Ad Hoc Review Group

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Implementation Plan

Canada

Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

CANADA - NASCO IMPLEMENTATION PLAN

(2007)

INTERNATIONAL FISHERIES DIRECTORATE
FISHERIES AND AQUACULTURE MANAGEMENT
200 KENT STREET
OTTAWA, ONTARIO, CANADA

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PREAMBLE

The North Atlantic Salmon Conservation Organization (NASCO) and its Parties have agreed to adopt and apply a Precautionary Approach to the conservation, management and exploitation of salmon in order to protect the resource and preserve the environments in which it lives. To this end, NASCO has adopted a number of Resolutions and Agreements which address the Organization's principal areas of concern for the management of salmon stocks. The Organization has also developed Guidelines on topics which have a more general relevance to salmon management, including the consideration of social and economic factors in decisions under the Precautionary Approach and the development of stock rebuilding programmes.

As part of the 'Next Steps' process, NASCO has determined that it needs to develop a simpler and more transparent approach for reporting on progress on the implementation of these agreements. NASCO has therefore agreed that each Party or relevant jurisdiction should develop an Implementation Plan for meeting the objectives of NASCO's agreements and should subsequently report to NASCO on actions taken to meet its management objectives.

For Canada the Implementation Plan will provide an opportunity to consolidate a significant amount of information on Atlantic salmon stocks and programs. It will provide an in depth review of conservation activities since the peak of the commercial fisheries of bygone days to the present and attempt to describe complexities and the diversity of these activities and Atlantic salmon stocks in eastern Canada. This plan is not only a full description of how salmon stocks are managed in Eastern Canada, but also a Plan listing actions and activities to address major issues and challenges. This plan was put together in collaboration with provincial governments, Aboriginal People, and NGO's.

Over the years, Canada like many other Atlantic salmon countries has focused its policies and scientific research on ensuring productive freshwater, estuarine habitats. It has become clear however that we lack knowledge of what happens to salmon at sea.

NASCO has embarked on a major multi-year research project focused on marine survival issues. Canada is already involved in many research projects to the tune of $2M and is supportive of continued marine research.

The plan will be updated and revised based on Canada's report to NASCO and on commitments made at the annual June meeting.

2006 -2011 IMPLEMENTATION PLAN FOR CANADA

1. INTRODUCTION

1.1 Objective

In order to achieve the conservation of wild Atlantic salmon, three objectives must be fulfilled:

1. Safeguard the genetic diversity of wild Atlantic salmon;
   To sustain Atlantic salmon and their associated benefits, it is necessary to safeguard their geographic and genetic diversity and their habitats.

2. Maintain habitat and ecosystem integrity;
   The health and long-term well-being of wild Atlantic salmon is inextricably linked to the availability of diverse, healthy and productive freshwater, coastal, estuarine and marine habitats.

3. Manage fisheries for sustainable use and benefits.

The conservation of wild Atlantic salmon and their habitat is a priority. After conservation, access by Aboriginals for food, social and ceremonial is a right that has been affirmed by decisions of Canada's Supreme Court. Further, many Aboriginal People have Land claims Agreements with the Government of Canada which describes access to Atlantic salmon (such as the Labrador Inuit Land Claims). This priority use for Aboriginals is followed by the other fisheries.

These objectives and priorities are first and foremost in the decision-making process in Canada for conservation of Atlantic salmon. The Plan is not a "cure all or wish list" for Atlantic salmon but reflects realistic endeavors based on resources that would be likely available over the term of the Plan.

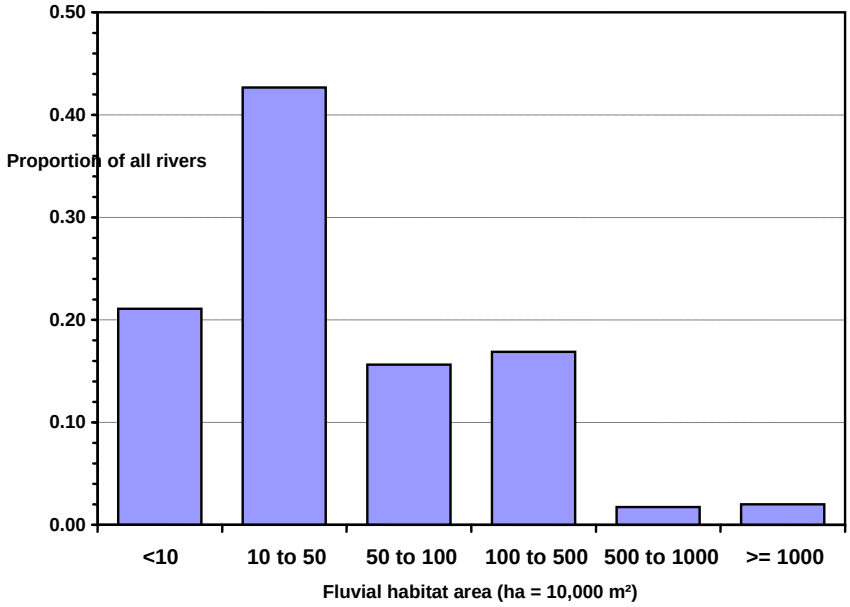
The issue of at sea mortality has emerged as very challenging area for NASCO and its Parties to tackle. There is a large amount of knowledge of what's needed for Atlantic salmon in terms of other influences such as habitat, management, and pollution. However, marine survival is an area where significant research needs to be done to understand what happens to salmon at sea. NASCO has embarked on a major research program over the next few years which will require involvement of all Parties. This is viewed by Canada as a major priority for NASCO.

In the context of its current commitments in NASCO, Canada participates strongly with other NASCO countries in the SALSEA project to conduct marine research to gain knowledge about the salmon's journey in the North Atlantic Ocean.

1.2 Nature and Extent of the Resource

On the Atlantic coast of Canada, anadromous Atlantic salmon (*Salmo salar*) are found in rivers from the US border at the mouth of the Bay of Fundy (46°N) north to Nain, Labrador (56°37'N) as well as in Ungava Bay (58°N). The number of rivers with anadromous Atlantic salmon runs in Canada was previously noted at over 600 rivers (NASCO Rivers database) but a recent and ongoing review indicates there may be upwards of 900 rivers which contain salmon. The discrepancy is due to the definitions used to declare a river a salmon river and in some cases there have not been any surveys to verify the presence of salmon in numerous small and remote rivers.

Most Atlantic salmon rivers of eastern Canada are small with annual run sizes of less than a thousand adult salmon. There are few rivers with annual run sizes in excess of 10,000 salmon. There are a large number of small rivers and rivers in the northern portion of the distribution where little, if any, information is available about run size and status.



Relative proportion of sizes of Atlantic salmon rivers in eastern Canada. Size of rivers is based on the estimates of fluvial spawning and rearing area. A river with a fluvial habitat area of < 10 ha would have adult Atlantic salmon run sizes of about one hundred fish or less. Rivers with habitat areas greater than 500 ha (< 4% of measured rivers) would be expected to have annual run sizes greater than 10,000 fish.

Stocks are managed in five administrative areas in eastern Canada among the five provinces: Newfoundland and Labrador, Québec, New Brunswick, Prince Edward Island (P.E.I.), Nova Scotia and, the Nunatsiavut Government.

Severe declines in abundance of Atlantic salmon in the 32 rivers of the inner Bay of Fundy have resulted in this component being designated as "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed in Schedule 1 of Canada's Species at Risk Act. These are mostly small rivers. (reference http://www.dfo-mpo.gc.ca/species-especes/species/species_atlanticSalmon_e.asp)

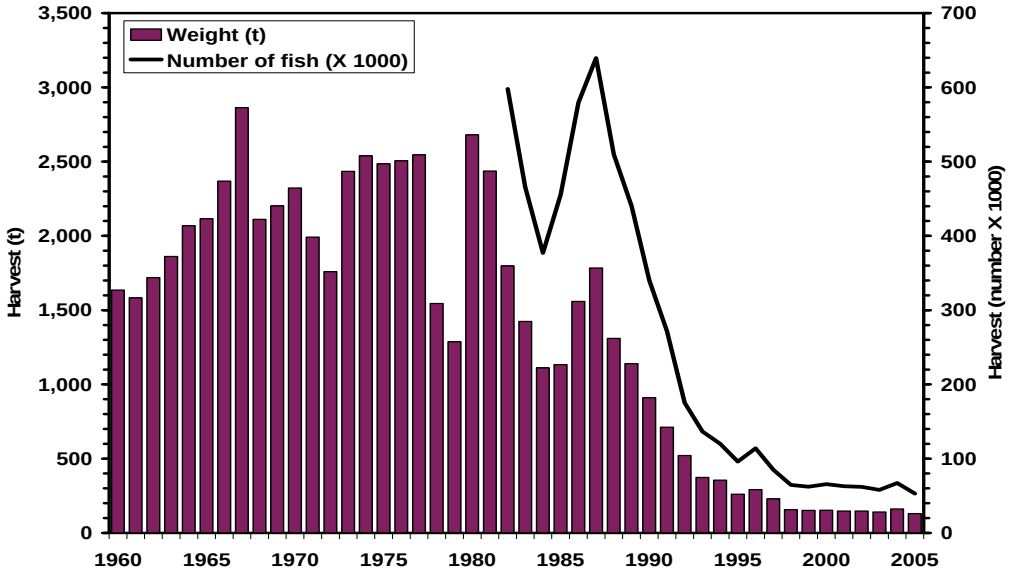
1.3 Fisheries and Management

Fisheries are principally managed on a river-specific basis. The management of retention fisheries for Atlantic salmon is governed by the status of the river-specific stocks. In rivers where retention is permitted harvests are regulated by tagging and/or quotas and catch reporting. Salmon are harvested only in recreational and aboriginal fisheries. The commercial fishery has been closed since 2000.

Fisheries on the age groups of Atlantic salmon are managed based on the fork length of the fish; small salmon less than 63 cm, large salmon equal to or greater than 63 cm. These length classes represent predominantly one-sea-winter salmon in the small category, multi-sea-winter and repeat spawners in the large category.

A distinction is made between harvests and catches. Harvest represents fish which are retained in the legal fisheries. Catches include fish which are retained as well as those released alive to the water in legal fisheries. The release category for catch applies primarily to the recreational fishery. Any Atlantic salmon caught as bycatch in other fishing gear or fisheries cannot be retained and must be returned to the water. Historically, Atlantic salmon were exploited in aboriginal, commercial, and

recreational fisheries. Total harvest (fish retained) by all users since 1960 peaked in 1967 at 2,863 t. Peak harvest in number of fish (since 1982) occurred in 1987 at 640,000 fish, size groups combined. Harvests declined rapidly post 1985 as a result of important management actions in both the commercial and recreational fisheries. In 2005, the harvest of 130 t (53,000 fish all size groups) is the lowest level of the 1960 to 2005 time series.



Harvests of Atlantic salmon (all size groups) in all fisheries of eastern Canada, 1960 to 2005.

Aboriginal Peoples and Food, Social and Ceremonial Fisheries

The Aboriginal Peoples of the northeast corner of the North American continent have, since time immemorial, accessed and used the natural-life resources found within their Traditional territories for the expressed benefit of the community, family, and the individual. The Aboriginal Peoples continue to rely upon Atlantic Salmon as Traditional food source.

In 1990, the Supreme Court of Canada re-affirmed, through the Sparrow Decision, the Aboriginal priority rights to fishing for food, social and ceremonial purposes over recreational and commercial fisheries. Atlantic salmon continue to be fished by more than 40 First Nations Reserve communities and by the larger population of Traditional Ancestral Homeland Aboriginal Peoples (off-reserve) in Eastern Canada. Due to conservation considerations some aboriginal communities do not fish for salmon.

When Aboriginal fisheries occur in areas such as Quebec, Labrador, Newfoundland, New Brunswick, Nova Scotia, and Prince Edward Island, Aboriginal Peoples are generally engaged in agreements, arrangements or licences which may stipulate gear, season and catch limits. Many Aboriginal communities follow a strict communal harvesting guideline which respects the resource in accordance with an eco-centric worldview recognizing an interrelated and interdependent relationship with this environment. Harvests are required to be reported collectively by each Aboriginal user group. However, if reports are not available, the catches are then estimated to derive total harvest numbers.

Since 2004, food fishery arrangements were developed with the Labrador Inuit Association, the Innu First Nation, and the Labrador Métis Nation These fisheries occur in traditional areas i.e. bays and estuaries close to river mouths and in near

shore areas of coastal Labrador. Considering that the fishery occurs away from the headland areas where the commercial fishery historically took place there is minimal interception of mixed stock fisheries.

Since 2000, a licensed food fishery for Labrador residents has taken place in the Lake Melville and Southern Labrador areas. Residents were permitted to retain a maximum of four salmon of any size as a by-catch while fishing for trout and charr using fixed gill nets of specified size. Retained salmon were required to be tagged along with a requirement to complete and return a logbook to DFO following the closure of the fishery.

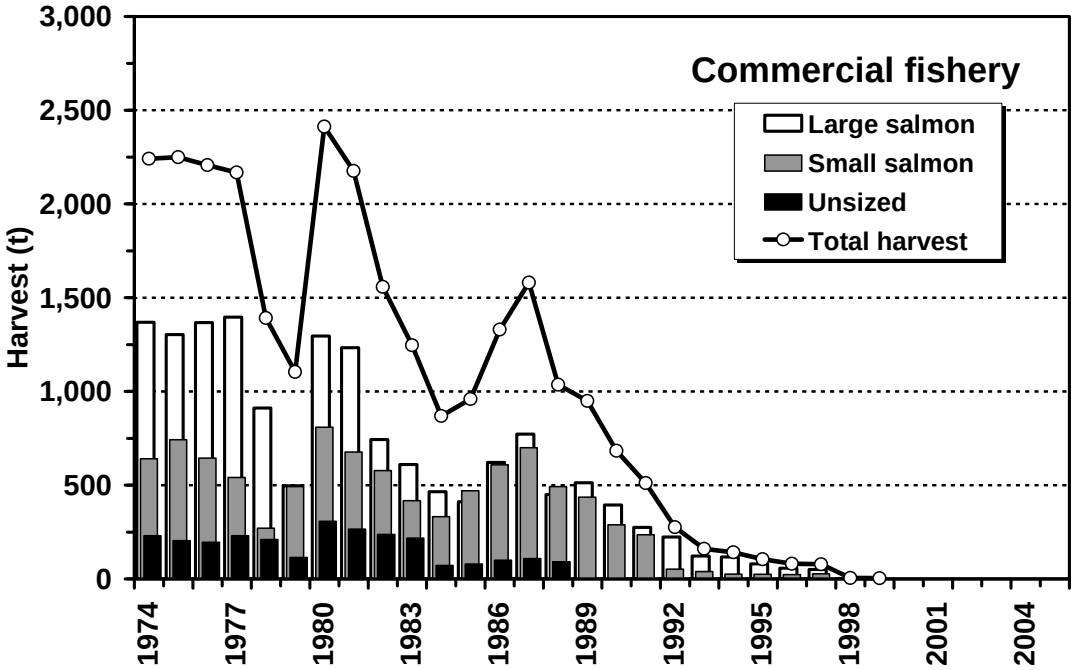
Since 2000, the aboriginal and food fishery harvests have varied between 47 and 63 t annually, with less than 50% by number of the harvested fish being large salmon. In 2005, the harvest was 59.6 t, with 34% by number of the harvested fish being large salmon. The fisheries in 2005 occurred principally in rivers and estuaries, 61% of the total harvest by weight.

Commercial Fisheries

Commercial fisheries for Atlantic salmon in Canadian waters have been under increasing restrictions since the passing of the Fisheries Act in 1868. Commercial exploitation of salmon was continually reduced through gear, season, location and license transfer regulations until a general license reduction program was initiated in 1972.

Conservation measures were initiated in 1972 continued in 1984, when the commercial fisheries of the New Brunswick, Nova Scotia, and Prince Edward Island as well as portions of Quebec were closed. Further reductions were introduced through the late 1980s and early 1990s leading to a moratorium on commercial salmon fishing for insular Newfoundland in 1992, followed by moratorium in 1998 for Labrador. A coast wide license buy-back was initiated to reduce effort. Finally, in 2000, all commercial fisheries for Atlantic salmon closed.

Over the time series commencing in 1910, the peak commercial harvest of salmon in eastern Canada occurred in 1931 at 6,101 t. Since 1974, the year when size composition data of the commercial harvests became available, the peak harvest of 2,412 t occurred in 1980. Harvests of less than 2 t were reported in 1998 and 1999 and no harvests have occurred since 2000. The large salmon category comprised between 46% and 82% by weight of the commercial fishery harvests. The commercial fishery was primarily a coastal fishery except for some large estuaries of some of the Maritime Provinces' rivers.

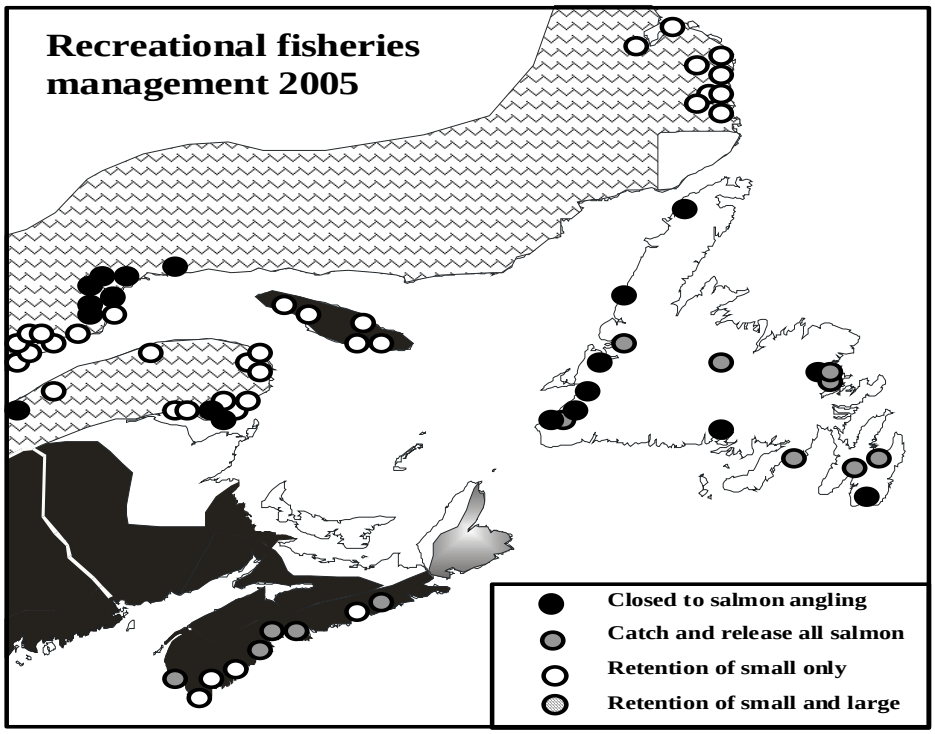


Annual commercial fisheries harvests (t) by size group in eastern Canada, 1974 to 1999.

Recreational fisheries

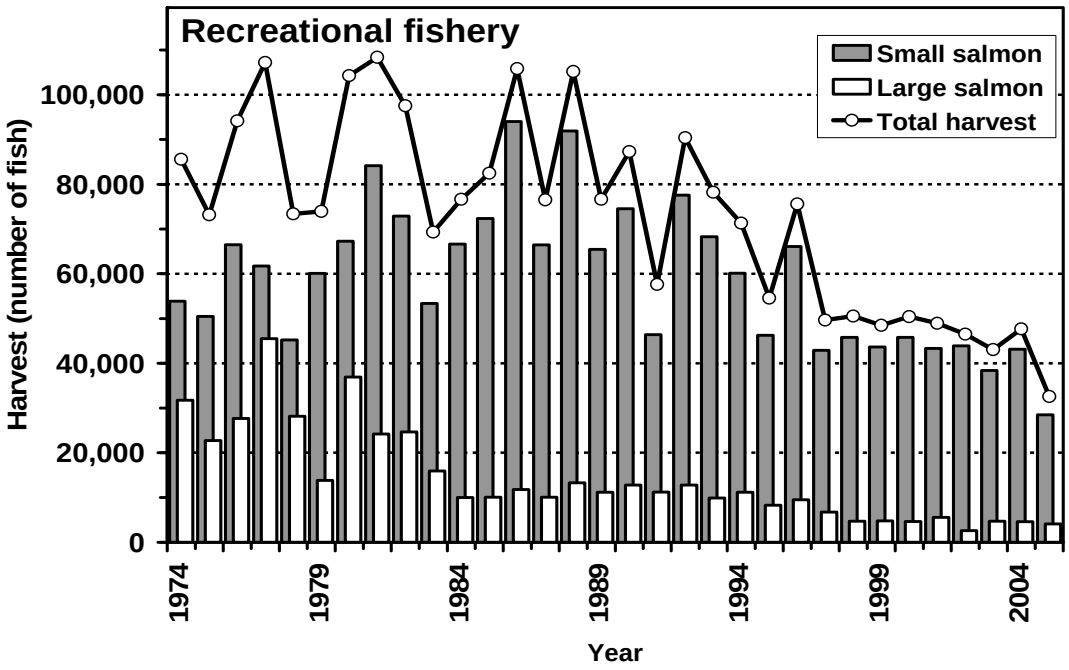
Licenses are required for all persons fishing recreationally for Atlantic salmon. All recreational fisheries occur in rivers with restrictions on gear. The fisheries are also regulated by seasons as well as with daily and seasonal bag limits. The daily and seasonal bag limits vary by and within provinces, within areas and by river. The maximum season limit was eight small salmon (no large salmon) in New Brunswick and parts of Nova Scotia. In Newfoundland, retention limits ranged from a seasonal limit of six fish to catch-and-release based on a river classification system. In those rivers of southern Labrador crossed by the Trans Labrador Highway, a seasonal retention limit of two small salmon and no retention of large salmon was applied. Where large salmon could be retained in Quebec and Labrador, the maximum limit was seven fish of any size in Quebec and four fish in Labrador (of which only one could be a large salmon). All retained salmon must be tagged.

Retention of salmon occurred within the recreational fisheries of Newfoundland and Labrador, Quebec, Prince Edward Island and those portions of New Brunswick and Nova Scotia bordering the Gulf of St. Lawrence. Catch and release only fisheries occurred along the Atlantic coast of Nova Scotia and the eastern portion of Cape Breton Island as well as in selected rivers of Newfoundland. Atlantic salmon recreational fisheries were prohibited in large areas of the Maritime Provinces and in 30 rivers in Quebec and nine rivers of Newfoundland. Numerous rivers in Quebec were subject to in-season assessments and based on estimates of returns to date, retention of large salmon may be prohibited for the remainder of the season.



Summary of recreational fisheries management for Atlantic salmon for 2005

Total harvest of salmon ranged between 70,000 and 110,000 fish annually between 1974 and 1990. There has been a near continuous decline in the total harvest of small and large salmon since 1992 with the lowest harvest of 32,600 fish reported in 2005. The peak harvest of large salmon was reported in 1977 at 45,500 fish whereas peak harvest of small salmon was reported in 1986 at 94,046 fish. Large salmon harvests declined after 1983 as a direct result of changes in management of the recreational fishery. The small salmon size group has contributed 87% on average of the total harvests since the imposition of catch-and-release recreational fisheries in the Maritime Provinces and Newfoundland in 1984.



Annual recreational fisheries harvests (number of fish) by size group in eastern Canada, 1974 to 2005

The practice of catch and release has increased in the recreational fisheries of Canada. In 1984, it became mandatory for anglers to release all large salmon in the Maritime Provinces and Newfoundland. In recent years, anglers have been required to release all salmon on some rivers and, on others, anglers voluntarily release caught fish. In recent years, some provinces have introduced catch and release only licenses.

Number of salmon caught and released in Canada			
Year	Small	Large	Total
2000	40,501	23,981	64,482
2001	33,146	26,241	59,387
2002	33,344	17,580	50,924
2003	30,413	23,232	53,645
2004	34,251	28,065	62,316
2005	25,297	20,589	45,886

In 2005, about 45,900 salmon (about 20,600 large and 25,300 small) were caught and released, representing about 58% of the total number caught, including retained fish. Most of the fish released were in Newfoundland (50%), followed by New Brunswick (26%), Québec (16%), Nova Scotia (8%), and Prince Edward Island (0.4%). Expressed as a proportion of the fish caught, Nova Scotia released the highest percentage (90%), followed by New Brunswick (67%), Prince Edward Island (62%), Newfoundland (55%), and Québec (50%). There is some mortality on these released fish, which is accounted for in rivers assessed for their attainment of conservation requirements

1.4 Management Authority

Regulations are made under the authority of the federal *Fisheries Act*. The federal Department of Fisheries and Oceans (DFO) is the main authority for regulations concerning management of Atlantic salmon except in Quebec where the Provincial government has been delegated the authority. All people fishing for Atlantic salmon must be authorized by a license. The Atlantic Provinces are responsible for licensing recreational freshwater fisheries for Atlantic salmon. The Federal government licenses all Aboriginal fisheries for Atlantic salmon. Within the Labrador Inuit Land Claims Area, the Nunatsiavut Government co-shares management with Fisheries and Oceans through the Torngat Fisheries Board.

Management and Licensing Authority by Province

Province	Management Responsibilities For Atlantic Salmon	Authority
Newfoundland / Labrador	**Federal government manages the marine and freshwater fisheries and licensing of Aboriginal fisheries and the Nunatsiavut government licenses its Inuit domestic fishery. Province is responsible for licensing of the recreational harvest in freshwater and requires the use of tags for the Recreational Fishery.**	**Fishery (General) Regulations, Newfoundland Fishery Regulations, Aboriginal Communal Fishing License Regulations** **Wildlife Regulations – Newfoundland/Labrador** **Labrador Inuit Land Claim Agreement**
New Brunswick, Nova Scotia, Prince Edward Island	**Federal government manages marine and freshwater fisheries and licensing of Aboriginal fisheries. Provinces license recreational harvest in freshwater and requires the use of tags for sport caught salmon.**	**Fishery (General) Regulations, Maritime Provinces Fishery Regulations, Aboriginal Communal Fishing License Regulations** **General Angling Regulations – N.B. Fishing Regulations – N.S. Angling Regulations – P.E.I.**
Quebec	**The Province manages and licenses the harvest and requires the use of tags for sport caught salmon.**	**Fishery (General) Regulations, Aboriginal Communal Fishing License Regulations** **Quebec Fishery Regulation**

(Note: A *National Parks Act* fishing license is required in a National Park)

The *Fisheries Act* also has provisions for habitat protection. This extends to levying penalties for destruction of fish or fish habitat, and includes provisions for habitat restoration by a guilty party. The *Fisheries Act* is considered to be the most powerful environmental legislation in Canada concerning fish and the protection, and restoration of fish habitat.

Additional federal environmental legislation of significance for protecting habitat whether its freshwater or marine are included in the *Canadian Environmental Assessment Act* (used to assess proposed projects which could affect habitat ie. Dams, mines, aquaculture sites,) and the *Oceans Act* (provides a means to deal with at sea pollution and protection of sensitive marine habitat).

Inner Bay of Fundy Atlantic salmon are also provided protection under the *Species At Risk Act* and the Canadian *Nationals Park Act*.

Federal environmental legislation is also supplemented by legislation under Provincial authority (Annex I) aimed at preventing water pollution and habitat destruction by various activities such as the petroleum industry, logging, transportation, pulp and paper.

2. STATUS OF STOCKS

Stock status is evaluated in the context of abundance and attainment of river-specific conservation requirements. The objective is to maintain spawning escapements above the conservation requirements. In the Maritime provinces, the conservation limit is an egg deposition rate of 240 eggs per 100 m² of fluvial habitat and this rate is expected to maximize freshwater production. In Newfoundland, a deposition rate of 240 eggs per 100 m² of fluvial area is used with an additional requirement of 368 eggs or 105 eggs per ha of habitat area, the latter rate is applied to rivers in the northern peninsula of the province. In Quebec, conservation limits are defined in terms of an egg deposition rate equivalent to 1.67 eggs per unit of production, the unit of production varying with the type of habitat in the river and the latitude. In Labrador, a deposition rate of 190 eggs per 100 m^2 of fluvial habitat is used. The rearing of salmon parr in lakes and ponds also occurs in Labrador and specific conservation rates may be recommended in the future.

Conservation limits in terms of two-sea-winter salmon, as a subset of the total conservation requirements, have also been defined for eastern Canada and are used in the development of the catch advice and risk analysis for mixed stock marine fisheries at West Greenland and in Canada.

Assessments are prepared for a limited number of rivers based on the importance of the river in a region, as an indicator of patterns within a region, or because of specific requests for fisheries management advice. The returns represent the size of the population before any in-river and estuarine removals. Spawning escapement is determined by subtracting all the known removals, including food fisheries, recreational harvests, broodstock collections, and scientific samples from the total returns.

Estimates of returns of salmon are obtained using various techniques including total counts at fishways and counting fences, using mark and recapture experiments, visual counts by snorkelling, boat/canoe or from shore, and based on angling catches and estimated exploitation rates.

Indices of freshwater production are available from a subset of assessed rivers. Wild smolt production was monitored from eleven rivers in 2005 distributed among Newfoundland, Quebec, New Brunswick and Nova Scotia. Juvenile abundances are monitored in New Brunswick and Nova Scotia rivers and serve as an index of spawning escapement levels and where escapements are known, are used to monitor fresh water survival.

Fish designated as being of wild origin are defined as the progeny of fish where mate selection occurred naturally and whose life cycle is completed in the natural environment. Limited hatchery production and stocking in support of public fisheries takes place in eastern Canada. Four non-government hatcheries continue to stock modest numbers of juvenile salmon of various life stages in New Brunswick, Nova Scotia, and PEI rivers of the southern Gulf of St. Lawrence. Limited stocking from one provincial hatchery occurs in Quebec only for rivers below conservation requirements. Federal biodiversity centres have re-focused their operations on preservation of endangered populations in the Inner Bay of Fundy and restoration of populations threatened with loss in the outer Bay of Fundy and Atlantic coast of Nova Scotia.

The presence of aquaculture escapees is monitored in rivers with trapping facilities and these fish are generally identified by fin erosion and scale characteristics.

2.1 Abundance

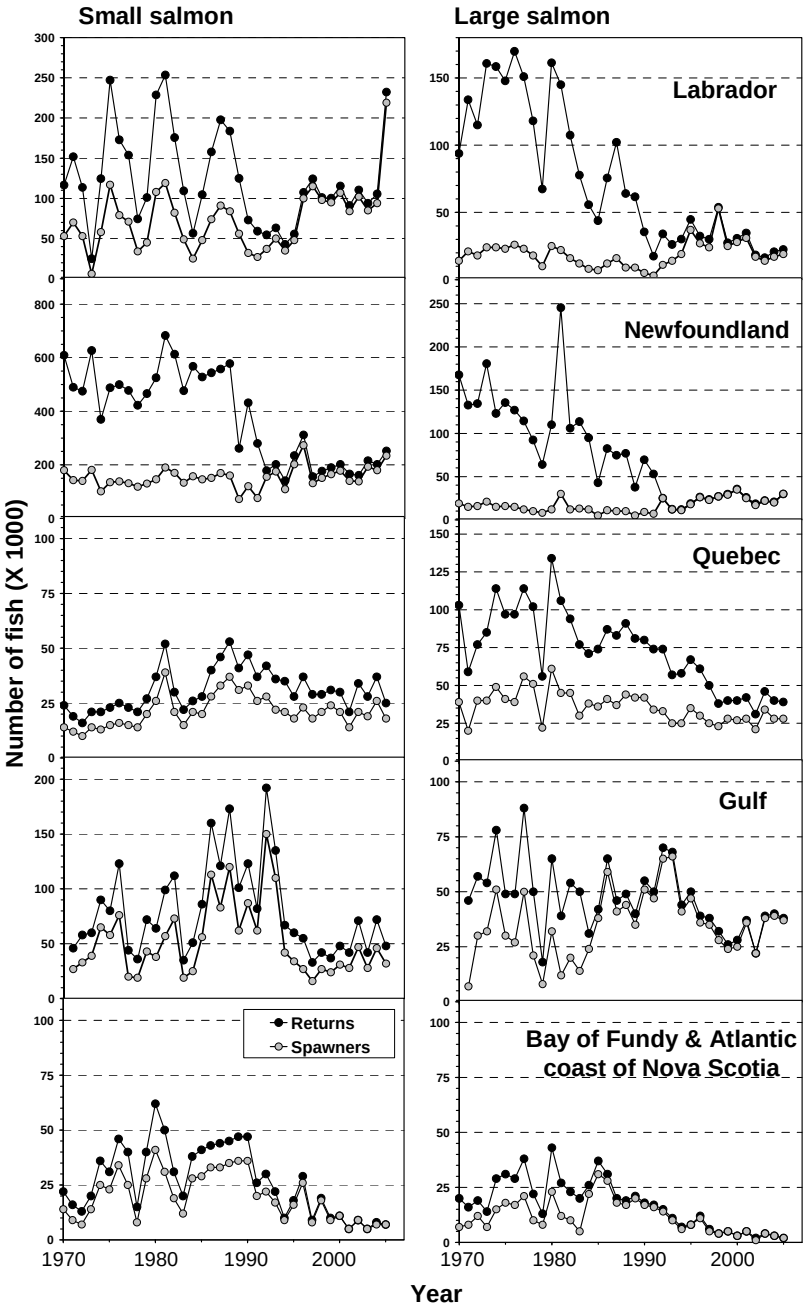
The abundance of Atlantic salmon by size group and specifically for 2SW salmon as well as the attainment of the conservation limits are described for five geographic areas of eastern Canada. For Newfoundland and Labrador, the abundance represents recruitment to each area and incorporates components of the harvests in Newfoundland and Labrador. For the other areas, the abundance is expressed as returns to the respective coastal areas and account for their respective marine fisheries but not for interceptions in the Newfoundland and Labrador. The commercial fishery has been closed for several years. Harvests of North American origin salmon at West Greenland are excluded from the estimates of recruits and returns for all areas.

The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic prior to any exploitation at sea has oscillated around a declining trend since the 1970s to an average of 506,000 fish over the past five years. The 2SW salmon component is specifically considered because it is the primary age group which is potentially exploited at West Greenland and in eastern Canada represents the dominant egg bearing age group.

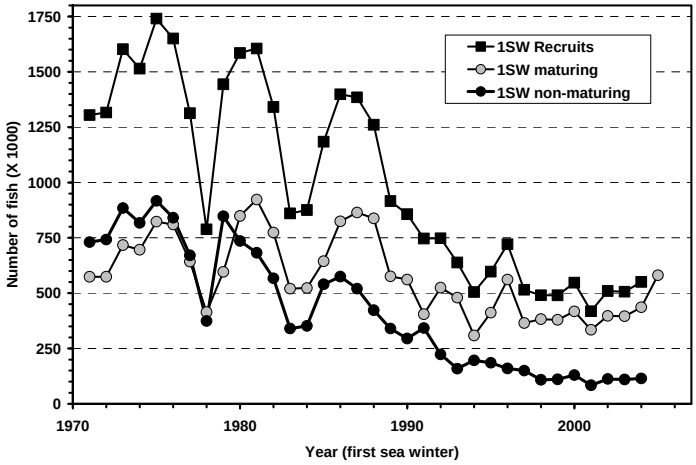
Spawning escapements of 2SW salmon have been maintained at reduced levels as a result of fisheries management measures in each area. Despite these major changes in fisheries management, returns and spawning escapements have continued to decline in the southern area and many populations are currently threatened with extirpation.

The abundance of Atlantic salmon in five geographic areas of eastern Canada can be summarized as follows:

- Total abundance (number of fish) is highest in the northern areas (Labrador and Newfoundland).
- The declines in abundance are noted in all areas post 1990.
- Large salmon abundance has declined in all areas and the abundances are presently at the lowest levels since 1970.
- Declines in abundance of small salmon have been most severe and sustained in Newfoundland, Gulf, and the Bay of Fundy/Atlantic coast of Nova Scotia.
- Spawning escapement has been sustained by reductions in exploitation in marine, estuarine and in-river fisheries. The exception being the southern area where the spawning escapement trends have tracked the declines in abundance.



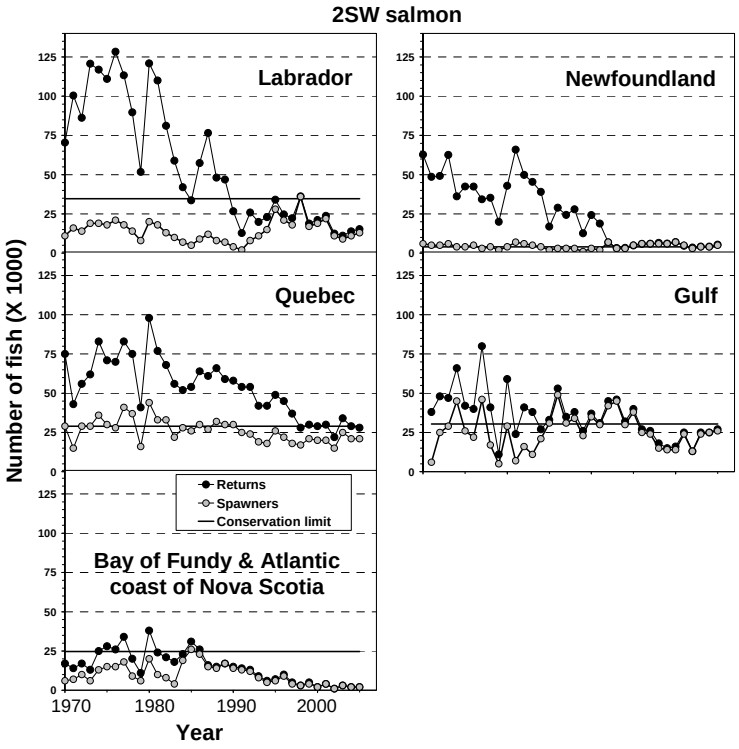
- The decline from earlier high levels of abundance has been more severe for the 2SW salmon component (1SW non-maturing) than for the small salmon (1SW maturing) age group.
- The abundance of the non-maturing 1SW salmon reached its lowest level in 2001 (returns as 2SW salmon in 2002 to North America) at 85,000 fish.



- Over the last ten years, the abundance of non-maturing 1SW salmon has averaged 127,000 fish, which is about 50% of the total 2SW salmon spawner requirement for North America (212,189 fish adjusted for natural mortality).

The returns and spawners of 2SW salmon to the five geographic areas of eastern Canada are of similar characteristics to the trends in returns and spawners of the large salmon group described previously.

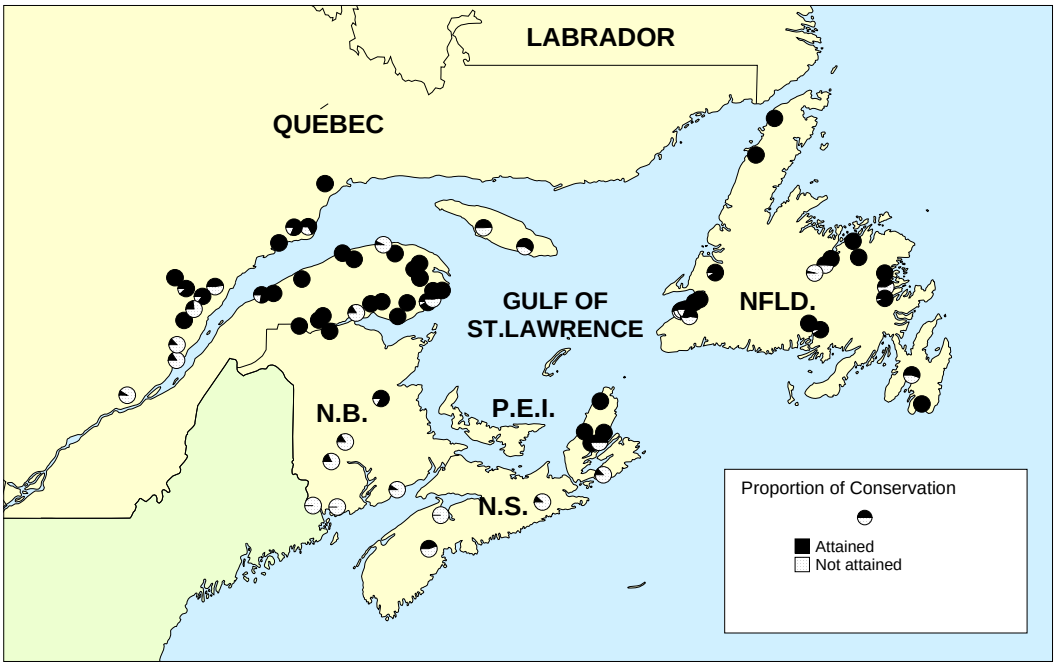
- In the early decades, returns to each area were sufficient to meet area specific 2SW conservation limits (CL).
- Returns relative to the CLs were deficient in the southern area post 1986, in Labrador post 1989, and in Gulf post 1995.
- Returns approximately equal the CL in Quebec since 1998 and have remained at or above the CL for Newfoundland since 1992.



- The abundance of 2SW salmon has been at about 10% of the southern area CL over the past five years.

River-specific spawning escapements

Egg depositions by all sea-ages combined in 2005 exceeded or equaled the river specific conservation limits in 34 of the 75 assessed rivers (45%) and was less than 50% of conservation limits in 20 other rivers (27%).



- Large deficiencies in egg depositions were noted in the Bay of Fundy (between New Brunswick and Nova Scotia) and Atlantic coast of Nova Scotia where 9 of the 12 rivers assessed (75%) had egg depositions that were less than 50% of conservation limits (CL).
- In Quebec, 24% of the assessed rivers had egg depositions less than 50% of CLs.
- For 3 of 4 of the Gulf rivers (New Brunswick, Prince Edward Island and Nova Scotia) and 55% of the Québec rivers, egg depositions equaled or exceeded conservation limits.
- In Newfoundland, 38% of the rivers assessed met or exceeded the conservation limits and 9% had egg depositions that were less than 50% of conservation limits; most of the deficits occurred in the southwest rivers of Newfoundland.

In eastern Canada since 2000, the number of assessed rivers which met or exceeded the river-specific conservation limits has only been above 50% in 2004.

	2000	2001	2002	2003	2004	2005
Percentage of assessed rivers exceeding CL	43%	38%	29%	44%	54%	45%

Freshwater production

There is high annual variability in the smolt production and generally it has not increased in any of the monitored rivers over the past decade. Smolt production remains low in the southern areas which are consistent with the low spawning escapements to these rivers.

Juvenile salmon abundance monitored annually in a number of southern region and Gulf rivers show trends consistent with stock status. In the rivers of the southern Gulf, densities of juveniles have increased since 1985 in response to increased spawning escapements. Abundances of juveniles in the Atlantic coast rivers of Nova Scotia and Bay of Fundy rivers are low and have declined with decreasing spawning escapement. In 2000, juvenile salmon could not be found in half of 57 rivers sampled on the Southern Upland portion of Nova Scotia and in 16 of the 57 rivers, there were fewer than 5.0 juveniles per 100 m^2 or 7% of a "normal" abundance. In 2002, young-of-the-year salmon were absent from 30 of 34 rivers sampled in the Inner Bay of Fundy.

Marine survival

Time series of return rates of smolts to 1SW and 2SW adults of varying lengths are available for 11 wild and two hatchery stocks in eastern Canada for 2005. The characteristics can be summarized as follows:

- Survival of fish is low compared to historical levels, especially in the south;
- Survival of stocks to home waters did not increase as expected after closure of the commercial fisheries in 1984 and 1992; and
- Return rates of wild stocks exceed those of hatchery stocks.

RETURN RATES OF MONITORED STOCKS OF CANADA FOR THE LAST FIVE YEARS					
Origin	Age Group	Region	Return rate		Number of stocks
			Mean (%)	Range (%)	
Wild	1SW	Maritimes	3.4	1.1 to 6.4	4
		Québec	0.6	0.3 to 1.0	2
		Newfoundland	5.4	2.4 to 11.4	5
Wild	2SW	Maritimes	1.0	0.2 to 2.2	3
		Québec	0.6	0.1 to 1.4	2
Hatchery	1SW	Maritimes	0.50	0.27 to 0.87	2
Hatchery	2SW	Maritimes	0.12	0.05 to 0.21	2

2.2 Diversity

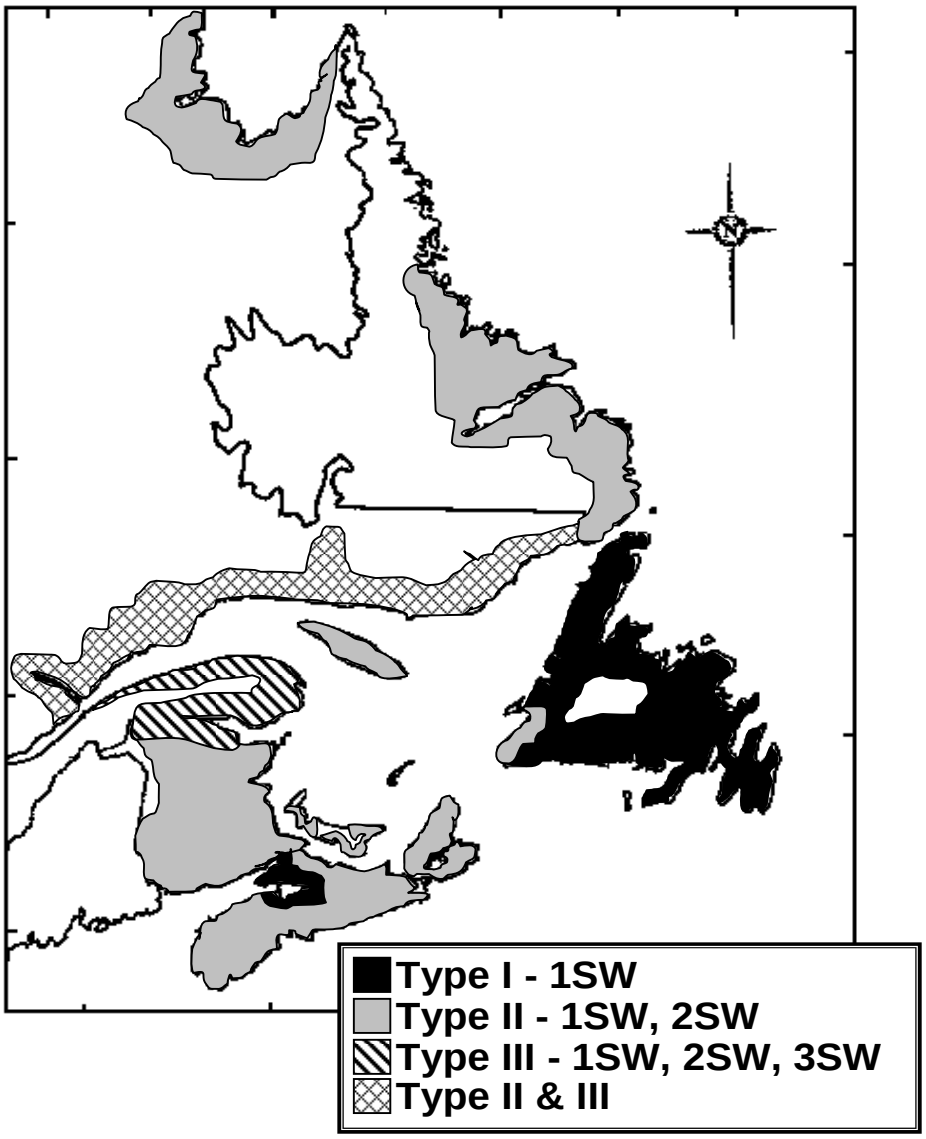
Atlantic salmon return with a high degree of fidelity to their natal river for spawning. This characteristic has led to the formation and maintenance of river-specific adaptations, resulting in variability in genetic, life-history, and behavioral traits. Few population genetics studies of Atlantic salmon have been carried out at fine spatial scale in the species' Canadian range. Based on limited studies, salmon of the Southern Upland portion of the Atlantic coast of Nova Scotia, the inner Bay of Fundy

and elsewhere in Atlantic Canada are considered to be genetically distinct from each other. Further ecological, life history, and molecular genetic information and analyses are required to delineate Atlantic salmon structure throughout their Canadian distribution.

Adult Atlantic salmon return to rivers from feeding and staging areas in the sea mainly between May and November, but some runs can begin as early as March and April. In Canada, Atlantic salmon can spawn annually for up to six spawning events.

Depending on the stock, spawners returning to rivers are comprised of varying proportions maiden fish (those spawning for the first time) and repeat spawners.

Adapted from / Adapté de O'Connell et al. 2006



Distribution of generalized groupings of stock types of Atlantic salmon in North America. Stock Type I consists mainly of 1SW spawners, Type II has 1SW and 2SW spawners, and Type III is comprised of 1SW, 2SW, and 3SW spawners. Within each stock type area there may be a few stocks which belong to another stock type (O'Connell et al. 2006).

Most salmon stocks consist of varying proportions of smaller fish that return to spawn after one winter at sea (1-sea-winter or 1SW, also known as grilse), larger fish that return after two or more winters at sea (2, 3-sea-winter, also designated as

multi-sea-winter or MSW) and repeat spawning salmon. Relative proportions of grilses, MSW and repeat spawning age groups and associated biological characteristics vary widely among stocks and with geographic location in North America. In rivers in which the dominant age group is 1SW salmon, it is the dominant egg-bearing age group. In stocks with multi-sea-winter salmon, the dominant egg-bearing age groups are 2SW and older salmon.

Special Designated Stocks

Inner Bay of Fundy

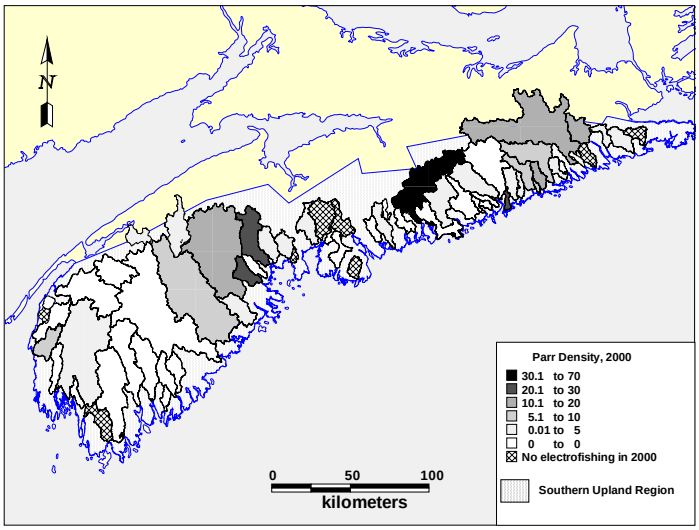
Inner Bay of Fundy stocks have been designated as endangered under Canada's *Species At Risk Act*[1]. Based on reported recreational catch and electrofishing data, Atlantic salmon are known to have occupied at least 32 rivers around the inner Bay of Fundy. It was estimated that, historically, as many as 40,000 salmon likely returned to these rivers. An analysis for the Stewiacke River, an index river for this complex, indicated with a 90% probability that the population declined by more than 99.6% between 1967 and 2000, and by more than 92% since the early 1990's. Densities of juvenile salmon are increasing in rivers with Live Gene Banking (LGB) support from the biodiversity centres but salmon densities remain low in many parts of these rivers. River-specific extirpations are ongoing in rivers without LGB support.

While the overall prognosis on adult population status is bleak, the increased abundance of juvenile salmon in rivers receiving LGB support indicate that this program has halted the decline of salmon in rivers receiving LGB support, and has potentially prevented the extirpation of salmon from some rivers and safeguarded against the loss of this distinct genetic lineage.

Southern Upland rivers of Nova Scotia

At least 65 rivers within the geological area known as the Southern Upland of Nova Scotia were known to maintain salmon populations. Rivers of the southern upland region are generally organic-acid stained, of lower productivity, and, when combined with acid precipitation it can result in acidic conditions toxic to salmon.

As of 1986, there were 20 rivers that were partially acidified (main-river annual mean pH between 4.7 and 5.0) and at least 14 rivers were heavily acidified (pH < 4.7) and had lost their population of Atlantic salmon. Population simulation analysis indicated that at those acidity levels and 5% marine survival only seven of 47 rivers on the Southern Upland were expected to be self sustaining.



[1] *Species at Risk Act* – Federal Legislation to protect wildlife species from becoming extinct which obligates governments to provide a Recovery Strategy and Action Plans.

There is evidence that despite reduction in sulphate depositions, acidity in Southern Upland rivers has not been reduced at rates observed in other geographic areas. Juvenile monitoring in recent years suggests that population extirpations have doubled in the 15 years since 1986 and that most populations are critically low.

3. THREATS AND MANAGEMENT MEASURES

The decline in abundance of Atlantic salmon in eastern Canada has stimulated two intensive reviews by DFO, one following the exceptional low return of salmon in 1997 (DFO 1998) and a second workshop in June 2000 (Cairns 2001). The latter identified several possible factors and research initiatives which could lead to a better understanding of the factors and possible interventions to arrest the decline in Atlantic salmon. Factors addressed in the following section pertain specifically to Atlantic salmon in eastern Canada and include: fisheries, habitat, aquaculture, and other natural factors. These initiatives are consistent with the NASCO agreement on the management of fisheries, on the protection and restoration of Atlantic salmon habitat, and on the management of aquaculture, introductions and transfers.

3.1 Impact of Fisheries on Stocks

International Council for Exploration of the Sea (ICES) considers that fisheries on mixed stocks pose particular difficulties for management as they cannot target stocks that are at full reproductive capacity. Conservation would be best achieved if fisheries target stocks that have been shown to be at full reproductive capacity. Fisheries in estuaries and rivers are more likely to meet this requirement.

Consistent with national and NASCO policy and as recommended by ICES, the fisheries in eastern Canada have moved away from mixed stock marine fisheries to fisheries on river-specific stocks within estuaries and fresh water. Fisheries are principally managed on a river-by-river basis and, in areas where retention of the dominant egg-bearing size group is allowed, harvests are closely controlled.

Measures for Aboriginal Food, Social and Ceremonial Fisheries

As indicated previously, Aboriginal food, social and ceremonial fisheries take place subject to arrangements, agreements or through licences issued to Aboriginal Communities. The licences generally stipulate gear, seasons, methods, catch limits and locations. Most of these fisheries take place in fresh water or in estuaries close to river mouths. Although the reports of harvests are incomplete, the fisheries impact river-specific stocks whose status is closely monitored. In large areas of eastern Canada, aboriginal fishing was curtailed due to concern about stock status.

Gill nets are the most common gear for fishing in estuaries but in some locations such as the Miramichi and other Gulf New Brunswick rivers, there has been a concerted effort to fish with estuary trapnets rather than gill nets to allow the selective harvest of small salmon and the release of large salmon and other incidental catches unharmed to the water.

Some of the aboriginal and food fisheries of Labrador take place in what are considered to be coastal waters. This fishery is however different from the historical commercial fishery in that it occurs close to river mouths and likely harvests few

salmon from other than local rivers. Reporting rates in this fishery are very high, upwards of 85% compliance in the completion of fishing logbooks.

Measures for Recreational Fisheries

In 2005, 54% of the reported harvest of Atlantic salmon occurred in the recreational fisheries. In this fishery, 100% of the effort and catch occur in fresh water and are therefore river-specific. Licenses are required to fish recreationally and fishing is generally restricted to fly fishing with daily/seasonal limits. All salmon harvested are required to be tagged. Recreational fisheries vary by area from complete closures of all fisheries to retention of both small and large salmon.

The compliance of licensed recreational anglers is considered to be very good. The management measures intended to promote the objective of meeting or exceeding the conservation limits is summarized below:

- In the Maritime provinces (NS, NB, PEI):
    - No retention of large salmon is allowed;
    - Daily retention limits of one or two fish per day depending on the river;
    - Maximum daily catch limits of four fish per day;
    - A review in early July of returns to date determines whether the limited catch and release fishery in the LaHave River remains open;
    - A large portion of the Maritime provinces is closed to retention fisheries of any size due to low stock abundance.
- In Quebec:
    - Management rules are set before the season in order to reach the conservation limit on each river;
    - All harvests of salmon, regardless of size, must be reported within 48 hours;
    - On rivers where large salmon can be retained, if the first fish retained is a large salmon, then fishing must cease for the day. A daily maximum of two fish retained per day is allowed;
    - In the northern zone each river has its own set of restrictions as most of these rivers are difficult to access and effort is lower than in the southern rivers;
    - In the southern zone, where approximately 90% of the fishing effort takes place, fisheries are closed due to small population size. Retention of small salmon only is permitted on about 50% of the rivers. On the remaining rivers where large salmon retention is allowed, river-specific in-season assessments are conducted. If the number of fish observed during the in-season assessment is less than the value which would provide a high probability of meeting conservation by the end of the season, then retention fishing for large salmon is prohibited.
- In Newfoundland:
    - Retention of large salmon is prohibited. These fish provide a buffer to meeting conservation limits;
    - A river classification system is used, where possible, to establish river-specific season retention limits for small salmon. The classification system considers the size of the river and its previous status relative to

conservation to set the license-specific retention limits from 0 to a maximum of 6 fish per year;

- Daily retention limits of two small salmon and maximum catch and release limit of four fish;
- Barbless hooks are mandatory.

- In Labrador:
  - Retention of large salmon is permitted on a limited number of rivers;
  - Retention of large salmon is prohibited on rivers crossed by the Trans-Labrador highway with a seasonal retention limit of two small salmon;
  - On other rivers in Labrador, there is maximum season retention of four fish of which only one may be a large salmon. These remaining rivers are remote, difficult to access and have low overall recreational fishing effort;
  - Barbless hooks are mandatory.

Special consideration for catch and release fisheries

The practice of catch and release has increased in importance in the recreational fisheries of Canada. In 2006, about 49,279 salmon were caught and released, representing about 58% of the total number caught, including retained fish. Under the right conditions, catch and release angling is considered to be an effective conservation and management tool (DFO 1998). Water temperature and handling during release are factors which affect the survival rate of released fish. Numerous studies on the stress and mortality associated with catch and release have been conducted and form the basis for the estimates of incidental mortality and the environmental criteria under which recreational fisheries are allowed (Dempson et al. 2002).

Examples of some of the tools used:

- The mortality rate for catch and release fish in eastern Canada are estimated to be 3% to 10%.
- In Newfoundland and Labrador barbless hooks are mandatory.
- Environmental Protocols are used in Newfoundland & Labrador to close rivers to recreational fishing when the water temperature is equal to or greater than 22ºC on two consecutive days, as measured in mid-afternoon. During the period 1975 to 1999, 65% or more of the rivers in Newfoundland were closed for some period of time and on average 28% of the rivers have been affected annually (Dempson et al. 2001).
- Intermittent closures to recreational fishing have been in place in the Miramichi River in response to warm water and low water conditions during July and August. There are no formal environmental criteria in place and decisions are based on observed exceptional mortalities of fish (not all due to angling) and concerns for the increased opportunities for illegal fishing activities.

By catch of salmon in other Canadian fisheries

In eastern Canada, Atlantic salmon cannot be retained in non-salmon directed fisheries and any salmon caught as bycatch in these fisheries must be returned to the water. In 2004, NASCO requested advice from ICES on the potential fisheries and the level of bycatch of salmon in eastern North America. ICES concluded that there were some fisheries in eastern Canada with the potential to catch salmon

incidentally but there was no evidence of significant bycatch of salmon in these fisheries (ICES 2004).

Specific measures currently in place to reduce the amount of salmon bycatch and include:

- The moratorium on the groundfish fishery in eastern Canada in 1992 has eliminated a large amount of gear which historically captured salmon.
- Various measures in Newfoundland to minimize bycatch in the bait and Pelagic fisheries include: restricting fishing times or implementing closures in areas with high salmon abundance and restrictions on how and where nets are set.
- Gaspereau trapnet fisheries seasons in the Miramichi River (New Brunswick) are adjusted to minimize handling of Atlantic salmon bycatch.
- Estuary American shad fisheries in the Saint John River (New Brunswick) are closed when salmon are present.

Effects of non-Canadian fisheries

Salmon of Canadian origin are captured in the marine fisheries of St. Pierre and Miquelon and at West Greenland.

St. Pierre and Miquelon (France)

There are no salmon producing rivers on the islands of St. Pierre and Miquelon (SPM). Reported harvests of salmon in the marine gill net fishery ranged between 2 and 3 t per year over the past ten years. All adult age groups of salmon are harvested in the fishery. In the context of total harvests, the SPM fishery is small but it is a mixed stock and interception fishery.

A recent genetic analysis of a sample of the catches from 2004 indicated that 98% of the fish were of Canadian origin (ICES 2006). As this fishery occurs in a marine area adjacent to the south coast of Newfoundland it likely has an impact on under performing stocks in this area as well as other stocks in Canada.

West Greenland

The fishery at West Greenland (WG) harvests fish of North American and Northeast Atlantic origin and is therefore, a mixed-stock interception fishery. The salmon caught in the WG fishery are mostly (>90%) non-maturing 1SW salmon, most of which are destined to return to home waters as multi-sea-winter (2SW primarily) fish. In the past ten years, the continent of origin of the harvested fish has been predominantly North American. The fishery for local consumption of 2002 to 2005 has harvested between 2,300 and 4,000 fish of North American origin.

Year of the fishery	Harvest at West Greenland (t)	Percent North American origin	North American origin harvest (number of fish all age groups)
1996	92	70%	23,400
1997	58	85%	17,200
1998	11	79%	3,200
1999	19	91%	5,600
2000	21	65%	5,800
2001	43	67%	9,900
2002	9	69%	2,300
2003	9	64%	2,800
2004	15	72%	4,000
2005	14	74%	3,700

It is likely that fish from all multi-sea-winter producing areas of eastern Canada are intercepted in this fishery.

The North American stock complex of non-maturing salmon has declined to among the lowest levels in the time series dating to 1971. The overall status of stocks contributing to the WG fishery is among the lowest recorded.

ICES's advice was to not allow a fishery at West Greenland to take place in 2006, 2007, or 2008 or on mixed stocks of 2SW salmon in North America in 2006 to 2009.

Consideration for listed stocks

The inner Bay of Fundy stocks have been designated as "endangered" and listed in Schedule 1 of Canada's *Species at Risk Act*. The directed freshwater fisheries on this stock have been closed since the early 1990's.

A recovery plan for Inner Bay of Fundy Atlantic salmon was put in place in 2002. Juvenile and adult salmon populations in key rivers is being monitored as part of the plan. The plan also includes research on the distribution and ecology of salmon in the Bay of Fundy and its outer reaches. Tagging and tracking of inner Bay of Fundy smolts has been ongoing since 1999 to measure abundance of the population, and try to identify and mitigate the reasons for poor marine survival. Provisions have also been made to protect habitat.

Live Gene Banking (LGB) support from the biodiversity centers has halted the decline of salmon in rivers receiving LGB support, and has potentially prevented the extirpation of salmon from some rivers.

An allowable harm assessment conducted in 2004 concluded that any level of human-induced harm could jeopardize survival or recovery of the stock complex (DFO 2004). As such, no fisheries with expected bycatch of salmon of this stock complex would be permitted under the *Species at Risk Act*. Additional resources have been invested in conservation and protection efforts to safeguard the life stages residing and returning to fresh water.

Illegal harvests

Illegal harvests of Atlantic salmon, commonly referred to as poaching, occur in both inland and marine waters to varying degrees throughout Atlantic Canada. Poaching in marine waters is most frequently carried out using illegal gillnets, and also using otherwise-legal fishing gear (such as bait nets) that have been modified or set so as

to increase salmon bycatch. Poaching in inland waters is carried out by a variety of means, including jigging and, most seriously, sweeping of pools by nets.

The level of activities and the amount of salmon lost to such activities are difficult to quantify. The best estimates of the amount of salmon lost to such activities have been reported to ICES and NASCO and have varied from 81 t to 118 t annually 2001 to 2005. It is impossible to confirm these estimates as there is no actual harvest.

Numerous measures have been put in place to reduce the potential for poaching activities. These include:

- The installation, upkeep and monitoring of protection barriers in large guarded headwater pools which limit the upstream access of salmon in order to protect fish from poaching in remote upriver sections which are difficult to patrol. The province of New Brunswick in collaboration with communities and conservation organizations maintains six such facilities in four rivers. In the province of Quebec, stakeholders operate and maintain such facilities. Salmon are released to continue their short migration upstream to spawning areas in early fall when poaching interests are reduced.
- Closure of sections or entire rivers to fishing activities under low water conditions which concentrate salmon in a reduced number of holding pools and increase opportunities for jigging of fish.
- The targeting of enforcement activities on organized and large illegal fishing activities motivated by the illegal sale of wild salmon. There is significant enforcement effort compared to other fisheries put towards dealing with illegal fisheries targeting Atlantic salmon. This effort includes Federal and Provincial enforcement personnel.
- Increased collaboration among provincial, federal and aboriginal conservation and protection personnel in the establishment of joint patrols and exchange of information.
- The use of programs such as “Dial-a-poacher” and “Crime-stoppers” to solicit information from the public leading to the arrest and prosecution of violators.
- The investment by local watershed associations towards the purchase, installation, and monitoring of video cameras at key pools and public announcements of these monitoring devices to deter illegal fishing activities and assist in prosecutions.
- Efforts to increase deterrence by seeking the most severe penalties possible for convictions for salmon poaching. As an added deterrent, details of convictions are published in local newspapers and on the government web sites. Convicted individuals are increasingly asked to make restitution to local conservation organizations.
- Facilitation of and support for numerous watershed stewardship groups which promote local awareness of and compliance with salmon conservation measures. In some instances employees of these groups perform compliance monitoring.
- Development and distribution of education and awareness products such as restaurant placemats, school presentations, and radio advertisements to promote compliance.

These are considered essential toward the control and continued reduction of poaching activities in eastern Canada.

Fishery Officers and Guardians enforce the habitat protection provisions of the Fisheries Act outlined below, with some priority for monitoring and enforcement generally placed on works or undertakings that have a potential to impact on Atlantic salmon habitat.

3.2 Habitat

In freshwater, estuaries and marine areas, human activities can affect the biological, physical, and chemical components of salmon habitat resulting in adverse impacts during critical spawning, rearing, and migration periods. Identifying and protecting habitat as wells as restoring and rehabilitating degraded aquatic habitats are key activities of federal and provincial governments in Canada.

The *Fisheries Act* of Canada defines fish habitat as: "Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes."

It is important to note that DFO does not authorize works or undertakings but rather authorizes the negative impacts on fish and fish habitat associated with works or undertakings, where these impacts are deemed acceptable and can be compensated. The regulation of works or undertakings associated with land and water uses resides with provincial or municipal level governments.

Physical Habitat

The *Fisheries Act* contains specific provisions that provide DFO's Habitat Management Program with the regulatory framework for the conservation and protection of fish and fish habitat. The application of these provisions is guided by the 1986 Policy for the Management of Fish Habitat with the overall objective of "net gain of habitat for Canada's fisheries resources". This is supported by three goals; fish habitat conservation (no net loss), fish habitat restoration and fish habitat development. Specific actions related to these goals are described below.

Fish habitat conservation

One of the responsibilities of DFO's Habitat Management Program is to evaluate proposed works or undertakings during the planning stages to determine the impact on fish and fish habitat. Where fish and fish habitat are threatened by proposed works or undertakings in or around water, the first and preferred approach to conserving fish habitat is to relocate or redesign the project so that the anticipated impacts are completely mitigated. Where it is not possible to completely mitigate the impacts of the proposed works or undertakings, DFO may authorize the loss of fish habitat as long as the loss can be off-set through the replacement or compensation of habitat using the hierarchy of preference in the Habitat Policy.

In 2004, the Habitat Management Program began to modernize the delivery of its responsibilities by implementing the Environmental Process Modernization Plan (EPMP). The aim is to apply a risk management approach to ensure that resources are focused on those fish and their habitats that are most important to their production and on the review of those works or undertakings that pose the greatest risk to fish and fish habitat. Low risk works or undertakings, where measures to avoid or mitigate impacts are well understood, would be dealt with through other

mechanisms such as operational statements, guidelines and standards (Best Management Practices, bmp) together with compliance and effectiveness monitoring and auditing.

The most effective approach to habitat conservation is the application of best management practices which minimize impacts on fish habitat. This has been fostered through agreements and memoranda of understandings (MOUs) on habitat protection between Canada, the provinces, industry and stakeholder groups. Some of these include:

- Agreements with provincial departments of transportation (*guidelines, bmp, engineer environmental certification*) to ensure fish passage at stream crossings;
- Agreements with provincial department of environment (*watercourse and wetland alteration guidelines)* to protect habitat and water quality; and
- Agreements with provincial department of natural resources (*forestry guidelines, forester certification*) to minimize impacts of forestry activities.

Provincial and federal personnel perform compliance monitoring and enforcement functions in relation to provisions of the Fisheries Act which protect physical fish habitat. Investigations and enforcement actions in response to habitat violations frequently result in the remediation by the party of the habitat or fish loss, or court imposed fines. Court fines are often directed towards government departments or non-government organizations for habitat remediation.

Fish habitat restoration and rehabilitation

Numerous works in the previous decades have negatively impacted on fish and fish habitat, most frequently in the obstruction of fish passage, and in the deterioration of river morphology. The recognition of this loss of productive fish habitat has resulted in a concerted effort to correct the inadequacies of these dated works and to restore river structures.

Agreements between some Provinces and the federal government have produced the following results over the past five years:

- Agreements with the provincial departments of transportation in PEI, NB and NS have resulted in the construction of several hundred fish passage structures, and remediation of several hundred highway culverts which were deficient in fish passage. These initiatives have resulted in the recovery of several thousand square km of habitat on existing salmon rivers;
- Agreements with provincial departments of natural resources and Ducks Unlimited Canada have resulted in the construction of fish pass facilities in a dozen dams;
- Improved forestry guidelines written in collaboration with provincial departments and certification training for foresters have reduced salmon habitat degradation and reduced fish passage obstruction on forestry roads;
- Partnership initiatives with mining and forestry companies as well as with other federal departments to remove unused dams has resulted in the recovery of approximately 400 square km. of fish habitat;
- Initiatives with power generating companies to improve fish passage at hydro dams;

- The Nova Scotia Salmon Association's Adopt-A-Stream is an example of government/NGO partnerships. In 2006, 20 community groups restored approximately 150,000 square meters of habitat in 21 watersheds.
- Aboriginal Peoples' groups also are involved in several partnership initiatives to restore and enhance Atlantic salmon habitat; and
- Provincial governments have been working with agriculture groups and individuals to improve their practices to reduce the impact of agriculture on fish habitat.

In 2005, the natural evolution of this habitat protection program has resulted in the publication of "*Ecological Restoration of Degraded Aquatic Habitats: A Watershed Approach"* which is in line NASCO objective on habitat protection and restoration.

Community watershed groups in partnership with federal or provincial governments are involved in improving fish habitat by increasing habitat diversity in low gradient streams using in-stream structures to improve the productive capacity for salmon.

Acid Rain

Sulfur-dioxide (SO_2) emissions (from metal smelting, coal-fired electrical utilities) and nitrous oxide (NO_x) emissions (combustion) are the principal acidifying pollutants transported over long distances and falling as acids in the precipitation in several areas. A specific concern is the acid precipitation that has affected a complex of rivers in eastern Nova Scotia referred to as the Southern Upland.

Approximately 75% of the wet sulfate deposition in southern Nova Scotia is from United States sources; 25% is from Canadian sources. North American emissions of SO_2 peaked in the early 1970s with reductions implemented due to health and environment concerns.

There is evidence that despite a reduction in sulphate depositions of about one-third since the mid-1980s, pH in Southern Upland rivers has not recovered at rates observed in other areas. In many rivers slow recovery is expected because of the effect that natural organic acids and low levels of natural buffering. Recoveries of elements like calcium, necessary for growth of fish are expected to take fifty to one hundred years in these rivers.

Increased H+ ion concentrations coupled with the low concentrations of Ca++ are responsible for the mortality of salmon in acidified rivers of Nova Scotia. The combination of geochemistry, weather patterns, thin soils and low acid neutralizing capacity has caused severe acidification of 65 rivers in the Atlantic coast of Nova Scotia. Salmon are extirpated from 14 rivers and populations had declined by 90% in another 20 rivers. Population simulation analysis indicated that at those acidity levels and 5% marine survival only seven of 47 rivers on the Southern Upland were expected to be self sustaining (DFO 2000). Since that analysis, pH has not improved and marine survival of wild salmon in the LaHave River, the index river for this area, has averaged only 3%.

Efforts to reduce emissions

Eastern Canadian Provinces and New England Governors (US) adopted a work plan in June 1998 that called for further national emissions reductions of 50% of sulfur dioxide and 20-30% of nitrogen oxides beyond current commitments. Québec had already committed, as a first step, to reducing its emissions to 40% below its current SO_2 cap by the year 2002.

The “Canada-Wide Acid Rain Strategy for Post-2000” was approved in October 1998, by 26 federal, provincial and territorial ministers of environment and of energy. Commitments in the Strategy included aggressive pursuit of SO_2 emissions reductions in key areas of the US and establishment of targets and schedules for further SO_2 emission reductions in Ontario, Quebec, New Brunswick and Nova Scotia.

Liming to neutralize acidity and restore habitat productive capacity

DFO (2000) reviewed a number of approaches for neutralizing the effects of acidity in streams. The usual neutralizing substance is limestone, and effective treatment requires a release of lime proportional to the discharge and acidity of the water that is to be neutralized. Potential liming compounds differ in theoretical neutralizing capacities, solubility in water, ease and safety of handling and cost.

Only one artificial liming program has been initiated to date. In 2005, the Nova Scotia Acid Rain Campaign Committee (Nova Scotia Salmon Association and Atlantic Salmon Federation) selected the West River Sheet Harbour watershed as a first site for implementing a broad-scale liming plan. The committee is developing a long-term liming strategy and setting out criteria for prioritizing all acid rain affected rivers in the province. This latter initiative was facilitated in a workshop in May 2006 to examine the science around acid rain impacts on salmon and the potential for liming to mitigate these negative effects.

Stocking of hatchery-reared fish to increase salmon returns

Population supplementation through artificial breeding and rearing has been a standard tool to enhance Atlantic salmon fisheries for over a century. Increased reliance on this tool emerged from the impact of acidification on the vulnerable Southern Upland. The method appeared to be viable through to the 1980’s. However, with the downturn in marine survival for both natural and enhanced wild populations in the 1990’s even the wild portion of enhanced stocks began to perform poorly without explanation. In several cases, enhancement could no longer offset the decreased productivity attributed to low marine survival and the wild populations declined. In many rivers, there is no suitable population size of wild adult salmon to conduct genetically safe enhancement practices for wild populations.

Supplementation programs that increase the probability of persistence of the residual wild salmon populations while maintaining genetic diversity, reducing domestication and reducing loss of fitness have taken precedence over historic enhancement activities.

Live Gene Banking to preserve stocks

Establishment of living gene banks for the remaining wild populations of the Southern Upland has been initiated and needs to be assessed as an appropriate management option for these rivers. The program emphasis has shifted from smolt rearing to adult rearing from wild selected parr or smolts. These priority activities are expected to continue while there are residual wild salmon populations remaining to protect. Analysis of the effectiveness of this procedure to enhance the genetic and numeric persistence of remnant populations is being evaluated.

Restricting exploitation

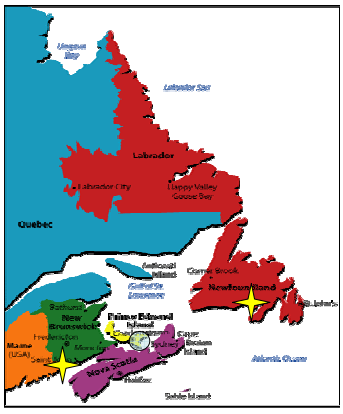
There are few opportunities to fish Atlantic salmon in the Southern Upland area. In the previous five years, there has essentially been no exploitation of wild salmon in any fisheries in the Southern Upland area rivers.

Contaminants

Recent studies have indicated that exposure of juvenile salmon to a range of sub-lethal concentrations of contaminants in fresh water, including pesticides and endocrine-disrupting chemicals, may compromise survival at sea (Fairchild et al. 2002). Sources of such compounds range from agriculture, sewage effluents, and industrial effluents. In addition, chemical pollution from chlorinated organic compounds which are widely distributed in the North Atlantic has been proposed as a complementary factor affecting the sea survival of Atlantic salmon (Scott 2001). The limited studies to date have examined a minute number of the vast variety of chemicals currently being utilized and introduced. Actions associated with contaminants and their effects on Atlantic salmon include:

- National Pesticide Program launched in 2002 by DFO to address issues pertaining to the biological impacts of pesticides on aquatic ecosystems; and
- Provision of information and scientific advice to the Pest Management Regulatory Agency which determines whether a pesticide should be registered. Chronic effects have been added to the criteria used by the regulatory agency in their evaluation.

3.3 Aquaculture



Aquaculture has brought much needed stability & employment to rural eastern Canada helping to minimize out-migration. It is an alternative for educated young people to pursue a career in their home communities. Presently, seventy-five percent of its workforce is under the age of 40.

Aquaculture in Atlantic Canada is often overshadowed by its salmonid mariculture sector ($225 million - 2005) which is predominantly concentrated on New Brunswick's Bay of Fundy (90%) ✦ coastline and in the Bay d'Espoir region ✦, Newfoundland and Labrador.

The Blue mussel is the most important shellfish species in the region ($32.9 million - 2005), notably for Prince Edward Island ◯ (65%), with the remaining industry shared among the remaining Atlantic Provinces and Quebec.

Aquaculture sites in Canada operate in a manner intended to minimize environmental effects. Management choices might include: choosing sites to avoid sensitive habitats; altering production schedules to allow fallowing periods; introducing best management practices and standards for equipment and containment of fish; and adapting stocking densities to improve a site's environmental performance.

The Government of Canada and provincial governments share the responsibility of defining and implementing management measures that reflect the requirements of their appropriate regulatory frameworks and international commitments.

Among its international commitments, Canada is engaged in the development of the Food and Agriculture Organization Guidelines for Aquaculture Certification. More recently, Canada became a member of the International Standards (ISO) Organization's Technical Committee 234 on Fisheries and Aquaculture.

The federal government is responsible for, among others, the review of licensing applications under the *Canadian Environmental Assessment Act*[1], research on wild/farmed species interactions, and the development of national (federal and provincial) programs concerning fish health and planned introductions and transfers. The federal government is guided by a government wide integrated risk management (IRM) policy. A major focus of the IRM approach is on ecosystem's performance. In addition to the obvious benefits to the ecosystem, there are opportunities for governments, industry, and other stakeholders to address species specific issues within the envelope of this approach.

Provinces are responsible for licensing aquaculture operations, providing tenure on Crown Lands for aquaculture activities, regulating activities related to fish health management, disease monitoring and surveillance, environmental performance, escape prevention, siting, waste management, and ensuring the orderly development of aquaculture. The provinces foster development of the industry and communities through financial programming and facilitate interaction with the public, environmental non-government organizations and stakeholder groups. The provinces also play a role in research and development.

Provincial and Federal Ministers collaborate on aquaculture governance issues of mutual interest through the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM). In recent years, two outcomes of this group are particularly relevant to NASCO objectives: the National Code on Introductions and Transfers of Aquatic Organisms (national I&T Code) and the National Aquatic Animal Health Program (NAAHP).

The following outlines both existing and new initiatives relevant to Canada's commitment to NASCO's Williamsburg Resolution. These encompass federal, provincial and industry initiatives captured under the themes of: introductions and transfers; fish health; containment codes; bay management; science; and sharing of information.

Transgenic salmon are not discussed in this document as they are not used in commercial aquaculture applications in Canada[2]. Furthermore, the Canadian aquaculture industry has no intentions to pursue the use of transgenic salmon commercially. Meanwhile, DFO continues to enhance its science base for risk assessment of the potential risks of new products of aquatic animal biotechnology.

3.3.1 Introductions and Transfers (I&T)

Background

In 2003, CCFAM Ministers endorsed a national I&T Code founded on science–based risk assessment principles[3]. The Code is national in scope and provides consistent, science-based procedures for assessing biological risks of intentional introductions

[1] Marine aquaculture projects requiring a federal environmental assessment will undergo a process that documents and assesses the environmental effects of the project, determines measures to minimize or mitigate these effects; and considers comments from the public. The process is consistent with Williamsburg Resolution, Article 3 - … provide all information necessary to demonstrate that the proposed activity will not have a significant adverse impact on wild salmon stocks or lead to irreversible change.

[2] Environment Canada, Health Canada and DFO regulate aquatic products of biotechnology under the *Canadian Environmental Protection Act* (*CEPA, 1999*) New Substances Notification Regulations (Organisms).

[3] Williamsburg Resolution, Article 4 - the Parties should develop and apply appropriate risk assessment methodologies in considering the measures to be taken in accordance with this Resolution.

and transfers of live aquatic animals (finfish, molluscs, crustaceans) and applies to stock enhancement, aquaculture, research, and educational displays.

Federal-provincial Introduction and Transfers Committees (ITCs) are responsible for assessing biological risks associated with I&T of aquatic animals in terms of disease/parasites, genetic, and ecological impacts. This process also ensures that transfers occur only to sites in compliance with all provincial and federal regulations and that all organisms meet fish health standards. The process minimizes the risk of an introduction or transfer of a species or strain of aquatic animals not present in a body of water or an aquaculture facility.

Current Status

There is an active ITC in each province and territory. Approximately 2000 I&T applications, involving shipments of finfish, molluscs and crustacean seedstock and broodstock, were reviewed in Canada[4] in 2005. Aquaculture applications accounted for 55% of all applications with enhancement activities making up 32%. National coordination of the program is provided by DFO's Aquaculture Management Directorate.

3.3.2 Fish Health

Background

Fish health regulations, policies and services have existed both provincially and federally through the expansion of the aquaculture sector in Canada. Also during this period, private companies and universities established fish health services and programs. Canada's National Aquatic Animal Health Program (NAAHP) enhances both public and private fish health programming. It is a science-based regulatory program designed to help protect Canada's aquatic resources from the introduction or spread of infectious disease into or within Canada and it meets international (OIE) aquatic animal health requirements.

Current Status

Funding for the NAAHP was secured in 2005. Staffing of biologists and veterinarians at the Canadian Food Inspection Agency (CFIA) is nearly complete. The CFIA, as lead agency, is developing the program for delivery in cooperation with DFO in its role as a service provider. DFO is responsible for diagnostics, research and science advice and the National Aquatic Animal Health Laboratory System.

Other benefits to aquatic animal health management in Canada are derived from significant provincial contributions:

- Veterinarians, managing Nova Scotia's Fish Health Program, provide support for the I&T program and independently inspect stock, prescribe treatments and educate farmers on best practices. As part of ongoing site visits they provide animal health surveillance, working closely with the CFIA.

- Newfoundland and Labrador's veterinarians are committed to a comprehensive fish health strategy that is preventative based. Supported by fish health laboratories in St. John's, and St. Alban's, the fish health program is prepared to identify and control pathogens of concern. The province is currently expanding its program.

- The government of New Brunswick provides fish health services for the finfish and shellfish operations. Overseen by the provincial fish health veterinarian, a

[4] 38% of total applications were in the Atlantic Provinces

major ongoing effort continues to be fish health management and bio-security issues[5]. Specialists also conduct diagnostic testing for specific diseases through the provincial fish health laboratory.

3.3.3 Containment Codes

Background

Proper containment of fish is an underlying tenet of good fish farm management. Components of a comprehensive containment strategy include standards for cage design and moorings, inspection and audit programs, and contingency plans in the event of breaches. For governments, the integration of codes with regulatory frameworks ensures a consistent application of best management practices by the industry.

Current Status

Newfoundland and Labrador's Code of Containment for the Culture of Salmonids (1999) is a condition of the finfish aquaculture license. The provincial government conducts bi-annual inspections of all net-cage and surface mooring components. In addition, there are periodic audits of cage systems which include net strength testing[6]. A fundamental component of the Code is an annual reporting and review process[7].

The New Brunswick Salmon Grower's Association is collaborating with the New Brunswick Department of Agriculture and Aquaculture and DFO to develop Codes of Containment for marine finfish farms in New Brunswick. This Code will be consistent with provincial and federal legislation and meet international commitments made by the Province of New Brunswick and the Government of Canada, especially in terms of the NASCO Williamsburg Resolution. The code includes a mandatory reporting of a breach of containment[8] and recapture contingency planning. Adherence to the Code will be a condition of license.

3.3.4 Bay Management

Background

Using geophysical data to develop fish health and production strategies for a given area promotes healthier ecosystems, with obvious benefits to both farmed and wild fish stocks. Bay management is an effective tool for areas with high concentration of

[5] Last revised in February 2007, New Brunswick's Department of Agriculture and Aquaculture's ISA (infectious salmon anaemia) Management and Control Program (1998) is a comprehensive fish health management program that is a requirement of all commercial aquaculture licence holders to follow. Specific components of the program address surveillance and biosecurity issues, including harvest vessel audits, and responses to disease outbreaks. Certificates of Health are also a requirement.

[6] Williamsburg Resolution, Article 5 - minimize escapes of farmed salmon to a level that is as close as practicable to zero through the development and implementation of action plans as envisaged under the

Guidelines on Containment of Farm Salmon (CNL(01)53)

[7] Annually, a Code of Containment Compliance report is prepared for discussion at an Annual Aquaculture Liaison Committee Meeting. This process ensures consultation and reporting to all stakeholders' and provides an opportunity to review and improve containment practices.

[8] The provincial government will report breaches to other government agencies (federal and provincial), the Atlantic Salmon Federation, and the State of Maine.

aquaculture sites and compliments existing production policies[9]. Site fallowing and crop rotation are critical elements of this approach.

Current Status

Newfoundland and Labrador's bay management strategy considers site separation, mandatory fallow periods, and single year class sites and is a condition of the aquaculture license.

New Brunswick's policy (2006-2007) divides the Bay of Fundy into a number of management areas. Within each area, only farmed salmon born in the same year are raised within the same management area - this prevents parasites or pathogens from being transmitted to disease-free incoming smolts.

3.3.5 Science

Background

The aquaculture industry is a knowledge-based industry. It requires the participation of many disciplines, including engineering, the environmental sciences, oceanography, ecology, habitat, marine biology, the health sciences and the field of socio-economics. Federal departments[10], provincial governments[11], academia and industry[12] are among a myriad of individuals, partners and groups that conduct research and develop new technologies that benefit sustainable aquaculture development and governance decisions. Examples of research initiatives consistent with the intent of those articulated in Articles 5[13] and 11[14], and Annex 7[15] of the Williamsburg Resolution are listed in the table below.

[9] In 2006, the New Brunswick aquaculture industry introduced performance–based standards, a production system that ensures aquaculture companies are operating within acceptable science-based environmental parameters.

[10] The Aquaculture Collaborative Research and Development Program is a DFO initiative to increase the level of collaborative research and development activity between the aquaculture industry and the department.

[11] The province of Newfoundland and Labrador is examining ocean current patterns to better inform decision-makers on its siting policies.

[12] GMG Fish Services Ltd., a subsidiary of Cooke Aquaculture, has an ongoing program to work with scientists and researchers at the Institute of Ocean Technology to improve net pen cage-system designs.

[13] Williamsburg Resolution, Article 5 - mitigation measures can include activities to safeguard against potential future impacts (e.g. contingency planning, gene banks).

[14] Williamsburg Resolution, Article 11 - each Party should encourage research and data collection in support of this Resolution…

[15] Williamsburg Resolution, Annex 7 - areas for research and pilot testing include: sterile fish; tagging and marking; evaluation of production methods; aquaculture broodstock; genetics; diseases and parasites; interactions; risk assessment frameworks; biological impacts; and escape prevention.

Sample of Research Initiatives with linkages to NASCO's Williamsburg Resolution

A workshop on biological containment strategies (e.g. sterility, triploid fish) for farmed fish will examine "genetic isolation" technologies and possible approaches for salmonid aquaculture. ***2007-2008***

International experts have been engaged to develop a State of Knowledge Report evaluating closed containment technologies. ***2007-2009***

The development of support technology for high energy sites will provide managers with offshore siting options, furthering the distance between salmon farms and salmon rivers (Industry). **2009**

A workshop on offshore aquaculture is scheduled for St. Andrews, New Brunswick to examine the technology and its applications (DFO). **Fall 2007**

A research project comparing DNA markers in wild strains of Atlantic salmon to domestic strains of farmed salmon will provide baseline data in Newfoundland and Labrador (DFO). **2008**

Projects to enable access of salmon farmers to sea lice therapeutants will enhance the ability of farmers to manage the parasite (Industry). **2008**

The International Salmon Farmers Association Sea Lice Workshop, consolidated the state-of-knowledge of science-based sea lice treatment products and methods, and identified immediate needs and opportunities. (Industry - NBSGA). **August 13, 2007**

A genetic research project is underway to establish appropriate strains for aquaculture in Bay of Fundy. Phase I is complete. (Industry) **Phase II is ongoing**

A study to gain a better understanding of the effects of stress on physiological and immunological processes in fish (National Research Council - Institute for Marine Biosciences). **2008**

A study testing recombinant vaccines for fish aquaculture (DFO & National Research Council - Institute for Marine Biosciences). **2008**

A study investigating the molecular biochemistry, infectivity, and pathogenicity of the strain of a typical furunculosis bacterium found in the Bay d'Espoir estuary to determine if the development of new fish health interventions is warranted (Newfoundland and Labrador). **2010**

Current Status

DFO's Science sector supports federal IRM decision-making by providing scientific information and advice to help develop and manage aquaculture-related activities. For example, its State of Knowledge[16] initiative covers marine finfish and shellfish, and freshwater finfish, aquaculture. State-of-Knowledge review papers, written under the direction of DFO scientists, provide the current status of scientific information and identify knowledge gaps and research needs.

Created in February 2007, the new DFO Centre for Integrated Aquaculture Science (CIAS) will lead and implement an integrated aquaculture research program that will leverage DFO expertise on aquaculture science across the department, and generate scientific knowledge in support of future policies and management decisions.

3.3.6 Sharing of information

Background

There are many ways for sharing information. Canada participates in public engagement forums internationally, nationally, provincially and regionally. The internet is used to broadcast detailed information on policies, governance and address specific sustainability issues.

Current Status

DFO's revised (2006) web site provides a broad overview of aquaculture related issues and seeks to inform its visitors on the regulation and management of the

[16] http://www.dfo-mpo.gc.ca/science/environmental-environnement/interactions_e.htm

sector (www.dfo-mpo.gc.ca/aquaculture). It includes information on the risks that introductions and transfers of aquatic species on wild salmon (Pacific and Atlantic) and measures undertaken to mitigate them[17].

In addition to the internet, other venues for sharing information between the aquaculture sector and those interested in Atlantic salmon conservation include:

- Members of Atlantic Canada's salmon farming sector, through its membership in the International Salmon Farmers' Association, actively participate in NASCO Liaison Group[18] activities and meetings.
- Newfoundland and Labrador conduct local aquaculture awareness initiatives to inform the public and engage various special interest groups, such as the Salmonid Council of Newfoundland and Labrador.
- The New Brunswick Salmon Growers Association is actively participating with other stakeholders in the work of the Inner Bay of Fundy Salmon Recovery Team.

3.4 Other Influences

Despite major changes in fisheries management in eastern Canada over the past four decades, the abundance of Atlantic salmon has continued to decline. Where stocks have been monitored, freshwater production has remained unchanged or consistent with decreasing spawning escapement whereas measured marine survival rates are low. In some areas, freshwater factors are considered important, for example acid rain in the Southern Upland (see Section 3.2). The factors constraining abundance of Atlantic salmon throughout its range are considered to be acting at sea. Two intensive reviews (DFO 1998; Cairns 2001) have identified a broad list of factors potentially impacting Atlantic salmon abundance. A few factors of relevance to NASCO are discussed below.

Invasive species

There are several non-indigenous species of freshwater fish which have become established in a large number of wild salmon watersheds in New Brunswick and Nova Scotia. The species of most concern include smallmouth bass, rainbow trout and species in the pike family. These species are potentially both competitors and predators of juvenile Atlantic salmon. Introductions are generally the result of directed and illegal transfers of live fish between watersheds. With few exceptions, once established, it is nearly impossible to eradicate them and prosecution of illegal activities is difficult. A new emerging threat is Asian carp (silver carp). This species was introduced into the U.S. in the 1970s for use in sewage lagoons. They have escaped and are having a significant impact on indigenous species and the aquatic environment in the Mississippi River watershed. This species is migrating northward

[17] Williamsburg Resolution, Article 11 - educational materials should be developed and distributed to increase awareness of the risks that introductions and transfers of aquatic species may pose to wild salmon stocks and the need for the measures that control these activities.

[18] The Liason Group is an advisory group established to provide an international forum for liaison between the salmon farming industry in the North Atlantic and the relevant authorities responsible for wild Atlantic salmon and aquaculture on issues of mutual interest and to make recommendations for action. The Liaison Group comprises representatives of NASCO, the International Salmon Farmers' Association (ISFA) and the salmon farming industry in Scotland and the Russian Federation.

and there is growing concern this fish may soon reach the Great Lakes and invade other freshwater areas in Canada.

Didymo is also becoming a concern as an invasive species in some areas of Southern Quebec. The spread of didymo is being monitored in neighbouring Canadian waters.

Actions specific to invasive species control include:

- proposed introductions and transfers of non-native species are evaluated by I&T committees and a risk analysis conducted to determine if the activity can proceed taking account of containment methods and disease;
- communication and education activities to inform the public on the consequences of invasive species and actions to take to reduce the potential for unintentional transfer; and

Climate change

Climate change has been identified as an important source of aquatic disturbance on a global scale by possibly altering species composition and dominance in aquatic ecosystems. Cold water ecosystems are particularly at risk with the displacement of population's further north or altering life-history traits. The impacts of climate are expected to be manifested in both the freshwater and marine environments. From 1990 – 2100 mean surface air temperature is projected to increase by 1.4 to 5.8ºC, with more rapid warming in the Northern regions of North America (IPCC 2001). In Atlantic Canada, a 2 to 6°C increase is expected in the next century with increases in air temperature expected to be greatest in western New Brunswick and Quebec, and lowest in Labrador. The responses of Atlantic populations across its range in eastern Canada are uncertain but they are expected to differ across the latitudinal range. Changes in temperatures, salinities, currents, species composition and distribution (including predators and prey of salmon) are all anticipated as a result of climate change. In combination, these factors will impact on Atlantic salmon production and survival in fresh water and at sea. The population trajectories associated with these changes are difficult to model as the anticipated conditions are outside the range of values observed in the relatively short time frame during which salmon have been studied.

Marine Survival

Marine and estuarine conditions are believed to exert important influences on Atlantic salmon and against a background of serious concern about the decline of the species; it is becoming increasingly important to consider these factors for the conservation and management of wild Atlantic salmon. Sea surface temperature may be one of the key factors affecting natural salmon mortality by influencing the distribution of plankton assemblages and associated dependent prey species.

Oceanic influences on salmon growth, behavior and survival are complex and difficult to study because of the dynamic nature of the marine environment. Linking variations in salmon returns to changes in the aquatic ecosystems requires costly large-scale monitoring programs. Efforts are needed nationally and internationally to collaborate/cost share with interested parties in the conduct of a comprehensive Northwest Atlantic-wide survey to collect information on migration patterns, distribution and possible factors that affect the status of salmon.

Canada provides approximately $2 million annually to conduct at sea marine research. Canada's projects have been described in the annual inventory collated by the International Atlantic Salmon Research Board (IASRB) of NASCO. These projects

include index rivers programs for monitoring variations in sea survival, acoustic telemetry programs to define where and when mortality is occurring, and collaboration in the international sampling program at West Greenland.

It is imperative that marine research be expanded to understand the causes of salmon mortality at sea. The SALSEA program is the collaborative efforts of the NASCO Parties to understand this issue. It is important for all NASCO Parties to cooperate and contribute to the SALSEA program.

Canada has also championed the sharing of knowledge and cooperation between the North Pacific Anadromous Fish Commission and NASCO.

4. MANAGEMENT APPROACH

The Government of Canada is developing important initiatives dealing with wild Atlantic salmon in Canada. These initiatives are:

i) Wild Atlantic Salmon Conservation Policy – modernize the current 20 year old policy to reflect current directions and strategies concerning stewardship, and ecosystem-based integrated management approach;

ii) Aquaculture Framework Agreement - harmonization of regulations, with a "one window approach" and national standards and enforcement.

These initiatives will influence the conservation and management of Atlantic salmon stocks in Canada over the long term. Fisheries and Oceans Canada recognizes the importance of partnership and collaboration with all those able to contribute to conservation of wild Atlantic salmon and its habitat. The Department is committed to work collaboratively with Aboriginal groups, community groups, provincial governments and other stakeholders towards the development of multi-year management plans and shared responsibilities.

Memoranda of Agreement, partnership agreements and strategic working arrangements could be entertained between DFO, community organizations and Aboriginal groups. In the Atlantic Provinces, DFO will play an active role in working with provincial authorities to encourage and support community-based management plans and priorities.

In the interim, management measures described previously (Section 3) will continue. As a part of the usual course of managing wild salmon stocks in Canada adjustments will be made to address the circumstances associated with individual stocks and stock groupings.

The following is intended to provide a description of new measures that will be implemented from 2006 to 2010 inclusive. **These measures will help achieve the objectives outlined in NASCO's agreements i.e. precautionary approach, ecosystem approach, habitat.**

NEW MEASURES

ACTION: An overhaul of the *Fisheries Act* is being considered by the Canadian government. The changes being considered will:

- **Require for the first time the consideration of a *precautionary approach* to conserve aquatic resources**
- **Put in place a *science-based* ecosystem approach to fisheries management**

- **Introduce provisions concerning *Aquatic Invasive Species***
- **Enhance the approach in dealing with and enforcing fish habitat provisions.**

The proposed overhaul of the *Act* was presented in the Canadian Parliament in late 2006. There are a number of stages including public consultations that the proposed changes must go through before coming into force. After this process there will be an implementation stage when some components of the revised *Act* would go into effect immediately and others involving new regulations, would be phased in. The new *Act* will direct Canadian government decisions and activities over the longer term (2007 and beyond) in several areas involving management of fisheries, and restoration and protection of habitat.

Action: Wild Atlantic Salmon Conservation Policy. The Policy was released to the public, for consultations, in May 2007. Wild salmon will be conserved by managing populations by "Salmon management areas" (SMAs). The status of SMAs will be evaluated through monitoring programs in index rivers and assessed against selected benchmarks, and reported publicly. Habitat protection and management for wild Atlantic salmon will focus on an integrated approach involving assessment of habitat condition, identification of indicators and benchmarks, and monitoring of status. Ecosystem considerations will be incorporated into salmon management, particularly in relation to marine survival.

4.1 Management of Fisheries

Integrated management planning that incorporates the biological, economic and social factors for sustainable fisheries has been used in Canada for several years. This process will continue and much emphasis is placed at increasing the stakeholders, aboriginal and provincial participation in the planning and shared delivery of the plans to achieve together the set objectives. Management measures are reviewed annually and in most situations throughout the year. **This structured, systematic, and inclusive approach to management plans applies the principles of risk management and the precautionary approach. It also uses the methodology outlined in NASCO's Decision Structure**. The following outlines actions in the integrated management of wild Atlantic salmon stocks.

Action: Canada will maintain its annual participation of science personnel to the ICES Working Group North Atlantic Salmon to address questions posed by NASCO, to the development of catch advice for marine fisheries, and to further the international collaborations on salmon research at sea.

Action: Canada will meet informally with the United States at intersessional meetings.

Action: Based on the status of Atlantic salmon stocks and the advice from ICES, Canada will maintain the closure of commercial Atlantic salmon fisheries.

***Action:* Canada will annually provide a summary of the status of Atlantic salmon stocks to NASCO via the questions addressed by ICES. The details of this annual assessment will form the basis for development of domestic regional Atlantic salmon management**

plans. The management objective is to maintain the spawning escapement in each river above the conservation limit. Management measures to control undesired consequences of the fisheries are user specific and consider stock status relative to conservation objectives and socio-economic factors of the fisheries.

Action: ***Canada's Aboriginal Fisheries*** **will be subject to negotiated annual agreements or licenses which will stipulate gear, season and catch limits, and catch reporting.**

Action: Continue to work with the aboriginal communities and aboriginal governments to reduce the catch of large salmon (some of which are 2SW fish) and incorporate live capture fishing gears which allow for selective harvesting where concerns exist on the status of the river-specific stocks.

Action: ***Canada's Recreational Fisheries*** **will be** ***regulated by seasons as well as with daily and seasonal bag limits*** **and subject to gear restrictions*****.*** **As well a*****ll retained salmon must be tagged.***

Action: Canada will cooperate with France and encourage the provision of catch statistics; biological samples and other data for detailed analysis of the SPM fishery and will encourage France to become a member of NASCO**.*** **Continue to meet with French officials annually, and encourage them to adjust their fishery to meet conservation concerns.**

Action: In season counts of returning salmon to index rivers of eastern Canada will continue to be made available on the Internet to track the status of rivers in eastern Canada.

Action: Consult with recreational stakeholders (fall 2007) on adjustments to the 5-year (2007-2011) fisheries management plan which provides a balance between conservation/rebuilding with fishing opportunities for Newfoundland and Labrador and the Southern Gulf of St. Lawrence.

4.1.1 Catch Data

Unreported catch in Canada is significant compared to reported catch. Significant resources have been committed in recent years to deal with poaching and expanding and improving catch reporting systems. There are questions about the level of confidence associated with the annual unreported catch estimates. In 2007, examinations will begin on past Catch, Catch and Release and Unreported Catch Estimates as provided to ICES.

Action: Canada will improve catch data reporting, with emphasis on validating unreported catch. A review will be done on reporting methodology for weakness in reliability and consistency.

Action: Canada will analyze the issue of unreported catch and will implement changes to reporting methodology to improve reliability and consistency in reporting of catch including unreported catch.

4.1.2 Coastal and Bycatch Fisheries

Additional measures were introduced in 2006 to reduce the catch of large salmon (including 2SW fish) in coastal areas of Labrador. These included prohibition of larger mesh nets (maximum mesh size of 4.5 inches), and a monitoring program was used for in-season closures to coincide with peak runs of large salmon. The effectiveness of these measures will be evaluated and adjustments will be made if a further reduction in the catch of large salmon is warranted in 2007 and beyond.

Recognizing the ICES advise concerning the West Greenland fishery for 2006, 2007 and 2008 (no fishery), Canada will consult with the NASCO Parties on 2006 measures (maximum 20 tonnes internal subsistence) being applicable in 2007 and 2008. This will be based on an agreed framework of indicators which are to be used in identifying any significant change in the previously provided multi-annual advice.

Action: **Enforcement activities will be maintained and efforts will continue to improve the effectiveness of enforcement measures to thwart illegal fishing. Enforcement activities, violations, prosecutions and penalties assessed will be summarized annually. There will be continued effort to increase the severity of the penalties related to illegal fisheries on Atlantic salmon.**

4.1.3

A recovery plan for Inner Bay of Fundy Atlantic salmon was put in place in 2002. The recovery of these stocks will require a long term effort due to the complexities of factors impacting these stocks.

Action: **Maintain protection for Inner Bay of Fundy Atlantic salmon under the *Species At risk Act.***

Action: **Report on development on the recovery plan for Inner Bay of Fundy Atlantic Salmon.**

4.2 Protect and Restore Salmon Habitat

Habitat efforts outlined in Section 3 will continue. In many cases these efforts include a collaborative approach that integrates the roles and responsibilities governments (federal, provincial and municipal) and that of key partners such as First Nations, non-government organizations such as the Atlantic Salmon Federation, watershed groups, universities, and industries. One important action was the establishment of the Atlantic Salmon Endowment Fund in early 2007 when $30 million was presented to the Atlantic Salmon Conservation Foundation (ASCF). The ASCF, a non-profit charitable organization, will invest the principal and use the income earned on the investment to fund projects that contribute to salmon restoration and conservation in the Atlantic Provinces and Quebec. Although funded by the Federal Government, the ASCF will operate at arm's length.

The following highlights only those areas in which there are going to be important habitat initiatives that should improve habitat for a number of stocks.

Action: **The ASCF will report annually on its accomplishments concerning salmon restoration and conservation.**

Action: Continue the Nova Scotia Salmon Association Adopt-A-Stream program habitat restoration projects.

Action: Continue to enforce provisions of the Fisheries Act and seek important monetary penalties for destruction of fish or fish habitat, including provisions for habitat restoration by a guilty party.

4.2.1 Acid Rain

The "Canada-Wide Acid Rain Strategy for Post-2000" included commitments of SO_2 emissions reductions in key areas such as Ontario, Quebec, New Brunswick and Nova Scotia. Ontario, a significant Canadian source of emissions, has embarked on a plan to significantly reduce SO_2 emissions by 2010 and further reductions by 2015 (a possible 46% reduction from 1994 levels). This plan includes elimination of a number of coal fired electrical generation plants. In Quebec strategies are also in place to reduce emissions from the mining and smelting industry (a significant source). A 50% reduction in emissions by 2010 has been targeted in Quebec. Despite almost halving Canadian SO_2 emissions since 1980, without further significant reductions of SO_2 emissions from the US, the acid rain problem in eastern Canada will not be resolved. Unfortunately, power providers in the U.S. are expected to build the equivalent of 280 coal fired electricity generating plants (500 megawatt) between 2003 and 2030 (Scientific American 2006).

Action: The Nova Scotia Acid Rain Campaign Committee (Nova Scotia Salmon Association and Atlantic Salmon Federation) will monitor the effectiveness of the targeted liming project on the West River Sheet Harbor at achieving the conservation objectives related to increased salmon and trout freshwater production.

Action: Canada will promote acid rain as an issue for NASCO attention.

Action: Canada will promote the dissemination and exchange of information about acid rain impacts and ways to reduce its effects.

4.3. Manage Aquaculture

Actions of this implementation plan are itemized according to the same thematic titles provided in section 3.3 of this document.

Introductions and Transfers

Government of Canada and provinces - Discussions between CFIA, DFO and ITCs to develop a revised model for cooperative delivery of I&T management are continuing. Proposed amendments to Canada's Health of Animal Regulations under the *Health of Animals Act* will further strengthen the I&T process and bring the significant resources and expertise of the CFIA to aquatic animal health management. CFIA will have the authority and expertise to undertake risk assessments for diseases of international and national concern and issuing import and movement permits from a disease perspective for proposed shipments, while regional ITCs will focus primarily on biological risk assessments concerning genetic and ecological impacts associated with movements of aquatic animals.

Action: A revised I&T delivery model is expected by 2008 –09

Fish Health

Government of Canada - Amendments to Canada's Health of Animals Regulations will allow for the full implementation of the NAAHP. CFIA will be responsible for managing disease risks associated with trade in aquatic animals, based on new

zonation schemes, surveillance and monitoring programs, and disease control and contingency plans. When implemented, the program will provide a robust disease management regime for all wild and cultured fish populations in Canadian waters[19].

Action: Amendments to Health of Animals Regulations are expected by 2008 – 09

Newfoundland and Labrador - The province's Provincial Management Plan for Aquaculture (2007) will guide the orderly and sustainable development of the aquaculture industry. The plan is supported by a Processing Waste Water Treatment Program (spring 2007) to minimize the risk of disease transfer and environmental degradation from processing. This will ensure that the water being released is free of any substance that could harm wild and farmed aquatic species. Complimenting this effort is a new Aquatic Veterinary Diagnostic Facility.

The Aquatic Veterinary Diagnostic Facility will ensure that its aquaculture resource is protected over the long-term through effective disease management with more rapid diagnostic testing, surveillance, providing management and biosecurity strategies to industry, and disease intervention. A biosecurity plan for the region is currently being developed between industry and provincial and federal agencies.

Action: Regional Fish Health Facility to be fully operational by 2008-09

Containment Codes

New Brunswick - Regulatory and policy amendments are required at the provincial level in order to facilitate implementation of its new containment measures. Participants are seeking to finalize these activities to allow for full implementation of the Code in a timely manner.

Action: Industry to ratify New Brunswick's Code of Containment by 2008.

Action: Provincial regulatory amendments for the Code expected by March 2008.

Bay Management

Provinces – Bay management strategies are subject to revision as new science becomes available.

Science

Governments and industry - Funding of research projects through the various mechanisms will continue, driven by appropriate priorities, program criteria, and available resources.

In the case of the federal government, research priorities will be in a manner consistent with its regulatory and policy commitments to ecosystem-based and integrated management. DFO's CIAS continues to develop its strategy for implementing an integrated departmental research aquaculture program.

Sharing of Information

Governments and industry – Governments and industry will continue to update websites, meet special interest groups on a regular basis, and address specific issues as they arise.

[19] Williamsburg Resolution, Article 5 - minimise the risk of disease and parasite transmission between all aquaculture activities, introductions and transfers, and wild salmon stocks.

4.4 Actions to be Taken in Relation to Other Influences

4.4.1 Marine Survival

Canada is committed to NASCO's SALSEA program to link research, information and data gathering systems on Atlantic salmon in estuarine, coastal and marine areas across the North Atlantic. The Canadian government is looking at ways to provide substantial financial support to the SALSEA research program. Canada views marine survival as a very important issue that needs the attention and support of all NASCO Parties. Without collaboration on the understanding of environmental factors affecting Atlantic Salmon, the reasons for severe declines in many Atlantic Salmon stocks will go unanswered.

Action: For 2006 – 2007, the Fisheries and Oceans Minister has appointed a representative to inform, promote the SALSEA program in Canada and to focus upon the need for public and private participation in this important international Atlantic salmon research to identify the causes and the possible solutions to the causes of mortality at sea.

Action: Canada is expecting to commit $100,000 CAN to the SALSEA program in 2007/08.

Action: Continue to contribute to the IASRB inventory of research programs related to salmon mortality at sea on an annual basis.

Action: Canada will continue the research on early marine migration and survival of smolts, postsmolts and kelts using acoustic telemetry. Several of these projects represent close collaborations between DFO, Atlantic Salmon Federation, province of Quebec, and universities. These activities will be enhanced by the new Oceans Tracking Network initiative.

***Action:* Canada will also promote links between NASCO's SALSEA program and similar programs underway in the North Pacific on Pacific salmon. Such opportunities will be available when Canada participates in North Pacific Anadromous Fish Commission (NPAFC) annual meetings and scientific meetings and exchanges.**

***Action: Promote and attend the* joint NASCO/NPAFC meeting in 2009 or 2010.**

Action: Develop a research strategy, 2008-2009, for the study of Atlantic Salmon marine ecology in consultation with the Atlantic Salmon Federation and the United States National Marine Fisheries Service. This will entail access to Canadian science vessels and joint collaboration to collect information on salmon marine ecology.

Action: Report on the findings of the research strategy to the North American Commission of NASCO and the IASRB (2009-2010).

4.4.2 Invasive Species

Action: Canada will establish and maintain a public education program including a network to raise awareness and to prevent the introduction and spread of invasive species.

Action: Canada will consult and develop an action plan to address invasive species (2006-2011).

Action: Canada will bolster its environmental enforcement to address aquatic invasive species (beginning late 2007).

5. EVALUATION

***Action:* Annual report on the status of the developments involving the major policy issues, i.e. Wild Salmon Conservation Policy.**

***Action:* Canada will report annually as required in Article 14 and 15 of the Convention.**

5.1 Management of Fisheries

Efforts and resources will be used (see Sec. 2) to assess the status of stocks on an annual basis. The historical time series of adult, juvenile and smolt assessments will provide the basis for assessing changes in stock status and the efficacy of management measures and the need for further adjustments or initiatives.

Action: Meet and consult annually with First Nations and stakeholders to seek input on effectiveness of management measures.

Action: Maintain assessments on about 75 rivers and, where possible, increase the number of assessments of stock status and the effectiveness of management measures.

Action: Report annually on enforcement efforts (prosecutions, charges laid, effort, and penalties) in the protection of Atlantic salmon.

Canada undertakes a survey of the recreational fishery in Canada every 5 years. It is a collection of information about recreational fishing activities in all jurisdictions to assess the socio-economic importance of the fishery. The Survey of Recreational Fishing in Canada 2005 was released in August 2007. The Survey can be used a means to measure the contribution of the Atlantic salmon recreational fishery.

Action: Provide the information associated with the Atlantic Salmon Recreational fishery as reported in the Survey of Recreational Fishing in Canada 2005.

Action: Undertake a socio-economic survey of the recreational fishery in Canada in 2010.

Action: Provide reporting frameworks for harvests and catches in the recreational fisheries:

- **In Quebec, all retained fish must be reported to river authorities within 48 hours of harvest.**
- **In Newfoundland and Labrador, Nova Scotia and Prince Edward Island, all catches must be recorded on the stub provided with the license and be returned to authorities at the end of the fishing season. An alternative program for New Brunswick is being evaluated.**

5.2 Habitat

Action: **Canada will report annually on the number and extent (area of habitat affected) of habitat remediation activities undertaken annually. Many of these would be corrective measures to remediate dated and deficient historical structures.**

Action: Provide a summary of *Fisheries Act* habitat protection activities which relate to salmon habitat on an annual basis.

Action: Continue to publicly announce convictions and penalties for prosecutions for destruction of fish habitat.

Action: **Provide an in depth report at a Special Session of NASCO on the progress being made to protect, recover and restore salmon related habitat. The report will outline the trends in rivers affected by acid rain and the progress made on Canada-Wide Acid Rain Strategy.**

Action: The Canadian government has introduced the Regulatory Framework for Air Emissions. This sets overall national fixed emissions caps for air pollutants. This will lead to reductions in air pollutant emissions that cause smog and acid rain by up to 55% as early as 2012.

Action: **The ASCF will report annually on its accomplishments concerning salmon restoration and conservation. This report will be useful in evaluating the successes of this program.**

5.3 Aquaculture

Amendments to appropriate regulatory frameworks will be made to allow for:

- a new delivery model for Canada's Introduction and Transfer services; and
- full implementation of the National Aquatic Animal Health Program, and New Brunswick's code of Containment.

Action: Canada, through the North American Commission, will develop a protocol for the sharing of information with respect to Introductions and transfers and breeches of containment.

5.4 Other Influences

Action: **Canada will continue to be a member of the IASRB and will report on progress being made with respect to Canadian activities and research on SALSEA.**

Action: **Canada will annually provide an update on the status of invasive species of concern for Atlantic salmon in eastern Canada.**

ANNEX I

PROVINCIAL AUTHORITY APLICABLE TO FISH HABITAT

NEW BRUNSWICK

Agency and Legislation	Scope of Application of Legislation
Dept. of Natural Resources & Energy: Crown Lands & Forest Act Quarryable Substance Act Ecological Reserves Act Endangered Species Act Oil & Natural Gas Act St. Croix International Waterway Commission	 Forestry Crown land Water lot activities Coastal Zone Development
Dept. of Environment & Local Government Clean Env. Act & Environmental Assessment Regulation Clean Water Act – Watercourse Alteration Regulation	Environmental Impact Assessments Watercourse Alteration
Dept. of Transportation	Watercourse Alteration, Culvert and Fish passage
Dept. of Agriculture, Fisheries and Aquaculture	Aquaculture, Irrigation projects, Tidal barrier

NEWFOUNDLAND & LABRADOR

Agency and Legislation	Scope of Application of Legislation
Dept. of Forest Resources & **Agrifoods :** Forestry Act Wildlife Act	All project proposals registered for Newfoundland Environmental Assessment. Projects not requiring registration but in or near water may be forwarded to Area Habitat staff for review
Dept of Works, Services & **Transportation:** Works, Services and Transportation Act	All projects registered for Newfoundland Environmental Assessment. Projects not requiring registration but in or near water may be forwarded to Area Habitat staff for review
Dept. of Mines & Energy: Mining Act Quarry Materials Act	All Hydro project proposals Mines and Quarries located in/near water. Various Quarry Proposals are submitted to Area Habitat staff.
Dept. of Government Services & Land: Lands Act	All project proposals registered for Newfoundland Environmental Assessment. Projects not requiring registration but are in or near water may be forwarded to Area Habitat staff for review.
Dept. of Fisheries & Aquaculture: Aquaculture Act	All Aquaculture Proposals

Dept. of Tourism, Culture & Recreation Wilderness & Ecological Reserves Act Provincial Parks Act National Parks Lands Act	All project proposals registered for Newfoundland Environmental Assessment. Projects not requiring registration but in or near water may be forwarded to Area Habitat staff for review.
Dept. of Environment: Newfoundland and Labrador Environmental Protection Act Water Resources Act	Same as above.

NOVA SCOTIA

Agency and Legislation	**Scope of Application of Legislation**
Dept. of Natural Resources: Crown Lands Act Beaches and Foreshores Act Conservation Easements Act Endangered Species Act Wildlife Habitat and Watercourse Protection Regulations	Tidal Environments Forestry Shoreline All works between the Ordinary High Water and Low Water
Dept. of Environment & Labour: Water Resources Protection Act Environment Act Special Places Protection Act Water Resources Protection Act Watercourse Alteration Regulation	All Watercourse Alterations Transportation Projects Shoreline and Wetland Habitat Restoration and Enhancement Works
Dept. of Agriculture & Fisheries: Fisheries & Coastal resources Act Fisheries Organizations Support Act	Aquaculture Offshore and in-land Aquaculture Projects
Canadian Nova Scotia Offshore Petroleum Board: The independent joint agency of the Governments of Canada and Nova Scotia is responsible for the regulation of petroleum affairs and safe practices offshore Nova Scotia Canada – Nova Scotia Offshore Petroleum Resources Accord Implementation Act (Provincial Version) Office Consolidated Canada – Nova Scotia Accord Legislation (Federal Version)	All proposals for oil and gas exploration and development beyond the 12 mile limit.

PRINCE EDWARD ISLAND

Agency and Legislation	Scope of Application of Legislation
Dept. of Fisheries, Aquaculture	All Aquaculture projects are referred directly to DFO from the proponents.
Dept. of Agriculture & Forestry: Pesticides Act	Agricultural Projects are forwarded to Dept of Env.
Dept. of Transportation & Public Works:	All watercourse alteration
Department of Environment Environmental Protection Act	All activities

QUEBEC

Agency and Legislation	Scope of Application and Legislation
Ministère du développement durable de l'environnement et des parcs : Environnent Quality Act Act Respecting Threatened and Vulnerable Species Natural Heritage Conservation Act (integrates the Act Respecting Ecological Reserves and the Act Respecting Nature Reserves on Private Land) Water Resources Preservation Act Quebec water policy	All projects with environmental impacts (except the territory covered by the James Bay and Northern Quebec Agreement) Protection of the species designated under the Act. Conservation of representative, rare or exceptional natural environments, and protection of the biodiversity of Quebec's ecosystems. Prohibits out-of-province transfers of water withdrawals taken from Quebec. Provides for integrated management of activities by watershed committees. Also provides for integrated management of the St. Lawrence River through ZIP committees (priority intervention zones) under the Canada–Quebec St. Lawrence Action Plan and the creation of the St. Lawrence Committee, which is made up of provincial and federal government representatives and key partners.
Ministère des Ressources naturelles et de la faune: Watercourses Act (with MENV) Forest Act Mining Act Act Respecting the Conservation and Development of Wildlife	Licenses for use of hydraulic power and hydraulic sites, leases for aquaculture sites. Standards for logging and forest roads (stream crossings). License and standards for mineral exploration, mining operations and mine site restoration. Wildlife development and enhancement and protection of wildlife habitat, including fish habitat.

Agency and Legislation	Scope of Application and Legislation
Ministère de l'Agriculture, des Pêcheries et de l'Alimentation : Act Respecting Commercial Fisheries and Aquaculture Proposed Commercial Aquaculture Act (under review since December 2002)	Development of commercial fisheries, seafood products businesses in non-tidal waters on Crown land and establishment of fish farms. Aquaculture licenses Designed to provide a framework for commercial aquaculture operations in waters on Crown land.