time this has occurred since 2010. Based on analysis showing that new fishing vessels are being built or planned in China, Russia, and Norway, it seems future growth of the fishery is imminent (See CCAMLR-40/BG/11 for more information).

Some vessels reported poor krill harvesting conditions in the first half of 2021, with limited krill availability compared to previous seasons (Aker BioMarine 2021). Poor performance by industrial fishing vessels may be an early indication that krill predators also experienced poor feeding conditions this year. Investments in new drone technology for the purpose of harvesting is increasing; meanwhile, scientific progress to develop a new management approach has slowed, in part due to difficulties associated with virtual meeting formats as a consequence of the COVID-19 pandemic. Reports of poor conditions, combined with continued warming, support urgent adoption of a precautionary conservation measure so that science and management adapt to keep pace with industrial activities and a changing environment.

Completing the scientific work plan to secure ecosystem-based management for the krill fishery

In 2019, the Scientific Committee and Commission endorsed the krill management work plan to progress the "preferred management strategy" (SC-CAMLR-38 2019, paragraphs 3.18 to 3.45) to be codified into a new CM by 2021 when CM 51-07 expires. The envisioned management strategy is aimed at providing a science-based method to inform the revision of CM 51-07.
The work plan comprises three priority elements (CCAMLR-38 2019, paragraph 5.17):

1. A stock assessment to estimate precautionary harvest rates
2. Regular updates of biomass estimates, initially at the subarea scale, but potentially at multiple scales
3. A risk assessment framework to inform the spatial allocation of catch

Regularly updated stock assessments based on frequent survey-generated biomass estimates are considered a key component of setting science-based catch limits in single-species fisheries management systems worldwide. The risk assessment framework is a method developed and agreed by CCAMLR to minimize the risks of negatively impacting krill predators. Its implementation can make the management system truly ecosystem based. To set catches at smaller scales, the risk assessment uses data such as estimates of krill predator consumption and the desirability of different areas to the fishery to determine which scenario of spatial management units minimizes impacts to the ecosystem and the fishery. See Figure 1 for an illustration of the components of the krill work plan.

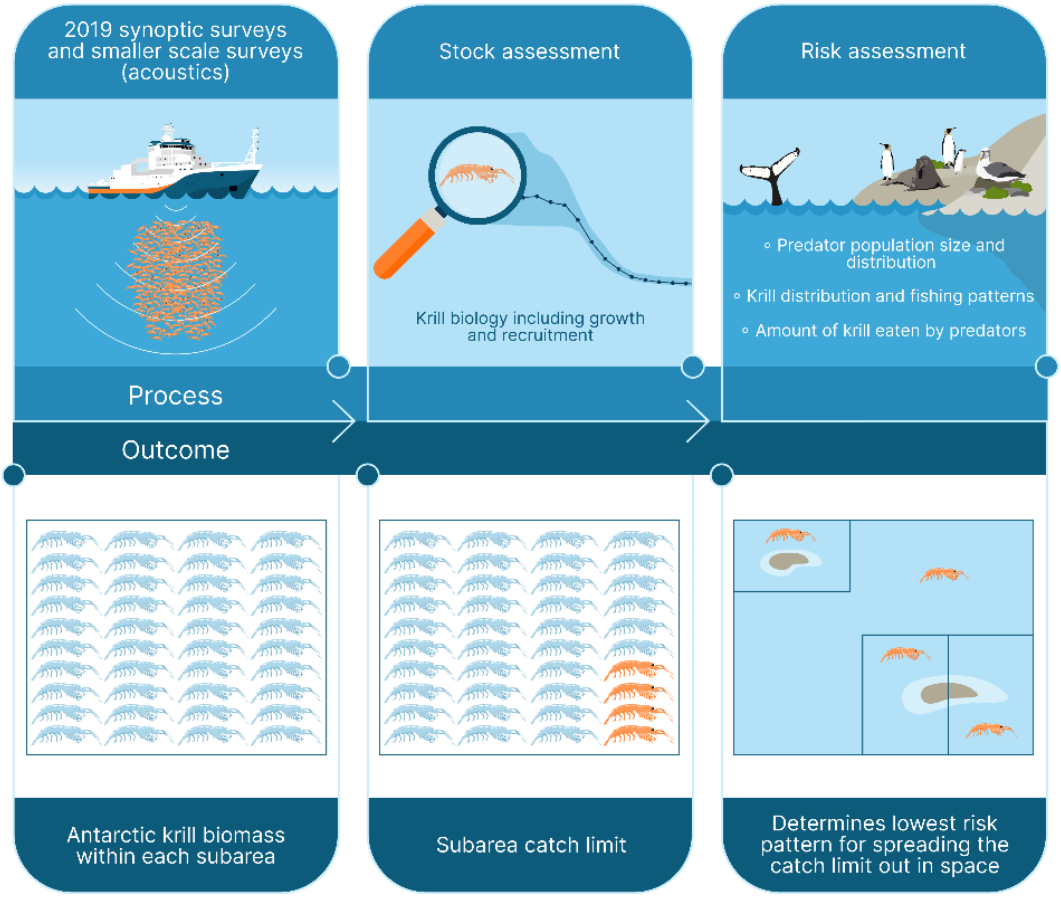

Figure 1. In 2019, CCAMLR scientists and member states agreed to implement a krill scientific work plan. The priority elements, including the biomass estimate, stock assessment and the risk assessment, can be used together by the Scientific Committee to provide advice on a new ecosystem-based management measure to replace CM 51-07. Graphic by Visual Knowledge (www.visualknowledge.design).

During the last two years, SC-CAMLR has made significant progress on the agreed krill fishery work plan. At WG-EMM 2021, the importance of providing an interim management approach by 2021 was highlighted, given that CM 51-07 is soon to expire, and the Commission is expecting advice. As was agreed by WG-EMM in 2021, any outcome from the new krill management approach should be no less precautionary than the current CM 51-07 in place. WG-EMM this year also acknowledged that additional work may be needed to complete all three components of the strategy, particularly for Subareas 48.2 and 48.3.

In addition, during a 2021 workshop comprising over 100 krill scientists, marine ecologists, and krill fishing industry, managers, and NGO representatives, 0% of poll participants indicated that "there was no real need to change" management of the krill fishery. About 80% of participants indicated there was a need to "improve the generation of scientific data relevant to management".

Furthermore, to protect the krill-based ecosystem, it is incumbent on SC-CAMLR to provide rigorous advice when completing elements of the work plan. For example, the stock assessment should incorporate realistic parameters based on what has been observed in the field. Care should also be taken to not overinflate the biomass estimate to plug into the stock assessment (gRym) such as could happen if densities from inshore areas are applied to offshore areas to calculate subarea wide biomass estimates.

Progressing or preserving a critical krill conservation measure

The interim distribution of the trigger level under CM 51-07 is a key management measure for the krill fishery in Area 48. This CM will expire at the end of the 2020/21 fishing season if not renewed (or replaced). To ensure a precautionary approach, management of the krill fishery must be conducted at a scale that matches the fishing operations and the ecological needs of predators (see Figure 2). CCAMLR has agreed to move forward with management at smaller than subarea scales using the risk assessment approach. An expiration of CM 51-07 without replacement would revert the fishery management system backwards and CM 51-01, established in 2009, would become the main Conservation Measure regulating the krill fishery in Area 48. This will eliminate the precautionary finer-scale subarea fisheries management approach, and potentially allow a catch of 620,000 tonnes to be taken entirely in Subarea 48.1. This could reduce the krill availability in areas important for land-based predators, recovering fish populations and marine mammals.

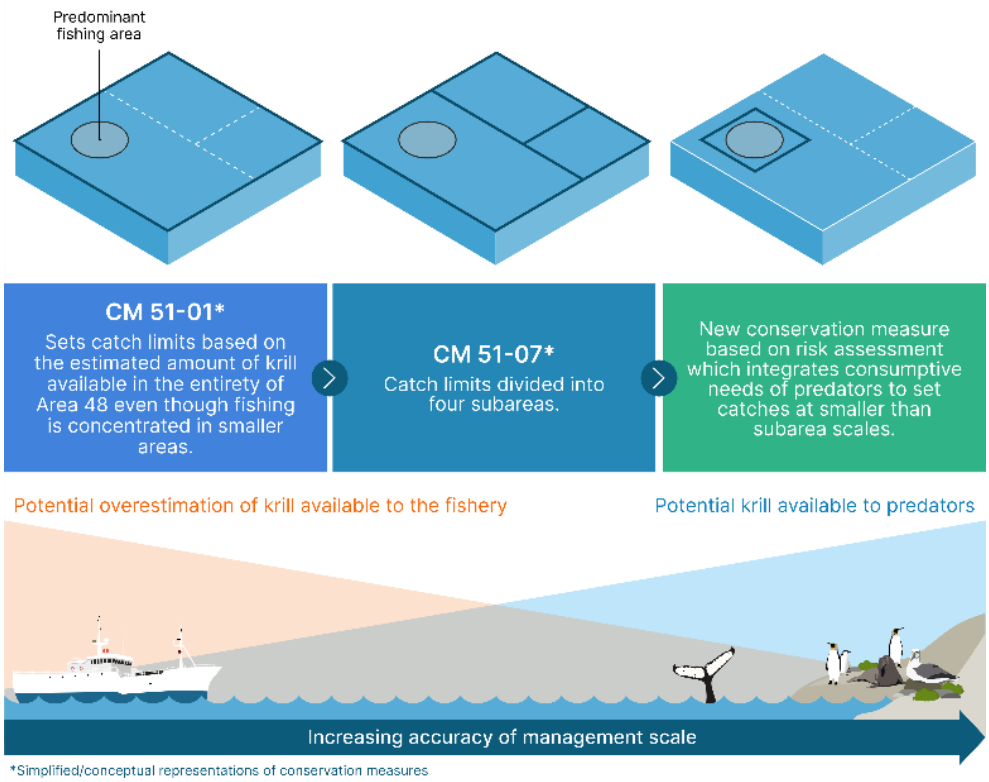

Figure 2. It is important that CCAMLR move forward with managing the krill fishery at a scale that matches the scale of fishing operations and the foraging areas of krill predators. Graphic by Visual Knowledge (www.visualknowledge.design).

Since climate change impacts and increased fishery concentration already pose a risk to the krill-based ecosystem, relying solely on CM 51-01 would undermine the conservation objective of the CAMLR Convention. It would also risk the credibility of the sustainable fishery designation (as currently labeled by entities like the Marine Stewardship Council and the Sustainable Fisheries Partnership) and CCAMLR Members' commitment to Southern Ocean conservation.

Participants in the 2021 WG-EMM meeting acknowledged that CM 51-07 may not be as precautionary as it once was considered given the increasing spatial concentration of the krill fishery. Thus, any outcome regarding a new fisheries management approach must be no less precautionary than CM 51-07.

If SC-CAMLR is not in the position to provide advice on a new fisheries management approach at the 2021 CCAMLR meeting, then CM 51-07 should be extended for a period that allows the SC to complete the agreed krill work plan and formulate a new CM. The expectation is that CCAMLR works to replace CM 51-07 with a new CM as soon as possible. It is important that CCAMLR does not lose momentum for scientific progress and management since the fishery continues to expand.

Conclusion and Recommendations

CCAMLR must move forward with the implementation of an effective new management system that sets highly precautionary catch limits. Following this implementation, CCAMLR must continue to be a leader in precautionary ecosystem-based management by incorporating the best available science to make additional improvements to the management of Antarctic fisheries. In conclusion, ASOC recommends that:

- SC-CAMLR completes the krill work plan agreed in 2019 —including the biomass estimate, stock assessment, and risk assessment, and CCAMLR subsequently agrees on a new, improved conservation measure replacing CM 51-07.
- CCAMLR renews CM 51-07 if a new CM cannot be agreed this year, so that the SC can complete the agreed krill work plan and formulate a new CM.
- CCAMLR avoids the complete lapse of CM 51-07 as reversion to management under CM 51-01 alone would be irresponsible given that the combined impacts on the ecosystem of climate change and concentrated fishing are already of concern.

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