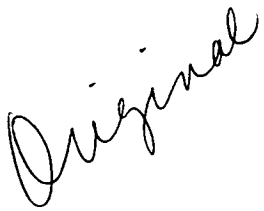
Report on the Status of Harp Seals in the Northwest Atlantic



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Northwest Atlantic Harp Seals

Background

The Harp seal is an abundant, medium sized seal which migrates annually between Arctic and sub-Arctic regions of the north Atlantic. Male harp seals are only slightly larger than females with adults averaging approximately 1.6m in length and weighting an average of 130 kg. Harp seals give birth ("whelp") on the ice in the White Sea, near Jan Mayen Island and in the northwest Atlantic. The northwest Atlantic breeding stock, historically the largest, summers in the Canadian Arctic and Greenland. In the fall most of these seals migrate southward to the Gulf of St.Lawrence ("Gulf"), or to the area off southern Labrador and northern Newfoundland ("Front") where they give birth in late February or March. Females nurse a single pup for ten to twelve days, after which they mate and then disperse. The pup, known as a whitecoat, moults its white fur at approximately three weeks of age. Older harp seals form large moulting concentrations on the sea ice off northeastern Newfoundland and in the northern Gulf of St. Lawrence in April and May. Following the moult, seals disperse and eventually migrate northward. Small numbers of harp seals may remain in southern waters throughout the summer.

The Fishery

Harp seals have been hunted commercially since the early eighteenth century. About 250,000 animals were harvested per year at the beginning of the century but the hunt declined during the First World War to about 150,000 from 1919 to 1939. Commercial harvesting almost stopped completely during World War Two, but then it increased rapidly reaching 450,000 in 1951 and averaging about 300,000 seals per year from 1945 to 1966. The first TAC was set in 1971 at 245,000 and varied until 1982 when it was set at the present level of 186,000. Prior to 1983, the large-vessel take of pups on the whelping patch accounted for the majority of the harvest. A ban on the importation of whitecoat pelts implemented by the European Economic Community in 1983 severely reduced the market, ending the traditional large-vessel hunt. Harp seals are still hunted by land-based sealers in both the Gulf and Front areas during the winter although catches have remained low.

Table I: TAC and commercial catches of harp seals (,000s) in Atlantic Canada 1972-1994.

	1972-82	1983-90	1991	1992	1993	1994
TAC	175	186	186	186	186	186
Catch	172.0	49.6	52.6	67.7	26.9	61.2

Harp seals are also hunted in the Canadian Arctic and Greenland but there are no recent catch statistics for either area. During the late 1970s catches in the Canadian Arctic were thought to range between 1,200 and 6,500. Catches in Greenland were estimated to be in the order of 14,000 - 18,000 in the early 1980s. Recent information suggests that Greenland catches may now be in the order of

50,000 harp seals annually but this has not been confirmed. An unknown number of harp seals are incidentally caught in the groundfish gillnet fishery in Eastern Canadian waters.

Resource Status

The total number of harp seals in the northwest Atlantic cannot be assessed directly. Surveys of the total population are impractical because harp seals are distributed widely across the Arctic and north Atlantic during the summer and, even though they congregate during the whelping and moulting periods, not all of the population is present at the surface at any one time and place. However, since pups remain on the ice while being nursed, harp seals populations can be assessed by estimating pup production (births) as a first step. Then by incorporating information on the pregnancy rates of female seals and the ages of seals caught, a population model can be constructed and the total population size estimated.

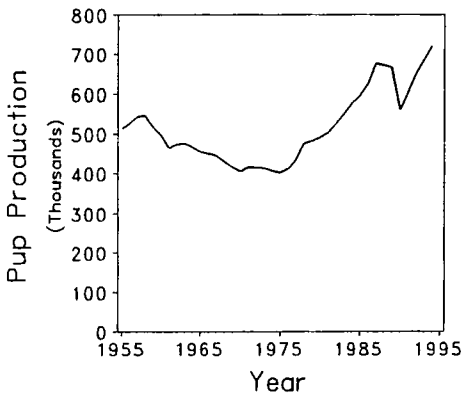
In the past, pup production has been estimated by examining catch data, mark-recapture experiments or aerial survey techniques. The results for similar time periods were often conflicting. Estimates for the mid to late 1970s ranged from approximately 250,000 to 500,000. The Royal Commission on Seals and Sealing in Canada concluded that pup production in 1978 was in the order of 300,000 - 350,000 and the total population was 1.5 -1.75 million. In 1990, aerial surveys of the Front and Gulf of St. Lawrence resulted in an estimate of 580,000 ± 78,000 pups and a total population of 3.1 million (95% Confidence Intervals (C.I.) 2.7-3.5 million).

1994 Pup Production

The most recent estimate of harp seal pup production in the Gulf of St. Lawrence and at the Front was obtained from surveys conducted by the Department of Fisheries and Oceans in March 1994. Extensive reconnaissance flights were carried out to find the whelping concentrations and monitor their movements. Both visual and photographic surveys were conducted to estimate pup production while on-ice observations were used to correct the results for pups which may not have been present at the time of the survey. The total number of pups born was estimated to be 447,000 ± 114,000 at the Front, 199,000 ± 48,000 in the southern Gulf, and 57,000 ± 27,000 in the northern Gulf. Since it is unlikely that any whelping concentrations were missed, the total pup production for 1994 was in the order of 703,000 ± 127,000 (Fig. 1).

Total pup production has increased between 1990 and 1994. There were large increases in the northern and southern Gulf while production at the Front in 1994 was slightly lower. These changes may be due to the movement of females among whelping areas. The proportion of the total production in each area varies among years but traditionally, approximately a third of the pups are born in the Gulf. The increased production observed in Gulf during 1994 marks a return to this traditional level.

Figure 1 Estimates of pup production 1955-95.



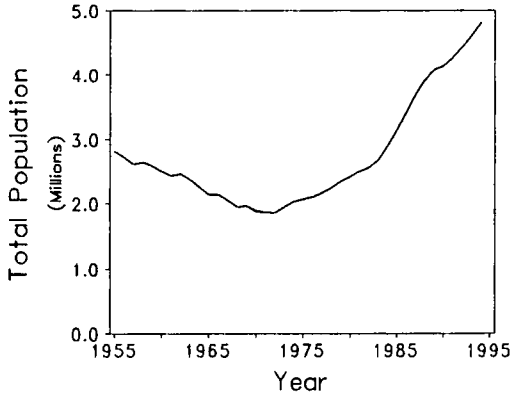
Population Dynamics

Catch at age data is obtained from the reported catch statistics and by direct sampling of seals caught by commercial sealers. Teeth are removed from jaws and the ages determined by reading lines within the teeth.

The reproductive tracts of females are examined to determine whether they are mature, if they had a pup the previous year, and if they are pregnant again. It is now clear that pregnancy rates have dropped significantly in recent years. For example, approximately 90% of the mature females were pregnant in the early 1980s, but only 70% were during the early 1990s. The age at which females become sexually mature has also changed. In the

early 1980s the average age at which they matured was 4.6 years while in the early 1990s it was 5.5 years. The exact timing of these changes cannot be determined since they occurred at a time when few reproductive samples were available. However, they appear to have taken place since the mid 1980s. The pregnancy rates and age at maturity influence strongly the calculations of population estimates.

Figure 2 Estimates of total population 1955-95.



Total Population

A harp seal population model, incorporating information on pup production since the late 1970s, reproductive rates since 1955 and catch at age data since 1952, has been developed to provide estimates of total population. The model indicates that pup production declined from the late 1950s through the mid 1970s, increased until 1987, declined from 1988 - 1990 and then increased again (Fig. 1). The decline in the late 1980s reflects the lower pregnancy rates observed. The estimated number of pups born in the late 1980s is somewhat dependent upon the way in which the reproductive data are incorporated in the model. Uncertainty in the timing of the decline in reproductive rates makes it difficult to determine the extent of the increase in pupping during the early 1980s and the decline in the late 1980s. The number of pups born has started to increase again in recent years due to the continued increase in the number of breeding females.

Estimates of the total population declined during the 1960s, reached a minimum in the early 1970s, and then increased steadily to the present (Fig. 2). The total population in 1994 was estimated to be approximately 4.8 million (95% C.I. 4.1 - 5.0 million). This estimate could be as low as 4.5 million if pup mortality is assumed to be higher than that of older seals. The uncertainty associated with the estimates of natural mortality and pup exploitation are accounted for in the confidence intervals but not all possible sources of uncertainty are included, and therefore these confidence intervals are underestimates of the total uncertainty.

The recent reproductive data provides evidence that the pregnancy rates of seals since the late 1980s were lower than those used in the previous harp seal model to estimate the 1990 population. Incorporating these new reproductive data into the current model has a major influence on our estimate of 1990 population. The estimate increased to 4.1 million (95% C.I. 3.6 - 4.3 million). Therefore, in recent years the population has grown at about 5% per year.

Replacement Yield

The replacement yield, which is the number of seals that can be harvested without changing the total population, is approximately 287,000 (95% C.I. 208,000 - 293,000). It is important to note that this estimate of replacement harvest is sensitive to the age of the catches, which are assumed to be the same those caught in 1993, and to the pregnancy rates used in the model.

Prey Consumption

The consumption of Arctic cod, capelin and Atlantic cod in the Northwest Atlantic between 1981 and 1994 was estimated using an energetics model. The energy requirements of individuals were estimated based on their size and then extrapolated to the entire population using estimates obtained from the population model. The proportion of energy obtained from various prey species and the amount consumed was estimated using information on the seasonal distribution of seals, the composition of their diet in various areas, and the energy content of the prey.

Total prey consumption by harp seals in the Northwest Atlantic has increased from 3.6 million tonnes in 1981 to 6.9 million tonnes in 1994. Almost half (46%) of the prey consumed were from Arctic waters while 40% came from waters off eastern Newfoundland and the remainder (14%) from the

Gulf of St. Lawrence. The major prey off Newfoundland is Arctic cod (a non-commercial gadoid) and capelin. Harp seals consumed an estimated 1.2 million tonnes (95% C.I. 750,000 - 1.7 million) of Arctic cod, and 620,000 tonnes (95% C.I. 288,000 - 1.0 million) of capelin in 1994. Although Atlantic cod is a relatively small component (about 3%) of the diet, the large number of seals present consumed approximately 88,000 tonnes (95% C.I. 45,000 - 140,000).

In the Gulf of St. Lawrence, capelin was the major prey of harp seals while Arctic cod was a minor component of the diet as it is not common in these waters. In 1994, seals consumed an estimated 445,000 tonnes (95% C.I. 208,000 - 729,000) of capelin and 20,000 tonnes (95% C.I. 0 - 48,000) of Arctic cod. Harp seals consumed an estimated 54,000 tonnes (95% C.I. 14,000 - 102,000) of Atlantic cod in the Gulf during 1994 which was approximately 5.6% of their diet.

The majority of fish eaten by harp seals were 10-20 cm long. The Atlantic cod were primarily 1-2 years old, younger than those taken in the commercial fishery. The capelin eaten were mainly 1-3 years which represents some overlap with commercial fisheries.

These estimates of consumption depend upon a number of assumptions which have various degrees of uncertainty associated with them. The energy requirements of individual seals and the abundance of seals used in the model are thought to be accurately estimated and within the ranges assumed. The areas of greatest uncertainty are due to our lack of knowledge concerning the seasonal distribution of seals and the annual, seasonal and geographic variability in their diet. Relatively small changes in these assumptions could have significant effects on the results. Studies are currently being conducted to improve our knowledge of both the diet and distribution of harp seals. Until they are completed however, these estimates of consumption should be considered preliminary and used with caution.

For More Information

Research Documents:

Stenson, G.B., M.O. Hammill, M.C.S. Kingsley, B. Sjare, W.G. Warren and R.A. Myers. 1995. Pup production of harp seals, *Phoca groenlandica*, in the northwest Atlantic during 1994. DFO Atl. Res. Doc. 95/20.

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Shelton, P.A., G.B. Stenson, B. Sjare and W.G. Warren, 1995. Model estimates of harp seal numbers at age for the northwest Atlantic, DFO Atl. Res. Doc. 95/21.

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