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CCAMLR and Antarctic Krill: Ecosystem Management Around the Great White Continent

By Virginia Gascón and Rodolfo Werner*

** Virginia Gascón, LL.M., is Policy Advisor, and Rodolfo Werner, Ph.D., is Science Advisor of the Antarctic Krill Conservation Project.* *The authors would like to thank The Lighthouse Foundation, and especially its Director, Jens Ambsdorf, for their support during the research for this paper. They also thank Gerry Leape and Mark Stevens at the National Environmental Trust, for their constant support and encouragement, and Cynthia Fernández, for her research and assistance. Special thanks also to Steve Nicol, Andrew Constable, and So Kawaguchi at the Australian Antarctic Division; John P. Croxall at the British Antarctic Survey; and Alistair Graham at the Tasmanian Conservation Trust, for their time and interest in this work.*

INTRODUCTION

Generally regarded as a model for regional cooperation in the area of fisheries, the Commission for the Conservation of Antarctic Marine Living Resources ("CCAMLR") celebrates its twenty-fifth anniversary this year. Negotiated by Consultative Parties of the Antarctic Treaty to regulate harvesting of most marine species in the Southern Ocean, CCAMLR implements laws based on conservation principles. One of the central and continuing tasks of CCAMLR is the ecosystem management of Antarctic krill.

This article introduces the reader to the importance of Antarctic krill and the structure of the ecosystem approach as formulated by CCAMLR. It also explains reasons behind the need of CCAMLR's management of Antarctic krill resulting from a steady increase in krill harvesting, and its potential for becoming one of the world's largest fisheries. It also further delineates the conservation challenges that must be tackled to ensure the long-lasting health of the Antarctic marine environment.

ANTARCTIC KRILL AND THE KRILL FISHERY

ABOUT ANTARCTIC KRILL

"Krill" is a term applied to describe over 80 species of open-ocean crustaceans known as Euphausiids. *Euphausia superba* is the species commonly referred to as "Antarctic krill," which are shrimp-like crustaceans subject to significant commercial fishing. Adult krill aggregate into huge schools or swarms, that may extend for kilometers with thousands of krill packed into each cubic meter. This swarming behavior is what makes krill attractive to commercial harvesting.[i]

Antarctic krill are central to the Antarctic marine food web, as most organisms are either direct predators of krill or are just one trophic level removed from it. For many marine mammals and sea birds, krill is the most abundant food source. Areas of highest krill concentration are often close to the land-based breeding colonies of krill-eating birds and seals. These predators depend on krill being within reach of their colonies in order to feed and rear their offspring during the Antarctic summer.[ii]

Acoustic surveys have estimated the circumpolar biomass of Antarctic krill to be from 60 to 155 million tonnes.[iii] The distribution of Antarctic krill coincides almost entirely with the ecological boundaries of the so-called "Southern Ocean," extending from the High Antarctic Continental Shelf north as far as the Antarctic Polar Front Zone. The extended distribution of the species--approximately 36 million square kilometers-- was behind the designation of the management area for CCAMLR.[iv]

THE ANTARCTIC KRILL FISHERY

Krill is fished mainly as feed for aquaculture. Interest in krill fisheries was sparked in the 1960s.[v] The highest catches occurred in the early 1980s, reaching over half a million tonnes. In the early nineties, catches dropped dramatically due to the break-up of the Soviet Union, which forced this heavily subsidized fleet to cease operations.[vi] The Antarctic krill fishery has been relatively stable for the last decade with catches around 100,000 tonnes, but observers note a trend towards expanded fishing operations.[vii]

The Antarctic krill fishery may become the largest global fishery. Its size gives it the potential to significantly affect the trophic structure of the Antarctic marine ecosystem.[viii] Operating in the South West Atlantic, this fishery is located almost entirely within the CCAMLR Area.

THE ECOSYSTEM APPROACH AND CCAMLR

The "ecosystem approach" to fisheries management, and analogous formulations such as "ecosystem-based management," is subject to increased attention in the literature,[ix] programs, and conferences dealing with the use of marine living resources.[x] In spite of the generalized international acceptance of the need to adopt an ecosystem approach to fisheries management, there remains a lack of widely agreed-upon guidelines for implementation.[xi]

CCAMLR[xii] is the first international agreement to incorporate ecosystem and precautionary approaches as basic principles for the management of marine living resources. Subsequent treaties have followed the example set by CCAMLR; for example, the UN Fish Stocks Agreement ("UNFSA") requires the assessment of the impact of fishing on non-target and associated or dependent species and their environment. These are essential elements of the ecosystem approach. UNFSA also mandates application of the precautionary approach, which has been identified as an integral element of the ecosystem approach.[xiii]

The key role of krill in the Antarctic ecosystem influenced the conservation principles embraced by CCAMLR in Article II. Specifically, the ecosystem approach stated in Article II, (3)(b) of the Convention delineates the need to maintain the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources, and to restore depleted populations.

The formulation of the precautionary principle is not explicitly reflected in the text of CCAMLR. However, Article II, (3)(c) embodies a clear requirement for the application of precautionary approaches to management. This provision requires that harvesting is conducted in a way that minimizes the "risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of available knowledge of the direct and indirect impact of harvesting, the effect of the introduction of alien species, the effects of associated activities on the marine ecosystem and of the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources."

CCAMLR is recognized as the only regional fisheries body that routinely carries out a comprehensive application of the ecosystem approach to fisheries management.[xiv] Overall, the specific achievements of CCAMLR's ecosystem approach are: (1) the development of a precautionary approach to the management of target species; (2) the collection of data on by-catch and ecosystem impacts through the CCAMLR Scheme of International Observation; (3) the adoption of effective seabird by-catch mitigation rules and other gear restrictions to minimize the ecosystem impacts of fishing;[xv] (4) the development of specific policies to manage new and exploratory fisheries;[xvi] (5) the establishment of an ecosystem monitoring program; and (6) the development of a management regime for Antarctic krill that takes into account the impact of fishing on dependent species.

REGULATORY GAPS: CCAMLR'S MANAGEMENT OF ANTARCTIC KRILL

Soon after its entry into force in 1982, CCAMLR faced the task of translating its conservation principles into specific rules that could be effectively implemented. The ecosystem approach has imperative implications for krill management; thus, there is a need to consider not only krill as target species but also a subset of dependent species, including seabirds and seals, which are monitored by the CCAMLR Ecosystem Monitoring Program ("CEMP").[xvii] The Working Group on Ecosystem Monitoring and Management ("WG-EMM"), a subsidiary body of the Scientific Committee, takes on all relevant technical work in relation to krill, and is in charge of developing ecosystem-based management procedures.[xviii]

While developing models to estimate appropriate levels of krill harvesting, CCAMLR soon recognized that the Maximum Sustainable Yield model ("MSY"), commonly used in traditional fisheries management, was clearly not an appropriate basis for determining catch levels of krill. The MSY failed to incorporate interactions between exploited stocks and other species, a crucial element to address the objectives of Article II. Thus, to take into account the needs of krill-dependent species, CCAMLR adopted more conservative reference points than the ones commonly applied in a single-species fisheries management. These were integrated into a new Krill Yield Model ("KYM").[xix]

CATCH LIMITS TO KRILL FISHING

Since 1991, krill catch limits have been adopted in the Atlantic and Indian Ocean sectors of the Southern Ocean, covering just over 51 percent of the CCAMLR Area. The current catch limit for krill in the Atlantic sector of the Southern Ocean, where the fishery currently operates, is established at four million tonnes, divided across several subsections.[xx] These catch limits are complemented by the provision that, if the total catch in the Atlantic sector in any fishing season exceeds a "trigger level" of 620,000 tonnes, the limits would be subdivided into smaller management units following the advice of the Scientific Committee. The trigger-level is

designed to allow proper management of krill stocks in anticipation of a rapid expansion of the fishery.[xxi]

In 2002, endorsing advice from the Scientific Committee, the Commission subdivided the South West Atlantic into fifteen small units for the management of the krill fishery known as Small-Scale Management Units ("SSMUs"). The Commission also directed the Scientific Committee to consider how the krill catch limit could be allocated among these SSMUs.[xxii]

The majority of krill is harvested in shelf or shelf break areas. These areas coincide with the foraging grounds used by land-based predators, like penguins, to obtain food to rear their offspring. Therefore, until catch limits at the SSMU level are in place, concern remains about the localized impact within these subareas on krill populations and, particularly, on land-breeding predators.

OTHER CCAMLR MEASURES APPLICABLE TO KRILL FISHING

Krill fishing is exempt from most monitoring, control, and surveillance measures that are applicable to other CCAMLR fisheries despite the central role krill plays in the ecosystem. For example, scientific observers are required on board all fishing vessels in the Convention Area, except for krill vessels, despite calls by CCAMLR's Scientific Committee to collect data necessary to develop proper management advice.[xxiii]

Similarly, CCAMLR requires the notification of intended entrance into a number of Southern Ocean fisheries, but not for krill.[xxiv] In recent years, krill-fishing nations have voluntarily provided information on fishing intentions. However, there is a need to ensure that detailed information on fishing plans is regularly provided to CCAMLR scientific bodies in order to predict fishery trends.[xxv]

Another important regulatory gap with respect to the Antarctic krill fishery is the absence of required vessel monitoring devices. CCAMLR requires flag States to monitor the position of their fishing vessels licensed to fish in the Convention Area through an automated satellite-linked Vessel Monitoring System ("VMS").[xxvi] This requirement is applicable to all CCAMLR fishing vessels except for krill.[xxvii] The fact that krill vessels are not subject to VMS makes this fishery poorly regulated and difficult to monitor.

CONSERVATION CHALLENGES

A FISHERY IN EXPANSION

Recent developments in the krill fishery and markets indicate that expansion of this industry might be about to occur.[xxviii] The main driving factor of this expansion is the increasing demand for krill products, particularly for aquaculture feeds.[xxix] As "conventional" supplies of fishmeal and fish oil become scarce, alternatives need to be found. Krill demand as aquaculture feed, especially for farmed salmon, is likely to enlarge due to its excellent value as a nutrient source. Krill have outstanding properties as feed such as a desirable protein and energy content, essential amino acids, natural pigment, and palatability. In addition, an interest in developing pharmaceutical products from krill has been observed, which may contribute to the profitability of the fishery.[xxx]

New technology also creates an expectation of increased krill fishing. The Norwegian aquafeed and fishing industry is leading developments in relation to krill. The business strategy of Norwegian operators is based on the use of modern harvesting technologies, including the catching and simultaneous on-board processing of krill. This avoids rapid deterioration of krill, one of the main factors that has limited the economic feasibility of fishing operations in the past. With the use of this technology, catch projections are increased up to 120,000 tonnes per year per vessel.[xxxi]

ECOLOGICAL CONCERNS

CCAMLR Conservation Measures for Antarctic krill currently cannot ensure that krill fishing does not negatively affect the Antarctic marine food web. Although current krill fishing levels are still below established catch limits, these limits are set for large areas of the ocean and do not take into account the ecological relationships between krill, dependent species, and fishing operations, which occur at much smaller scales.[xxxii]

The current fishery for krill coincides almost entirely within foraging ranges of land-based predators, causing competition for krill between fishing vessels and krill predators. CCAMLR scientists have acknowledged that the potential for localized effects of the krill fishery on predators is great unless harvest controls are established for smaller areas and not just for large harvesting units, as is currently the case.[xxxiii]

Additional concerns for management include long-term environmental factors like global warming, which could have significant effects on krill stocks.[xxxiv] The Scientific Committee has acknowledged difficulties in determining whether changes in the ecosystem are caused by fishing operations or by environmental factors.[xxxv]

Since the establishment of SSMUs in 2002, the WG-EMM has been considering how the current catch limit for the South West Atlantic should be further subdivided. Options currently being assessed take into account different factors such as historical catches, estimated biomass, estimated predator demand, and the relationship between the spatial distribution of krill and predator demand in the different areas.[xxxvi] The WG-EMM is in the process of developing performance measures for the various elements involved (krill, predators and fishery), as well as simulation models, to determine how well these options would meet CCAMLR's objectives.[xxxvii]

An important consideration is that all proposed procedures to establish localized catch limits under discussion are affected by uncertainties, which need to be adequately addressed on a precautionary basis. In addition, all decisions would have little impact on fishing operations as long as current catch levels remain constant. However, as the fishing effort increases, a trade-off will need to be found between options that are precautionary, but more likely to displace the fishery, and those that do not displace the fishery, but are more likely to cause disruptions in the ecosystem.[xxxviii] For this reason, it is important that the adequate management procedures are in place before the fishery expands. The CCAMLR experience has shown that reaching consensus to make difficult adjustments only after the need becomes apparent presents a major problem.[xxxix] Overall, CCAMLR needs to ensure that the fishery does not grow faster than its capacity to manage it.[xl]

CONCLUSION

CCAMLR has been a pioneer in establishing an ecosystem-based approach to the use of marine resources. The development of the krill fishery will present CCAMLR's ecosystem approach its real test, offering the Convention an opportunity to become a 21st century model for fisheries management. To meet this challenge, CCAMLR needs to translate its basic conservation principles into flexible, effective management procedures that ensure the long-lasting health of the Antarctic marine environment and the species that reside therein. It must establish a management procedure that: 1) follows criteria for catch limit allocations that account for the needs of krill-dependent predators in each SSMU; 2) incorporates uncertainties on the basis of precaution, and 3) allows for further revisions in the light of new information. In the meantime, the fishery needs to be properly monitored and controlled, especially through the collection of scientific observation data.

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