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Newfoundland and Labrador Region
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STOCK ASSESSMENT OF NEWFOUNDLAND AND LABRADOR ATLANTIC SALMON

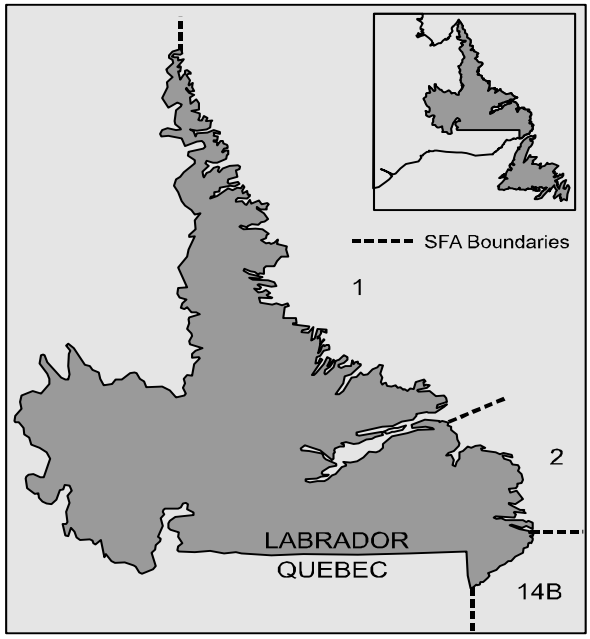

Figure 1: Labrador portion of the NL Region

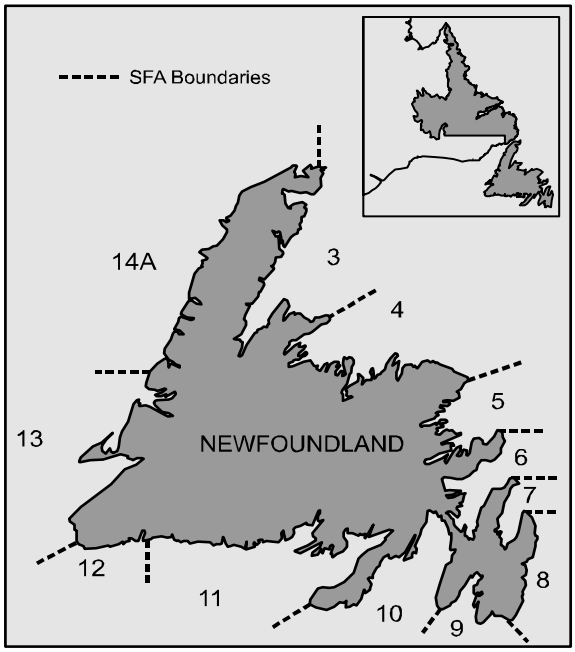

Figure 2.Newfoundland portion of the NL Region.

Context

There are 15 Atlantic salmon (Salmo salar) management areas, known as Salmon Fishing Areas (SFAs) 1-14B, in Newfoundland and Labrador (Figs. 1 and Fig. 2). Within these areas there are more than 200 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, & 14B), and western Newfoundland (SFAs 13 & 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. 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. Conservation requirements are

established for individual rivers in insular Newfoundland and Straits Area of Labrador (SFAs 3-14B) based on 2.4 eggs per m^2 of river rearing habitat and 368 or 105 eggs per hectare of lake habitat, depending on the river system. 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. There should be no human induced mortality on stocks that are below 100% of conservation. Conservation requirements have not been established for rivers in SFA 1 & 2. Egg deposition reference levels are currently being considered. In SFA 1 & 2, stocks are assessed by evaluating trends in abundance on monitored rivers and catch statistics.

SUMMARY

Labrador (SFA 1-2 & 14B)

- In Labrador, returns of small salmon increased substantially in 2005.
- While better overall in 2005, returns of large salmon still appear to be lower than prior to the closure of the commercial fishery.

Labrador SFA 1

- There is concern regarding the viability of the salmon stock in English River.

Newfoundland (SFAs 3-14A)

- In Newfoundland, with the exception of most monitored rivers in Notre Dame and Bonavista Bays, there was a general decline in returns of small and large salmon compared to 2004 and the moratorium means.
- Abundance of salmon during the moratorium years continues to be lower than prior to the closure of the commercial fisheries.
- There is concern with the low level of large salmon spawners in the Bay St. George area (SFA13).

Northeast and Eastern Newfoundland (SFAs 3-8)

- In spite of greatly increased spawning in 1992-1996, subsequent returns of small and large salmon are still low.
- Conservation requirements were achieved in three (Campbellton, Gander and Middle Brook) of six assessed rivers.
- Exploits River, Terra Nova River and Northwest River (Port Blandford) have yet to achieve conservation requirements due mainly to habitat expansion.
- Campbellton River and Middle Brook have met or exceeded conservation requirements in each year of assessment during the commercial salmon fishery moratorium.
- Gander River has met or exceeded conservation requirements in only seven of the last 14 years.

- The lower Exploits River has achieved conservation requirements ten out of 14 years. The number of spawners in the middle Exploits has increased since the moratorium whilst the number of spawners in the upper Exploits has declined since 1997.

- Northwest River (Port Blandford) had record returns in 2005.

Southern Newfoundland (SFA 9-11)

- Returns of large salmon fell by 40 to 60% in three monitored rivers by comparison with 2004. Conservation requirements were only met at Northeast Brook (Trepassey).

Southwest Newfoundland (SFA 12 -13)

- Decreases in returns of small salmon were observed in five out of the seven rivers assessed in SFA 13 in 2005 relative to 2004. Returns of large salmon were similar or lower than 2004 in five of the seven rivers.

- Total population sizes remain low and in particular two-sea-winter (2SW) maiden salmon.

- Conservation requirements were only achieved in two out of seven rivers assessed.

- Declines in percent conservation met from 2004 in 2005 ranged from 34-52% for Highlands, Crabbes, Middle Barachois and Robinsons rivers.

Northwest Newfoundland (SFA 14A)

- Decreases in returns of small salmon were observed in both rivers assessed in SFA 14A.

- Conservation requirements were exceeded in the assessed rivers in 2005.

DESCRIPTION OF THE ISSUE

The Fisheries

Recreational

Labrador

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 is 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; while 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, as in previous years, from records kept by the Department of Fisheries and Oceans (DFO) Conservation and Protection (C & P) staff and logbooks from outfitting camps. For SFA 2, C & P and logbook data were used for 1974-1993 and a combination of C & P, logbook, and License Stub Return data was used for 1994-2005. For SFA 14B, C & P and logbook data were used for 1974-1993 and License Stub Return data for 1994-2005. In 2004, preliminary estimates suggest the total angling catch in SFAs 1, 2 & 14B was 10,258, the second highest on record. The total angling effort was 9,174 rod-days, an increase over 2002 and 2003 values of 8,751 and 8,054, respectively. The catch of small salmon was 8,354 (1,825 retained and 6,529 released) and large salmon was 1,804 (258 retained and 1,904 released). The proportion of salmon released by anglers in Labrador, has been increasing over time, was 80% of the total catch, and was the highest reported to date. In total, there were 8,175 small and large salmon estimated to be hooked and released in 2004 (Fig. 3). In SFA 1, the total catch in 2004 (small and large salmon combined) of 1,874 increased by 16% over 2003. In SFA 2, the total catch (small and large salmon combined) in 2004 of 6,027 has increased by 24% over 2003. Also, in SFA 14B, the total catch (small and large salmon combined) in 2004 of 2,357 increased by 13% over 2003.

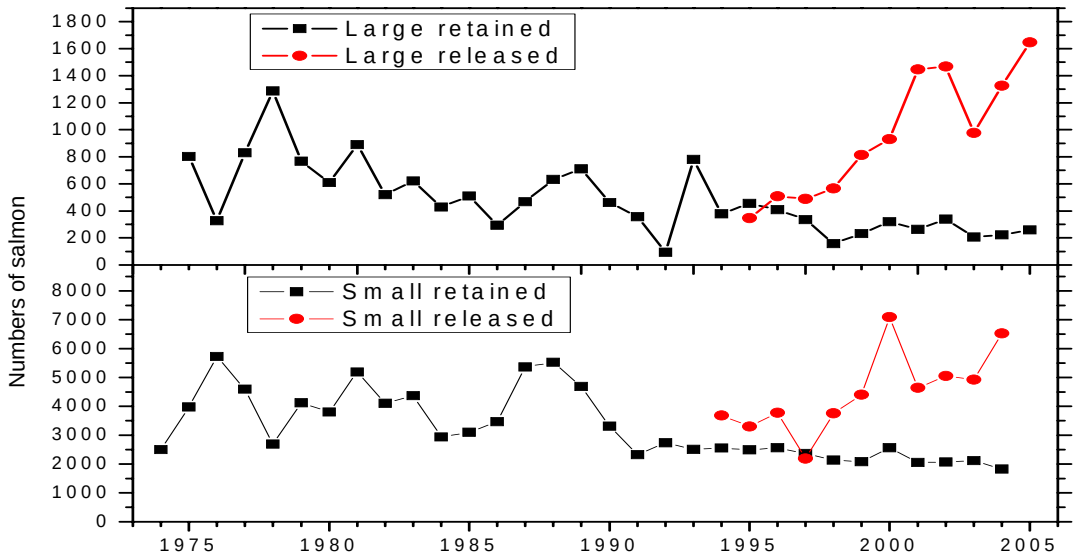

Figure 3. Angling catch statistics for Labrador SFA's 1& 2.

Newfoundland

The recreational salmon fishery in SFAs 2-14B is managed based on the River Classification System. A five-year (2002-2006) integrated Atlantic salmon fisheries Management Plan was introduced for Newfoundland and Labrador in 2002 (Anon. 2002). In the 2003 Management Plan, some rivers were reclassified as outlined in Angler's Guide for 2003 (Anon. 2003).

Angling catch statistics from License Stub Returns in 2005 are not yet available. Preliminary estimates of catches are based the 2000-2004 means.

Aboriginal

Aboriginal subsistence fisheries for salmon, charr and trout occurred in Labrador under communal license similar to 2004. An All Resident Subsistence Fishery for trout and charr permitted retention of up to four salmon as a by-catch in 2005 similar to 2004. In 2005, a Métis Subsistence Fishery was also permitted for salmon, charr and trout.

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 2002-2005. In 2005, there was a small commercial and recreational net fishery in St. Pierre et Miquelon territorial waters.

Information available on Labrador subsistence fishery catches indicates that about 31 tonnes (11,960 salmon) were harvested in 2004 of which large salmon represented 45% of the catch by weight and 31% by number. Subsistence food fishery landings in 2004 were the highest on record for the 5 years that data have been kept and increased by 42% over 2003 landings of 22 tonnes (Table 1). Subsistence fishery landings from 2005 log returns are not yet complete.

Table 1. Subsistence salmon fisheries landings in Labrador as of 15 November 2005.

	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	8,302	17,204	3,660	14,136	11,962	31,340

Prior to the closure of the Labrador commercial salmon fishery in 1998, landings (small and large salmon combined) averaged 369 tonnes annually during the period from 1984 to 1989, and 111 tonnes 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 tonnes. By comparison, approximately 31 tonnes of salmon were harvested in subsistence fisheries in 2004.

ASSESSMENT

Resource Status – Adult salmon

Labrador (SFA 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 Labrador small (Fig. 4) and large (Fig. 5) salmon, despite improvements in runs to some rivers in 2005, overall abundance remains relatively low when compared with levels when commercial fishing was taking place prior to 1998. While the abundance of small salmon was similar to previous levels 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.

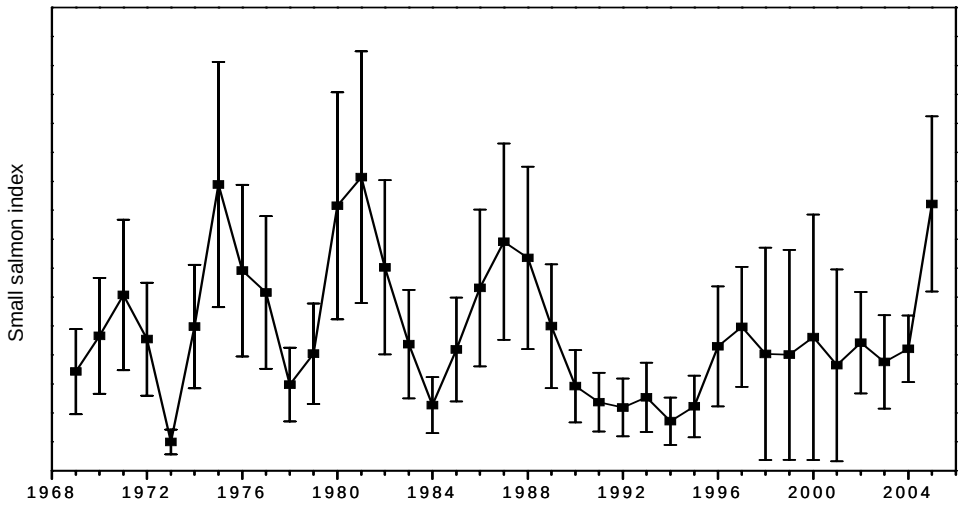

Figure 4: Trends in abundance of small Atlantic salmon in Labrador, 1969 to 2005. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

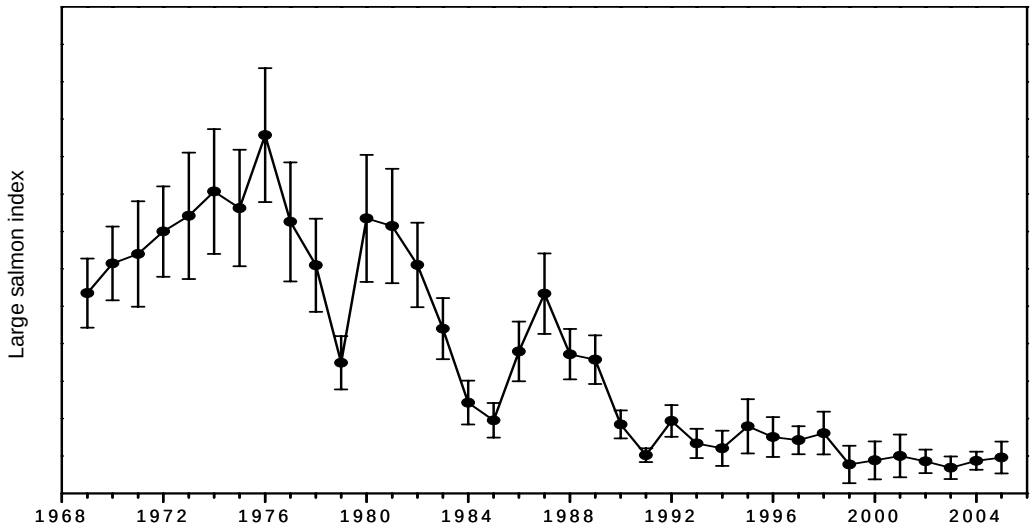

Figure 5: Trends in abundance of large Atlantic salmon in Labrador, 1969 to 2005. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.

The status of English River (SFA 1), Southwest Brook (Paradise River), Muddy Bay Brook, and Sand Hill River (SFA 2) (Fig. 1) was assessed using fish counting facilities. There are no additional facilities from which to determine the status of other Labrador salmon stocks.

Returns of small salmon to English River increased in 2005 over those of 2004 by 502% and increased for large by 32% (Table 2). Returns of small salmon to English River were the 2nd

highest since assessments commenced in the late 1990s. At Southwest Brook, a tributary of Paradise River, small salmon returns increased in 2005 by 40% while large salmon remained the same as values in 2004. Both small and large salmon returns in 2005 are the highest on record. Muddy Bay Brook with four years of data showed increases of 15% for small salmon while large salmon declined by 29% over returns in 2004. Sand Hill River although broken into 3 time periods (1970-73, 1994-96 & 2002-2005) has the longest series of count information in Labrador. Returns to the river in 2005 were the highest in the time series for both small and large salmon increasing by 75% for small salmon and 45% for large salmon over returns in 2004. Removals by marine fisheries are not included in total returns to these rivers.

Conservation spawning requirements for Labrador rivers have not been defined and the use of 2.4 eggs per m² of fluvial habitat and 105 eggs per hectare of pond habitat may not be appropriate (CSAS 2002). Efforts are needed to derive acceptable reference or conservation levels for Labrador rivers. Because of a general lack of long-time series of stock-recruit information for any Labrador river the availability of Labrador-specific conservation requirements is long in the future. However, using 2.4 eggs per m² as a reference level shows that Sand Hill River, Muddy Bay and Southwest brooks exceeded these levels in 2005 while English River did not. Southwest, Muddy Bay, English and Sand Hill rivers all showed increases in reference conservation levels. There is concern for the salmon stock at English River in that salmon may not be able to maintain a viable population on this river. However, the substantial increase in returns of small salmon in 2005 may improve the situation considerably.

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 assessed rivers is combined to derive composite indices of abundance. As illustrated below for Newfoundland small salmon, despite improvements in runs to many rivers in 2003 and 2004, overall abundance remains relatively low when compared with pre-moratorium levels (1984-1991) that have been corrected to account for marine exploitation. Overall abundance of small salmon in 2005 fell by comparison with 2004, but remains above the 1992-1996 and 1997-2004 means.

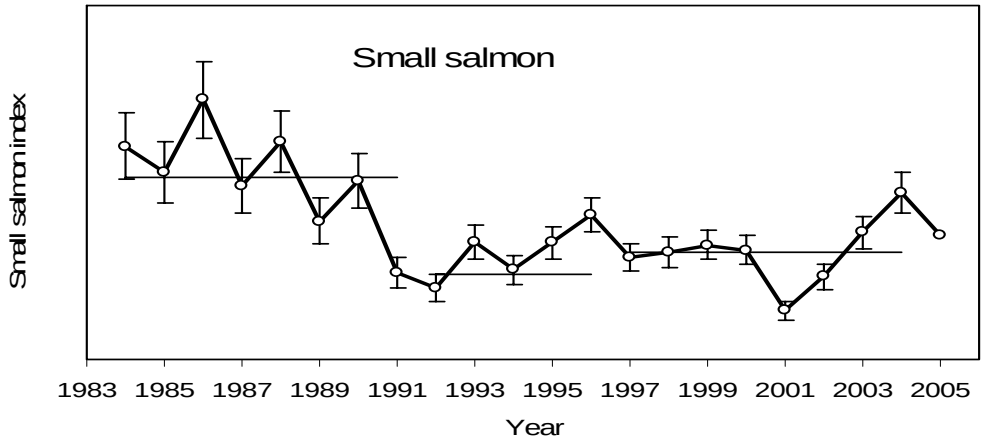

Figure 6. Trends in abundance of small Atlantic salmon in Newfoundland, 1984 to 2005. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2004. Vertical lines represent ± 1 standard error.

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 of large salmon then fell to moderately low levels in 2001 and 2002 before increasing in recent years although overall abundance declined again in 2005 relative to 2004 and was slightly below the 1997-2004 mean. Hence, while the overall returns and spawning escapements of salmon to rivers 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.

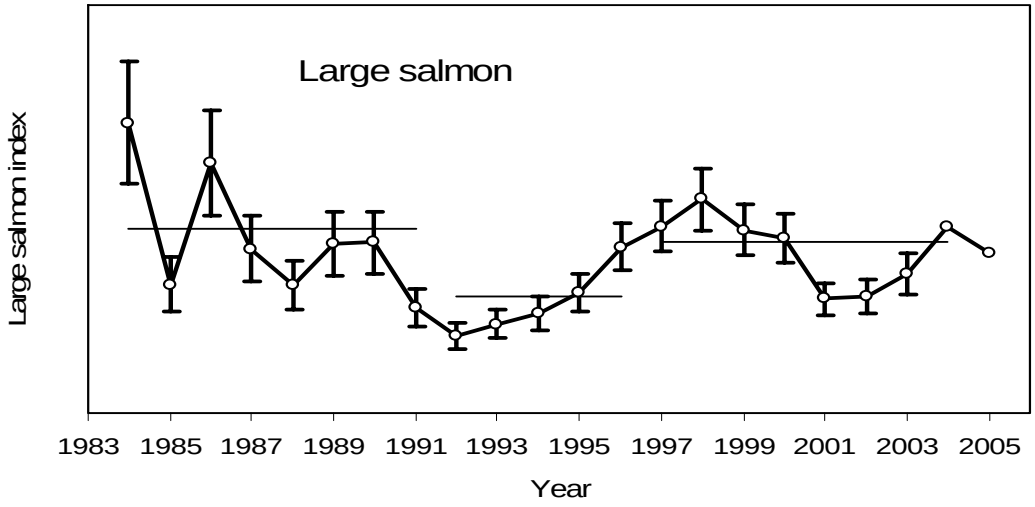

Figure 7. Trends in abundance of large Atlantic salmon in Newfoundland, 1984 to 2005. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2004. Vertical lines represent ± 1 standard error.

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 (Fig. 2). With the exception of Gander River, all stocks were assessed directly from salmon returning to fish counting facilities. The status of Gander River in 2005 was inferred from salmon returning to a fishway in Salmon Brook, a tributary.

Total returns of small salmon in 2005 increased over or remained similar to those of 2004 for all rivers except Terra Nova, which showed a decrease (20%). Compared to the means for 1992-2004, there were no declines. Campbellton River recorded the greatest increase (37% and 39% over 2004 and the mean). Returns of large salmon in 2005 increased relative to 2004 for Exploits, Campbellton, and Northwest rivers and remained similar for Gander River, while the remainder showed decreases. Exploits River had the highest increase (107%) while Middle Brook had the highest decrease (30%). All rivers except Middle Brook and Terra Nova River increased relative to the 1992-2004 mean. Northwest River had the highest increase (99%) and Middle Brook the highest decrease (50%). Conservation spawning requirements were met only at Campbellton River, Gander 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 seven of 14 years. Terra Nova River, Exploits River and Northwest River (Port Blandford) have yet to achieve conservation spawning requirements.

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 adult recruitment (i.e. small salmon) which should have started in 1997.

South Newfoundland (SFAs 9-11)

Specific rivers assessed in 2005 include: Northeast Brook (Trepassey) and Rocky River in SFA 9, and Conne 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 2005 decreased by 48% at Conne River by comparison with 2004 while returns at Rocky River increased by 153% to the highest value since 1997. At Northeast Brook (Trepassey) returns of small salmon were essentially the same as in 2004. In contrast to small salmon, returns of large salmon fell at all rivers declining by 40% at Conne River, 55% at Northeast Brook, Trepassey, and by 60% at Rocky River relative to 2004. The contribution of large salmon at Rocky River in 2004 (58%) appears anomalously high relative to other values during the past 10 years that have ranged from about 9% to 27%. As noted in past years, large salmon at Conne River are predominately alternate spawning grilse.

Conservation spawning requirements in 2005 were only achieved at Northeast Brook (Trepassey) (168%) while 55% was attained at Rocky River and 91% at Conne River. Rocky River has yet to achieve conservation while Conne River has met its requirement in 9 of the past 14 years since the commercial salmon fishery moratorium began.

Southwest Newfoundland (SFAs 12-13)

Seven rivers were assessed in SFA 13. Crabbes, Middle Barachois, Robinsons, Fischells, and Flat Bay rivers were assessed by snorkelling surveys, while the status of Highlands and Harry's rivers were assessed using fish counting facilities.

Returns of small salmon decreased substantially in four out of seven monitored rivers, in comparison to 2005 (Table 2). The returns of large salmon were variable among the seven monitored rivers with decreased returns to Highlands, Harrys, Fischells and Robinsons rivers.

The conservation egg deposition requirements were only achieved in two rivers (Fischells and Flat Bay) in 2005.

The egg deposition on Middle Barachois Brook decreased again in 2005 (52%) and there is concern for this stock which is below the 1992-04 mean. One possible explanation is that the stock has not recovered from the severe habitat disturbance that occurred during the flood in 1996.

Northwest Newfoundland (SFA 14A)

Two rivers were assessed: Torrent River and Western Arm Brook, using fish counting facilities. Returns to Lomond River were not evaluated in 2005.

Returns of small salmon in 2005 decreased for Torrent River and Western Arm Brook as compared to 2004. Returns, of large salmon in 2005 increased for Torrent River and declined for Western Arm Brook.

Conservation spawning requirements were exceeded in both rivers in 2005 and have done so in all years since the closure of the commercial salmon fishery.

Smolt Production and Marine Survival

In insular 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).

Smolt Production

Smolt production in 2005 decreased in four of five stocks by comparison with 2004. Decreases ranged from 8% at Campbellton River to 50% at Western Arm Brook where the number of smolts recorded was the lowest value in 26 years going back to 1979 (Fig. 8). In contrast, smolt production at Rocky River increased by 21% relative to the previous year and was the highest recorded since 1997. With the exception of Rocky River, the other four stocks have smolt production values in 2005 that are 6 to 41% lower than corresponding average values for the 5-year period 2000 to 2004. Four of the five rivers experienced peak production in 1997 with numbers of smolts at Campbellton River decreasing significantly since then (r^2 = 0.80, P = 0.001). Where smolt production declined in 2005, returns of small salmon in 2006 are expected to be lower unless there is a compensatory increase in marine survival.

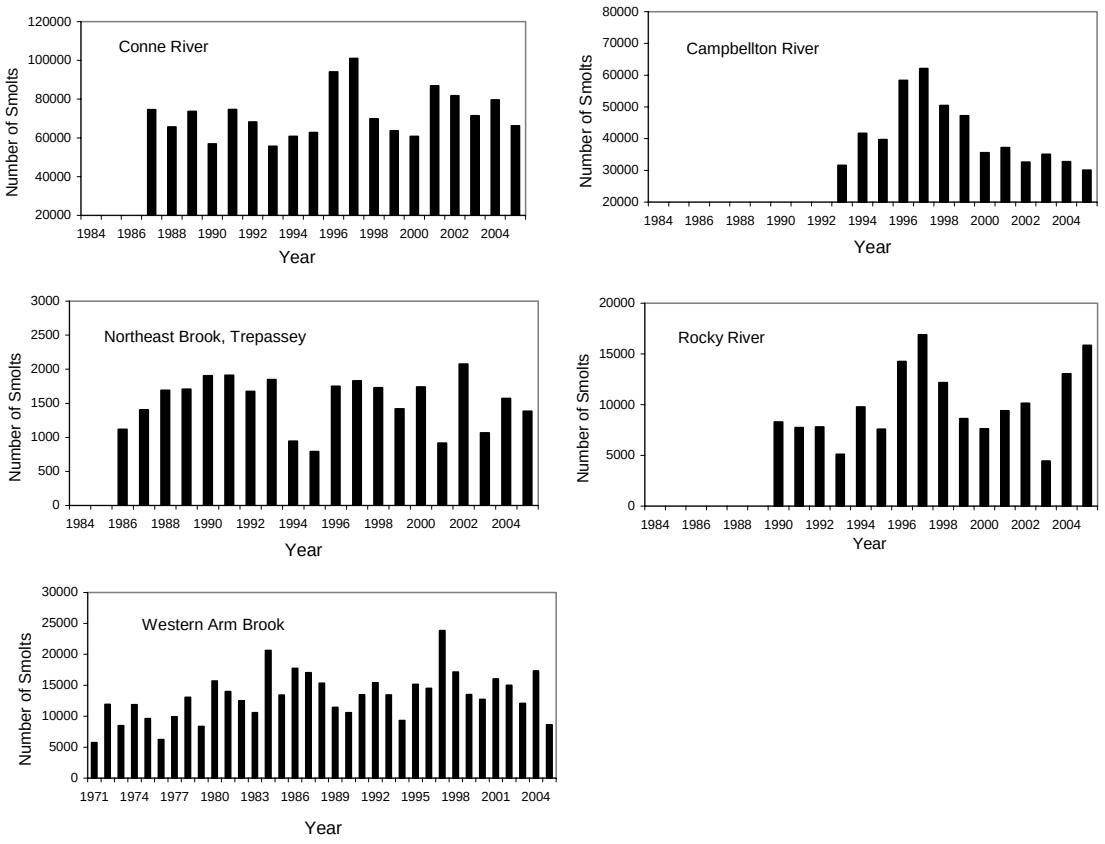

Figure 8. Trends in smolt production from various Newfoundland Atlantic salmon rivers.

Marine Survival

Marine survival, corresponding to adult small salmon returns in 2005, averaged 5.4% across all five rivers, ranging from a high of 11.4% at Campbellton River, to a low of 2.5% at Conne River (Fig. 9). Overall, survival decreased from 14% (Rocky River) to 54% (Conne River) by comparison with the previous year with the only increase occurring at Campbellton River that experienced its highest survival on record.

Marine survival, however, remains highly variable and generally low. Higher survivals have occurred in the past, even in years when directed ocean fisheries for salmon were in existence.

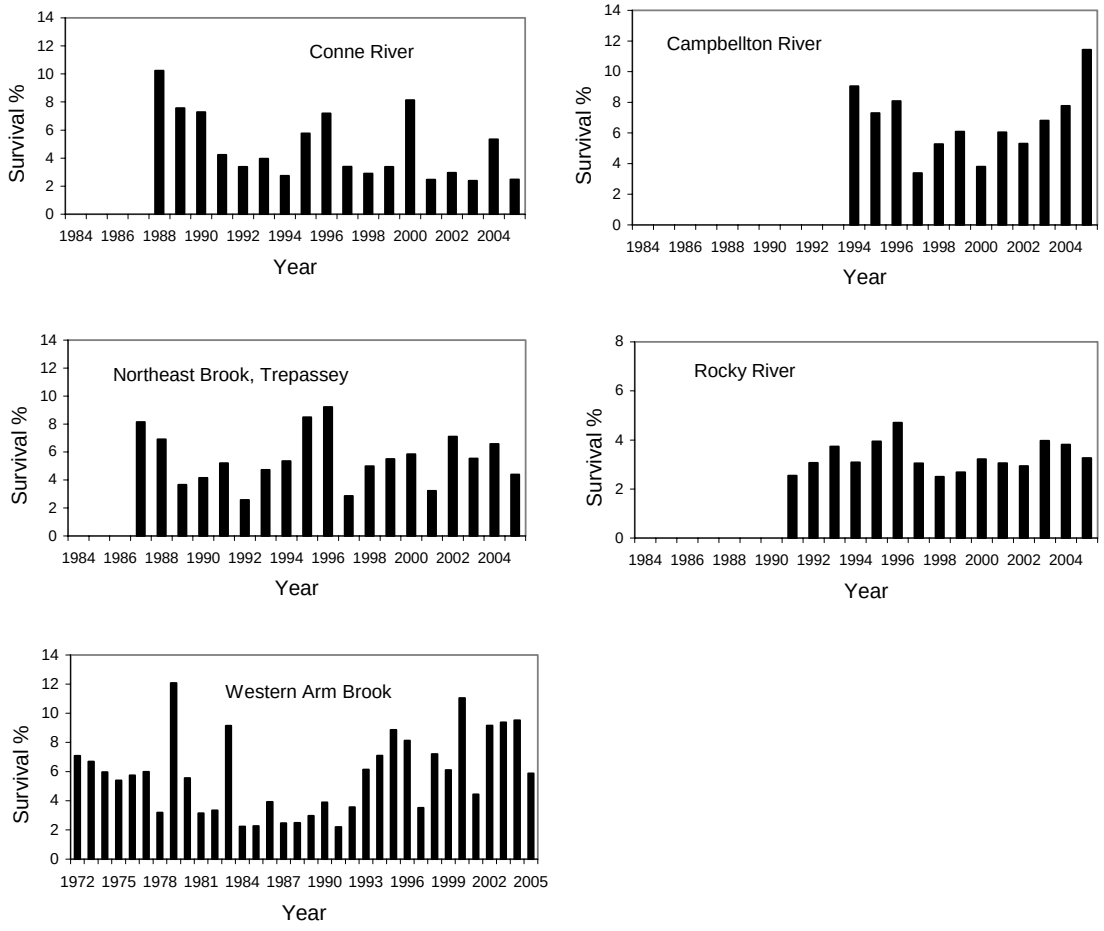

Figure 9. Marine survival rates for adult salmon (small salmon) at various Newfoundland rivers. Survival rates have not been adjusted for marine exploitation in years prior to 1992 when commercial fisheries for salmon occurred. Thus, values represent actual survival of salmon back to the river.

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 conservation requirements for the first time in five years in 2004 and again in 2005; it has achieved its requirements in only seven of 14 years. There is some uncertainty around estimates of returns from year 2000 onwards (O'Connell 2003). Observations by some anglers suggest returns were better than estimates extrapolated from Salmon Brook in certain years.

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

Research Recommendations

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.

Priority research is required to establish reference egg deposition levels for Labrador salmon rivers (SFAs 1 and 2). This information is crucial to the assessment and management of these salmon stocks.

More research is required to provide return information for other rivers in SFA 1 to determine if the declines in salmon noted for English River are also occurring in other SFA 1.

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.

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) concern is expressed for the apparent low abundance of larger salmon (maiden 2SW salmon).

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. 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 **Northeast and Eastern** (SFAs 3-8), the improvement in the status of salmon in Northwest River (Port Blandford) in 2003, 2004 and 2005 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 (downstream of Grand falls fishway) has achieved conservation requirements eight of the last 12 years. The middle Exploits (Grand Falls fishway to Red Indian Lake fishway) continues to improve with spawning escapements averaging over

9,000 fish since 1993. 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 that were lower than returns prior to the commercial salmon moratorium. In general, stocks continue to under perform.

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, particular consideration should be given to the conservation of salmon stocks in Bay St. George. Although there has been some improvement in most of these stocks recently, 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 result in decreased returns in 2006 and 2007 unless there is compensatory survival. 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 Harrys River, and may have contributed to the increases observed in other Bay St. George rivers. 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 2006.

Conservation/Stock Recovery Strategies (Stewardship program) appears to have contributed to increased spawning stocks in targeted rivers. These strategies include 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.

OTHER CONSIDERATIONS

Environmental Conditions

Marine Environment

The North Atlantic Oscillation (NAO) index for 2005 was above normal. However, arctic outflow to the Northwest Atlantic was weaker-than-normal as the most significant pressure anomalies were shifted to the east. Air temperatures have been warmer than normal for six out of the past nine months up to September of 2005. Data on sea ice extent on the Newfoundland and

Labrador Shelf for 2005 are not yet available. However, preliminary analysis indicates less-than-normal sea-ice extent and duration during the winter and spring of 2005.

Ocean temperatures at Station 27 off St. John's Newfoundland for the first eight months of 2005 were above normal with surface values during the summer (August) comparable to the record highs of 2004. Oceanographic data collected during the spring and summer of 2005 on the Newfoundland Shelf generally showed above normal temperatures, particularly on the Grand Bank and off the south coast of Newfoundland. Observations from the mid-summer oceanographic survey indicated that the area of the cold-intermediate-layer (CIL <0°C) shelf water increased slightly over 2004 but was below normal for the 11th consecutive year off Cape Bonavista. In general, water temperatures on the Newfoundland and Labrador Shelf remained above normal during 2004 and the first half of 2005, continuing the warm trend that started during the late 1990s.

Preliminary analyses have shown strong 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 in eastern Newfoundland waters and spring sea-ice cover with later run-times associates with cold conditions and extensive ice cover. There is insufficient information at present to quantify these relationships. However, based on historical data the current marine environment in Newfoundland and Labrador waters is favorable for survival of Atlantic salmon.

Freshwater Environment

For several 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 warm water temperatures. During the 2005 angling season, 57 out of 158 scheduled rivers in insular Newfoundland (36.1%) were closed for varying periods of time because of low water levels and warm water temperatures. As a result, 5.2% of the potential fishing days available were lost, the third lowest in the past 10 years. This contrasts with 2004 when 112 rivers were closed with 19.7% of the angling days affected. Most closures occurred during the month of July while wetter conditions prevailed in August.

SOURCES OF INFORMATION

Anon., 2002. 2002-2006 Atlantic salmon integrated management plan Newfoundland and Labrador. Fisheries Management Branch, Newfoundland Region. St. John's, NL.

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

CSAS, 2002. Newfoundland and Labrador Atlantic Salmon Stock Status for 2002. DFO Science Stock Status Report D2-01 (2002), 20p.

Dempson, J. B., M. F. O'Connell, and C. J. Schwarz. 2004. Spatial and temporal trends in abundance of Atlantic salmon, *Salmo salar*, in Newfoundland with emphasis on impacts of the 1992 closure of the commercial fishery. Fisheries Management and Ecology 11: 387-402.

O'Connell, M. F. 2003. Uncertainty about estimating total returns of Atlantic salmon, *Salmo salar* to Gander River, Newfoundland, Canada, evaluated using a fish counting fence. Fisheries Management and Ecology 10: 23-29.

O'Connell, M. F., J. B. Dempson, D. G. Reddin, C. E. Bourgeois, T. R. Porter, N. M. Cochrane, and D. Caines. 2005. Status of Atlantic salmon (*Salmo salar* L.) stocks of insular Newfoundland (SFAs 3-14A), 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2006/058.

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Table 1. Summary of Atlantic salmon stock status in the Newfoundland Region. Conservation met refers to the actual percentage of the conservation spawning requirement achieved, but is intended as a reference level only for Labrador stocks, when reported. Refer to footnotes for definition of characters and abbreviations.

Region / River	Map SFA	Map Index	Method	Total Returns 2005 Small	2005 Large	2004 Small	2004 Large	1992-04 Small	1992-04 Large	Conservation met (%) 2005	2004	1992-04	1992-05	Status in 2005: Smolts Relative to: 2004	Smolts 1992-04	Marine Survival 2004	Marine Survival 1992-04	Egg Deposition 2004	Egg Deposition 1992-04
Labrador																			
Sand Hill River	2	1	Fe	7007	875	4008	604												
Muddy Bay Brook	2	2	Fe	520	20	454	28												
Southwest Bk. (Paradise River)	2	3	Fe	858	54	615	54												
English River	1	4	Fe	337	28	56	25												
Newfoundland																			
Northeast Coast																			
Exploits River	4	1	Fw	27832	1966	27093	949	21114	1165	51	48	39	0 of 14 yrs					⇔	⇧
Lower	4		Fw							99	136	115	9 of 14 yrs					↓	↓
Middle	4		Fw							51	37	27	0 of 14 yrs					⇧	⇧
Upper	4		Fw							4	2	7	0 of 14 yrs					⇧	↓
Campbellton River	4	2	Fe	3746	276	2726	161	2691	258	324	211	229	13 of 13 yrs	⇔	↓	⇧	⇧	⇧	⇧
Gander River *	4	3	EFw	17828	2461	18521	2668	17704	2326	111	114	100	7 of 14 yrs					⇔	⇧
Middle Brook	5	4	Fw	1567	62	1504	88	1677	125	162	164	185	14 of 14 yrs					⇔	↓
Terra Nova	5	5	Fw	2392	314	2999	397	2115	378	42	55	36	0 of 14 yrs					↓	⇧
Northwest River (Port Blandford)	5	6	Fe	1210	305	1207	265	545	153	93	92	46	0 of 11 yrs					⇔	⇧

Assessment Methods: Fe = counting fence; MR = mark-recapture; Fw = fishway count; EFw = estimated from tributary fishway count; Sc = snorkel count

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

Footnotes:
Map index numbers refer to text figure and legend.
Marine survival is from smolts in year i to small salmon in year i + 1.
Use of 240 eggs/100 m2 as a conservation requirement for Labrador rivers may not be appropriate, and is used here only as a reference level.
In some cases fewer years are included in the 1992-2003 mean for some rivers.
* Gander River was assessed using a fish counting fence from 1989 to 1999.

Table 1. Continued. Summary of Atlantic salmon stock status in the Newfoundland Region. Conservation met refers to the actual percentage of the conservation spawning requirement achieved, but is intended as a reference level only for Labrador stocks, when reported. Refer to footnotes for definition of characters and abbreviations.

Region	Map			Total Returns 2005		Total Returns 2004		Total Returns 1992-04		Conservation met (%)				Status in 2005: Smolts Relative to:		Status in 2005: Marine Survival Relative to:		Status in 2005: Egg Deposition Relative to:	
River	SFA	Index	Method	Small	Large	Small	Large	Small	Large	2005	2004	1992-04	1992-05	2004	1992-04	2004	1992-04	2004	1992-04
South Coast																			
Northeast Brook (Trepassey)	9	7	Fe	69	5	70	11	77	12	168	183	200	14 of 14 yrs	↓	⇔	↓	↓	⇔	↓
Rocky River	9	8	Fe	427	95	169	235	305	82	55	51	41	0 of 14 yrs	⇧	⇧	↓	⇔	⇔	⇧
Little River	11	9	Fe	216	15	656	31	328	41	99	295	152	7 of 14 yrs					↓	↓
Conne River	11	10	Fe	1978	105	3818	175	2940	163	91	160	127	9 of 14 yrs	↓	⇔	↓	↓	↓	↓
Southwest Coast																			
Highlands River	13	11	Fe	101	153	507	252	200	123	75	155	72	2 of 13 yrs					↓	⇔
Crabbes River	13	12	Sc			2150	275	983	236	78	123	72	1 of 10 yrs					↓	⇔
Middle Barachois	13	13	Sc	596	100	1086	100	864	120	52	79	71	0 of 9 yrs					↓	↓
Robinsons River	13	14	Sc			1976	167	1368	206	81	132	108	4 of 9 yrs					↓	↓
Fischells Brook	13	15	Sc			1254	190	890	143	101	99	69	3 of 9 yrs					⇔	⇧
Flat Bay Brook	13	16	Sc			1998	185	1691	223	162	126	110	4 of 9 yrs					⇧	⇧
Harry's River	13	17	Fe	2495	453	2828	498	1748	186	90	101	51	1 of 14 yrs					↓	⇧
Northwest Coast																			
Torrent River	14A	20	Fw	4408	780	5069	546	4591	468	675	686	687	14 of 14 yrs					⇔	⇔
Western Arm Bk	14A	21	Fe	1019	43	1151	74	1060	48	351	425	368	14 of 14 yrs	↓	↓	↓	↓	↓	⇔

Assessment Fe = counting fence MR = mark-recapture

Methods: Fw = fishway count EFw = estimated from tributary fishway count in 2000

Sc = snorkel count

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

Footnotes:

Map index numbers refer to text figure and legend.

Marine survival is from smolts in year i to small salmon in year i + 1.

Use of 240 eggs/100 m2 as a conservation requirement for Labrador rivers may not be appropriate, and is used here only as a reference level.

In some cases fewer years are included in the 1992-2003 mean.

Total returns are not available for some Bay St. George Rivers.