Agenda Item 7
For decision

Council

CNL(05)26

Predator-related Mortality

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1. Since holding a Special Session in 1996 entitled 'The Atlantic Salmon as Predator and Prey' the issue of predator-related mortality has been included on the Council's agenda for each subsequent Annual Meeting with the exception of those held in 1998 and 1999. This has provided an opportunity for both the Parties and the NGOs to present information in relation to predator-related mortality, and for some dialogue. Last year the Parties appointed coordinators who provided the following to the Secretariat prior to the Twenty-First Annual Meeting:

   - information on the impact on salmon populations of predation by piscivorous birds, fish and mammals;
   - details of measures implemented in relation to management of these predators of salmon and any assessment of their effectiveness;
   - details of on-going research in relation to predator-related mortality.

   This led to more detailed information being made available to the Council than in previous years by Canada, Denmark (Faroe Islands), the European Union, Iceland, Norway, the Russian Federation and the USA. This information was presented in documents CNL(04)25 and CNL(04)31 and is summarised in Annex 1.

3. While many predators of Atlantic salmon have been identified, their impact is hard to quantify, particularly in the marine environment. Some of the predator populations are increasing, and some have statutory protection, while the abundance of Atlantic salmon is low. This has led to calls to restore the balance to ecosystems through the introduction of management measures, both lethal and non-lethal, so as to reduce the impact on salmon of some species of predators. The returns made last year indicate that such measures are being used by some Parties.

4. This is undoubtedly a complex area, with considerable uncertainties associated with the assessment of the impacts of predation on salmon populations and political complexities associated with management intervention, not least because of strong public opinion on predator management programmes. However, it is clear from the consultation meetings that our stakeholders believe that NASCO should be giving greater focus to this issue. The issue of predator-related mortality is also a concern for the salmon farming industry. Through the Liaison Group the industry representatives have suggested that NASCO focuses too much of its attention on the impacts of the salmon farming industry on the wild stocks but is not seriously addressing predation issues. The question therefore arises as to an appropriate role for NASCO. One NASCO Party has proposed that the issue of predator-related mortality should be considered under the Precautionary Approach so as to develop appropriate recommendations on actions that might be taken. Other Parties, however, clearly believe that NASCO's role should be to provide a forum for information exchange on this issue. A number of possible options have been discussed over the years including:

- holding another Special Session (it is ten years since the last one) or a workshop to assemble comprehensive information and to consider NASCO's future role on this issue;
- to seek more comprehensive returns on the Habitat Plan of Action under which the Parties are required to take into account factors affecting productive capacity of salmon, including predator-prey interactions;
- to discuss the issue within the Liaison Group, since predator-related mortality may affect both wild and farmed salmon;
- to include a permanent Council agenda item to allow the Parties to report new information as it arises;
- to remove the item from the agenda and only reinstate it at the request of a Party when new information is available.

5. The Council is asked to consider what further action, if any, it wishes to take in relation to predator-related mortality of wild Atlantic salmon. It is possible that the 'Next Steps for NASCO' Working Group may make some proposals on this issue.

Secretary
Edinburgh
5 April, 2005

Annex 1

Summary of Returns by the Parties in 2004

The summary information for Canada, Denmark (in respect of the Faroe Islands and Greenland), the EU, Iceland, Norway and the Russian Federation was presented to the Council last year in document CNL(04)25. In addition, we have summarised, and included here, information made available by the US in document CNL(04)31. The full Council documents should be consulted for further information.

Canada has provided information on a three-year management plan introduced in 2003. This plan established a harp seal quota of 975,000 over the three-year period 2003-2005. For the same period, the TAC for hooded seals is 10,000 animals per annum and a small harvest of grey seals is permitted. The seals hunted must be independent, self-reliant animals. Actual harvest levels are highly variable and dependent on environmental and market conditions. 289,000 harp seals were harvested in 2003. Less than 200 hooded seals and a small number of grey seals are hunted annually. An active seal research programme has been maintained for many years and in April 2003 a two-year Atlantic Seal Research Programme with funding of CAN$ 6 million was announced to expand research activities in relation to abundance and distribution of seals and their impact on fish stocks. The programme will also evaluate seal management tools to aid recovery of cod stocks including exclusion zones and reproduction control. The results of this scientific programme will inform future management. A recent study suggests that seal predation of smolts leaving the Miramichi River is unlikely to be significant and no evidence was found of consumption of adult salmon, although this may be because the heads of salmon were not consumed or the head parts used for identification had been digested. Information on a river observation programme in Newfoundland rivers is also presented. Recent warm winters have altered coastal ice coverage and allowed seals access to estuaries and rivers.

Denmark (in respect of the Faroe Islands and Greenland) has indicated that there is no ongoing research on predator-related mortality of salmon in the Faroe Islands.

The European Union has reported that the Atlantic salmon is preyed upon by a number of species of fish, birds and mammals throughout the European Union and there has been much conjecture about the impact of this predation on salmon stocks and fisheries. Many of the species that predate on salmon are themselves subject to protection although for some species this protection has been relaxed in response to concerns from fishery interests. Pike, brown trout, burbot and a number of gadoid species are among the fish species listed as predators of salmon. Red-breasted merganser, goosander and great cormorant are considered by managers to be particularly serious predators, with predation by grey heron significant in some areas. Of the mammalian predators, seals have received the greatest attention by managers and scientists. Details of potential interactions between predators and salmon and of the measures taken to reduce damage to salmon stocks and fisheries, are provided for a number of EU Member States.

In Finland, research suggests that the main prey of medium and large burbot in the river Teno in winter months is juvenile salmon but the impact of this predation has not been quantified.

In Germany, studies of the impact of hydro-electric schemes on migrating salmon smolts indicated that smolts weakened by their passage through turbines were easy prey for predatory fish gathered downstream. Harvesting of these predators has been recommended during the migration period of smolts. Both cormorant and grey heron populations have increased substantially since the 1970s. Increasing awareness that continuing high levels of protection for cormorants could jeopardize the salmon restoration programme in the Rhine may lead to the authorities allowing scaring-off or shooting of cormorants.

In Denmark, in response to an increase in the cormorant population and the number of complaints from fishermen a variety of control measures, both lethal and non-lethal, have been introduced. They include changes to fishing gear and the mode of fishing, scaring of birds (e.g. from release sites used for stocking salmon), removal of nests, shooting, spraying of eggs with paraffin oil and the illegal release of predators such as mink, a practice that can lead to predation on other species of birds. The mink may also prey on Atlantic salmon.

For Great Britain, information has been provided on the number of licences issued and the numbers of cormorants, herons, mergansers and goosanders shot under these licences. In England and Wales, the general view is that predation on salmon by seals is probably limited to a small number of seals that target fish in nets and in river mouths and estuaries. In Scotland, there are increasing reports of seals moving upstream into rivers and lochs and it is assumed that they are feeding on salmon. Although some seals are known to eat salmon, evidence of salmon in the diet of seals is limited. Details of the number of licences issued to shoot seals and the numbers shot under these licences is provided. Collaborative research projects are on-going in Scotland to assess the diet of seals and the use of scaring devices and to identify interactions and damage "hotspots".

In Sweden, damage to salmon stocks and fisheries from seals has been recorded.

In Ireland, salmon smolts are frequently recorded in the stomachs of pike in large lakes and some large rivers, although many large rivers lack suitable pike habitat, so predation in these rivers is low. Ferox trout may also prey on salmon smolts. The cormorant population in Ireland has increased following reduction in persecution by humans and stocking of game and coarse fish of a size suitable for consumption by cormorants. Disturbance of cormorants and, in exceptional circumstances, shooting are used to protect migrating smolts. Although salmon fishermen have reported that seals are major predators of salmon, studies on the diet of seals have failed to produce evidence to substantiate this. A report entitled "Seals/Atlantic Salmon Interaction Workshop – a recent Irish review of the evidence" is referred to. One recommendation from the Workshop was that further seal control measures should be tested in Ireland with a view to replacing the lethal control methods currently available.

Iceland has provided a list of potential predators of Atlantic salmon in both fresh and marine waters. It includes 15 species of birds, 8 species of fish and 3 species of mammal (including mink, a species introduced to Iceland), although no information is available on the impact on salmon of a particular predator. Information from an ocean ranching site suggests predation losses in the first 24 hours following release to be in the range of 0.2 – 1.1% of smolts released. The urgent need for an extensive study on the impact of predation on salmon stocks in Iceland is noted. Details of predator control programmes are provided. For most potential predators these are implemented during short periods of time considered to be critical for the salmon. They include activities to control seal populations and to keep them away from river estuaries during the peak salmon migration period.

Norway has also indicated that information on the impact of predation on salmon stocks is limited, but has listed those fish, birds and mammals which are potential or confirmed predators of salmon at the different stages of its life-cycle. A study of the diet of goosanders and red-breasted mergansers showed that salmon was the dominant prey species but it was concluded that this predation did not significantly affect smolt production. Salmonids made up to 70-80% of the diet of otters but only 10% of the fish eaten were juvenile salmon. Predation is presumed to be the most important cause of natural mortality of salmon at sea and mortality is highest in the first few months at sea. Cormorants, grey seals and harbour seals are thought to be capable of exerting heavy predation pressure during the post-smolt migration period. Avian predation probably declines as the salmon grow while seal predation can occur throughout the marine phase. Elevated sea lice levels on migrating post-smolts may lead to increased predation. No specific management measures to control predators of salmon have been implemented. It is noted that a review of the literature suggests that predation pressure at certain stages in the salmon's life-cycle may be high although there is no empirical evidence that the total predation pressure or any individual predator is having a significant negative impact on salmon stock level. In several Norwegian rivers catches and pre-fishery abundance of salmon have increased significantly since 1997 despite the presence of stable or slightly increasing populations of predators. It is believed, therefore, that the decline in abundance in other areas is the result of environmental pressures other than predation.

The **Russian Federation** has provided information from observations at in-river barrier fences on a number of rivers with regard to seal damage and from studies on piscivorous fish. The percentage of salmon examined which showed signs of seal damage ranged from <1% to 5.3%. Analysis of the diet of pike in the Umba River during the smolt migration period indicated that 19% of the fish examined contained juvenile salmon. Management of predatory fish populations is undertaken in rivers in the Murmansk region. Pike, perch and burbot are harvested.

The **United States** has reported that while predation in freshwater environments has been relatively well studied, the level of understanding of predator-related mortality of salmon in the marine environment is low. Information is provided on recent research on the impacts of marine predation on US stocks of Atlantic salmon, both species-specific investigations and research that clarifies the mechanisms for particularly high predation at various life stages, especially as smolts and post-smolts making the transition to life at sea. It is noted that several of the underlying mechanisms for the apparently high marine predation observed are becoming clear

and include water quality perturbations (in Maine, osmotic stress may be exacerbated by the low pH experienced by emigrating smolts) and decreased abundance of other anadromous fish (e.g. shad, smelt and blueback herring). However, many uncertainties remain. Several management measures aimed at reducing early marine predation have been initiated in the US, including a liming project in the Dennys River and non-lethal methods to displace foraging double-crested cormorants from the lower Narraguagas River and estuary during smolt migration. If the latter experiment is unsuccessful the project may use lethal methods in subsequent years. Research is also being undertaken to document the frequency and extent of seal predation at salmon farms so as to assist the industry to identify successful mitigation measures which could, in turn, assist wild salmon recovery efforts by minimizing escapes. Several other options are yet to be tested in the US, including non-lethal seal exclusion from estuaries. This approach has been used to deter harbour seal predation on Pacific salmon in British Columbia. Open-sea releases of hatchery smolts could also be used to reduce predation.