2005

THE CANADIAN SEAL HUNT: NO MANAGEMENT AND NO PLAN

TECHNICAL NOTE

GREENPEACE

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executive summary

In the spring of 2004, the Canadian Government began the implementation of their three-year Atlantic Seal Hunt Management Plan (for the period 2003-2005). This Management Plan allows the largest commercial hunt of harp seals since total allowable catches (TACs) were first introduced in 1971. Although whitecoats (harp seal pups between 0-14 days) are now protected, 95% of the 350,000 harp seals expected to be killed this spring are still likely to be under one year old. Even if management conditions are strictly adhered to, the hunt is expected to result in substantial reductions in harp seal populations over time.

The large-scale resumption of the Canadian hunt, driven largely by increases in market interest for pelts and other seal products in Asia, is happening against a background of continued uncertainty regarding seal population dynamics and ecosystem interactions, as well as the ever-increasing uncertainties of habitat stability under ongoing and predicted future climate change. Although the harp seal is currently the most abundant seal species on the Canadian ice, this is no guarantee that commercial hunting on the scale proposed will not lead to rapid decline in populations and threats to their long-term viability.

This report provides an historical and ecological background against which the scientific justifiability and ecological sustainability of the current and proposed future Canadian harp seal hunts can be evaluated. In particular, it documents the diversity of threats facing seal populations, including the commercial hunt itself, and discusses the known and perceived interactions of harp seals with other components of the ecosystem and with commercial fisheries.

The Canadian harp seal hunt, though by no means unique, is by far the largest commercial hunt of marine mammals on a global basis. Despite the long period over which the hunt has been conducted, estimates of population abundance (on which TACs are set and future trends predicted) remain highly uncertain. Furthermore, although management thresholds have been set, which if passed should trigger large reductions or even cessation of sealing activities, the effectiveness of these "control rules" in preventing severe and potentially irreversible population declines are greatly limited by:

a) use of rather liberal, non-precautionary assumptions regarding uncertainties in population trajectories resulting from the hunt,

b) reliance on infrequent (5 yearly) surveys to determine actual populations and

c) inability of management models to incorporate and account for the full range of threats facing harp seal populations and their associated uncertainties.

For example, using 5-yearly surveys, it could easily take 15 years for a consistent trend in population to be reliably determined, by which time critical management thresholds could well have been passed. Technical aspects which are subject to particularly high uncertainties and which are not properly reflected in setting of TACs include proportions of seals "struck and lost" during the hunt (i.e. killed but not recovered and, therefore, never reported) and the intensity and impacts of the subsidised Greenland hunt for harp seals.

At the same time, the likely short and long-term consequences for seal populations of climate change, including the increased frequency of "bad ice years" already recorded, simply cannot be captured within the management models used. Inevitably, the population projections used are based upon assumptions that all other environmental and biological factors will remain unchanged during the period over which the hunt is carried out, a premise which is, at best, highly questionable.

It is against and in spite of this highly uncertain scientific background, then, that the current hunt is being conducted. The use of non-precautionary assumptions in setting TACs and control rules suggest that the Management Plan aims primarily at maintaining the commercial viability of the hunt in the short to medium-term rather than ensuring conservation of the harp seal and maintenance of ecosystem structure in the longer-term. Indeed, if more statistically defensible confidence limits were applied, it is possible the hunt would already be deemed unsustainable even in pure resource management terms.

Seals remain in sharp political focus in Canada also in relation to their purported role in preventing recovery of previously overfished cod stocks in the North Atlantic. The collapse of the cod fishery is undoubtedly the best known, though by no means the only, example of ineffective management of marine resources under the jurisdiction of the Canadian Department of Fisheries and Oceans (DFO). Initial attempts by fisheries managers to identify harp seals as the major factor preventing cod stock recovery have since been reconsidered, not least because detailed surveys of seal diet confirm that other fish and invertebrate species tend to constitute the bulk of harp seal prey. However, despite the fact that the Canadian Government has since stepped back from use of the "seals eat cod" paradigm to argue for higher commercial quotas for harp seals, the widespread misunderstanding that culling seals is the only way to save the cod fishery lingers on.

In reviewing the recent history of Canadian marine resource management, and of the resumption of the harp seal hunt in particular, it is difficult to ignore the pervasiveness with which political considerations have influenced, or even driven, management decisions, despite continued assertions that such decisions have a firm basis in scientific assessment. A truly scientific evaluation of the justification for, and likely viability and long-term impacts of, the resumed large-scale commercial harp seal hunt in Canada would inevitably result in markedly different conclusions. The contrast between the somewhat narrow, well-defined and simplistic population trajectory modelling employed by the DFO to support the hunt, and the diverse, complex and highly uncertain conditions and interactions which characterise the real world ecosystem of which the harp seal is an integral part, is striking.

Continuation of the Canadian commercial hunt cannot be viewed as consistent with maintenance of the long-term conservation status of the harp seal, which is likely to be increasingly threatened by the onset of climate change-related impacts to the sea ice ecosystem. Until such time as the substantial uncertainties surrounding the status of, and various pressures on harp seal populations can be fully resolved, including those relating to climate change, such that reliable assessment and control could feasibly be exercised, the only sustainable and scientifically justifiable course of action must be to suspend the commercial hunt immediately. In fact, it is virtually certain that most of these uncertainties will never be adequately resolved.

"The Canadian Seal Hunt: No management and no plan" is a report written by Greenpeace scientists from the Greenpeace Research Laboratories at the University of Exeter in the United Kingdom. It attempts to evaluate the scientific and political bases for the authorisation and management of the current commercial seal hunt conducted in Canada. It attempts to establish that on a precautionary basis this commercial seal hunt should be ended immediately. It should not be interpreted as endorsing the current management practices used by the Canadian Government in their attempts to regulate this industry.

Greenpeace opposes any human activity, which is harmful to populations of pinnipeds; the killing of pinnipeds for commercial trade; the taking of any pinnipeds from endangered, threatened, or seriously reduced populations, or from populations whose status is unknown, or where it is thought that such takes may have an adverse effect.

Greenpeace does not oppose the indigenous hunt in Canada and Greenland

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introduction

The true seals (Phocidae), the eared seals (sea lions, fur seals) (Otaridae) and the walrus (Odobenidae), taken together, currently have 33 living representatives. All groups face a variety of threats and these threats have already pushed one species (the Caribbean monk seal) to extinction with some other species being left in a relatively precarious state. Historically, representatives of all three groups have suffered heavily from commercial exploitation for their blubber, meat and skins. The overall importance of commercial sealing has largely declined in all but a few countries. The significance of other threats to seal populations, however, have since emerged, including entanglement in fishing nets, toxic pollution, fisheries related culls, fisheries bycatch, climate change, habitat disturbance and disease.

Nevertheless, the numbers taken commercially still represent a significant proportion of some targeted seal populations, and there are legitimate concerns attached to the sustainability of sealing activities, and to the lack of a precautionary ethic driving the current management paradigms. Commercial sealing has been thrown into sharper focus following the decision by the Canadian Government to resume sealing activities at levels greater than any in the preceding fifty years as detailed in a published management plan for the years 2003-2005. In addition, the resumption of the hunt at this scale has led to a reiteration of the concerns about animal welfare, which were first articulated in the 1960s and formed an important element of the protests against the hunt in the 1970s and 1980s through to the present.

It is intended that this document should provide a contextual framework within which the current Canadian sealing activities can be evaluated. Accordingly it will outline the following elements:

- The current conservation status of seal populations globally and status of associated sealing activities
- The historical context of the Canadian seal hunt and projected population impacts
- The perceived ecological interactions of harp seals particularly in relation to fisheries

The focus, therefore, will be largely upon the species most intensively targeted by current sealing activities under Canadian jurisdiction: the harp seal (Pagophilus groenlandica). The harp seal is the numerically most abundant pinniped in the north-west Atlantic, and is landed in the greatest numbers. It is not, however, the only species targeted by sealing, even in Canada.

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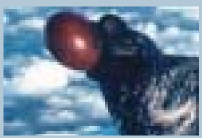
I GLOBAL OVERVIEW OF SEAL CONSERVATION STATUS AND SEALING ACTIVITIES

Given the historical targeting of pinniped species it is perhaps surprising that only one of these has so far become extinct. Nevertheless, other species are already threatened or vulnerable, for a variety of reasons. This section provides a brief overview of the conservation and ecological status of seal species around the world. It draws heavily on the excellent source material published by the Seal Conservation Society (SCS 2005), which describes in more detail the biology and ecology of each of the pinniped species.

i the northern seals



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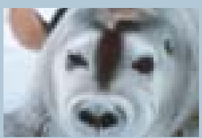
the hooded seal *(Cystophora cristata)* The hooded seal is distributed from Svalbard in the East, to the Gulf of St. Lawrence in the west and the total population is estimated at around 600,000 individuals. It is listed under Appendix III of the Bern Convention. The hooded seal, along with the harp seal, is blamed by Canadian fishermen for the failure of groundfish stocks in recovering from overfishing. Hooded seal populations are currently targeted by Canadian, Russian and Norwegian sealing activities. The shift to killing seals for fur from the 1940s onward led to intensive hunting of this species on the Canadian "Front" (the coast of Labrador and Newfoundland). The species is still hunted on the "Front" under licence from the Canadian authorities where an annual quota of 10,000 has been set. Only around 200 animals a year have been taken since 1998, but lack of enforcement resulted in 25,000 being taken in 1996, more than three times the 8,000 quota in operation at the time. The Norwegian and Russian hunts take place in the spring. In Norway, the adult quota for 2001 was set at 10,300 adults (1.5 suckling pups considered equal to one adult). The Norwegian industry was in recent times considered to be in decline, but the sealing industry is working hard to make it viable once more. The Russian kill was estimated at an average of 2,400 between 1986-1995. In recent years, 4,000-6,000 hooded seals have been taken in native subsistence hunts in Greenland, with a further 100 or so in northern Canada. Icelandic hunters shoot an unknown number annually.



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the bearded seal *(Erignathus barbatus)* The bearded seal is also listed under Appendix III of the Bern Convention. It is found around the Arctic Ocean and adjacent seas as far as 80-85°N with two recognized subspecies. E.barbatus barbatus is found in the western Laptev Sea, Barents Sea and North Atlantic Ocean south to the Gulf of St. Lawrence and Iceland/Norway. E.barbatus nauticus inhabits the remainder of the Arctic Ocean as well as the Bering and Okhotsk Seas, and may be found rarely as far south as China and Japan. The most recent population estimates date from the 1970s for E.barbatus barbatus and number this sub-species at 300,000. E.barbatus nauticus population was estimated at between 250,000-300,000 animals in the early 1980s. The reliability of these estimates is not known. The species is likely to be very vulnerable to changes in the Arctic ecosystem resulting from climate change. It is targeted locally, largely for subsistence purposes. This accounts for 1,500-2,000 seals annually in Russia in the Bering and Okhotsk Seas. Alaskan hunters are thought to take around 1,750 animals. Around 100, and up to 1,000 seals annually are taken in Svalbard and Greenland respectively.

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the grey seal *(Halichoerus grypus)* Grey seals are found on both sides of the North Atlantic. The western Atlantic population, estimated at least 150,000, is distributed from north Labrador to New England. The eastern Atlantic population is found for the most part around the UK and Ireland, but also on the coasts of the Faroes and Iceland and on French, Dutch and German coasts numbering 130,000-140,000. A third population of around 7,500 is found in the Baltic Sea, giving a global total of 290,000-300,000. Large-scale commercial hunting has not taken place in recent years, but there have been calls to allow catches in Canada. In addition, this species is involved in frequent conflicts with fishing activities. It is listed as a protected species under the EU Habitats Directive (Annex II and Annex V) as well as under Appendix III of the Bern Convention. Even so it is targeted illegally over much of its range. The Baltic Sea population has been reduced from an estimated 100,000 animals at the beginning of the 20th Century due to hunting but also due to pollution by persistent organic pollutants.

Only a limited number of grey seals are allowed to be hunted in Canada, although a request was made for 25,000 seals a year to be taken over three years. A further proposal was made to allow 20,000 animals to be taken at Sable Island, but this remains restricted. The Norwegian Government permitted a hunt for 400 grey seals between Lista and Stad during 2000, despite poor data on population size.

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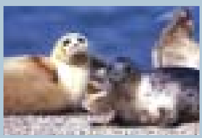

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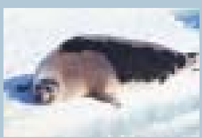
the caspian seal *(Phoca caspica)* This species is found only in the Caspian Sea and is classified as vulnerable on the IUCN Red List. The population has fallen from over one million in the early 1900s to an estimated 360,000-400,000, although the quality of these estimates is in some doubt, and the population may well be much lower. Annual takes averaged 160,000 between 1933-1940 when restrictions were emplaced. This brought the kills down to 50,000-60,000 annually until 1970. Further limits on kills of 20,000-25,000 pups were then emplaced. Currently it is thought that around 25,000 pups are taken annually, though this may be an underestimate. In addition to hunting pressure, distemper virus is thought to have killed many thousands of Caspian seals in 2000. The chronic pollution of the Caspian Sea by persistent organic pollutants is thought to be impacting the seals' reproductive vigour. There is a very strong possibility that this species could become endangered.

© KATHY FROST, ALASKA DEPARTMENT OF FISH AND GAME

the ribbon seal *(Phoca fasciata)* The Ribbon seal is another ice breeding species that is found in the North Pacific Ocean and adjoining areas of the Arctic Ocean. No reliable population estimates exist, but around 240,000 has been suggested, with an estimate of 100,000 or so animals in the Bering Sea. Up to 20,000 ribbon seals were taken annually by Russian sealers, but this now appears to have stopped. Around 100 are taken each year by Alaskan subsistence hunters. This species may also be highly vulnerable to climate change.



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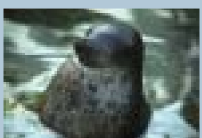
the harp seal *(Phoca groenlandica)* Also known as Pagophilus groenlandica, this seal is found in three distinct populations in the northwest Atlantic, east Greenland and the Barents Sea. Precise population numbers are not known, but estimates of between 4.0-6.4 million have been made for the northwest Atlantic population, 300,000 in the east Greenland population and 1.2 million in the Barents Sea White Sea areas. As discussed below the Canadian authorities currently permit a TAC of 325,000 animals, although "struck and lost" individuals may be significant in number.

Hunt quotas are also managed jointly by Norway and Russia on the West Ice (near Jan Mayen Island) and the East Ice (White Sea). The Norwegian quota on these two areas in 2001 was 20,000 seals. Between 1991 and 1996 the Norwegians had taken on average around 15,000 animals, a total that fell markedly between 1997 and 1999, only to increase dramatically to almost 19,000 seals in the 2000 hunt. The Norwegian hunt is heavily subsidized.

The Russian hunt is also government subsidized and in 1999, almost 35,000 whitecoats were killed. Quotas set for 2000 and 2001 were 63,500 and 76,000 pups respectively. The Greenland indigenous hunt is of increasing importance with almost 100,000 seals estimated as killed off west Greenland each summer. The harp seal is the most numerous of the northern seals.



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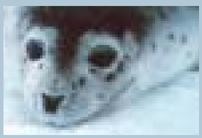
the ringed seal *(Phoca hispida)* The ringed seal has five recognized sub-species of this ice-living seal. Phoca hispida hispida is found in the greatest numbers and occurs in the whole Arctic Ocean sea areas. In the late 1980s a crude estimate of all five sub-species was given as 2.3 to 7 million. The sub-species P.h. ochotensis, found in the Okhotsk Sea and Northern Japan is thought to number up to 1 million. P.h. botnica, the Baltic ringed seal, is found mostly in the Bothnian Bay and numbers around 5,500. This population numbered some 200,000 around 1900, but was reduced to 25,000 by hunting by the 1940s. Pollution induced reproductive failure caused a further decline to around 10,000 seals in the 1970s. Hunting was finally banned in the Baltic in 1988. Around 2000 Ladoga seals are found in Lake Ladoga in Russia (P.h. ladogensis) and only around 250 Saimaa seals (P.h.saimensis) remain in Lake Saimaa in Finland. These are populations trapped at the end of the last ice age freshwater lakes.

Although ringed seals are one of the most important subsistence species across their whole range, the scale of hunting is not well characterised. The best estimates suggest that 3000 a year may be killed in Alaska. 50,000-70,000 are killed annually in Greenland. It is possible that indigenous hunts may expand in the future. The Ladoga seal is listed as vulnerable on the IUCN Red List and is listed under Appendix II of the Bern Convention. By 1980 when hunting was banned the original 20,000 Ladoga seals present at the start of the 20th Century had been severely reduced. 200-400 per year died through entanglement in fishing gear from the 1950s through to the 1990s. The Saimaa seal was threatened with extinction falling from 700 in around 1900 to a low of 180 in the 1980s. Currently it is listed as endangered on the IUCN Red List and under Appendix II of the Bern Convention.



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the spotted seal *(Phoca largha)* This species is found on the ice and in the waters of the north Pacific. The population was estimated at up to 450,000 in the 1970s, but this is thought to be an overestimate. The Japanese commercial spotted seal hunt no longer takes place, but some hunting still takes place. The Russians have a quota of up to 15,000 for use as food on fur farms, while subsistence hunting in Alaska accounts for a further 2,000.

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the baikal seal *(Phoca sibirica)* The Baikal seal population has fallen in recent years. Around 5,000 died of distemper virus infection in 1987-1988. Of the 104,000 present at the time of the 1994 survey, only 85,000 remained at the time of the 2000 survey and it is listed as lower risk: near threatened on the IUCN Red List. Hunting of Baikal seals is still carried out, accounting for an estimated 3,500 pups in 2000, reduced from a quota of 6,000 in 1999. Significantly, "struck and lost" seals may number three for each one killed. There is an increased problem with poaching, and a tourist hunt has also been proposed. In addition, development and coastline habitat loss are also threatening this seal. It was probably descended from ringed seals isolated in the lake some 500,000 years before present.

© SALKO DE WOLF, ECOMARE

the harbour seal *(Phoca vitulina)* The harbour seal is distributed throughout the temperate and sub arctic waters of the north Atlantic and north Pacific oceans. The total population of the currently five recognized sub-species is 400,000-500,000 animals. The restricted range of individual groups means that they may be locally eliminated. A population around Lake Ontario was gone by the early 19th Century. The Greenland, Hokkaido and Baltic Sea populations are considered to be severely threatened as are the Ungava seals which are found in freshwater rivers and lakes in the Ungava peninsula in northern Quebec. Numbers in Greenland appear to have declined. Some Alaskan populations have declined markedly over the last three decades. An epizootic of distemper virus killed many thousands of the eastern Atlantic population in 1988 and the disease returned in 2000. Hunting still takes place in Iceland and Norway and 2741 were killed in Alaskan subsistence fisheries in 1996. In other areas, harbour seals are shot in order to protect fishery and aquaculture activities.

The eastern Atlantic harbour seal is listed under Appendix III of the Bern Convention, with the Baltic and Wadden Sea populations listed under Appendix II. It is also covered under Annex II and Annex V of the EU Habitats Directive. Some Canadian populations, notably the eastern and arctic have been added to the Canadian Species at Risk List with the status: Indeterminate.

ii monk, elephant and antarctic seals

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the leopard seal *(Hydrurga leptonyx)* The leopard seal is usually found on the edges of the Antarctic pack ice, and in common with other species in this domain have been largely protected from hunting since their habitat is so inaccessible. Despite this, and regulation of hunting under the Antarctic Treaty, Soviet commercial sealers killed 649 animals over the 1986-87 season. Plans by Norwegian scientists to kill 20 leopard seals as well as 60 other seals were prevented by the Norwegian government. It is largely a solitary animal, with a large range, both factors conspiring to make population estimates highly uncertain. It is thought that between 220,000 and 440,000 exist.

© SCHMIDT/GP

weddell seal *(Leptonychotes wedellii)* Generally found on near-shore fast ice it is estimated that around 800,000 live around the Antarctic continent, and small breeding groups are found also on sub-Antarctic islands. This species was killed in the past to feed sled-dogs, but was protected from large scale sealing activities by its inaccessibility. Now protected under the Antarctic Treaty, the only recent recorded kill was of 107 animals in 1986-87 by the Soviet Union.

© SCHMIDT/GP

crabeater seal *(Lobodon carcinophagus)* This species, which feeds on krill in Antarctic waters, is globally the most numerous of the world's pinnipeds. With a population estimated at 15 million (although this may be an overestimate) they are found throughout the Antarctic pack ice. Although largely shielded from sealing activities, and protected under the Antarctic Treaty, nonetheless some 4,000 crabeater seals were taken by a commercial Soviet Union sealing expedition in the 1986-87 season.

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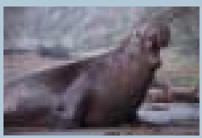
ross seal *(Ommatophoca rossii)* The Ross seal is the least well understood of all the Antarctic seals. Found largely in the Ross Sea it is also the rarest of the ice breeding seals. It has an estimated population of around 220,000, and apart from 30 animals taken for commercial purposes in 1986-87, it has been protected from large scale sealing due to its remoteness and inaccessible location.



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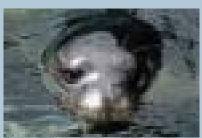
northern elephant seal *(Mirounga angustirostris)* The northern elephant seal breeds in California and Baja California, but feeds outside the breeding season as far north as Alaska. The Californian and Mexican populations total 84,000 and 32,000 respectively. These are all descended from the 100 to 1000 animals that escaped hunting of the species for its blubber oil in the 1800s. The genetic diversity of the population is therefore limited but continues to grow at an estimated 20-30% annually in California. This species is vulnerable to the impact of El Niño events. The 1997-98 event caused the death of up to 80% of the pups at some sites due to severe storms and high tides. In addition, food availability changes during El Niño can have an impact on pup survival. It was once listed under Appendix II of CITES but was removed from the list in 1992.

© TOM ARNBOM, UNIVERSITY OF STOCKHOLM

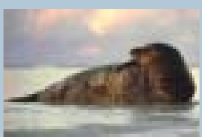
southern elephant seal *(Mirounga leonina)* The southern elephant seal is the largest of the pinniped species and has its main breeding grounds on the sub-Antarctic islands. The most important is South Georgia. The population numbers around 600,000. The species was hunted until 1964, but the intensive sealing in the 19th and 20th Centuries reduced numbers markedly. The population is currently declining markedly, with colonies losing between 50 and 90% of their numbers in some places. The South Georgia colony remains stable. It is thought that this decline may be a result of the species numbers equilibrating following population recovery from the intensive sealing activities of the past.



© MATTHIAS SCHNELLMANN, INTERNATIONAL MARINE MAMMAL ASSOCIATION

mediterranean monk seal *(Monachus monachus)* The Mediterranean monk seal is regarded as the most endangered of the pinniped species. Once distributed all over the Mediterranean Sea, Black Sea and north-western Africa, the remaining 400 animals are now limited to undisturbed locations in the region. The species is listed as critically endangered on the IUCN Red List, under Appendix I of CITES as well as under Appendix II of the Bern Convention, Appendix I & II of the Bonn Convention and Annexes II & IV of the EU Habitats Directive.

The long-standing enmity of fishers in the region, together with the sensitivity of the species to disturbance, has driven the decline. In addition, one of the more important breeding colonies on the northwest African coast succumbed to disease in 1997, reducing this component of the population from 310 animals to less than 90.



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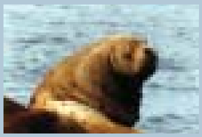
hawaiian monk seal *(Monachus schauinslandi)* The Hawaiian monk seal is the second most endangered pinniped species with a population of around 1,400 animals. It is found mainly in the north-western Hawaiian Islands. During the 1800s it was subjected to heavy hunting pressure that reduced numbers substantially. A period of partial recovery in the population was reversed in the mid 20th century with the population appearing to decline by around 40% over the period from the 1950s to 1980s. A further decline was caused by the high juvenile mortality of the French Frigate Shoals colony. Previous declines are attributed to disturbance by military activities causing the abandonment of high quality breeding sites. Entanglement in marine debris is another possible contributor. The seal is listed as endangered under the US Endangered Species Act, depleted under the US Marine Mammal Act, endangered on the IUCN Red List, and as an Appendix I species under CITES.

extinct

caribbean monk seal *(Monachus tropicalis)* Hunting of the Caribbean monk seal can be tracked back to the eight animals killed in 1495 by Columbus for meat. Later it was hunted for blubber and oil. Sensitive to disturbance, the last breeding colony was located between Nicaragua and Jamaica. It is now listed as extinct on the IUCN Red List and is and Appendix I species under CITES. There have been no confirmed sightings since 1952.

iii the sea lions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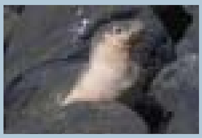
the steller sea lion *(Eumetopius jubatus)* The Steller sea lion is the largest of the eared seals and are found around the north Pacific Rim from Japan to California. In 2000 the population was estimated at around 85,000. This represents a substantial decline from the approximately 300,000 estimated in 1960. The population is divided into an eastern and western stock and it is the western stock that has been declining rapidly, with the eastern stock remaining relatively steady at 39,000 animals. In 1997 the US Alaskan population west of 144ºW was categorized as endangered under the endangered species act with the rest of the population designated as threatened. It is classified as endangered on the IUCN Red List.

The reasons for the decline are not known, but it may be due to depletion of groundfish from the critical habitat areas by bottom trawlers. This has led to establishment of protected areas and fishery restrictions being emplaced. The species is also vulnerable to entanglement in fishing gear.


© LIZ POON, CSIRO WILDLIFE AND ECOLOGY

the australian sea lion *(Neophoca cinerea)* This sea lion is found only in Australia and numbers some 10,000-12,000 individuals. It mostly inhabits islands along the southern and western Australia coasts. This species was the target of heavy hunting activity for the hide and blubber oil through the 1700s and 1800s at which time its range extended to Tasmanian waters. It is classified as rare in South Australia and as a special protected species in Western Australia. Entanglement in fishing gear is a major threat, and despite protective measures, the population may now be in decline.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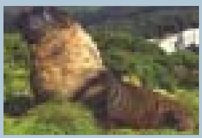
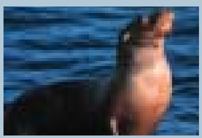
the south american sea lion *(Otaria flavescens)* The population of this species is estimated at around 265,000 although the information supporting this is somewhat fragmentary. The sea lion is found along the coasts and offshore islands of South America, from southern Brazil to northern Peru. The Uruguay and Falklands populations are in rapid decline, while in Argentina and Chile the population is increasing. The 19th and 20th Centuries saw large scale sealing activity on this species, and many hundreds of thousands of animals were taken. Hunting continued up to the 1950s on some groups. Currently there is no commercial hunting, though pressure exists in some countries for a resumption of sealing for fisheries protection (Uruguay, Peru), the major problem faced by this species is the interaction with various fisheries which takes place over the whole of its range. The populations on the Pacific coast are vulnerable to El Niño events. The 1997-98 event reduced a Peruvian population from around 180,000 animals to around 30,000.


© NATHAN MCNALLY, UNIVERSITY OF OTAGO

the new zealand sea lion *(Phocarctos hookeri)* This species, also known as the Hookers sea lion, is found exclusively in New Zealand. It breeds on New Zealand sub-Antarctic islands in a highly restricted area. It is one of the rarest (and most threatened) sea lion species and the 12,000-14,000 population was reduced by an unknown extent in a mass mortality event of unknown cause in 1998. Mortality was thought to be around 20% of the adult population and perhaps 50% of the young of year. Previous to 1893, when hunting the species became illegal in New Zealand, the species was hunted on a large scale for the hide and oil. The restricted breeding area confers a vulnerability on Hookers sea lion. Negative fisheries interactions in the squid trawl fishery kill significant numbers of animals, the permitted by-catch having been regularly exceeded. New Zealand domestic legislation classifies this species as threatened and it appears on the IUCN Red List as a vulnerable species.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california, galapagos and japanese sea lions *(Zalophus californianus)* There are three subspecies of Z.californianus of which the Japanese sea lion Z.c. japonicus is considered to be extinct. It has not been reported in over 30 years. The California sea lion is found from southern Mexico to British Columbia while the Galapagos seal is found on the Galapagos Islands and rarely in Ecuador and Columbia.

It is estimated that there are 210,000 California sea lions in the US. Around 31,000 are found in the Gulf of California, although the Baja California estimate of 74,000 is considered to be too high. 30,000 Galapagos seals existed in the late 1970s, since when no reliable census has been carried out.

A large-scale hunt of California sea lions was carried out for hides, blubber and genitals from the 1800s through to the early 1900s. Although partly protected thereafter, hunting continued until the 1960s and 1970s. The California sea lion is now protected in the US, Mexico and Canada, although illegal shooting of the species by fishermen is still taking place. Sea lions are suffering increasing mortality through entanglement in fishing gear.

The California sea lion is also impacted by El Niño events, suffering reduced pup production through lack of food. In addition there have been incidents of poisoning caused by a toxin produced in algal blooms and transferred to the sea lions through their prey. In addition, pollution continues as a threat to this sub-species.

The Galapagos sea lion Z.c.wollebaeki is classed as vulnerable on the IUCN Red List, and although not subject to the large-scale commercial hunting which depleted the Californian sub-species was killed to provide tourist curios. Many are still killed as a result of illegal and local fishing and the sea lions are prone to entanglement in a variety of fishing gears.

iv the fur seals

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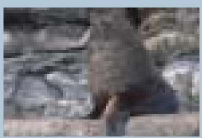
south american fur seal *(Arctocephalus australis)* Distributed from southern Brazil to southern Peru the South American fur seal numbers some 300,000-450,000 animals. The large Chilean population (c. 100,000) may have been more than halved as a result of the 1997-1998 El Niño event. The species was commercially hunted in Uruguay from 1515, and between 1873 and 1907 it is estimated that at least 750,000 were killed there. The seals were killed for fur, leather and oil, and the male genitalia, which were exported to Asia. Hunting is thought to have taken them almost to extinction. Almost 10,000 were killed in Chile between 1976 and 1979. Hunting was banned in Uruguay in 1991 and there is currently no commercial hunting of this species.

There have been calls to resume the hunt in Uruguay, fuelled by supposed fisheries concerns, but more plausibly by the lucrative trade in male genitalia. The species is listed under Appendix II of CITES.



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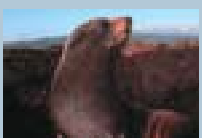
new zealand fur seal *(Arctocephalus forsteri)* The populations of southern fur seal are estimated at around 50,000 adults in New Zealand and around 34,600 in Australia at the time of the surveys in 1994 and 1990 respectively. Both populations were thought to be increasing at the time of surveying. They have been hunted for over ten centuries in New Zealand, first by the Polynesians and over the last 300 years by Europeans. They were nearly driven to extinction, but are now protected. The major threat to the population is entanglement and drowning in the nets of trawl fisheries, particularly the west coast hoki fishery which accounted for around 5,600 mortalities over the period 1989-98. This may be the reason behind the decline in numbers observed at several colonies in recent years.

In the case of the Australian populations, hunting was responsible for killing tens of thousands of seals by the fur trade, which pushed the population nearly to extinction. They have been protected regionally since 1892 in Western Australia, 1919 in South Australia and since 1975 nationally. Bycatch of the species has taken place regularly in trawling operations off Tasmania.

The Southern Fur seal is listed under Appendix II of CITES.



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galapagos fur seal *(Arctocephalus galapagoensis)* Thousands of Galapagos fur seals were killed by commercial sealers in the 19th Century and they became a protected species under Ecuadorian law in the 1930s. This protection was only made really effective when the islands were declared a National Park. The most recent survey took place in 1978 and population was estimated at 40,000. The 1982-83 El Niño event is though to have halved the population. All of the four youngest year classes were lost along with around 30% of the adult females and almost 100% of the large males. The 1997-98 event did not seem to have had a comparable impact. These natural variations appear to be the major threat to the population. The species is listed as vulnerable on the IUCN Red List and as and Appendix II species under CITES.

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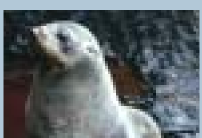
the antarctic fur seal *(Arctocephalus gazella)* 95% of this species breeds on South Georgia, which is ice free for part of the year. In 1990 the population was estimated at 1.5 million, but may have since increased to around 4 million. The population was pushed almost to extinction, with the current large population establishing itself from a few hundred survivors. Most large-scale sealing took place in the 1700s and 1800s but small-scale hunting continued until 1907. It is now protected by the Convention for the Conservation of Antarctic Seals, the Antarctic Treaty and various national legislatures. It is listed in Appendix 2 of CITES. Since this protection has been emplaced, the population seems to have been increasing at around 10% per year.



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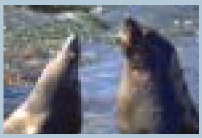
juan fernández fur seal *(Arctocephalus phillippi)* Following its discovery on islands off the Chilean coast, this fur seal was very heavily hunted for pelt, blubber and meat from the 17th to 19th Centuries. The original population estimated in the millions was reduced to the extent that the species was considered extinct at the beginning of the 20th Century. It was rediscovered in 1965, since when it has been fully protected. The current population is estimated at 12,000 animals, but low genetic diversity is a major concern. Accordingly, it is listed as vulnerable in the IUCN Red List and is and Appendix II species under CITES.



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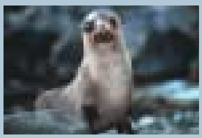
south african and australian fur seals *(Arctocephalus pusillus)* The South African and Australian fur seals comprise of two sub-species. The Australian sub-species, A.p.pusillus is restricted to breeding on nine islands in Bass Strait and numbers 30,000-50,000 animals. It is thought to have originated from the South African (Cape) fur seal population A.p.doriferus. This is found along the coasts of Namibia and South Africa with a population estimated at 1.5-2 million. Both subspecies are listed on Appendix II of CITES.

Historically, both the Australian and South African fur seals have been exploited. The Australian hunt killed an estimated 200,000 animals for fur in the 18th to 19th Centuries, and restricted hunting persisted in Tasmania until 1970. National protection has been in place since 1975, but despite this, fisheries conflicts remain a threat.

Sealing has been conducted on the South African fur seal population since the 17th Century. More than 2.7 million have been killed since 1900 alone, mostly in Namibia. The South African Hunt was suspended in 1990. Average kills between 1973 and 1982 comprised almost 19,000 juveniles and 500 adult males, and the averages until hunting was stopped were 3,500 pups and 4,300 adult males. A commercial hunt in Namibia persists, however, and the 2000 quota was set at 60,000 pups and 7,000 adult males, almost doubling the 1999 quota. The most lucrative trade is in male genitalia. Plans have been made to construct a factory to act as an abattoir, bone meal and fat processing plant.



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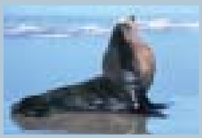
the guadalupe fur seal *(Arctocephalus townsendi)* This is the rarest species of fur seal and the only member of the genus Arctocephalus to be found in the northern hemisphere, off the coast of Baja California, Mexico. As with other fur seals, this species was hunted almost to extinction in the late 1700s to early 1800s. They were hunted commercially in Mexican waters until 1894 after disappearing from Californian waters 70 years earlier. Prior to sealing it is thought that there could have been up to 100,000 individuals. The population is now estimated at 7,000 and gradually increasing. The species was actually considered extinct after 1928, but reappeared in 1954 when it was placed under full protection in Mexico. The species is regarded as vulnerable on the IUCN red list and is an Appendix I species under CITES. It is a depleted and strategic species under the US Marine Mammal Act.



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the sub-antarctic fur seal *(Arctocephalus tropicalis)* This species, which breeds on temperate islands in the South Atlantic and Indian Oceans, was also hunted virtually to extinction in commercial sealing operations targeting the fur. Some island colonies were totally wiped out and small-scale hunting persisted until the 1950s, after which it became protected. Since then, most populations have been increasing at around 13-15% and current global populations are estimated at between 277,000 and 356,000. This species is listed under Appendix II of CITES. The sub-Antarctic fur seal is not thought to be currently facing any major threats.

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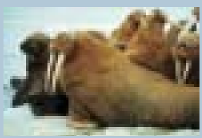
the northern fur seal *(Callorhinus ursinus)* The northern fur seal occurs throughout the North Pacific Ocean and has a total world population estimated at up to 1.365 million animals. Almost 75% of the population (1 million animals) breeds on Pribilhof Islands in the southern Bering Sea. Historically, the species has been subject to intense sealing, with many millions of seals killed following the discovery of the species in the 1700s. The population was seriously reduced and a The North Pacific Fur Seal Convention was signed in 1911 to regulate killing at sea and on land. The last commercial hunting was discontinued in 1984. From this point the population seems to have remained stable but is only half the estimated size in the 1950s. The northern fur seal is still hunted for subsistence purposes accounting for 8-9,000 animals overall. Some populations are sensitive to the impacts of El-Niño events. The San Miguel population lost 87% of the years pups in the 1997-98 event. Elsewhere, entanglement in fishing gear seems to be an important factor. The Northern fur seal is listed as vulnerable on the IUCN Red List and the US population is categorized as depleted under the US Marine Mammal Protection Act.

v walrus



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walrus *(Odobenus rosmarus)* The walrus has two recognized subspecies. The Atlantic walrus (O.r.rosmarus) is found in from the east Canadian Arctic to the Kara Sea, while the Pacific Walrus (O.r.divergens) is found in the north Pacific and in arctic waters from the east Siberian Sea to the western Beaufort Sea. The Laptev Sea population has been proposed as a third subspecies also. The population estimates are uncertain, but it is thought that there are around 22,500 Atlantic walrus and 200,000 Pacific walrus. The walrus is listed as an Appendix III species under CITES by Canada and as and Appendix II species under the Bern Convention.

Populations of the Atlantic walrus were decimated by European sealers and whalers, and they have proven unable to recover from this. It is still well below the pre-exploitation level estimated as several hundred thousand. There is still an indigenous hunt of walrus accounting for around 1,150 per year as estimated in 1995. Hunting in Norwegian waters and the Russian western Arctic has been banned since 1952 and 1956 respectively. There are growing concerns that persistent organic pollutants may be responsible for the increasing number of external and internal physical abnormalities observed in this species.

The Pacific walrus has been commercially exploited since the 18th Century, which substantially reduced numbers. It has been allowed to recover three times over the last 150 years. Most recently, the population was reduced to between 50,000 and 100,000 in the mid 1950s. Conservation measures have allowed the population to reach pre-exploitation levels, but the populations now seem to be in decline.

vi summary of threats facing pinniped populations

The foregoing overview allows some important conclusions to be drawn concerning pinnipeds:

* Pinniped species face a variety of threats that include hunting, environmental variation, pollution and fisheries conflicts.
* Several species have a conservation status which is of high concern
* Most species are now protected, and no commercial hunting on them currently takes place.
* Historically, many species have been driven close to extinction by sealing. One species and one subspecies appear to have become extinct
* Indigenous subsistence hunting targets a variety of seals in the Northern Hemisphere
* Recovery of pinniped populations has been variable, with some recovering from very low numbers and others failing to recover or recovering only to a limited extent.
* The current general presumption against sealing directed at southern hemisphere stock is justified by population vulnerability to environmental variation.
* Large-scale commercial hunting targets are restricted currently to three species: harp seals, hooded seals and South African fur seals.
* The harp seal hunt (commercial and subsistence) takes by far the largest numbers annually.
* The Canadian harp seal hunt is the largest commercial sealing operation globally
* The harp seal appears to be numerically the largest species in the northern hemisphere.
* There are wide uncertainties in the population estimates of many seal species.
* For many species, ecological relationships and aspects of seal biology are very poorly understood.

II OVERVIEW OF THE CANADIAN SEAL HUNT

i historical context

The Department of Fisheries and Oceans Canada (DFO 2003a) notes that harp seals have been hunted in the Canadian Arctic since the 16th century. Nonetheless, the present day Atlantic coastal commercial seal hunt assumed its present form in the late 1980's. This evolution came after the US had banned the importation of seal products in 1972, followed in 1983 by a European Union ban on the import of whitecoat (<12 day old juvenile) seal pelts. This caused the collapse of the market for seal pelts in Europe. The European ban was made permanent in 1989. In 1987 Canadian legislation was passed which ended operations from large vessels (over 19.8m in length) (see: Ambrose 2004).

The International Marine Mammal Association (IMMA 2005) documents the history of Canadian sealing from its early inception to the present day noting that scientists started to express concerns about the impact of sealing on the harp seal population as early as the 1950s. Between 1950 and 1970 it was estimated that the harp seal population had declined by around 50%-66% and, at around 2 million individuals, was considered to be "in trouble". The market collapse had the effect of reducing actual kill to 51,000 individuals on average between 1983 and 1995, although the official TAC was set at 186,000 animals. The failure to reach the TAC was largely attributable, therefore, to market forces rather than regulation of the catch levels per se.

The truth of this was vividly illustrated by the marked increase in numbers of seals taken in response to improvements in markets for seal products from 1996 onwards, especially as Asia replaced Europe as the major destination for exports of seal oil and skins (together with limited quantities of meat). Numbers of seals killed jumped from c. 60,000 in 1995 to c. 240,000 in 1996, supported by revised population estimates. In turn, these revised estimates were used to justify a further increase in the TAC from 250,000 in 1996 to 270,000 in 1997. Since that time, landings have inevitably depended upon both market conditions and weather conditions. Hence, landings of 92,000 seals in 2000 fell well below the TAC, while in 2002 the landed number of 312,000 substantially exceeded the TAC of 275,000.

ii use of TAC as a management tool against a background of uncertainty

While no explanation seems to have been forthcoming from DFO Canada on the above excedence of TAC, it is perhaps significant that in 2003 a three year management plan was adopted allowing for a total of 975,000 harp seals to be taken over three years, with a maximum annual TAC of 350,000 in any one year. This system seems tacitly to recognise that there may be difficulties in estimating and policing the precise numbers of animals taken each year, though it is not yet clear whether any excedence in the final year of the 2003-2005 management plan will be reflected in further increases in TAC for the 2006-2008 period. In previous years it was accepted that Canadian TACs were set with the underlying management objective of maintaining a relatively constant population, despite the fact that, in practice, the numbers of seals taken in the period 1996-1998 exceeded the limits within which population stability might have been expected to be maintained (Johnston et al 2000). Ultimately, however, the 2003-2005 management plan marked a clear departure from the general objective of population stability. Currently, if fully exploited, the TACs represent an annual kill equivalent to, or even greater than, those that took place in the 1950s and 1960s and which resulted in a decline in the population of harp seals to its lowest recorded level of less than two million animals (SCFO 1999).

Simply, therefore, if TACs are fully exploited, then harp seal populations will once again decline. This is acknowledged in the 2003-2005 management plan (DFO 2003a) that anticipates that the population will decline to around 4.7 million, (nonetheless considered well above the 70% reference point) by 2006. This conclusion appears to be based, in turn, upon assumed likely intensities and patterns of exploitation, selected from the full range of values considered within model simulations of population trajectory (Hammill & Stenson 2003a).

The management plan itself is based upon a maximum population size of 5.5 million (extrapolated from the estimate of 5.2 million figure given in the 1999 survey) and a series of numerical reference points coupled with so-called "control rules" (specified actions in response to reference points being reached). The reference points are 70% of maximum population which triggers measures to return the population to above 70% of maximum, 50% of maximum where significant management measures are introduced and 30% of maximum which triggers a suspension of the sealing. This Objective Based Fisheries Management Approach (which is regarded by the Canadian Government as a precautionary approach) appears to have been formulated with reference to the findings and recommendations of the 1999 Seal Report (SCFO 1999) and the subsequent 2002 Seal Forum (DFO 2002). Indeed, the numerical threshold limits adopted appear to have been taken without modification from a discussion paper published in 2003 (Hammill & Stenson 2003b) using a population size of 5.5 million as the benchmark. However, the 5.5 million figure appears to be an extrapolation from the 5.2 million estimate, itself based upon reported kills, as stated in their 2003a publication.

SCFO (1999) broadly accepted harp seal population estimates. They note that the 1999 survey (still the most recent published estimate, although one is expected in 2005) gave a total of 5.2 million animals. Nevertheless, this benchmark figure is in itself subject to substantial uncertainty. The original published estimate (DFO 2000a) had 95% confidence limits attached. Hence, this report considered the population (with 95% certainty) to be somewhere between 4.0 and 6.4 million animals. Moreover, these confidence limits do not reflect all the areas of uncertainty. Although uncertainties in pup production are factored in, uncertainties attached to reproductive rates, total removals, and the age of catches are not included. The 95% confidence intervals expressed in this uncertainty estimate therefore underestimate (to an unknown extent) the total uncertainties attached to the population numbers.

What seems clear from this is that there is no empirical basis for the TACs that have been set by the Canadian authorities. Rather these have been based upon a series of estimates, each with uncertainties attached and with only some of these explicitly recognised. Many of these uncertainties cannot be readily defined and so should more accurately be regarded as indeterminacies. There is, however, one key uncertainty that needs to be resolved, namely the probability of identifying and quantifying the trends in population resulting from the hunting.

THE CANADIAN SEAL HUNT: NO MANAGEMENT AND NO PLAN

TECHNICAL NOTE

iii limitations of surveys in informing management decisions

The Canadian seal hunt targets young of year seals. Since harp seals have their first pup at five years old, removal of the young individuals would not impact upon the breeding population until some four years later. Impacts upon the population would then be detectable as a reduction in seal pup production. Since pup surveys are conducted only every 4-5 years at present, impacts could take 10 years to detect and another 5 years to confirm. Add to this the time subsequently needed for protective measures to take effect at high levels of hunting and rapid population decline, possible to below critical levels, may be unavoidable.

There is another factor at play here also. In recent years the Greenland hunt seems to have expanded, from around 10,000 per year in the early 1970s to around 90,000 in 1999, though few truly reliable data exist. The subsidised Greenland summer hunt targets adults and juveniles, and thus activities in this jurisdiction can have substantial impacts upon the harp seal population overall and upon the proportion that can be allocated as TACs in Canadian waters. Surprisingly, no joint management regime has been formulated despite the fundamental inter-relationship between the two hunts. Without clear and accurate data on the Greenland element of sealing activities, the uncertainties attached to the impact of Canadian sealing on harp seal populations are appreciably increased.

iv limitations of models in providing precautionary management targets

Another key factor is the point at which the harp seal population is considered to have reached any of the management thresholds set under the Objective Based Management Scheme. Modelling exercises have been carried out (Hammill & Stenson 2003a), and the closest approach to current TACs appears to be the scenario where kills of 325,000 take place for three years followed by a fall in TAC to 275,000 in subsequent years. According to this projection the 70% threshold (i.e. 70% of maximum estimated population) would be reached in 2013.

This estimate, however, hides a surprising and questionable statistical manipulation. Instead of using the lower 95% confidence interval to estimate this point, (the most conservative and thus most precautionary value considered in the models), the 60% lower confidence interval has been used. This has the effect of delaying the time at which minimum estimates fall below the 70% threshold by several years, the precise timing depending upon levels at which the TAC is set. Moreover, the disparity between the 95% and 60% confidence limit actually gets more marked with time, reflecting the increasing uncertainty over time since the last available population estimate.

It is difficult to see a statistical justification for selection of the 60% rather than the 95% confidence interval. A pragmatic reason may well be that the more precautionary 95% lower confidence interval would be difficult to use as a management tool, not least because the 70% reference level could possibly be reached during 2005, or indeed may already have been passed. This point is illustrated well by Figure 2 of Hammill & Stenson (2003a). The 60% lower confidence interval shows a population of around 4.6 million for 2006 whereas the lower 95% confidence interval falls at around 3.6 million, below the 70% threshold. Alternatively it could be viewed that the 60% threshold has been set more to provide a more secure outlook for the seal industry rather than for robust protection of the seal population.

Hammill & Stenson (2003a) also attempt to compensate in their modelling exercises for two other important sources of mortality, namely i) seals killed or fatally wounded but not recovered by the hunt ("struck and lost") and ii) seals killed by negative interactions with fisheries.

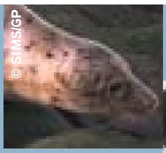
"struck and lost" A certain proportion of harp seals killed or fatally wounded are never recovered by the sealers and do not , therefore, appear in reported statistics. Models currently used in the Canadian hunt assume a "struck and lost" percentage of 5% for pups killed in the Canadian sector, 50% for animals >1 year old, and 50% of all seals caught in Greenland and the Canadian Arctic (Healey and Stenson 2000). These authors note that these assumed figures are estimates and that their use is based upon a recommendation by the National Marine Mammal Peer Review Committee that they should be applied until additional information becomes available. Attempts to determine real values for the "struck and lost" component have been limited.

Data described as preliminary (Sjare & Stenson 1999) suggested that 0-2% of beaters may be lost when taken on ice and 3.2-10% when taken while in the water. Seals > 1 year old showed 1.3-11.1% losses on ice and 13.8-50.0% in water. The study notes that sample sizes were limited in relation to the size of the most recent TAC values. This study was followed up by more extensive observations in 1998 and 1999 (Sjare et al. 2000). The results of this subsequent survey largely reaffirmed the values from the earlier work, although the upper value estimate of losses for 1+ seals almost doubled to 21.6%. Once again, the authors drew attention to the limited nature of the data and the need for further such data to be collected.

Actual removals of seals over the 1996-1998 period have been estimated to be as high as 397,000 per year from the Canadian hunt, rising to 548,000 if the Greenland hunt is taken into account (see Johnston: et al. 2000). However, even if one assumes that the TACs were being adhered to, a relatively low "struck and lost" mortality estimate of 2% would still add up to an additional 6,500 animals on a TAC of 325,000. Furthermore, if a higher figure of 10% is taken as a worst case scenario, then the total number of animals killed could be as high as 357,500.

Accurate determination of the "struck and lost" rates is vital if TACs are to be soundly supported by empirical data but, as with population estimates and projections, these seem to be based upon numerous assumptions which may prove unjustified in the long term. Overall, "struck and lost" estimates are based upon such limited data that they could justifiably be regarded as conjectural. Without better data on this aspect of mortality and mortality driven by environmental conditions, the setting of TACs is not defensible. This implies that the TAC management paradigm could entail a far higher degree of risk than is currently acknowledged.

fishery-related seal mortality A second significant source of mortality in the harp seal population is negative interactions with fisheries. The lumpfish fishery is particularly important in this regard. Once again, estimates are predominantly based on surrogate values, in this case lumpfish roe landings as an indicator fisheries effort data, correlated with numbers of entangled seals recorded by fishers participating in the voluntary By-Catch Monitoring Program initiated by DFO. Estimates of by-caught harp seals in Newfoundland indicate significant mortality, accounting for around 36,000 animals in 1994, falling to around 17,000 in 1998 and subsequent years (Walsh et al. 2000). While these values may be considered best available estimates, they are subject to considerable uncertainty and much effort is needed to resolve numbers more accurately.



Taken together, these additional sources of mortality in combination with overall uncertainties in population and loss estimates have a significant bearing on the definition of the critical threshold of 30% of the maximum population (1.65 million animals), the point at which all removals should cease under the control-rule model. This seems to have been set on the pragmatic rather than empirical basis (see: DFO 2001) that this is around the reduced number from which the population has recovered in the past. Modelling simulations have shown that once the declining population had fallen below the 70% threshold, halting the decline with an 80% chance of the population increasing thereafter would mean cutting TACs by more than half. On this basis alone, it is obvious that current sealing activities are far from sustainable.

interactions with other environmental variables Finally, modelling results are predicated upon a number of additional assumptions that may or may not be robust in the long term. These include: stable environmental conditions, (food availability, ice conditions) biological parameters (reproductive and mortality rates) and that the age structure of the hunted animals remains the same overall for the harp seal population.

Some of these assumptions are questionable even in the short term. Assumptions that ice conditions will remain the same are a case in point, especially given the climate-related changes in sea ice extent already reported for the Arctic region. In 1998, 2000 and 2002, poor ice conditions prevailed in the Gulf of St. Lawrence and are thought to have resulted in high pup mortality. In 2002 in particular, large numbers of whitecoats were reported in the water and dead animals were found on beaches along the west coast of Newfoundland. Following similar conditions in 1981, the year class was almost absent from subsequent age class samples collected (Hammill & Stenson 2003a).

The 2004 Arctic Climate Impact Assessment (ACAI 2004) notes that temperatures have risen sharply in the region, especially in winter. At the same time, the average extent of summer sea ice cover has declined by 15-20% over the last thirty years, with an annual average decline of around 8%. The decline is expected to accelerate, such that near total loss of summer sea-ice is projected for the end of the century. It is likely, therefore, that the southernmost edge of the winter sea ice will retreat progressively northwards. Some evidence of decreasing sea ice extent in the Gulf and off the Newfoundland coast is provided by the work of Hill et al. (2002) in their reconstruction of sea ice conditions from 1815 to 1962 and comparisons with data from an existing sea ice database covering subsequent years. Their analysis shows a general downward trend in sea ice extent over the last 50 years.

ACIA (2004) are quite blunt about the likely impacts of these changes for marine mammals, noting that marine species dependent on sea ice are likely to decline, with some facing extinction. Moreover, it must be recognised that, rather than representing an anomaly, bad ice years seem increasingly to be the norm. DFO modelling should assume, therefore, not only that such years are likely to increase in frequency but also that the geographical scale of this impact is likely to increase markedly.

As noted above, it is likely to take some time to detect and verify large-scale pup mortality such as may result from increasingly frequent poor ice conditions. Furthermore, if population estimates and projected trends under exploitation fail to take account of the likelihood of climate-related increased pup mortality (and hence a progressive failure of young to enter the breeding population 4-5 years later), the harp seal population could decline rapidly, perhaps even below threshold values, well before such declines could be reliably detected under current monitoring regimes.

Indeed, projected climate change impacts, in and of themselves, provide sufficient justification for a more precautionary approach to marine ecosystem governance than is currently employed, including an immediate end to the hunting of all ice dependent pinnipeds across their ranges.

The assumption that food availability for seals is likely to remain stable is also highly questionable. ACIA (2004) point out that fisheries are likely to be impacted both positively and negatively by climate change, barring a large-scale ecological regime shift such as has been predicted under some climate change scenarios for Arctic regions. The likely scale and direction of impacts upon capelin, the preferred prey species of harp seals, are similarly uncertain, though it is already known that changes in the distribution of harp seals broadly follow changes in the distribution of their prey (see: Lacoste & Stenson (2000). Parsons & Lear (2001), in their assessment of climate change impacts for the DFO, concluded that there is a link between long-term trends in the North Atlantic Oscillation and the productivity of various components of the marine ecosystem. However, despite the fact that the broad trends are evident, the mechanisms remain poorly understood.

v uncertainty as a backdrop to the canadian harp seal hunt

Essentially, therefore, nearly every aspect of the management of the Canadian harp seal hunt is associated with uncertainties, or more accurately, irreducible indeterminacies. Far from being grounded in a precautionary ethic, the management of this species can be regarded as at best highly speculative and at worst, approaching irresponsible.

The major concerns can be summed up as follows:

- The current harp seal population is estimated at 5.2 million but is subject to wide 95% confidence limits (4.0-6.8 million) due to uncertainties that cannot be easily resolved.
- These confidence limits underestimate the true uncertainty by an unknown extent since they do not incorporate all known sources of error.
- The significance of the confidence limits is not made explicit in the 2003-2005 management plans.
- The use of the 60% confidence interval rather that the 95% confidence interval is not the most conservative nor, therefore, the most precautionary approach
- Current TACs are projected to reduce the harp seal population to 4.7 million by 2006. It is not clear whether this is an average, 95% confidence limit or 60% confidence limit based estimate.
- Current intensity and frequency of pup production monitoring could result in a 10-15 year period before population declines are confirmed
- Estimates of “struck and lost” seals are based on quantitatively poor data and the uncertainties in the figures relative to the whole population are unknown.
- The subsidised Greenland summer hunt appears to be increasing in intensity, but is not sufficiently accounted for in Canadian TAC determinations.
- The population projections are based upon assumptions that environmental and biological factors remain unchanged over the short to long term, a premise that is highly questionable.

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III ECOLOGICAL INTERACTIONS AND FISHERIES

The most intensively debated ecological interaction in relation to harp seal populations in Canada is the significance of their impact on commercially exploited fish species. The collapse of the Northwest Atlantic cod stocks and subsequent moratorium on fishing emplaced in 1992 came as a severe shock to both the fishing industry and its regulators. The dismay was compounded when most of these stocks failed to recover and when, in 2003, the Canadian Government subsequently announced the closure of the northern cod and northern and southern Gulf of St. Lawrence cod fisheries. This decision followed a continued decline in stocks even after fishing effort had been reduced (DFO 2003b). The collapse of these fisheries was, at the time, seen as sudden, drastic and unexpected and sparked a wide-ranging debate as to the causal factors.

i underlying causes of cod stock collapse

The first response of the fisheries managers was to attribute the blame to a variety of external factors, principally anomalously low water temperatures which, it was postulated, were either increasing natural mortality or forcing a southerly population shift (see: Hutchings and Myers 1994). Subsequent analyses (see: CDLI 1996) have led to the recognition that a number of factors could have played a role in this collapse:

1. overly high Total Allowable Catch (TAC) levels for many stocks, set too high because of overoptimistic scientific projections, inadequate understanding of stock dynamics and inaccurate data on commercial fishing activity;

2. under-reporting of actual catches, which caused harvesting overruns, and misleading data for management and scientific assessments;

3. destructive fishing practices such as highgrading, discarding and dumping of immature fish or non-target species; foreign overfishing of straddling stocks on the Nose and Tail of the Grand Banks;

4. failure to control expansion of fishing effort, which in part has been in response to the demands of a processing sector plagued by overcapacity, and failure to minimize the possible adverse impact of various fishing gear technologies;

5. unforeseen and possibly long-lasting ecological changes, including cooling water temperatures since the mid-1980's, changes in water salinity, and shifting predator-prey relationships, particularly among seals, capelin and cod, which have affected adversely the growth, abundance and distribution of various species". (CDLI 1996)

These views are broadly supported by an extensive and comprehensive review of the Northwest Atlantic ground fisheries over the last 500 years compiled by a scientist working for DFO (Lear 1998). This review quotes the Canadian Fisheries Resource Conservation Council (FRCC) as stating that:

"the fishery crisis cannot be related to a single cause or blamed on a single group: it is the failure of our whole fisheries system"

Nevertheless, it must be remembered that the cod fisheries collapse took place against a strong background of institutional fisheries science, which in theory provided the major checks and balances. At the time that it was founded in 1979, the Department of Fisheries and Oceans was arguably the strongest in the world (Kenchington 1998). Later in his submission to the Standing Committee on Fisheries and Oceans, Kenchington (1998) went on to state that, after 20 years of fiscal cuts, the level of ability and motivation among DFO's scientists had been considerably eroded, such that its capabilities could be regarded as seriously questionable.

Indeed, the concerted attempts by the fisheries managers to blame the collapse on external factors provoked a remarkable, stinging, critique of the DFO by Hutchings et al. (1996), which convincingly portrayed the science output of DFO as being in the thrall of the political processes served by bureaucrats (see also: Brubaker 2000). In relation to the northern cod stocks the authors concluded:

"The perceived need for scientific consensus and an "official position" has seriously limited the effectiveness of government based research to contribute effectively towards an understanding of the collapse of the Atlantic cod. Non-science influences on fisheries research incompatible with normal scientific inquiry included:

* government denunciation of independent work
* misrepresentation of alternative hypotheses
* interference in scientific conclusions
* disciplining of scientists who communicated publicly the results of peer-reviewed research and
* misrepresentation of the scientific basis of public reports and government statements". (Hutchings et al. 1996)

ii other experiences in marine resource mismanagement

The cod fishery collapse is undoubtedly the most conspicuous example of poor fishery management practices under Canadian jurisdiction and has often been cited as a case example of such failures (see e.g. O'Reilly Hinds 1995, Charles 1997, Mitchell 1997, Sinclair et al. 1999). However, it is by no means the only such example within Canadian waters. Hutchinson et al. (1997) outlined similar concerns in relation to management of the salmon fishery on the Canadian west coast.

In the case of the Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus), long exploited in North American waters, landings from the Canadian fishery were reaching a peak in the early 1990s at a time when much stricter controls were already emplaced in the USA (Smith and Clugston 1997). This long-lived and slow growing species, which in colder northern waters reaches sexual maturity at around 27-28 years, is particularly vulnerable to overexploitation. It is thought that the highly targeted fishery for this species, concentrated in the St. Lawrence River and all too often taking immature fish, was a major contributor to the severe decline in Canadian stocks observed during the last decade.

Similar concerns extend to shellfish and other invertebrate fisheries in Canadian waters. For example, Wallace (1999) notes that the Northern abalone (Haliotis kamchatkana) in British Columbia had been exploited almost to commercial extinction during the 1980s, necessitating a total closure of the fishery in 1990. Since then, there has been only limited evidence for recovery, probably due in part to continued illegal "poaching" encouraged by high market value.

More recently, Perry et al. (2002) described the rapid "boom and bust" development of the fishery for green sea urchin (Strongylocentrotus droebachiensis) in British Columbia. From its initiation in 1986, to supply a primarily Japanese market for urchin roe, the fishery had reached crisis point within only a few years. Management measures such as licensing, periodic area closures and minimum size restrictions failed to curb

exploitation in the early 1990s, during which both landings and prices initially increased rapidly before collapsing in 1993. Since then, yet more stringent management controls have been applied, with some evidence of recovery in catch per unit effort. It is worth noting, however, that this fishery had been allowed to develop to the brink of commercial extinction with very limited knowledge of stocks and their distribution, the first scientific survey being conducted only in 1995.

Lack of scientific information regarding life histories and possible ecosystem interactions continues to underlie the various fisheries for krill in Canadian waters (on both the Pacific and Atlantic coasts). Although at present neither the fisheries in waters off British Columbia nor in the Gulf of St Lawrence are particularly heavily developed, substantial concerns surround potential impacts at ecosystem level, including on the endangered right whale on the Scotian Shelf, should commercial exploitation of these organisms expand in the future (Nicol and Endo 1999). The ability of existing monitoring and control regimes within this sector to detect impacts and warn of systematic depletion remains in question.

Even in a long-established and well-studied fishery as the Atlantic lobster fishery, for which management regimes are generally considered to have been a success, conservation concerns nevertheless remain (Charles 1997). Declines in catches during the mid to late 1990s following high takes in the previous decade, though blamed by some on natural variation in recruitment and population density, may equally foretell impending collapse of the fishery. Investigations during the mid 1990s revealed a lack of proper enforcement of management controls, such that developments in technology and practice were allowing substantial increases in effort to go largely undetected, while at the same time the fishery focused heavily on immature individuals. In the light of these findings, substantial changes have apparently since been introduced in an attempt to achieve a sustainable harvest (Charles 1997).

Management difficulties therefore seem to be something of a recurring theme within the Canadian experience of marine resource exploitation and conservation. There may be many and varied reasons for this apparent phenomenon, including the difficulties presented by the sheer size and complexity of Canada's coastline. Juda (2003) offers a useful perspective on the problems, including the contribution from the institutional dimension of governance and the associated limits to the practical implementation of the objectives of the Oceans Act (1996). In addition, impacts of climate variability can be inferred upon the stock dynamics of various commercially targeted species, though it is only in relatively recent years that the full potential scope of such impacts has become a focus for research (Parsons & Lear 2001)

iii significance of seals as a factor in poor recovery of depleted fish stocks

Following the cod stock collapse fisheries managers sought explanations that, in effect, tended to shift the focus away from them. One of the potential contributory factors, namely changed predator-prey relationships between seals and capelin, has come under particularly heavy scrutiny. The failure of the cod stocks to recover, while the harp seal population continued to increase, led to the idea that seal predation was the reason for the failure. This idea gained considerable currency, and became highly politically charged. As an illustration, the key element of scientific research of the action plan devised to help those affected by the fisheries closure (DFO 2003c) was a two year, $6 million expansion of activities to evaluate and assess the impact of seals on fish stocks.

the eminent panel on seal management The tensions surrounding the "seals eat cod" issue had already been highlighted in an earlier Report from the Eminent Panel on Seal Management (DFO 2001), commissioned by DFO ostensibly:

"to provide advice on the best strategies for management of seal populations in Atlantic Canada, including a balanced and objective view of scientific information on seal populations and predator-prey relationships and how this information can contribute to development of management strategies".

The majority of the Eminent Panel expressed the view that, while available evidence confirmed that seals consumed large numbers of fish (albeit with considerable uncertainties attached), there was much less evidence that this was having a major impact on commercial fish stocks. However, a non-scientific member of the panel, former high level public servant Mr. David Vardy, insisted on the insertion of a statement dissenting from this consensus view. Mr. Vardy, who had served in a variety of positions at deputy minister level within the Newfoundland provincial government over a period of close to 30 years, advanced the view, contrary to the scientific findings of the Panel, that depleted cod stocks were especially vulnerable to seal predation. Furthermore, he insisted that, while cod formed a relatively small proportion overall of fish consumed by seals, the total was still high in relation to the amount of cod remaining. It is interesting to note that Mr. Vardy's provincial political affiliations are strikingly similar to those of John Efford, whose radical, even extreme, views on the culpability of seals are discussed below.

Certain other aspects of the Panel's report were less conclusive and, therefore, less polarised. For example, the panel advanced the view that removal of a large proportion of the seal population in management Divisions 2J3KL and 4RS3Pn could reasonably be expected to have a substantial effect on the size of the fish stocks. In an apparent paradox, however, they also pointed out that reduction of seal numbers generally would not promote a rapid recovery of cod stocks, which would still be slow even in the absence of seals. Ultimately, the panel concluded that, in the absence of a more detailed analysis incorporating a wide range of assumptions, any prediction of benefits to cod stocks of sealing would be purely speculative.

Although it is not entirely clear upon what basis the conclusion concerning areas 2J3KL and 4SR3Pn was reached, it seems to have been based on the rather limited conclusions of Bundy (2001). Indeed, a later evaluation by DFO (Stenson & Perry 2001) stated that the relative importance of seal predation upon cod stocks would not be amenable to analysis until other sources of natural mortality had been quantified. In arriving at their estimate that harp seals accounted for 37,000 tonnes (95% confidence interval 14,000-62,000 tonnes) of Atlantic cod consumption in NAFO Division 2J3KL (Eastern Newfoundland, Southern Labrador), compared to a total consumption for the Division of all fish species by harp seals of 1.116 million tonnes, Stenson & Perry (2001) noted that predation by seals was a normal ecological interaction. These authors also considered that much more research was required. This theme was also evident in the consideration of Area 4T cod stocks (Hammill et al. 1999). The absence of comprehensive diet information for pinniped species, and a need to consider seal predation in the context of overall natural mortality prevented any evaluation of the impact of seal species on cod stocks.

In the case of the southern Gulf of St. Lawrence, estimates of cod consumption by harp seals are still lower. Harp seals in region 4T were estimated to consume only around 60 tonnes of cod a year, although grey seals were estimated to consume 5,700 tonnes (Hammill & Stenson 2002). Stenson and Hammill (2004) estimated a consumption of 27,000 tonnes of cod in Division 4RS3Pn. In all of the above studies, attention was drawn to the large number of unverified assumptions made in the estimates and to the fact that many uncertainties remained unresolved.

the significance of Atlantic cod to harp seal diet Any prediction of likely benefit to cod stocks from a reduction in the harp seal population is complicated by the fact that harp seal diet seems to vary according to location and season and cannot be simply assessed as an average. Harp seal stomachs from 1167 animals collected from nearshore waters between 1990 and 1993 were examined by Lawson et al. (1995). Of 62 fish species consumed, six accounted for the majority of the fish consumption. Sculpins and the non-commercial Arctic cod (Boreogadus saida) were the main prey items of seals in nearshore waters off Labrador. Atlantic herring replaced sculpins in the diet of seals from northeastern Newfoundland. Seals from the west coast of Newfoundland consumed capelin, herring, Atlantic cod, redfish and Arctic cod, while Atlantic cod and redfish were important to seals along the south coast of Newfoundland. In Northeastern Newfoundland, the relative importance of herring, capelin and squid increased during the summer, although Arctic cod was the dominant species taken. In 1992, invertebrates and capelin appeared to increase in importance (Lawson et al. 1995; Beck et al. 1993).

In offshore areas, diets have been found to be different to those documented in nearshore areas. Arctic cod, capelin and Greenland halibut were important prey species. Atlantic cod were also found in the stomachs of seals, though significantly the authors noted that, while the stomachs of seals caught as by-catch in the groundfish trawl fishery contained exclusively cod, seals caught by other means in the same areas contained none. This was thought likely to be due in part to seals feeding on discarded cod from trawler operations. Similarly, although cod made up more than 30% of the total weight (wet mass) of prey recorded in the stomachs of seals shot in southern Labrador in spring, these fish were present in only a small proportion of the stomachs examined (Lawson & Stenson 1997).

Finally, in both nearshore and offshore waters, harp seals have been reported preferentially to select capelin relative to other species when given the choice (Lawson, et al 1998). In nearshore waters (though not, it seems, in offshore), Arctic cod were also preferentially selected. Harp seals were neutrally selective towards Atlantic cod, American plaice and Greenland halibut. The broad relevance of these results to the wider harp seal population, however, is limited by the relatively small sample sizes and hence large uncertainties about how representative these estimates are. Put simply, these findings cannot be reliably extrapolated to the harp seal population at large.

Even if the population estimates and consumption estimates are considered accurate and reliable, attempting to restore cod stocks by removing seals might simply result in increased consumption by other predators. Perhaps in recognition of the complexities involved, DFO now seems to be distancing itself from the argument that seal predation may be behind the failure of the cod stocks to recover from overfishing. Their treatment of the subject in the 2004/2005 DFO Factsheet (DFO 2004) is reproduced in full below, and makes for interesting comparisons against information contained in earlier versions:-

* "Studies of predation by seals on fish in Atlantic Canada have focused on harp seals and grey seals. Predation by harbour and hooded seals has also been estimated. Harp seals accounted for the largest amount of consumption, followed by hooded and grey seals. However, recent data on diets of hooded seals suggest that they may also be important fish predators.
* The commercial seal quota is established based on sound conservation principles, not an attempt to assist in the recovery of groundfish stocks.
* Seals eat cod, but seals also eat other fish that prey on cod. There are several factors contributing to the lack of recovery of Atlantic cod stocks such as fishing effort, the poor physical condition of the fish, poor growth, unfavourable ocean conditions and low stock productivity at current levels.
* It is widely accepted in the scientific community that there are many uncertainties in the estimates of the amount of fish consumed by seals. Seals and cod exist in a complex ecosystem, which mitigates against easy analysis or simple solutions to problems such as the lack of recovery of cod stocks". DFO (2004)

This contrasts with the 2000 version where estimates of seal fish consumption are given in more detail, including the estimate that harp seals took 90,000 tonnes of Atlantic cod (DFO 2000b) although it was pointed out that commercial species comprised only a small proportion of the overall diet. This estimate fell to 75,000 tonnes in the 2001 fact sheet, while in the 2002 fact sheet no figures are given for harp seals but an estimate of 55,000 tonnes is given for grey seals. In 2003, the figure was revised downwards again to 37,000 tonnes. No figure was provided for 2004/5.

to kill or not to kill? - seal culling as a fishery management strategy The interaction of marine mammals with fisheries in competitive terms has also come under scrutiny with respect to the perceived impact of whales on fish stocks. This broader context has been examined in some detail (Kaschner & Pauly 2004). They consider that the simplistic food consumption models coupled with so-called "surplus yield" calculations constitute a naïve approach. They point out that these approaches exhibit a somewhat crude understanding of complex ecosystem interactions. In fact, rather than cull marine mammals to increase fish stocks, they conclude that a more fruitful approach might be to:

"spend some time thinking about the fact that marine mammals- and other top predators- have been "successfully managing" marine resources, consuming larger amounts than those taken by global fishing operations today, for millennia. Unlike us, they appear to have done so sustainably, without causing their prey species to collapse. Maybe we could learn something from them."

The uncertain benefits of managing seal populations to improve fish stocks are also outlined by Lavigne et al. (1999) in a measured discussion of the impacts of harp seals upon fisheries in Canada. As an illustration of the extraordinarily entrenched position of some in the political domain, however, he cites the incendiary statements made by John Efford to Newfoundland's House of Assembly on 4 May 1998:

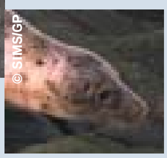
"… Mr. Speaker, I would like to see the six million, or whatever number is out there, killed or sold, or destroyed or burned. I do not care what happens to them. The fact is that the markets are not there to sell more seals. What they (the fishermen) wanted was to have the right to go out and kill the seals. They have that right, and the more they kill the better I will love it." (Efford 1998)

In March 1999, Efford called on the federal fisheries minister to increase the quota for harp seals from the current 275,000 to between 475,000 and 575,000, with a view to cutting the population in half (see Hamilton 1999). In 2003, he was named Minister of Natural Resources and has since served as a member of the standing committees on Canadian Heritage and on Fisheries and Oceans.

Given the documented vulnerability of scientific work and scientists within DFO to political manipulation, a situation that is likely still to exist to some extent, the current cabinet position of John Efford gives rise to justifiable concern. Indeed, he seems already to have a track record of political interference in scientific studies. As Minister of Aquaculture and Fisheries of Labrador and Newfoundland he sponsored a consultancy study that aimed at proving that the TACs imposed by DFO were smaller than could be sustained by the population.

"The findings of the study should be drawn on by the Department of Fisheries and Oceans to develop an informed management strategy for the burgeoning harp seal herd". (Government of Newfoundland and Labrador 1999).

Mr. Efford apparently continues to maintain an aggressive pro-sealing stance (Jaimet 2003). Recognising the prominence of such views, the question has to be posed as to what extent the TACs allocated for the Canadian harp seals have been driven by political imperatives as opposed to being informed by science. Certainly, as is illustrated by the discussion above, there is no scientific basis for increasing TACs to their current high levels as a means of facilitating cod stock recovery.



iv summary of harp seal interactions with groundfish fisheries

Overall the following conclusions can be drawn in relation to harp seal populations and cod:

* The prevailing scientific view, and also that of the Canadian fisheries managers in DFO, is that harp seals (or indeed any seal species) were not responsible for the collapse of the Atlantic cod population. This was caused by overfishing.
* The mismanagement of cod stocks is one example of several which can be documented from Canadian waters.
* In the aftermath of the collapse in cod populations, which led to a moratorium on fishery activity in 1992, it became clear that the DFO's scientific advice in relation to the stocks had been inaccurate
* During the period from 1979-1999, the DFO underwent a protracted period of restructuring and financial cuts which seriously undermined its expertise base and capacity
* DFO was exposed as particularly vulnerable to political interference in its scientific work as evidenced by a number of documented, non-science related (political) actions taken against personnel engaged in the process of scientific inquiry.
* The cod stocks failed to recover, leading to total closure of cod fisheries in southern and northern Newfoundland in 2003. This recovery failure was widely portrayed as due to seal predation by politicians and industry representatives.
* The degree to which political considerations are reflected in the published 2001 findings of the Eminent Panel on Seal Management on the issue of seals and fisheries is not clear. A dissenting statement from the consensus view, however, was filed on the issue of fisheries and seals by a senior political figure and non-scientist Mr. David Vardy.
* The pro sealing view of senior politician John Efford was predicated largely upon the premise that seals were responsible for the failure of groundfish stocks to recover and this view was articulated in an extreme manner within the Newfoundland provincial legislature. Mr. Efford has now entered office as the Federal Minister of Natural Resources, and continues to have a pro-sealing stance.
* Following the 2003 fisheries closure, an element of $6 million CAD was allocated to conduct seal research as part of the government industry support package.
* Initially DFO apparently supported the view that seal predation might be responsible for groundfish stocks remaining low, but between 2000 and 2003 had revised estimates of cod taken by harp seals from 90,000 tonnes down to 37,000 tonnes; no figure was estimated for 2004-2005.
* Estimates of groundfish consumption by seals made by DFO have been made using a variety of unverified assumptions and are subject to a wide number of unquantified and uncharacterized uncertainties.
* The prevailing scientific view is that the failure of cod stocks to recover is a multifactorial phenomenon and that the biological and physical ecosystem interactions are not easily understood.
* Increased TACs for harp seal cannot be justified on the grounds that cod stocks will be helped to recover.

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conclusions

Many specific conclusions have already been drawn from the discussions presented above. What crystallizes from this analysis overall, however, is the highly questionable nature of the decision to resume the commercial hunt for harp seals in scientific and ecosystem governance terms. Given the numerous and substantial uncertainties associated with the long-term future of the harp seal even in the absence of hunting activities, combined with the equally prevalent uncertainties characteristic of the Atlantic Seal Hunt Management Plan itself, it is difficult to see how resumption of any commercial hunting could be considered a responsible management approach.

Continuation of the commercial hunt cannot be reconciled against maintenance of the long-term conservation status of the harp seal, itself likely to be increasingly threatened by the onset of climate change-related impacts to the sea ice ecosystem. Until such time as the substantial uncertainties surrounding the status of, and various pressures on harp seal populations can be fully resolved, including those relating to climate change, such that reliable assessment and control could feasibly be exercised, the only sustainable and scientifically justifiable course of action must be to suspend the commercial hunt immediately. In fact, it is virtually certain that most of these uncertainties will never be adequately resolved.

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