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**Newfoundland and Labrador Region** **Stock Status Report 2004/040**

# Newfoundland & Labrador Atlantic Salmon 2004 Stock Status Update

***Background***

*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 statistic.*

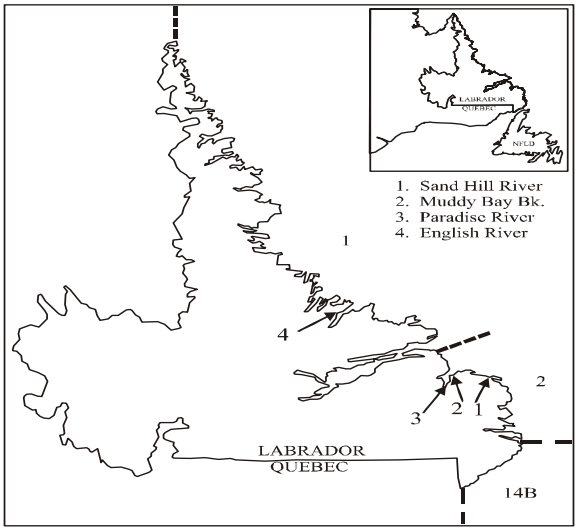


*Figure 1: Map illustrating the location of Salmon Fishing Areas of Labrador, along with salmon rivers assessed in 2004.*

## *Summary*

**Newfoundland & Labrador**

- Compared to 2003, returns of small and large salmon improved for most rivers. Returns of small salmon improved relative to the moratorium means in most



Canada

cases, but this was not as pronounced for large salmon.

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

**Labrador (SFAs 1-2)**

- Based on returns to four counting facilities, stocks appear low considering the management measures implemented to increase stock abundance.

- Total returns of small and large salmon in English River (SFA 1) have declined for the fourth consecutive year.

- For SFA 2, returns of small salmon increased in Muddy Bay Brook, Sand Hill River and Southwest Brook, compared to 2003. Large salmon declined in Muddy Bay Brook and Sand Hill River but increased in Southwest Brook. Total returns were records at Muddy Bay and Southwest brooks.

- Abundance of large salmon (mainly 2SW) remains low and is a cause of concern because of the large contribution they make to egg deposition.

- 2004 landings in Labrador subsistence fisheries increased greatly over previous years.

- Increased access provided by the Trans Labrador Highway has the potential to increase angling exploitation.

- The construction of the Trans Labrador Highway could have adverse habitat effects which should be mitigated.

**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 six of the last 13 years.

- The lower Exploits River has achieved conservation requirements nine out of 13 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 2004.

**Southern Newfoundland (SFAs 9-11)**

- Stock size overall continues to be lower during the commercial salmon fishery moratorium than prior to the moratorium and there should be no increase in mortality.

- Conservation requirements were achieved in three out of four assessed rivers.

- Northeast Brook (Trepassey) and Rocky River returns declined compared to 2003 while Little River and Conne River increased over 2003.

**Southwest Newfoundland (SFA 12-13)**

- Increases in returns of small salmon were observed in all seven rivers assessed in SFA 13 in 2004 relative to 2003. Returns of small salmon to Highlands, Crabbes and Harrys rivers were the highest on record. Returns of large salmon were similar or higher than 2003 in five of the seven rivers.

- Total population sizes remain low.

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

**Northwest Newfoundland (SFA 14A)**

- In spite of greatly increased spawning escapements for Lomond and Torrent rivers in 1992-1996, there has been no corresponding increase in adult (small salmon) recruitment, which should have started in 1997.

- Conservation requirements were exceeded in all three assessed rivers in 2003.

**Smolt production**

- Smolt production in insular Newfoundland increased in four out of five stocks, by comparison with 2003.

- Four of the five rivers experienced peak production in 1997, but since then substantive declines have occurred at Western Arm Brook, Campbellton and Rocky rivers.

**Marine survival**

- Survival at sea (smolt to returns to rivers as small salmon) ranged from 3.8% to 9.5%, remaining highly variable but generally low. Northern stocks tend to have a higher survival.

- Higher survivals have occurred in the past, even in years when directed ocean fisheries for salmon were in existence.

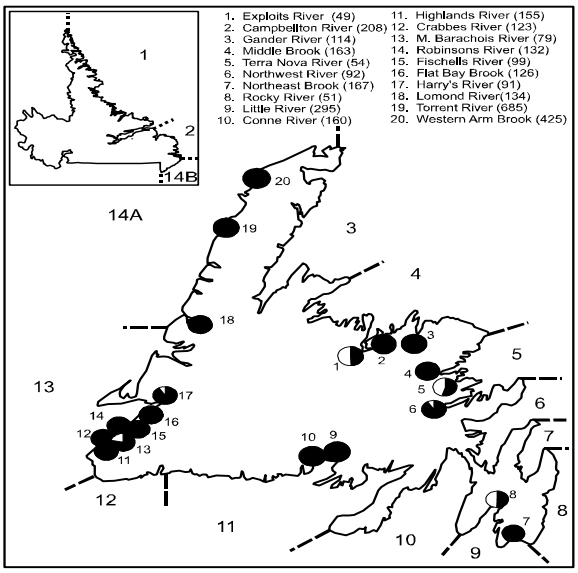


*Figure 2: Map illustrating the location of the Salmon Fishing Areas of Newfoundland, along with various salmon rivers assessed relative to conservation requirements. The black portion of the circle and the numbers in parentheses indicate the percentage of the conservation requirement achieved for each river in 2004.*

## *Environmental conditions*

***Freshwater*** – 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 2004 angling season, 112 out of 158 scheduled rivers in insular Newfoundland (70.9%) were closed for varying periods of time for environmental reasons. Most affected areas were SFAs 7, 8, 9, and 14A where 30 to 43% of the potential fishing days available were closed in 2004. In total for all SFAs, 19.7% of all fishing days were closed, the second highest since 1987 when

36.9% were unavailable. This contrasts with 2003 when 93 rivers were closed with 15.5% of the angling days affected.

***Marine*** - Ocean temperatures at Station 27 off St. John's, Newfoundland for the first eight months of 2004 were mostly above normal with surface values during the summer (August) among the highest on record. Oceanographic data collected during the spring of 2004 on the Newfoundland Shelf generally showed above normal temperatures, particularly on the Grand Bank and St. Pierre Bank. Observations from the mid-summer oceanographic survey indicated that the area of the cold-intermediate-layer (CIL <0°C) shelf water decreased over 2003 and was below normal for the 10$^{th}$ consecutive year off Cape Bonavista.

The North Atlantic Oscillation (NAO) index for 2004 was below normal indicating a weak arctic outflow during the winter months in the Northwest Atlantic. Air temperatures have been warmer than normal for 14 out of the past 15 months up to August of 2004. This is in sharp contrast to the cold air temperatures experienced during the winter and spring of 2003. Data on sea ice extent on the Newfoundland and Labrador Shelf for 2004 are not available. However, preliminary analysis indicates less-than-normal sea-ice extent and duration during the winter and spring of 2004.

Preliminary analyses have shown strong associations between marine environmental conditions and both marine survival of salmon and adult salmon run timing (Colbourne et al., 2002). However, there is insufficient information at present to quantify these relationships.

## *The Fisheries*

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).

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 accessibility via the Trans-Labrador Highway. Rivers without direct access from the highway were left at four salmon, as was previously the case.

Aboriginal subsistence fisheries for salmon, Arctic charr and trout occurred in Labrador under communal licence similar to 2003. An All Resident Subsistence Fishery for trout and charr permitted retention of up to four salmon as a by-catch in 2004 similar to 2003. In 2004, 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 2002-2004. In 2004, there was a small commercial and recreational net fishery in St. Pierre et Miquelon territorial waters.

***Newfoundland*** - Angling catch statistics from Licence Stub Returns in 2004 are not yet available.

***Labrador*** – Angling catch data for SFA 1 was derived, as in previous years, from records kept by Department of Fisheries and Oceans (DFO) Conservation and Protection staff and logbooks from outfitting camps. For SFA 2, DFO data were used for 1974-1993 and a combination of DFO data and License Stub Return Data was used for 1994-2004. For SFA 14B, DFO data were used for 1974-1993 and License Stub Return Data for 1994-2003. In 2003, preliminary estimates suggest the total angling catch in SFAs 1, 2 & 14B was 9,695, the second highest on record. The total angling effort was 9,230 rod-days, an increase over 2001 and 2002 values of 7,986 and 8,751, respectively. The catch of small salmon was 7,891 (2,045 retained and 5,846 released) and large salmon was 1,804 (226 retained and 1,578 released). The proportion of salmon released by anglers in Labrador, which has been increasing over time, was 77% of the total catch, and was the highest reported to date. In total, there were 7,424 small and large salmon estimated to be hooked and released in 2003 (Fig. 3). In SFA 1, the total catch (small and large salmon combined) of 1,620 increased by 108% over 2002. In SFA 2, the total catch of 4,927 was slightly lower than in 2002. In SFA 14B, the total catch (small and large salmon combined) of 3,148 increased by 21% over 2002.

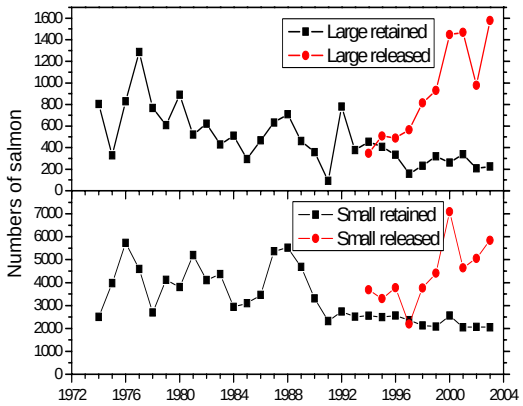


*Figure 3: Angling catch statistics for small and large salmon in Labrador SFAs 1&2, 1974-2003 (data for 2003 are preliminary).*

Preliminary data are also available from angling camp logbooks in 2004 from some rivers in SFAs 1 & 2. In 2004, preliminary estimates suggest the total angling catch in SFAs 1 & 2 was 6,913, the second highest on record. The total angling effort was 5,026 rod-days, an increase over 2002 and 2003 values of 5,713 and 6,547, respectively. The catch of small salmon was 5,553 (1,377 retained and 4,175 released) and large salmon was 1,360 (282 retained and 1,078 released).

Information available on subsistence fishery catches indicates that 29 tonnes (11,174 salmon) were harvested in 2004 of which large salmon represented 44% of the catch by weight and 29% by number. Subsistence food fishery landings in 2004 were the highest on record for the 6 years that data have been kept and increased by 31% over 2003 landings of 22 tonnes. Subsistence fishery landings from 2004 log returns are preliminary.

| 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 | 7,900 | 16,258 | 3,273 | 12,693 | 11,174 | 28,951 |

*Subsistence salmon fisheries landings in Labrador as of 5 November 2004.*

## *Resource Status - Adult salmon*

Subsequent to the closure of the commercial salmon fishery in Newfoundland in 1992, the numbers of small and large salmon returning to rivers in Newfoundland are considered to be the total salmon production for these rivers. Spawning escapements are determined by accounting for known in-river removals of salmon after monitoring has occurred. Recreational harvests for 2004, used in assessing stocks were, for most rivers, estimated based on average catches derived from licence stub returns in 1997-2002. Hence, returns of small and large salmon and values for percentage conservation requirements achieved are preliminary.

Adult salmon stocks in 2004 were assessed in 20 rivers in insular Newfoundland and four in Labrador (Table 1). These were distributed among nine of the 14 SFAs (Fig. 1 and Fig. 2).

Four of the 20 stocks assessed in insular Newfoundland (Exploits River, Terra Nova River, Northwest River (Port Blandford) and Rocky River) have undergone enhancement (colonization) activities that made large amounts of new habitat accessible to anadromous salmon. These stocks are still in the development stage thus are not expected to achieve conservation requirements in the near future.

### 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 Labrador small (Fig. 4) and large (Fig. 5) salmon, despite improvements in runs to some rivers in 2004, 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 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.

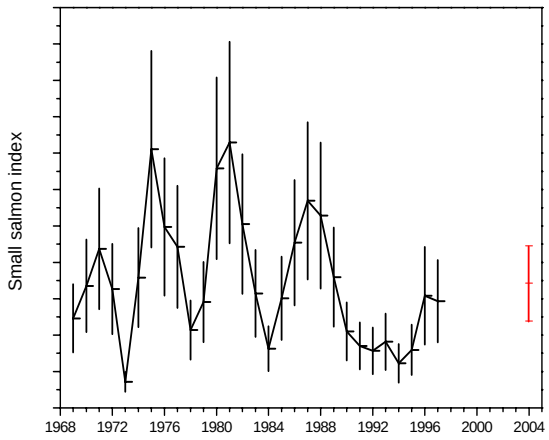


*Figure 4: Trends in abundance of small Atlantic salmon in Labrador, 1969 to 1997 and 2004. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95$^{th}$ confidence intervals.*

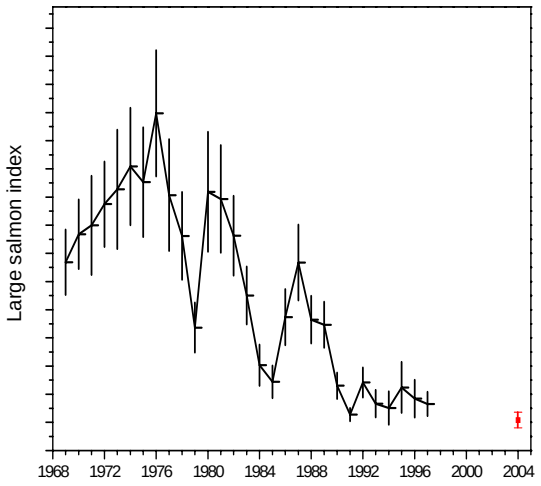


*Figure 5: Trends in abundance of large Atlantic salmon in Labrador, 1969 to 1997 and 2004. Returns have been corrected to account for marine exploitation. Vertical lines represent the 95th confidence intervals.*

There are 28 scheduled salmon rivers in SFAs 1-2 and 14B, although many other rivers contain populations of Atlantic salmon. 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 29 tonnes of salmon were harvested in subsistence fisheries in 2004.

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.

***Status*** - Returns of small salmon to English River were 58% below returns in 2003 , but large salmon increased by 32% (Table 1). Returns of small salmon to English River were the lowest since assessments commenced in 1999. At Southwest Brook, tributary of Paradise River, small salmon returns increased in 2004 by 289% and large salmon by 238%. Both small and large salmon returns in 2004 were the highest on record. Muddy Bay Brook with three years of data showed increases of 15% for small salmon while large salmon declined by 10% from returns in 2003. Sand Hill River has the longest series of monitoring information in Labrador; although it is broken into three time periods (1970-73, 1994-96 & 2002-2004). Returns of large salmon to the river in 2004 were similar to those of 2003, but increased by 30% for small salmon. Returns of small salmon in 2004 were the second highest on record while large salmon were the third highest. Removals by marine fisheries are not included in total returns to these rivers.

Biological conservation spawning requirements have not been developed for Labrador rivers, since it may not be appropriate to apply egg deposition levels that are used for northern Newfoundland (i.e. 2.4 eggs per m² of fluvial habitat and 105 eggs per hectare of pond habitat). Additional effort is needed to define reference or conservation levels for Labrador rivers. There is uncertainty in reconciling and determining the appropriateness of different approaches and criteria for developing reference levels. 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. There is concern that the salmon stock in English River is at critically low level and may not be able to maintain a viable population if further decline occurs.

## 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 for Newfoundland small salmon (Fig. 6), 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.

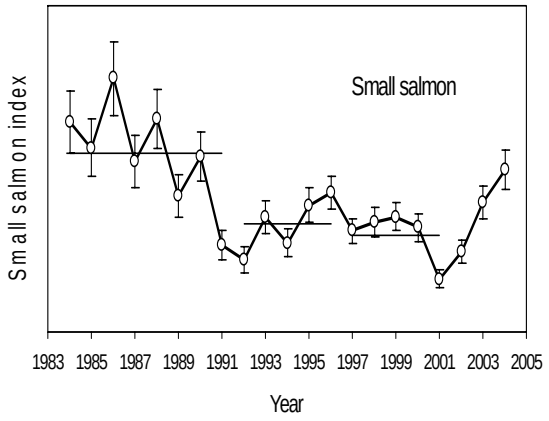


*Figure 6: Trends in abundance of small Atlantic salmon in Newfoundland, 1984 to 2004. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2001. Vertical lines represent ± 1 standard error.*

A somewhat similar situation exists for large salmon (Fig. 7). 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. 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.

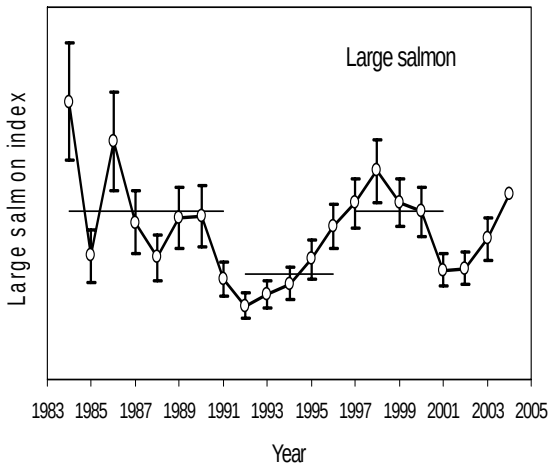


*Figure 7: Trends in abundance of large Atlantic salmon in Newfoundland, 1984 to 2004. Returns from 1984 to 1991 have been corrected to account for marine exploitation. Horizontal lines illustrate the mean abundance index for the periods 1984-1991, 1992-1996, and 1997-2001. Vertical lines represent ± 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 2004 was inferred from salmon returning to a fishway in Salmon Brook, a tributary.

***Status*** - Total returns of small salmon in 2004 increased over 2003 (ranging from 19% for Northwest River to 36% for Gander River) for all rivers except Exploits River, which showed a slight decline. Compared to the 1992-2003 means, returns to Campbellton River (1%), Gander River (5%) and Middle Brook (-9%) remained similar; while increases were noted for Exploits (31%), Terra Nova (49%) and Northwest (156%) rivers. Returns of large salmon in 2004 increased relative to 2003 in all rivers, except Exploits and Northwest which remained similar to 2003. Exploits (-20%) and Campbellton (-40%) rivers and Middle

Brook (-31%) decreased relative to the 1992-2003 means while increases occurred for Gander (16%) and Northwest (89%) rivers; Terra Nova River (6%) remained similar. Conservation spawning requirements were met only at Campbellton River, Gander River, and Middle Brook (Fig. 2, Table 1). Campbellton River and Middle Brook have exceeded their conservation spawning requirements in each of the years they have been assessed during the moratorium (Table 1). Gander River has met or exceeded conservation requirements in only six of 13 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 (N = 3) include: Northeast Brook (Trepassey) and Rocky River in SFA 9, and Conne River in SFA 11 (Fig. 2). Northeast River (Placentia) (SFA 10) was not assessed in 2004. Spawning escapements are evaluated using fish counting facilities while mark-recapture methods are used to estimate smolt production at Conne River.

***Status*** - Total returns of small salmon in 2004 decreased by 39% at Northeast Brook (Trepassey) and 58% at Rocky River by comparison with 2003, despite both stocks having either similar or slightly higher marine survival rates for 2004 adult salmon returns. In contrast, adult small salmon returns to Conne River increased by 95%, the highest since 2000. While returns of large salmon were similar to the previous year at Northeast Brook (Trepassey), returns of large salmon increased by over 200% at both Conne River and Rocky River. Large salmon at Conne River are predominately alternate spawning grilse.

Conservation spawning requirements in 2004 were achieved at Northeast Brook (Trepassey) (167%) and Conne River (160%), with approximately 51% attained at Rocky River. Rocky River has yet to achieve its conservation level, while Conne River has met its requirement in nine of the past 13 years since the commercial salmon fishery moratorium began.

**Southwest Newfoundland (SFAs 12-13)**

Seven rivers were assessed in SFA 13 (Fig. 2). 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.

***Status*** - Returns of small salmon increased substantially in all seven monitored rivers, both in comparison to 2003 and to the 1997-2003 mean, and were the highest recorded in Highlands, Crabbes and Harry's rivers (Table 1). The returns of large salmon were variable among the seven monitored rivers. Highlands and Harrys rivers experienced the highest returns of large salmon on record; while Robinsons River and Middle Barachois Brook showed declines, which were the second and third lowest respectively since 1996 (Table 1). The returns of large salmon to Crabbes River, Fischells, Brook, and Flat Bay Brook increased compared to 2003. The returns of large salmon to Crabbes River being the second highest recorded since 1996.

There was an increase in the estimated egg deposition for all seven monitored rivers in 2004, with record high egg depositions estimated for Highlands, Crabbes and Harry's rivers. The conservation egg deposition requirements were achieved or approximated in all rivers except Middle Barachois Brook and Harry's River. For Highlands River, the conservation spawning requirements were exceeded (155%) or approximated (99%) for the second time in

seven years. In 2004, Crabbes River exceeded (123%) its conservation egg deposition requirement for the first time since surveys began in 1996.

The egg deposition on Middle Barachois Brook remains low (79%) and there is concern that this stock did not increase to the extent observed in other nearby rivers. One possible explanation is that the stock has not recovered from the severe habitat disturbance that occurred during the flood in 1996. The annual egg deposition in Fischells Brook appears to have extreme fluctuations. No direct information is available explain these fluctuations.

The egg deposition in Robinsons River has increased for the past two years from a low of 82% of its conservation level in 2001. The egg deposition in 2004 was the third highest recorded, 1996-2004. Although the egg deposition in Harrys River remains below its conservation level (91%), there has been an increasing trend since 2000.

***Northwest Newfoundland (SFA 14A)***

Three rivers were assessed (Fig. 2). Lomond River, Torrent River, and Western Arm Brook using fish counting facilities.

***Status*** - Returns, in 2004, of small salmon increased for Torrent River (25%) but declined for Lomond River (-5%) and Western Arm Brook (-18%) as compared to 2003. Returns, in 2004, of large salmon increased in all three rivers as compared to 2003. Increases ranged from 74%, 101% and 546% for Western Arm Brook, Lomond River and Torrent River respectively.

Conservation spawning requirements were exceeded in all three assessed stocks in 2003 and have done so in all years (except Lomond River in 2001) since the closure of the commercial salmon fishery (Fig. 2, Table 1). Torrent River is an enhanced (colonized) stock and Lomond River is a stock that has benefited from construction of a fishway to improve fish passage.

In spite of greatly increased spawning escapements for Lomond River and Torrent River in 1992-1996, immediate benefits of closure of the commercial fisheries, there has been no corresponding increase in adult (small salmon) recruitment, which should have started in 1997. Western Arm Brook showed an increase over the period.

## *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 2004 increased in four out of five stocks, by comparison with 2003. Increases ranged from 11% at Conne River to more than 40% at both Northeast Brook (Trepassey) and Western Arm Brook. At Rocky River, assuming the 2003 smolt count was correct (4440), then the run in 2004 increased by almost a factor of three (Fig. 8). In contrast, smolt production at Campbellton River decreased by 6.6% relative to the previous year. With the exception of Campbellton River, the other four stocks have smolt production values in 2004 that are 9 to 62% higher than corresponding average values for the 5-year period 1999 to 2003. Four of the five rivers experienced peak production in 1997. At Campbellton River, where smolt production declined, returns of small salmon in 2005 are expected to be lower unless there is a compensatory increase in marine survival.

## ***Marine survival***

Marine survival, corresponding to adult small salmon returns in 2004, averaged 6.6% across all five rivers, ranging from a high of 9.5% at Western Arm Brook, to a low of 3.8% at Rocky River (Fig. 9). Overall, survival increased (Conne River, Northeast Brook, Trepassey, Campbellton River) or remained approximately the same (Western Arm Brook; Rocky River) by comparison with the previous year with the greatest improvements occurring at two south coast monitored rivers (Conne River and Northeast Brook (Trepassey).

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.

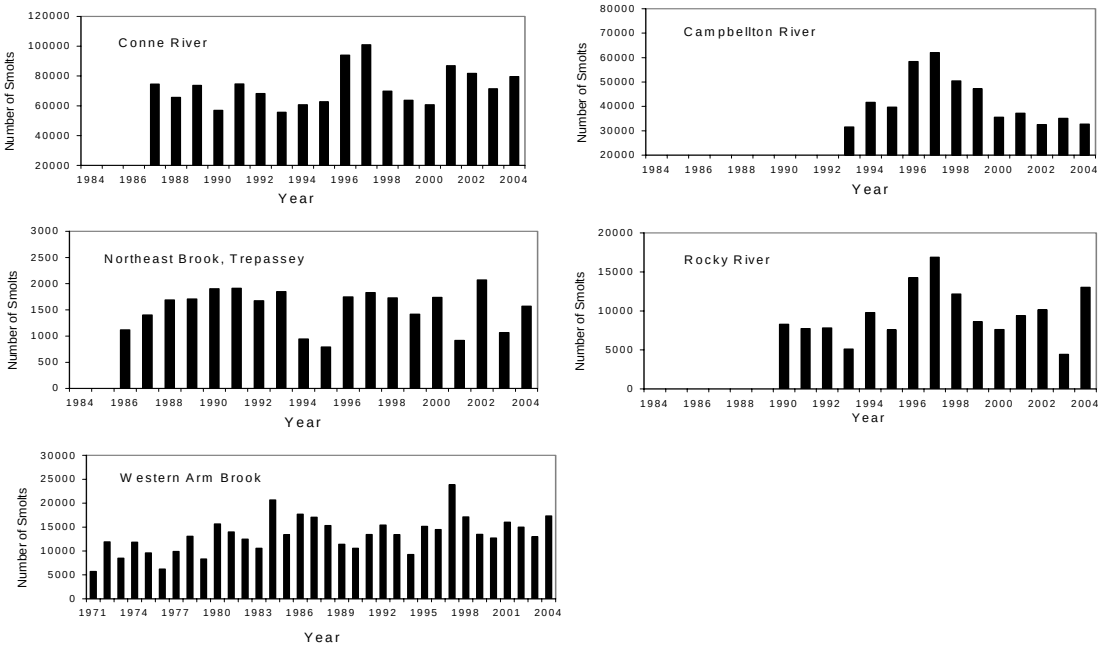


Figure 8. Trends in smolt production from various Newfoundland Atlantic salmon rivers.

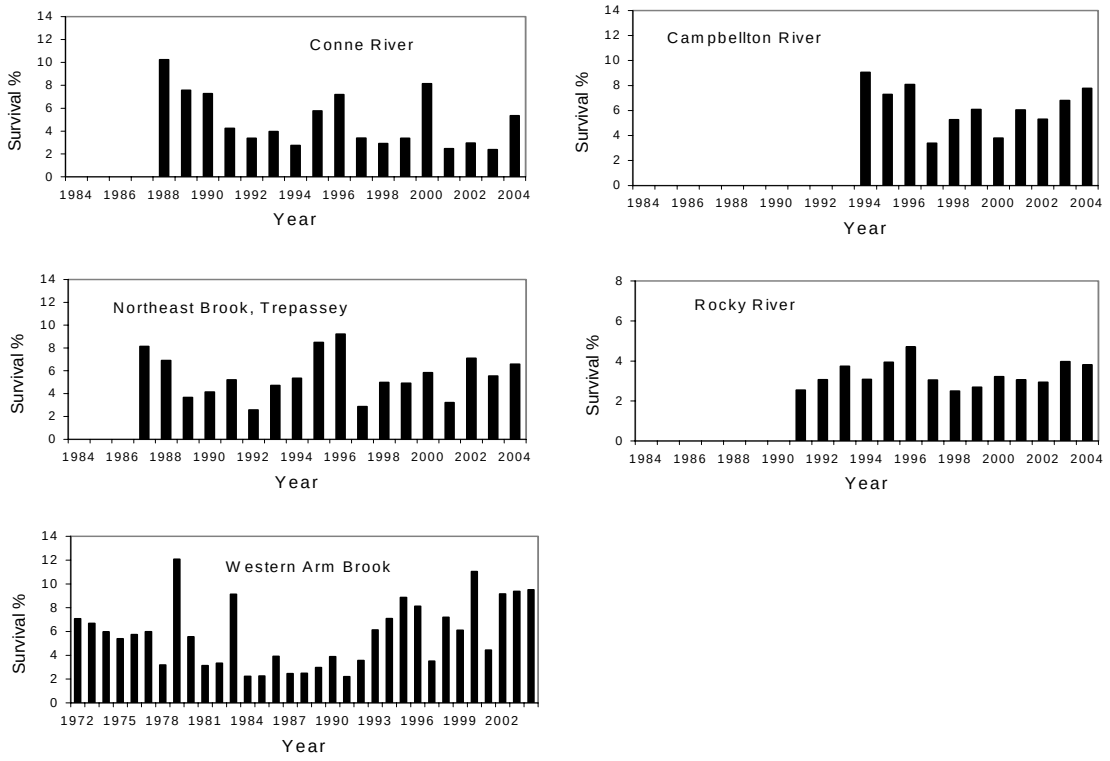


Figure 9. Marine survival rates for adult small salmon at various Newfoundland rivers. Survival rates have not been adjusted for marine exploitation in years prior to 1992 when commercial fisheries for salmon occurred. Thus, values represent actual survival of salmon back to the river or local home waters.

## *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.

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.

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

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 rivers.

Biological conservation levels or management reference levels need to be developed for Labrador stocks. Advice for management is constrained without a meaningful spawning stock reference level.

## *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 appears high in some areas. These should be minimised.

Recently, there was some concern about salmon by-catch in bait-nets. The advice provided in CSAS (2002) is still relevant. Based on studies by Reddin et al. (2002), and Anon. (2002c), setting bait-nets parallel to shore, with head ropes one fathom below the surface would minimize salmon by-catch. Also bait nets should be kept away from salmon rivers and areas where salmon are concentrated.

In **Labrador** (SFAs 1-2) overall, salmon abundance as evidenced by returns to four counting facilities, appears to be low considering closure of commercial fisheries in 1998. Concern is expressed for apparent low abundance of larger 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.

The declining trend of salmon returns to English River, SFA 1, for the last four years is of particular concern. The stock appears to be at a seriously low level. Special management measures are warranted.

There is no information available to ascertain whether or not the returns to English River are indicative of low returns to other rivers in SFA 1. However, returns to Big Brook also in SFA 1 when last measured in 2000 were low compared to conservation requirements (Reddin et al. 2001). Caution is advised when setting the level of fishing mortality in SFA 1, for 2005.

In **Northeast and Eastern** (SFAs 3-8), the improvement in the status of salmon in Northwest River (Port Blandford) in 2003 and 2004, appears to be attributed in part to conservation/recovery plan established for the resource since 2002.

Compared to 2003, salmon spawning populations assessed in SFAs 4-5 improved in 2004 with the exception of the Exploits River.

Gander River met conservation requirements for the first time in five years in 2004 and only achieved its requirements in 6 of 13 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.

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) has averaged 633 spawners from 1993-2004; in 2004 this section of the watershed only received 203 spawners. 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. There should be no increase in mortality.

The management plan in effect at Conne River in 2004 could continue in 2005. Specifically, the recreational fishery should not open until June 21, and only if at least 425 salmon have entered the river by that date. In addition, the river should be closed from July 5 to July 8, 2005, for Science to conduct 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 in 2003 and 2004, 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. Information from Middle Barachois Brook indicates that 27% of virgin 2-sea-winter salmon are only 60-63 cm upon entering freshwater. This may also apply to other early-run salmon rivers in the area and needs to be investigated. The increase in returns of small salmon in 2004 to Bay St. George rivers may indicate an improvement in returns of large salmon in 2005.

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 be have been successful on Harrys River, and may have contributed to the increases observed in other Bay St. George rivers in 2004. 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 2005

In **Northwest Newfoundland** (SFA 14A), assessed rivers had returns that exceed their conservation requirements, thus there is potential for increased harvest. However, there is concern as to whether or not this can be extrapolated to other rivers. Given the high annual variability in marine survival and declining stocks, caution should be exercised when considering any change in fisheries management measures.

**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.

## *For more Information*

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This report is available from the:

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ISSN 1480-4913 (Printed)


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

## *Correct Citation for this publication*

DFO, 2004. Newfoundland and Labrador Atlantic Salmon 2004 Stock Status Update. Can. Sci. Advis. Sec. Stock Status Update 2004/040.

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 when reported. Refer to footnotes for definition of characters and abbreviations.

| Region / River | Map SFA | Map Index | Method | Total Returns 2004 Small | 2004 Large | 2003 Small | 2003 Large | 1992-03 Small | 1992-03 Large | Conservation met (%) 2004 | 2003 | 1992-03 | 1992-04 | Status in 2004: Smolts Relative to: 2003 | 1992 - 03 | Marine Survival Relative to: 2003 | 1992 - 03 | Egg Deposition Relative to: 2003 | 1992 - 03 | Egg Dep% Change 2003 | 1992-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Labrador** | | | | | | | | | | | | | | | | | | | | | |
| Sand Hill River | 2 | 1 | Fe | 4108 | 605 | 3171 | 627 | 2921 | 578 | | | | | | | | | | | | |
| Muddy Bay Brook | 2 | 2 | Fe | 454 | 28 | 394 | 31 | 250 | 21 | | | | | | | | | | | | |
| Southwest Bk. (Paradise River) | 2 | 3 | Fe | 615 | 54 | 158 | 16 | 231 | 26 | | | | | | | | | | | | |
| English River | 1 | 4 | Fe | 56 | 25 | 108 | 19 | 190 | 31 | | | | | | | | | | | | |
| **Newfoundland** | | | | | | | | | | | | | | | | | | | | | |
| **Northeast Coast** | | | | | | | | | | | | | | | | | | | | | |
| Exploits River | 4 | 1 | Fw | 26998 | 949 | 29070 | 1336 | 20605 | 1183 | 49 | 54 | 39 | 0 of 13 yrs | | | | | ⇔ | ⇧ | -9% | 26% |
| Lower | 4 | | Fw | | | | | | | 142 | 156 | 115 | 9 of 13 yrs | | | | | ⇔ | ⇧ | -9% | 23% |
| Middle | 4 | | Fw | | | | | | | 37 | 39 | 27 | 0 of 13 yrs | | | | | ⇔ | ⇧ | -5% | 37% |
| Upper | 4 | | Fw | | | | | | | 2 | 7 | 8 | 0 of 13 yrs | | | | | ⇩ | ⇩ | -71% | -75% |
| Campbellton River | 4 | 2 | Fe | 2726 | 161 | 2219 | 152 | 2688 | 267 | 208 | 193 | 231 | 12 of 12 yrs | ⇔ | ⇩ | ⇧ | ⇧ | ⇔ | ⇔ | 8% | -10% |
| Gander River * | 4 | 3 | EFw | 18521 | 2668 | 13657 | 1853 | 17636 | 2297 | 114 | 81 | 97 | 6 of 13 yrs | | | | | ⇧ | ⇧ | 41% | 18% |
| Middle Brook | 5 | 4 | Fw | 1539 | 88 | 1182 | 74 | 1691 | 128 | 163 | 134 | 186 | 13 of 13 yrs | | | | | ⇧ | ⇩ | 22% | -12% |
| Terra Nova | 5 | 5 | Fw | 3036 | 399 | 2279 | 330 | 2042 | 377 | 54 | 42 | 35 | 0 of 13 yrs | | | | | ⇧ | ⇧ | 29% | 55% |
| Northwest River (Port Blandford) | 5 | 6 | Fe | 1207 | 265 | 1012 | 273 | 471 | 140 | 92 | 81 | 40 | 0 of 10 yrs | | | | | ⇧ | ⇧ | 14% | 130% |

Assessment Fe = counting fence MR = mark-recapture

Methods: 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.

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 when reported. Refer to footnotes for definition of characters and abbreviations.

| Region | Map | | | Total Returns 2004 | | 2003 | | 1992-03 | | Conservation met (%) | | | | Status in 2004: Smolts Relative to: | | Marine Survival Relative to: | | Egg Deposition Relative to: | | % Change | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| River | SFA | Index | Method | Small | Large | Small | Large | Small | Large | 2004 | 2003 | 1992-03 | 1992-04 | 2003 | 1992 - 03 | 2003 | 1992 - 03 | 2003 | 1992 - 03 | 2003 | 1992-03 |
| **South Coast** | | | | | | | | | | | | | | | | | | | | | |
| Northeast Brook (Trepassey) | 9 | 7 | Fe | 70 | 11 | 115 | 11 | 78 | 12 | 167 | 285 | 200 | 13 of 13 yrs | ⇧ | ⇔ | ⇧ | ⇧ | 🡻 | 🡻 | -41% | -17% |
| Rocky River | 9 | 8 | Fe | 169 | 235 | 402 | 73 | 317 | 69 | 51 | 50 | 40 | 0 of 13 yrs | ⇧ | ⇧ | ⇔ | ⇧ | ⇔ | ⇧ | 2% | 28% |
| Little River | 11 | 9 | Fe | 656 | 31 | 322 | 13 | 301 | 42 | 295 | 144 | 140 | 7 of 13 yrs | | | | | ⇧ | ⇧ | 105% | 111% |
| Conne River | 11 | 10 | Fe | 3818 | 175 | 1953 | 51 | 2866 | 162 | 160 | 81 | 124 | 9 of 13 yrs | ⇧ | ⇔ | ⇧ | ⇧ | ⇧ | ⇧ | 98% | 29% |
| **Southwest Coast** | | | | | | | | | | | | | | | | | | | | | |
| Highlands River | 13 | 11 | Fe | 507 | 252 | 294 | 166 | 172 | 112 | 155 | 99 | 64 | 2 of 12 yrs | | | | | ⇧ | ⇧ | 57% | 142% |
| Crabbes River | 13 | 12 | Sc | 2135 | 272 | 1105 | 265 | 837 | 231 | 123 | 81 | 56 | 1 of 9 yrs | | | | | ⇧ | ⇧ | 52% | 120% |
| Middle Barachois | 13 | 13 | Sc | 1082 | 98 | 740 | 104 | 832 | 123 | 79 | 61 | 66 | 0 of 8 yrs | | | | | ⇧ | ⇧ | 30% | 20% |
| Robinsons River | 13 | 14 | Sc | 1993 | 167 | 1212 | 182 | 1294 | 210 | 132 | 94 | 87 | 4 of 8 yrs | | | | | ⇧ | ⇧ | 40% | 52% |
| Fischells Brook | 13 | 15 | Sc | 1254 | 190 | 1071 | 180 | 838 | 136 | 99 | 86 | 56 | 2 of 8 yrs | | | | | ⇧ | ⇧ | 15% | 77% |
| Flat Bay Brook | 13 | 16 | Sc | 2122 | 192 | 1537 | 189 | 1646 | 228 | 126 | 99 | 78 | 3 of 8 yrs | | | | | ⇧ | ⇧ | 27% | 62% |
| Harry's River | 13 | 17 | Fe | 2828 | 498 | 2334 | 422 | 1629 | 158 | 91 | 82 | 46 | 0 of 13 yrs | | | | | ⇧ | ⇧ | 11% | 98% |
| **Northwest Coast** | | | | | | | | | | | | | | | | | | | | | |
| Lomond River | 14A | 19 | Fw | 928 | 101 | 972 | 81 | 1048 | 86 | 134 | 129 | 139 | 12 of 13 yrs | | | | | ⇔ | ⇔ | 4% | -4% |
| Torrent River | 14A | 20 | Fw | 4927 | 546 | 3938 | 336 | 4550 | 461 | 685 | 496 | 687 | 13 of 13 yrs | | | | | ⇧ | ⇔ | 38% | 0% |
| Western Arm Bk | 14A | 21 | Fe | 1151 | 74 | 1406 | 23 | 1053 | 46 | 425 | 466 | 364 | 13 of 13 yrs | ⇧ | ⇧ | ⇔ | ⇧ | ⇔ | ⇧ | -9% | 17% |

Assessment Methods: Fe = counting fence; Fw = fishway count; Sc = snorkel count; MR = mark-recapture; EFw = estimated from tributary fishway count in 2000

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

Footnotes:
Map index numbers refer to text figure and legend.
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