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Estimates of Conservation Spawner Requirements for Atlantic Salmon (*Salmo salar* L.) for Canada

by

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Abstract

Conservation egg and spawner requirements for Atlantic salmon were estimated for rivers in Atlantic Canada. These estimates were provided in response to a request from the International Council for the Exploration of the Sea (ICES) Working Group on North Atlantic Salmon and were based on the best information available at the time. While ICES requested estimates specifically for the 2SW component, an attempt was made to derive spawner requirements for as many of the various life-history components (1SW, MSW, repeat spawners, etc.) of each stock as possible. There was no consistency among rivers in this regard due to variation in the quantities and kinds of information available. Presented for the first time is a comprehensive list of references documenting the methodologies and origins of parameter values used for the derivation of egg and spawner requirements throughout Atlantic Canada. The process of providing conservation requirements is an evolving one and periodic updates will occur as data deficiencies are overcome.

Résumé

La ponte et le nombre de géniteurs de saumons de l'Atlantique nécessaires pour assurer la conservation ont été estimés pour certaines rivières du Canada atlantique. Ces estimations ont été fournies à la demande du Groupe de travail du saumon de l'Atlantique Nord du Conseil international pour l'exploration de la mer (CIEM) et reposent sur les meilleures informations alors disponibles. La demande du CIEM portait spécifiquement sur la composante des dibermarins, mais nous avons tenté de déterminer les besoins en géniteurs pour le plus de composantes possibles (unibermarins, pluribermarins, géniteurs ayant déjà frayé, etc.) pour chaque stock. Il n'y avait pas d'uniformité entre les rivières à cet égard étant donné la variabilité tant de la quantité que du type de renseignements disponibles. On trouvera cependant, pour la première fois, une liste détaillée de références renvoyant aux méthodologies et aux origines des valeurs des paramètres ayant servi au calcul des besoins en matière de ponte et de géniteurs dans tout le Canada atlantique. Le processus de la détermination des besoins de la conservation est évolutif et des mises à jour seront faites périodiquement à mesure que les carences liées aux données seront éliminées.

INTRODUCTION

In response to a request from the International Council for the Exploration of the Sea (ICES) Working Group on North Atlantic Salmon, this paper presents estimates of two-sea-winter (2SW) Atlantic salmon conservation spawner requirements for Atlantic Canada. Previously, requirements for some areas were in terms of the large salmon (≥ 63 cm in length) category as a whole and not the 2SW component specifically. The large salmon category can contain varying proportions of virgin and repeat spawning one-sea-winter (1SW) salmon and virgin and repeat spawning multi-sea-winter (MSW: 2SW, 3SW) salmon. Small salmon (< 63 cm) are primarily virgin 1SW salmon with varying proportions of repeat spawning 1SW fish. The various methodologies and rationales used in the development of 2SW conservation requirements are referenced and documented.

While ICES requested estimates for the 2SW component of spawners, the conversion of egg requirements to spawners for each region was based on the underlying conservation principle that all available mature life-history groups should contribute to spawning escapement. Relative proportions of these groups, which are quite variable throughout eastern Canada, have been modified by size selective fisheries in the marine environment. With the closure of most marine fisheries in eastern Canada in recent years, it is not known how close relative proportions in current river returns reflect the pre-exploited situation. For many stocks in the Maritime Provinces and Quebec, 1SW salmon are predominantly males; the egg requirement comes from MSW salmon (e.g., Cairns et al. MS 1996; Chaput et al. MS 1996; Locke et al. MS 1996). This approach provides a balance between biological requirements and harvest requirements. In insular Newfoundland, except for Bay St. George, the egg requirement comes from 1SW salmon (predominantly female) with the contribution from MSW salmon and repeat spawners serving as a buffer (O'Connell and Dempson MS 1991a,b). In Bay St. George (Reddin and Mullins MS 1996) and Labrador (Lowe and Mullins MS 1996; Reddin et al. MS 1996), there is an additional requirement for MSW salmon.

METHODS

Fig. 1 is a map showing the Salmon Fishing Areas (SFAs) of Newfoundland and Labrador and the Maritime Provinces, and the Salmon Management Zones (Qs) of Quebec.

Newfoundland and Labrador

Labrador

2SW requirement

The 2SW conservation requirements for rivers in SFAs 1 and 2 were previously derived on the basis of achieving 30% of the total returns in the spawning run (Anon. MS 1993). Habitat-weighted requirements were not derived as is commonly done for rivers in insular Newfoundland and Atlantic Canada because it has been demonstrated that the 1:250000 maps available for Labrador are

not of sufficient resolution to accurately estimate parr rearing habitat (Reddin et al. MS 1995). Thus, it was assumed that conservation requirements could best be derived from the average of 2SW returns in Labrador for 1974-78 (Anon. MS 1993). Conservation requirements for Labrador were imputed from the minimum and maximum values of total commercial catches in Labrador and part of the catch in Greenland for the period 1974-78 assuming an approximate 3:1 ratio (30%) of recruits:spawners, similar to that observed in other rivers in insular Newfoundland in recent years (O'Connell et al. MS 1995). The same approach was used in this paper with a couple of modifications. First, catch statistics were updated to reflect the current geographic boundaries of SFAs 1 and 2. Next the equation in Anon. (MS 1993) was adjusted to include SFA 14B salmon which is also in Labrador but was not included in the previous calculations. Conservation requirements were calculated for the three SFAs as a unit and then subdivided on the basis of the proportionate parr-rearing habitat in each SFA. While parr-rearing habitat from the 1:250000 maps is not of sufficient accuracy to be used as an absolute measure of habitat, they can be used as a relative index of the proportionate habitat in each SFA.

Spawner requirements were estimated from minimum and maximum values of total returns for 2SW Labrador-origin stocks for the period of 1974-78. Total returns prior to the Labrador commercial fishery were derived from commercial catches of large salmon in Labrador adjusted to reflect numbers of Labrador-origin 2SW salmon. To these were added the Labrador-origin portion of the catch in Greenland, discounted for 10 months of natural mortality. The equation is:

$$\text{Min. value} = \{(AR_{2SW}) + [(AC_{1SW}) \times (AF_{RA>3})] \times (AF_{2SW})\} \quad (1)$$

where,

AR_{2SW} = Average of the minimum 2SW salmon returns in Labrador for 1974-78

AC_{1SW} = Average catch of North American-origin 1SW salmon with river age > 3 caught at Greenland (1973-77), discounted for 10 months of natural mortality (10%) = 59381

$AF_{RA>3}$ = Assumed fraction of Labrador-origin salmon with river age > 3 of total production = 0.7

AF_{2SW} = Average fraction of 2SW salmon in the spawning run of the total returns = 0.30

The maximum value is derived using the maximum returns to Labrador rivers prior to commercial fishing and the mid-point is derived as the average of the minimum and maximum values.

The bases for the parameter values used in equation 1 are:

1. Average of the minimum 2SW salmon returns in Labrador for 1974-78 in SFAs 1, 2, and 14B is from Anon. (MS 1996).

2. Average catch of North American origin 1SW salmon with river age > 3 years caught at Greenland (1973-77) was calculated using data from Anon. (MS 1993). Basic steps were the quotas in weight converted to numbers of salmon by dividing by the mean weights. Numbers of salmon were converted to numbers of North American-origin 1SW salmon with river age > 3 years. There were [(54336+58455+96757+40689+46668)/5] = 59381 salmon.

3. Rate of natural mortality (10%) for Atlantic salmon for the 10 months from the time of the West Greenland fishery and the return to homewaters is from Doubleday et al. (MS 1979). In homewaters there would be 59381 x 0.9 = 53443 salmon.

4. The fraction of Labrador-origin salmon (river age > 3) of 0.7 was assumed (Anon. MS 1993).

5. Average fractions of SFAs 1, 2, and 14B parr-rearing habitat of the Labrador total. Anon. (MS 1978) and Anderson (1985) list parr rearing habitat for Labrador rivers, which although suitable for comparing habitat on a proportionate basis, is unsuitable for deriving conservation requirement due to a lack of detail on the maps. SFA 1 has 252000 units (unit = 100 m^2) (23%), SFA 2 has 801000 units (63%), and SFA 14B has 50000 units (4%) for a total of 1.103 million units.

6. Average fraction of 2SW salmon in the spawning run of the total number of salmon produced was derived from data in Anon. (MS 1995). Recruits per spawner were calculated by lagging spawners by their appropriate sea age and weighting them by the river-age distribution by region. The average for Labrador-origin salmon stocks for spawning years 1974 -78 is 0.3 spawners per recruit.

Large salmon

Conservation requirements for large salmon in Labrador can be derived by multiplying the values for 2SW salmon by 1.3875.

1SW

One-sea-winter conservation requirements were estimated from minimum and maximum values of total returns for Labrador origin stocks for the period of 1974-78 using the same approach as for 2SW salmon. Total returns prior to the Labrador commercial fishery were derived from commercial catches of large salmon in Labrador adjusted to reflect numbers of Labrador-origin 1SW salmon (this paper). The equation is:

$$\text{Min. value} = AR_{1SW} \times AF_{1SW} \qquad (2)$$

where,

AR_{1SW} = Average of the minimum 1SW salmon returns in Labrador for 1974-78

AF_{1SW} = Average fraction of 1SW salmon in the spawning run of the total returns = 0.43

The maximum value is derived using the maximum returns to Labrador rivers prior to commercial fishing and the mid-point is derived as the average of the minimum and maximum values.

The bases for the parameter values used in equation 2 are:

1. Average of the minimum and maximum 1SW salmon returns in Labrador for 1974-78 in SFAs 1, 2, and 14B is from Anon. (MS 1996).

2. As in item number 5 above for 2SW salmon.

3. Average fraction of 1SW salmon in the spawning run of the total number of salmon produced was derived from data in this paper. Recruits per spawner were calculated by lagging spawners by their appropriate sea age and weighting them by the river age distribution by region. The average for Labrador origin salmon stocks for spawning years 1974-78 is 0.43 spawners per recruit.

Small salmon

Estimates of for 1SW salmon are equivalent to small salmon.

Insular Newfoundland

Details of the calculations of the amounts of accessible fluvial and lacustrine habitats and estimates of egg requirement for each SFA are provided in the references and footnotes shown in Table 1. The methodology for the development of the biological parameter values used is presented in O'Connell and Dempson (1995). Drainage area calculations are from Porter et al. (MS 1974a-d). Essentially, conservation egg deposition requirement was determined as the product of the number of fluvial habitat units (unit = 100 m^2) and an egg deposition rate of 240 eggs/unit plus the product of the number of hectares of lacustrine habitat and an egg deposition rate of 368 eggs/ha (Anon. MS 1991).

For the present exercise, a conservation requirement for the large salmon category will be developed for each river and the number of 2SW salmon in the large category will be determined. This is a departure from the current situation for insular Newfoundland, where for most SFAs egg requirements come from small salmon only, with egg deposition from large salmon providing a buffer (O'Connell and Dempson MS 1991a,b). Conservation requirements for small and large salmon and the 2SW component for each river were calculated using the following equations:

$$S = E/[(P_{small} \times W_{small} \times PF_{small} \times RF) + (P_{large} \times W_{large} \times PF_{large} \times RF)] \quad (3)$$

where,

S = total number of spawners
E = egg requirement

P_{small} and P_{large} = proportion of small (< 63 cm) and large (≥ 63 cm) salmon in total river returns
W_{small} and W_{large} = mean weight (kg) of female small and large salmon
PF_{small} and PF_{large} = proportion of female small and large salmon
RF = relative fecundity (eggs/kg)

$$N_{small} = S \times P_{small} \quad (4)$$

$$N_{large} = S \times P_{large} \quad (5)$$

$$N_{2SW} = S \times P_{large} \times P_{2SW} \quad (6)$$

where,

N_{small}, N_{large}, and N_{2SW} = number of small, large, and 2SW spawners, respectively
P_{2SW} = proportion of 2SW spawners in the large salmon category

Where river-specific data were available, average values for the period 1992-95 for proportions of small and large salmon in total river returns (Appendix 1a) and mean weight and proportion of female small salmon (Appendix 1b) were used. Where river-specific data were not available for small salmon, data combined for all rivers and years in the entire SFA were used in default. The averages for the period 1992-95 were used for small salmon because these years correspond to the commercial Atlantic salmon fishery moratorium in insular Newfoundland (O'Connell et al. MS 1996). Because of small sample sizes during the moratorium years, values of biological characteristics used for large salmon for SFAs 3-11 (Appendix 1c) and SFAs 12-14A (Appendix 1d) were averages for all available rivers and years combined. Relative fecundity values (Appendix 1b) used for small salmon also applied to large salmon for a given river.

For SFSs 3, 6, 7, 8, 11, 12, 13, and 14A, estimates of small and large salmon conservation requirements were taken from Anon. (MS 1986a). The estimates from Anon. (MS 1986a) were updates from Anon. (MS 1978) incorporating estimates of conservation requirements for lacustrine habitat and newly colonized areas. Estimates of 2SW conservation requirements were obtained by applying the average proportions of 2SW salmon in the large salmon category presented in Appendix 1c and d.

Maritime Provinces

SFAs 15 - 17

Methodology for the calculation of the amount of accessible fluvial habitat (lacustrine habitat not considered) and estimates of conservation egg requirement for SFAs 15, 16, and 17 are provided in the references and footnotes shown in Tables 3-5. Conservation egg deposition requirement was the product of the number of fluvial rearing units and an egg deposition rate of 240 eggs/unit (Anon.

MS 1991). For these SFAs, egg deposition comes from large salmon; 1SW salmon are designated for male contributions.

The numbers of 2SW, 3SW, and repeat spawning large salmon required for rivers in SFA 15 were calculated from the following equations:

$$N_{2SW} = E/[(P_{2SW} \times ES_{2SW}) + (P_{3SW} \times ES_{3SW}) + (P_{RS} \times ES_{RS})] \times P_{2SW} \quad (7)$$

$$N_{3SW} = E/[(P_{2SW} \times ES_{2SW}) + (P_{3SW} \times ES_{3SW}) + (P_{RS} \times ES_{RS})] \times P_{3SW} \quad (8)$$

$$N_{RS} = E/[(P_{2SW} \times ES_{2SW}) + (P_{3SW} \times ES_{3SW}) + (P_{RS} \times ES_{RS})] \times P_{RS} \quad (9)$$

where,

P_{2SW}, P_{3SW}, and P_{RS} = overall proportion of 2SW, 3SW, and repeat spawners, respectively
ES = eggs per spawner

Conservation requirements for SFAs 16 and 17 were calculated the same as for SFA15, except the terms in the equation for 3SW salmon did not apply. Biological characteristics for Restigouche River were used for all rivers in SFA 15 (Appendix 2a for mean fork length, percent overall, percent female, and ES; Appendix 2b for percentage of each life-history group). For SFA 16, conservation requirements were determined only for Miramichi River using average biological characteristics for the period 1984-89 (Appendix 3). For SFA 17, average biological characteristics for all rivers combined in the SFA (Appendix 4) were used to calculate river-specific conservation requirements. Eggs per spawner (ES) for Restigouche River comes from Randall (MS 1984) and that of Miramichi River from Randall (1989). Details of eggs per spawner calculations for SFA 17 are provided in Appendix 4.

SFAs 18 - 23

Estimates of juvenile salmon rearing units (unit = 100 m^2) for SFAs 18-23 were based mainly on remote measured areas of riverine (> 0.12% and < 25% orthophotographic map grade) substrate (Amiro 1993). Area is the product of gradient classified stream lengths measured on 5 m contoured 1:10000 orthophotographic maps and widths measured from colour 1:10000 air photography.

Fluvial habitat for rivers in Nova Scotia without remote measures (Northumberland Strait) was estimated from calculations of drainage area and measures of surveyed substrate in a near-by river basin. Drainage areas were taken from maps and tables produced by Maritime Resource Management Services, Amherst, N.S. Rearing area was derived as the product of the drainage area (km^2) and the proportion of a known substrate area of its drainage basin area. Most field estimates of production area, including those replaced by remote measured areas, were completed in the 1950s and early 1960s and frequently exclude small tributaries and habitats such as flats, stillwaters, and bedrock substrate.

Conservation requirements for 2SW salmon for SFAs 18-23 (Anon. MS 1978; MS 1986b; MS 1993; MS 1995; MS 1996) were revised on the basis of new physical and biological data. Requirements in general were based on estimated rearing units and a required egg deposition of 240 eggs/unit (Anon. MS 1991) and biological characteristics of selected populations (Appendix 5). Biological characteristics include fecundities of small and large salmon (usually from a fecundity-length relationship), proportion of males and females in each sea-age component, and proportion of 2SW fish among large salmon. Citations in Appendix 5 frequently reflect charcteristics of earlier data when in-river samples sometimes represented post-fishery populations. Data are presented for: the East River Pictou, River Philip, South and Margaree rivers (SFA 18); St. Mary's and Liscomb rivers (SFA 20); LaHave (SFA 21); Saint John River above Mactaquac and Nashwaak River [Saint John River below Mactaquac] (SFA 23) and, with the exception of Margaree River contribute to revisions of 2SW spawners required for conservation.

In general, conservation egg requirements were sought from returning females in proportion to their abundance and fecundity by sea-age, i.e., parameters needed include proportion of each sea-age group, and proportion of females and eggs per female within each sea-age group. Populations dominated by large salmon (SFAs 18, 19, and the outer-Fundy portion of SFA 23) tend to be of high female composition (80-95%) and consequently provide the bulk of the egg deposition. One-sea-winter fish in these populations are generally few, predominantly males (70-90%), and make only a minor contribution to egg depositions. One-sea-winter males, however, were frequently included in spawning requirements to provide a 1:1 male:female ratio in the escapement. Populations in SFAs 20, 21, 22, and the inner-Fundy portion of SFA 23 are dominated by 1SW fish. Male:female ratios among 1SW and MSW fish of these populations range from 0.40:0.60 to 0.60:0.40 and do not require additional males. The calculation of conservation requirements of small, large, and 2SW salmon essentially followed the same procedures as outlined above. The proportions of 2SW fish among large salmon were based on data from one or a few populations within the SFA and are presumed to be representative of unsampled populations. Derivation of spawning requirements are shown for LaHave and Saint John rivers (Appendix 5).

Quebec

Egg depositions for zones Q1-Q11 come from large salmon only and are expressed in terms of units (unit = 100 m^2) of accessible fluvial habitat and an egg deposition rate of 240 eggs/unit. Target numbers of 2SW, 3SW, and repeat spawning large salmon required for rivers in zones Q1-Q10 were calculated according to the following equations:

$$N_{large} = E/(P_{large} \times W_{large} \times PF_{large} \times RF_{large}) \quad (10)$$

$$N_{2SW} = N_{large} \times P_{2SW} \quad (11)$$

$$N_{3SW} = N_{large} \times P_{3SW} \quad (12)$$

$$N_{RS} = N_{large} \times P_{RS} \quad (13)$$

where,

P_{2SW}, P_{3SW}, and P_{RS} = proportion of 2SW, 3SW, and repeat spawners, respectively in the large salmon category

RF_{large} = relative fecundity of large salmon (eggs/kg)

Conservation egg requirements and biological characteristics are presented in Appendix 6. A relative fecundity value of 1535 eggs/kg for large salmon was used for all rivers. The conservation requirement for Q11 comes from Anon. (MS 1986a).

CONSERVATION REQUIREMENTS

Newfoundland and Labrador

Labrador

2SW

The updated values for minimum, maximum, and average spawner requirements for SFAs 1, 2, and 14B are:

Minimum = {(Average of the minimum 2SW salmon returns in Labrador for 1974-78)

+ (Average catch at Greenland in 1973-77 with river age > 3 x 0.9 x 0.7)} x 0.3

= {((50030 + 47715 + 55186 + 48669 + 38644/5) + (59381 x 0.9 x 0.7)} x 0.3

= 25638

Maximum = 43851

Average = (25638 + 43851)/2

= 34745

A summary of the conservation requirements for 2SW salmon divided proportionately according to the parr-rearing habitat of 23% in SFA 1, 73% in SFA 2, and 4% in SFA 14B is as follows:

SFAs	Minimum	Maximum	Mid-point
1	5897	10086	7992
2	18716	32011	25364
14B	1026	1754	1390
Total	25639	43851	34746

1SW

The values for minimum, maximum, and average spawner requirements for Labrador 1SW salmon (SFAs 1, 2, and 14B) are:

Minimum = {(Average of the minimum 1SW salmon returns in Labrador for 1974-78) x 0.43}

= {(54068 + 107319 + 75081 + 66818 + 32310/5) x 0.43}

= 23089

Maximum = 62435

Average = (23089 + 62435)/2

= 42762

A summary of the new spawner requirements for 1SW Labrador salmon divided proportionately to the parr-rearing habitat of 23% in SFA 1, 73% in SFA 2, and 4% in SFA 14B is as follows:

SFAs	Minimum	Maximum	Mid-point
1	5310	12433	8872
2	16855	47405	32130
14B	924	2598	1761
Total	23089	62435	42762

Small and large salmon

Conservation requirements for the small and large salmon categories for Labrador are summarized in the following text table:

	SFA 1	SFA 2	SFA 14B	All SFAs
Small	8900	32100	1800	42800
Large	11100	35200	1900	48200
Total	20000	67300	3700	91000

The total numbers of small and large spawners required to meet conservation levels in Labrador are 91,000.

Insular Newfoundland

Lacustrine habitat determinations and egg requirements in terms of both fluvial and lacustrine habitats were available only for rivers in SFAs 4, 5, 9, and 10 (Table 1). Since lacustrine habitat determinations were not available for the remaining SFAs (except for a few isolated rivers), total egg requirement (fluvial plus lacustrine) could not be determined. Conservation requirements in terms of small and large salmon and the 2SW component of the large salmon category are presented in Table 2. Efforts are continuing to determine the amount of accessible lacustrine habitat for rivers in SFAs other than 4, 5, 9, and 10, and to replace estimates of fluvial habitat based on the ratio of fluvial habitat to watershed area (Table 1) with information from habitat surveys. For the time being however, conservation requirements for SFAs without lacustrine habitat information (Table 2) are those brought forward from Anon. (MS 1986a).

Maritime Provinces

SFAs 15 - 17

Accessible fluvial rearing habitat and conservation egg requirements for rivers in SFAs 15-17 are presented in Tables 3-5, respectively. Corresponding conservation spawning requirements for 2SW salmon and other life-history groups are provided in Tables 6-8, respectively.

SFAs 18 - 23

Accessible fluvial rearing area and conservation egg and spawner requirements for rivers in SFAs 18-23 are shown in Table 9.

Production areas of some small rivers of the inner Bay of Fundy, New Brunswick, have not been fully documented. These rivers and those of the inner Bay of Fundy, Nova Scotia (Fig. 1), produce very few 2SW fish and returns are primarily 1SW fish (and repeat spawning 1SW salmon) that are believed to confine their marine life to the Gulf of Maine and area. Many rivers in SFAs 20 and 21 are acid impacted. Requirements for all acid-stressed rivers remain at 240 eggs/unit (Anon. MS 1991), a full recovery scenario, but are under review. Although the pH in some of these streams currently precludes natural recruitment (Anon. MS 1988a), many are stocked with hatchery smolts so that returns can contribute to the preservation of depleted stocks or the maintenance of harvests. The egg requirement for the St. Croix River, a boundary river between Canada and United States, is for the entire drainage. Requirements for the Saint John River, New Brunswick include only waters (>0.12% gradient) within New Brunswick and below the barrier at Grand Falls.

Quebec

Conservation egg and spawner requirements for rivers in zones Q1-Q11 of Quebec are presented in Table 10.

DISCUSSION

This paper presents for the first time a comprehensive list of references documenting the methodologies and origins of parameter values used for the derivation of Atlantic salmon conservation spawning requirements for Canada. The development of requirements is a continuing and evolving process using the best information available at the time. It should be cautioned that there was no consistency across regions and rivers in the quantities and kinds of information used for these derivations. In many instances, habitat determinations were based on crude estimation techniques and spawner calculations relied on default biological characteristics, the extent of which is quite evident from the tables and appendices.

Ideally, conservation requirements should be based on river-specific stock-recruitment relationships (Chaput MS 1997; O'Connell and Dempson 1995). Except for Labrador, an egg deposition rate of 240/100 m^2 was applied throughout for fluvial habitat and an additional deposition rate of 368 eggs/ha of lacustrine habitat was used for insular Newfoundland. These parameter values were previously defined as levels required for the conservation of Atlantic salmon stocks for eastern Canada (Anon. MS 1991). The use of fixed parameter values and defaults could be risky, since these values are subject to inter-river and inter-annual variability (O'Connell and Dempson 1995). Conservation requirements for Atlantic salmon in eastern Canada were examined in relation to current thinking on conservation principles and concepts at a workshop held in Halifax, Nova Scotia, in March 1996. It is the intention to use the proceedings of this workshop (Chaput MS 1997) as a focus to set future direction for the derivation of requirements that would insure that conservation priciples are met while at the same time providing maximum benefits to users of the resource. An effort will be made to set conservation requirements and exploitation strategies that incorporate mechanisms to minimize risk.

As the data deficiencies identified above are gradually overcome and depending on future direction, conservation requirements will be periodically updated. The 2SW conservation requirement estimates for SFAs 18-23 presented at the ICES Working Group on North Atlantic Salmon meeting held in Moncton, New Brunswick, in April 1996 (Anon. MS 1996), were preliminary and have been updated in the present paper. For Labrador, in addition to 2SW salmon, conservation requirements for 1SW salmon and the small and large salmon categories have been included in the present document. In Anon. (MS 1996), the 2SW the requirement for St. Croix River was not included in the estimate for SFA 23, but is included in Table 9 of this paper.

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Table 1. Drainage area, fluvial and lacustrine rearing area, and Atlantic salmon conservation egg requirements for rivers in each SFA of insular Newfoundland.

SFA	River name	Drainage area (sq. km)	Fluvial rearing units (100 sq. m)	Lacustrine rearing area (ha)	Egg requirement (millions) Fluvial*	Lacustrine**	Total	References
SFA 3	West	254	975 (H)					1, 2
	Salmon	730	6440 (H)					1, 2
	Freshwater	75	412 (H)					1, 2
	Northeast	257	1391 (H)					1, 2
	Unnamed	189	924 (H)					1, 2
	Soufflets	393	1354 (H)					1, 2
	Little Harbour Deep	489	4725 (H)					1, 2
	Coney Arm	146	971 (H)					1, 2
	Main (Sop's Arm)	1048	17179 (H)	44917				1, 2
	Hampden	126	1075 (H)					1, 2
	Big Chouse	112	768 (H)					1, 2
	Wild Cove	133	189 (H)					1, 2
	Western Arm	74	525 (H)					1, 2
	Middle Arm	328	2133 (H)					1, 2
	Baie Verte	195	210 (H)					1, 2
	South	123	45 (H)					1, 2
	Paquet	119	378 (H)					1, 2
	Total		**39694**					
SFA 4	West	484	1620 (H)	2013	0.39	0.74	1.13	1,3a,4
	South	672	6050 (H)	3616	1.45	1.33	2.78	1,3a,4
	Tommy's Arm	242	3377 (H)	1157	0.81	0.43	1.24	1,3a,4
	West Arm	261	1469 (H)	779	0.35	0.29	0.64	1,3a,4
	New Bay	205	1984 (H)	2293	0.48	0.84	1.32	1,3a,4
	Northern Arm	181	2498 (H)	1009	0.60	0.37	0.97	1,3a,4
	Peter's	33	1737 (H)	442	0.42	0.16	0.58	1,3a,4
	Exploits	11272	347862 (H)	33758	83.49	12.42	95.91	5a
	Campbellton	295	5960 (H)	4037	1.43	1.49	2.92	6
	Horwood	364	1685 (H)	4173	0.40	1.54	1.94	1,3a,4
	Gander	6398	159560 (H)	21488	38.29	7.91	46.20	1,3a,4
	Ragged Harbour	440	3653 (H)	5742	0.88	2.11	2.99	1,3a,4
	Total		**537455**	**80507**	**128.99**	**29.63**	**158.62**	

Table 1 (cont'd)

SFA	River name	Drainage area (sq. km)	Fluvial rearing units (100 sq. m)	Lacustrine rearing area (ha)	Egg requirement (millions)			References
					Fluvial*	Lacustrine**	Total	
SFA 5	Indian Bay	703	3861 (H)	9878	0.93	3.64	4.56	1,3b,4
	Traverse	404	2639 (H)	4389	0.63	1.62	2.25	1,3b,4
	Middle	276	2640 (H)	4636	0.63	1.71	2.34	1,3b,4
	Gambo	1152	28940 (H)	4768	6.95	1.75	8.70	1,3b,4
	Terra Nova	1883	32659 (H)	17547	7.84	6.46	14.30	1,3b,4
	Northwest	689	3944 (H)	8489	0.95	3.12	4.07	7
	Salmon	110	892 (H)	1223	0.21	0.45	0.66	1,3b,4
	Southwest	491	3415 (H)	590	0.82	0.22	1.04	1,3b,4
	Total		**78990**	**51520**	**18.96**	**18.96**	**37.92**	
SFA 6	**Total**							
SFA 7	**Total**							
SFA 8	**Total**							
SFA 9	Biscay Bay	239	8175 (H)	2685	1.96	0.99	2.95	1,3a,4
	Northwest	178	7460 (H)	648	1.79	0.24	2.03	1,3a,4
	Peter's	144	4105 (H)	614	0.99	0.23	1.21	1,3a,4
	Salmonier	257	5145 (H)	912	1.23	0.34	1.57	1,3a,4
	Colinet	158	4228 (H)	1083	1.01	0.40	1.41	1,3a,4
	Rocky	296	10823 (H)	2191	2.60	0.81	3.40	5b
	North Harbour	73	912 (H,G)	63	0.22	0.02	0.24	1,3a,4
	Little Salmonier	123	4488 (H)	928	1.08	0.34	1.42	1,3a,4
	Big Barachois	83	1259 (H)	348	0.30	0.13	0.43	1,3a,4
	Branch	118	6412 (H)	150	1.54	0.06	1.59	1,3a,4
	Total		**53007**	**9622**	**12.72**	**3.54**	**16.26**	
SFA 10	Great Barasway	68	928 (H)	88	0.22	0.03	0.26	1,3a,4
	Southeast	140	2639 (H,G)	1128	0.63	0.42	1.05	1,3a,4
	Northeast	94	1352 (H,G)	1072	0.32	0.39	0.72	1,3a,4
	Come By Chance	64	3093 (H)	214	0.74	0.08	0.82	1,3a,4
	Black	200	1375 (H)	1446	0.33	0.53	0.86	1,3a,4
	Pipers Hole	781	8877 (H)	1184	2.13	0.44	2.57	1,3a,4
	Cape Roger	93	1284 (H)	398	0.31	0.15	0.45	1,3a,4
	Bay de L'Eau	152	3508 (H)	557	0.84	0.20	1.05	1,3a,4
	Total		**23056**	**6087**	**5.53**	**2.24**	**7.77**	

Table 1 (cont'd)

SFA	River name	Drainage area (sq. km)	Fluvial rearing units (100 sq. m)	Lacustrine rearing area (ha)	Egg requirement (millions) Fluvial*	Lacustrine**	Total	References
SFA 11	Garnish	212	7762 (H)					1,2
	Long Harbour	1002	30089 (H)					1,2
	Soutwest	162	267 (H)					1,2
	Rencontre	195	1621 (H)					1,2
	Northwest	86	300 (H)					1,2
	Bay du Nord	1171	2908 (H)					1,2
	Salmon	196	1292 (H)					1,2
	Bottom	175	524 (H)					1,2
	Little	183	928 (H)					1,2
	Conne	602	13180 (H)	3187				8
	Southwest	84	947 (H)					1,2
	Salmon	2708	500 (H)					1,2
	D'Espoir	285	266 (H)					1,2
	Dolland	688	1132 (H)					1,2
	Grey	2394	25725 (H)					1,2
	White Bear	2027	53624 (H)					1,2
	Kings Harbour	128	404 (H)					1,2
	Grandy's	264	24790 (H)					1,2
	Total		**166259**					
SFA 12	East Bay	57	1013 (R)					1
	LaPoile	588	21457 (G)	519				9
	Farmers Arm	89	1112 (H)					1,2
	Garia	228	4618 (H)					1,2
	Northwest, Garia	119	216 (H)					1,2
	Burnt Island	273	4850 (R)					1
	Isle aux Morts	214	3801 (R)					1
	Grand Bay	134	2380 (R)					1
	N.W. River, Grand Bay	65	1155 (R)					1
	Barachoix	49	870 (R)					1
	Total		**41472**					
SFA 13	Bear Cove	30	841 (D)					1,2
	Little Codroy	244	3890 (H)					10
	Grand Codroy	956	25963 (H)					10
	Highlands	183	6219 (G)	136				11
	Crabbes	551	18429 (H)	381				2,10
	Barachois	241	8395 (H)	362				2,10
	Robinsons	439	13491 (H)	124				11
	Fischells	360	13661 (H)	948				11
	Flat Bay	635	16012 (H)					10
	Little Barachois	354	7104 (H)					10
	S.W. & Bottom	814	18970 (H)					10
	Harrys	816	26394 (H)					10
	Romaines	98	4572 (G)					12
	Fox Island	194	6558 (H)					10
	Serpentine	433	17799 (H)					10
	Cooks	101	1474 (H)					10
	Humber	7,679	115307 (H)	1751				10
	Hughes	132	1550 (G)					13
	Goose Arm	212	1978 (H)					10
	Total		**308,607**					

Table 1 (cont'd)

SFA	River name	Drainage area (sq. km)	Fluvial rearing units (100 sq. m)	Lacustrine rearing area (ha)	Egg requirement (millions) Fluvial*	Lacustrine**	Total	References
SFA 14A	Trout	254	1120 (G)					14
	Lomond	470	5781 (G)	1570				1,2
	Deer Arm	126	2046 (G)					14
	Bakers	141	1567 (G)					14
	Western	192	2150 (G)	17				14
	Parsons Pond	389	4567 (R)					1
	Bound	66	1132 (G)					13
	Portland	985	3867 (G)					1,2
	River of Ponds	861	4364 (H)	7940				11
	Little Brook Ponds	76	218 (H)					1,2
	Torrent	619	5168 (H)	2323				1,2
	Big East	136	4585 (H)					1,2
	Doctors	79	534 (H)					1,2
	Castor	544	6387 (R)					1
	Ste. Genevieve	318	3734 (R)					1
	Western Arm	149	2900 (H)	2017				15
	Eastern Arm	43	505 (R)					1
	Eddies Cove	90	1057 (R)					1
	Big Brook	212	2489 (R)					1
	Watsons	95	1115 (R)					1
	Pincents	65	763 (R)					1
	Parkers	46	540 (R)					1
	Bartletts	40	470 (R)					1
	Upper	39	458 (R)					1
	East	61	716 (R)					1
	Total		**58,233**					

Notes: 1. Fluvial habitat was determined from: H = helicopter survey
G = ground survey
D = digital 1:50000 topographical maps
R = SFA ratio of fluvial habitat to drainage area x drainage area of individual river.

2. Lacustrine habitat was determined from 1:50000 topographical maps.

3. *Fluvial habitat: multiplier is 240 eggs/100 sq. m (Anon. MS 1991).
**Lacustrine habitat: multiplier is 368 eggs/ha (Anon. MS 1991).

References:

1- Porter et al. (MS 1974a-d); 2 - River files, unpublished; 3a - O'Connell and Dempson (MS 1991a); 3b - O'Connell and Dempson (MS 1991b); 4 - O'Connell and Dempson (1995); 5a - Bourgeois et al. (MS 1996a); 5b - Bourgeois et al. (MS 1996b); 6 - Reddin and Downton (MS 1994); 7 - Linehan and O'Connell (MS 1996); 8 - Dempson et al. (MS 1987); 9 - Mullins et al. (MS 1994); 10 - Porter and Chadwick (MS 1983); 11 - O'Connell and Ash (1993); 12 - Gibson et al. MS 1996; 13 - Bourgeois, unpublished; 14 - Gibbons et al. (MS 1995); 15 - Hickey et al. (MS 1983); 16 - Chadwick and Green (1985).

Table 2. Atlantic salmon conservation spawner requirements in terms of small and large salmon and the 2SW component of the large salmon category for rivers in each SFA of insular Newfoundland.

SFA	River name	Spawner requirement (No.)					References
		Small salmon	Large salmon	Total	Prop. 2SW	2SW	
SFA 3	West						
	Salmon						
	Freshwater						
	Northeast						
	Unnamed						
	Soufflets						
	Little Harbour Deep						
	Coney Arm						
	Main (Sop's Arm)						
	Hampden						
	Big Chouse						
	Wild Cove						
	Western Arm						
	Middle Arm						
	Baie Verte						
	South						
	Paquet						
	Total	**29000**	**2000**	**31000**	**0.12**	**240**	Anon. (MS 1986a)
SFA 4	West	466	35	501	0.12	4	
	South	1147	86	1234	0.12	10	
	Tommy's Arm	510	38	548	0.12	5	
	West Arm	264	20	283	0.12	2	
	New Bay	544	41	585	0.12	5	
	Northern Arm	400	30	430	0.12	4	
	Peter's	239	18	257	0.12	2	
	Exploits	40963	1707	42670	0.12	205	
	Campbellton	1095	58	1153	0.12	7	
	Horwood	800	60	860	0.12	7	
	Gander	18975	1877	20852	0.12	225	
	Ragged Harbour	1233	93	1325	0.12	11	
	Total	**66635**	**4063**	**70698**	**0.12**	**488**	

Table 2 (cont'd)

SFA	River name	Spawner requirement (No.)					References
		Small salmon	Large salmon	Total	Prop. 2SW	2SW	
SFA 5	Indian Bay	1528	189	1716	0.12	23	
	Traverse	753	93	846	0.12	11	
	Middle	894	47	941	0.12	6	
	Gambo	2914	360	3274	0.12	43	
	Terra Nova	4881	861	5742	0.12	103	
	Northwest	1148	324	1471	0.12	39	
	Salmon	222	27	250	0.12	3	
	Southwest	347	43	390	0.12	5	
	Total	**12687**	**1945**	**14631**	**0.12**	**233**	Anon. (MS 1986a)
SFA 6	**Total**	**1000**	**50**	**1050**	**0.12**	**6**	Anon. (MS 1986a)
SFA 7	**Total**	**800**	**40**	**840**	**0.12**	**5**	Anon. (MS 1986a)
SFA 8	**Total**	**400**	**13**	**413**	**0.12**	**2**	Anon. (MS 1986a)
SFA 9	Biscay Bay	1019	54	1073	0.12	6	
	Northwest	588	44	633	0.12	5	
	Peter's	351	26	378	0.12	3	
	Salmonier	455	34	490	0.12	4	
	Colinet	410	31	441	0.12	4	
	Rocky	844	137	981	0.12	16	
	North Harbour	70	5	75	0.12	1	
	Little Salmonier	411	31	442	0.12	4	
	Big Barachois	125	9	134	0.12	1	
	Branch	462	35	497	0.12	4	
	Total	**4736**	**407**	**5143**	**0.12**	**49**	
SFA 10	Great Barasway	67	5	72	0.12	1	
	Southeast	277	21	298	0.12	3	
	Northeast	190	14	204	0.12	2	
	Come By Chance	217	16	233	0.12	2	
	Black	228	17	245	0.12	2	
	Pipers Hole	678	51	729	0.12	6	
	Cape Roger	120	9	129	0.12	1	
	Bay de L'Eau	277	21	297	0.12	2	
	Total	**2054**	**155**	**2209**	**0.12**	**19**	

Table 2 (cont'd)

SFA	River name	Spawner requirement (No.)					References
		Small salmon	Large salmon	Total	Prop. 2SW	2SW	
SFA 11	Garnish						
	Long Harbour						
	Soutwest						
	Rencontre						
	Northwest						
	Bay du Nord						
	Salmon						
	Bottom						
	Little						
	Conne						
	Southwest						
	Salmon						
	D'Espoir						
	Dolland						
	Grey						
	White Bear						
	Kings Harbour						
	Grandy's						
	Total	**19100**	**800**	**19900**	**0.12**	**96**	Anon. (MS 1986a)
SFA 12	East Bay						
	LaPoile						
	Farmers Arm						
	Garia						
	Northwest, Garia						
	Burnt Island						
	Isle aux Morts						
	Grand Bay						
	N.W. River, Grand Bay						
	Barachoix						
	Total	**3500**	**100**	**3600**	**0.48**	**48**	Anon. (MS 1986a)

Table 2 (cont'd)

SFA	River name	Spawner requirement (No.)					References
		Small salmon	Large salmon	Total	Prop. 2SW	2SW	
SFA 13	Bear Cove						
	Little Codroy						
	Grand Codroy						
	Highlands						
	Crabbes						
	Barachois						
	Robinsons						
	Fischells						
	Flat Bay						
	Little Barachois						
	S.W. & Bottom						
	Harrys						
	Romaines						
	Fox Island						
	Serpentine						
	Cooks						
	Humber						
	Hughes						
	Goose Arm						
	Total	**44500**	**5300**	**49800**	**0.48**	**2544**	Anon. (MS 1986a)
SFA 14A	Trout						
	Lomond						
	Deer Arm						
	Bakers						
	Western						
	Parsons Pond						
	Bound						
	Portland						
	River of Ponds						
	Little Brook Ponds						
	Torrent						
	Big East						
	Doctors						
	Castor						
	Ste. Genevieve						
	Western Arm						
	Eastern Arm						
	Eddies Cove						
	Big Brook						
	Watsons						
	Pincents						
	Parkers						
	Bartletts						
	Upper						
	East						
	Total	**13748**	**595**	**14343**	**0.49**	**292**	Anon. (MS 1986a)

Note: Anon. (MS 1986a) refers to the number of large salmon overall and not the number of 2SW salmon.

Table 3. Accessible fluvial rearing area and Atlantic salmon conservation egg requirements for rivers in SFA15.

River	Fluvial rearing units (100 sq. m)	Egg multiplier (per 100 sq. m)	Egg requirement (millions)	References
Restigouche (SFA 15)	223260	240	53.58	1
Nepisiguit	39730	240	9.54	2
Jacquet	11350	240	2.72	2
Middle	9500	240	2.28	2
Big Tracadie	6010	240	1.44	2
Eel	4220	240	1.01	2
Tetagouche	2990	240	0.72	2
Pokemouche	2480	240	0.60	2
Total	**299540**		**71.89**	

Notes:

1. Egg and habitat estimates for the Restigouche River by Randall (MS 1984) have been reduced by 25% to obtain only the SFA 15 portion of the watershed.
2. The Matapedia River and Quebec portions of the Patapedia and Kedgwick rivers have been excluded.
3. Quebec-New Brunswick boundary waters are included in SFA 15.
4. Egg multiplier of 240 eggs/100 sq. m is according to Anon. (MS 1991).

References:

1 - Randall (MS 1984); 2 - Anon. (MS 1978).

Table 4. Accessible fluvial rearing area and Atlantic salmon conservation egg requirements for rivers in SFA 16.

River	Drainage Area (sq. km)	Fluvial rearing units (100 sq. m)	Egg multiplier (per 100 sq. m)	Egg requirement (millions)	Habitat estimation technique	References
Miramichi River	14000	546000	240	131.04	surveyed	1, 4
SW Miramichi River	7700	366579	240	87.98	surveyed	1, 4
NW Miramichi River	3900	167884	240	40.29	surveyed	1, 4
Bartibog River		11353	240	2.72	surveyed	1
Tabusintac River		8243	240	1.98	surveyed	3
Kougibouguac River		5880	240	1.41	surveyed	2
Kouchibouguacis River		5490	240	1.32	not surveyed	2
Other Rivers		3640	240	0.87	not surveyed	2
Northumberland Strait North Production Area						
Richibucto River		12260	240	2.94	not surveyed	2
Bouctouche River		6619	240	1.59	surveyed	3
Cocagne River		2830	240	0.68	not surveyed	2
Shediac River		2160	240	0.52	not surveyed	2
Scoudouc River		1460	240	0.35	not surveyed	2
Other Rivers		3330	240	0.80	not surveyed	2
Total		**597728**		**143.45**		

Notes:

1. Rivers referenced by Anon (1978) were surveyed (land based) in the 1950's and early 1960's.
2. Rivers noted as "not surveyed" had their habitat area estimated using a drainage area method: Rearing area = drainage area (sq. km) X Rearing area of surveys rivers (sq. m)/drainage area of surveyed rivers (sq.km).
3. Egg multiplier of 240 eggs/100 sq. m is according to Anon. (MS 1991).

References:

1 - Amiro (MS 1983); 2 - Anon. (MS 1978); 3 - DNRE (1989); 4 - Randall et al. (1989).

Table 5. Accessible fluvial rearing area and Atlantic salmon conservation egg requirements for rivers in SFA 17.

River	Drainage Area (sq. km)	Fluvial rearing units (100 sq. m)	Egg multiplier (per 100 sq. m)	Egg requirement (millions)	Habitat estimation technique	References
Mill	137000	583	240	0.14	surveyed	1
Dunk	218000	1931	240	0.46	surveyed	1
West	239000	1845	240	0.44	surveyed	1
Morell	171000	2372	240	0.57	surveyed	1
Valleyfield	94000	1275	240	0.31	surveyed	2
Total	**859000**	**8006**		**1.92**		

Note: Egg multiplier of 240 eggs/100 sq. m is according to Anon. (MS 1991).

References:

1 - Cairns et al. (MS 1995); 2 - Davidson and Angus (MS 1994).

Table 6. Atlantic salmon conservation spawner requirements (No.) for rivers in SFA 15.

River	Small salmon	Large salmon	2SW	3SW	Repeat spawners
Restigouche (SFA 15 only)	1605	8737	4456	1136	3146
Nepisiguit	690	1363	695	177	491
Jacquet	180	320	163	42	115
Middle	150	270	138	35	97
Big Tracadie	140	140	71	18	50
Eel	70	120	61	16	43
Tetagouche	50	80	41	10	29
Pokemouche	60	60	31	8	22
Total	**2945**	**11090**	**5656**	**1441**	**3993**

Notes:

1. Targets for Restigouche River have been recalculated based on the age distribution of returning salmon in 1984-1994.
2. Total Restigouche River targets were reduced by 25% to eliminate Quebec portions of the watershed.
3. Large salmon targets for the other SFA 15 rivers have been subdivided assuming that age distribution is similar to that of Restigouche River.

Table 7. Atlantic salmon conservation spawner requirements (No.) for rivers in SFA 16.

River	Egg requirement (millions)	Spawner requirements (1SW for male contributions) 1SW	2SW	Repeat spawners	Reference stock
Miramichi River	131.04				Miramichi
SW Miramichi River	87.98				Miramichi
NW Miramichi River	40.29				Miramichi
Bartibog River	2.72				Miramichi
Tabusintac River	1.98				Miramichi
Kougibouguac River	1.41				Miramichi
Kouchibouguacis River	1.32				Miramichi
Other Rivers	0.87				Miramichi
Northumberland Strait North Production Area					
Richibucto River	2.94				Miramichi
Bouctouche River	1.59				Miramichi
Cocagne River	0.68				Miramichi
Shediac River	0.52				Miramichi
Scoudouc River	0.35				Miramichi
Other Rivers	0.80				Miramichi
Total	**143.45**	**19871**	**21050**	**4428**	Miramichi

Notes:

1. For calculating spawner requirements, biological characteristics from 1984 to 1989 were used.
2. All eggs come from MSW salmon because one MSW salmon equals about eight 1SW salmon.

Table 8. Atlantic salmon conservation spawner requirements (No.) for rivers in SFA 17.

River	Egg requirement (millions)	Spawner requirements (1SW for male contributions) 1SW	2SW	Repeat spawners	Reference stock
Mill	0.14	21	39		Morell
Dunk	0.46	69	129		Morell
West	0.44	66	124		Morell
Morell	0.57	85	159		Morell
Valleyfield	0.31	46	86		Morell
Total	**1.92**	**287**	**537**		Morell

Table 9. Accesssible fluvial rearing area and Atlantic salmon conservation egg deposition and spawner requirements for rivers in Nova Scotia and southwest New Brunswick (SFAs 18-23).

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 18	(Gulf Nova Scotia)										
	Afton	43	189	4	45442	0	14	14			1,2-South
	Barney's	156	2128	14	510674	16	79	95			1-R.Philip,2-East
	East, Pictou	536	7291	14	1749926	57	271	328			1-R.Philip,2-East
	French	128	1740	14	417484	13	65	78			1-R.Philip,2-East
	Middle, Pictou	217	2953	14	708707	22	110	132			1-R.Philip,2-East
	Pomquet	176	769	4	184545	1	57	58			1,2-South
	[illegible]	182	2470	14	592778	18	92	110			1-R.Philip,2-East
	River John	292	3973	14	953513	30	148	178			1-R.Philip,2-East
	River Philip	726	9621	13	2309040	72	358	430			3-below dam
	South	217	950	4	228002	0	70	70			4
	Sutherlands		666		159840	5	25	30			4-below falls
	Tracadie (Monastery)	120	525		126075	1	39	40			1,2-South
	Wallace	458	6229	14	1494972	46	232	278			1-R.Philip,2-East
	Waugh	230	3132	14	751582	23	116	139			1-R.Philip,2-East
	West, Antigonish	353	4803	14	1152656	1	353	354			1-R.Philip,2-East
	West, Pictou	245	3326	14	798342	25	124	149			1-R.Philip,2-East
	Subtotal		50765		12183577	330	2153	2483	0.82	1765	prop-Margaree
SFA 18	(Gulf Cape Breton)										
	Blair	58	974	16.7	233666	3	42	45			1-North,2-Cheticamp
	Cheticamp	298	3220	10.8	772800	10	140	150			5- App VI 6 p.162
	Chisolm Brook	17	279	16.7	66934	6	10	16			1-North,2-Margaree
	Fishing Cove	31	521	16.7	125050	2	23	25			1-North,2-Cheticamp
	Graham Brook	27	456	16.7	109418	9	17	26			1-North,2-Margaree
	Grand Anse	51	852	16.7	204408	2	37	39			1-North,2-Cheticamp
	Judique Intv. Bk	44	738	16.7	177154	16	27	43			1-North,2-Margaree
	L. Judique Bk	34	568	16.7	136272	12	21	33			1-North,2-Margaree
	Mabou	188	2351	12.5	564300	49	87	136			1,2-SW/ Margaree
	MacKenzie	75	1244	16.7	298596	4	54	58			1-North,2-Cheticamp
	Margaree	1,100	27976	25.4	6714240	582	1036	1618			6, 2-Margaree
	Northeast Mabou	254	4242	16.7	1018032	88	157	245			1-North,2-Margaree
	Red	35	588	16.7	141082	2	26	28			1-North,2-Cheticamp
	S.W. Mabou	123	1540	12.5	369600	32	57	89			1,2-SW/ Margaree
	Subtotal		45548		10931551	817	1734	2551	0.82	1422	prop-Margaree
	Total SFA 18		**96313**		**23115128**	**1147**	**3887**	**5034**		**3187**	

Table 9 (cont'd)

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 19	(Atlantic Cape Breton)										
	Aconi Brook		1045		250800	8	45	52			7,2-Sydney
	Baddeck		8363		2007120	80	450	530			7,2-Baddeck,8
	Barachois		5979		1434960	57	322	379			7,2-Baddeck
	Catalone		4311		1034640			509			7,2-Grand
	Clyburne	70	1165	16.7	279594	10	65	75			1,2-North
	Framboise		6698		1607520			790			7,2-Grand
	Gerrat Brk		842		202080	7	47	54			7,2-North
	Grand		4618		1108320			545			7,2-Grand,9
	Indian Brk (Eskasoni)		1007		241680	8	57	65			7,2-North
	Ingonish		1934		464160	16	109	125			7,2-North
	Inhabitants		5889		1413360	44	252	296			7,2-Sydney
	Little Lorraine Brk	37	718	19.6	172355	5	31	36			1,2-Sydney
	Lorraine Brk		2611		626640	19	112	131			7,2-Sydney
	MacAskills Brook	50	840	16.7	201606	6	36	42			1-North,2-Sydney
	Marie Joseph		4231		1015440	36	238	273			7,2-North
	Middle		8646		2075040	80	470	550			7,2-Middle,8
	North Aspy	168	2807	16.7	673721	24	158	181			1,2-North
	North		3827		918480	32	215	247			7,2-North,8,10
	Northwest Brk (River Ryan)	53	1031	19.6	247369	9	58	67			1-Sydney,2-North
	River Bennett	24	469	19.6	112515	4	26	30			1-Sydney,2-North
	River Deny's	214	4196	19.6	1006952	39	179	218			1-Sydney,2-Middle
	Salmon River (Victoria Co.)	219	3657	16.7	877692	31	206	236			1,2-North
	Salmon/Gasperaux		6790		1629600	51	539	590			7,2-Sydney
	Skye	116	1945	16.7	466896	18	106	124			1-North,2-Middle
	Sydney		3615		867600	27	155	181			7,2-Sydney,11
	Tillard		1129		270960	8	48	57			7,2-Sydney
	Total SFA 19		**88363**		**21207100**	**620**	**3922**	**6386**	**0.80**	**3138**	prop-blended

Table 9 (cont'd)

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 20	(Eastern Shore NS)										
	Chezzetcook		1852		444480	244	21	265			12,7,2-Liscomb
	Clam Harbour		2736		656640	360	31	391			12,7,2-Liscomb
	Cole Harbour		1244		298560	164	14	178			12,7,2-Liscomb
	Country Harbour		3270		784800	430	38	468			7,2-Liscomb
	East Sheet Harbour		29749		7139760	3914	342	4256			12,7,2-Liscomb
	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
	Gaspereau Brook		2823		677520	371	32	404			7,2-Liscomb
	Guysborough		4217		1012080	555	48	603			7,2-Liscomb
	Halfway Brook		1604		384960	211	18	229			12,7,2-Liscomb
	Isaac's Harbour		2043		490320	269	23	292			12,7,2-Liscomb
	Larry's		2410		578400	317	28	345			12,7,2-Liscomb
	Lawrencetown Lake (Salmon R.)		6446		1547040	848	74	922			12,7,2-Liscomb
	Liscomb		16856		4045440	2218	194	2412			12,13-Liscomb+St. Mary's
	Little Salmon (Lk Major)		750		180000	99	9	107			12,7,2-Liscomb
	Moser		15208		3649920	2001	175	2176			7,2-Liscomb
	Musquodoboit		7919		1900560	846	204	1050			7,2-LaHave
	New Harbour		3148		755520	414	36	450			12,7,2-Liscomb
	Port Dufferin		5389		1293360	709	62	771			12,7,2-Liscomb
	Porters Lake (East Brook)		2332		559680	307	27	334			12,7,2-Liscomb
	Quoddy		6849		1643760	901	79	980			7,2-Liscomb
	Saint Mary's		39854		9564960	3155	889	4044			7,2-St. Mary's
	Salmon: Guysborough Co.		11789		2829360	1551	136	1687			7,2-St. Mary's
	Salmon: Halifax Co.		2811		674640	370	32	402			12,7,2-Liscomb
	Ship Harbour Lake Charlotte		19615		4707600	2581	226	2806			7,2-Liscomb
	Tangier		13583		3259920	1787	156	1943			12,7,2-Liscomb
	West Porters Lake		1185		284400	156	14	170			12,7,2-Liscomb
	West Sheet Harbour		16672		4001280	1163	132	1295			12,7,2-Liscomb,14
	Total SFA 20		**230017**		**55204080**	**26948**	**3129**	**30077**	**0.86**	**2691**	prop-Liscomb

Table 9 (cont'd)

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 21	(South Shore NS)										
	Barrington		4999		1199760	534	128	663			12,7,2-LaHave
	Clyde		24256		5821440	2592	623	3216			12,7,2-LaHave
	East(Lun)		3969		952560	424	102	526			7,2-LaHave
	Gold		17741		4257840	1896	456	2352			7,2-LaHave
	Hubbards		923		221520	99	24	122			7,2-LaHave
	Ingram		3702		888480	396	95	491			7,2-LaHave
	Jordan		15777		3786480	1686	406	2092			12,7,2-LaHave
	LaHave		50848		12203520	5434	1307	6741			7,2-LaHave
	Martins		5441		1305840	581	140	721			7,2-LaHave
	Medway		67653		16236720	7230	1739	8969			7,2-LaHave
	Middle		9270		2224800	991	238	1229			7,2-LaHave
	Mushamush		2303		552720	246	59	305			7,2-LaHave
	Nine Mile		3334		800160	356	86	442			12,7,2-LaHave
	Petite		6444		1546560	689	166	854			7,2-LaHave
	Roseway		17792		4270080	1901	457	2359			12,7,2-LaHave
	Sable		8869		2128560	948	228	1176			12,7,2-LaHave
	Sackville		6485		1556400	693	167	860			7,2-LaHave
	Salmon (Digby)		7727		1854480	826	199	1024			7,2-LaHave
	Tusket		65764		15783360	7028	1690	8718			7,2-LaHave
	Total SFA 21		**323297**		**77591280**	**34550**	**8310**	**42860**	**0.70**	**5817**	prop-LaHave

Table 9 (cont'd)

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 22	(Inner-Fundy NS)										
	Annapolis		20886		5012640	2232	537	2769	0.70	376	7,2-LaHave
	Apple		2111		506640	125	47	171	0.03	1	7,2-Stewiacke
	Bass (Colchester Co.)		696		167040	41	15	56	0.03	0	7,2-Stewiacke
	Chiganois		3369		808560	199	74	273	0.03	2	7,2-Stewiacke
	[illegible]		1706		409440	182	44	226	0.70	31	7,2-LaHave
	Debert		3499		839760	206	77	284	0.03	2	7,2-Stewiacke
	Diligent		335		80400	20	7	27	0.03	0	7,2-Stewiacke
	Economy		2386		572640	141	53	193	0.03	2	7,2-Stewiacke
	Folly		2896		695040	171	64	235	0.03	2	7,2-Stewiacke
	Gaspereau (Kings Co.)		3856		925440	412	99	511	0.70	69	7,2-LaHave
	Great Village		2587		620880	153	57	210	0.03	2	7,2-Stewiacke
	Harrington		629		150960	37	14	51	0.03	0	7,2-Stewiacke
	Kennetcook		3976		954240	235	88	322	0.03	3	7,2-Stewiacke
	Maccan		8228		1974720	485	182	667	0.03	5	7,2-Stewiacke
	North (Colchester Co.)		4485		1076400	265	99	364	0.03	3	7,2-Stewiacke
	Parrsboro		705		169200	42	16	57	0.03	0	7,2-Stewiacke
	Portapique		3309		794160	195	73	268	0.03	2	7,2-Stewiacke
	River Hebert		2282		547680	135	50	185	0.03	2	7,2-Stewiacke
	Salmon (Colchester Co.)		13468		3232320	795	297	1092	0.03	9	7,2-Stewiacke
	Shubenacadie		10340		2481600	610	228	838	0.03	7	7,2-Stewiacke
	St. Croix (Hants Co.)		4283		1027920	253	95	347	0.03	3	7,2-Stewiacke
	Stewiacke		13086		3140640	772	289	1061	0.03	9	7,2-Stewiacke,15,16
	Tantramar		-								
	Total SFA 22		**88232**		**21175680**	**5471**	**1969**	**7440**	**0.03**	**531**	prop-Stewiack, LaHave

Table 9 (cont'd)

SFA	River name	Drainage area (sq. km)	Rearing units (100 sq. m)	R. units per sq. km	Egg requirement (240/unit)	Spawner requirement (No.) Small salmon	Large salmon	Total	Prop. 2SW	2SW	References
SFA 23	(Inner-Fundy NB)										
	Demoiselle Crk										
	Crooked Crk										
	Shepody										
	West (Albert Co.										
	Alma					60	29	89			15
	Point Wolfe					139	63	202			15
	Petitcodiac		28150		6756000	1688	101	1789			17
	Big Salmon		9093		2182320	280	420	700			7,2-Big Salmon,8,18
	Irish										
	Mosher (Saint John Co.)										
	Subtotal		37243		8938320	2167	613	2780	0.13	80	prop-Big Salmon
SFA 23	(Outer-Fundy NB)										
	Digdeguash		4220		1012800	100	170	270			5, App VI-14 p170
	Magaguadavic		5630		1351200	140	230	370			5, App VI-14 p170
	Saint John above Mactaquac		134722		32333280	4900	4900	9800			7,2-Saint John,19
	Saint John below Mactaquac		199740		47937600	7400	7400	14800			7,2-Nashwaak trib,19
	St. Croix		30790		7389600	680	1710	2390			20
	Others		2350		564000	60	100	160			5, App VI-14 p170
	Subtotal		377452		90588480	13280	14510	27790	0.90	13059	prop-Saint John
	Total SFA 23		**414695**		**99526800**	**15447**	**15123**	**30570**		**13139**	

1-Drainage area from Maritime Resource Management Service, rearing units per sq. km from 'named' river; 2-Spawners from 'named' river; 3-Edwards (MS 1956); 4-Chaput and Jones (MS 1994) 5-Anon.(MS 1978); 6-Marshall (MS 1982); 7-Rearing units > 0.12% ortho-gradient measured on air photos (Amiro 1993); 8-Marshall et al. (MS 1992); 9- Amiro and Longard (MS 1990); 10-Amiro and Marshall (MS 1990); 11-Marshall et al. (MS 1996); 12- Significant acidification; 13-Semple and Cameron (MS 1990); 14-Liscomb proportion at age data, 1992-95; 15-Amiro and Jefferson (MS 1996); 16-Amiro (MS 1990); 17- Semple (MS 1984); 18- Amiro and McNeill (MS 1986); 19- Marshall and Penney (MS 1983); 20-Anon. (MS 1988b).

Table 10. Atlantic salmon conservation e ;g deposition and spawner requirements for rivers in zones Q1 - Q11, Quebec.

River	Eggs required (millions)	Large salmon	2SW	3SW	Repeat spawners
ZONE Q1					
Bonaventure	8.42	1873	1592	94	187
Petite Cascapédia	4.26	704	422	176	106
Cascapédia	8.64	1268	659	482	127
Nouvelle	2.64	478	382	48	48
Matapédia	11.44	1929	1447	289	193
Patapédia	2.33	470	376	47	47
Kedgwick	0.97	164	123	16	25
Total zone	**38.70**	**6886**	**5002**	**1152**	**732**
ZONE Q2					
Darmouth	2.99	630	504	63	63
York	4.39	800	440	240	120
Saint-Jean	3.77	794	738	8	48
Malbaie	0.46	113	108	0	6
Grande Rivière	2.02	480	408	24	48
Du Petit Pabos	1.16	262	248	0	13
Du Grand Pabos Ouest	0.60	105	100	0	5
Du Grand Pabos	1.22	282	268	0	14
Port-Daniel Nord	0.54	131	124	0	7
Port-Daniel du Milieu	0.27	65	62	0	3
Petite rivière Port-Daniel	0.30	73	69	0	4
Anse à la Barbe	0.20	48	46	0	2
Total zone	**17.92**	**3784**	**3116**	**335**	**333**
ZONE Q3					
Ouelle	1.97	368	295	37	37
Du Sud-Ouest	0.08	17	15	1	2
Rimouski	0.37	70	56	7	7
Mitis	4.76	973	779	146	49
Matane	5.64	1250	1062	62	125
Cap-Chat	1.57	304	244	15	46
Sainte-Anne	2.16	419	335	42	42
Mont-Louis	0.26	52	47	0	5
Madeleine	4.72	899	764	45	90
Total zone	**21.53**	**4353**	**3596**	**355**	**402**

Table 10 (cont'd)

River	Eggs required (millions)	Large salmon	2SW	3SW	Repeat spawners
ZONE Q5					
Jacques-Cartier	4.50	1236	989	124	124
Du Gouffre	1.50	406	337	24	45
Total zone	**6.00**	**1642**	**1326**	**148**	**168**
ZONE Q6					
Petit Saguenay	2.40	537	398	86	54
Saint-Jean	0.41	84	51	28	4
_ Mars	2.42	690	621	34	34
Sainte-Marguerite Principale	4.30	881	635	220	26
Sainte-Marguerite Nord-est	1.74	363	262	91	11
Total zone	**11.27**	**2556**	**1966**	**460**	**130**
ZONE Q7					
Des Escoumins	2.41	541	428	54	60
Laval	0.93	122	36	67	18
Betsiamites	18.62	3370	2662	101	607
Aux Anglais	0.11	21	19	0	2
Mistassini	0.17	32	29	0	3
Franquelin	0.34	64	58	0	6
Godbout	8.26	1788	1645	18	125
De la Trinité	3.03	383	341	4	38
Petite rivière de la Trinité	0.26	57	54	0	3
Du Calumet	0.08	15	14	0	2
Pentecôte	0.63	125	113	0	13
Aux Rochers	4.95	1221	1063	49	110
Total zone	**39.79**	**7740**	**6461**	**293**	**986**

Table 10 (cont'd)

River	Eggs required (millions)	Large salmon	2SW	3SW	Repeat spawners
ZONE Q8					
Moisie	52.74	8712	5053	2526	1132
Matamec	0.26	53	50	0	3
Pigou	0.01	2	2	0	0
Au Bouleau	0.24	49	46	0	2
Sheldrake	0.08	16	15	0	1
Jupitagon	0.27	65	61	0	3
Magpie	-	-	-	-	-
Saint-Jean	17.30	4765	4527	95	143
Mingan	4.37	951	923	10	19
Romaine	0.68	157	149	0	8
De la Corneille	0.11	30	27	1	1
Piashti	0.02	4	4	0	1
Watshishou	2.20	587	546	29	12
Petite rivière Watshishou	0.33	90	83	4	2
Nabisipi	6.30	1682	1514	84	84
Aguanus	0.01	2	2	0	0
Natashquan	34.05	8125	6988	406	731
Au Tonnerre	0.17	35	35	0	0
Total zone	**119.14**	**25326**	**20026**	**3157**	**2142**
ZONE Q9					
Kégaska	0.21	43	38	0	4
Musquaro	-	-	-	-	-
Musquanousse	0.06	22	17	0	4
Washicoutai	0.01	2	2	0	0
Olomane	3.94	968	919	0	48
Coacoachou	0.15	36	32	0	4
Etamamiou	4.17	905	787	0	118
Nétagamiou	0.00	0	0	0	0
Du Petit Mécatina	0.23	55	50	0	6
Du Gros Mécatina	0.15	36	32	0	5
Véco	0.18	43	39	0	4
Kécarpoui	0.20	48	43	0	5
Saint-Augustin Nord-Ouest	1.48	354	319	0	35
Saint-Augustin	12.59	3015	2714	0	302
Coxipi	3.97	951	856	0	95
Chécatica	0.01	2	2	0	0
Napetipi	4.19	1004	903	0	100
Du Vieux Fort	0.65	271	217	0	54
Saint-Paul	13.59	3458	692	0	2767
Ruisseau au Saumon	0.31	74	67	0	7
Ruisseau des Belles Amours	0.02	5	4	0	0
Brador-est	0.28	67	60	0	7
Total zone	**46.39**	**11360**	**7794**	**0**	**3566**

Table 10 (cont'd)

River	Eggs required (millions)	Large salmon	2SW	3SW	Repeat spawners
ZONE Q10					
_ l'Huile	0.37	104	99	0	5
MacDonald	0.40	113	107	0	6
_ la Patate	0.23	65	62	0	3
Vauréal	0.30	82	78	0	4
Aux Saumons	1.35	370	351	0	18
Du Renard	0.39	107	101	0	5
Petite rivière de la Loutre	0.51	140	133	0	7
Bell	0.42	106	95	0	11
Ruisseau Box	0.33	81	73	0	8
Dauphiné	0.80	187	168	0	19
Petite rivière de la Chaloupe	0.20	56	54	0	3
Maccan	0.20	56	54	0	3
De la Chaloupe	1.17	330	313	0	16
Ferrée	0.30	85	80	0	4
Ruisseau Martin	0.26	73	70	0	4
Du Pavillon	0.27	74	70	0	4
Aux Plats	0.37	101	96	0	5
Chicotte	0.43	133	126	0	7
Galiote	0.84	237	225	0	12
Jupiter	5.02	1374	1319	0	55
_ la Loutre	0.48	131	125	0	7
Aux Cailloux	0.18	49	47	0	2
Sainte-Marie	0.19	52	49	0	3
Bec-Scie	0.23	72	68	0	4
Total zone	**15.24**	**4177**	**3963**	**0**	**215**
ZONE Q11 (from Anon. 1986a)					
Aux Feuilles	-	-	-	-	-
Koksoak	27.88	-	-	-	-
_ la Baleine	-	-	-	-	-
George	-	-	-	-	-
Total zone	-	**15000**	**7500**	-	**7500**

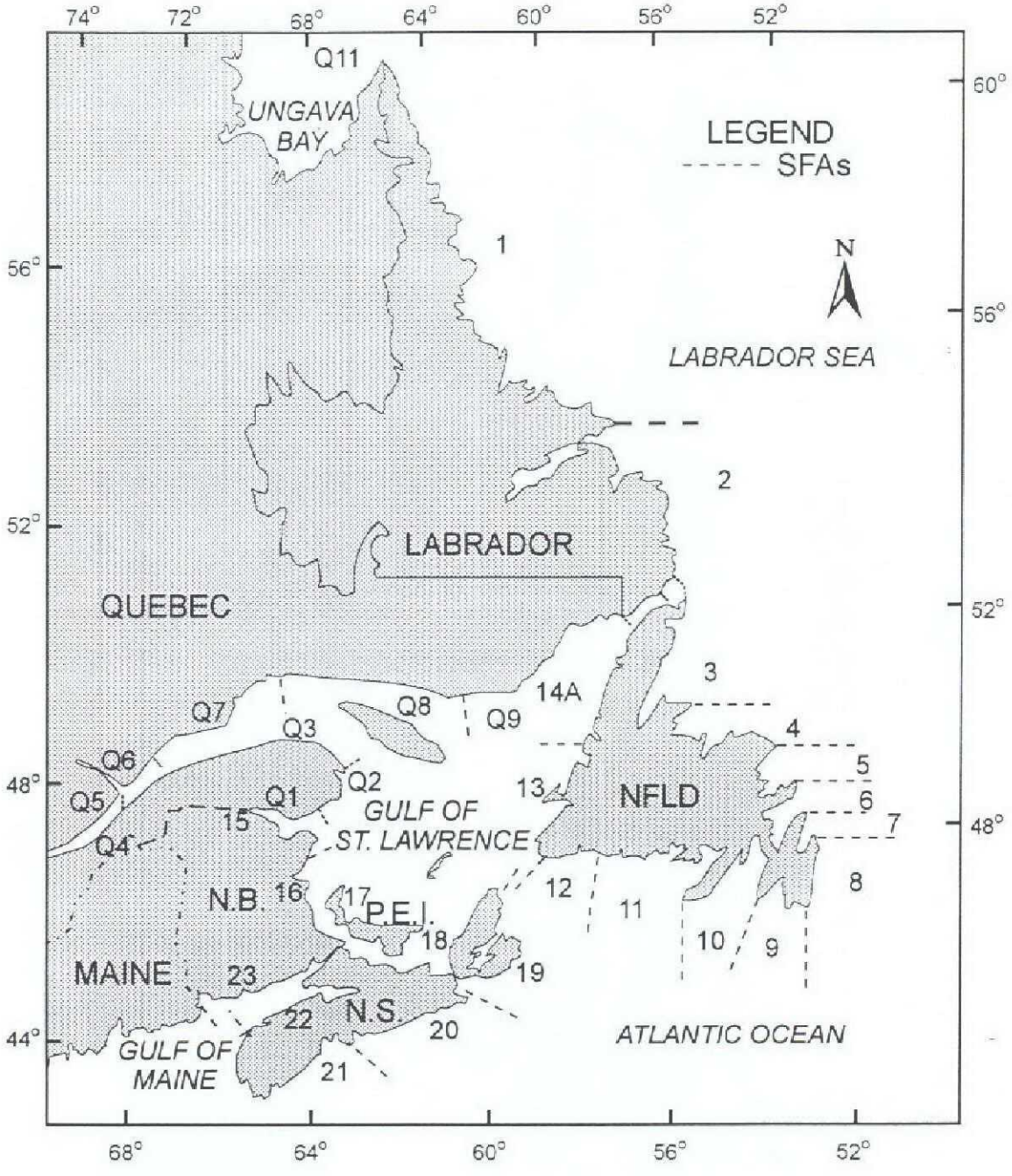

Fig. 1. Map showing the Salmon Fishing Areas (SFAs) of Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island, and Management Zones (Qs) of Quebec.

Appendix 1a. Proportions of small (< 63 cm) and large (>= 63 cm) salmon in total returns to certain rivers in SFAs 4, 5, 9, and 10, insular Newfoundland, 1992-95.

SFA	River	Year	% Small	% Large
4	Exploits River	1992	98	2
		1993	97	3
		1994	95	5
		1995	94	6
		Total	96	4
	Campbellton River	1993	97	3
		1994	94	6
		1995	93	7
		Total	95	5
	Gander River	1992	81	19
		1993	94	6
		1994	94	6
		1995	95	5
		Total	91	8
	SFA 4	Total	93	7
5	Middle Brook	1992	97	3
		1993	96	4
		1994	95	5
		1995	90	10
		Total	95	5
	Terra Nova River	1992	87	13
		1993	87	13
		1994	89	11
		1995	81	19
		Total	85	15
	Northwest River	1995	78	22
	SFA 5	Total	89	11
9	Biscay Bay River	1992	97	3
		1993	90	10
		1994	96	4
		1995	95	5
		Total	95	5
	Rocky River	1992	84	16
		1993	80	20
		1994	89	11
		1995	91	9
		Total	86	14
	SFA 9	Total	93	7
10	Northeast River (Placentia)	1992	95	5
		1993	94	6
		1994	91	9
		1995	91	9
		Total	93	7

Appendix 1b. Mean weight and percent of female for small (< 63 cm) salmon for certain rivers in SFAs 4, 5, 9, and 10, insular Newfoundland, 1992-95.

SFA	River	Year	Mean wt. of females in kg (N)	% Female (N)	Relative fecundity in eggs/kg (N)
4	Exploits River	1992	1.48 (777)	72 (906)	
		1994	1.74 (142)	73 (221)	
		1995	1.70 (16)	87 (34)	
		Total	1.52 (935)	73 (1179)	1935 (184)
	Campbellton River	1993	1.47 (60)	74 (88)	
		1994	1.55 (28)	72 (40)	
		1995	1.55 (38)	83 (38)	
		Total	1.51 (126)	75 (166)	2114 (45)
	Gander River	1992	1.78 (87)	61 (87)	
		1993	1.85 (73)	70 (73)	
		1994	1.83 (101)	73 (101)	
		1995	1.70 (49)	67 (49)	
		Total	1.80 (310)	68 (310)	1665 (173)
	SFA 4	Total	1.58 (1371)	72 (1655)	1839 (402)
5	Middle Brook	1992	1.74 (37)	82 (37)	
		1993	1.65 (71)	76 (71)	
		1994	1.75 (33)	74 (33)	
		1995	1.47 (33)	62 (33)	
		Total	1.65 (174)	74 (174)	1941 (175)
	Terra Nova River	1992	1.30 (6)	75 (6)	
		1993	1.63 (12)	80 (12)	
		1994	1.92 (19)	80 (19)	
		1995	1.57 (12)	67 (12)	
		Total	1.69 (49)	76 (49)	1713 (66)
	Northwest River	1992	1.75 (149)		
		1993	1.74 (149)		
		1994	1.81 (148)		
		1995	1.78 (94)	75 (95)	
		Total	1.77 (540)	75 (95)	1767 (69)
	SFA 5	Total	1.74 (763)	75 (318)	1863 (346)
9	Biscay Bay River	1993	2.10 (9)	56 (9)	
		1994	1.82 (13)	68 (13)	
		1995	1.99 (31)	66 (31)	
		Total	1.96 (53)	65 (53)	2066 (290)
	Rocky River	1994	1.89 (49)	79 (49)	
		1995	1.87 (85)	85 (85)	
		Total	1.88 (134)	83 (134)	2066 (290)
	SFA 9	Total	1.90 (187)	77 (187)	2066 (290)
10	Northeast River (Placentia)	1993	1.76 (10)	83 (10)	
		1994	1.61 (5)	100 (5)	
		1995	1.67 (25)	100 (25)	
		Total	1.69 (40)	95 (40)	2267 (106)
	SFA 10	Total	1.69 (40)	95 (40)	2267 (106)
	SFA 9 and 10	Total	1.86 (227)*	80 (227)*	

*Default for SFAs 9 and 10.

Appendix 1c. Proportion of life-history groups for Atlantic salmon (>= 63 cm) for several insular Newfoundland rivers combined (SFAs 4, 5, and 9), percent female overall, and mean weight of females, 1975-94.

Year	Life-history group*								% female (N) overall	Mean wt. of females in kg (N)
	1SW		CS 1SW		AS 1SW		2SW			
	No.	%	No.	%	No.	%	No.	%		
1975	3	37.5	3	37.5	1	12.5	1	12.5	75.0 (9)	3.36 (9)
1976	0	0.0	4	66.7	1	16.7	1	16.7	65.0 (13)	2.73 (13)
1977	3	42.9	1	14.3	2	28.6	1	14.3	75.0 (18)	2.75 (18)
1978	2	22.2	4	44.4	3	33.3	0	0.0	90.9 (10)	2.72 (10)
1979	2	15.4	5	38.5	6	46.2	0	0.0	80.0 (16)	3.55 (16)
1980	3	75.0	1	25.0	0	0.0	0	0.0	100.0 (4)	3.68 (4)
1981	0	0.0	1	50.0	0	0.0	1	50.0	50.0 (1)	3.30 (1)
1982	2	11.1	10	55.6	4	22.2	2	11.1	81.8 (18)	2.92 (18)
1983	4	19.0	11	52.4	3	14.3	3	14.3	79.2 (19)	2.92 (19)
1984	1	4.0	21	84.0	1	4.0	2	8.0	88.6 (31)	3.21 (19)
1985	5	50.0	4	40.0	1	10.0	0	0.0	64.3 (9)	2.91 (9)
1986	4	4.9	13	15.9	43	52.4	22	26.8	81.4 (79)	3.25 (78)
1987	13	18.8	31	44.9	23	33.3	2	2.9	87.5 (112)	3.24 (81)
1988	2	18.2	4	36.4	2	18.2	3	27.3	72.0 (18)	3.00 (18)
1989	7	33.3	10	47.6	1	4.8	3	14.3	66.7 (20)	2.95 (20)
1990	12	38.7	7	22.6	8	25.8	4	12.9	52.4 (22)	3.22 (22)
1991	3	42.9	4	57.1	0	0.0	0	0.0	25.0 (1)	2.70 (1)
1992	2	14.3	7	50.0	2	14.3	3	21.4	80.0 (8)	3.26 (8)
1993	1	4.5	18	81.8	3	13.6	0	0.0	70.0 (7)	2.845(6)
1994	12	27.9	26	60.5	2	4.7	3	7.0	68.1 (32)	3.07 (12)
Total	81	19.1	185	43.7	106	25.1	51	12.1	76.9 (447)	3.13 (382)

*Sexes combined plus unsexed fish.
CS = consecutive spawners; AS = alternate spawnners.

Appendix 1d. Proportion of life-history groups for Atlantic salmon (>= 63 cm) for SFAs 13 and 14A, insular Newfoundland (sexes combined plus unsexed fish).

		1SW		CS 1SW		AS 1SW		CS 2SW		2SW		3SW	
SFA	Year	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
13	1988	2	20.0	2	20.0	1	10.0			5	50.0		
	1989					1	8.3			11	91.7		
	1992	1	100.0										
	1993	1	1.9	2	3.8	2	3.8	20	37.7	28	52.8		
	1994	10	11.9	6	7.1	44	52.4	1	1.2	23	27.4		
	1995			1	0.8	45	38.1	6	5.1	66	55.9		
	Total	14	5.0	11	4.0	93	33.5	27	9.7	133	47.8		
14A	1973							1	100.0				
	1975									1	100.0		
	1977					2	100.0						
	1978			1	33.3					2	66.7		
	1979	1	100.0										
	1980			4	66.7					2	33.3		
	1981			1	33.3			1	33.3	1	33.3		
	1982									3	100.0		
	1985									1	100.0		
	1986									5	100.0		
	1987	1	100.0										
	1988	1	11.1			2	22.2			6	66.7		
	1989			1	50.0					1	50.0		
	1991	1	100.0										
	1992	3	9.4	1	3.1	12	37.5			16	50.0		
	1993	2	1.9			1	0.9	43	40.2	60	56.1	1	0.9
	1994	2	28.6	1	14.3					4	57.1		
	1995					28	90.3			3	9.7		
	Total	11	5.1	9	4.2	45	20.8	45	20.8	105	48.6	1	0.5

CS = consecutive spawners; AS = alternate spawners.

Appendix 2a. Atlantic salmon biological characteristics for Restigouche River (SFA 15). FL = fork length; ES = eggs per spawner.

Type of data	Year	1SW salmon				2SW salmon				3SW salmon			
		% overall	% female	Mean FL (cm)	ES	% overall	% female	Mean FL (cm)	ES	% overall	% female	Mean FL (cm)	ES
Trapnet	1972						28	75.1	4116		76	89.6	10273
	1973	22	5	52.8	96	57	60	76.7	4116	21	91	89.6	10273
	1974	42	4	54.2	96	43	65	76.6	4116	14	69	93.9	10273
	1975	47	4	52.8	96	42	65	78.0	4116	11	88	94.4	10273
	1976	47	1	53.4	96	41	62	77.3	4116	13	85	94.4	10273
	1977	36	0	52.6	96	52	75	73.6	4116	12	43	94.9	10273
	1978	25	1	53.5	96	53	50	77.3	4116	22	89	93.1	10273
	1979	56	3	52.3	96	20	33	76.4	4116	24	76	91.8	10273
	1980	32	3	53.0	96	53	47	76.7	4116	16	56	98.3	10273
Average 1972-80		39	2	52.0	96	43	54	76.0	4116	14	85	92.0	10273

Reference: Randall (MS 1984)

Appendix 2b. Percentage of 2SW, 3SW, and previous spawners in runs to Restigouche River, 1984-94.

Year	2SW	3SW	Previous spawners
1984	79	16	5
1985	63	30	7
1986	76	14	10
1987	64	24	12
1988	72	15	13
1989	57	15	28
1990	68	9	23
1991	50	27	23
1992	54	11	35
1993	40	13	47
1994	60	14	26

Appendix 3. Atlantic salmon biological characteristics for Miramichi River (SFA 16). FL = fork length (cm); ES = eggs per spawner.

River	Year	1SW salmon					2SW salmon					3SW salmon				Repeat spawners					Proportion of eggs by	
		% overall	% female	Mean FL	ES	Mean wt. (kg)	% overall	% female	Mean FL	ES	Mean wt. (kg)	% overall	% female	Mean FL	Mean wt. (kg)	% overall	% female	Mean FL	ES	Mean wt. (kg)	2SW	Rep. spawners
Miramichi (system)	1984	66.58	21.74	51.85	622	1.47	29.89	80.00	71.49	5253	4.14	0.00				3.53	37.50	76.40	2705	5.14	0.943	0.057
	1985	74.71	22.83	51.67	646	1.46	22.33	75.65	72.19	5037	4.23	0.00				2.97	46.15	81.85	3669	6.08	0.912	0.088
	1986	80.02	21.26	55.56	758	1.58	16.87	80.88	74.66	5647	4.57	0.00				3.11	52.94	84.30	4388	6.54	0.875	0.125
	[illegible]																					
	1988	85.11	21.54	54.43	719	1.54	12.16	92.91	75.18	6551	4.64	0.00				2.74	59.46	86.02	5071	6.87	0.852	0.148
	1989	80.49	22.05	53.42	694	1.51	12.51	83.33	74.79	5832	4.58	0.00				7.00	68.42	82.82	5531	6.26	0.653	0.347
Average 1984 to 1989		78.05	24.14	53.25	750	1.51	18.14	84.42	74.03	5836	4.48					3.82	56.58	83.15	4653	6.34	0.856	0.144
	1990	75.06	18.29	55.11	635	1.56	15.33	93.67	74.98	6580	4.61	0.06	100.00	90.00	6.97	9.54	51.79	87.54	4527	7.17		
	1991	67.22	14.44	53.74	463	1.52	19.85	91.51	73.74	6278	4.44	0.00				12.94	74.03	88.05	6525	7.27		
	1992	81.19	9.01	55.04	312	1.56	11.11	93.33	74.26	6467	4.51	0.00				7.70	74.19	88.50	6587	7.36		
SW Miramichi River	1992	77.14	9.90	55.40	350	1.57	16.94	89.70	74.96	6298	4.61	0.00				5.92	72.03	88.30	6375	7.32		
	1993	66.63	9.40	53.30	294	1.51	23.25	87.44	73.13	5929	4.36	0.00				16.43	73.68	87.94	6484	7.25		
	1994	71.58	14.15	55.80	511	1.58	21.09	90.17	75.70	6420	4.71	0.00				7.33	71.93	85.99	6132	6.86		
NW Miramichi River	1992	76.32	11.40	54.20	376	1.54	15.59	91.03	75.39	6444	4.67	0.00				8.09	87.10	89.81	7895	7.63		
	1993	81.64	6.70	54.20	221	1.54	13.30	90.43	73.30	6152	4.38	0.00				5.06	68.75	88.70	6123	7.40		
	1994	63.84	21.99	55.30	772	1.57	25.59	73.00	75.62	5190	4.70	0.00				10.57	56.00	85.40	4728	6.75		

Notes:

1. 1987 Millbank samples of large salmon are low in number (only 20 salmon - 16 2SW and 4 PS). Most of the sampling for large salmon was carried on at SW and NW Enclosure traps. Only Millbank samples are included in the 1984-92 Miramichi data.
2. Mean weights are calculated from the relationship between lengths and weights collected from 1970-92 at Millbank. Separate relationships were calculated for 1SW, 2SW, and PS salmon.
3. Eggs per spawner calculated as per Randall (1989) - 1SW eggs/spawner = % female x exp(3.1718 x ln(FL) - 4.5636)
   MSW eggs/spawner = % female x exp(1.4132 x ln(FL) + 2.7560)
4. Detailed biological characteristics found in Moore et al. (1995).

Appendix 4. Atlantic salmon biological characteistics for SFA 17. FL = fork length (cm); ES = eggs per spawner.

Year	1SW salmon					2SW salmon					3SW salmon				Repeat spawners				
	% Overall	% Female	Mean FL	ES	Mean wt. (kg)	% Overall	% Female	Mean FL	ES	Mean wt. (kg)	% Overall	% Female	Mean FL	Mean wt. Kg)	% Overall	% Female	Mean FL	ES	Mean wt. (kg)
1981	86.7			550		13.3			3576										
1982	91.7			550		8.3			3576										
1983	50.0			550		50.0			3576										
1984	55.6			550		44.4			3576										
1985	93.3			550		6.7			3576										
1986	99.0	15.2		478		1.0			3576										
1987	94.5	17.7		556		5.5	87.2		4328										
1988	94.1	24.0		754		6.0	62.1		3082										
1989	72.8	12.5	56.1	393	1.51	27.2	62.5	73.8	3102	4.08									
1990	86.7	27.2		855		13.3	62.3		3092										
1991	89.3			550		10.7			3576										
1992	95.2			550		4.8			3576										
1993	98.3			550		1.7			3576										
1994	55.4	8.3		261		44.6	86.2	73	4278	3.91									
1995	92.5			550		7.5			3576										

Note: For 1986-1990 and 1994, ES is calculated as proportion female x the mean fecundity measured in 1989. Fecundity measured in 1989 was 3143 eggs for small salmon and 4993 eggs for large salmon. For other years, ES is given as the mean value of 1986-1990 and 1994.

Appendix 5a. Biological charecteristics for several rivers in SFA 18. FL = fork length (cm); ES = eggs per spawner.

River	Year	1SW salmon					2SW salmon						3SW salmon						Repeat spawners					
		Prop. returns	Prop. female	Mean FL	Mean Wt (kg)	ES	Prop. returns	Prop. eggs	Prop. female	Mean FL	Mean Wt (kg)	ES	Prop. returns	Prop. eggs	Prop. female	Mean FL	Mean Wt (kg)	ES	Prop. returns	Prop. eggs	Prop. female	Mean FL	Mean Wt (kg)	ES
East River	1	0.11	0.05	57.50	1.70	150	0.74		0.68	74.10	4.44	5326	0.02		1.00	88.75	8.18	14430	0.13		0.71	92.00	8.93	11184
River Philip	2	0.08	0.09	57.60	2.04	324	0.80		0.64	74.40	4.43	5001	0.01		1.00	84.00	6.92	12207	0.11		0.73	90 90	8.72	11229
South River	1	0.17	0.03		1.30	69	0.73		0.50		3.70	3263							0.10		1.00	87.80		
Margaree River																								
	1990	0.36	0.22	56.5	1.54	607	0.48	0.55	0.66	75.6	3.98	4609	0.08	0.19	0.81	87.8	6.48	9203	0.08	0.26	0.85	95.1	8.40	12637
	1991	0.43	0.32	52.8	1.24	694	0.50	0.84	0.48	72.9	3.54	2976	0.01	.	.	87.8	6.48	.	0.06	0.16	0.43	87.5	6.40	4842
	1992	0.18	0.07	56.7	1.56	190	0.71	0.78	0.74	75.7	4.00	5236	0.05	0.09	0.85	87.7	6.45	9631	0.06	0.12	0.73	90.5	7.15	9231
	1993	0.32	0.11	54.8	1.40	264	0.57	0.68	0.68	75.2	3.91	4687	0.03	0.08	0.92	88.9	6.74	10981	0.07	0.23	0.89	93.0	7.81	12246
	All samples	0.28	0.15	55.3	1.44	375	0.60	0.72	0.70	75.2	3.91	4861	0.04	0.11	0.84	87.9	6.50	9642	0.07	0.17	0.78	91.8	7.49	10331
	3-yr annual avg. (excludes 1991)	0.29	0.13	56.00	1.50	353	0.59	0.676	0.69	75.50	3.96	4844	0.05	0.126	0.86	88.13	6.56	9938	0.07	0.198	0.82	92.87	7.79	11371

1- Chaput and Jones (MS 1994)

2 - Unpublished data from 82 samples collected at a First Nation estuary trap in 1995 - S.F. O'Neil DFO, Halifax, N.S.

Appendix 5b. Biological characteristics for the Atlantic salmon stocks of SFA 20. FL = fork length (cm); ES = eggs per spawner.

River	Year	1SW salmon				2SW salmon				3SW salmon				Repeat spawners			
		Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL (cm)	ES
Liscomb	1984	0.86	0.52	53.06	1403	0.03	0.63	69.50	3219					0.10	0.63	65.31	2735
	1985	0.58	0.56	53.11	1500	0.21	0.64	69.50	3274	0.53	0.64	86.00	6223	0.21	0.64	70.39	3390
	1986	0.66	0.64	54.21	1790	0.13	0.72	73.10	4223	0.32	0.72	90.50	8313	0.21	0.72	69.03	3604
	1987	0.74	0.65	53.74	1800	0.06	0.68	72.26	3837	0.25	0.68	100.00	11296	0.20	0.68	71.29	3695
	1988	0.66	0.75	54.13	2092	0.11	0.62	71.48	3408					0.23	0.62	70.85	3326
	1989				1717				3592								
	1990				1717				3592								
	1991				1717				3592								
	1992	0.82	0.69	54.25	1955	0.05	0.67	70.67	3557					0.13	0.55	68.00	2623
	1993	0.91	0.60	53.55	1636	0.01	1.00	68.50	4904					0.08	0.64	66.73	2913
	1994	0.92	0.77	53.59	2116	0.03	1.00	70.75	5353					0.06	0.75	66.62	3418
	1995	0.95	0.78	53.12	2104	0.02	1.00	69.33	5065					0.03	0.80	62.60	3118
Mean 1984-88 plus 1992-95		0.79	0.66	53.64	1821.74	0.07	0.77	70.57	4093.32	0.37	0.68	92.17	8610.80	0.14	0.67	67.87	3202.34
Saint Mary's		0.78	0.52	57.00	1630	0.14	0.57	74.00	3462	0.09	0.73	85.00	6804				

Appendix 5c. Biological characteristics and estimated conservation requirement for the LaHave River, SFA 21. FL = fork length (cm); ES = eggs per spawner.

River	Year	1SW salmon				2SW salmon				Repeats spawners and 3SW salmon			
		Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL	ES
LaHave													
	1984	83.89	0.35	54.2	1109	9.82	0.74	70.0	4154	6.29	0.52	69.2	2838
	1985	68.18	0.42	53.2	1296	25.95	0.69	70.4	3946	5.87	0.49	72.2	3005
	1986	72.89	0.37	56.2	1264	17.63	0.85	72.6	5268	9.48	0.37	81.2	3090
	1987	82.62	0.39	54.9	1267	10.75	0.90	73.4	5697	6.63	0.56	78.5	4287
	1988	86.40	0.37	54.6	1176	7.89	0.93	72.9	5839	5.71	0.54	77.8	4016
	1989	83.97	0.32	53.9	1018	10.63	0.86	71.0	5013	5.40	0.83	75.9	5784
	1990	83.01	0.33	54.4	1059	9.03	0.91	71.2	5355	7.96	0.58	75.0	3925
	1991	68.17	0.38	53.8	1177	21.72	0.94	71.5	5556	10.11	0.66	76.3	4680
	1992	89.99	0.39	54.1	1244	6.92	0.89	71.5	5306	3.09	0.55	76.1	3846
	1993	87.75	0.38	53.6	1194	11.69	0.94	71.0	5462	0.56	0.67	71.8	4007
	1994	83.36	0.36	55.0	1180	9.49	1.00	71.5	5942	7.15	0.40	76.1	2808
	1995	80.14	0.32	53.2	987	17.50	0.88	71.1	5142	2.36	0.71	77.5	5213
	Mean	80.86	0.37	54.26	1164	13.25	0.88	71.51	5223	5.88	0.57	75.63	3958

			Spawner requirements:			
			1SW	941	6155161	5434 a
LaHave	egg req =	12203520	2SW	692	4525513	904 a
			MSW	233	1522846	403 a
			per spawner	1867	12203520	6741 a

Eggs per female = 446.54 * exp 0.0362*FL, where FL is fork length (cm)

a - These numbers arrived at using the actual count data and are not calculated from this sheet.

Appendix 5d. Biological characteristics and estimated conservation requirement for the Saint John River system, SFA 23. FL = fork length (cm); ES = eggs per spawner.

River	Year	1SW salmon				2SW salmon			
		Prop. returns	Prop. female	Mean FL	ES	Prop. returns	Prop. female	Mean FL	ES
Saint John River above Mactaquac									
	1988	0.77	0.15	60.7	3837	0.23	0.95	76.90	6881
	1989	0.70	0.17	61.3	3921	0.30	0.93	78.80	7368
	1990	0.69	0.27	60.2	3769	0.31	0.91	77.80	7108
	1991	0.58	0.18	58.3	3519	0.42	0.91	78.30	7237
	1992	0.62	0.13	59.2	3635	0.38	0.95	77.70	7082
	1993	0.52	0.06	59.0	3609	0.48	0.96	77.90	7133
	1994	0.55	0.14	60.1	3755	0.45	0.94	76.10	6685
	1995	0.57	0.11	58.3	3519	0.43	0.94	77.20	6955
Mean 1984-95		0.63	0.15	59.64	3695	0.37	0.94	77.59	7056
		Req'd no. MSW = 32333280/eggs per spawner, i.e., 4900.2 (4606 fem. & 294 males); deficit males are 4606-294= 4312.							
		Req'd no. 1SW fish to attain deficit males = 4312/0.85 or 5,073; round to 4900 also.							
Saint John River below Mactaquac									
(Nashwaak :)	1993	0.63	0.28	57.10	3370	0.37	0.86	77.80	7108
	1994	0.65	0.52	58.80	3583	0.35	0.85	78.70	7342
	1995	0.68	0.36	57.20	3382	0.32	0.98	78.30	7237
Mean 1993-95		0.66	0.39	57.70	3445	0.34	0.90	78.27	7229
		Req'd no. MSW = 47937600/eggs per spawner, i.e., 7392.9 (7400) [6654 fem. & 739 males]; deficit males are 6654-739= 5915.							
		Req'd no. 1SW fish to attain deficit males = 5915/0.61 or 9697; round downwards to 7400 also.							

Notes: 1. Eggs per female= 430.19 * exp(0.03605* fork length) (Marshall and Penny MS 1983).

2. Previous spawner requirements (Marshall and Penny MS 1983) were 4400 MSW and 3200 1SW fish for the area above Mactaquac and 5700 MSW and 4400 1SW fish for the area below Mactaquac and included fish of hatchery origin.

Appendix 6. Atlantic salmon biological characterestics for rivers in zones Q1 - Q11, Quebec. F = female.

River	Eggs required	Small salmon		Large salmon		Percentage		Percentage among large					
								2SW		3SW		Repeat spawners	
	(millions)	% F	weight (kg)	% F	weight (kg)	Small	Large	%	weight (kg)	%	weight (kg)	%	weight (kg)
ZONE Q1													
Bonaventure	8.42	5.0	1.56	60.0	4.88	29.1	70.9	85.0	4.40	5.0	7.90	10.0	7.45
Petite Cascapédia	4.26	5.0	1.89	60.0	6.57	33.7	66.3	60.0	5.00	25.0	8.50	15.0	9.63
Cascapédia	8.64	5.0	1.97	60.0	7.40	7.1	92.9	52.0	5.00	38.0	8.50	10.0	15.70
Nouvelle	2.64	5.0	1.85	60.0	6.00	24.0	76.0	80.0	5.00	10.0	8.50	10.0	11.50
Matapédia	11.44	5.0	1.85	60.0	6.44	24.0	76.0	75.0	5.00	15.0	8.50	10.0	14.15
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kedgwick	0.97	5.0	1.85	60.0	6.43	20.0	80.0	75.0	5.00	10.0	8.50	15.0	12.20
Total zone	**38.70**												
ZONE Q2													
Darmouth	2.99	5.0	1.53	60.0	5.15	20.0	80.0	80.0	4.50	10.0	8.00	10.0	7.50
York	4.39	5.0	1.63	60.0	5.96	13.0	87.0	55.0	4.50	30.0	8.00	15.0	7.23
Saint-Jean	3.77	1.0	1.60	67.5	4.59	23.3	76.7	93.0	4.40	1.0	7.90	6.0	6.92
Malbaie	0.46	5.0	1.62	60.0	4.41	26.9	73.1	95.0	4.40	0.0	7.90	5.0	4.60
Grande Rivière	2.02	5.0	1.56	60.0	4.57	22.0	78.0	85.0	4.20	5.0	7.90	10.0	6.05
Du Petit Pabos	1.16	35.5	1.62	64.5	4.48	35.5	64.5	95.0	4.40	0.0	7.90	5.0	6.00
Du Grand Pabos Ouest	0.60	5.0	1.64	80.0	4.64	50.2	49.8	95.0	4.40	0.0	7.90	5.0	9.20
Du Grand Pabos	1.22	5.0	1.51	60.0	4.69	26.0	74.0	95.0	4.40	0.0	7.90	5.0	10.20
Port-Daniel Nord	0.54	5.0	1.62	60.0	4.48	39.5	60.5	95.0	4.40	0.0	7.90	5.0	6.00
Port-Daniel du Milieu	0.27	5.0	1.62	60.0	4.48	61.5	38.5	95.0	4.40	0.0	7.90	5.0	6.00
Petite rivière Port-Daniel	0.30	5.0	1.62	60.0	4.48	58.7	41.3	95.0	4.40	0.0	7.90	5.0	6.00
Anse à la Barbe	0.20	5.0	1.80	60.0	4.50	33.0	67.0	95.0	4.40	0.0	7.90	5.0	6.40
Total zone	**17.92**												
ZONE Q3													
Ouelle	1.97	12.0	2.18	65.0	5.36	60.0	40.0	80.0	4.60	10.0	7.90	10.0	8.90
Du Sud-Ouest	0.08	5.0	2.18	60.0	5.00	50.0	50.0	85.0	4.60	5.0	7.90	10.0	6.95
Rimouski	0.37	5.0	1.81	60.0	5.70	50.0	50.0	80.0	5.00	10.0	8.20	10.0	8.80
Mitis	4.76	5.0	1.74	60.0	5.31	57.0	43.0	80.0	4.60	15.0	7.90	5.0	8.90
Matane	5.64	5.0	1.77	60.0	4.90	51.0	49.0	85.0	4.40	5.0	7.90	10.0	7.65
Cap-Chat	1.57	5.0	1.85	60.0	5.60	34.0	66.0	80.0	5.00	5.0	8.00	15.0	8.00
Sainte-Anne	2.16	5.0	1.90	60.0	5.60	31.0	69.0	80.0	5.00	10.0	7.90	10.0	8.10
Mont-Louis	0.26	5.0	1.81	60.0	5.44	23.0	77.0	90.0	5.00	0.0	7.90	10.0	9.40
Madeleine	4.72	5.0	1.72	60.0	5.70	40.0	60.0	85.0	5.00	5.0	7.90	10.0	15.65
Total zone	**21.53**												

Appendix 6 (cont'd)

River	Eggs required	Small salmon		Large salmon		Percentage		Percentage among large					
								2SW		3SW		Repeat spawners	
	(millions)	% F	weight (kg)	% F	weight (kg)	Small	Large	%	weight (kg)	%	weight (kg)	%	weight (kg)
ZONE Q5													
Jacques-Cartier	4.50	14.0	1.80	51.0	4.65	64.0	36.0	80.0	4.40	10.0	6.00	10.0	5.30
Du Gouffre	1.50	14.0	1.80	51.7	4.65	64.0	36.0	83.0	4.40	6.0	6.00	11.0	5.80
Total zone	**6.00**												
ZONE Q6													
Petit Saguenay	2.40	41.0	1.80	52.9	5.50	49.0	51.0	74.0	4.45	16.0	7.80	10.0	9.59
Saint-Jean	0.41	5.0	1.98	60.0	5.32	44.0	56.0	61.0	4.80	34.0	6.00	5.0	7.04
_ Mars	2.42	5.0	2.02	58.0	3.94	60.0	40.0	90.0	3.50	5.0	6.00	5.0	9.80
Sainte-Marguerite Principale	4.30	5.0	1.90	58.0	5.48	33.0	67.0	72.0	5.00	25.0	6.50	3.0	8.50
Sainte-Marguerite Nord-est	1.74	5.0	2.06	58.0	5.38	42.0	58.0	72.0	5.00	25.0	6.00	3.0	9.33
Total zone	**11.27**												
ZONE Q7													
Des Escoumins	2.41	20.0	1.70	58.0	5.00	42.0	58.0	79.0	4.25	10.0	7.90	11.0	7.75
Laval	0.93	5.0	1.70	60.0	8.30	1.0	99.0	30.0	5.00	55.0	8.50	15.0	14.17
Betsiamites	18.62	5.0	2.20	60.0	6.00	24.0	76.0	79.0	5.70	3.0	9.60	18.0	6.72
Aux Anglais	0.11	5.0	1.50	80.0	4.30	74.0	26.0	90.0	4.25	0.0	7.90	10.0	4.75
Mistassini	0.17	5.0	1.50	80.0	4.30	74.0	26.0	90.0	4.25	0.0	7.90	10.0	4.75
Franquelin	0.34	5.0	1.50	80.0	4.30	74.0	26.0	90.0	4.25	0.0	7.90	10.0	4.75
Godbout	8.26	6.0	1.70	70.0	4.30	45.0	55.0	92.0	4.25	1.0	7.90	7.0	4.44
De la Trinité	3.03	7.0	1.60	96.0	5.37	55.0	45.0	89.0	4.25	1.1	7.90	9.9	4.50
Petite rivière de la Trinité	0.26	5.0	1.50	80.0	3.70	85.0	15.0	95.0	3.70	0.0	7.90	5.0	3.70
Du Calumet	0.08	5.0	1.50	80.0	4.30	74.0	26.0	90.0	4.25	0.0	7.90	10.0	4.75
Pentecôte	0.63	5.0	1.60	80.0	4.10	52.0	48.0	90.0	4.00	0.0	7.90	10.0	5.00
Aux Rochers	4.95	5.0	1.60	60.0	4.40	40.0	60.0	87.0	4.25	4.0	7.90	9.0	4.29
Total zone	**39.79**												

Appendix 6 (cont'd)

River	Eggs required	Small salmon		Large salmon		Percentage		Percentage among large					
								2SW		3SW		Repeat spawners	
	(millions)	% F	weight (kg)	% F	weight (kg)	Small	Large	%	weight (kg)	%	weight (kg)	%	weight (kg)
ZONE Q8													
Moisie	52.74	5.0	1.60	58.0	6.80	1.6	98.4	58.0	4.25	29.0	7.90	13.0	15.72
Matamec	0.26	5.0	1.70	80.0	4.00	77.0	23.0	95.0	3.90	0.0	7.90	5.0	5.90
Pigou	0.01	5.0	1.70	80.0	4.00	53.0	47.0	95.0	3.90	0.0	7.90	5.0	5.90
Au Bouleau	0.24	5.0	1.70	80.0	4.00	53.0	47.0	95.0	3.90	0.0	7.90	5.0	5.90
Sheldrake	0.08	5.0	1.70	80.0	4.00	53.0	47.0	95.0	3.90	0.0	7.90	5.0	5.90
Jupitagon	0.27	5.0	1.60	80.0	3.40	53.0	47.0	95.0	3.30	0.0	6.00	5.0	5.30
Magpie	-	5.0	1.70	80.0	4.00	53.0	47.0	95.0	3.90	0.0	7.90	5.0	5.90
Saint-Jean	17.30	2.0	1.60	55.0	4.30	22.0	78.0	95.0	3.90	2.0	7.90	3.0	14.57
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Romaine	0.68	5.0	1.80	60.0	4.70	38.0	62.0	95.0	3.90	0.0	7.90	5.0	19.90
De la Corneille	0.11	6.0	1.80	69.0	3.50	42.0	58.0	91.0	3.30	5.0	6.00	4.0	4.93
Piashti	0.02	5.0	1.80	80.0	3.70	52.0	48.0	83.0	3.40	5.0	6.00	12.0	4.82
Watshishou	2.20	21.0	1.70	61.0	4.00	37.0	63.0	93.0	3.70	5.0	7.90	2.0	8.20
Petite rivière Watshishou	0.33	5.0	1.60	80.0	3.00	82.0	18.0	93.0	2.80	5.0	6.00	2.0	4.80
Nabisipi	6.30	21.0	1.70	61.0	4.00	37.0	63.0	90.0	3.70	5.0	7.90	5.0	5.50
Aguanus	0.01	50.0	1.60	70.0	3.90	57.0	43.0	94.0	3.80	0.0	6.00	6.0	5.47
Natashquan	34.05	50.0	1.80	70.0	3.90	49.0	51.0	86.0	3.70	5.0	6.00	9.0	4.64
Au Tonnerre	0.17	5.0	1.70	80.0	4.00	53.0	47.0	100.0					
Total zone	**119.14**												
ZONE Q9													
Kégaska	0.21	5.0	1.80	80.0	4.00	81.0	19.0	90.0	3.90	0.0	7.90	10.0	4.90
Musquaro	-	5.0	1.80	80.0	2.80	54.0	46.0	75.0	2.70	0.0	7.90	25.0	3.10
Musquanousse	0.06	5.0	1.80	60.0	3.00	34.0	66.0	80.0	2.90	0.0	7.90	20.0	3.40
Washicoutai	0.01	5.0	1.80	80.0	3.90	67.0	33.0	90.0	3.80	0.0	7.90	10.0	4.80
Olomane	3.94	5.0	1.90	52.0	5.10	6.0	94.0	95.0	5.00	0.0	7.90	5.0	7.00
Coacoachou	0.15	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Etamamiou	4.17	22.0	1.80	79.0	3.80	70.0	30.0	87.0	3.70	0.0	7.90	13.0	4.47
Nétagamiou	0.00	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Du Petit Mécatina	0.23	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Du Gros Mécatina	0.15	5.0	1.80	79.0	3.40	86.0	14.0	87.0	3.30	0.0	7.90	13.0	4.07
Véco	0.18	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Kécarpoui	0.20	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Saint-Augustin Nord-Ouest	1.48	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Saint-Augustin	12.59	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Coxipi	3.97	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Chécatica	0.01	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Napetipi	4.19	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Du Vieux Fort	0.65	5.0	1.90	60.0	2.60	40.0	60.0	80.0	2.50	0.0	7.90	20.0	3.00
Saint-Paul	13.59	5.0	1.80	80.0	3.20	74.0	26.0	20.0	3.00	0.0	6.00	80.0	3.25
Ruisseau au Saumon	0.31	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Ruisseau des Belles Amours	0.02	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Brador-est	0.28	5.0	1.80	80.0	3.40	65.0	35.0	90.0	3.30	0.0	7.90	10.0	4.30
Total zone	**46.39**												

Appendix 6 (cont'd)

River	Eggs required	Small salmon		Large salmon		Percentage		Percentage among large					
								2SW		3SW		Repeat spawners	
	(millions)	% F	weight (kg)	% F	weight (kg)	Small	Large	%	weight (kg)	%	weight (kg)	%	weight (kg)
ZONE Q10													
_ l'Huile	0.37	14.0	1.50	68.0	3.40	53.0	47.0	95.0	3.30	0.0	7.90	5.0	5.30
MacDonald	0.40	14.0	1.40	68.0	3.40	60.0	40.0	95.0	3.30	0.0	7.90	5.0	5.30
_ la Patate	0.23	14.0	1.60	68.0	3.40	53.0	47.0	95.0	3.30	0.0	7.90	5.0	5.30
Vauréal	0.30	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Aux Saumons	1.35	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Du Renard	0.39	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Petite rivière de la Loutre	0.51	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Bell	0.42	14.0	1.60	68.0	3.80	26.0	74.0	90.0	3.50	0.0	7.90	10.0	6.50
Ruisseau Box	0.33	14.0	1.60	68.0	3.90	20.0	80.0	90.0	3.50	0.0	7.90	10.0	7.50
Dauphiné	0.80	14.0	1.60	68.0	4.10	27.0	73.0	90.0	3.80	0.0	7.90	10.0	6.80
Petite rivière de la Chaloupe	0.20	14.0	1.50	68.0	3.40	45.0	55.0	95.0	3.50	0.0	7.90	5.0	1.50
Maccan	0.20	14.0	1.50	68.0	3.40	45.0	55.0	95.0	3.50	0.0	7.90	5.0	1.50
De la Chaloupe	1.17	14.0	1.50	68.0	3.40	45.0	55.0	95.0	3.30	0.0	7.90	5.0	5.30
Ferrée	0.30	14.0	1.60	68.0	3.40	49.0	51.0	95.0	3.30	0.0	7.90	5.0	5.30
Ruisseau Martin	0.26	14.0	1.60	68.0	3.40	49.0	51.0	95.0	3.30	0.0	7.90	5.0	5.30
Du Pavillon	0.27	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Aux Plats	0.37	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Chicotte	0.43	14.0	1.50	68.0	3.10	50.0	50.0	95.0	3.00	0.0	7.90	5.0	5.00
Galiote	0.84	14.0	1.50	68.0	3.40	35.0	65.0	95.0	3.30	0.0	7.90	5.0	5.30
Jupiter	5.02	14.0	1.40	68.0	3.50	30.0	70.0	96.0	3.30	0.0	7.90	4.0	8.30
_ la Loutre	0.48	14.0	1.50	68.0	3.50	46.0	54.0	95.0	3.30	0.0	7.90	5.0	7.30
Aux Cailloux	0.18	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Sainte-Marie	0.19	14.0	1.50	68.0	3.50	36.0	64.0	95.0	3.30	0.0	7.90	5.0	7.30
Bec-Scie	0.23	16.0	1.50	63.0	3.30	50.0	50.0	94.0	3.30	0.0	7.90	6.0	3.30
Total zone	15.24												
ZONE Q11													
Aux Feuilles	-	10.0	1.99	85.0	5.02	31.0	69.0	94.0		2.0		4.0	
Koksoak	27.88	10.0	1.99	85.0	5.02	31.0	69.0	94.0		2.0		4.0	
_ la Baleine	-	10.0	1.99	85.0	5.02	31.0	69.0	94.0		2.0		4.0	
George	-	10.0	1.99	85.0	5.02	31.0	69.0	94.0		2.0		4.0	
Total zone	-												

Note: Zone 11 is represented by data from Koksoak river. The different categories of salmon have been adjusted to include estuarine salmon.