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Newfoundland and Labrador Region
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Canadian Science Advisory Secretariat
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CANADIAN ATLANTIC SEAL MANAGEMENT STRATEGY

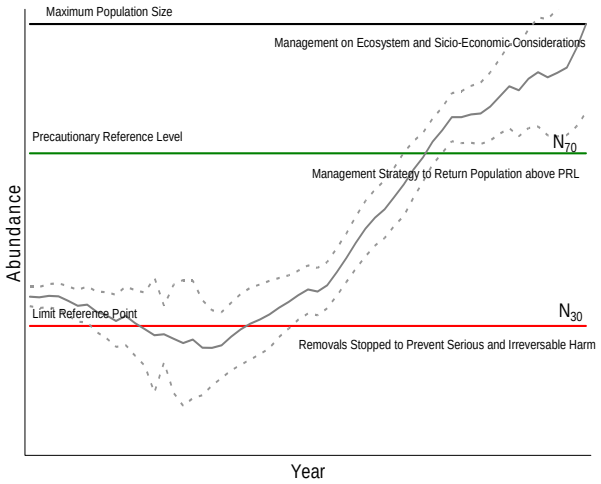

Figure 1: Reference levels identified under the Atlantic seal management strategy

Context :

The Canadian Atlantic seal management framework, established prior to the 2003 season and renewed in 2006 for a 5-year period, recognizes two key reference points that create three population management zones. The first reference point, termed N_{70}, is set at 70% of the maximum observed population size. The second is N_{30} (30% of the maximum). The size of the population in relation to these two reference points indicates the health of the population and what management approach is to be followed in setting the Total Allowable Catch (TAC), which is done on an annual basis. These management approaches are pre-agreed in the Integrated Fisheries Management Plan (IFMP) for Atlantic seals.

While preparing the new five-year IFMP for Atlantic seals, Ecosystems and Fisheries Management has requested that Science consider a series of questions regarding the precautionary levels as defined above in the current IFMP. The advice will be used in the development of the new IFMP, which will be discussed with various industry and stakeholder groups before implementation.

SUMMARY

- The Atlantic Seal Management Strategy, formerly referred to as Objective Based Fisheries Management (OBFM), was the first plan to incorporate a precautionary approach in the management of marine species in Canada. It provides a framework that identifies precautionary and critical reference limits which define healthy, cautious and critical zones of abundance, along with management actions that are triggered when thresholds are exceeded to reduce potential damage to the resource.

- Currently, the precautionary and critical reference levels are defined as 70% and 30% of the maximum observed population size.

- Results of model simulations show that the full impact of any proposed management plan on the dynamics of the population cannot be identified within the life of the management plan and therefore, management plans should be evaluated over a period of 15-20 years. The longer time frame can also result in higher and more stable catches.

- The current management approach uses estimates of total population to assess the status of the population with respect to the reference levels. Although pups are the component of the population that is directly measured, their numbers are estimated infrequently and respond slowly to environmental changes or harvest levels that affect young seals. Therefore, model estimates of total abundance provide a more responsive measure of current population status to harvest history. Because inputs to the assessment model such as pup production and reproductive rates are subject to measurement error, they, and the assessment, must be updated frequently.

- Although additional simulations are required to determine if there are more appropriate precautionary levels, based on model simulations carried out to date, the current precautionary reference level (N_{70}) and the management objective with respect to population size (L_{20}) do not appear to be overly cautious.

- The current management plan allows for 10% of the unused quota in one year to be carried over to the following year within a 5-year management plan. Increasing the amount of carry over to 20% is unlikely to have a negative impact on the population as long as the total removal is the same over the life of the management plan.

INTRODUCTION

Within the context of fisheries management, the Precautionary Approach (PA) strives to be more cautious when information is less certain, does not accept the absence of information as a reason for the failure to implement conservation measures, and defines, in advance, decision rules for stock management when the resource reaches clearly stated reference points. In 2003, the Privy Council Office, on behalf of the Government of Canada published a framework applicable to all federal government departments that set out guiding principles for the application of precaution to decision making about risks of serious or irreversible harm where there is a lack of full scientific certainty.

The Canadian Atlantic Seal Management Strategy, formerly referred to as Objective Based Fisheries Management (OBFM), was the first plan to incorporate a precautionary approach in the management of marine species in Canada. It provides a framework that identifies precautionary and critical reference limits which define healthy, cautious and critical zones of abundance, along with management actions that are triggered when thresholds are transgressed to reduce potential damage to the resource. The current approach uses an estimate of total population size as the metric for population health. The critical reference limit (referred to as 'N_{30}'), i.e. the level below which the population could be at risk of serious and irreversible harm, was set at 30% of the highest population observed or inferred. In order to avoid the possibility of the population falling below this critical limit undetected, the population

should be managed around a precautionary reference point. Based upon the biology of seals, previous work with other marine mammals, and the frequency of surveys, the precautionary reference level (referred to as 'N_{70}') was set at 70% until the appropriate simulation studies could be carried out. In order to account for the increasing uncertainty in the model-based estimates of population size that occurs over time after a survey, the management objective that must be met is that there is an 80% likelihood (referred to as the L_{20}) that the population be above the precautionary reference level.

The original seal management approach was designed to address the management of harp, hood and grey seals, all of which are commercially harvested. To date, the robustness of the framework has been evaluated primarily focussing on harp seals, the species for which there are the most data. This species is also the most abundant and subjected to the largest hunt.

Since being adopted in 2003, the Canadian seal management framework has been widely reviewed by stakeholders and by national and international scientific committees. A new Integrated Fisheries Management Plan (IFMP) for Atlantic seals is being developed and in order to ensure that the IFMP continues to meet the requirement for the Precautionary Approach, Science has been asked to provide input on a series of questions (see below) that can be used in the development of a new IFMP.

ANALYSIS

1. Over what time period should the requirement to remain above the precautionary limit be in order to meet the management plan objectives?

The time frame over which the results of proposed management actions should be compared to the precautionary limit was not specified when the strategy was initially adopted. As a result, there has been some confusion with the default being the end of the individual plan which is usually a maximum of 5 years. Given that the Canadian hunt focuses almost exclusively on young of the year (YOY), the impact of mortality or catches that focus on young seals will have very little impact in the short term. Therefore, it is important that the time frame be long enough for the impact of the action to affect the population and that it can be recognized in the assessments given the current frequency of pup production surveys (4-5 years for harp seals) and precision of the estimates.

Previous analyses have shown that a single year of high pup mortality could significantly affect the population, but that these changes would not be noticed as detectable changes in pup production for at least 20 years. An annual low level (10%) mortality of pups would also result in changes in the population and pup production that could not be detected until 15 or more given the current survey frequency.

Extending the time frame over which the management plan is met also allows for larger overall harvests and greater catch stability, which may be important considerations with respect to markets.

Simulations with an assessment model show that the impact of any proposed management plan on the population cannot be identified within the life of the management plan. Therefore,

although there are important assumptions required for models that predict populations more than a few years in the future, management actions should be evaluated over a period of 15-20 years.

2. What is the appropriate measure to use when comparing to the precautionary level?

Currently, a measure of total abundance is compared to the precautionary reference level to evaluate the health of the population and to determine if the proposed actions are consistent with the management objectives. Total abundance is estimated using a population model that incorporates annual estimates of human induced mortality, age-specific reproductive rates and periodic independent estimates of pup production. In principle, it is best to use a metric for population status that is measured directly, which, in the case of Atlantic seals, is pup production. However, pup production of harp seals is estimated every 4 to 5 years, grey seals every 3 years and hooded seals approximately every 10 years. Survey results are often difficult to interpret with respect to changes in population size due to the time lag associated with the impact of environmental changes or harvest levels. Therefore, a population can be significantly reduced before changes in pup production are recognized. In contrast, estimates of total population can provide indications of impacts much quicker. By monitoring annual reproductive rates and removals, changes in the resource can be identified by modelling the total population. Therefore, it is recommended that model estimates of total abundance continue to be used as the measurement of current population status, recognizing that the estimates are uncertain and need be periodically updated by new input data (reproductive rates and pup production) to the model.

3. At what level should the precautionary reference level (currently N_{70}) be set at to ensure a high (i.e. 95%) probability of avoiding falling below the N_{30}?

Although simulations to determine the impact of changing the precautionary reference level have not yet been carried out, results of simulations exploring the impact of changing the precision of the population estimate (see below) suggests that the current approach of using an 80% likelihood of being above a precautionary reference level set at 70% of the maximum population is not overly conservative.

4. How should uncertainty in the annual estimate of the metric be taken into account (currently L_{20})?

To determine if the current requirement to maintain an 80% likelihood of being above the precautionary reference level (i.e. L_{20}) was sufficient to ensure that the population remains above the critical reference level (N_{30}), the impact of an unidentified 20% increase in morality among young of the year harp seals was explored. Using the current harvest control rule (HCR) resulted in a greater than 95% likelihood of remaining above the critical reference level (N_{30}) for at least 35 years. Using a less cautious level of 60% (i.e. L_{40}) resulted in catches that caused the population to fall below N_{30} within 25 years. Simulations using the intermediate level of 70%

(L_{30}) maintained the population above N_{30} under some conditions, but not under others. Under all simulations, catches were initially high, but declined rapidly and the hunt was closed after approximately 20 years. However, in spite of the closure of the commercial hunt, in simulations

the mean, L_{30} and lower 95% of the confidence limits of the population estimate fell below the critical reference limit (N_{30}) within 35 years.

Using a simple scenario assuming that mortality was higher than normal indicates that the current HCR requiring an 80% likelihood of being above the precautionary reference level provides a reasonable probability of the population remaining above the critical reference level. Results of simulations show that the likelihood of the population falling below the critical reference level without being recognized when the HCR is reduce to a 70% probability, is greater. A lower requirement (N_{60}) can clearly result in an unrecognized decline in the population to a level where it is considered to be in serious and irreversible harm. Therefore, we feel that the current requirement to have an 80% likelihood of being above the precautionary level provides a reasonable level of certainty that the population will not fall below the critical limit.

5. If 'Carry forward' of uncaught quota is allowed, what would be the impact of an additional catch of up to 20% (currently 10%) on our ability to meet the management objectives?

Increasing the amount of carry over in quota from the current 10% to 20% is unlikely to have an impact on the population over a period of 20 years. This would indicate that catches can be varied as long as the total remains similar over the life of the management plan.

Sources of Uncertainty

Additional scenarios should be examined to determine the robustness of the current management approach to potential biases and unforeseen events that could adversely affect the populations. Not excluding other possible uncertainties, the impact of biases in the pup production estimates, errors in reproductive data and of increased adult mortality should be explored.

The robustness of the management approach to uncertainty, errors and biases in the population size will depend upon how the values of life history variables change in response to changing abundance. The current simulations of harp seal populations used a model that did not incorporate any such changes. Models that do include such changes should be developed so that the robustness of the current management approach can be better evaluated.

Sources of mortality, frequency of surveys and the precision of our estimates vary among seal species. However, similarities in life history characteristics of Atlantic seal species suggest that the current approach developed based upon harp seals may apply more broadly.

CONCLUSIONS

The current management approach appears to be robust. It has been successful in managing harp seals during a period of intense exploitation and has provided an example of a management strategy that implements the precautionary approach that can be applied elsewhere.

SOURCES OF INFORMATION

This Science Advisory Report is a Fisheries and Oceans Canada, Canadian Science Advisory Secretariat national advisory process held 22-26 November 2010, during the annual meeting of the National Marine Mammal Peer Review Committee. Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

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FOR MORE INFORMATION

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