

Resource exploitation in the Antarctic region

Virtually as soon as ships entered far southern waters, humans have been seeking to exploit the region's food resources. Exploitation has at times been so heavy that it may have irreversibly changed whole elements of the region's ecosystems.

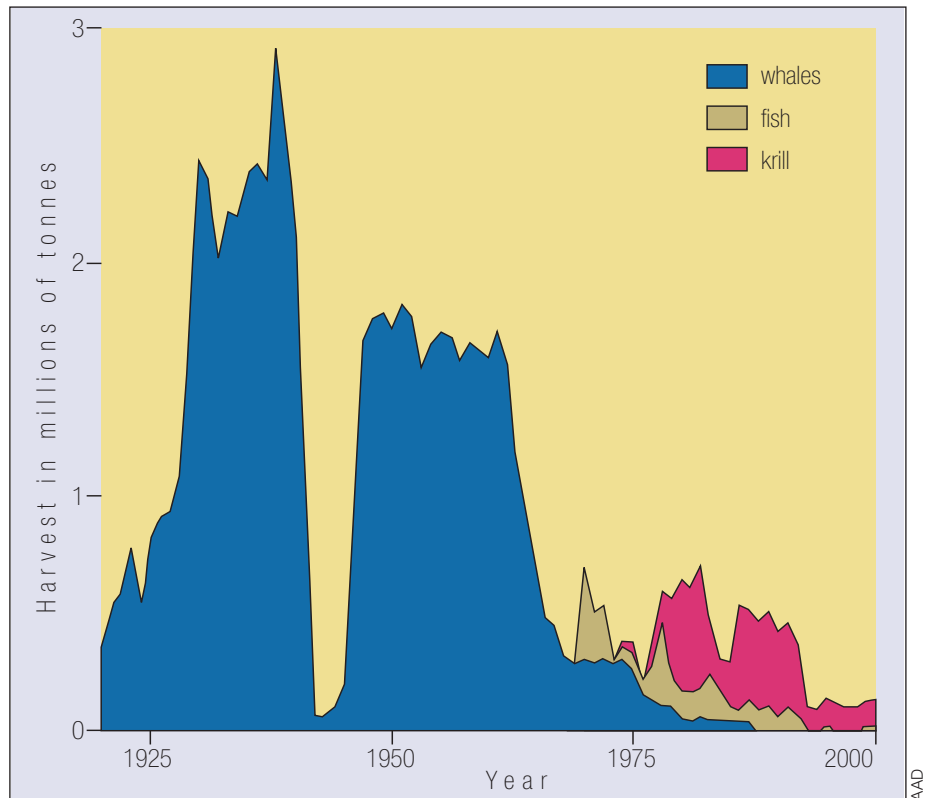
During the heyday of seal hunting from 1791 to 1822, whole island populations of fur and elephant seals were eradicated. The removal of such large numbers of these higher order predators of fish, squid and krill must have had a substantial effect on the marine ecosystem, but the extent of this can only be guessed at because of the lack of any systematic studies of the region before and after the period of exploitation.

Between 1904 and 1986, commercial whaling occurred on an even larger scale, resulting in further significant modification to Southern Ocean marine ecosystems. Attempts were made to study the effects of whaling on the Southern Ocean, most notably by the British *Discovery* expeditions, but a definitive appraisal has proved elusive. Before the large baleen whales became the chief targets of Antarctic whaling, they consumed an estimated 190 million tonnes of krill each summer. The loss of 1.5 million great whales from the Southern Ocean is estimated to have reduced the species' krill consumption to 40 million tonnes. The difference between these figures, 150 million tonnes, became known as the 'krill surplus' and fuelled one of the next waves of exploitation.

Krill fishing began in the 1970s. Catches reached 0.5 million tonnes a year in the mid 1980s, but the demise of the largest fishing nation, the USSR, along with marketing and processing problems, led to a subsequent decline. The annual catch has recently stabilised at around 100,000 tonnes a year, but there is still much discussion about the fishery's potential to reach its theoretically sustainable level of around five million tonnes a year.

Fish, too, have not escaped exploitation. Stock levels of icefish and Antarctic cod have never recovered from heavy fishing in the 1970s and 1980s. Current Southern Ocean fish catch levels are a comparatively low 20,000 tonnes or less a year. High value species such as Patagonian toothfish, however, attract illegal fishing vessels which are thought to have depleted stocks around some sub-antarctic islands. Their incidental longline bycatch has also had a devastating effect on the region's seabirds.

Exploitation of the Southern Ocean's



Harvesting of Antarctic marine living resources in the 20th century. What will be the next wave of exploitation?

marine-based species has thus had a major effect on ecosystems through the reduction in size of the populations of the targeted species, the indirect effects of harvesting such as bycatch, and the removal of so many predators from the ecosystems. Commercial harvesting has been the greatest documented human effect on the Antarctic, but this also serves as one of the few regionally-based controls on ecological change.

Southern Ocean fisheries are managed by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) which sets catch limits on target species. Unlike most fisheries management bodies, CCAMLR has adopted an ecosystem approach to managing the resources of the region. Catch limits are set in a precautionary framework that takes into account not only the long term yield of the harvested population but also the needs of dependent and related species. CCAMLR has taken 20 years coming to grips with this complex process (see *Australian Antarctic Magazine* #1, p. 57).

Management of an ecosystem or a series of interrelated ecosystems has to take account natural changes as well as human induced processes such as climate change and local changes such as harvesting. It also has to

acknowledge that the ability to manage the system on a regional scale is limited largely to the harvesting controls that can be applied at various trophic levels.

When the CCAMLR agreement was negotiated, in the aftermath of overexploitation of the great whales, a particular concern was that the harvesting of krill should not impede the recovery of whale numbers. With current changes in the Southern Ocean, it may not be sufficient merely to place controls on krill harvesting. Simplistic solutions to problems developed in isolation may exacerbate existing problems.

The uncontrolled harvesting of the last 200 years indicate that caution is required when intervening in ecosystem processes. Comprehensive Southern Ocean ecosystem management will require a far deeper knowledge of ecological links and the consequences of management actions at different levels in the food chain. CCAMLR is progressing towards the construction of predictive ecosystem models which will allow the simulation of perturbations and such an approach will eventually replace the hit and miss management procedures of the past.

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