
Harp seal populations in the northwestern Atlantic: modelling populations with uncertainty

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Summary

- For the past six years, nearly 400,000 harp seals from the Northwest Atlantic population have been hunted annually by Canada and Greenland, the highest number since the 1950s. When such hunting pressure last occurred, the harp seal population declined rapidly by over 50%. With current levels of hunting pressure being so high, it is important to have accurate information about the total harp seal population size and the subsequent effects of differing hunting strategies. Therefore, in this report we evaluate the scientific model used by the Canadian Department of Fisheries and Oceans to estimate harp seal population size, set harp seal total allowable catches (TACs) and model the effect of different culling pressure.
- Two aspects make the Canadian harp seal population model unsafe: (i) it assumes that many variables such as the environment and food availability play no part in determining numbers of harp seals; and (ii) it assumes that all the input variables into the model are accurate.
- Significantly, the model fails to take into account many variables that can affect harp seal numbers. These include environment unpredictability, climate change and the bioaccumulation of anthropogenic toxins, which in turn reduce reproductive rates and increase mortality. When so many variables are unknown, a precautionary approach should be applied. However, no such measure is applied to the Canadian management plan.
- There is no direct way to measure harp seal populations; population estimates and TACs are modelled using three main input variables – annual pup production, pregnancy data and catch-at-age data (an indicator of mortality rates).
- Similarly, the total number of pups produced each year (pup production) cannot be counted directly. Instead, estimates from a small area (<2% of the breeding site) are extrapolated to give a total population estimate. Differing methods of counting pups may give large differences (60,000 – 160,000) in numbers for single breeding sites.
- Adult mortality rates used in the model do not take into account sex- or age-biases in mortality. In addition, data from Canadian kills are assumed to be representative of (i) the Greenland kill and (ii) fisheries bycatch; however, since the Canadian kill occurs at a different time of the year and in different areas, this is unlikely to be true. The estimated number of seals killed through fisheries bycatch is thought to be an underestimation.

- Pregnancy data are based on very few females, making information on pregnancy rates inaccurate. In other harp seal populations, pregnancy rate is related to female body condition; reduced food availability increases age at first reproduction and reduces population fecundity.
- Harp seal females begin to breed at ages 5 – 6; thus, the impact of culling so many pups will not be noticed in the population for 5 – 6 years.
- Currently the model used to estimate harp seal population size and used to assess TACs misses many important biological variables, is insensitive to rapid population changes and ignores many important threats to the population. Current levels of removals are as high or higher than the years before the population crashed.
- In their 2000 stock assessment for harp seals, the DFO predicted a decline in the population (from the estimated 5.2 million) over the following years as a result of high kill levels in the commercial seal hunt. This is not surprising considering that between one third and one half of all pups born in the population over the past ten years have been slaughtered. Yet four years later, the DFO estimated the Northwest Atlantic harp seal population at 5.9 million seals – an increase of 0.7 million. This contradicts the DFO's own predictions and highlights the unreliability of the model used to predict the size of the Northwest Atlantic harp seal population. This harp seal population may already be approaching the 70% level advocated by the Department of Fisheries and Oceans. The DFO says that it is committed to maintaining the population above this reference point.
- Several other Canadian fisheries have collapsed as a consequence of many variables, including environmental change and mismanagement. Despite the uncertainties surrounding the estimates of harp seal numbers and the uncertainty surrounding many other variables, the Canadian model does not apply a precautionary principle and so threatens the survival of seal populations.

The cull of harp seals in the northwest Atlantic

The biology of the harp seal

The harp seal (*Phoca groenlandica*) is a widespread species found in the northern Atlantic and Arctic oceans (Sergeant, 1991). Three distinct populations are recognised, one breeding in the Gulf of St Lawrence (Northwest Atlantic population), one breeding north of Jan Mayen Island in the Greenland Sea (Greenland Sea population) and one in the White Sea (White Sea population). Genetic evidence demonstrates that the Northwest Atlantic population is distinctly different from the other two populations, and little gene flow occurs between them (Perry *et al.*, 2000). All three populations undergo an annual north-south migration of 6000-8000km. The Northwest Atlantic population spends the summer feeding in Hudson Bay,