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Convention on the Conservation of Antarctic Marine Living Resources

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Summary

CCAMLR is an intergovernmental convention that came into force in 1982; it was established mainly in response to concerns that an increase in fishing of commercial species in the Southern Ocean could have a serious effect on population of other marine life. CCAMLR is now responsible for safeguarding the environment and protecting the integrity of the ecosystem of the ocean surrounding Antarctica.

The Antarctic marine ecosystem is unique both for its geographic and climatic characteristics. Much of the Antarctic marine ecosystem is considered to be of low productivity and the associated food chain is very short, based almost entirely on krill. Krill are the key species crucial to the sustainability and production of all other fisheries.

Krill fisheries in the Southern Ocean may have immense long-term impacts on the marine ecosystem, disrupting the food web and blocking energy flows through the system. Currently two major finfish species are also exploited from Antarctic waters, the Patagonian toothfish and the Mackerel icefish.

The convention is primarily focused on the conservation of living resources within the stated conservation area. Where insufficient data are available to assess sustainable harvesting levels or other conservation measures, a precautionary approach has been developed to account for the potential risks associated with incomplete knowledge about the dynamics of a particular resource. Fisheries in Antarctic water may only continue by maintaining the ecosystem in a relatively stable state. The challenge is to understand the processes through which the marine ecosystem functions to achieve a sustainable fishery in the Southern Ocean through science-based management strategies.

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1 Introduction

Only recently has global society begun to realize and accept the finite nature of our planets ability to assimilate our wastes, and provide us and other species with the resources and environment we need to live.

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is an intergovernmental organisation established by an international convention. The Commission is assisted by the Scientific Committee also established under the Convention. CCAMLR is responsible for developing measures necessary for the conservation of the marine life of the Southern Ocean surrounding Antarctica (CCAMLR 2006). The Contracting Parties recognize the importance of safeguarding the environment and protecting the integrity of the ecosystem of the ocean surrounding Antarctica; noting the concentration of marine living resources found in Antarctic waters and the increased interest in the utilisation of these resources as a source of protein (CCAMLR 2006).

Historically living resources in the Southern ocean were exploited to the point of collapse within decades of their discovery as in the case of whales and seals, and within years for some finfish such as Norothenia rossii (Parkes 2000). The creation of CCAMLR was a precautionary response to the boom and bust exploitive fisheries that had operated in the Southern Ocean during the 1960's and 1970's, and the rise of the krill fishery in the 1980's which had the potential to disrupt the foundations of the Southern Ocean food web.

2 The Antarctic Marine Ecosystem

The Antarctic marine ecosystem is unique both for its geographic and climatic characteristics. It is defined by the Antarctic convergence (polar front), the boundary oscillating between 48 and 60 degrees of south latitude that separates the colder Antarctic surface waters it from the warmer sub-Antarctic waters to the north (United-Nations 2006). The Southern Ocean consists of a system of deep basins separated by three large mid-oceanic ridges: the Macquarie Ridge south of New Zealand and Tasmania, the Kerguelen–Gaussberg Ridge and the Scotia Ridge. Much of the Antarctic marine ecosystem is considered to be of low productivity, measured in milligrams of chlorophyll per cubic meter (mg m^{-3}). Typical productivity values for the Antarctic marine environment are 0.1 - 1 mg chlorophyll m^{-3}, this compares with productive regions of ocean elsewhere where values are often greater than 10 mg m^{-3} (Broady 2006). The low productivity is linked with extreme weather conditions, and also with the limited light penetration due to the winter ice cover (United-Nations 2006). Two hundred Antarctic finfish species inhabit the area south of the Antarctic convergence, 25% of these are unique to the area. Antarctic species of zooplankton, fish, squid, benthic organisms, seals, whales and birds found at this latitude have complex mechanisms for survival under very cold conditions. The food chain is very short and based almost entirely on krill (*Euphausia superba*), a small shrimp-like crustacean and a key species crucial to the sustainability and production of all other fisheries.

3 Antarctic Fin-fisheries

Large-scale exploitation of many fish stocks in the Convention Area began before the establishment of CCAMLR, and many stocks were already overexploited in 1982 when CCAMLR came into force. This commercial exploitation of finfish began in the southern ocean in the 1960s, early fishing operations were largely operated by the former Soviet Union or other eastern block countries (Constable et al. 2000). Early Soviet fishing caused the complete depletion of the bottom dwelling marbled rock cod (Norothenia rossii) from around South Georgia Island with the removal of 514,000 tones in two seasons. Commercial fisheries continued for the marbled rock cod around other islands until the end of 1980, when this species was finally depleted throughout Antarctic waters. The population of marbled rock cod is still estimated to only be around 5% of pre-exploitation stocks (Constable et al. 2000). There are currently two major species being exploited from Antarctic waters, the Patagonian toothfish and the Mackerel icefish.

The Patagonian toothfish is a large bottom dwelling species that lives between 35 and 50 years. Fishing for this species began around the same time as for the marbled rock cod, with mixed bottom trawling in the area of South Georgia Island. Trawling generally catches juvenile fish, but the introduction of long line fisheries around 1987 saw an increase the removal of mature Patagonian toothfish from Antarctic waters. Long-line fishing is now the main method of catching toothfish as the quality of fish is increased and the larger more mature fish fetch higher prices (Constable et al. 2000).

The Mackerel icefish is a shallow water fish (100 – 350 m) with a short life cycle of around 6 years. There are three main commercial stocks supporting the fisheries around South Georgia, Kerguelen and Heard Islands. The Mackerel icefish became a commercial target

species of the Soviet fishing fleets after the decline of the marbled rock cod in the 1970s. Although the annual mean catch of Mackerel icefish declined over the first 20 years of fishing, it is the only pre CCAMLR fishery to remain viable (Constable et al. 2000).

4 Antarctic Krill-fishery

The commercial exploitation of krill had begun in the in the early 1970s and peaked in 1982 with 528,201 t, catches then sharply declined until the mid 1980s due to marketing and processing problems related to the high levels of fluoride in the exoskeleton of the krill. At this time CCAMLR claimed that circumpolar abundance estimates of krill stocks were in the range of tens to hundreds of millions of tonnes, and thus were at least two orders of magnitude greater than the annual catches. CCAMLR's first priority was to conserve fish stocks, not manage the krill fishery. Krill became an important issue in the late 1980s when processing issues were overcome and demand increased. Krill fishing began to be concentrated in the foraging areas of krill-dependent predators such as penguins and seals (CCAMLR 2006). The demand for krill rapidly declined after the demise of the Soviet Union in 1991. The majority of krill fishing now occurs in the South Atlantic, current catch reported estimates are in the region of 80 – 100,000 t well under the precautionary catch limits (Constable et al. 2000). However, reported landings in 1998-99 were reported at 119,898 t and unregulated krill fishing is thought to be five to six times that figure (United-Nations 2006). Antarctic waters are also thought to have major stocks of squid; nations currently involved with commercial krill fisheries are showing considerable interest in the exploitation of squid stocks (United-Nations 2006).

5 Establishing International Agreement

CCAMLR operates under the Antarctic Treaty system, consultative parties to the treaty agreed in 1977 to negotiate policy to prevent the irreparable over-exploitation of Antarctic fish stocks (CCAMLR 2006). The negotiation period continued for three years and in 1980, the convention was established. This convention came into force in 1982; the basis of this convention was to allow for the rational use of living resources from the southern ocean. All parties to the convention are equally entitled to participate in the commission that oversees the implementation of the convention, and the decision-making. Currently CCAMLR has 23 members and all decisions within the commission are on a consensus system. The convention does not impose fisheries regulations on members but facilitates negotiations and agreement between members who are then constrained under the convention to uphold these decisions. CCAMLR applies to all marine living resources between the Antarctic coastline and the Antarctic convergence (polar front), with the exception of whales and seals that are covered by separate international conventions (International Convention for the Regulation of Whaling and the Convention for the Conservation of Antarctic Seals respectively) (CCAMLR 2006).

6 CCAMLR Precautionary Ecosystem Management:

6.1 Conservation Principles

The convention is primarily focused on the conservation of living resources within the stated conservation area. The Scientific Committee advises the Commission on harvesting levels and other management measures developed through consultation and the application of advanced scientific techniques. Where insufficient data are available to assess sustainable harvesting levels or other conservation measures, a precautionary approach has been developed to account for the potential risks associated with incomplete knowledge about the dynamics of a particular resource (CCAMLR 2006).

Article 2 of the convention has three guiding principles, these are summarised below; (Constable et al. 2000)

(a) Prevention of population decrease of any harvested species to levels below those that ensure its stable recruitment.

(b) Maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources

(c) Prevention of changes or minimization of the risk of changes in the marine ecosystem that are not potentially reversible over two or three decades.

These three principles provide the framework for the precautionary ecosystem approach to fisheries management. CCAMLR collects the data it can, and then weighs up the extent and effect of the uncertainties and gaps in such data before making a management

decision. The approach is precautionary in that it avoids actions that will have a long term adverse effects on species populations. CCAMLR also follows an 'ecosystem' approach (Miller et al 2004). Ideally, this takes into account all the delicate and complex relationships between organisms (of all sizes) and physical processes (such as currents, sea temperature) that constitute the Antarctic marine ecosystem (Miller et al 2004). Precautionary catch limits are set to maintain the population of prey species; this in turn reduces the disruption to the food supply of predators. CCAMLR's ecosystem approach not only focuses on regulating fishing for certain species, it also aims to ensure that fishing does not adversely impact other species that are related to, or dependent on, the target species. Article 2 of the convention also allows for the rational use of resources, in accordance with the precautionary ecosystem approach (Parkes 2000).

6.2 Ecosystem Monitoring

The Antarctic marine ecosystem only began to be considered during the early 1980s. Early investigations suggested monitoring top predators in the marine ecosystem as a means of detecting changes in the abundance and distribution of prey species. It had been observed in a number of studies that the population of seabirds and marine mammals were reasonably good indicators of prey abundance in some environments (Agnew 1997). During this period, environmental impact assessments (EIAs) were developing in many countries as an environmental management tool. An EIA requires a base line study of an environment in order to predict the affects that an activity will have on its environment, and monitoring required within the environment to detect these effects when they occur. CCAMLR adopted the idea that predator species were good indicators of the abundance of harvested prey species. This concept was used to develop a fisheries management system in the EIA framework which monitored the ongoing affect on the marine

ecosystem (Agnew 1997). During the development of this management system, it became clear that both the harvested species and their predators would need to be monitored. However, it would be impractical to monitor all of the species affected by fishing. Therefore, CCAMLR adopted a set of indicator species, these were dependant or related species that were likely to reflect the abundance of the harvested species.

Since soon after the adoption of CCAMLR, Members have collaborated in the design and conduct of Antarctic marine research – e.g. the 1981 BIOMASS / FIBEX programmes and the 2000 Synoptic Survey in relation to krill biomass and distribution (CCAMLR 2006). The CCAMLR Ecosystem Monitoring Programme (CEMP) was set up in 1985 with two main objectives;

(a) To detect and record significant changes in the critical components of the ecosystem, to serve as a basis for the Conservation of Antarctic Marine Living Organisms.

(b) To distinguish between changes due to harvesting of commercial species and changes due to environmental variability, both physical and biological.

6.3 Conservation Practice

CCAMLR management attempts to address a number of substantial problems relating to the direct effects of fishing on various components of the Antarctic marine ecosystem (CCAMLR 2006). These problems range form illegal fishing to accidental by-catch; CCAMLR's priority is the conservation of the marine resource.

6.3.1 Catch Document Scheme

Illegal unreported and unregulated fishing in the convention area threatens serious depletion of populations of commercial toothfish species. In response to (IUU) fishing for Patagonian toothfish (*Dissostichus*) CCAMLR has implemented a Catch Documentation Scheme for Patagonian toothfish (CCAMLR 2005/06). The Scheme is designed to track the landings and trade flows of toothfish caught in the Convention Area and, where possible, adjacent waters. This scheme is intended to enable the Commission to identify the origin of toothfish entering the markets of all parties to the scheme, and help determine whether toothfish taken in the convention area are caught in a manner consistent with CCAMLR's conservation measures. Each catch or shipment of toothfish must be accompanied by a valid catch document, issued in line with CCAMLR rules ensuring compliance with CCAMLR Conservation Measures.

The Catch Documentation Scheme is implemented in New Zealand through the fisheries regulations 2000 and associated customs import and export prohibition orders for toothfish. In New Zealand the scheme is administered by the Ministry of Fisheries. All landings, imports and exports of Patagonian Toothfish (*Dissostichus*) to or from New Zealand must be accompanied by a valid catch document (MFAT 2006).

6.3.2 Trawling

Trawling can be distinguished into bottom and mid-water trawling. Bottom trawling has a destructive impact on the benthic community on the sea floor. The trawl net disrupts benthic species and stirs up sediments, burying the seafloor habitat in silt. Bottom trawls do not discriminate between target and non-target species, catching whatever the trawl encounters. In the mid-1980s, for example, several by-catch fish species in the trawl fisheries around South Georgia and the South Orkney Islands were unintentionally over fished (CCAMLR 2006).

CCAMLR's management approach requires that consideration be given to the effects that harvesting has on non-target species. This has meant that total allowable catches (TAC) for target species are linked to allowable by-catch. In some circumstances, a fishery will be closed when it reaches the TAC level for the by-catch of a particular species, regardless of the target species catch.

CCAMLR has prohibited fishing when the risk to by-catch species is too great, as was the case with the mackerel icefish fishery around the South Orkney Islands. Fishing for this particular species has been confined to the use of mid-water trawls only, as the potential for by-catch is lower (CCAMLR 2006).

Mid-water trawling is often targeting krill; the very fine nets used to catch the tiny crustaceans also entrain juvenile fish and larvae. The removal of juvenile fish from the ecosystem has serous potential to disrupt the population of mature stocks. Investigations are now underway analysing by-catch from the krill fishery. Initial investigations indicate that the by-catch rates are affected by area and season (CCAMLR 2006). This data may be used to designate areas off limit areas of high by-catch risk during specific seasons.

6.3.3 Seabird By-Catch

The main source of seabird by-catch is long-line fishing for Patagonian toothfish, here 5 000 to 15 000 baited hooks are trailed on a "long-line" behind the fishing vessel. The danger to seabirds occurs when laying the line, when out of the water the baited hooks attract scavenging albatross and white-chinned petrels (CCAMLR 2006). The birds then either become hooked or entangled on the line, as the line is let out the bird is dragged below the water and killed.

Under CCAMLR regulations long-liners operating in conservation areas are now required to employ various methods to reduce seabird by-catch. For example, longlines are set at night, offal is not thrown overboard during setting and bird scare devices are used to minimise bird attraction to baited hooks during line setting. The beginning of the toothfish season has also been moved to a time when fewer birds are likely to be in the convention area. As one of their operational jobs, scientific observers serving on board all long-line vessels in the convention area monitor and record any deaths of seabirds during fishing. Night time line setting has caused a reduction in albatross deaths by about 80% over the past three years. Despite these successes, CCAMLR estimates that in excess of 100 000 birds may have been caught by illegal and unregulated vessels fishing in the Convention Area between 1997 and 1999. In addition, many Antarctic seabirds are taken by long-liners operating outside the Convention Area.

6.3.4 Fishing Debris

Garbage from ships can be just as deadly to marine life as oil or chemicals. The greatest danger comes from plastic, which can float for years. Fish and marine mammals can in some cases mistake plastics for food or they can become trapped in plastic ropes, nets, bags and other items (MARPOL 1973/1978).

Investigations during the 1990s by the CCAMLR scientific committee revealed that synthetic materials such as plastic ties and nylon net/ rope fragments were causing harm to wildlife (CCAMLR 2006). In response to this CCAMLR has set out to improve the awareness of vessel operators. It has also made recommendations to operators that if waste is discharged at sea efforts should be made to remove plastic, or care taken to eliminate risk to wildlife (cutting looped plastic material). During the late 1990s MARPOL developed standards and specifications for shipboard incinerators for waste disposal at sea, there is however no regulations requiring incineration. It is also unlikely that vessels operating illegally in the conservation area will comply with CCAMLR or MARPOL regulations for waste disposal.

7 Conclusions

The greatest challenge facing CCAMLR is the vastness of the Southern Ocean. Although there are good policies in place governing the appropriate conduct in the conservation area, the task of policing activities is complicated. Illegal, unregulated and unreported fishing are the greatest immediate threats to fish stocks, and member states and operators within the convention need to assist CCAMLR in the policing of pirate fishing to reduce the poaching of stocks.

Intentionally polluting the ocean with solid wastes while fishing is inexcusable (particularly plastics), if disposal while at sea is required incineration should be mandatory on all vessels operating legally within the conservation area.

Fisheries in Antarctic water may only continue by maintaining the ecosystem in a relatively stable state. The challenge is to understand the processes through which the marine ecosystem functions to achieve a sustainable fishery in the Southern Ocean through science-based management strategies (United-Nations 2006).

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