

INTERNATIONAL EFFORTS TO CONTROL MARINE DEBRIS IN THE ANTARCTIC

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ABSTRACT

Since much of the Antarctic, including the surrounding seas, remains in a relatively pristine state, the monitoring of environmental changes in this area often provides early warning of hazardous global phenomena, e.g., the stratospheric depletion of ozone. Reacting to a U.S. initiative, members of the Commission for the Conservation of Antarctic Marine Living Resources have taken steps to monitor the potential problem of marine debris, particularly from fishing operations. The Commission is joining with the Scientific Committee for Antarctic Research in establishing a program to monitor the effect of plastic pollution and entanglement on marine animals. The initiatives undertaken to establish monitoring programs for marine debris, the results to date, the reasons for their success and future needs in the Antarctic are discussed in this review.

INTRODUCTION

The 1984 Workshop on the Fate and Impact of Marine Debris provided ample warning that marine debris of terrestrial and shipborne origin was widespread in the marine environment and was apparently capable of contributing substantially to increased mortality of marine life (Shomura and Yoshida 1985). Of particular concern was the implication of debris arising from fishing operations (including lost or discarded net fragments, plastic packing bands, lines, and rope) in the harmful entanglement of substantial numbers of animals from many North Pacific populations of pinnipeds: northern fur seal, *Callorhinus ursinus* (Scordino 1985); Steller sea lion, *Eumetopias jubatus* (Calkins 1985); northern elephant seal, *Mirounga augustirostris*, California sea lion, *Zalophus californianus*, and harbor seal, *Phoca vitulina richardsi* (Stewart and Yochem 1985); and Hawaiian monk seal, *Monachus schuainslandi* (Henderson 1985). Fowler's (1985 1987) analyses of the substantial database for northern fur seals even suggested that the mortality of fur seals due to entanglement may be contributing significantly to declining trends (4-8% per year since the mid-to-late 1970's) of the population on the Pribilof Islands.

To begin addressing the uncertainties surrounding the marine debris problem while mitigating the known impacts, the 1984 workshop recommended, among other things, that educational efforts be undertaken to advise user and interest groups of the nature and scope of the issue. It was thought appropriate to include relevant international groups in this educational approach. The 1984 workshop also agreed that additional efforts should be undertaken to establish the severity of the debris problem in areas other than the North Pacific. Consequently, the stage was set for aggressive initiatives at several international forums to determine if the marine debris problem was occurring in other ocean basins.

Given the apparent adverse impact of marine debris, especially from fishing operations, upon North Pacific pinniped populations, it seemed reasonable to focus attention upon the Antarctic, where large populations of pinnipeds also occurred. In response to the establishment of a substantial international trawl fishery in the Antarctic during the 1970's, the Convention and Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) had come into force in 1982. The United States was a founding member of CCAMLR and brought the marine debris issue to the Commission's attention at its third annual meeting, in September 1984, 4 months after the convening of the marine debris workshop.

U.S. ANTARCTIC INITIATIVES

Organization and Mandate of CCAMLR

The CCAMLR is a unique international agreement which implements an ecosystem approach to the conservation and management of marine living resources found in the Antarctic. The CCAMLR convention area includes the marine area south of the Antarctic Convergence, the boundary between lat. 48° and 60°S which separates cold Antarctic waters from warmer subantarctic waters (Fig. 1). The area south of this boundary is considered the Antarctic marine ecosystem. The convention applies to "the populations of finfish, mollusks, crustaceans, and all other species of living organisms, including birds, found south of the Antarctic Convergence" (Anonymous 1988a).

The CCAMLR currently comprises 20 member nations, and an additional 4 nations have acceded to the convention but have not yet been accorded membership (Anonymous 1988a). The major operational units which undertake the convention's responsibilities (Fig. 2) are the Commission for the Conservation of Antarctic Marine Living Resources (the "Commission") and the Scientific Committee for the Conservation of Antarctic Marine Living Resources (the "Scientific Committee"). The work of these bodies is facilitated by a permanent secretariat which resides at CCAMLR headquarters in Hobart, Tasmania, Australia.

The convention mandates a management regime which ensures that harvesting of Antarctic species, such as finfish and krill, is conducted in a manner that considers ecological relationships among dependent and related species. Article II of the convention specifically requires the Commission to follow four basic principles of conservation (Sherman and Ryan 1988):

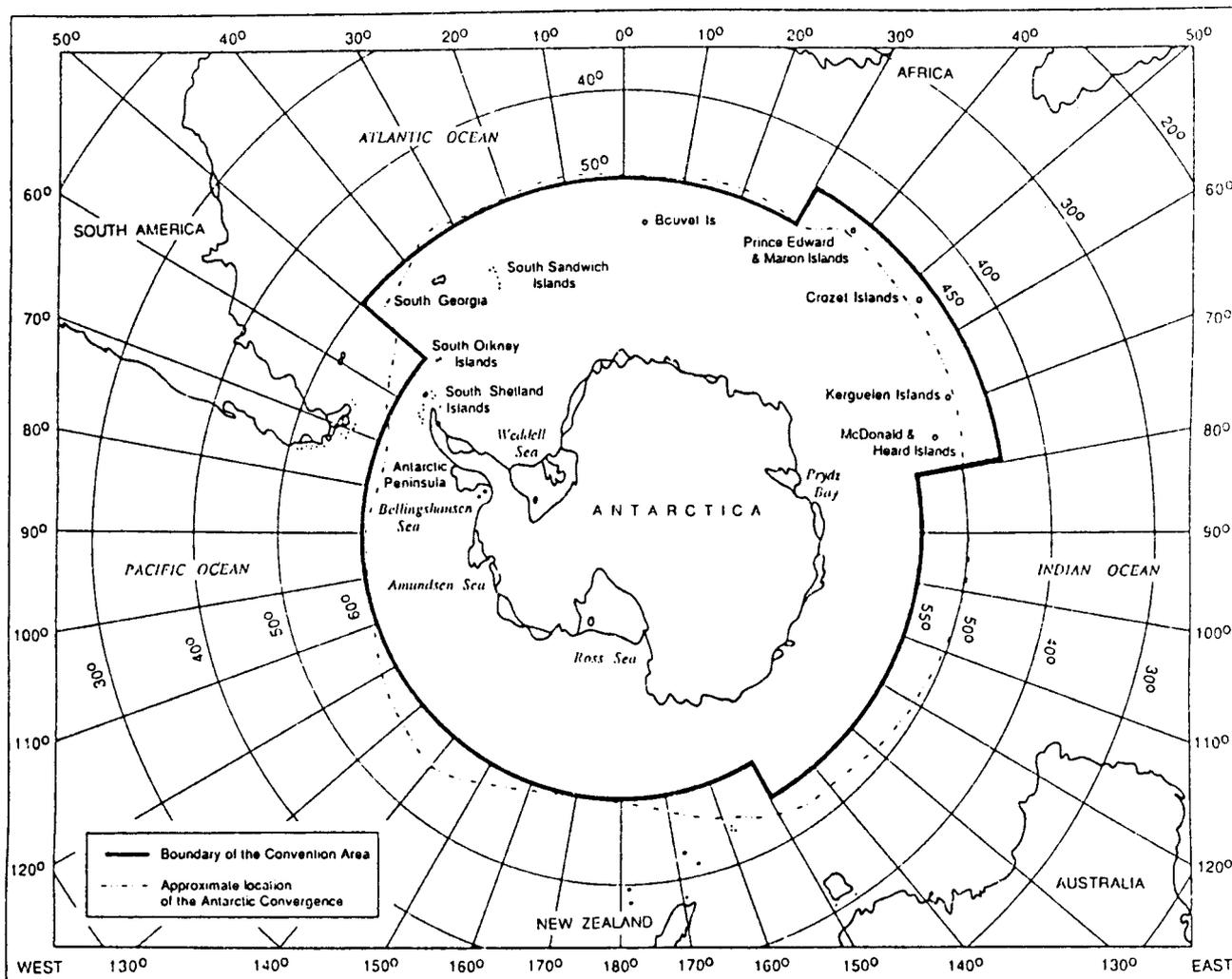


Figure 1.--Boundary of the area under the jurisdiction of the Convention for the Conservation of Antarctic Marine Living Resources (Anonymous 1988a).

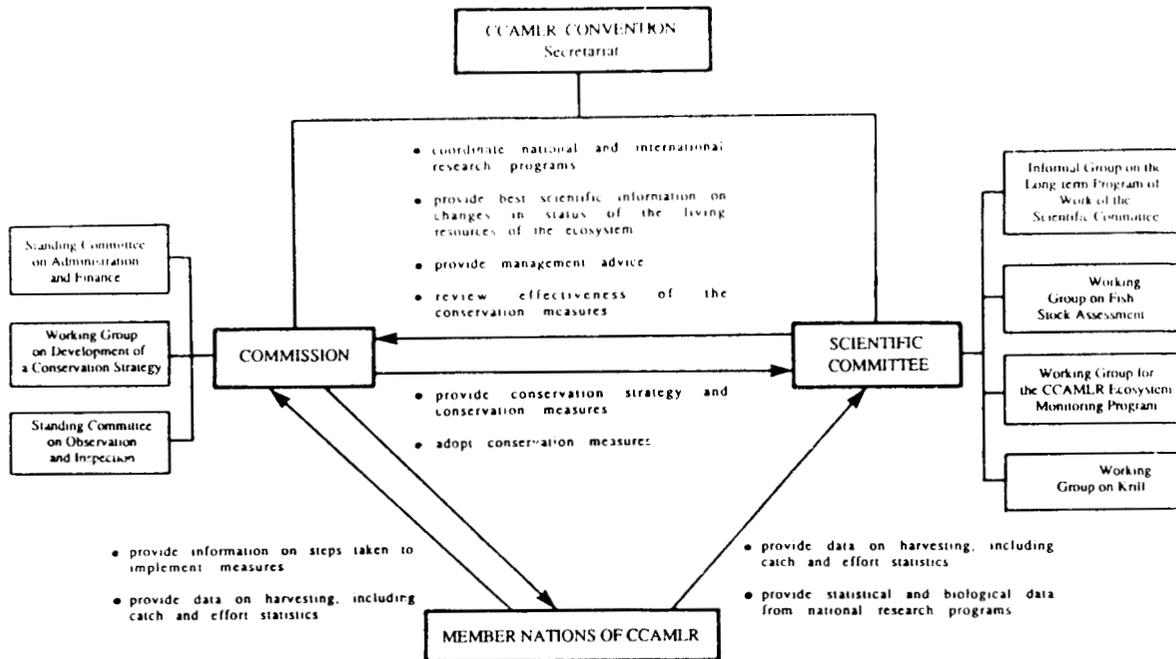


Figure 2.--Organizational structure of the Convention for the Conservation of Antarctic Marine Living Resources (after Sherman and Ryan 1988).

1. To prevent any harvested population from falling below the level that ensures the greatest net annual increment to stable recruitment;
2. to maintain the ecological relationships between harvested, dependent, and related populations of Antarctic marine living resources;
3. to restore depleted populations; and
4. to prevent or minimize the risk of changes in the Antarctic marine ecosystem that are not potentially reversible over two or three decades.

It was within this ecosystem context that the United States was able to raise the marine debris issue. In particular, the fourth principle gave rise to a powerful argument that the Commission must act to prevent irreversible changes in the Antarctic marine ecosystem which might arise from harvesting activities, including the loss or disposal of debris resulting from those activities. At least the Commission found itself compelled to give the issue due consideration when the United States introduced it at the 1984 annual meeting.

U.S. Proposals and CCAMLR Response

1984 Initiative

In 1984, the U.S. delegation submitted and the Commission considered a paper entitled "Assessment and avoidance of incidental mortality of Antarctic marine living resources." This document indicated that, while there did not seem to be any problem with entanglement of animals in lost or discarded fishing gear and other marine debris in the convention area, there was growing evidence in other areas, e.g., the North Pacific, that significant numbers of nontarget marine organisms were being caught and killed in such debris, as well as being caught and killed incidentally during certain fishing operations. The Commission agreed with these conclusions, and asked its members to undertake steps to study and assess the possible sources, fates, and effects of marine debris in the convention area, including (Anonymous 1984):

- reviewing and reporting on past encounters with marine debris at sea or at coastal research stations;
- reporting on the nature of problems arising from debris such as fouled propellers or entangled animals, and
- periodically surveying beaches at research stations or other areas to ascertain the types, quantities, and sources of debris accumulating there.

The Commission also agreed that members should report on the number of birds, marine mammals, and other nontarget species taken incidentally during fishing operations. Moreover, members were asked to inform their nationals of international and national laws prohibiting or restricting the disposal of netting and other potentially hazardous materials at sea and to report on measures taken to assess, avoid, and mitigate incidental mortality of Antarctic marine life. Finally, it was agreed to include this item on the agenda for the 1985 meeting and to consider the desirability of marking fishing gear for identification purposes, as well as restricting the use of gillnets in the convention area.

In 1985, the Commission received formal reports from four members, including the United States, on steps taken in response to the basic monitoring program established in 1984. A number of oral reports were received as well, and the United States submitted a preliminary report of the proceedings of the 1984 Workshop on the Fate and Impact of Marine Debris. Based upon this information, the Commission again concluded that there was no evidence that significant quantities of fishing gear, binding material, or other hazardous debris had been or were being lost or discarded in the convention area (Anonymous 1985). However, given the compelling evidence for such debris in other ocean areas, including areas adjacent to the convention area, and of the extent of its harmful effects to marine life and of its hazards to navigation, the Commission agreed to continue its monitoring program.

The Commission further agreed that members should continue studying the feasibility and desirability of marking fishing gear and of maintaining inventories of such material brought into the convention area. However, given that there were no substantial gillnet operations in the area at the time, the Commission concluded that prohibiting the use of gillnets as a preventative measure could interfere unnecessarily with the Commission objective of assuring the rational use of resources. The Commission did agree to keep the matter under review.

1986 Initiative

At the 1986 meeting, the Commission received reports from members on monitoring results and the United States submitted a paper proposing additional steps for ensuring that accidental and incidental mortality of marine life did not become a problem in the convention area. While the information provided continued to indicate that incidental and accidental mortality of living marine resources did not appear to be a problem, the Commission recognized that such mortalities, including those resulting from entanglement in or ingestion of marine debris, could interfere with efforts to achieve the objectives of the convention (Anonymous 1986). As a consequence, the Commission agreed to new measures to reduce or prevent the at-sea discarding of fishing and other hazardous debris:

- Members would take steps to ratify and implement both optional Annex V of the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL) and the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention); and
- the secretariat would prepare drafts of an information brochure to advise fishermen, researchers, and others working in the convention area of the hazards of marine debris; and of a placard for displaying on ships which listed the "do's and don'ts" for storing, handling, and discarding refuse.

The Commission agreed to continue its monitoring provisions and the collection of incidental catch data. Moreover, it agreed to undertake three new monitoring steps (Anonymous 1986):

1. recording and reporting fishing gear lost in the convention area;
2. if feasible, collecting and safely disposing of marine debris encountered; and
3. collecting samples of marine debris along with pertinent data, including species and numbers of entangled marine animals, for archival by the secretariat.

At the 1987 meeting, progress on all agreed monitoring measures was reviewed, and the Commission closely examined the information on lost or

discarded fishing gear obtained from national reviews of such data and from beach surveys in the convention area. Although several members observed no marine debris or entanglement problems, others reported sightings of debris consisting of fishing buoys, gas bottles, plastic containers, trawl net fragments, and plastic packing bands (Anonymous 1987). Moreover, two fur seals, *Arctocephalus gazella*, were seen entangled in derelict fishing nets and a third in longline gear. The Commission agreed not only to continue all elements of the monitoring program, including new steps agreed upon in 1986, but also to establish the issue of incidental/accidental mortality of Antarctic marine living resources as a standing item on the agenda for subsequent annual meetings.

The Commission also reviewed in 1987 the secretariat's drafts of an information brochure and a placard for display on vessels operating in the convention area. The secretariat was authorized to publish the agreed texts and members were urged to give these the widest possible circulation. Moreover, given that Annex V to the MARPOL Convention would prohibit or control the disposal of debris arising from fishing operations in the convention area, members were again specifically urged to ratify and implement this international measure.

In 1988, the Commission received further reports from members regarding loss of trawl cod ends and sightings of other derelict debris, including net fragments and packing bands. Moreover, five fur seals, *A. gazella*, were seen entangled in derelict fishing gear and two adult male fur seals died after becoming entangled in trammel nets (Anonymous 1988b). The Commission agreed to continue all elements of its monitoring program but noted that the reporting of incidental mortality as recommended in 1986 had been inadequate so far.

Also in 1988, the secretariat published and distributed the information brochure and placard for display on the ships of all member nations. As requested by the Commission, the U.S. has made these available to scientists and others working in the Antarctic and to the operators of vessels entering the convention area, including the National Science Foundation, the U.S. Coast Guard, and the National Oceanic and Atmospheric Administration.

FUTURE NEEDS AND ACTIVITIES

Improving Monitoring Efforts

The assumption is often made that much of the Antarctic, including the surrounding seas, remains unsullied by human activities. Consequently, if significant environmental changes are observed there, it is often presumed that these may be resulting from significant environmental perturbations occurring elsewhere on the globe, e.g., the stratospheric depletion of ozone resulting from the production and use of chlorofluorocarbon compounds in the Northern Hemisphere (Anonymous 1988e). The evidence reviewed so far by the Commission would tend to indicate that the marine debris problem in the Antarctic is minimal. That is, it would appear that the levels of debris discarded by vessels in the convention area or the amount brought in

by circulation or by other means from other ocean basins have not yet been sufficient to generate major problems for Antarctic marine life.

However, recent information suggests that the level of CCAMLR's monitoring efforts to date may not have been sufficient to ascertain the levels and consequences of marine debris effectively. The Bird Biology Subcommittee of the International Council of Scientific Unions, Scientific Committee for Antarctic Research (SCAR) concluded that a high proportion of Antarctic seabirds had ingested plastic particles, that the incidence was increasing in at least some species in the Southern Ocean and that the problem was particularly acute for procellariiform species which accumulate rather than excrete plastics (Anonymous 1988d). Van Franeker and Bell (1988) and Ainley et al. (1990) suggested that the source of the ingested plastic is from wintering areas outside the Antarctic. The SCAR Group of Specialists on Seals also noted that entanglements of Antarctic fur seals in discarded fishing gear had been reported from several areas around the Antarctic, including South Georgia, the South Shetland, Crozet, Marion, Heard, and Bouvet Islands (Anonymous 1988c). Consequently, one might conclude that CCAMLR has so far been seeing only the tip of the marine debris iceberg.

Taking note of CCAMLR's early monitoring initiatives in this area, both SCAR groups requested the Commission's assistance in examining the problem further. The SCAR's Bird Biology Subcommittee requested that CCAMLR consider initiating programs to monitor the level and effects of plastic pollution in subantarctic and Antarctic seabirds, considering both ingestion of plastic particles and entanglement. The SCAR Group of Specialists on Seals also requested that CCAMLR seek detailed information on the frequency of occurrence and nature of entanglement events involving seals in order to identify the causes of entanglement and trends in the frequency and extent of such entanglement over time (Anonymous 1988b).

At its 1988 meeting, however, the Commission noted that its monitoring program had three shortcomings relevant to SCAR's requests (Anonymous 1988b):

1. It did not address the problem of ingestion of plastics.
2. It did not specifically provide for quantitative and detailed reports of entanglement when fishing operations were not directly involved.
3. It may not provide adequately detailed information on incidental mortality during fishing operations to enable assessment of the problem or to monitor changes quantitatively.

To see if these shortcomings could be rectified so that assistance might be given to SCAR, the Commission authorized the chairman of the Scientific Committee to open a dialogue with the relevant SCAR groups (Anonymous 1988b). In particular SCAR's advice was sought (and provided at the 1989 meeting (Anonymous 1989)) on how the levels and effects of ingestion of plastics by Antarctic seabirds could be monitored, how quantitative

surveys could be conducted to determine the incidence, causes, and effects of marine mammal entanglements, and how the CCAMLR system of reporting incidental mortality might be improved in order to precisely determine the incidence, causes, and effects of such mortality. This new interaction between the Commission and SCAR should pave the way for greatly improving CCAMLR's pioneering efforts to monitor the marine debris problem.

Improving the Coordination of Efforts

The CCAMLR's exhortations on behalf of MARPOL apparently paid off, since Annex V came into force in December 1988 (Anonymous 1988e). It is now illegal for ships registered in the 35 ratifying nations, including the United States, to dump plastic debris such as that arising from fishing operations into the sea.

To become even more effective in controlling the marine debris problem in the Antarctic, it would seem desirable for the Commission to begin coordinating its actions with the International Maritime Organization (IMO). The IMO is the specialized agency of the United Nations which oversees implementation of MARPOL and the London Dumping Convention. This possible coordination, along with the pending cooperation between the Commission and SCAR, points out a growing need for an effective coordinating mechanism on this and other Antarctic issues.

In fact there has been a continuing debate among the Antarctic Treaty consultative parties (ATCP's) regarding the need for an Antarctic Treaty secretariat (Kimball 1987). The ATCP's favoring such a secretariat point to the increasing variety and complexity of issues being dealt with which require more numerous and more frequent communications within and between instruments of the Antarctic Treaty system, including CCAMLR, as well as with other relevant international organizations and elements of the outside world. The growing number of players becoming involved in dealing effectively with the issue of marine debris in the Antarctic (CCAMLR, SCAR, and IMO) may well provide another argument in favor of a secretariat.

DISCUSSION

Despite possible shortcomings and problems, it would appear that substantial progress has been made in trying to deal with the issue of marine debris in the Antarctic. The CCAMLR's monitoring program has evolved quite rapidly since the United States introduced the issue in 1984. Although the program is, perhaps, not yet as quantitative as some scientists would wish, the Commission is at least in a very good position to ascertain and evaluate trends in levels of debris and entanglements of marine life.

Under the convention, the Commission must take all of its decisions by consensus, which has led at times to a lowest-common-denominator-syndrome and resulted in somewhat ineffectual measures. So, the progress made with respect to marine debris might seem all the more remarkable unless one considered it in the light of the unique nature of the convention itself. The CCAMLR not only requires an ecosystem approach to the conservation and management of living marine resources but also sets forth the principle

that the Commission must act to prevent or minimize irreversible changes to that ecosystem. More than anything, these unique provisions probably account for the success achieved on the issue.

The philosophy behind CCAMLR provides great flexibility and a basis for dealing with many kinds of marine conservation issues, not just those dealing with the use of resources. This is a powerful tool, and the convention should be taken seriously as a model for all future resource use conventions and agreements in other ocean areas.

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