



STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON - 2009

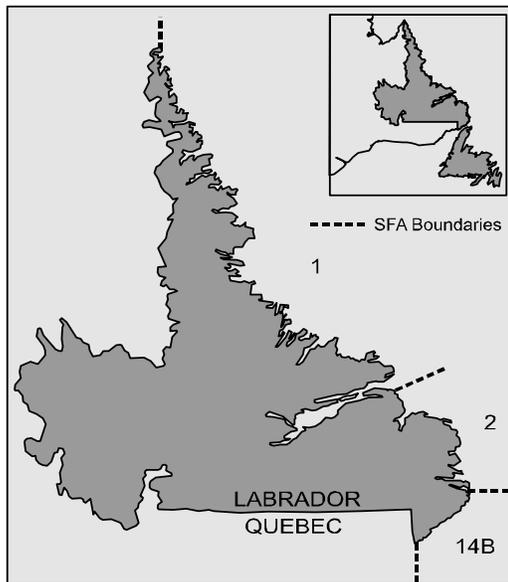


Figure 1. Labrador portion of NL Region.

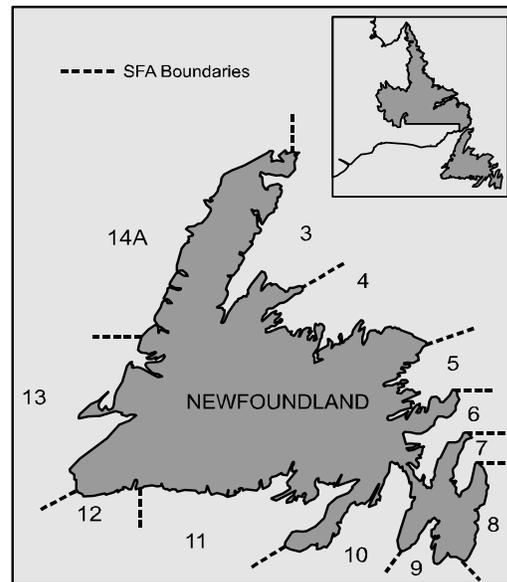


Figure 2. Newfoundland portion of NL Region.

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 \geq 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 m² of river rearing habitat, Straits Area of Labrador (SFAs 14A-14B) based on 2.4 eggs per m² of river rearing habitat and 105 eggs per hectare of lake habitat and insular Newfoundland (SFAs 3-13) based on 2.4 eggs per m² 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 deposition 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 in November 2009 in St. John's, NL to update those stocks/rivers considered during the last assessment meeting. 2009 marks the third 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 1980's continues to be the 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 - 2009 returns (Fig. 10).
- Within insular Newfoundland, overall abundance of small and large salmon declined in 2009 from the estimated abundance for 2008, and was below the moratorium mean (1992-2008). Low abundance of small salmon was noted in 2001, 2007 and 2009 and for large salmon particularly low abundance was noted in the early 1990's and 2007.
- Within Labrador, abundance of small salmon decreased over 2008 and is below the long term mean and overall abundance of large salmon has remained particularly low since the late 1980's. The 2009 index of abundance of small salmon decreased substantially from the 2008 level and is below the long-term mean. The index of abundance of large salmon shows an increasing trend since 2003 although it has declined substantially since the 1970s and early 1980s.

Labrador (SFA 1-2 and 14B)

- In Labrador, returns of small salmon decreased in 2009 compared to 2008 at all four counting facilities.
- In 2009, numbers of large salmon decreased for two out of four rivers, increased on one and remained unchanged on a fourth compared to 2008. When compared to previous year means large salmon returns increased at two counting fences and did not change (<10%) at another counting fence. Overall, large salmon remained lower than prior to the closure of the commercial fishery. There remains concern with the low level of large salmon spawners in Labrador. (Table 2).
- Conservation requirements were met on only one of the four assessed rivers.
- Conservation spawning requirements for Labrador rivers have been defined as 190 eggs per 100 m² of fluvial habitat which is assumed to include lacustrine habitat (Reddin et al. 2006).

Labrador SFA 1

- English River met conservation requirements in 2009 for a fourth consecutive year.

-
- In 2009, there was a decline in returns (>10%) of small salmon in SFA 1 compared to 2008 and to the previous 6-year mean.
 - There was an increase in returns (>10%) of large salmon in SFA 1 compared to 2008 and to the previous 6-year mean.

Labrador SFA 2

- Sand Hill River did not meet the conservation requirements in 2009 but it did in a total of four out of 14 years (1970-73, 1994-96, and 2002-2009).
- Muddy Bay Brook did not meet conservation requirements in 2009 but it did in five of the last eight years.
- Southwest Brook (Paradise River) did not meet conservation requirements in 2009 as it did for seven out of eleven years.
- There was a decrease in returns of small salmon in SFA 2 compared to 2008 and declines at two while a third remained unchanged compared to six-year means at all three counting fences. (Table 2).
- There was an decrease in returns of large salmon in SFA 2 compared to 2008 at two counting fences while a third remained unchanged.

Newfoundland (SFAs 3-14A)

- Abundance levels of large and small salmon, on average, are below levels achieved prior to the moratorium. Low marine survival, since the late 1980's, continues to be the major factor affecting overall abundance of Atlantic salmon within the insular portion of the region.
- Overall there was a decrease in returns of small and large salmon from returns in 2008. The returns of large salmon are the third lowest since the closure of the commercial fisheries in 1992. Small salmon returns increased on 6 rivers, decreased on 5 rivers and showed no change on the remaining 2 while large salmon returns increased on 4 rivers and decreased on 9 rivers as compared to the 1992-2008 mean.
- Conservation egg deposition was achieved on 7 of the 13 assessed rivers; Of the 6 rivers that did not achieve conservation 4 were rivers with newly opened habitat (Exploits, Terra Nova, Northwest and Rocky rivers) while Harry's River and Conne River failed to achieve conservation.
- Overall mean sea survival of the 5 monitored rivers of the 2008 smolt class was amongst the lowest values observed and smolt to small salmon survival averaged less than 5%. Smolt out put for the 5 monitored rivers declined for four of the rivers from 2008 to 2009.

Northeast and Eastern Newfoundland (SFAs 3-8)

- Conservation egg depositions were achieved in three of the six stocks examined.
- Abundance of small salmon remained unchanged in 2 stocks and declined in four of the six stocks examined.
- Abundance of large salmon increased in one stock, remained unchanged in one stock and declined in four of the six stocks examined.
- Concern is expressed for the low egg deposition levels in the Upper Exploits watershed.

Southern Newfoundland (SFAs 9-11)

- Conservation requirements were achieved in two (Little River and Northeast Brook Trepassey) of the four rivers assessed (Table 2).

Southwest Newfoundland (SFAs 12-13)

- Only Harry's River was assessed in 2009. Estimates of small salmon returns decreased in 2009 compared to 2008, while estimates of large returns showed no change. Counts at the Gallant's counting facility are below the 5 year average. Egg deposition declined relative to 2008 but increased compared to the 1992-2008 mean.

Northwest Newfoundland (SFA 14A)

- Conservation requirements were exceeded in the two assessed rivers in 2009 (Torrent River and Western Arm Brook). Returns of small salmon at both facilities declined in 2009 compared to 2008 while returns of large salmon increased at Western Arm Brook but remained unchanged for Torrent River. Egg deposition at Western Arm Brook decreased in 2009 compared to 2008 and the 1994-2008 mean. At Torrent River the egg deposition decreased in 2009 compared to 2008 but remained unchanged from the 1992-2008 mean.

BACKGROUND**Recreational Fisheries****Labrador**

In 2008, 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 were left as Class II with a seasonal retention limit of four salmon, as was previously the case.

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, logbooks from outfitting camps 1974-1993 and logbooks from outfitting camps 1994 onwards. For SFA 2, C & P and logbook data were used for 1974-1993 and a combination of logbook and License Stub Return data was used for 1994-2009. For SFA 14B, C & P and logbook data were used for 1974-1993 and License Stub Return data for 1994-2009. Also the recreational data in SFAs 1, 2 & 14B for 2008 has been updated. In 2008, the total angling catch for Labrador was 8437 (Fig. 3). The total angling effort was 8119 rod-days, a slight increase over the 2007 value of 7930. The catch of small salmon was 6835 (1659 retained and 5176 released) and large salmon was 1602 (202 retained and 1400 released). The proportion of salmon released by anglers in Labrador, which has been increasing over time, was 78% of the total catch. In total, there were 6576 small and large salmon estimated to be hooked and released in 2008. In SFA 1, the total catch in 2008 (small and large salmon combined) of 1515 declined slightly from that of 2007. In SFA 2, the total catch (small and large salmon combined) in 2008 of 5168 increased by 24% compared to 2007. Also, in SFA 14B, the total catch (small and large salmon combined) in 2008 of 1754 decreased by 10% compared to 2007. Data for 2009 are currently unavailable.

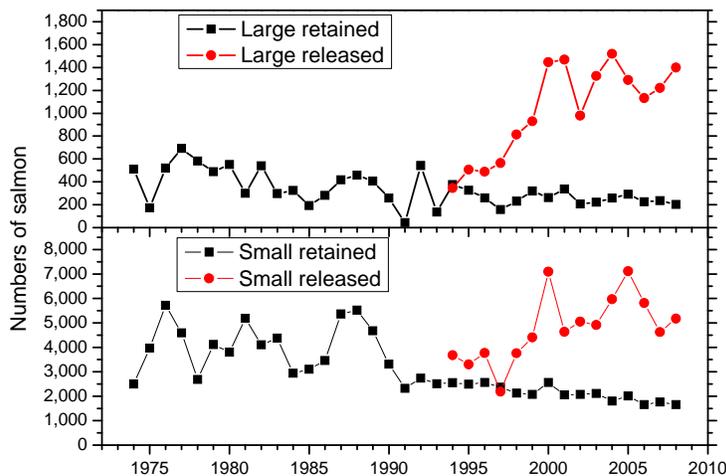


Figure 3: Angling catch statistics for Labrador SFAs 1, 2 & 14B.

Newfoundland

The recreational salmon fishery in SFAs 2-14B is managed according to the River Classification System. A five-year (2007-2011) integrated Atlantic salmon fisheries Management Plan was introduced for Newfoundland and Labrador in 2007 (DFO 2007).

Angling catch statistics from License Stub Returns in 2009 are not yet available.

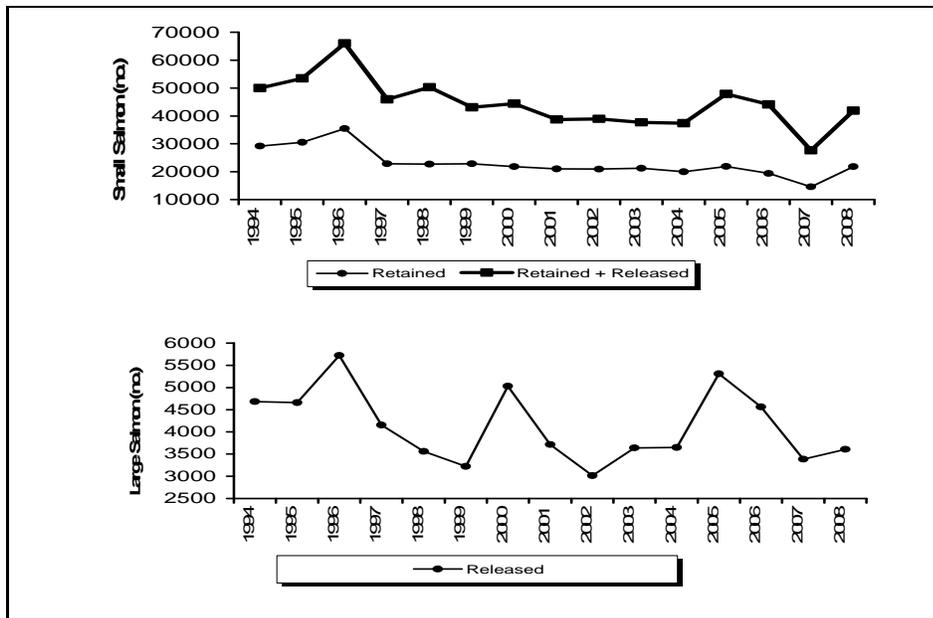


Figure 4. Recreational catch of small salmon (retained and retained plus released) and large salmon released, 1994-2008, for Insular Newfoundland (SFAs 3-14A).

Aboriginal/Subsistence Fisheries

Aboriginal subsistence fisheries for salmon, Arctic charr and brook trout occurred in the coastal and estuarine waters of Labrador under communal license similar to 2008. An All Resident Subsistence Fishery for trout and charr permitted the 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 2002-2009 of less than 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 about 36 t (13,743 salmon) were harvested in 2008 of which large salmon represented 47% of the catch by weight and 28% by number. Subsistence food fishery landings in 2008 increased by 37% from the 26 t landed in 2007 (Table 1). Landings for 2009 are currently unavailable.

Table 1. Subsistence salmon fisheries landings in Labrador as of October, 2009

Year	Small salmon		Large salmon		Total	
	Number	Weight(kg)	Number	Weight(kg)	Number	Weight(kg)
2000	5,323	10,353	1,352	5,262	6,675	15,613
2001	4,789	9,789	1,673	6,499	6,478	16,288
2002	5,806	11,581	1,437	5,990	7,243	17,572
2003	6,477	13,196	2,175	8,912	8,653	22,108
2004	8,385	17,379	3,696	14,270	12,091	31,649
2005	10,436	21,038	2,817	10,876	13,253	31,914
2006	10,377	21,198	3,090	11,523	13,467	32,721
2007	9,208	17,070	2,652	9,386	11,860	26,456
2008	9,834	19,386	3,909	16,975	13,743	36,361

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 to 1989, and 111 t per year from 1990 to 1997, 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 36 t of salmon were harvested in subsistence fisheries in 2008.

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 m² 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. 5) and large (Fig. 6) salmon in Labrador, despite improvements in runs to some rivers in recent years, overall abundance remains relatively low when compared with levels when commercial fishing was taking place prior to 1998. The abundance of small salmon while relatively high in recent years has declined in 2009 to amongst the lowest in the time series. The large salmon index while increasing since 2003 still remains relatively low. This is a very important consideration for Labrador as large salmon are primarily multi-sea-winter salmon, have a high percentage of female salmon, and thus carry a high proportion of the overall egg requirement.

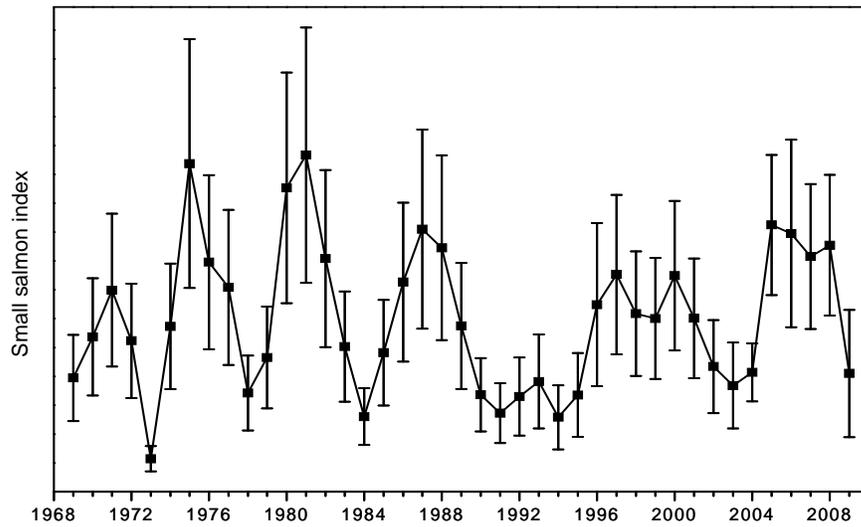


Figure 5: Trends in abundance of small Atlantic salmon in Labrador, 1969 to 2009. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

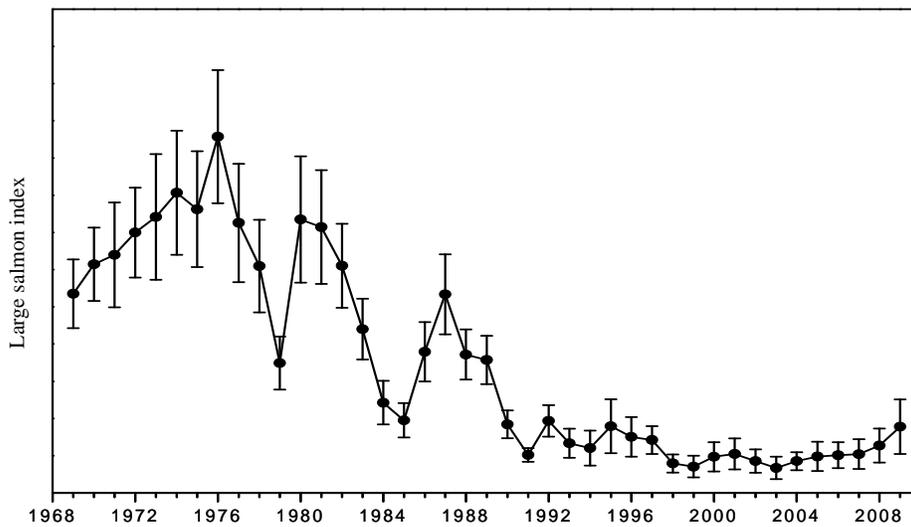


Figure 6: Trends in abundance of large Atlantic salmon in Labrador, 1969 to 2009. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

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 2009, returns of small salmon decreased

compared to 2008 and were also lower than the mean returns averaged over the previous 5-years. In 2009, returns of large salmon increased over 2008. When compared to the previous 5 year long-term mean, returns of large salmon had also increased.

English River has met or exceeded conservation requirements for the fourth consecutive year of eleven years.

In 2009, the egg deposition relative to 2008 did not change (<10%) but when compared to the previous 6 year long-term mean the egg deposition had increased.

Southern Labrador (SFA 2)

In 2009, three rivers were assessed in SFA 2: Sand Hill River, Muddy Bay Brook, and Southwest Brook (tributary of Paradise River). There was a decrease in returns of small salmon compared to 2008 returns and also when compared to long-term previous year means at all three counting fences (Table 2). There was a decrease in returns of large salmon compared to 2008 at Southwest Brook (Paradise River) and at Muddy Bay Brook and no change in returns (<10%) at Sand Hill River counting fence. When 2009 returns are compared to long-term previous year means, large salmon returns decreased at Southwest Brook (Paradise River) and at Muddy Bay Brook, and increased slightly at Sand Hill River.

All three rivers did not meet conservation requirements in 2009.

In 2009, the egg deposition relative to 2008 decreased at all three enumeration facilities. When compared to the previous 6 year long-term mean, the egg deposition had also decreased at all three facilities.

Labrador Straits (SFA 14B)

No rivers were assessed in SFA 14B in 2009.

Newfoundland (SFAs 3-14A)

Small salmon

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 modeling process. As illustrated below for Newfoundland small salmon, despite improvements in runs to many rivers in 2003, 2004, and 2008 overall abundance continues to fluctuate and has generally remained low by comparison with pre-moratorium levels (1984-1991) where adjustments to correct for marine exploitation have been made. Overall, abundance fell dramatically from 2004 to 2007, the latter being a record low; but, rebounded in 2008 to the second highest value since the moratorium began in 1992. Abundance has fallen again in 2009 to about average abundance 1992-2008; although particularly high returns occurred in Exploits and Campbellton rivers.

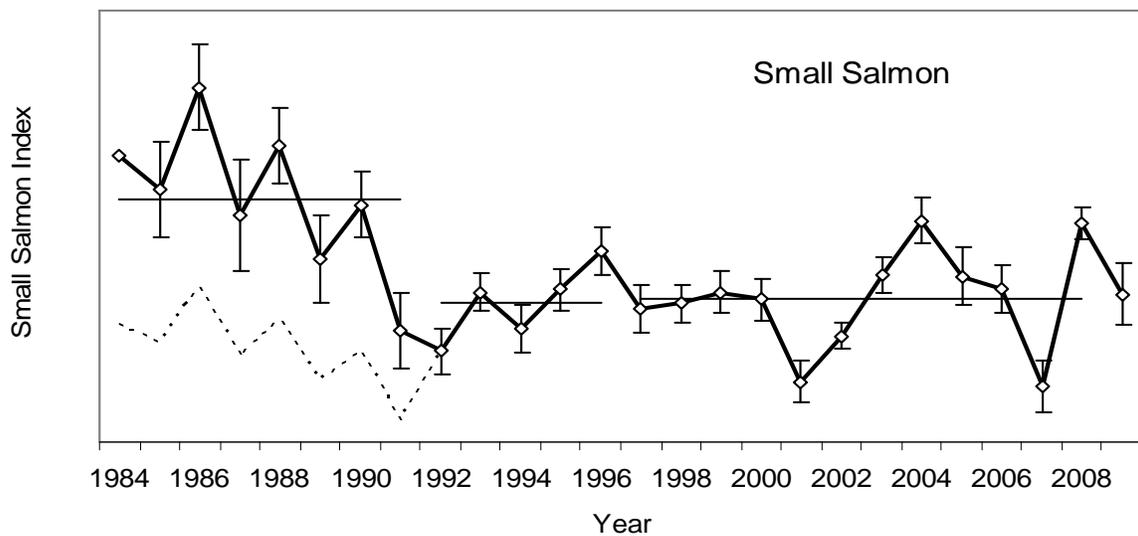


Figure 7. Trends in abundance of small Atlantic salmon in Newfoundland, 1984 to 2009. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2008. Vertical lines represent ± 1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984 – 1991.

Large salmon

A somewhat similar situation exists for large salmon. There was also a precipitous decline in abundance from the mid-1980s until the early 1990s. Following the closure of the Newfoundland commercial salmon fishery in 1992, the collective abundance of large salmon increased consistently until 1998. Abundance fell to moderately low levels in 2001 and 2002 then rose again from 2004 to 2006. However, since then the collective abundance of large salmon has been on a declining trend with 2009 being the lowest recorded since 1993. While small increase occurred in 2008, overall abundance of large salmon remains below the 1997–2008, and 1992-1996 means. Notwithstanding the combined index, high returns of large salmon occurred on Exploits River, Campbellton River and Torrent River, with the former river experiencing a record high return for the second year in a row.

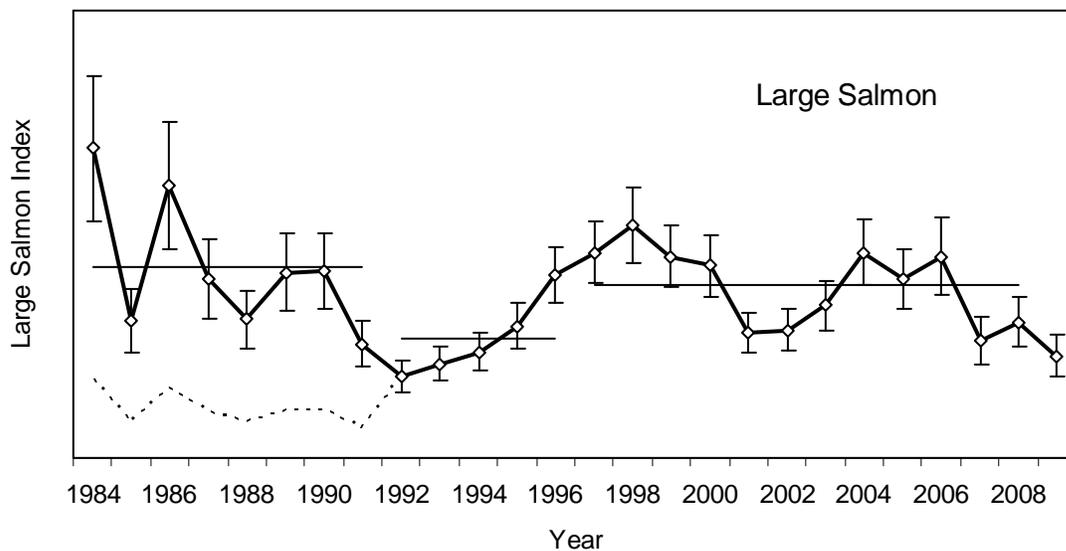


Figure 8. Trends in abundance of large Atlantic salmon in Newfoundland, 1984 to 2009. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2008. Vertical lines represent ± 1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984 – 1991.

Summary

In recent years, more extreme variability has been observed in the returns of small salmon where values have fluctuated from almost record lows to record highs. While the overall returns and spawning escapements have increased relative to the pre-moratorium period, total stock size is still only similar to or lower than levels obtained prior to the closure of the Newfoundland commercial salmon fishery.

Northeast and Eastern Newfoundland (SFAs 3-8)

Six rivers were assessed: Exploits, Campbellton, and Gander rivers 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 in 2009 was inferred from salmon returning to a fishway, on Salmon Brook tributary.

Total returns of small salmon in 2009 were unchanged over those of 2008 for Exploits and Campbellton rivers and decreased for the remaining four rivers assessed in this geographic area. Returns of large salmon decreased in four rivers in 2009, increased at the Exploits River, was unchanged at Campbellton River.

Relative to the mean egg deposition for 1992-2008, egg deposition was above the mean for Exploits and Campbellton, unchanged for Gander, Middle Brook and Terra Nova rivers and declined below the mean for Northwest River. In 2009, conservation spawning requirements were met on Gander River, Campbellton River and Middle Brook (Table 2). Campbellton River and Middle Brook have exceeded their conservation spawning requirements in each of the years they have been assessed during the moratorium (Table 2). Gander River has met or

exceeded conservation requirements in only 9 of 18 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.

In spite of greatly increased spawning escapements for most assessed rivers in this area in 1992-1996, which were the immediate benefits of the moratorium, there has been no corresponding increase in long term adult recruitment (i.e. small salmon) which should have started in 1997.

Concern is expressed for the low egg deposition level achieved in the Upper Exploits watershed in 2009. Egg deposition decreased by over 50 % from 2008 to 2009 in the upper section of the Exploits River watershed coincident with a change to the management plan for the Exploits allowing a retention angling fishery in middle section of the Exploits watershed.

South Newfoundland (SFAs 9-11)

Specific rivers assessed in 2009 (N = 4) include: Northeast Brook (Trepassey) and Rocky River in SFA 9, Conne River and Little River in SFA 11 (Fig. 2). Northeast River (Placentia) (SFA 10) has not been assessed since 2002. 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 2009 fell substantially at three monitored rivers relative to 2008. At Conne River, returns of small salmon declined by 35%, at Northeast Brook (Trepassey) returns were down by almost 50%, while Rocky River experienced a drop of 28%. In contrast, returns of small salmon increased substantially at Little River where more than 200 salmon were counted, the highest since 2004. Returns of small salmon to Conne River were the fourth lowest on record.

Regarding large salmon, only one fish was counted on Northeast Brook (Trepassey) and on Little River. At Conne and Rocky rivers, returns of large salmon declined by 53% and 39%, respectively. As noted in past years, large salmon at rivers such as Conne River, are predominately alternate spawning grilse.

Conservation spawning requirements in 2009 were not achieved at Conne River (72%) nor Rocky River (54%). At Northeast Brook (Trepassey) conservation was exceeded (114%) while requirements were essentially met at Little River (98%) for the first time since 2005. Rocky River has yet to achieve conservation while Conne River has met its requirement in 11 of the past 18 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 five of the past seven years.

Southwest Newfoundland (SFAs 12-13)

No rivers were assessed in SFA 12 in 2009.

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 snorkeling 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. Total estimate of number of spawners as well as estimates of small salmon on Harry's River decreased in 2009 compared to 2008. However, the estimates of

number of spawners (egg deposition) increased in 2009 compared to the 1992-2008 mean but decreased compared to the most recent 5 year mean number of spawners (2004-2008).

Additional rivers (Middle Barachois, Robinsons, Fischells, Flat Bay, and Crabbes) normally assessed by a snorkeling survey were not completed in 2009 due to heavy rains and high waters resulting in poor visibility and unsafe conditions.

The conservation egg deposition requirement was not met for Harry's River (72 %).

Northwest Newfoundland (SFA 14A)

Two rivers, Torrent River and Western Arm Brook, were assessed in 2009 using fish counting facilities. On Torrent River, returns of small salmon decreased in 2009 compared to 2008 while the number of large salmon showed no change. On Western Arm Brook, the number of small fish decreased compared to 2008 and the 2004-2008 mean while the number of large fish increased over 2008 but remained unchanged from the previous 5-year mean. It should be noted that for Western Arm Brook and Torrent River, large fish are mostly repeat spawners.

Egg deposition on these two rivers consistently exceeds the conservation requirement. The egg depositions were estimated to be 749% and 341% of conservation requirements for Torrent River and Western Arm Brook respectively.

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 2009 decreased in four of five monitored stocks by comparison with 2008 (Fig. 9). Decreases ranged from 23% fewer smolts at Rocky River to a 7% decrease at Conne River. Numbers of smolts at Western Arm Brook rose by 6% relative to the previous year. Long term means were exceeded at Northeast Brook (Trepassey), Western Arm Brook, and at Rocky River while numbers of smolts in 2009 were below the long term average at Conne River and Campbellton River. Where increased smolt production has occurred, returns of small salmon in 2010 could expect to be higher assuming marine survival rates are similar to those in 2009.

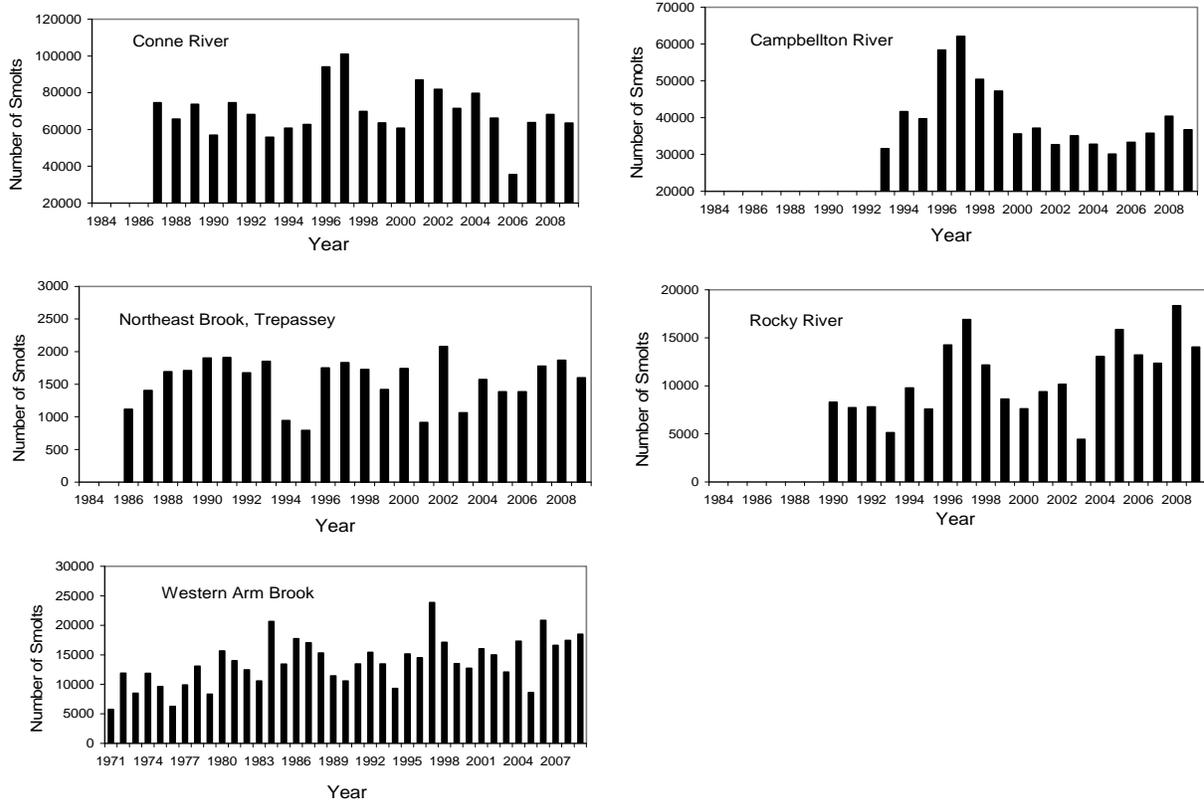


Figure 9. Trends in smolt production from various Newfoundland Atlantic salmon rivers.

Marine survival

Marine survival, corresponding to adult small salmon returns in 2009, averaged 4.7% across all five rivers, with lower survival rates experienced at all monitored rivers by comparison with 2008 (Fig. 10). Survival rates of less than 3% occurred at the three south coast monitored rivers (Conne, Rocky, and Northeast Brook Trepassey), while higher rates were again observed at the northern locations (Western Arm Brook and Campbellton River). At Campbellton River, survival while remaining relatively high compared to the long-term trend fell by about 13% relative to 2008. However, at the other four locations, survival decreased from 40% at Conne River to approximately 50% declines registered at Rocky, Western Arm Brook, and Northeast Brook, Trepassey. This continues the pattern observed in other years whereby lower survivals have been observed in southern areas.

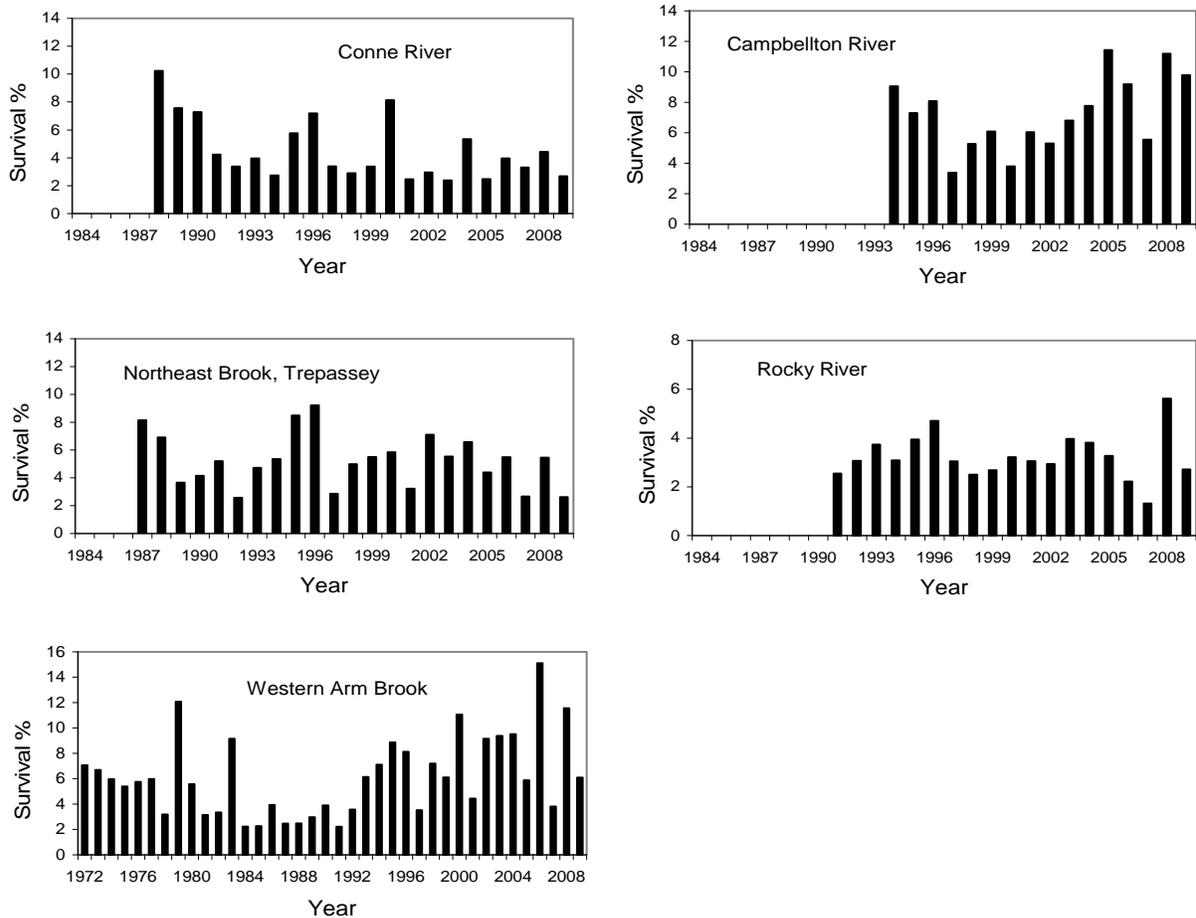


Figure 10. Marine survival rates for adult small salmon at various Newfoundland rivers. Survival rates have not been adjusted for marine exploitation in years prior to 1992 when commercial fisheries for salmon occurred. Thus, values represent survival of salmon back to the river.

A composite index of marine survival derived from all five rivers is shown below. Here, standardized mean annual rates of survival of smolts to adult small salmon are illustrated for the period 1972 to 2009, where year represents the year of adult small salmon return. As observed, the standardized index of smolt survival fell dramatically for smolts that went to sea in 2008 and returned as adults in 2009.

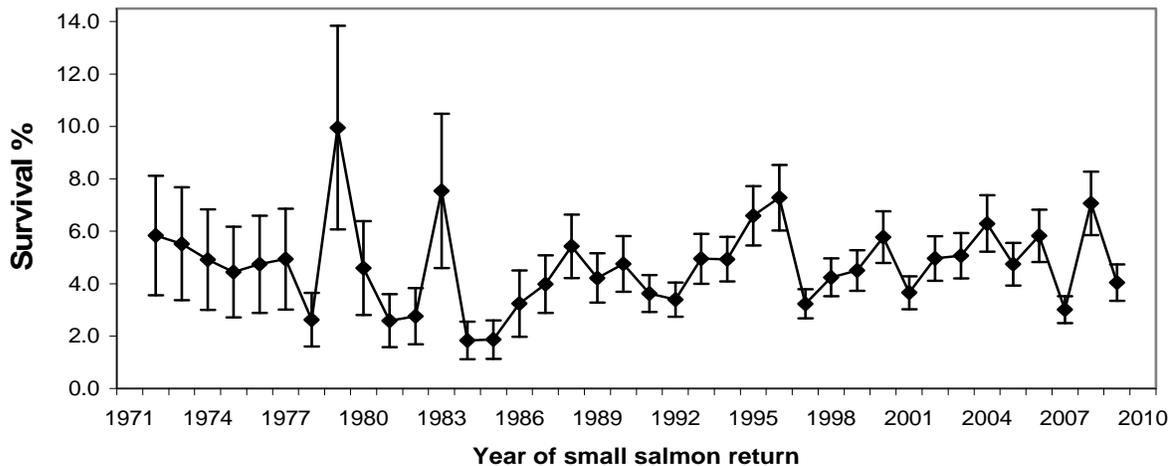


Figure 11. Standardized mean survival of smolts to adult small salmon derived from a general linear model analysis of monitored Newfoundland rivers. Year represents the year of smolt migration. Vertical lines represent one standard error about the mean.

Sources of Uncertainty

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

Large inter-annual variability in abundance makes it difficult to forecast future run sizes with any confidence.

CONCLUSIONS AND ADVICE

Overall there is still concern for the Bay St. George stocks particularly the important large salmon components, many of which are 2-sea-winter salmon. Concern for these stocks has been registered for more than two decades. The low egg depositions experienced in some rivers in 2001 and 2002 could have contributed to the decreased returns in 2007. Rivers in Bay St. George experience dramatic fluctuations in salmon abundance. 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/recovery plans and 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.

Conservation/Stock Recovery Strategies (Stewardship programs) which have associated monitoring programs provide the ability to enumerate returning adults and hence measure stock recovery. Spawning stocks have increased in these rivers coincident with the implementation of these recovery strategies including stewardship. One of these strategies includes allowing directed fishing mortality when stocks are below their conservation requirements if the

monitoring data continues to observe the stock recovery. Science only supports such directed fisheries in cases where annual in-season resource monitoring is conducted. Also this approach enables immediate management adjustments.

Concern was expressed in 2008 for Middle Barachois Brook, which only achieved 28% of its required egg deposition. The salmon stock in Middle Barachois Brook is declining and is currently at seriously low levels. In response to these concerns the Middle Barachois Salmon Working Group was formed and a conservation/recovery strategy was presented to Fisheries Aquaculture Management Branch. Unfortunately due to high water levels in 2009 there is no count of returning adults for Middle Barachois Brook with which to judge the degree of success of the conservation/recovery strategies.

Details of methodology to calculate the biological characteristics to be used in assessing Bay St. George salmon stocks should be tabled in a working paper at the next Regional Stock Assessment meeting for review. Consideration should be given to comparing the fecundity at the time of stripping versus that counts of eggs measured earlier in the season for all rivers including Exploits, Terra Nova, and Pipers Hole rivers, and Flat Bay Brook. Length and weight data are available for these rivers. It would be desirable to use egg length relationships for fecundity since there are more data available on lengths of salmon than on weights. Consideration should be given to using raw data in developing the fecundity relationships; and where logarithmic scale is used, both axes should be logged.

Management Advice

There should be a reduction in exploitation of large salmon in Labrador in 2010.

There should be no increase in fishing mortality/allocations on Newfoundland and Labrador salmon stocks in 2010 excepting areas which have in-season reviews and where conservation requirements are being achieved.

Science recommends that options be assessed and action be taken to increase egg deposition in the upper section of the Exploits watershed.

A concerted effort should be made to improve the number of spawners in all Bay St. George rivers in 2010 and in future years.

Steps should be taken in 2010 to implement means of assessing numbers of returning adults at Middle Barachois Brook.

Since returns to South Coast rivers have continued to remain at or below pre-moratorium levels compared to other rivers in the province which have done much better in recent years, Fisheries Management should consider developing recover/management plans that could be specifically applied to South Coast rivers with the view of aiding in increasing returns.

The Fisheries and Aquaculture Management Branch requested that Science Branch review the species designation of the "Mystery Fish" of the in Southwest Pond, Greenspond area. Science Branch informs Fisheries Management and Aquaculture Branch that the "Mystery" fish in Southwest Pond are anadromous Atlantic salmon. The Atlantic salmon population from the Southwest Pond area appear to have a high proportion of precocious postsmolt returning to freshwater to spawn in the same year that they migrated to sea as smolt.

Research Recommendations

Owing to the general lack of response of monitored south coast salmon rivers to the commercial salmon fishery moratorium, by comparison with other regions in Newfoundland and Labrador, it is imperative that salmon abundance monitoring be expanded to determine if other south coast stocks are similarly under producing with respect to adult salmon abundance. In addition, with the proposed expansion of salmon aquaculture operations at Fortune Bay, salmon abundance monitoring and biological sampling should be initiated in several rivers in this area.

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.

More research is required on large salmon populations, in Labrador, to determine if the four rivers that are monitored rivers are representative of populations in other rivers, in particular, rivers in Lake Melville and the Straits areas.

Studies are required to determine why populations of large salmon are not increasing to levels observed in the 1970's.

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

River specific biological characteristics data should be collected in Bay St. George. Any analysis should define biological characteristic data to be used on each watershed

Although data from recent cruises are not yet analysed it appears from general observations onboard ship that the fish captured appear to be healthy. Studies should be initiated at earlier times in the life history, such as from smolts leaving rivers to the late summer to discern life history characteristics of salmon at sea.

OTHER CONSIDERATIONS

Environmental Conditions

Marine Environment

The North Atlantic Oscillation (NAO) index for 2009 was slightly above normal indicating a weak arctic air outflow in the Northwest Atlantic. Air temperatures in eastern Newfoundland at St. John's remained well above normal during the winter and spring of 2009, reaching near +3°C above normal in February. The annual sea-ice extent on the Newfoundland and Labrador Shelf during 2009 was slightly below the long-term average for the 15th consecutive year; however there appears to be an increasing trend since 2007. In fact spring (April-June) sea-ice extent was above the long term average the first time since 1994.

Surface water temperatures at Station 27 off St. John's Newfoundland remained above normal during the winter (Jan.-Mar.) of 2009 by >0.5°C. Spring temperatures in 2009 increased over 2007 and 2008 to >0.5°C above normal. Temperature data collected during the spring multi-species assessment surveys off the south coast of Newfoundland generally showed a slight

warming compared to 2007. Observations from a mid-summer oceanographic survey indicated that the area of the cold-intermediate-layer (CIL <0°C) shelf water off eastern Newfoundland increased over 2007 but was below normal for the 15th consecutive year off Cape Bonavista. In general, sea-surface temperatures during the spring throughout the Northwest Atlantic show a decreasing trend since the record highs observed in 2006.

Preliminary analyses have shown associations between marine 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 ($r^2=0.52$) in eastern Newfoundland waters and spring (April-June) sea-ice cover ($r^2=0.42$) 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 large salmon for all insular waters of Newfoundland are also highly correlated ($r^2=0.52$) with sea surface temperatures. More research is required to quantify these relationships. However, based on historical data the marine environment in Newfoundland and Labrador waters during recent years, except for 2007, were generally favorable for Atlantic salmon.

Freshwater Environment

In past years, freshwater environmental conditions have been inferred by examining the frequency and extent that scheduled salmon rivers in were closed for environmental reasons, specifically, low water levels and water temperatures. In 2009 the environment protocols were dropped and rivers were only closed in extreme conditions existed. During the 2009 angling season 39 out of 158 (24.7%) scheduled rivers in insular Newfoundland were closed, similar to that in 2008, although the duration of the closures were less this year. The majority of the closures occurred in SFAs 9 and 10. Overall, 2.7% of all potential fishing days were affected by environmental closures.

SOURCES OF INFORMATION

DFO, 2003. Angler's Guide, 2003. Newfoundland and Labrador. Fisheries Management Branch, Newfoundland Region. St. John's, NL.

DFO, 2007. 2007-2011 Atlantic salmon integrated management plan Newfoundland and Labrador. Fisheries Management Branch, Newfoundland Region. St. John's, NL.

Reddin, D.G., Dempson, J.B., and Amiro, P.G. 2006. Conservation requirements for Atlantic salmon (*Salmo salar* L.) in Labrador rivers. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/071, 29 pp.

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 River	SFA	Method	Total Returns						Conservation met (%)				Status in 2008					
			2009		2008		1992-08		2009	2008	1992-08	1992-09	Smolts		Marine Survival		Egg Deposition	
			Small	Large	Small	Large	Small	Large					Relative to:	Relative to:	Relative to:	Relative to:	Relative to:	
LABRADOR																		
English River	1	Fe	280	105	428	51	275	34	117	109	70	4 of 11 yrs					↔	↑
Sand Hill River	2	Fe	1605	723	4842	795	3865	643	59	125	97	4 of 11 yrs					↓	↓
Muddy Bay Brook	2	Fe	115	10	474	36	376	22	46	184	142	5 of 8 yrs					↓	↓
Southwest Bk. (Paradise River)	2	Fe	67	13	495	35	375	34	26	157	126	7 of 11 yrs					↓	↓
INSULAR NEWFOUNDLAND																		
<u>Northeast Coast (SFA's 3-8)</u>																		
Exploits River	4	Fw	32252	5579	31823	4575	22418	1706	66	62	42	0 of 18 yrs					↔	↑
Campbellton River	4	Fe	3952	433	3998	432	2791	289	380	382	247	17 of 17 yrs	↔	↔	↓	↑	↔	↑
Gander River *	4	EFw	18883	869	22442	1560	17409	2201	103	128	102	9 of 18 yrs					↓	↔
Middle Brook	5	Fw	1842	85	2167	143	1632	123	197	237	180	18 of 18 yrs					↓	↔
Terra Nova River	5	Fw	2503	228	3575	430	2218	373	40	62	38	0 of 18 yrs					↓	↔
Northwest River (Port Blandford)	5	Fe	448	121	1257	229	669	168	37	92	54	0 of 15 yrs					↓	↓
<u>South Coast (SFA's 9-11)</u>																		
Northeast Brook (Trepassey)	9	Fe	49	1	97	4	76	10	114	232	195	18 of 18 yrs	↓	↔	↓	↓	↓	↓
Rocky River	9	Fe	498	34	695	56	330	77	54	76	43	0 of 18 yrs	↓	↑	↓	↓	↓	↑
Little River	11	Fe	231	1	71	3	278	35	98	31	129	7 of 18 yrs					↑	↓
Conne River	11	Fe	1828	67	2823	144	2754	152	72	117	119	11 of 18 yrs	↔	↔	↓	↓	↓	↓
<u>Southwest Coast (SFA's 12-13)</u>																		
Harry's River	13	Fe	2165	365	3526	398	1949	249	72	110	60	2 of 18 yrs					↓	↑
<u>Northwest Coast (SFA 14A)</u>																		
Torrent River	14A	Fw	2758	1406	5847	1298	4525	594	749	1203	712	18 of 18 yrs					↓	↔
Western Arm Bk	14A	Fe	1063	21	1920	15	1107	44	341	611	380	18 of 18 yrs	↔	↑	↓	↓	↓	↔

Assessment Fe = counting fence
 Methods: Fw = fishway count
 EFw = estimated from tributary fishway count
 Sn = snorkel 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.
 In some cases fewer years are included in the 1992-2007 mean for some rivers.
 * Gander River was assessed using a fish counting fence from 1989 to 1999.

FOR MORE INFORMATION

Contact: C. E. Bourgeois
P. O. Box 5667
St. John's, NL
A1C 5X1

Tel: 709-772-2128
Fax: 709-772-3578
E-Mail: Chuck.Bourgeois@DFO-MPO.GC.CA

This report is available from the:

Centre for Science Advice (CSA)
Newfoundland and Labrador Region
Fisheries and Oceans Canada
P. O. Box 5667
St. John's, NL
A1C 5X1

Telephone: 709-772-3688

Fax: 709-772-6100

E-Mail: Nadine.templeman@dfo-mpo.gc.ca

Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-5079 (Print)

ISSN 1919-5087 (Online)

© Her Majesty the Queen in Right of Canada, 2010

La version française est disponible à l'adresse ci-dessus.



CORRECT CITATION FOR THIS PUBLICATION

DFO. 2010. Stock Assessment of Newfoundland and Labrador Atlantic Salmon - 2009. DFO
Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/068.