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Newfoundland and Labrador Region
Canadian Science Advisory Secretariat
Science Advisory Report 2008/063

STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON - 2008

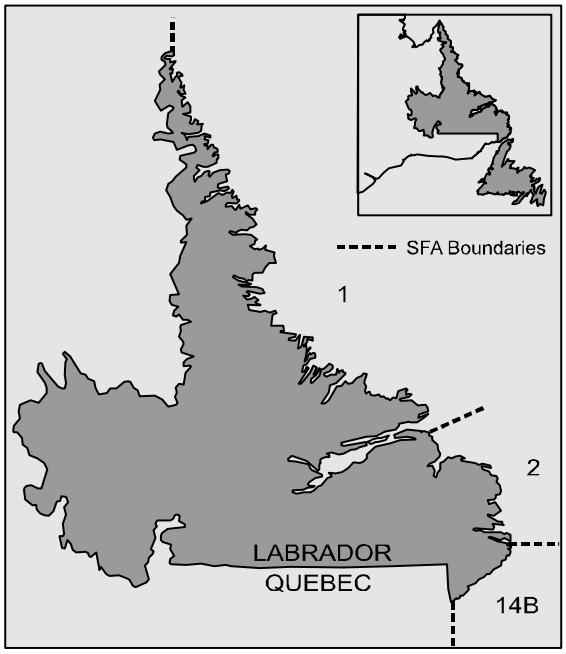

Figure 1: Labrador portion of the NL Region.

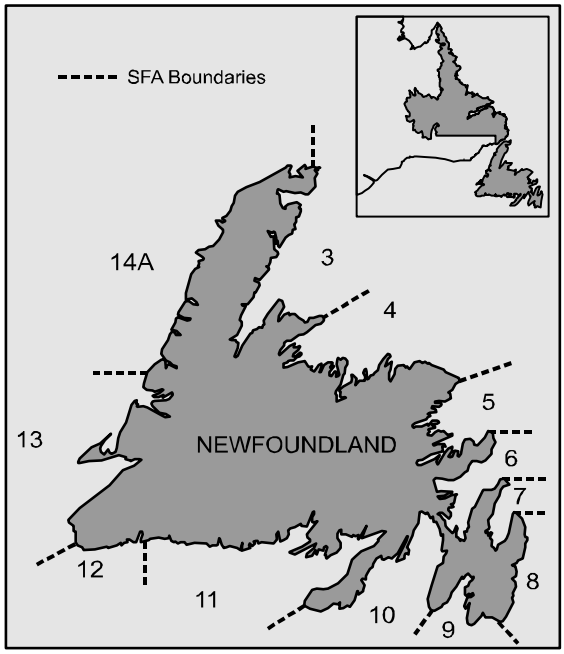

Figure 2: Newfoundland portion of the NL Region.

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

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 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 2008 in St. John's, NL to update those stocks/rivers considered during the last assessment meeting. 2008 marks the second 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 affecting overall 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 and 2008 returns (see Fig. 10).

- Within insular Newfoundland, abundance of small salmon improved in 2008 and was above post moratorium means (1992-2007). Low abundance of small salmon was noted in 2001 and 2007, and for large salmon particularly low abundance was noted in the early 1990's and 2007.

- Within Labrador, abundance of small salmon has increased since 2004 but overall abundance of large salmon has remained particularly low since the late 1980's.

Labrador (SFA 1-2 and14B)

- In Labrador, returns of small salmon increased in 2008 compared to 2007 at three out of four counting facilities while returns to the fourth declined. The 2008 index of abundance increased from the 2007 level and remains above the moratorium mean.

- Numbers of large salmon increased for four rivers. There remains concern with the low level of large salmon spawners in Labrador as evidenced from an index of abundance which have remained lower than prior to the closure of the commercial fishery.

- Conservation requirements were met on all assessed rivers.

- In 2008, there was a decline in returns (>10 %) of small salmon in the one river monitored in SFA 1 compared to 2007. However, small salmon returns increased over the previous 6 year mean. There was an increase in returns of small salmon in the three rivers monitored in SFA 2 compared to 2008 and when compared to means of previous years at all three counting fences (See Table 2).

- There was an increase in returns (>10 %) of large salmon in the one river monitored in SFA 1 compared to 2007. However, when compared to the previous 6 year mean, large salmon returns increased. There was an increase in returns of large salmon in SFA 2 compared to 2007 at the three counting fences. When compared to previous year means large salmon returns increased at two counting fences and did not change (<10 %) at another counting fence. Returns of large salmon still appear to be lower than prior to the closure of the commercial fishery (See Table 2).

- Conservation spawning requirements for Labrador rivers have been defined as 190 eggs per 100 m² of fluvial habitat, which is assumed to include pond habitat (Reddin et al. 2006).

Labrador SFA 1

- English River has met or exceeded conservation requirements for a third consecutive year of the ten years.

Labrador SFA 2

- Sand Hill River met conservation requirements in 2008 as it did in a total of four out of 13 years (1970-73, 1994-96, and 2002-08).

- Muddy Bay Brook met conservation requirements in 2008 as it did in five of seven years.

- Southwest Brook (Paradise River) has met conservation requirements for seven out of ten years including 2008.

Newfoundland (SFAs 3-14A)

- In Newfoundland there was an increase in returns of small salmon compared to 2007 and to the 1992-2006 mean. Egg depositions were for the most part above the moratorium means (1992-2007).

- Marine survival of smolts increased at all five monitored rivers compared with 2007 and accounts for some the highest overall survival recorded since the moratorium. Marine survival varies greatly on an inter-annual basis.

- Conservation requirements were met on 11 of the 18 assessed rivers.

- Abundance of salmon during the moratorium years continues to be lower than prior to the closure of the commercial fisheries.

- There is concern for the viability of the salmon stock in the upper section of the Exploits River (upstream of Red Indian Lake), however 2008 returns increased greatly over the previous 5 year mean.

- There is concern with the low level of large salmon spawners (2SW) in the Bay St. George area (SFA 13). Additional concern is expressed over the low level of egg deposition achieved in Middle Barachois Brook in 2008.

Northeast and Eastern Newfoundland (SFAs 3-8)

- In spite of greatly increased spawning in 1992-96, subsequent returns of small and large salmon, on average, are still low.
- Egg deposition improved in all assessed rivers in 2008 compared to 2007 and the 1992-2007 mean (Table 2).
- Conservation requirements were achieved in three (Gander, Campbellton and Middle Brook) of six assessed rivers (Table 2).
- Exploits River, Terra Nova River and Northwest River (Port Blandford) have yet to achieve conservation requirements (due to provision of access to new habitat) (Table 2).
- The number of spawners in the middle and upper Exploits increased greatly over the 2007 and 1992-2007 mean.

Southern Newfoundland (SFAs 9-11)

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

Southwest Newfoundland (SFAs 12-13)

- Stock sizes increased, compared to 2007, in all assessed rivers with the exception of Middle Barachois. In most rivers the 2008 population estimates exceeded the 5 year average (Table 2).
- Total population sizes remain low, particularly in two-sea-winter (2SW) maiden salmon.

Northwest Newfoundland (SFA 14A)

- Conservation requirements were exceeded in the two assessed rivers in 2008 (Torrent River and Western Arm Brook) (Table 2).
- Returns of small and large salmon and egg deposition increased in 2008 compared to 2007 and the 1992-2007 mean (Table 2).

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 at 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 and logbooks from outfitting camps (1974-93) and logbooks from outfitting camps only from 1994 onwards. For SFA 2, C & P and logbook data were used for 1974-93 and a combination of logbook and License Stub Return data was used for 1994-2008. For SFA 14B, C & P and logbook data were used for 1974-93 and License Stub Return data for 1994-2008. However, the recreational data in SFAs 1, 2 and 14B for 2007 has been updated. The total angling catch (retained and released) for Labrador in 2007 was 7936 (Fig. 3). The total angling effort was 7643 rod-days, a decrease over 2005 and increase over 2006 values of 8499 and 6713, respectively. The catch of small salmon was 6756 (1720 retained and 5036 released) and large salmon was 1180 (233 retained and 947 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 5983 small and large salmon estimated to be hooked and released in 2007 (Fig. 3). In SFA 1, the total catch in 2007 (small and large salmon combined) of 1737 remained similar to that of 2006. In SFA 2, the total catch (small and large salmon combined) in 2007 of 4120 decreased by 15 % compared to 2006. Also, in SFA 14B, the total catch (small and large salmon combined) in 2007 of 2079 decreased by 9 % compared to 2006. Data for 2008 are currently unavailable.

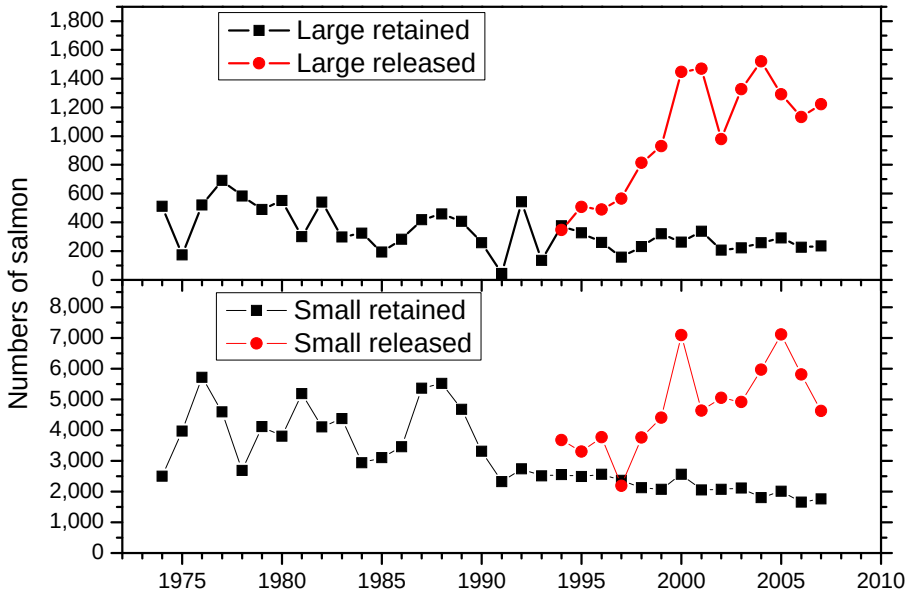

Figure 3: Angling catch statistics for Labrador SFAs 1, 2 and 14B.

Newfoundland

The recreational salmon fishery in SFAs 2-14B is managed according to the River Classification System. Five-year integrated Atlantic salmon fisheries Management Plans were introduced for Newfoundland and Labrador in 2002 and 2007 (DFO 2002, 2007). In 2003 some rivers were reclassified as outlined in Angler's Guide for 2003 (DFO 2003).

Angling catch statistics from License Stub Returns in 2008 are not yet available. Preliminary estimates of catches are based on the 2003-07 means.

Aboriginal/Subsistence Fisheries

Aboriginal subsistence fisheries for salmon, Arctic charr and brook trout occurred in Labrador under communal license similar to 2007. An All Resident Subsistence Fishery for trout and charr permitted retention of up to four salmon as a by-catch in 2008 similar to 2007.

There has been no commercial salmon fishing in insular Newfoundland since 1991, 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 2002-07 of less then 30 t including estimates for unreported catches. In 2008, 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 26 t (11,860 salmon) were harvested in 2007, of which, large salmon represented 35 % of the catch by weight and 22 % by number. Subsistence food fishery landings in 2007 declined by 19 % from the 32 t landed in 2006 (Table 1). Landings for 2008 are currently unavailable.

Table 1. Subsistence salmon fisheries landings in Labrador as of November, 2007.

	Small salmon		Large salmon		Total	
Year	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

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 26 t of salmon were harvested in subsistence fisheries in 2007.

ASSESSMENT

Conservation Requirements for Labrador Rivers

Conservation requirements for Atlantic salmon in Labrador were discussed in detail by Reddin et al. 2006. In 2007, the interim conservation limit of 190 eggs per 100 m^2 was used in Labrador (SFAs 1 and 2).

Resource Status–Adult salmon

Labrador (SFA's 1, 2, and 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. 4) and large (Fig. 5) 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 has declined in each of the last two years. The large salmon index 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.

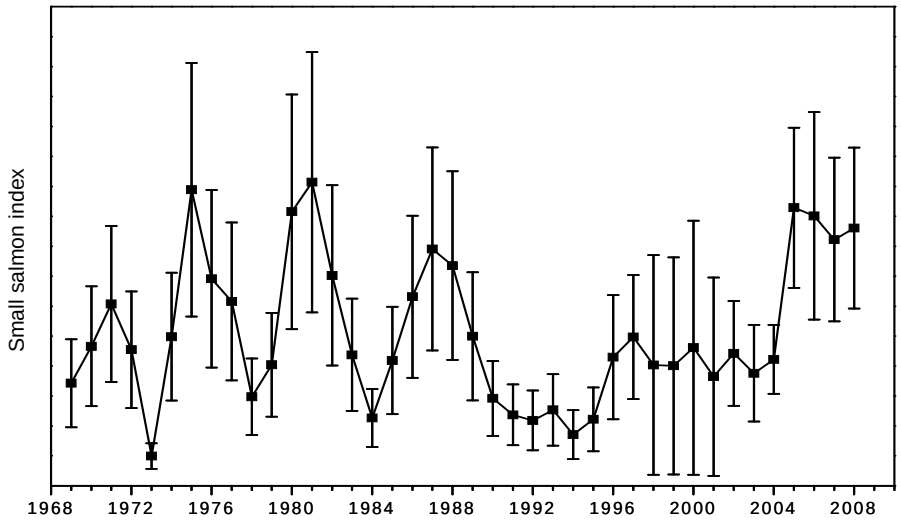

Figure 4: Trends in abundance of small Atlantic salmon in Labrador, 1969-2008. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

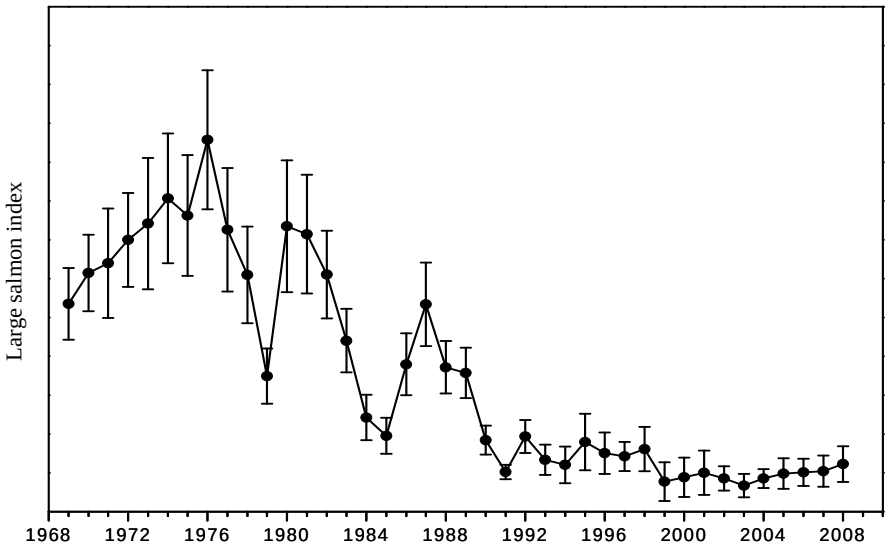

Figure 5: Trends in abundance of large Atlantic salmon in Labrador, 1969-2008. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

Northern Labrador and Lake Melville (SFA 1)

One river was assessed in SFA 1. Salmon and charr stocks were enumerated and salmon stocks assessed from returns to the fish counting facility at English River near Postville. In 2008, small salmon returns decreased compared to 2007. However, small salmon returns increased considerably over the previous 6 year long-term mean. In 2008, large salmon returns increased over 2007. When compared to the previous 6 year mean long-term mean, large salmon returns had also increased.

English River has met or exceeded conservation requirements for the third consecutive year of the ten years that the program has been in place.

In 2008, the egg deposition relative to 2007 did not change (<10 %) but when compared to the previous 6 year long-term mean the egg deposition had increased.

Southern Labrador (SFA 2)

Three rivers were assessed in SFA 2: Sand Hill River, Muddy Bay Brook, and Southwest Brook (tributary of Paradise River). There was an increase in returns of small salmon compared to 2007 returns and also when compared to long-term year means at all three counting fences. There was an increase in returns of large salmon compared to 2007 at Sand Hill River and at Muddy Bay Brook and no change in returns (<10 %) at the Southwest Brook (Paradise River) counting fence. When 2008 returns are compared to long-term year means, large salmon returns increased at Sand Hill River and at Muddy Bay Brook, and did not change (<10 %) at Southwest Brook (Paradise River).

Southwest Brook (Paradise River) has met conservation requirements in 2008 and for seven out of ten years. Muddy Bay Brook has met conservation requirements for 2008 and in five years

out of a total of seven years. Sand Hill River has met conservation requirements in 2008 as it did in four years out of a total of 14 years (1970-73, 1994-96, and 2002-08).

In 2008, the egg deposition relative to 2007 increased at Sand Hill River and Muddy Bay Brook and did not change (<10 %) at Southwest Brook (Paradise River). When compared to the previous 6 year long-term mean the egg deposition had increased at Sand Hill River, Muddy Bay Brook and Southwest Brook (Paradise River).

Labrador Straits (SFA 14B)

No rivers were assessed in SFA 14B in 2008.

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 modeling process. As illustrated below for Newfoundland small salmon (Fig. 6), despite improvements in runs to many rivers in 2003 and 2004, overall abundance has remained relatively low by comparison with pre-moratorium levels (1984-91) 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 to the second highest value since the moratorium began in 1992. Individually, three rivers (Conne River, Northeast Brook Trepassey, Little River) experienced record low returns of small salmon in 2007. This has been followed by record high returns at six rivers in 2008 (Exploits River, Terra Nova River, Northwest River (Port Blandford), Rocky River, Harry's River and Western Arm Brook) with all monitored rivers experiencing substantive increases in returns in 2008 relative to the previous year.

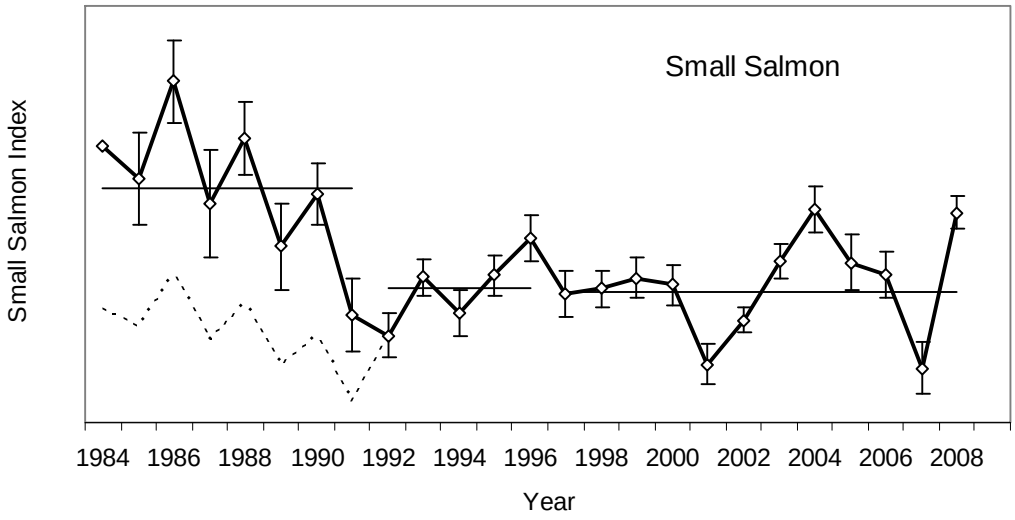

Figure 6: Trends in abundance of small Atlantic salmon in Newfoundland, 1984-2008. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-91, 1992-96, and 1997-2007. Vertical lines represent ±1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984 – 1991.

A somewhat similar situation exists for large salmon. There was also a precipitous decline in abundance from the mid-1980s until the early 1990s (Fig 7). 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, in 2007 large salmon abundance fell to levels not observed since the early 1990s and was below the 1997-2006 average. A small increase occurred in 2008, but overall, abundance of large salmon remains below the 1997-2007 mean. While returns of large salmon to Exploits River were at an all time high, record lows occurred at Little River, Middle Barachois, and Robinsons River.

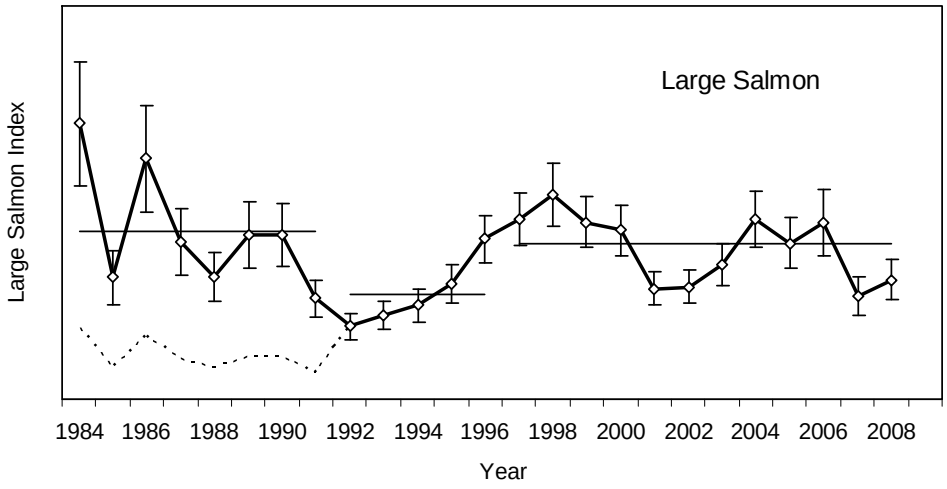

Figure 7: Trends in abundance of large Atlantic salmon in Newfoundland, 1984-2008. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-91, 1992-96, and 1997-2007. Vertical lines represent ±1 standard error. The fine dashed line represents returns unadjusted for exploitation for the period 1984–91.

In 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 2008 was inferred from salmon returning to a fishway, on Salmon Brook tributary.

Total returns of small salmon in 2008 increased over those of 2007 for all rivers and compared to the means for 1992-2007. Returns of large salmon in 2008 declined on 4 rivers relative to 2007 (Gander, Terra Nova, Middle brook and Northwest (Port Blandford) rivers) while the remainder showed increases.

Egg deposition increased on all rivers over 2007 and relative to the 1992-2007 mean. 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 8 of 17 years. Terra Nova River, Exploits River and Northwest River (Port Blandford) have yet to achieve conservation spawning requirements as a 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.

South Newfoundland (SFAs 9-11)

Specific rivers assessed in 2008 (N = 4) include: 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 2008, while still low, more than doubled at Conne River by comparison with 2007 and were the highest recorded since 2004. This increase follows a record low return in 2007. A similar situation occurred at Northeast Brook (Trepassey) where a record low return in 2007 was followed by the highest return since 2003. At Rocky River, the highest returns ever of adult small salmon occurred in 2008 while at Little River, returns were higher than those of 2007, but were still well below the long term average. In general, for the past 13 years (1996–2008) returns to Conne River and Little River have been following a similar trend ($r^2 = 0.62$; $P = 0.001$).

Regarding large salmon, abundance increased at all monitored locations except Little River where returns declined to only three large fish. However, large salmon returns were below the low term moratorium average (1992–2007) at all locations. As noted in past years, large salmon at rivers, such as Conne River, are predominately alternate spawning grilse.

Conservation spawning requirements, in 2008, were not achieved at Little River (31 %) or Rocky River (76 %). However, Rocky River, a watershed where Atlantic salmon was first introduced in 1983, experienced the highest egg deposition recorded. On the other hand, conservation requirements were again attained at Conne River (117 %) and Northeast Brook, Trepassey (232 %). Rocky River has yet to achieve its egg deposition conservation requirements; while, Conne River has met its requirement in 11 of the past 17 years since the commercial salmon fishery moratorium began. As noted, Little River has been subject to enhancement activities; but, conservation requirements have been met in four of the past seven years.

Southwest Newfoundland (SFAs 12-13)

No rivers were assessed in SFA 12 in 2008.

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. A snorkeling survey was also carried out on Harry's River below the counting fence 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 and large salmon on Harry's River increased in 2008 compared to 2007. The estimates of number of spawners also increased compared to the mean number of spawners during the commercial salmon fishing moratorium (1992-2007) (Table 2).

Four rivers (Middle Barachois, Robinsons, Fischells and Flat Bay) were assessed by a snorkeling survey. Compared to the last snorkeling survey conducted on these rivers in 2005, stock sizes on Robinsons and Fischells increased; whereas, populations decreased on Flat Bay and Middle Barachois. However, despite a decline in adult salmon population on Flat Bay Brook, the 2008 stock size was the second highest assessed on this river since the snorkel surveys began in 1996. Crabbes River which is normally assessed by a snorkeling survey could not be completed in 2008 due to heavy rains that caused the cancellation of the snorkeling survey on Crabbes River.

The conservation egg deposition requirements were met for Harry's River (104 %), Robinsons (110 %), and Flat Bay (127 %). Fischells (99 %) and Middle Barachois (28 %) did not meet their conservation egg deposition requirements.

Northwest Newfoundland (SFA 14A)

Two rivers, Torrent River and Western Arm Brook, were assessed in 2008 using fish counting facilities. On Torrent River, returns of small salmon increased to the highest level on record since 1996. Large and small returns increased relative to the moratorium mean (1992-2007) (Table 2). On Western Arm Brook, the number of small fish increased compared to 2007 and the 1992-2007 mean (Table 2). 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 1197 % and 611 % of conservation requirements for Torrent River and Western Arm Brook respectively.

Smolt Production and Marine Survival

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) (Fig. 8, Table 2). 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 over 35 years at Western Arm Brook to 16 years at Campbellton River.

Smolt Production

Smolt production in 2008 increased in all five monitored stocks by comparison with 2007 (Fig. 8). Increases ranged from 48 % more smolts at Rocky River, where a record high number of smolts occurred, to 5 % increases reported at Northeast Brook, Trepassey, and Western Arm Brook. Campbellton River experienced its largest smolt run since 1999. Smolt runs in 2008 were above the long term average for each river. Spawning escapements in 2003 and 2004 were not exceptionally high at either Rocky or Campbellton rivers and thus could not account for the noted increases in smolt production. It is likely that overall freshwater survival improved. Where increased smolt production has occurred, returns of small salmon in 2009 could expect to be higher assuming marine survival rates are similar to those reported in 2008.

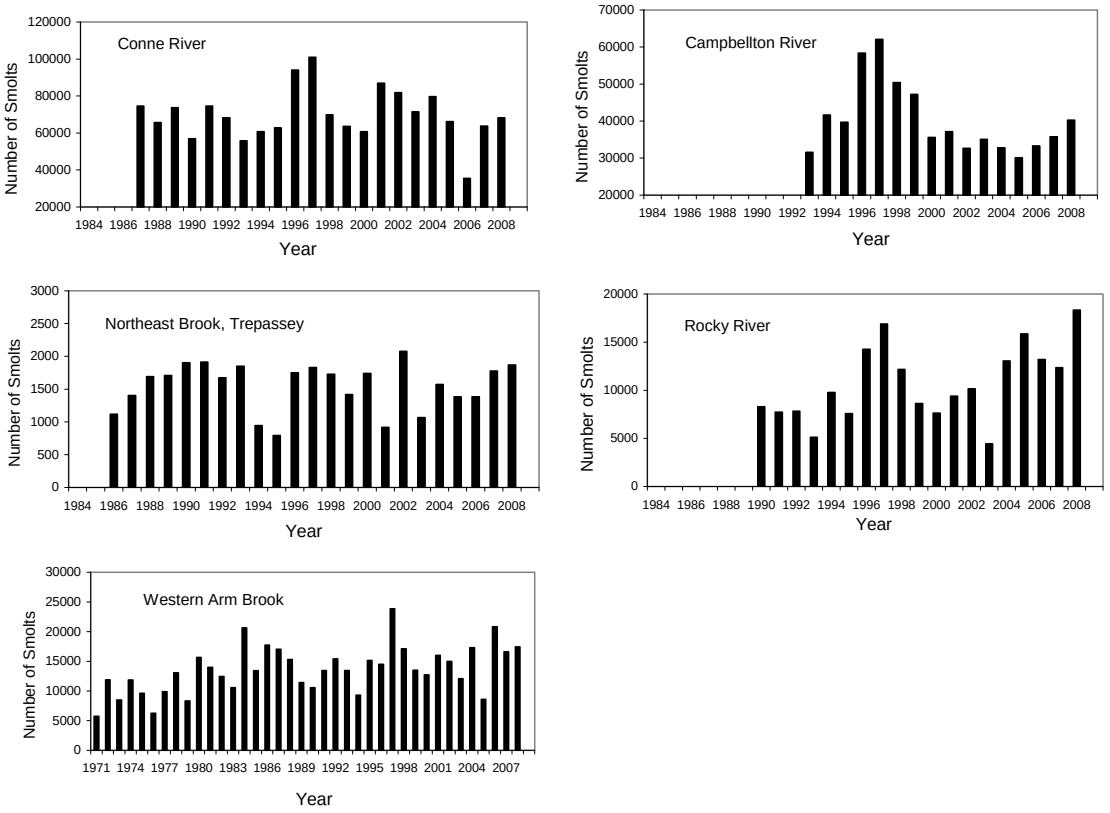

Figure 8: Trends in smolt production from various Newfoundland Atlantic salmon rivers.

Marine survival

Marine survival, corresponding to adult small salmon returns in 2008, averaged 7.7 % across all five rivers (Fig. 10), with higher survival rates experienced at all monitored rivers (Fig. 9). The highest survivals occurred at Western Arm Brook and Campbellton River where survival exceeded 11 %. The record high returns of small salmon to Rocky River coincided with the highest recorded survival on record at this location. The lowest survival was recorded at Conne River (Fig. 9), although, survival at Conne, Rocky and Northeast Brook, Trepassey, were about half that of Western Arm Brook and Campbellton. This continues the pattern observed in other years whereby lower survivals have been observed in southern areas.

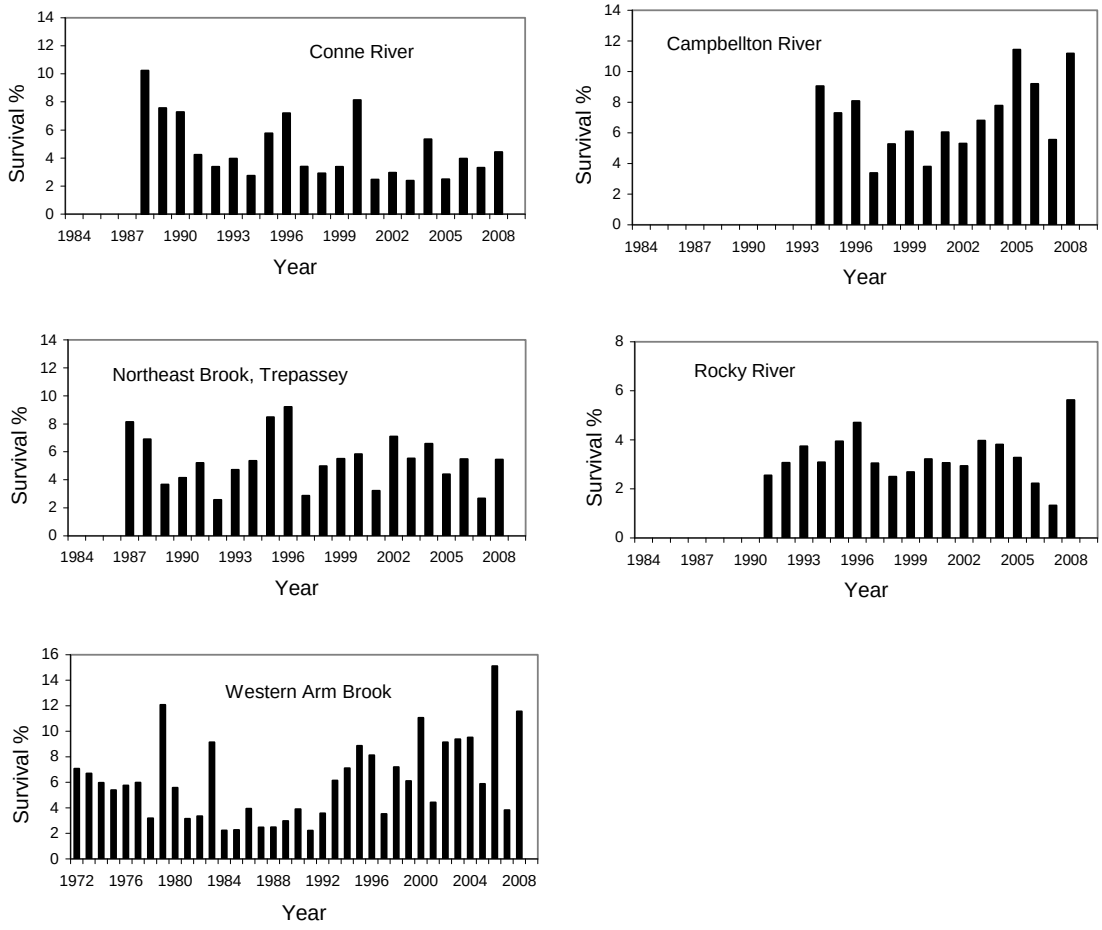

Figure 9: Marine survival rates for adult small salmon at various Newfoundland rivers. Survival rates have not been adjusted for marine exploitation in years prior to 1992 when commercial fisheries for salmon occurred. Thus, values represent survival of salmon back to the river.

A composite index of marine survival derived from all five rivers is shown below (Fig. 10). Here, standardized mean annual rates of survival of smolts to adult small salmon are illustrated for the period 1972-2008, 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 2006 such that it is the lowest value since the early 1980s. This rebounded with adult returns in 2008 to the highest survival since 1996.

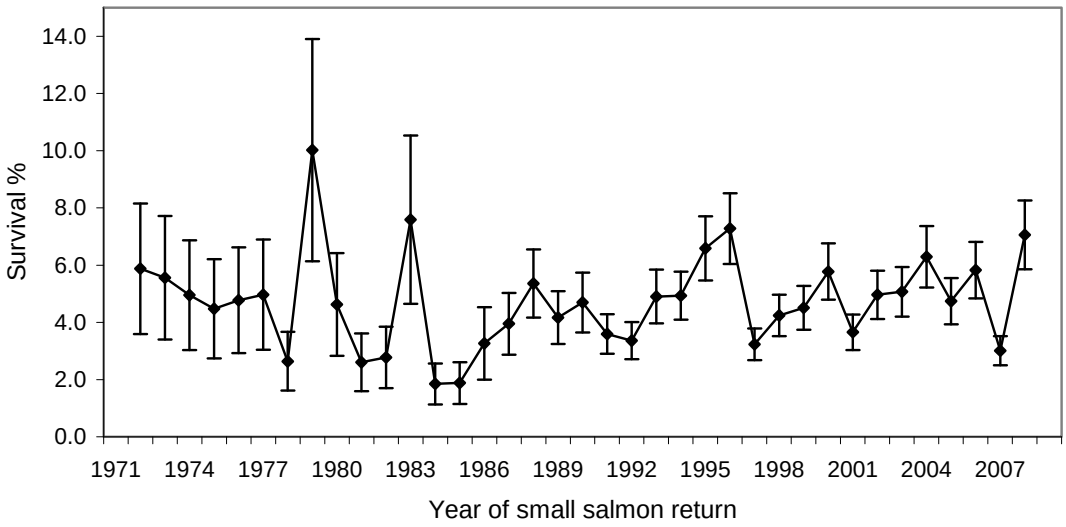

Figure 10: Standardized mean survival of smolts to adult small salmon (returns to river) derived from a general linear model analysis of monitored Newfoundland rivers. Vertical lines represent one standard error about the mean. Data have not been adjusted for marine exploitation.

Sources of Uncertainty

Unrecorded removals need to be quantified as there is some evidence that these removals could be higher than the recorded fishing mortality on some stocks. High unrecorded mortality is of particular concern at present stock levels.

Gander River met egg deposition conservation requirements for the third time in five years (2004, 2005, and 2008); although, it has only achieved its requirements in 8 of 17 years. There is some uncertainty around estimates of returns from year 2000 onwards following the termination of the fish counting fence project on Gander River (O'Connell 2003). Observations by some anglers suggest returns, in some years, were better than estimates extrapolated from counts of salmon at the Salmon Brook fishway.

Other sources of uncertainty include current rates of egg production (fecundity) versus historical information from individual stocks, annual changes in sex ratios and variation in biological characteristics that could, collectively, impact on the reproductive potential of stocks.

CONCLUSIONS AND ADVICE

Management Advice

Provision of advice on the status of salmon stocks is constrained by our inability to understand the causes of the low survival of salmon at sea and the inter-annual variation in marine survival.

Marine survival of Atlantic salmon stocks remains low throughout Newfoundland and Labrador even with the reductions in directed marine fisheries since 1992.

Illegal removals near-shore and in-rivers appear high in some areas. These removals should be minimized.

In **Labrador** (SFAs 1-2 and 14B) concern is expressed for the apparent low abundance of larger salmon (maiden 2SW salmon). Declines in large salmon in Labrador are similar to those experienced in other areas of Eastern Canada and Europe.

Increased access provided by the Trans-Labrador Highway has the potential to increase angling exploitation rates on fishery resources. Careful monitoring of stock status and the compilation of accurate catch statistics are essential to ensure the long-term sustainability of the resource. In the absence of resource monitoring coupled with harvest adjustments, sustainability could be jeopardized. All sources of mortality should be examined as well as potential habitat effects.

There is no information available to ascertain whether or not the returns to English River are indicative of returns to other rivers in SFA 1. The returns of large salmon to English River have been consistently low over the period of time the fence has been operated. Furthermore, recent scale analysis has indicated that large salmon at English River consist of a high proportion of grilse repeat spawners. It is unknown if the few large salmon and in particular those that are MSW salmon are indicative of MSW returns to other rivers in SFA 1. However, returns to Big Brook also in SFA 1 when last measured in 2000 were low. Caution is advised when setting the level of fishing mortality in SFA 1.

In SFA 2, returns of small and large salmon increased on all three rivers monitored. Estimates of egg deposition have also increased on two out of the three monitored rivers facilities and are above the 2002-07 means. In spite of the good returns in 2008, concern remains for the numbers of large salmon in SFA 2 rivers and caution should be used in setting harvest levels for 2009 and the future.

There are no salmon counting facilities in Lake Melville and SFA 14B with which to determine stock status. Mortality levels from the food fishery in Lake Melville including Resident, and Food Social and Ceremonials (FSCs) is considered to be high given the level of recorded landings, managers should exercise caution when setting harvest levels for 2009.

In **Northeast and Eastern Newfoundland** (SFAs 3-8), the improvement in the status of salmon in Northwest River (Port Blandford) in 2003-08 appears to be attributed in part to conservation/recovery plan established for the resource since 2002.

The Exploits River watershed is managed in three sections – lower, middle and upper, which have all undergone enhancement activities ranging from fishway construction to adult and fry stockings. The lower section of the Exploits River (downstream of Grand falls fishway) has achieved conservation requirements in nine of the last 13 years. The middle Exploits (Grand Falls fishway to Red Indian Lake fishway) continues to improve with spawning escapements averaging over 10,800 fish from 1993-2007 and the 2008 count exceeding 21,000 fish. The upper Exploits (area above Red Indian Lake fishway) continues to be an area of concern with respect to spawners and consideration should be given to reducing mortality to ensure that the stock in the upper section of the Exploits River is not compromised.

In **Southern Newfoundland** (SFAs 9-11), some rivers (e.g. Northeast Brook (Trepassey) and Conne River) had average returns of small salmon in 1992-2003 and 2007 that were lower than returns prior to the commercial salmon moratorium. In general, stocks continue to under perform and three of four stocks attained record low levels of returns in 2007.

Specific management measures are in effect for Conne River including the requirement for an in season review.

Southwest Newfoundland (SFAs 12-13): No information is available on the salmon stocks in SFA 12. In SFA 13, the large inter-annual variability in Harry's River run sizes makes it impossible to predict future run sizes. For example 2007 produced one of the lowest spawning escapements on record: whereas, 2008 produced one of the highest. One of the better indicators of expected returns is the run timing. The 2008 run supported this hypothesis with the run timing following close to that of 2006, which was also a good year. A late start to the 2009 run should be a cause for concern and the Department should be ready to act if indications suggest that returns will be low again in 2009.

The snorkelling survey which could not be conducted in 2006 and 2007 due to poor weather and water conditions was resumed in 2008. Numbers of salmon similar to 2004 and 2005, were counted on all rivers surveyed except Middle Barachois. However, the variability in the snorkelling survey data is large and no significant trends in abundance can be detected.

Although there have been some improvement in most of the Bay St. George stocks (2007 being the exception), the sizes of the stocks are still low, 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 appear to have been successful on Bay St. George Rivers, again with 2007 being the exception. DFO should continue to support the stewardship initiatives and implement management options that will maximise the spawning population.

A concerted effort should be made to improve the number of spawners in all Bay St. George Rivers in 2009.

Conservation/Stock Recovery Strategies (Stewardship programs) appear to have contributed to increased spawning stocks in targeted rivers. These strategies included allowing directed fishing mortality when stocks are below their conservation requirements. Science only supports such directed fisheries in cases where annual in-season resource monitoring is conducted to determine whether or not the fishery is having a negative impact on the spawning stock. Also this approach enables immediate management adjustments.

Concern is expressed for Middle Barachois Brook, which only achieved 28 % of its required egg deposition in 2008. The salmon stock in Middle Barachois Brook appears to be declining and is currently at seriously low levels. Additional effort should be undertaken to improve the abundance of spawners. It is recommended that Science Branch and Fisheries and Aquaculture Management Branch conduct investigations to identify the possible causes with a goal to increase the egg deposition.

Northwest Newfoundland (SFA 14A): Western Arm Brook and Torrent River consistently exceed spawning requirements, suggesting both stocks are quite healthy. The total returns of adult salmon to Western Arm Brook for 2008 were 1,935.

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. Thus, efforts should be made to resume salmon counting operations at Northeast River, Placentia, and Biscay Bay River where historic information exists.

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.

Finally, there are no data from which to determine the conservation status of salmon in rivers along the entire south coast in the area west of Conne River.

Priority research is required to address the lack of understanding of factors contributing to low survival of salmon at sea. There is some indication that in some years higher mortality may occur near-shore. There is also a lack of understanding of factors responsible for variation in freshwater (egg-to-smolt) survival which can be similar to or even higher than the variation observed in marine survival.

In spite of recommendations on interim reference egg deposition levels for Labrador salmon rivers, it is still crucial that stock and recruit data along with smolt production be collected on at least one Labrador river. This information could be used to confirm the recommended level of 1.9 eggs per m^2 and adjust egg requirements accordingly.

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

Research needs to be conducted on the genetic component of large salmon and repeat spawners. This research is required to determine if management objectives are achievable.
The contribution of egg deposition by repeat spawners should be evaluated.

OTHER CONSIDERATIONS

Environmental Conditions

Freshwater Environment

In past years, freshwater environmental conditions have been inferred by examining the frequency and extent that scheduled salmon rivers were closed for environmental reasons, specifically, low water levels and water temperatures. During the 2008 angling season 42 out of 158 (26.6 %) scheduled rivers in insular Newfoundland were closed, up from only 2 rivers that were affected in 2007. Overall, 4.3 % of all potential fishing days were affected by environmental closures. The majority of rivers that were closed were in SFAs 3 and 4, where

20.7 % and 9.4 % of the potential fishing days, respectively, were affected by environmental closures.

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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						Conservation met (%)				Status in 2008					
			2008		2007		1992-07						Smolts		Marine Survival		Egg Deposition	
													Relative to:		Relative to:		Relative to:	
River	SFA	Method	Small	Large	Small	Large	Small	Large	2008	2007	1992-07	1992-08	2007	1992-07	2007	1992-07	2007	1992-07
LABRADOR																		
English River	1	Fe	428	51	498	42	258	33	109	115	66	3 of 10 yrs					⇔	⇧
Sand Hill River	2	Fe	4842	795	3222	693	3757	626	125	89	94	4 of 10 yrs	🡻				⇧	⇧
Muddy Bay Brook	2	Fe	474	36	240	14	360	20	184	90	135	5 of 7 yrs					⇧	⇧
Southwest Bk. (Paradise River)	2	Fe	495	35	303	32	362	34	157	102	122	7 of 10 yrs					⇧	⇧
INSULAR NEWFOUNDLAND																		
Northeast Coast (SFA's 3-8)																		
Exploits River	4	Fw	31722	4554	21676	3956	21827	1527	63	44	40	0 of 17 yrs					⇧	⇧
Campbellton River	4	Fe	3997	434	1849	487	2711	279	383	212	238	16 of 16 yrs	⇧	⇔	⇧	⇧	⇧	⇧
Gander River *	4	EFw	22442	1560	11571	1243	17094	2242	129	71	100	8 of 17 yrs					⇧	⇧
Middle Brook	5	Fw	2103	143	1079	142	1600	121	240	125	176	17 of 17 yrs					⇧	⇧
Terra Nova River	5	Fw	3588	431	1672	241	2133	369	61	29	37	0 of 17 yrs					⇧	⇧
Northwest River (Port Blandford)	5	Fe	1257	229	675	94	624	163	92	50	51	0 of 14 yrs					⇧	⇧
South Coast (SFA's 9-11)																		
Northeast Brook (Trepassey)	9	Fe	97	4	37	3	74	10	232	92	191	16 of 17 yrs	⇔	⇧	⇧	⇔	⇧	⇧
Rocky River	9	Fe	695	56	174	35	308	78	76	22	41	0 of 17 yrs	⇧	⇧	⇧	⇧	⇧	⇧
Little River	11	Fe	71	3	39	8	291	37	31	20	135	7 of 17 yrs					⇧	🡻
Conne River	11	Fe	2823	144	1174	49	2749	153	117	55	119	11 of 17 yrs	⇔	⇔	⇧	⇔	⇧	⇔
Southwest Coast (SFA's 12-13)																		
M. Barachois Brook	13	Sn	451	20	-	-	834	118	28	-	66	0 of 13 yrs						🡻
Robinsons River	13	Sn	1790	103	-	-	1370	196	110	-	91	5 of 13 yrs						⇧
Fischells River	13	Sn	1664	94	-	-	945	145	99	-	63	3 of 13 yrs						⇧
Flat Bay Brook	13	Sn	2302	134	-	-	1791	233	127	-	88	5 of 14 yrs						⇧
Harry's River	13	Fe	3383	388	1414	287	1852	240	104	55	57	2 of 17 yrs					⇧	⇧
Northwest Coast (SFA 14A)																		
Torrent River	14A	Fw	5816	1283	3036	521	4446	551	1197	458	682	17 of 17 yrs					⇧	⇧
Western Arm Bk	14A	Fe	1920	15	793	17	1056	46	611	258	365	17 of 17 yrs	⇔	⇧	⇧	⇧	⇧	⇧

Assessment Methods:
Fe = counting fence
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.

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