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Science | Sciences
Newfoundland and Labrador Region
Canadian Science Advisory Secretariat
Science Advisory Report 2010/087

STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON - 2010

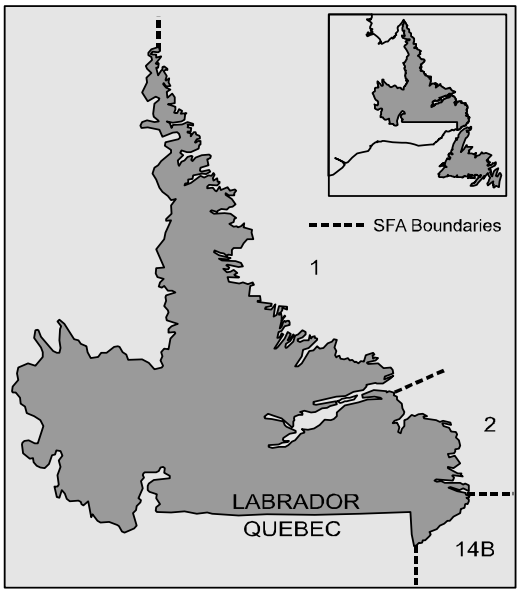

Figure 1: Labrador portion of NL Region.

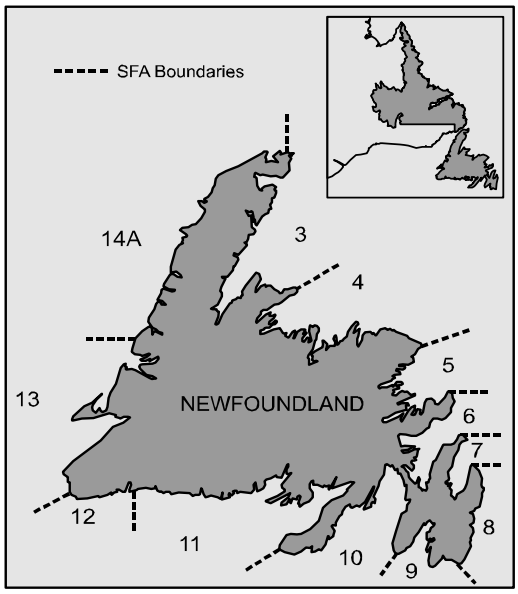

Figure 2: Newfoundland portion of NL Region.

Context :

There are 15 Atlantic salmon (Salmo salar) management areas, known as Salmon Fishing Areas (SFAs) 1-14B, in Newfoundland and Labrador (Fig. 1 and Fig. 2). Within these areas there are more than 470 rivers with reported Atlantic salmon populations characterized by differences in life history traits including freshwater residence time, age at first spawning, and the extent of ocean migrations. Spawning populations consist of varying proportions of small (fork length < 63 cm) and large (fork length ≥ 63 cm) salmon. The majority of rivers in Newfoundland contain populations of small salmon or grilse which are predominantly maiden fish (never spawned before) that have spent one year at sea before returning to spawn (one-sea-winter salmon, 1SW). In Labrador (SFAs 1, 2 and 14B), and western Newfoundland (SFAs 13 and 14A), there are important large salmon components that contain a mixture of maiden fish that have spent two (2SW) or more years (MSW) at sea before spawning and repeat spawners which are returning for a second or subsequent spawning. In other Newfoundland rivers, the large salmon component consists mainly of repeat spawners. Conservation requirements for Atlantic salmon rivers are considered to be threshold reference points. Conservation requirements have been established for individual rivers in Labrador (SFAs 1-2) based on 1.9 eggs per m^2 of river rearing habitat, Straits Area of Labrador (SFAs 14A-14B) based on 2.4 eggs per m^2 of river rearing habitat and 105 eggs per hectare of lake habitat and insular Newfoundland (SFAs 3-13) based on 2.4 eggs per m^2 of river rearing habitat and 368 eggs per hectare of lake. The status of stocks is assessed on the basis of the proportion of the conservation egg limit achieved in a given year and the trends in abundance of various life stages. ***The consequences of egg depositions below conservation to the long-term sustainability of the stock***

are unknown but the likelihood of deleterious effects are greater when egg depositions are below conservation. There should be no human induced mortality on stocks that are below 100% of conservation.

A Regional Advisory Process (RAP) meeting was held on the 2-3rd of November 2010 in St. John's, NL to update those stocks/rivers considered during the last assessment meeting. 2010 marks the fourth year of a five-year Atlantic salmon management program. This resource is assessed on an annual basis.

SUMMARY

Newfoundland and Labrador Region (SFAs 1-14B)

- Low marine survival since the late 1980s continues to be a major factor contributing to the overall low abundance of Atlantic salmon within the region. Inter-annual variation in the index of marine survival continues to fluctuate widely as evidenced by the marine survival of the 2007-10 returns (Fig.11).

- The index of abundance of small and large salmon in insular Newfoundland for 2010 was above the previous five year mean (2005-09). However, the previous five year mean remains below the pre-moratorium index of abundance for both small and large salmon.

- In Labrador, returns of small and large salmon declined from the previous six year mean. 2010 was the second year of lower small salmon returns and is of concern. Of particular importance would be a three year consecutive decline that represents a generation of spawners and could considerably reduce production of future smolt classes. Abundance of large salmon has remained particularly low since the late 1980s.

- Seven of the 16 (44%) Atlantic salmon stocks assessed in Newfoundland and Labrador achieved their conservation egg limit. Conservation was not achieved in any of the three rivers assessed in Labrador and the mean egg limit achieved was 65%.

Labrador (SFA 1-2 and 14B)

- Abundance levels of large and small salmon in Labrador, on average, are below levels achieved prior to the moratorium. Low marine survival, since the late 1980s, continues to be a major factor affecting overall abundance of Atlantic salmon within the Labrador portion of the region.

- In 2010, numbers of small and large salmon were below the previous six year mean. The 2010 index of abundance of large salmon decreased to one of the lowest levels on record and is below the long-term mean. There remains concern regarding the low level of large salmon spawners in Labrador.

- As a result of high water conditions, the counting fence at Sand Hill River was installed later than normal (approximately 2-3 weeks) and returns were adjusted accordingly.

Newfoundland (SFAs 3-14A)

- Returns of small and large salmon in 2010 were some of the highest since the closure of the commercial fisheries in 1992. Compared to the previous five year mean (2005-09), small salmon returns increased on 12 rivers and decreased on one, whereas, large salmon returns increased on seven and decreased on six. The index of abundance of small and large salmon was above the previous five year mean in insular Newfoundland.

- Conservation egg limit was achieved on seven of 13 assessed rivers. Four of the six rivers that did not achieve conservation have had newly opened habitat (i.e. Exploits, Terra Nova, Northwest and Rocky). The remaining two rivers that did not achieve conservation were Conne River (69%) and Harry's River (94%).

- Compared to the previous five year mean (2005-09), sea survival increased on three of the five monitored rivers. The index of marine survival for 2010 was above the previous five year mean. The direction of change for smolt production was variable among the assessed rivers.

BACKGROUND

Recreational Fisheries

Labrador

In 2010, the recreational salmon fishery for all Labrador rivers opened 15 June and closed 15 September. Retention of large salmon was not permitted in SFA 14B of Labrador but was permitted on some rivers in SFA 2 and all rivers in SFA 1. In SFA 1 and some SFA 2 rivers, anglers could retain four salmon for the season, one of which could be large; other scheduled salmon rivers in SFA 2 were given a Class III designation, with a seasonal retention limit of two small salmon and no large salmon. The lower retention limit for some rivers in SFA 2 was implemented as a precautionary measure to prevent increased fishing mortality expected as a result of increased angling on rivers made easily accessible via the Trans-Labrador Highway. Rivers without direct access from the highway remained at a seasonal retention limit of four salmon.

Angling catch data for SFA 1 were derived from records kept by the Department of Fisheries and Oceans (DFO) Conservation and Protection (C & P) staff and outfitting camp logbooks from 1974-1993. Since 1994 C & P data were no longer collected. For SFA 2, C & P and logbook data were used from 1974-1993 and a combination of logbook and License Stub Return data was used from 1994-2009. For SFA 14B, C & P and logbook data were used for 1974-1993 and License Stub Return data was used for 1994-2009. The recreational data in SFAs 1, 2 & 14B for 2009 has been updated. In 2009, the total angling catch for Labrador was 5848 (Fig. 3). The total angling effort was 6360 rod-days, a decrease over the 2008 value of 9025. The catch of small salmon was 4331 (1240 retained and 3091 released) and large salmon was 1571 (218 retained and 1299 released). The proportion of salmon released by anglers in Labrador, which has been increasing over time, was 75% of the total catch. In total, there were 4390 small and large salmon estimated to be hooked and released in 2009. In SFA 1, the total catch in 2009 (small and large salmon combined) of 1479 remained similar from that of 2008. In SFA 2, the total catch (small and large salmon combined) in 2009 of 3380 decreased by 39% compared to

2008. Also, in SFA 14B, the total catch (small and large salmon combined) in 2009 of 989 decreased by 59% compared to 2008. Data for 2010 are currently unavailable.

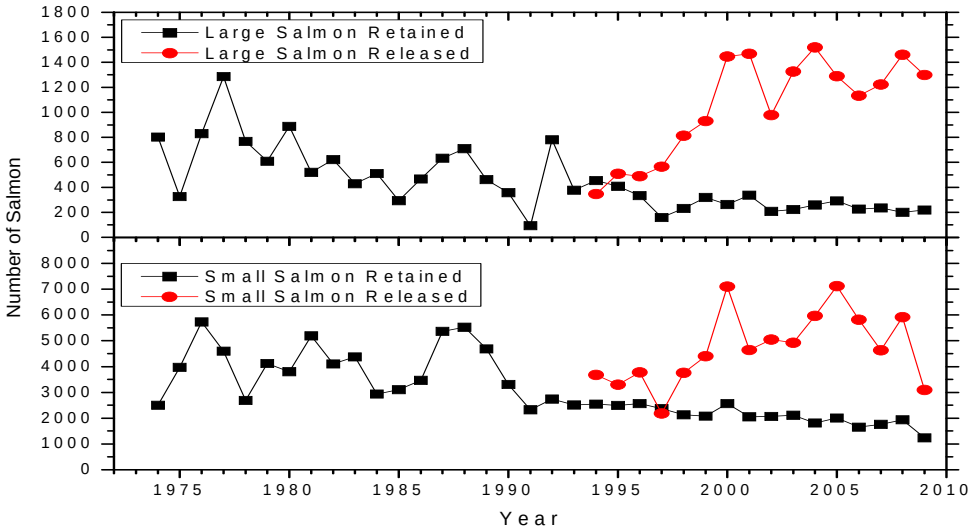

Figure 3: Angling catch statistics for Labrador SFAs 1, 2 & 14B.

Newfoundland

The recreational salmon fishery in SFAs 2-14B is managed according to the River Classification System. A five-year (2007-11) integrated Atlantic salmon fisheries Management Plan was introduced for Newfoundland and Labrador in 2007 (DFO 2007). Recreational catch of small and large salmon for insular Newfoundland are presented in Figure 4. Angling catch statistics from License Stub Returns in 2009 and 2010 are not yet available.

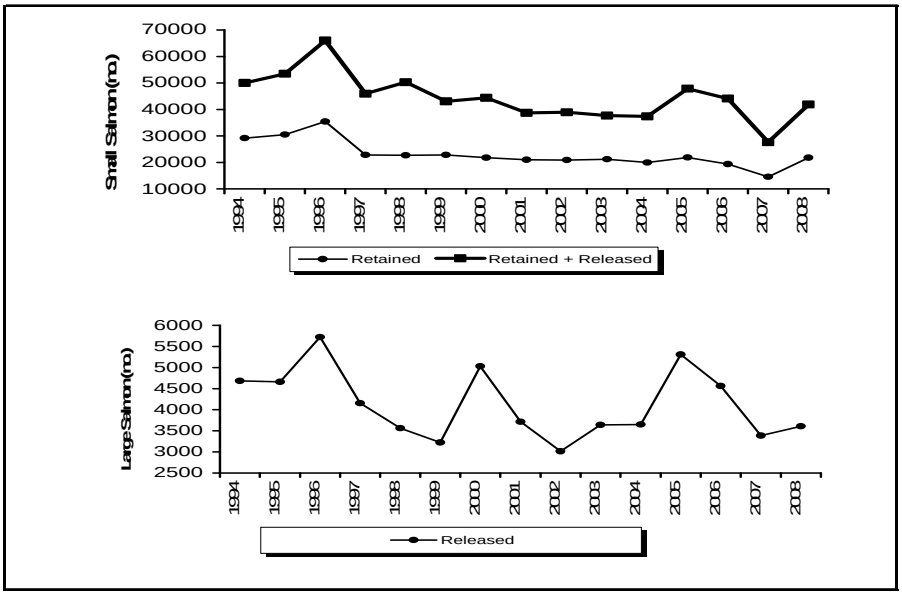

Figure 4: Recreational catch of small salmon (retained and retained plus released) and large salmon released, 1994-2008, for insular Newfoundland (SFAs 3-14A).

Aboriginal/Subsistence Fisheries

Aboriginal subsistence fisheries for salmon, Arctic charr and brook trout occurred in Labrador under communal licence similar to 2008. An All Resident Subsistence Fishery for trout and charr permitted retention of up to four salmon as a by-catch in 2009 similar to 2008.

There has been no commercial salmon fishing in insular Newfoundland since 1992, the Straits area of Labrador (SFA 14B) since 1997, and the rest of Labrador (SFAs 1-2) since 1998.

Commercial salmon fishing in Greenland territorial waters was suspended in 2002. Greenlanders continued a subsistence harvest in 2002-09 of less then 30 t including estimates for unreported catches. In 2009, there was a small commercial and recreational net fishery in St. Pierre et Miquelon territorial waters. Harvests have been less than 5 t annually.

Information available on Labrador subsistence fishery catches indicates that around 30 t (11,332 salmon) were harvested in 2009 of which large salmon represented 46% of the catch by weight and 30% by number. Subsistence food fishery landings in 2009 decreased by 18% from the 36 t landed in 2008 (Fig. 5, Table 1). Landings for 2010 are currently unavailable.

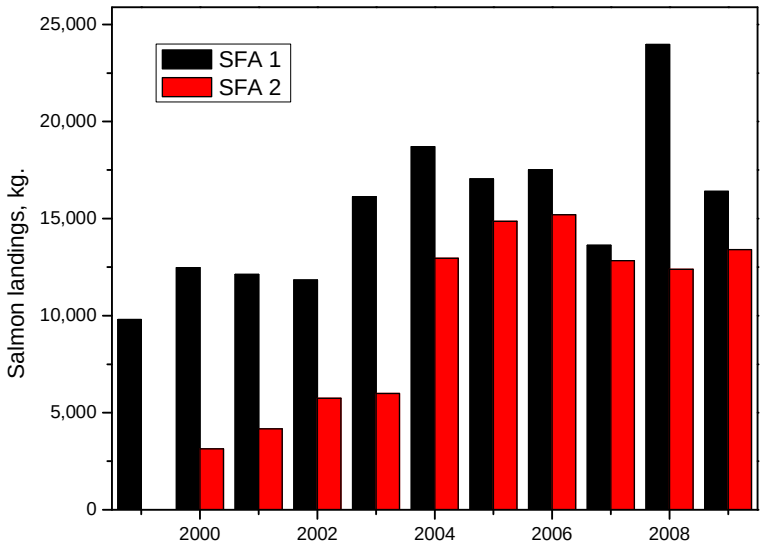

Figure 5: Landings (kg) reported in the food fisheries in Labrador for SFAs 1 and 2 (1999-2009).

Prior to the closure of the Labrador commercial salmon fishery in 1998, landings (small and large salmon combined) averaged 369 t annually during the period from 1984-89, and 111 t per year from 1990-97, the period in which quotas and allowances were in effect. Commercial salmon landings during the last year of the fishery (1997) were about 47 t. By comparison, approximately 30 t of salmon were harvested in subsistence fisheries in 2009.

ASSESSMENT

Conservation Requirements for Labrador Rivers

Conservation requirements for Atlantic salmon in Labrador were discussed in detail by Reddin et al. (2006). Since 2007, an interim conservation limit of 190 eggs per 100 m^2 of fluvial habitat has been used in Labrador (SFAs 1 and 2).

Resource Status–Adult salmon

Labrador (SFAs 1, 2, & 14B)

Stock status can be tracked by examining trends of individual stocks, or in a collective manner where information from fisheries and from assessed rivers is combined to derive indices of abundance. As illustrated for small (Fig. 6) and large (Fig. 7) salmon in Labrador, despite improvements in runs to some rivers in recent years, overall abundance remains relatively low compared with pre-moratorium levels, where adjustments to correct for marine exploitation have been made. The abundance of small salmon while relatively high in recent years declined in 2009 to amongst the lowest in the time series. There was no change in the abundance of small salmon in 2010. The large salmon index, while increasing in recent years, remains relatively low and in 2010 levels decreased to one of the lowest on record. This is a very important consideration for Labrador as the large salmon component has a higher portion of multi-sea-winter salmon. These multi-sea-winter salmon have a high percentage of female salmon, and thus can account for a high proportion of the overall egg requirement.

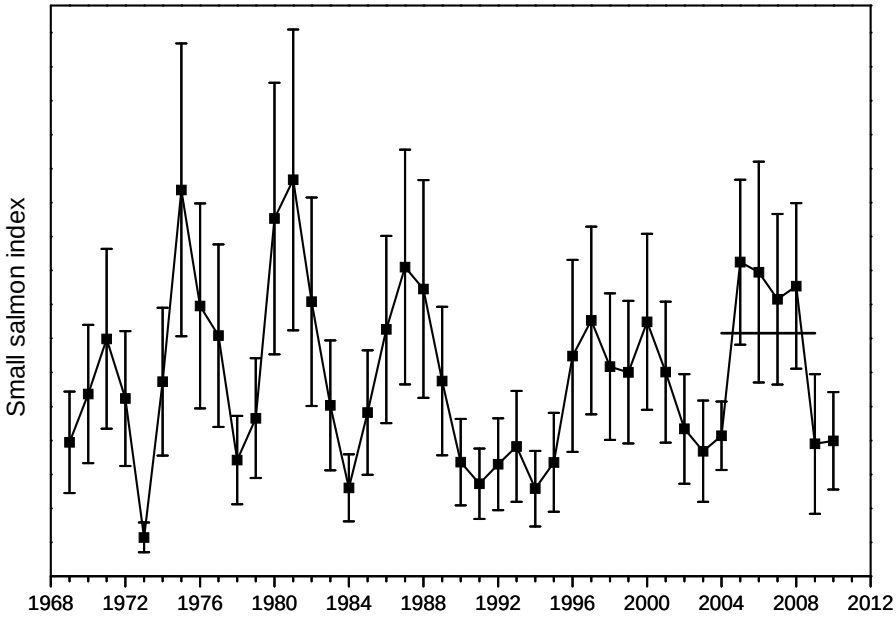

Figure 6: Trends in abundance of small Atlantic salmon in Labrador, 1969 to 2010. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

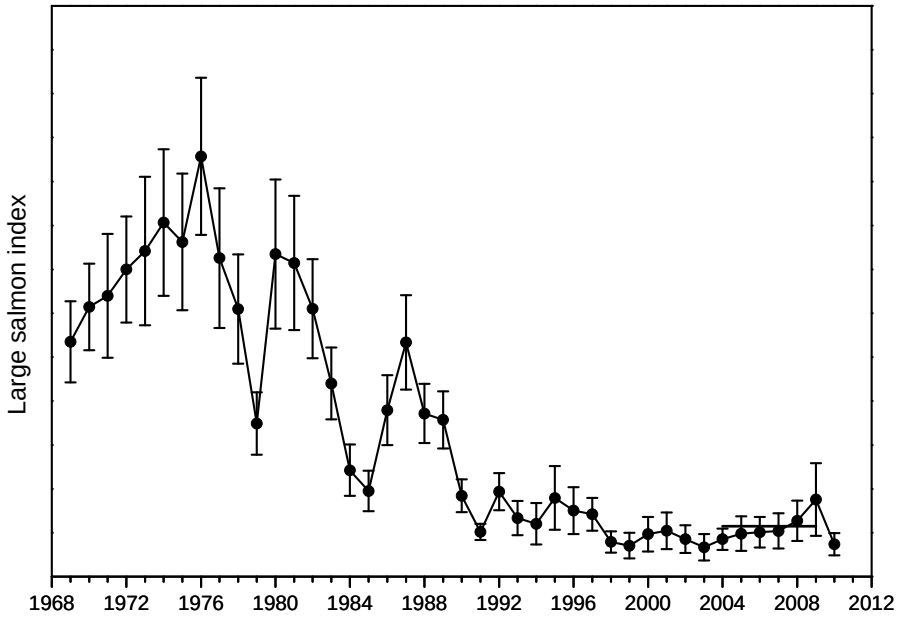

Figure 7: Trends in abundance of large Atlantic salmon in Labrador, 1969 to 2010. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

Northern Labrador & Lake Melville (SFA 1)

One river was assessed in SFA 1. Salmon and charr stocks were assessed from returns to the fish counting facility at English River near Postville. In 2010, small salmon returns were lower than the mean returns averaged over the previous six years, but small salmon returns were similar when compared to 2009. When compared to the previous six year mean, large salmon returns had also increased.

In 2010, the egg deposition relative to the previous six year mean and that of 2009 decreased.

Southern Labrador (SFA 2)

In 2010, two rivers were assessed in SFA 2: Sand Hill River and Southwest Brook (tributary of Paradise River). There was a decrease in returns when compared to the previous six year mean but an increase in returns of small salmon compared to 2009 at both counting fences. When 2010 returns are compared to the previous six year mean, large salmon returns decreased at Southwest Brook (Paradise River) and Sand Hill River. There was an increase in returns of large salmon compared to 2009 at Southwest Brook (Paradise River) and a decrease at Sand Hill River.

In 2010, the egg limit at Sandhill River and South West Brook decreased compared to the previous six year mean. Relative to 2009 the egg limit decreased at Sand Hill River but increased at South West Brook.

In 2010, Sand Hill River experienced high water which delayed the installation of the counting fence by approximately 2-3 weeks. Adjustments were made to fence counts to estimate total returns of both small and large salmon.

Labrador Straits (SFA 14B)

No rivers were assessed in SFA 14b in 2010.

Newfoundland (SFAs 3-14A)

Salmon abundance, and hence stock status, can be tracked by examining trends of individual stocks, or in a collective manner where information on salmon returns to all monitored rivers is combined to derive composite indices of abundance. In the latter case, the variability inherent in each individual river is accounted for in the modelling process. Overall abundance for Newfoundland small salmon continues to fluctuate and has generally remained low by comparison with pre-moratorium levels (1984-91) where adjustments to correct for marine exploitation have been made (Fig. 8). Abundance fell dramatically from 2004-07, with the latter being a record low year. However, since then abundance has increased such that 2010 was the highest recorded since 1988 and was slightly higher than the adjusted pre-moratorium mean, and, well above the average index for the past five years (2005-09). Only two rivers had returns in 2010 that were lower than the previous year (Conne and Campbellton), and three rivers had record high returns of small salmon in 2010 (Exploits, Terra Nova, and Rocky).

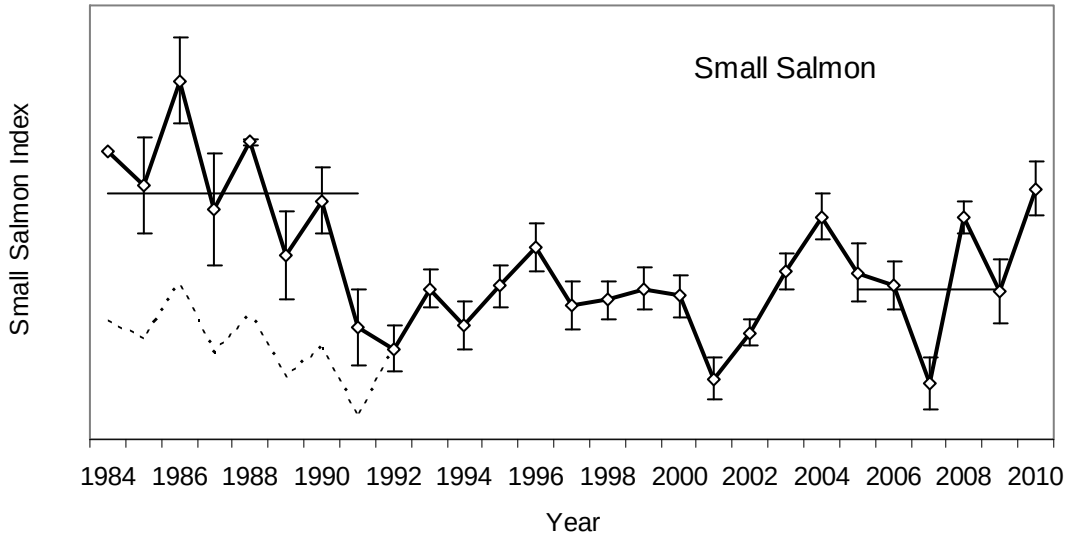

Figure 8: Trends in abundance of small Atlantic salmon in Newfoundland, 1984 to 2010. Returns from 1984-91 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-91 and 2005-09. Vertical lines represent ± 1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984–91.

Overall abundance for Newfoundland large salmon shows somewhat similar trends. There was a precipitous decline in abundance from the mid-1980s until the early 1990s (Fig. 9). Following the closure of the Newfoundland commercial salmon fishery in 1992, abundance of large salmon increased consistently until 1998. Since then there has been a general declining trend through to 2009, which was the lowest abundance since 1993. Abundance of large salmon increased in 2010 driven by exceptionally high returns at Exploits, Terra Nova, Campbellton,

and Torrent rivers. With the exception of one river (Rocky River), returns of large salmon increased from 2009.

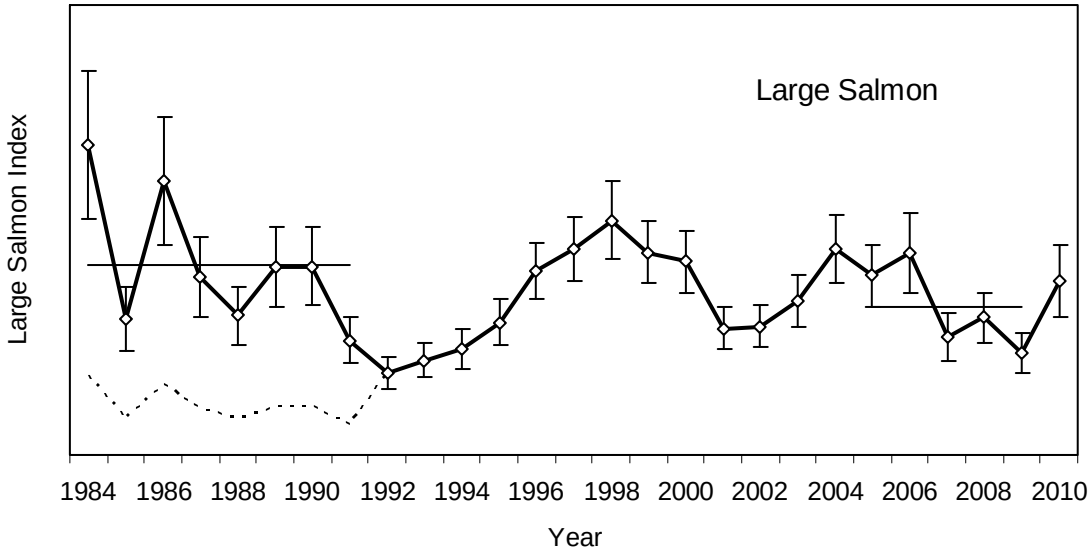

Figure 9: Trends in abundance of large Atlantic salmon in Newfoundland, 1984-2010. Returns from 1984-91 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-91 and 2005-09. Vertical lines represent ± 1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984–91.

In recent years, returns of small salmon have been extremely variable fluctuating from almost record lows to record highs. While the overall returns and spawning escapements have increased relative to the pre-moratorium period, the total stock size remains below levels obtained prior to the closure of the Newfoundland commercial salmon fishery. 2010 marked the first time that abundance of small salmon was slightly higher than the estimated average during the pre-moratorium years.

Northeast and Eastern Newfoundland (SFAs 3-8)

Six rivers were assessed in 2010: Exploits River, Campbellton River, and Gander River in SFA 4, and Middle Brook, Terra Nova River and Northwest River (Port Blandford) in SFA 5. With the exception of Gander River, all stocks were assessed directly from salmon returning to fish counting facilities. The status of Gander River has been inferred from salmon returning to a fishway on Salmon Brook tributary since 2000.

Compared to the previous five year mean (2005-09), total returns increased on all monitored rivers for small salmon and all but Gander River for large salmon. Returns of large salmon to Gander River have been below the previous five year mean since 2006, which has resulted in a steady decline of that mean.

Egg deposition was above the previous five year mean (2005-09) for five monitored rivers but remained unchanged for Northwest River. In 2010, conservation spawning requirements were met on Gander River, Campbellton River and Middle Brook (Table 2). Campbellton River and Middle Brook have exceeded conservation spawning requirements in each assessed year of the moratorium period (Table 2). Gander River met or exceeded conservation requirements in only

4 of the past 6 years. Terra Nova River, Exploits River and Northwest River (Port Blandford) have yet to achieve conservation spawning requirements as of result of newly opened habitat. Total returns of both small and large salmon to the Exploits River in 2010 were the highest on record. Terra Nova River also experienced a record high return of small salmon in 2010.

In spite of great increased spawning escapements for most assessed rivers in SFA 4 and 5 during the initial five year moratorium period (1992-96), longer term increases in adult recruitment (i.e. small salmon) have not been realised.

Concern has been expressed for the lack of growth in egg deposition level achieved in the Upper Exploits watershed, which was made accessible in 1989.

South Newfoundland (SFAs 9-11)

Four rivers were assessed in 2010: Northeast Brook (Trepassey) and Rocky River in SFA 9, Conne River and Little River in SFA 11 (Fig. 2). Spawning escapements are evaluated using fish counting facilities while mark-recapture methods are used to survey smolt production at Conne River.

Total returns of small salmon in 2010 increased at three of four monitored rivers relative to the previous five year mean (2005-09). Only at Conne River did returns decline (~15%) from the previous five year mean. Returns at Northeast Brook (Trepassey) and Little River were 19% and 95% greater, respectively, than the previous means. Rocky River achieved a record high return with small salmon returns more than double the previous five year mean. Returns of small salmon to Conne River were the fourth lowest recorded.

Less than 10 large fish were counted at either Northeast Brook (Trepassey) or Little River. At Conne River returns of large salmon were lower than the previous five year mean (~15%). Despite the record high return of small salmon at Rocky River, returns of large salmon were 46% less than the 2005-09 mean. As noted in past years, large salmon at rivers such as Conne River are predominately alternate spawning grilse.

Conservation spawning requirements in 2010 were not achieved at Conne River (69%) while Rocky River essentially attained conservation for the first time in 2010 (98%). At Northeast Brook (Trepassey) conservation was exceeded (188%) while requirements were also met at Little River (118%) for the second time since 2005. Conne River has met its requirement in only 11 of the past 19 years since the commercial salmon fishery moratorium began. As noted, Little River has been subject to enhancement activities but conservation requirements have essentially been met in six of the past eight years. Rocky River is still considered to be in a development phase.

Southwest Newfoundland (SFAs 12-13)

No rivers were assessed in SFA 12 in 2010.

In SFA 13, Atlantic salmon were monitored in Harry's River at approximately river km 25 near the community of Gallants using a counting fence. Data from past snorkel surveys carried out on Harry's River below the counting fence were used to estimate the number of adults in the lower reaches of the river. Estimates of the total number of spawners as well as the number of small salmon on Harry's River increased in 2010 compared to the previous five year mean (2005-09).

Additional rivers (Middle Barachois, Robinsons, Fischells, Flat Bay, and Crabbes) previously assessed using a snorkel survey were not completed in 2010.

The preliminary estimate suggests that Harry's River will achieve 94% of its conservation egg limit.

Northwest Newfoundland (SFA 14A)

Two rivers, Torrent River and Western Arm Brook, were assessed in 2010 using fish counting facilities. On both rivers total returns of large and small salmon increased compared to the previous five year mean (2005-09). It should be noted that for Western Arm Brook and Torrent River, large fish are mostly repeat spawners.

Egg deposition on both SFA 14A rivers consistently exceeded the conservation egg limit. Egg depositions for 2010 are estimated to be 1063% and 598% of conservation limits for Torrent River and Western Arm Brook respectively. Both of these values are above the previous five year mean.

Smolt Production and Marine Survival

Smolt production

In Newfoundland, information on both smolt and adult salmon counts is available from five rivers: Campbellton River (SFA 4), Northeast Brook (Trepassey) (SFA 9), Rocky River (SFA 9), Conne River (SFA 11), and Western Arm Brook (SFA 14A). Thus, estimates of marine survival from smolts to adult small salmon can be derived and examined in relation to trends over time or in view of changes in management plans. The data series ranges from almost 40 years at Western Arm Brook to 17 years at Campbellton River. Smolt monitoring at Highlands River (SFA 13) ended in 2000.

Smolt production in 2010 increased in three of five monitored stocks by comparison with the previous five year mean (2005-09) (Fig. 10). Increases ranged from 2% at Rocky River to 25% at Campbellton River where 2010 was the highest run since 1999. Numbers of smolts were 11% below average at Conne River while at Northeast Brook (Trepassey) smolt production was the lowest since 2001 and was 37% below the 2005-09 mean. Where increased smolt production has occurred, returns of small salmon in 2010 are expected to be higher if marine survival rates are similar to those in 2010.

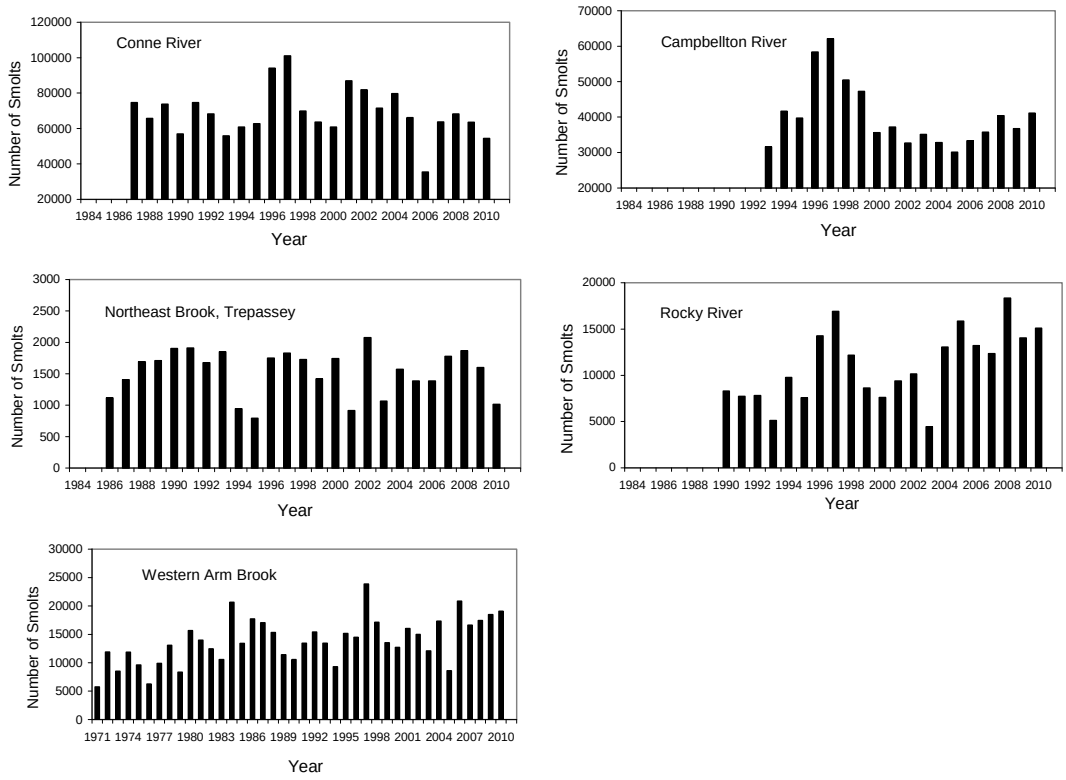

Figure 10: Trends in smolt production from various Newfoundland Atlantic salmon rivers.

Marine survival

Marine survival, corresponding to adult small salmon returns in 2010, averaged 6.8% across all five rivers, with higher survival rates experienced at all monitored rivers, except Conne River, by comparison with 2009 (Fig. 11). At Conne River, survival was again less than 3% while a record high rate of return occurred at Rocky River (6.8%). Survival was higher than the 2005-09 mean at all rivers except Conne. Consistent with past years, higher survival rates were observed at northern locations (Western Arm Brook and Campbellton River) while survival of southern populations is often lower.

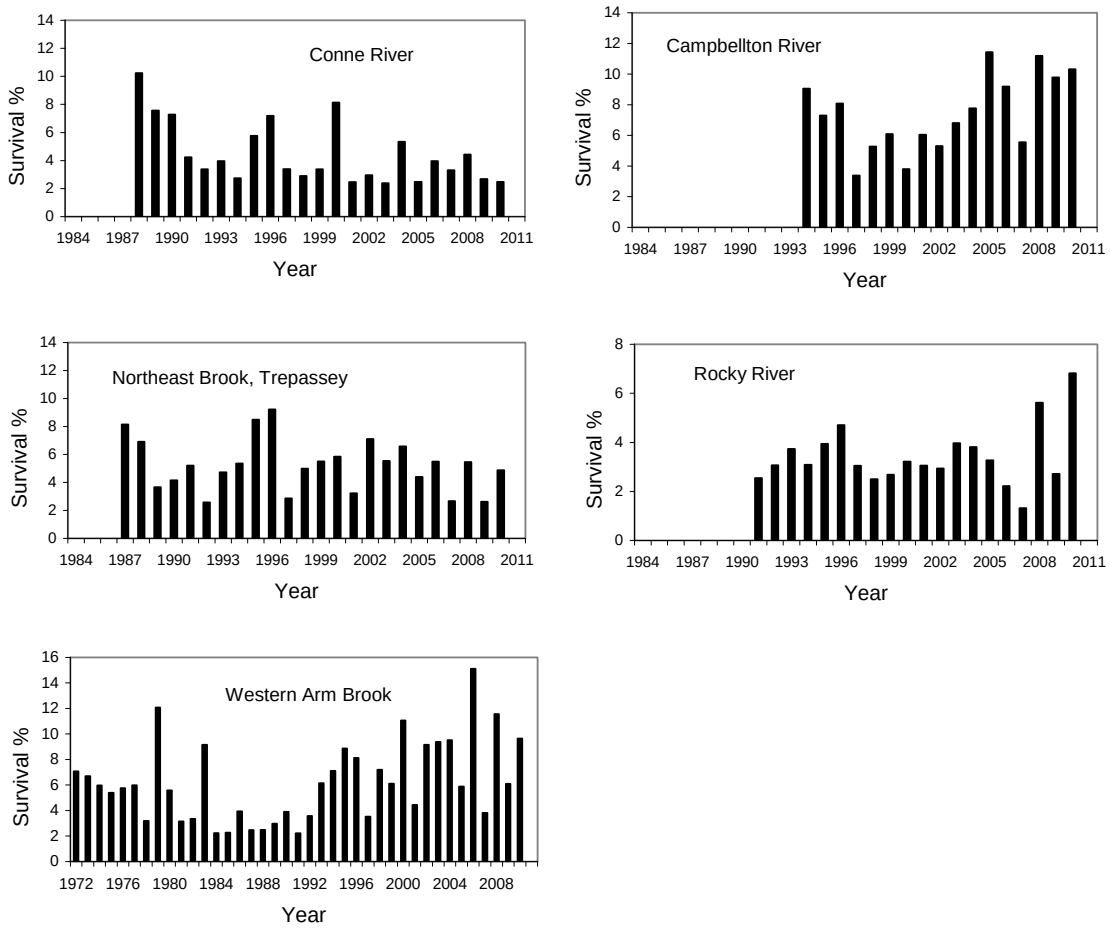

Figure 11: Marine survival rates for adult small salmon at various Newfoundland rivers. Survival rates have not been adjusted for marine exploitation in years prior to 1992 when commercial fisheries for salmon occurred. Thus, values represent survival of salmon back to the river.

A composite index of marine survival derived from all five rivers is shown in Figure 12. Survival of smolts to adult small salmon is illustrated for the period 1986 to 2010, where year represents the year of adult small salmon return. The index of smolt survival fell dramatically for smolts that went to sea in 2008 and returned as adults in 2009. This was followed by an increase in survival of salmon that returned in 2010.

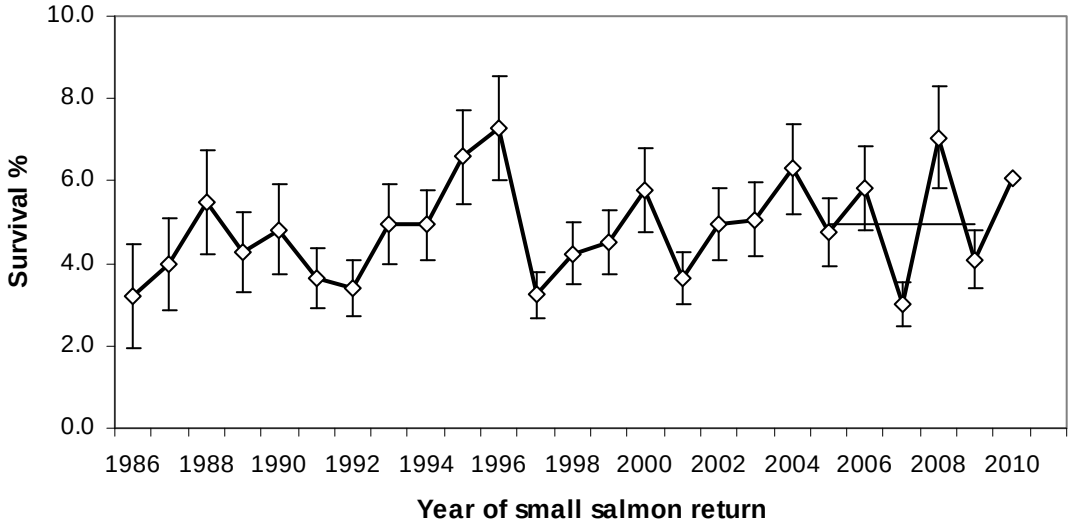

Figure 12: Standardized mean survival of smolts to adult small salmon derived from a general linear model analysis of monitored Newfoundland rivers. Year represents the year of smolt migration. Vertical lines represent one standard error about the mean.

Sources of Uncertainty

No information is available on the salmon stocks in SFAs 3, 6, 7, 10, 12 and 14B and the Lake Melville area of SFA 1.

Salmon populations in assessed rivers may be unique and not representative of other rivers in the SFA.

Returns of small salmon for most rivers include repeat spawners. Therefore, sea survival of smolts to small salmon is an overestimate of marine survival.

Returns to Gander River have been estimated using counts from an upstream tributary, Salmon Brook, since 2000. A retrospective comparison between the actual and estimated total returns on the Gander River revealed deviations of 50-60%. Uncertainties around Gander River estimates are included in the insular Newfoundland stock status report.

Returns to Harry's River in 2010 were estimated using four previous snorkel surveys. Uncertainties around this estimate will be included in the insular Newfoundland stock status report.

In 2010, Sand Hill River experienced high water which delayed the installation of the counting fence by approximately 2-3 weeks. Adjustments were made to fence counts to estimate total returns of both small and large salmon. Uncertainties around this estimate will be included in the Labrador stock status report.

CONCLUSIONS AND ADVICE

There are four areas of concern for salmon populations in the region: Labrador, Conne River, Bay St. George and Exploits River.

Small salmon in Labrador experienced a second year of lower returns, which is concerning. Of particular importance would be a three year consecutive decline that represents a generation of spawners and could considerably reduce production of future smolt classes.

There is concern that returns at Conne River in 2010 declined (~15%) from the previous five year mean while the overall cumulative decline since the mid-1980s has been over 70%. Conne River continues to remain at or below pre-moratorium levels compared to other rivers in the province which have improved in recent years.

In Bay St. George there is particular concern for the large salmon components, many of which are 2-sea-winter salmon. Concern for these stocks has been noted for more than two decades. Some, but not all of these fluctuations, may be attributed to the frequent extremes in river discharge. Poaching in some Bay St. George rivers is also believed to be a long-standing problem hampering stock recovery. The increased management efforts with respect to conservation/stock recovery strategies (Stewardship Programs) and associated monitoring plans, as well as enforcement have been successful on Bay St. George Rivers. DFO should continue to support the stewardship initiatives and implement management options that will maximize the spawning population.

Concern was expressed in 2008 for Middle Barachois Brook (Bay St. George), which only achieved 28% of its conservation egg limit. The Middle Barachois Brook salmon population had shown declines and was believed to be at seriously low levels. Further assessment of the status of Atlantic salmon in Middle Barachois Brook is required.

Future assessments for Harry's River will use yearly means for length, weight, and percent female for large and small salmon when sample sizes are 30 or greater. Sturge's fecundity estimate (1540 eggs/kg) will be abandoned and the new estimate of 1880 eggs/kg for small salmon and 1570 eggs/kg for large salmon based on Flat Bay fecundity data will be used. Flat Bay assessments will continue to use Flat Bay fecundity data (2218 eggs/kg and 1719 eggs/kg small and large). All other rivers in Bay St. George will use river specific data where available (pre-1992 data if necessary). If no river specific data exists, a mean value from the 1992-2010 data for all Bay St. George rivers will be used.

Concern has been expressed for the lack of growth in the egg deposition level achieved in the Upper Exploits watershed, that was made accessible in 1989.

Management Advice

There should be a reduction in exploitation of large salmon in Labrador in 2011.

There should be no increase in fishing mortality/allocations on Newfoundland and Labrador salmon stocks in 2011 except for areas which have in-season reviews and where conservation requirement limits are being exceeded.

Science recommends that options be assessed and action be taken to increase egg deposition in the upper section of the Exploits watershed (e.g. reduce exploitation, transfer adults). A

research project should be initiated to determine the impact of harvesting, below Red Indian Dam, on production in the upper Exploits.

Continued and enhanced efforts should be made to improve the number of spawners in all Bay St. George rivers.
Given the conservation issues regarding South Coast rivers, particularly Conne, Fisheries Management should consider developing recovery/management plans that could be specifically applied to South Coast rivers.

Research Recommendations

In general, monitored south coast rivers did not respond to the commercial salmon fishery moratorium in any consistent, positive way by comparison with other regions in Newfoundland and Labrador. Accordingly, it is recommended that salmon abundance monitoring be expanded to determine if other south coast stocks are under producing with respect to adult salmon abundance.

Efforts to better understand interactions of aquaculture on the Conne River salmon populations should also be conducted.

No assessment information is available on the salmon stocks in SFAs 3, 6, 7, 10, 12, 14B and Lake Melville in SFA 1. It is recommended that assessment data be collected in all SFAs as recommended in the Wild Atlantic Salmon Conservation Policy (2009).

“Rational management of a mixed stock fishery requires knowledge of the stocks that contribute to the fishery and the status of each of those stocks” (NASCO 2009). Such information is not currently available for salmon taken in fisheries in coastal waters and estuaries of Labrador. It is recommended that these fisheries be sampled in 2011 using genetic stock identification techniques and be analysed in a timely fashion along with samples already collected from Labrador.

Research is required on the Labrador large salmon populations to determine if the assessed rivers are representative of other populations, in particular, rivers in the harvested areas of Lake Melville and the Straits. These stocks are known to have different biological characteristics.

It is recommended that additional research be conducted with respect to modelling initiatives, since refinements of the models could enhance capabilities to forecast large changes in sea survival.

OTHER CONSIDERATIONS

Environmental Conditions

Marine Environment

The North Atlantic Oscillation (NAO) index for 2010 was at a record low, indicating below normal arctic air outflow in the Northwest Atlantic. As a result air temperatures in Newfoundland and Labrador were well above normal, reaching near +8 ºC above normal during the winter and 1.8 ºC above normal during spring at Cartwright on the mid-Labrador Coast. The annual sea-ice extent on the Newfoundland and Labrador Shelf during 2010 was below the long-term average

for the 16th consecutive year; in fact it was the lowest on record during the winter months and the 5th lowest during spring. This was in contrast to the spring (April-June) sea-ice extent in 2009 which was above the long term average, the first time since 1994.

Surface water temperatures at Station 27, offshore from St. John's Newfoundland, remained above normal during the winter (Jan.-Mar.) of 2010 by nearly 1.5 ºC. Spring surface temperatures in 2010 increased over 2007-09 to 0.9 ºC above normal while bottom temperatures were the 2nd highest on record at nearly 1 ºC above normal. Temperature data collected during the spring multi-species assessment surveys off the south coast and on the Grand Banks of Newfoundland generally showed a warming trend compared to the past several years. Observations from spring and summer AZMP oceanographic surveys indicated that the area of the cold-intermediate-layer (CIL <0 ºC) shelf water off eastern Newfoundland decreased over 2009 to the second lowest on record in some areas. In general, sea-surface temperatures during the winter and spring off Newfoundland and throughout much of the Northwest Atlantic increased over 2009 values.

Analyses have shown strong associations between environmental conditions and marine survival of salmon, adult salmon run timing and abundance of both large and small salmon. For example, salmon run-times are significantly correlated with both sea-surface temperature (r=0.7) in eastern Newfoundland waters and spring (April-June) sea-ice cover (r=0.6), with later run-times associated with cold conditions and extensive ice cover. The latest run time on record occurred in 1991 when ocean temperatures off Newfoundland were at an all time low. The abundances of both small and particularly large salmon for all insular waters of Newfoundland are highly correlated with sea surface temperatures and climate conditions in general. More research is required to quantify these relationships. However, based on historical data the marine environment in Newfoundland waters during recent years, except for 2007, were generally favourable for Atlantic salmon.

Freshwater Environment

No scheduled salmon rivers were closed for environmental reasons in 2010.

There is concern regarding the potential impact that hurricane Igor may have had on freshwater fish and fish habitat. Fortunately, the hurricane occurred on September 21 prior to the salmonid spawning season. Potential impacts may have occurred as a direct result of Igor (e.g. high water flow, bed-load transport, sedimentation) or indirectly in relation to construction activities that were permitted to occur in or near water bodies throughout the spawning season.

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APPENDIX

Table 1. Subsistence Atlantic salmon fisheries landings in Labrador as of October, 2010.

		Number			Weight (kg)		
SFA 1	**Year**	**Small**	**Large**	**Total**	**Small**	**Large**	**Total**
	2000	4,111	1,092	5,203	8,111	4,364	12,475
	2001	3,394	1,299	4,709	6,995	5,121	12,117
	2002	3,609	1,015	4,624	7,386	4,441	11,827
	2003	4,382	1,639	6,021	9,094	7,026	16,120
	2004	4,822	2,210	7,032	10,038	8,656	18,694
	2005	4,958	1,687	6,644	10,116	6,930	17,046
	2006	5,422	1,639	7,061	11,189	6,330	17,519
	2007	4,625	1,566	6,191	8,131	5,332	13,463
	2008	5,154	2,955	8,109	10,342	13,627	23,968
	2009	3,964	1,907	5,871	8,173	8,232	16,405
SFA 2	**2000**	1,212	260	1,472	2,242	897	3,139
	2001	1,396	401	1,770	2,793	1,378	4,172
	2002	2,197	374	2,571	4,196	1,549	5,745
	2003	2,095	536	2,632	4,102	1,885	5,987
	2004	3,564	1,486	5,050	7,341	5,614	12,955
	2005	5,479	1,130	6,609	10,922	3,946	14,868
	2006	5,422	1,639	7,061	11,189	6,330	17,519
	2007	4,700	1,560	6,261	8,306	5,314	13,619
	2008	4,680	954	5,634	9,044	3,349	12,393
	2009	4,024	1,437	5,461	7,956	5,449	13,405

Table 2. Summary of Atlantic salmon stock status in the Newfoundland and Labrador. Conservation met refers to the actual percentage of the conservation spawning requirement achieved. Refer to footnotes for definition of characters and abbreviations.

Region			Total Returns 2010		Total Returns 04-09 mean		Conservation met (%)			Status in 2010: Smolts Relative to:	Status in 2010: Marine Survival Relative to:	Status in 2010: Egg Deposition Relative to:
River	SFA	Method	Small	Large	Small	Large	2010	04-09 mean	2004-2010	04-09 mean	04-09 mean	04-09 mean
LABRADOR												
English River	1	Fe	296	47	347	49	83	94	4 of 7 yrs			⬇
Sand Hill River	2	Fe	2225	320	4275	710	54	110	4 of 7 yrs			⬇
Southwest Bk. (Paradise River)	2	Fe	173	17	444	37	57	144	5 of 7 yrs			⬇

Region			Total Returns 2010		Total Returns 05-09 mean		Conservation met (%)			Status in 2010: Smolts Relative to:	Status in 2010: Marine Survival Relative to:	Status in 2010: Egg Deposition Relative to:
River	SFA	Method	Small	Large	Small	Large	2010	05-09 mean	2005-2010	05-09 mean	05-09 mean	05-09 mean
INSULAR NEWFOUNDLAND												
Northeast Coast (SFA's 3-8)												
Exploits River	4	Fw	39130	7277	27795	3889	81	53	0 of 6 yrs			⇧
Campbellton River	4	Fe	3790	495	3263	391	381	308	6 of 6 yrs	⇧	⇔	⇧
Gander River *	4	EFw	23184	1559	16937	1612	131	98	4 of 6 yrs			⇧
Middle Brook	5	Fw	2574	115	1598	109	273	165	6 of 6 yrs			⇧
Terra Nova River	5	Fw	4147	471	2544	330	70	44	0 of 6 yrs			⇧
Northwest River (Port Blandford)	5	Fe	1146	237	875	189	67	66	0 of 6 yrs			⇔
South Coast (SFA's 9-11)												
Northeast Brook (Trepassey)	9	Fe	78	4	66	4	188	157	6 of 6 yrs	⬇	⇧	⇧
Rocky River	9	Fe	956	30	429	55	98	50	0 of 6 yrs	⇔	⇧	⇧
Little River	11	Fe	270	6	139	11	118	63	1 of 6 yrs			⇧
Conne River	11	Fe	1762	91	2085	107	69	89	2 of 6 yrs	⬇	⬇	⬇
Southwest Coast (SFA's 12-13)												
Harry's River	13	Fe	2888	417	2536	440	94	92	2 of 6 yrs			⇔
Northwest Coast (SFA 14A)												
Torrent River	14A	Fw	4861	1285	3952	1088	1063	786	6 of 6 yrs			⇧
Western Arm Bk	14A	Fe	1782	47	1219	28	598	402	6 of 6 yrs	⇧	⇧	⇧

Assessment Methods: Fe = counting fence; Fw = fishway count; EFw = estimated from tributary fishway count

Trend symbols: ⬇ > 10% decrease; ⇧ > 10% increase; ⇔ no change = ± 10%

Footnotes:
Marine survival is from smolts in year i to small salmon in year i + 1.
190 eggs/100 m2 was used to determine the conservation levels for Labrador rivers.
* Gander River was assessed using a fish counting fence from 1989 to 1999.

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