Status of Marine Mammals in the North Atlantic

THE RINGED SEAL

(Photo C. Lydersen)

This series of reports is intended to provide information on North Atlantic marine mammals suitable for the general reader. Reports are produced on species that have been considered by the NAMMCO Scientific Committee, and therefore reflect the views of the Council and Scientific Committee of NAMMCO.

North Atlantic Marine Mammal Commission
Polar Environmental Centre N-9296 Tromsø, Norway
Tel.: +47 77 75 01 80, Fax: +47 77 75 01 81 Email: nammco-sec@nammco.no, Web site: www.nammco.no

RINGED SEAL *(Phoca hispida)*

The ringed seal is the smallest of all living seal species, with males reaching a length of 1.5 m and a weight of 95 kg, and females 1.4 m and 80 kg (Bonner 1994). The ringed seal has a north circumpolar distribution. It is the most ice-adapted of seals, and is known to occur throughout the Arctic Ocean, including the north pole (Reeves 1998). The name of the ringed seal refers to the light-coloured rings on the dark grey pelt that are visible on adult animals.

Distribution and stock definition

In the North Atlantic the ringed seal occurs in marine areas virtually everywhere where there is seasonal ice cover (Fig. 1, not yet completed) (Reeves 1998). In the Western Atlantic they occur as far south as northern Newfoundland, northward to the pole and throughout the Canadian Arctic archipelago. They occur throughout Greenland, but are most abundant where fast ice occurs. Ringed seals occur around Svalbard and Franz Josef Land, and are occasionally encountered in the Faroe Islands and off northern Iceland. In the Eastern Atlantic, ringed seals inhabit the entire Eurasian Arctic coast, including the coastal waters of the White Sea and southeastern Barents Sea, the Gulf of Bothnia and the Baltic Sea. Freshwater populations of ringed seals occur in Canada and in Lakes Ladoga and Saimaa in Europe (Sipilä and Hyvärinen 1998).

There is no definitive genetic or other information to differentiate stocks of ringed seals. Their distribution is virtually continuous and there are few geographical barriers that would prevent their dispersion. Indeed, individual tagged ringed seals have been shown to move very long distances on occasion (Kapel *et al.* 1998, Ridoux *et al.* 1998, Teilmann *et al.* 1999). However, most tagged seals have been recaptured in the same general area where they were tagged (Kapel *et al.* 1998). There is no compelling evidence that ringed seals undertake co-ordinated seasonal migrations, as do many other seal species.

On a North Atlantic scale, the NAMMCO Scientific Committee (NAMMCO 1997) recognised 3 stock areas (Fig. 1), based primarily on the low likelihood of mixing between the areas. While there is presently no genetic or other evidence to support such stock divisions, they are useful in determining the status of North Atlantic ringed seals. Area 1 is centred on Baffin Bay and includes northeastern Canada and West Greenland. It is separated from Area 2, which includes East Greenland and the Greenland Sea east to Svalbard, by the Greenlandic land mass. Area 3 includes the Barents and Kara Seas east to the Severnaya Zemlya, where it was considered that ice conditions and low productivity would limit the movements of ringed seals.

Ecology

The following is from Reeves (1998) unless otherwise indicated. Ringed seals occur in areas of landfast and drifting pack ice over virtually any water depth. While they may prefer areas of landfast ice for breeding, they may also breed successfully in areas of stable pack ice, such as Baffin Bay or the Greenland Sea. Unlike other northern seals such as harp and hooded seals, the ringed seal is completely adapted to ice-covered waters and does not migrate to open water areas in the winter. Instead ringed seals are able to maintain several breathing holes in ice that may be over 2 m in thickness, using their strong sharp foreclaws and teeth to scratch through the ice. During the summer ringed seals forage in areas of pack ice or open water, and may haul out on land where no ice is available.

Female ringed seals begin to reach sexual maturity at age 4 to 5, but the timing is variable and some may not mature until they are 7 to 8 years old. Males mature about 2 years later than females. Thereafter ringed seal females usually have one pup per year, although this may decline if conditions are not favourable (eg. Kingsley and Byers 1998). Ringed are relatively long-lived and animals as old as 45 years have been found in Svalbard (Lydersen 1998).

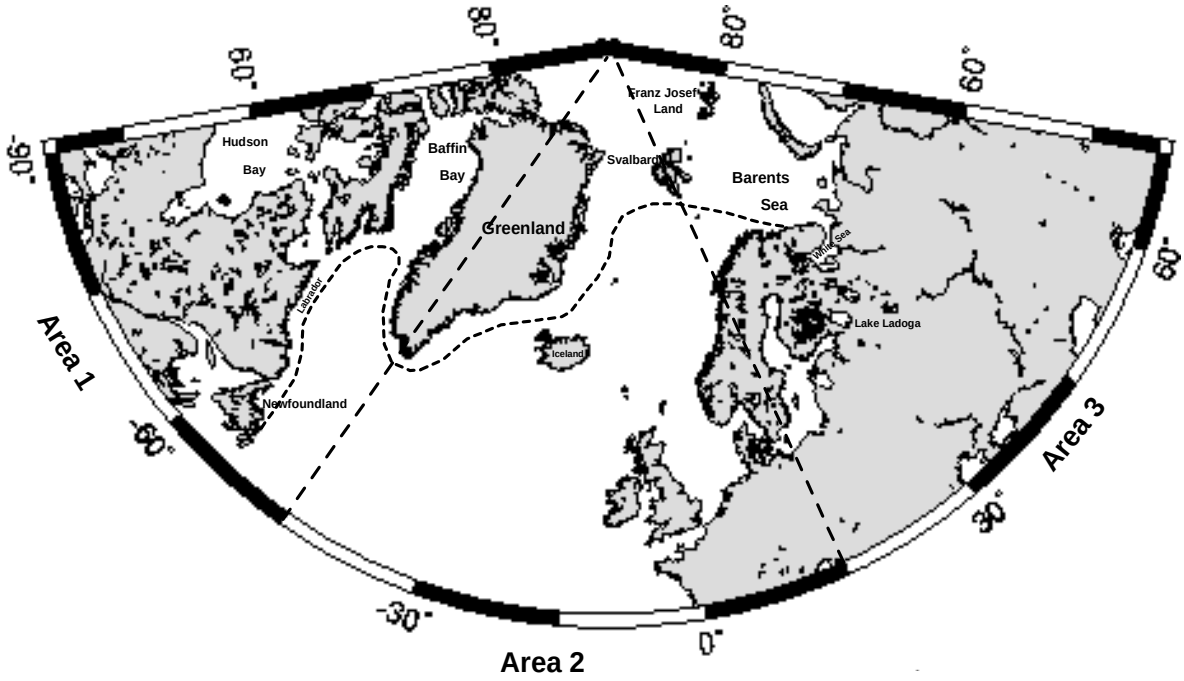

Figure 1. Map showing the approximate southern limit of the distribution of ringed seals in the North Atlantic. Stock areas designated by the NAMMCO Scientific Committee are shown.

Breeding takes place in April to May, probably beneath the ice. During this period the male seals exude a smelly substance from glands in their face and exhibit territorial behaviour (Lydersen 1998). Before giving birth the female excavates a birth lair in a snowdrift over a breathing hole, and it is here that her pup is born in late March or April. The lair provides a warm microclimate for the growing pup, reducing its energy requirements to keep warm (Belikov and Boltunov 1998). However in some areas, like the Baltic Sea (Härkönen *et al*. 1998), ringed seal pups are born on bare ice. Like many ice-breeding seals, the newborn pup has a white natal coat that is shed in 4 to 6 weeks and replaced by a coat with juvenile coloration. The pup nurses for 5 to 7 weeks, but is also quite active during this period and may spend a large proportion of its time making short feeding dives under the ice (Lydersen 1998).

Ringed seals are opportunistic feeders and prey on a wide variety of fish and invertebrates. Adult ringed seals prefer to feed on pelagic schooling fish in most areas, with polar cod (*Boreogadus saida*) and capelin (*Mallotus villosus*) being the most commonly consumed species. However younger animals, and adults in some areas and seasons, feed heavily on smaller prey such as amphipods and euphausids (Lydersen 1998, Siegstad *et al.* 1998). Ringed seals feed less intensely during the spring moult than at other times of the year, and are leaner and consequently sink more easily when hunted in the early summer.

Ringed seals are the only Arctic seal that regularly maintains breathing holes in fast ice. They therefore occupy a vast area of habitat that is impenetrable to other seal species for much of the year. During the open water season and in areas of pack ice, they may occur with other seal species such as walrus (*Odobenus rosmarus rosmarus*), harp seal (*Phoca groenlandica*), hooded seal (*Cystophora cristata*) and bearded seal (*Erignathus barbatus*), and also whales such as beluga (*Delphinapterus leucas*), narwhal (*Monodon monoceros*) and bowhead whale (*Balaena mysticetus*). The diets of all these species, except for walrus and bearded seal, may overlap with that of ringed seals, and thus competition may be a factor affecting distribution and abundance in some areas. Ringed seals have

little interaction with commercial fisheries, both because they do not consume commercial fish species to any great extent, and because they do not often occur in areas subject to intense commercial fishing.

Polar bears (*Ursus maritimus*) are by far the most important predator on ringed seals. Polar bears prey on little else but ringed seals, and commonly kill a seal every 2 to 6 days. They kill seals in their sub-nivean lairs by crashing through the snow roof. They also stalk seals lying on the ice in the spring and summer, in ice cracks and even in open water. Polar bears tend to be most successful at killing pups and sub-adult seals, but adult seals are also taken. Ringed seals area also preyed upon by walrus, killer whales (*Orcinus orca*) and perhaps by Greenland shark (Ridoux *et al.* 1998). In addition, pups are taken by Arctic foxes (*Alopex lagopus*) and ravens (*Corvus corax*) in the spring.
Predators

Abundance and trends
Ringed seals are difficult to count. Other ice breeding seals, such as harp (*Phoca groenlandica*) and hooded (*Cystophora cristata*) seal, bear their pups on the surface of the ice. Aerial surveys for these species are conducted to count the pups during breeding season, and pup counts are then converted to total population estimates. Ringed seals give birth in lairs under the snow that are practically invisible from the ice surface. While they commonly haul out on the ice during the moulting period in late spring, it is unlikely that the entire population would be on the ice surface at any given time. Aerial, ground- or ship-based surveys can detect only those seals that are on the ice or at the surface of the water, and this proportion is usually unknown. Therefore, estimates of ringed seal abundance are simply not available for most areas.

Despite these difficulties, aerial surveys of fast-ice areas during the spring have been the most widely used method of assessing the abundance of ringed seals, although it is widely recognised that such counts are underestimates (reviewed by Reeves 1998). Counts of breathing holes and/or birth lairs using trained dogs have also proven effective in some areas (Hammill and Smith 1990, Lydersen 1998).

Some estimates of abundance have been derived by calculating the number of ringed seals required to support the predation of polar bears and humans in the area. The abundance of polar bears is usually more accurately known than the abundance of ringed seals. For example, Kingsley (1998) used a population estimate for polar bears in Baffin Bay, estimates of their food requirements, and the human harvest by Canada and West Greenland to estimate that there must be at least 1.2 million ringed seals in the area to support this level of predation. Kingsley (1990) used a similar approach to calculate that there must be at least 4 million seals in the Canadian Arctic.

The NAMMCO Scientific Committee (NAMMCO 1997) derived a rough estimate of the abundance of ringed seals in Area 1 (see above) of approximately 1.3 million seals, based on extending existing estimates to areas of similar habitat. This estimate has a large contribution from pack ice areas, where knowledge of ringed seal density is particularly poor. Nevertheless it is similar to the estimate by Kingsley (1998) for roughly the same area.

Because of the difficulties in deriving estimates of abundance, there is little information on trends in abundance for most areas. Short-term fluctuations in the numbers of young seals produced have been documented (eg. Kingsley and Byers 1998) and are likely related to annual variations in ice conditions. Seasonal reductions in abundance in the vicinity of hunting communities have also been noted (Reeves 1998). The only areas where population reductions that can definitely be related to overharvesting have been noted are in the Okotsk Sea and the Baltic Sea. Both these areas were subjected to large-scale commercial harvesting in the past. This harvesting has since been reduced (Okotsk Sea) or has ceased (Baltic Sea), and ringed seal populations are now thought to be recovering in these areas (Reeves 1998). Some small lake populations have also been affected by hunting (Sipilä and Hyvärinen 1998).

Current management and utilisation

Ringed seals are the "daily bread" of many northern peoples. Particularly the Inuit of Arctic Canada and Greenland are heavily dependent on ringed seals for food, and for skins for clothing and for sale. Indeed it can be said that, in some areas of the Arctic at least, the widespread and year-round existence of ringed seals made human life possible.

Ringed seals skins also have commercial value, although less today than at some times in the past (Reeves *et al.* 1998). The sale of the skins of young ringed seals continues to be an important source of cash income in Arctic Canada and Greenland (Reeves *et al.* 1998, Teilmann and Kapel 1998) and has been so in the past in some areas of northwestern Russia (Belikov and Boltunov 1998)

Ringed seals are hunted using a variety of methods, depending on the habitat, season and available equipment. Methods used in Arctic Canada and Greenland include stalking and shooting basking seals on the ice in the spring, open water shooting, harpooning and/or shooting at breathing holes, and netting using nets set in open water or under the ice (Reeves *et al.* 1998, Teilmann *et al.* 1998). In Canada, during the pupping season, the birth lairs of the highly-valued whitecoat pups are sought using dogs, or by looking for slight irregularities in the snowdrifts on the ice. The young seal is captured by jumping on the roof of the snow-covered lair, crashing through it and preventing the pup from diving down the breathing hole. In Russia, ringed seals are hunted by shooting on the ice or in open water, and by netting (Belikov and Boltunov 1998).

In most areas there are relatively few restrictions on the hunting of ringed seals. In Canada, Greenland and Russia, a licence is required, but there are almost no restrictions on season or the number of animals that can be taken (Belikov and Boltunov 1998, Reeves *et al.* 1998, Teilmann and Kapel 1998). Wastage is specifically prohibited in Canada. The lack of catch quotas means that there has been no requirement for hunters to register their catch. While records of commercial trade in sealskins exist for some areas, these may represent a variable and sometimes small proportion of the number of seals that are actually taken. Hence historical catch records for ringed seals are in many cases poor and incomplete. This situation is changing, however. Greenland has been collecting complete harvest statistics for all species since 1992 under the *Piniarneq* system (Teilmann and Kapel 1998), and harvest studies are a part of some native land claims in Arctic Canada (Reeves *et al.* 1998).

Ringed seal catches in Canada have varied considerably throughout the 20th century, in response to market fluctuations, and changes in settlement pattern and hunting technology (Reeves *et al.* 1998). Up to 48,000 ringed seal skins were traded commercially in the 1970's, whereas more recent trade figures have been in the low 1000's. However total catch in recent years is thought to have been in the neighbourhood of 50,000 to 65,000 annually, and perhaps up to 20% higher than this when hunting losses are considered.

Catches in Greenland have also varied greatly, as has the reliability of the catch reporting system (Teilmann and Kapel 1998). Ringed seal catches appear to have varied in response to changing environmental conditions, particularly temperature and ice cover. Catches may have been as high as 100,000 annually in the 1970s, and as low as 30,000 in the 1950s. Recent catches have been between 70,000 and 90,000, with no obvious trend (Table 1).

YEAR	CATCH	SOURCE
1994	70,971	NAMMCO 1998
1995	72,560	NAMMCO 1999
1996	89,782	NAMMCO 2000
1997	69,663	NAMMCO 2001
1998	82,108	NAMMCO 2001
1999	83,437	NAMMCO 2002

Table 1. Reported catches of ringed seals from Greenland.

Catch records are available only for the commercial portion of the western Russian catch of ringed seals, and the proportion of the total catch represented by the commercial catch has probably varied in response to market factors (Belikov and Boltunov 1998). Commercial catches have been as high as 12,000 annually during some parts of the 20th century, but recent catches have been only a few hundred. However it must be emphasised that this does not represent the true catch of ringed seals, since a large proportion are presumably kept for domestic consumption.

Threats

The distribution of ringed seals does not coincide with intensive fisheries in most areas, so they are seldom accidentally caught in fishing gear. However, capture in fishing gear is a problem for some small lake populations (Sipilä and Hyvärinen 1998) and in the Baltic Sea (Härkonen *et al.* 1998). Young seals seem particularly susceptible to capture in nets.

In addition to their direct toxicity, anthropogenic contaminants may affect the resilience and increase susceptibility to disease in marine mammals (Reijnders and de Ruiter-Dijkman 1995). Relatively high levels of chlorinated hydrocarbons are found in the blubber of ringed seals in some areas, probably as a result of atmospheric transport to the Arctic (Reeves 1998). In addition, metals including cadmium, mercury, zinc and selenium accumulate in other tissues (Dietz *et al.* 1998). Mercury contamination is a particular problem for some freshwater populations, and is thought to have contributed to elevated mortality of ringed seal pups in Lake Saimaa (Sipilä and Hyvärinen 1998). Environmental contaminants have also been implicated as a factor in the reduced fertility of Baltic Sea seals, which has inhibited the recovery of the population (Härkonen *et al.* 1998, Harding and Härkönen 1999). For most other areas, however, there is little evidence that contaminants are an immediate threat to ringed seals.

Increased oil exploration, drilling and shipping are potential threats to ringed seals in some areas. Ice breakers may directly disrupt the ice habitat of ringed seals, although this is likely of little significance in most areas. Noise from shipping and industrial activities may disturb ringed seals and disrupt their activities, possibly leading to the abandonment of prime habitat (Reeves 1998). Generally, however, the rather isolated and inaccessible habitat of ringed seals has provided them some protection from these threats, at least to date.

A potential long-term threat to ringed seals is human-induced global warming. The effects of such warming are thought to be greatest in polar regions. There has been a decrease in the extent, duration and area of Arctic sea ice since the 1970s (Johanessen *et al.* 1995). This has led to a decrease in the condition and survival of polar bears in Western Hudson Bay in Canada (Stirling *et al.* 1999), probably because of reduced access to their major prey, the ringed seal. It is not known if there have been effects on the ringed seals themselves. A reduction in the extent and duration of ice cover would directly reduce the habitat available to ringed seals. It might also lead to increased pup mortality due to the early destruction of birth lairs. In the southern Baltic Sea, a series of nearly ice-free winters from 1989-1995 led to very high pup mortalities (Härkönen *et al.* 1998).

Status and outlook

Ringed seals do not form large seasonal aggregations, as do some other seal species, and often occupy areas of pack ice that are extremely remote and inaccessible to hunters. These factors decrease their vulnerability to overexploitation. Harvests in Canada, Greenland and Russia have been sustained for hundreds or even thousands of years with little evidence of depletion. On the other hand reliable information on ringed seal numbers is lacking for most areas, so it is not possible to describe trends in the populations. The NAMMCO Scientific Committee concluded that harvests of ringed seals in the Baffin Bay area (Area 1, Fig. 1) were likely sustainable, but cautioned that more information was needed on ringed seal distribution and numbers, especially in pack ice areas (NAMMCO 1997). Harvests in other areas of the North Atlantic presently pose no threat to the populations.

The Baltic Sea population has been overexploited and is presently depleted. However, some recovery

in this population has been observed in recent years (Härkönen *et al.* 1998).

References

[NAMMCO] North Atlantic Marine Mammal Commission. 1997. Report of the Fourth Meeting of the Scientific Committee. In: NAMMCO, *Annual Report 1996*. Tromsø, Norway, pp. 97-178.

[NAMMCO] North Atlantic Marine Mammal Commission. 1998. Greenland - Progress report on marine mammal research, 1995. In: NAMMCO, *Annual Report 1997*. Tromsø, Norway, pp. 215-218.

[NAMMCO] North Atlantic Marine Mammal Commission. 1999. Greenland - Progress report on marine mammal research, 1996. In: NAMMCO, *Annual Report 1998*. Tromsø, Norway, pp. 139-40.

[NAMMCO] North Atlantic Marine Mammal Commission. 2000. Greenland - Progress report on marine mammal research, 1997. In: NAMMCO, *Annual Report 1999*. Tromsø, Norway, pp. 221-222.

[NAMMCO] North Atlantic Marine Mammal Commission. 2001. Greenland - Progress report on marine mammal research, 1998-1999. In: NAMMCO, *Annual Report 2000*. Tromsø, Norway, pp. 303-306.

[NAMMCO] North Atlantic Marine Mammal Commission. 2002. Greenland - Progress report on marine mammal research, 2000. In: NAMMCO, *Annual Report 2001*. Tromsø, Norway, pp. 279-282.

Belikov, S.E. and Boltunov, A.N. 1998. The ringed seal (*Phoca hispida*) in the western Russian Arctic. *NAMMCO Sci. Publ.* 1:63-82.

Bonner, N. 1994. Seals and sea lions of the world. Blandford, London, 224 pp.

Hammill, M.O. and Smith, T.G. 1990. App.ication of removal sampling to estimate the density of ringed seals (*Phoca hispida*) in Barrow Strait, Northwest Territories. *Can J. Fish. Aquat. Sci.* 47:244-250.

Harding, K.C. and Härkönen, T.J. 1999. Development of the Baltic grey seal (*Halichoerus grypus*) and ringed seal (*Phoca hispida*) populations during the 20th century. *Ambio* 28:619-627.

Härkönen, T., Stenman, O., Jüssi, M., Jüssi, I., Sagitov, R. and Verevkin, M. 1998. Population size and distribution of the Baltic ringed seal (*Phoca hispida botnica*). *NAMMCO Sci. Publ.* 1:167-180.

Härkönen, T., Stenman, O., Jüssi, M., Jüssi, I., Sagitov, R. and Verevkin, M. 1998. Population size and distribution of the Baltic ringed seal (*Phoca hispida botnica*). *NAMMCO Sci. Publ.* 1:167-180.

Johanessen, O.M., Miles, M.W. and Bjørgo, E. 1995. The Arctic's shrinking sea ice. *Nature* 376:126-27.

Kingsley, M.C.S. and Byers, T. 1998. Failure of reproduction in ringed seals (*Phoca hispida*) in Amundsen Gulf, Northwest Territories in 1984-1987. *NAMMCO Sci. Publ.* 1:197-210.

Lydersen, C. 1998. Status and biology of ringed seals (*Phoca hispida*) in Svalbard. *NAMMCO Sci. Publ.* 1:46-62.

Reeves, R.R. 1998. Distribution, abundance and biology of ringed seals (*Phoca hispida*): an overview. *NAMMCO Sci. Publ.* 1:9-45.

Reijnders, P.J.H. and de Ruiter-Dijkman, E.M. 1995. Toxicological and epidemiological significance of pollutants in marine mammals. In: Blix, A.S., Walløe, L. and Ulltang, Ø. (eds.); *Whales, seals, fish and man*. Elsevier, Amsterdam, 575-587.

Ridoux, V., Hall, A.J., Steingrimsson, G. and Olafsson, G. 1998. An inadvertent homing experiment with a young ringed seal, *Phoca hispida*. *Mar. Mam. Sci.* 14:883-888.

Sipilä, T. and Hyvärinen, H. 1998. Status and biology of Saimaa (*Phoca hispida saimensis*) and Ladoga (*Phoca hispida ladogensis*) ringed seals. *NAMMCO Sci. Publ.* 1:83-99.

Soper, J.D. 1944. The mammals of sothern Baffin Island, Northwest Territories, Canada. *J. Mammal.* 25:221-254.

Stirling, I., Lunn, N.J. and Iacozza, J. 1999. Long trends in population ecology of polar bears in western Hudson Bay in relation to climatic change. *Arctic* 52:294-306.

Teilmann, J., Born, E.W. and Acquarone, M. 1999. Behaviour of ringed seals tagged with satellite transmitters in the North Water Polynya during fast-ice formation. *Can. J. Zool.* 77:1934-1946.