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STATUS OF ATLANTIC SALMON (*Salmo salar*) IN THE TABUSINTAC RIVER IN 1999

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ABSTRACT

Esgenoôpetitj First Nation and the recreational angling community harvested Atlantic salmon from the Tabusintac River in 1999. First Nation food fishery removals of small salmon (n=31) and large salmon (n=19) were 28% and 6% of the respective communal allocations. A telephone creel survey conducted for public water angling during the 1999 season, indicated that total bright salmon catches increased from 1998 but remain only 45% of the previous five year mean. Total catches in 1999 for both large (n=31) and small (n=56) salmon on leased water were 23% higher than in 1998 but 160% higher than the four year mean (1994, 1996-98). Total returns of large salmon to the Tabusintac River in 1999 were estimated from a mark-recapture experiment using tags applied at an estuary trapnet and the catches and recaptures from an upstream (recapture) trapnet. Most probable total returns of large salmon, generated by a Bayes algorithm, were estimated to be 900 fish. Total returns of small salmon were calculated from the estimate of large salmon returns and the combined capture efficiencies for large salmon observed at both trapnets in the current year. Total returns of small salmon were estimated to be 800 fish. After accounting for removals, large salmon spawning escapement was estimated to be 851 fish, which alone accounts for 237% of the conservation requirement. Small salmon spawning escapement was estimated to be 704 fish. Total estimated egg deposition was 250% of the conservation requirement. Egg deposition has exceeded the requirement in all assessed years and is expected to do so in 2000. Increased Atlantic salmon juvenile densities in 1999 are encouraging for the future of the resource.

RÉSUMÉ

La Première Nation d'Esgenoôpetitj et les pêcheurs récréatifs à la ligne ont pêché du saumon Atlantique dans la rivière Tabusintac en 1999. Les captures de petits saumons (n=31) et de gros saumons (n=19) qui sont le fait de la pêche de subsistance de la Première Nation étaient respectivement de 28 % et de 6 % des allocations communautaires. Un sondage des pêcheurs effectué au téléphone et visant la pêche à la ligne dans les eaux publiques en 1999 indiquait que les prises globales de saumons de montée avaient augmenté par rapport à l'année précédente, mais qu'elles ne demeuraient quand même qu'à 45 % de la moyenne des cinq années précédentes. Le total des prises pour 1999 à la fois pour le gros saumon (n=31) et pour le petit saumon (n=56) dans les eaux louées était de 23 % supérieur au total de 1998 et de 160 % supérieur à la moyenne des quatre années (1994, 1996-1998). Le nombre total de gros saumons qui ont remonté la rivière Tabusintac en 1999 a été évalué à partir d'une expérience de marquage et de recapture en utilisant des étiquettes qui avaient été posées à un filet-trappe placé dans l'estuaire ainsi qu'à partir des prises et recaptures d'un filet-trappe placé en amont. D'après l'algorithme Bayésien, on évalue à 900 le nombre global le plus probable de retours de gros saumons. Le nombre total de retours de petits saumons a été calculé à partir de l'évaluation du nombre de gros saumons et en fonction de l'efficacité des observations aux deux filets-trappes au cours de l'année; le nombre de petits saumons a été évalué à 800. Après avoir tenu compte des poissons retirés de la rivière, l'échappée de gros saumons était évaluée à 851, chiffre qui à lui seul représente 237 % de l'objectif de conservation. L'échappée de petits saumons était évaluée à 704. La ponte s'établissait à 250 % de l'objectif de conservation. Au cours des années où une évaluation a été effectuée, la ponte a dépassé toutes les exigences de conservation et on s'attend aux mêmes résultats pour 2000. La plus forte densité de saumon Atlantique juvénile en 1999 est un signe encourageant pour l'avenir de la ressource.

SUMMARY SHEET

STOCK: Tabusintac River (SFA 16)
CONSERVATION REQUIREMENT: 1.978 million eggs (329 large salmon, 175 small salmon)

	1994	1995	1996	1997	1998	1999	Min	Max	Mean
Angling[1]									
Large (Released)	316	22	73	63	46	60	14	488	104
Small (Released + Kept)	328	33	128	126	34	45	15	330	130
First Nation Harvest[2]									
Large	44	42	187	NA	18	19	18	270	
Small	30	106	171	NA	18	31	18	171	
Total Returns									
Large	1414	NA	920	NA	1200	900			
Small	1067	NA	615	NA	1800	800			
Spawning Escapement									
Large	1214	NA	731	NA	1180	851			
Small	844	NA	368	NA	1766	704			
% Egg Requirement Met									
Large	391	NA	244	NA	358	237			
Large and Small	404	NA	245	NA	364	250			

[1]Angling catch min and max are for years 1969 to 1998; mean is for years 1994 to 1998.
[2]First Nation Harvest min and max are for years 1992 to 1998.

Description of Fishery: Salmon are angled in leased and public water. Public angling catch estimates for 1999 are provisional. Esgenoôpetitj First Nation harvests late run salmon by gillnet and in some years trapnets.

Aboriginal Community Harvests: The allocation of bright Atlantic salmon to the Esgenoôpetitj First Nation from the Tabusintac River remained the same for 1999 (304 MSW and 112 1SW). Tabusintac River black salmon allocations remained 100 MSW and 100 1SW for 1999.

Research Data: Tags applied at a trapnet and recaptured in an upstream trapnet were the basis for this assessment. Biological data was collected on the adult and juvenile stocks. Juvenile densities and percent habitat saturation were determined at 25 sites.

Estimation of Stock Parameters: The Bayesian estimate for large salmon returns was obtained using the catch and recaptures from the recapture trapnet. Small salmon returns were estimated from the large salmon estimate and the combined capture efficiencies of large salmon observed at both trapnets. Egg deposition was calculated from fecundity based on stock characteristics observed in the current year.

Assessment Results: Spawning escapement was exceeded for large and small salmon in 1999. Total egg deposition was 250% of the conservation requirement.

Forecast for 2000: No quantitative forecast can be made. Given that the conservation requirement was exceeded in all of five assessed years, it is likely that the conservation requirement will be met in 2000.

Management Considerations: There is a harvestable surplus of salmon from the Tabusintac River. The amount of this surplus is unknown and not predictable.

INTRODUCTION

The Tabusintac River is situated in Northumberland County, New Brunswick and flows east into the Gulf of St. Lawrence (Long. 65.00^{o}W; Lat. 47.34^{o}N) (Fig. 1). The spawning run of Atlantic salmon consists of both early (June-August) and late (September-November) run components. Late run fish, which are exploited for food by Esgenoôpetitj First Nation, also comprise approximately 75-80% of the reported salmon catch by anglers on this river.

The Atlantic salmon stock of the Tabusintac River has been assessed 4 times previously: in 1993 (Atkinson and Claytor 1994), 1994 (Atkinson and Hooper 1995) and 1996 and 1998 (Douglas et al. 1999). There was no assessment of the resource in 1995 or 1997. Under the Aboriginal Fisheries Strategy (AFS), the Department of Fisheries and Oceans provided funding in 1998 to Esgenoôpetitj First Nation to resume the 1998-99 salmon assessments on the Tabusintac River. As was the case in all previous assessments, a mark-recapture experiment was the basis for this assessment. Tags (marks) were applied at First Nation research trapnets in the estuary and recovered either from an upstream trapnet or from the angling fisheries on public and leased waters. This document details the 1999 mark-recapture experiment.

In 1999, the Tabusintac Fish and Game Association, in co-operation with the Department of Fisheries and Oceans (DFO), the Department of Natural Resources and Energy (DNRE), and the Tabusintac Club Ltd., resumed juvenile Atlantic salmon and brook trout surveys on the Tabusintac River. Results of the 1999 electroseining program are presented here and compared with similar data collected from the Tabusintac River by DNRE in 1994 (results presented in Atkinson and Hooper 1995).

DESCRIPTION OF FISHERIES

Commercial

Commercial harvesting of Atlantic salmon ceased at the end of the 1983 fishing season. The harvest from 1967 to 1983 in Salmon Fishing Area (SFA) 16 was presented in Atkinson and Claytor (1994).

First Nation

Esgenoôpetitj First Nation harvests salmon from the Tabusintac River during September and October using gillnets and in some years trapnets. With the exception of 1997, First Nation fishery guardians have provided harvest statistics from gillnets, as well as food fish removed from trapnets since 1992 (Table 1). Other species harvested for food with gillnets include striped bass (*Morone saxatilis*) and brook char (*Salvelinus fontinalis*) with landings of both species limited to agreed upon communal allocations. Because gillnets are not selective with respect to species caught and the overlap in timing of species migrations, this fishery is subject to closure as soon as the communal allocation of any one of the finfish species is reached.

Communal allocations for large ($\geq$ 63 cm) and small (< 63 cm) bright salmon from the Tabusintac River include 304 MSW and 112 1SW salmon respectively. From this, 25 MSW and 75 1SW salmon may be harvested from the recapture trap in years of trapnet operation. Harvesting of salmon began immediately at the implementation of the 1999 mark-recapture program and 14 large salmon (all but 2 were males) and 21 small salmon (all but 1 were males) were harvested.

Gillnetting effort in the Tabusintac River by Esgenoôpetitj First Nation is believed to have been reduced in 1999 (personal observation). Esgenoôpetitj First Nation reported fall gillnet harvests of 5 large and 10 small salmon. The total reported salmon harvest for Esgenoôpetitj First Nation in 1999 was 19 large and 31 small salmon; a 39% combined increase from 1998 (Table 1).

Recreational[3]

Recreational angling season lengths and bag limits for the Tabusintac River prior to 1996 are detailed in Atkinson and Hooper (1995).

Recreational angling is carried out on two short stretches of public water. The first stretch (3 km) is located at the head of tide, the other (5 km), above the private waters leased to the Tabusintac Club (Crown Angling Lease 13) (Fig. 1). Black salmon are angled only on the public section of the river. Beginning in 1996, the angling season for black and bright salmon was made continuous from April 15 through to the end of the season with most angling for bright salmon occurring from late September to the end of the season.

In 1999, the Tabusintac River returned to a fishery where the retention of two small salmon and a maximum hook and release of four salmon (any size) per day was permitted. The angling season on the Tabusintac River was extended to November 1 in 1999.

Complete catch and effort statistics from the Tabusintac Club (Table 2), required by the Province of New Brunswick as a condition of their lease on the river, indicate for 1999, a total of 31 large and 56 small salmon landed with all but 4 small salmon released. Total catch on the leased portion of the river was 160% higher in 1999 relative to the 4 yr. mean (94, 96-98) (Table 2) but only 23% higher than the total catch in 1998. Increased catches on the lease in 1999 were reported to be a consequence of good water conditions throughout most of the fall angling season.

Historically, the New Brunswick Department of Natural Resources and Energy has estimated catch and effort on the Tabusintac River from a province wide, random survey of license purchasers (FISHSYS). The number of anglers on the Tabusintac River is believed to be substantially fewer than those on other rivers in the region and therefore lends to a small proportion of Tabusintac anglers who complete the FISHSYS survey. For this reason, catch and effort on the Tabusintac River and other smaller rivers in New Brunswick is believed to have been overestimated for some years (Table 3). FISHSYS was not conducted for the 1996 angling season and final estimates for 1998-99 have not yet been compiled. Preliminary figures indicate that total catches of bright salmon on public water were substantially less than the previous five year mean (Table 3).

A telephone survey was conducted of 29 anglers who collectively account for at least 80% of the total angling effort on the public waters of the river (personal observation). The list of anglers has been accumulated over the past 7 years as described in Atkinson and Hooper (1995). Each angler was specifically asked to report only on large and small salmon landed and not those released at a distance by breaking the fishing line. Results indicated that the total angling catch in

[3] Since 1997, variation orders affecting regulations on the Tabusintac River have been included in SFA 15, which includes the Chaleur region, and not SFA 16.

1999 was 31% higher from 1998 with 60 large salmon and 13 small salmon caught and released, and 32 small salmon harvested. These catches are substantially below the mean catch for the past five years (Table 3). Total removals from the angling fisheries were calculated by applying a hook and release mortality factor of 3% (Currie 1985) to all released fish and subsequently adding the result to the known removals from the respective angling fisheries.

Other

Although the estuary and freshwater sections of the river are patrolled by Tabusintac Club wardens on a regular basis until ice-up, one reported illegal event occurred during the second week of November, 1999. Twenty-five grilse and salmon were gillnetted from the spawning grounds of the River near Bear Landing. During this same event, 4 grilse and 1 brook trout were seized by Club wardens.

A reliable source reported a mixture of 23 large and small salmon that had been removed from the Tabusintac River during mid October (Bernie Dubee, DNRE, personal communication). The exact number of small and large salmon removed by the latter two events is unknown and therefore had to be estimated. Numbers of removed small and large salmon were estimated by dividing the total number of removed fish by the ratio of small to large salmon observed at the trapnets in the estuary.

One severely decomposed large salmon floated into the leaders of both trapnets in 1999. No apparent injuries were visible and the cause of death was not determined. One of these mortalities had been tagged at the recapture trap 5 days prior to its recapture. Reported removals from all sources for 1999 are summarized as follows:

SUMMARY OF REMOVALS

	Removals	
Location	Small	Large
First Nation Food	31	19
Public Angling	32[1]	2[1]
Lease Angling	6[1]	1[1]
Other	27	27
Total	96	49

[1]3% hook and release mortality included.

CONSERVATION REQUIREMENT

The required number of spawners for the Tabusintac in 1999 was calculated using Method 2 as recommended by Randall (1985) for the Miramichi River. Briefly, the number of spawners needed to meet egg deposition requirements was calculated assuming all egg deposition came from large salmon. The number of small salmon required was calculated assuming that at least one male spawner was needed for each female large salmon. Average fecundity values were assumed to be equivalent to Miramichi stock based on river proximity. Sex ratios were derived based on external characteristics.

Egg deposition rate : 2.4 $eggs \cdot m^{-2}$ (CAFSAC 1991)
Rearing area : 824,000 m^2 (Atkinson and Hooper 1995)
Conservation Requirement : 1.978 million eggs; 329 large salmon; 175 small salmon

RESEARCH DATA

Mark/Recapture

Esgenoôpetitj First Nation operated two V-style trapnets in the tidal portion of the river to mark and recapture salmon. Sampling protocols are as established during previous assessments (Atkinson and Claytor 1994; Atkinson and Hooper 1995). Briefly, salmon captured in a trapnet situated one half kilometre upstream (west) of the Route 460 bridge at Cains Point (Fig. 1) were measured, sexed on external characters, scale sampled for later ageing, marked with individually numbered Carlin tags behind the first ray of the dorsal fin, and released to the wild. The other trapnet, located approximately two kilometres upstream from the marking trap (Fig. 1) is used as the primary recapture site. The recapture trapnet was relocated in 1999 to the opposite bank of the estuary (original site) in an effort to increase the low capture efficiency observed in 1998 (lowest of all previous assessments). All fish captured in the recapture trapnet were measured, sexed on external characters, scale sampled for ageing and either tagged or harvested. Total weight of harvested fish was recorded and gonads extracted for later processing. Trap and leader configurations and dimensions were as reported by Atkinson and Hooper (1995).

The trapnets were operated continuously from 26 August to 31 October 1999. The first salmon was intercepted on 30 August and the last on 27 October (Table 4). Combined catch for both traps was 198 (53%) large and 179 (47%) small salmon (Table 4). Weeks were standardized to define time series of trapnet operation, as well as, run timing of salmon to the river. In 1999, peak catches of both large and small salmon occurred during the third week of September (standard week 38) (Fig. 2), approximately 1 week earlier than in 1998. Total marks applied to large and small salmon are summarized below.

TAGS APPLIED

Location	Small	Large
Marking Trap	116	122
Recapture Trap	19	41
Total	135	163

Estimates of the total catch and recaptured tags were obtained from 3 available sources: the recapture trap, the angling fishery on public section of the river, and the angling fishery on the leased section of the river. These are summarized below.

TAGS RECAPTURED

	Small Salmon		Large Salmon	
Source	Catch	Tags	Catch	Tags
Recapture Trap	44	3	66	9
Lease Angling	56	8	31	11
Public Angling	45	3	60	8
Native gillnet	10	0	5	0

Biological Characteristics

Modal forklength of small salmon captured in the 1999 trapnet fishery was 59.8 cm and of large salmon, 78.7 cm; approximately 3 centimeters longer for both small and large salmon than in 1998 (Fig. 3). The mean length of small salmon was 58.3 cm; 9% were females and 91% males. The mean length of large salmon was 78.5 cm; 70% were females and 30% males. Ageing of salmon by scale samples is not complete for the 1996-99 mark-recapture programs and was therefore based on the length frequency distributions for those years. Caution must be used when interpreting results based on this method since small numbers of fish can alter proportions dramatically. The proportion of 2SW salmon as estimated from fish between the lengths of 68.0 cm and 83.0 cm was 69%; similar to that in 1998 (68%), but less than in 1996 (77%), 1994 (85%), and 1993 (81%). The proportion of repeat spawners for 1999 (31%) remained the same as in 1998 (32%).

Modal forklength values measured from all juvenile salmon sampled during the electroseining survey are 48, 79, and 100 mm for fry, small parr, and large parr respectively. Mean forklengths were 48, 77, and 105 mm (Fig. 4). Modal forklength values for all juvenile brook trout sampled during the electroseining survey are 54, 64, and 132 mm for fry, small parr, and large parr respectively. Mean forklengths were 51, 80, and 126 mm (Fig. 5).

Electroseining

Juvenile Atlantic salmon density and corresponding percent habitat saturation (PHS) values were determined for 25 sites electroseined throughout the Tabusintac watershed during the first 2 weeks of August, 1999. Ten of these sites were sampled in a similar fashion in 1994 by the Department of Natural Resources and Energy (results presented in Atkinson and Hooper 1995). Sites in 1999 were chosen on the basis of historic data, accessibility, and importance to various stake holders. Three sites were closed (Zippin 1956) and fished with 4 sweeps of the barriered area; the first in an upstream direction, with subsequent sweeps in a downstream direction. The remaining sites were open and fished with one upstream sweep with approximately 5 minutes of shocking time (Chaput et al. MS1995). All fish were anaesthetised with sodium bicarbonate salts, identified and measured to forklength (nearest mm).

Densities of salmonid fry and parr at closed sites were calculated using Zippin's (1956) removal method. Densities of salmon fry and parr at open sites were calculated using catch per unit of fishing effort coupled with the calibration of the upstream sweeps at open sites, with the initial upstream sweep at closed sites (Chaput et al. MS1995). Given the limited juvenile data set for the Tabusintac River, calibration data for years 1993-99 from the Miramichi River (Chaput et al. 1999 in preparation) were borrowed to predict fry and parr densities at open sites on the Tabusintac. Data collected from the three closed sites on the Tabusintac in 1999 were combined with the Miramichi data and a new regression calculated for both fry and parr (Fig. 6). CPUE data for the Tabusintac River from 1994 was not available and could not be incorporated into the new regressions. Caution must be used when interpreting results based on this method as all three Tabusintac points fall below the regression line and thus may be slightly overestimating density of fry and parr. Although the overestimation of fry and parr is likely minimal, the need for more data sets from closed sites is obvious. Brook trout fry and parr abundance was expressed as catch per unit of fishing effort. Percent habitat saturation was calculated for each site (Grant and Kramer 1990).

ESTIMATION OF STOCK PARAMETERS

Three recapture samples were available for estimation of stock parameters: one from the recapture trap, one from the angling on leased water, and one from angling on public water. A Bayesian estimator, as described by Gazey and Staley (1986), was used to calculate returns separately for large and small salmon from corresponding recapture samples. The most probable population size given R recaptures out of M marks placed in a sampled catch of C was calculated over a range of possible population sizes. Only tags applied in the current year or tags applied in a previous year that were observed at the traps were used. Tag loss was assumed to be negligible over the short period (two months) of the experiment. Total returns of small and large salmon were calculated by adding removals known to have occurred prior to marking (n = 0). Spawning escapement was calculated by subtracting known removals from all sources from the calculated estimate of large and small salmon total returns. A summary of the data used for estimation of stock parameters is given in Table 5.

ASSESSMENT RESULTS

Total Returns, Spawning Escapement, and Conservation Requirement

Recapture Trapnet Sample

The most probable estimates of total returns to the river were 900 (95% CL: 500-2100) large salmon and 1700 (95% CL: 800-16400) small salmon (Table 5). However given the small number of recaptured grilse from the recapture trap and the large confidence limits that surround this population estimate, a further estimate for small salmon was calculated. Small salmon total returns were calculated using the estimated large salmon total returns and the combined large salmon capture efficiencies observed at both trapnets in the current year. This method estimates a total return of 800 (95% CL: 450-1860) small salmon. Total returns of large and small salmon are 75% and 44% of those last reported for this river in 1998 (1200 large, 1800 small; Douglas et al. 1999). After subtracting removals, spawning escapement for small and large salmon was 704 and 851 respectively. The probability of having achieved the required numbers of small (Fig. 7) and large (Fig. 8) salmon was 100% for both. Based on fecundity values derived from stock characteristics observed in the current year (Table 6), total egg deposition was estimated at 250% of the conservation requirement for this system. The total number of physically handled fish in all fisheries (less removals, recaptures, hook and release mortalities, and possible multiple recaptures), represents 67% of the egg requirement for the watershed assuming all fish spawned.

Public and Leased Water Angling Samples

In 1999, the majority of public angling occurred at the head of tide with less effort afforded to the public section of the River above the lease. However, tags were removed and released by anglers below, within, and above the lease over the course of the angling season which made tracking of available tags to capture virtually impossible for either of the angling fisheries. Furthermore, both public and lease anglers reported many fish that were hooked and lost before either the size of the fish (large or small) or whether or not the fish was tagged, could be recorded.

Although population estimates derived from either the public angling sample or the lease angling sample were not considered reliable, estimated total returns from either of these means were sufficient to meet the conservation requirement (Table 5).

Sources of Uncertainty

The assumption that the exploitation rates for marked and unmarked fish, for either large or small salmon, are the same in the native gillnet food fishery needs to be verified. The reporting rate for recaptures from this fishery is poor and yet fish removals via gillnets can represent substantial portions of the total returns in some years.

The extent of the fall salmon run that had already migrated upstream before the onset of the mark recapture experiment is unknown. Large and small salmon were reported to be in pools near the head of tide during the first week of August.

As was the case for all previous assessments, fecundity estimate values for Miramichi fish have been used. Direct measurements could, and should, be obtained from food fish removed from assessment trapnets by the First Nation crews operating them, as well as by guardians from the First Nation gillnet fishery.

Change in catch per effort with time (years) in the angling fisheries would have been more effectively evaluated with a more timely delivery of the catch statistics.

Estimates of hook and release mortality for large and small salmon which reflect both the behaviour of the anglers and environmental conditions on this river would improve the accuracy of the stock parameters estimated by mark-recapture experiments. These data could probably be obtained with the co-operation of at least one of the angling groups on the river.

ECOLOGICAL CONSIDERATIONS

Seasonal and Environmental Conditions

Anglers reported good water conditions throughout most of the 1999 fall angling season. Very few fish were intercepted at the trapnets prior to the remnants of hurricane Floyd (Sept. 17-18) which increased discharge and decreased water temperatures (Fig. 2). Reports of salmon in the upper reaches of the Tabusintac's head waters beyond the lease may indicate that salmon had unrestricted access early in the season. Redd digging was observed during late October at the same time as spent fish were being hooked above the lease (Raoul Breau, DFO, personal communication).

Atlantic Salmon Spawner Distribution and Habitat Utilization

Spawning occurred throughout the Tabusintac watershed in 1998 (Fig. 9). Fry densities (Fig. 9) and parr densities (Fig. 10) were high at 12 and 11 of the 25 sites sampled in 1999. Low densities of fry and parr at some sites can be attributed to obstructed passage (beaver dams) (Ron McKnight, Tabusintac Fish and Game Association, personal communication) and small brooks that would be inaccessible to salmon in any given year.

River water levels were average to moderately high (after rain) during the first 2 weeks of August and the availability of juvenile habitat did not appear to be limited. Although the data needed to compare available habitat between sites in 1994 and 1999 was lacking, 70% and 60% of the 10 mutual sites sampled in those years demonstrated increased fry and parr densities respectively (Table 7). Fry density increased at the 10 mutual sites from 39.8/100m^2 in 1994 to the current level of 73.9/100m^2. Mean fry density for all sites with salmon sampled in 1999 was 72.7/100m^2. Salmon (1+) parr density increased at the 10 mutual sites from 18.4/100m^2 in 1994 to 24.9/100m^2 in 1999. Mean (1+) parr density for all sites with salmon in 1999 was 19.8/100m^2. Salmon (2+) parr density increased at the 10 mutual sites from 6.8/100m^2 in 1994 to the current level of 13.3/100m^2. Mean (2+) parr density for all sites with salmon in 1999 was 11.0/100m^2

Percent habitat saturation values were calculated following Grant and Kramer (1990) to determine the extent of juvenile interaction and habitat use within a stream. Juveniles have a 50% likelihood of expressing density dependant responses when PHS values are above 28 (Grant and Kramer 1990). PHS values have increased at 60% of the mutual sites sampled in 1994 and 1999 (Table 7). The mean PHS value at the 10 mutual sites was 22.2 for 1994 and 21.6 in 1999. Mean PHS value for all sites with salmon sampled in 1999 was 19.3.

Brook Trout Spawner Distribution and Habitat Utilization

Brook trout spawning in 1998 (Fig. 11) and habitat utilization by parr (Fig. 12) appears to be limited to small brook tributaries and not the main stem of the Tabusintac River. Brook trout fry abundance, expressed as catch per unit of fishing effort (CPUE), was high at only 1 of the 25 sites sampled (Table 8). Abundance of parr was generally low for all sites sampled (Table 8).

FORECAST/PROSPECTS

The available data suggest that the stock of Atlantic salmon in the Tabusintac River is stable and is continuing to meet its conservation requirement.

MANAGEMENT CONSIDERATIONS

The conservation requirement for the Tabusintac River was met in 1999, with an estimated egg deposition at 250% of the requirement. The river continues to produce a harvestable surplus of both large and small salmon, however, the extent of this surplus is unknown. In view of the inability to forecast returns on a year to year basis, diligent monitoring of removals in both Native food fisheries and small salmon angling fisheries would be prudent.

The conservation requirement for the Tabusintac River has been exceeded in all 5 years the salmon population has been assessed. The river will likely meet its conservation requirement in 2000.

It would seem prudent that harvest levels for 2000 reflect the fact that total returns in 1998 may have been overestimated, and that mortality factors associated with winter sea habitat have impacted total returns to many of the salmon rivers of eastern Canada in recent years. Furthermore, the Tabusintac River is not exceptional to the fact that returns of 2SW maiden salmon have decreased in many Maritime salmon rivers in recent years.

RESEARCH RECOMMENDATIONS

1. Continue to estimate returns of adult salmon to the Tabusintac River.

2. Continue electroseining surveys to determine the extent of salmon spawning and juvenile densities. Also, the number of barriered sites needs to be increased so the relationship between CPUE and density, that may be specific to the Tabusintac River and its tributaries, can be developed.

3. Evaluate more accurately the proportions of 2 sea-winter salmon as well as repeat spawners by updating database of salmon ages from scales.

4. Improve the capture efficiency of the recapture trap.

5. Continue the telephone creel survey, to obtain tag returns and evaluate DNRE catch estimates.

6. Obtain direct measurements of fecundity from the Esgenoôpetitj First Nation food fishery.

7. In partnership with all client groups, develop new criteria for recovering tags in the event that sufficient recaptures cannot be obtained from the trapnet program or from the angling fisheries. Options could include swim through snorkel counts and/or seining pools in non-tidal waters of the river.

8. Obtain hook and release mortality estimates that are specific to the Tabusintac River environment and its anglers.

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Table 1. Esgenoôpetitj First Nation harvest of Atlantic salmon from gillnet and trapnet fisheries in the Tabusintac River for years 1992-1999. Data not available (NA).

	Gillnets		Trapnets		Total	
Year	Small	Large	Small	Large	Small	Large
1992	126	270	0	0	126	270
1993	48	64	31	37	79	101
1994	22	28	8	16	30	44
1995	106	42	0	0	106	42
1996	142	154	29	33	171	187
1997	NA	NA	NA	NA	NA	NA
1998	18	16	0	2	18	18
1999	10	5	21	14	31[1]	19[2]

[1]communal allocation of 112 bright small salmon was not met.
[2]communal allocation of 304 bright large salmon was not met.

Table 2. Bright Atlantic salmon catches from the leased section of the Tabusintac River, 1981-1999. Estimates provided by the Tabusintac Salmon Club Ltd. Data not available (NA).

		Total Bright Salmon							
		Small			Large	Total			
Year	Source	Kept	Released	Total	Released	Catch	% Large	Rods	CPUE
1981	Tab. Club	24	100	124	30	154	19.5	445	0.346
1982	Tab. Club	17	61	78	78	156	50.0	542	0.288
1983	Tab. Club	0	6	6	7	13	53.8	602	0.022
1984	Tab. Club	2	4	6	7	13	53.8	285	0.046
1985	Tab. Club	3	7	10	3	13	23.1	NA	NA
1986	Tab. Club	24	40	64	91	155	58.7	473	0.328
1987	Tab. Club	36	52	88	103	191	53.9	520	0.367
1988	Tab. Club	21	67	88	92	180	51.1	454	0.396
1989	Tab. Club	13	31	44	35	79	44.3	405	0.195
1990	Tab. Club	17	72	89	48	137	35.0	520	0.263
1991	Tab. Club	14	52	66	92	158	58.2	555	0.285
1992	Tab. Club	8	55	63	46	109	42.2	530	0.206
1993	Tab. Club	8	69	77	76	153	49.7	520	0.294
1994	Tab. Club	0	16	16	5	21	23.8	NA	NA
1995	Tab. Club	NA	NA	NA	NA	NA	NA	NA	NA
1996	Tab. Club	3	15	18	7	25	28.0	NA	NA
1997	Tab. Club	1	11	12	5	17	29.4	225	0.076
1998	Tab. Club	1	38	39	32	71	45.1	155	0.458
1999	Tab. Club	4	52	56	31	87	35.6	74	1.176
Mean (94, 96-98)		1.25	20.00	21.25	12.25	33.50	31.57	190.00	0.267
99±Mean		220%	160%	164%	153%	160%	13%	-61%	341%

Table 3. Atlantic salmon angling catch on the Tabusintac River, 1969-1999. Estimates provided by DNRE except for 1996 and 1998-99 which were obtained through a DFO telephone survey of anglers who fished public waters. Dashes (-) indicate insufficient data to calculate. The 1999±Mean @ 0.8 reflects the strength of the 1999 fishery assuming the anglers interviewed by telephone accounted for 80% of all effort on public waters.

		Total Bright Salmon							
		Small			Large	Total			
Year	Source	Kept	Released	Total	Released	Catch	% Large	Rods	CPUE
1969	DNRE	126	-	126	133	259	51.4	-	-
1970	DNRE	46	-	46	25	71	35.2	-	-
1971	DNRE	24	-	24	31	55	56.4	-	-
1972	DNRE	67	-	67	244	311	78.5	-	-
1973	DNRE	107	-	107	114	221	51.6	-	-
1974	DNRE	28	-	28	68	96	70.8	-	-
1975	DNRE	115	-	115	49	164	29.9	-	-
1976	DNRE	228	-	228	43	271	15.9	773	0.351
1977	DNRE	-	-	-	-	-	-	84	-
1978	DNRE	101	-	101	66	167	39.5	1634	0.102
1979	DNRE	15	-	15	-	15	-	366	0.041
1980	DNRE	115	-	115	69	184	37.5	804	0.229
1981	DNRE	166	-	166	14	180	7.8	627	0.287
1982	DNRE	261	-	261	153	414	37.0	1359	0.305
1983	DNRE	90	-	90	140	230	60.9	1540	0.149
1984	DNRE	123	-	123	68	191	35.6	1118	0.171
1985	DNRE	19	-	19	38	57	66.7	229	0.249
1986	DNRE	129	-	129	301	430	70.0	1147	0.375
1987	DNRE	116	-	116	258	374	69.0	598	0.625
1988	DNRE	77	103	180	359	539	66.6	437	1.233
1989	DNRE	122	62	184	165	349	47.3	531	0.657
1990	DNRE	64	31	95	80	175	45.7	740	0.236
1991	DNRE	70	84	154	84	238	35.3	847	0.281
1992	DNRE	227	103	330	488	818	59.7	1663	0.492
1993	DNRE	102	156	258	191	449	42.5	1087	0.413
1994	DNRE	193	135	328	316	644	49.1	1693	0.380
1995	DNRE	33	0	33	22	55	40.0	29	1.900
1996	DFO	71	57	128	73	201	36.0	377	0.533
1997	DNRE	72	54	126	63	189	33.3	296	0.639
1998	DFO	13	21	34	46	80	57.5	301	0.266
1999	DFO	32	13	45	60	105	57.1	264	0.398
Mean (94-98)		76.4	53.4	129.8	104.0	233.8	43.2	539.2	0.744
99±Mean		-58%	-76%	-65%	-42%	-55%	32%	-51%	-46%
99±Mean@0.8		-48%	-70%	-57%	-28%	-44%	65%	-39%	-33%

Table 4. Daily and cumulative catches of small and large salmon in the Tabusintac River trapnets, fall 1999. Dates corresponding to standard weeks are shown.

Daily Catch

	Marking Trap		Recapture Trap		Combined Catch	
Date	Small	Large	Small	Large	Small	Large
26-Aug	0	0	0	0	0	0
27-Aug	0	0	0	0	0	0
28-Aug	0	0	0	0	0	0
29-Aug	0	0	0	0	0	0
30-Aug	1	0	0	0	1	0
31-Aug	0	0	0	0	0	0
01-Sep	0	1	0	0	0	1
02-Sep	0	1	0	0	0	1
03-Sep	0	0	0	0	0	0
04-Sep	0	0	0	0	0	0
05-Sep	0	0	0	0	0	0
06-Sep	0	0	0	0	0	0
07-Sep	0	0	0	0	0	0
08-Sep	0	0	0	0	0	0
09-Sep	0	0	0	0	0	0
10-Sep	0	0	0	0	0	0
11-Sep	0	0	0	0	0	0
12-Sep	1	0	0	0	1	0
13-Sep	0	0	1	0	1	0
14-Sep	0	0	0	0	0	0
15-Sep	0	0	0	0	0	0
16-Sep	0	0	0	0	0	0
17-Sep	onf	onf	onf	onf	onf	onf
18-Sep	0	0	0	0	0	0
19-Sep	11	10	4	5	15	15
20-Sep	22	11	4	6	26	17
21-Sep	14	7	2	2	16	9
22-Sep	4	7	0	0	4	7
23-Sep	5	2	1	3	6	5
24-Sep	15	5	9	9	24	14
25-Sep	7	7	2	0	9	7
26-Sep	2	1	0	0	2	1
27-Sep	4	3	1	1	5	4
28-Sep	4	4	1	0	5	4
29-Sep	2	4	0	0	2	4
30-Sep	8	8	4	6	12	14
01-Oct	3	1	0	0	3	1
02-Oct	4	10	2	2	6	12
03-Oct	3	4	0	1	3	5
04-Oct	4	2	0	0	4	2
05-Oct	1	1	1	2	2	3
06-Oct	1	4	0	4	1	8
07-Oct	2	6	3	8	5	14
08-Oct	3	7	0	1	3	8
09-Oct	0	0	0	0	0	0
10-Oct	0	2	2	6	2	8
11-Oct	0	3	1	2	1	5
12-Oct	2	1	0	4	2	5
13-Oct	3	4	0	0	3	4
14-Oct	1	1	2	1	3	2
15-Oct	2	6	1	0	3	6
16-Oct	0	1	0	0	0	1
17-Oct	2	3	2	2	4	5
18-Oct	1	1	0	0	1	1
19-Oct	1	0	1	1	2	1
20-Oct	0	0	0	0	0	0
21-Oct	1	1	0	1	1	2
22-Oct	0	0	0	0	0	0
23-Oct	onf	onf	onf	onf	onf	onf
24-Oct	1	0	0	0	1	0
25-Oct	0	1	0	0	0	1
26-Oct	0	0	0	0	0	0
27-Oct	0	1	0	0	0	1
28-Oct	0	0	0	0	0	0
29-Oct	0	0	0	0	0	0
30-Oct	0	0	0	0	0	0
31-Oct	0	0	0	0	0	0

onf = trap operating but not fished

Weekly Catch

Standard	Marking Trap		Recapture Trap		Combined Catch	
Week	Small	Large	Small	Large	Small	Large
34	0	0	0	0	0	0
35	1	2	0	0	1	2
36	0	0	0	0	0	0
37	1	0	1	0	2	0
38	56	37	11	16	67	53
39	42	32	17	16	59	48
40	18	28	6	17	24	45
41	9	18	5	14	14	32
42	7	12	4	4	11	16
43	1	2	0	0	1	2
44	0	0	0	0	0	0
Totals	135	131	44	67	179	198

Cumulative Catch

Standard	Marking Trap		Recapture Trap		Combined Catch	
Week	Small	Large	Small	Large	Small	Large
34	0	0	0	0	0	0
35	1	2	0	0	1	2
36	1	2	0	0	1	2
37	2	2	1	0	3	2
38	58	39	12	16	70	55
39	100	71	29	32	129	103
40	118	99	35	49	153	148
41	127	117	40	63	167	180
42	134	129	44	67	178	196
43	135	131	44	67	179	198
44	135	131	44	67	179	198

Standard Weeks

Week	Month	Days
34	September	20 - 26
35	September	27 - 02
36	September	03 - 09
37	September	10 - 16
38	September	17 - 23
39	September	24 - 30
40	October	01 - 07
41	October	08 - 14
42	October	15 - 21
43	October	22 - 28
44	October	29 - 04

Table 5. Summary of data used to estimate stock parameters, and the estimated stock parameters for large and small Atlantic salmon in the Tabusintac River, 1999.

	Recapture Sample or	Mark-Recapture Data			Total Returns				Spawning	% Egg
Size	Method	M	C	R	Mode	Median	0.025	0.975	Escapement	Requirement Met
Small	Trapnet	116	44	3	1700	2900	800	16400	1604	29
Large	Trapnet	122	66	9	**900**	900	500	2100	851	**237**
Small	Combined Salmon Efficiency @ Both Traps[1]	NA	NA	NA	**800**	800	450	1860	704	**13**
Small	Lease Angling	132[2]	53[3]	8	900	900	500	2300	804	15
Large	Lease Angling	159[2]	29[3]	11	400	400	200	700	351	98
Small	Public Angling	135	44[4]	3	2000	3300	1000	18100	1904	35
Large	Public Angling	163	57[4]	8	1200	1300	600	3000	1151	321

[1] Mark recapture data is not applicable (NA) because estimate is based on total returns of large salmon and the combined large salmon capture efficiency observed at both trapnets.
[2] Marks adjusted for known tag removals from the public angling fishery.
[3] Catch adjusted for possible multiple recaptures using exploitation rates of 0.06 for small and 0.07 for large salmon.
[4] Catch adjusted for possible multiple recaptures using exploitation rates of 0.02 for small and 0.05 for large salmon.

Table 6. Calculation of % egg requirement met for the Tabusintac River in 1999. Stock characteristics based on observations from the current year.

Area surveyed: Total habitat (m^2) (Atkinson and Hooper 1995)	
Tabusintac River main	610333
Big Eskedelloc River	75750
North Brook	21109
Middle Brook	6190
Pisiguit Brook	18208
Big Hole Brook	92704
Total	**824294**
Stock characteristics - current year	
Male proportion of large salmon	0.3
Female proportion of large salmon	0.7
Mean length of large female salmon (cm)	81.4
Eggs per large female (1.4132 x LN(FL) + 2.7560)(Randall 1985)	7889
Eggs per large salmon (eggs / female x % female)	5522
Male proportion of small salmon	0.91
Female proportion of small salmon	0.09
Mean length of small female salmon (cm)	57.7
Eggs per small female (3.1718 x LN(FL) - 4.5636)(Randall 1985)	4019
Eggs per small salmon (eggs / female x % female)	362
Calculation of % egg target met	
Egg deposition rate (no. / m^2) (CAFSAC MS 1991)	2.4
Total area (m^2) (Atkinson and Hooper 1995)	824294
Egg Requirement (Total area x deposition rate)	1978306
Large spawning escapement	851
Total large eggs	4699348
% egg target met by large salmon	**237**
Small spawning escapement	704
Total small eggs	254663
% egg target met by small salmon	**13**
% egg target met by all salmon	**250**

Table 7. Predicted salmon fry and parr densities for 25 sites sampled in the Tabusintac River, August 1999 and 10 mutual sites sampled in 1994.

	Habitat Type (%)				1994 Salmon Density / 100m2				1999 Salmon Density / 100m2				1999 Mean Forklength		
Location Description	Riffle	Run	Flat	Pool	0+	1+	2+	PHS	0+	1+	2+	PHS	0+	1+	2+
Big Eskedelloc @ Highway 8	10	90	0	0	0.00	0.00	0.00	0.00	6.11	0.00	8.50	0.71	48.00		100.00
Big Eskedelloc @ Home Camp crossing	60	40	0	0					75.97	12.07	12.07	17.84	48.88	79.00	112.25
Big Eskedelloc @ Kenny Camp	80	20	0	0	3.50	20.73	3.76	17.00	8.24	10.35	6.90	8.30	53.00	81.00	112.50
Big Hole Brook above crossing	90	10	0	0	111.78	78.71	8.41	59.30	70.06	25.25	37.88	31.42	51.50	76.33	102.94
Cove Brook @ Patsy Road	80	15	5	0					0.00	0.00	8.35	0.09			117.00
Little Eskedelloc @ Highway 8	50	0	50	0					0.00	0.00	0.00	0.00			
McLeods Brook lower site	100	0	0	0					0.00	0.00	0.00	0.00			
McLeods Brook upper site	90	0	10	0					0.00	0.00	0.00	0.00			
North Brook	80	20	0	0					47.27	20.02	17.54	23.13	54.81	81.88	109.14
Pisiguit Brook	60	40	0	0	0.00	0.00	0.00	0.00	52.27	4.00	8.01	13.06	54.19	84.00	101.00
Stymiests Mill Brook @ Breau Road	80	20	0	0					0.00	11.26	19.68	13.75		83.00	113.86
Stymiests Mill Brook @ Caissie Road	5	90	0	5					0.00	0.00	0.00	0.00			
Tabusintac @ Bear Landing	90	10	0	0					103.72	22.78	0.00	17.54	46.72	73.57	
Tabusintac @ Crohn's Gulch	40	60	0	0					257.00	32.46	8.12	43.69	48.11	80.19	110.25
Tabusintac @ Curve Pool; above pool	30	70	0	0	57.35	45.92	18.27	54.80	87.95	39.40	4.62	23.32	47.33	73.94	95.50
Tabusintac @ Devils Elbow; above pool	50	50	0	0	91.93	14.43	4.15	24.10	51.36	34.63	24.77	28.95	50.52	78.48	107.00
Tabusintac @ Head of Tide Island	30	70	0	0					157.24	11.11	0.00	22.02	47.77	87.50	
Tabusintac @ High Landing; above pool	40	60	0	0	41.84	3.88	0.58	7.70	216.53	34.58	5.17	36.08	46.36	78.56	105.67
Tabusintac @ Highway 8	0	100	0	0	16.30	0.00	1.77	3.90	50.75	16.34	6.54	16.76	51.75	83.40	105.50
Tabusintac @ Home Camp below pool	80	20	0	0	64.08	15.07	28.83	49.20	39.13	33.36	18.20	22.69	51.55	75.30	102.57
Tabusintac @ Main Crossing; below	40	60	0	0	11.32	5.50	1.72	5.90	156.82	50.89	11.94	34.36	44.94	73.76	107.00
Tabusintac @ Maliaget Brook	70	30	0	0					18.42	10.68	0.00	6.87	53.00	80.50	
Tabusintac @ Russell's Gulch	70	30	0	0					104.45	19.55	13.98	27.79	51.53	82.29	105.80
Trout Brook @ Dean Strang's camp	80	20	0	0					23.01	27.50	8.26	15.74	48.71	77.50	104.33
Trout Brook upper site	90	10	0	0					0.00	0.00	11.04	0.11			114.50
Mean - All Sites	**60**	**37**	**3**	**0.2**					**61.05**	**16.65**	**9.26**	**16.17**	**49.93**	**79.46**	**107.05**
Mean - 10 Mutual Sites (94-99)	**48**	**52**	**0**	**0**	**39.81**	**18.42**	**6.75**	**22.19**	**73.92**	**24.88**	**13.25**	**21.56**	**49.91**	**70.48**	**103.97**
Mean - Sites With Salmon	**60**	**40**	**0**	**0**					**72.68**	**19.82**	**11.03**	**19.25**	**42.79**	**68.10**	**91.75**

Table 8. Catch per unit effort (expressed as number of fish per 180 seconds of electrofishing time) for brook trout fry and parr at 25 sites sampled in the Tabusintac River, August 1999.

	Habitat Type (%)				CPUE		Mean Forklength		
Location Description	Riffle	Run	Flat	Pool	0+	1+	0+	1+	2+
Big Eskedelloc @ Highway 8	10	90	0	0	2.96	7.11	56.60	65.40	124.50
Big Eskedelloc @ Home Camp crossing	60	40	0	0	0.00	0.56			147.00
Big Eskedelloc @ Kenny Camp	80	20	0	0	0.54	0.54	55.00		124.00
Big Hole Brook above crossing	90	10	0	0	0.00	0.00			
Cove Brook @ Patsy Road	80	15	5	0	0.00	3.34			138.00
Little Eskedelloc @ Highway 8	50	0	50	0	20.07	5.31	52.62	74.43	96.50
McLeods Brook lower site	100	0	0	0	3.58	4.17	46.67	76.33	109.25
McLeods Brook upper site	90	0	10	0	0.00	2.93		83.50	108.33
North Brook	80	20	0	0	0.56	1.67	59.00	66.00	100.00
Pisiguit Brook	60	40	0	0	0.94	1.87	60.00	64.00	175.00
Stymiests Mill Brook @ Breau Road	80	20	0	0	2.33	0.00	53.00		
Stymiests Mill Brook @ Caissie Road	5	90	0	5	0.57	2.26	54.00	69.00	136.67
Tabusintac @ Bear Landing	90	10	0	0	0.00	0.59			153.00
Tabusintac @ Crohn's Gulch	40	60	0	0	0.00	0.00			
Tabusintac @ Curve Pool; above pool	30	70	0	0	0.54	0.00	42.00		
Tabusintac @ Devils Elbow; above pool	50	50	0	0	0.00	0.00			
Tabusintac @ Head of Tide Island	30	70	0	0	0.00	0.00			
Tabusintac @ High Landing; above pool	40	60	0	0	0.00	0.00			
Tabusintac @ Highway 8	0	100	0	0	0.00	0.60		89.00	
Tabusintac @ Home Camp below pool	80	20	0	0	0.00	0.00	52.00		
Tabusintac @ Main Crossing; below	40	60	0	0	0.00	0.00			
Tabusintac @ Maliaget Brook	70	30	0	0	1.09	0.00	50.00		
Tabusintac @ Russell's Gulch	70	30	0	0	0.00	0.00			
Trout Brook @ Dean Strang's camp	80	20	0	0	0.00	0.60			95.00
Trout Brook upper site	90	10	0	0	5.23	0.00	50.67		
Mean - All Sites	**60**	**37**	**2.7**	**0.3**	**1.54**	**1.26**	**52.63**	**73.46**	**125.60**
Mean - Sites With Brook Trout	**62**	**34**	**3.8**	**0.2**	**2.26**	**1.86**	**34.09**	**34.57**	**88.66**

Figure 1. Tabusintac watershed and trapnet locations for 1999. **MT** - marking trap; **RT** - recapture trap; **H** - head of tide; **LA** - lease angling; **PA** - public angling.

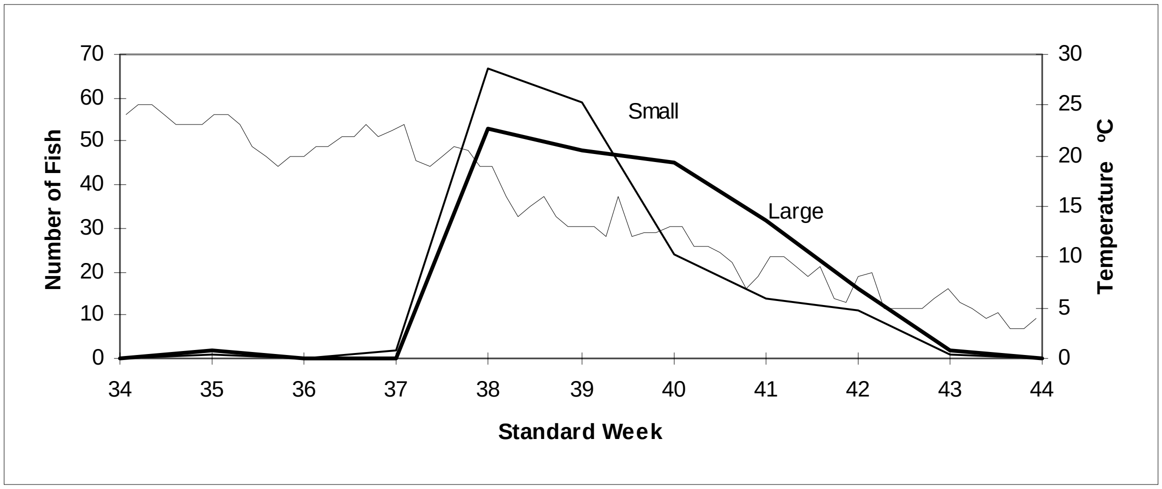


Figure 2. Run timing of Atlantic salmon (n = 198 large; n = 179 small) and surface water temperatures in the Tabusintac River, fall 1999.

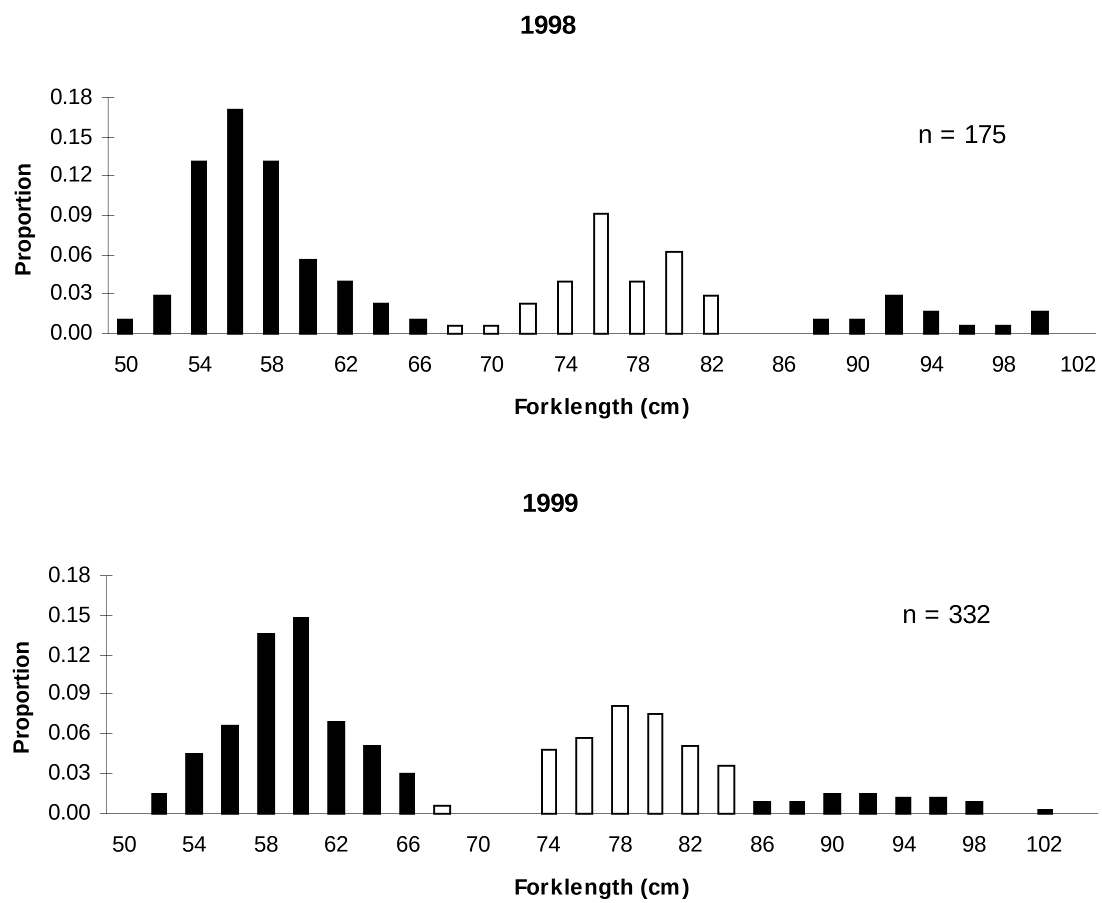


Figure 3. Length frequency distribution of salmon caught at research traps in the Tabusintac River, 1998 (upper panel) and 1999 (lower panel). Highlighted bars indicate proportion of 2 sea-winter Atlantic salmon based on forklengths between 68.0 and 83.0 cm.

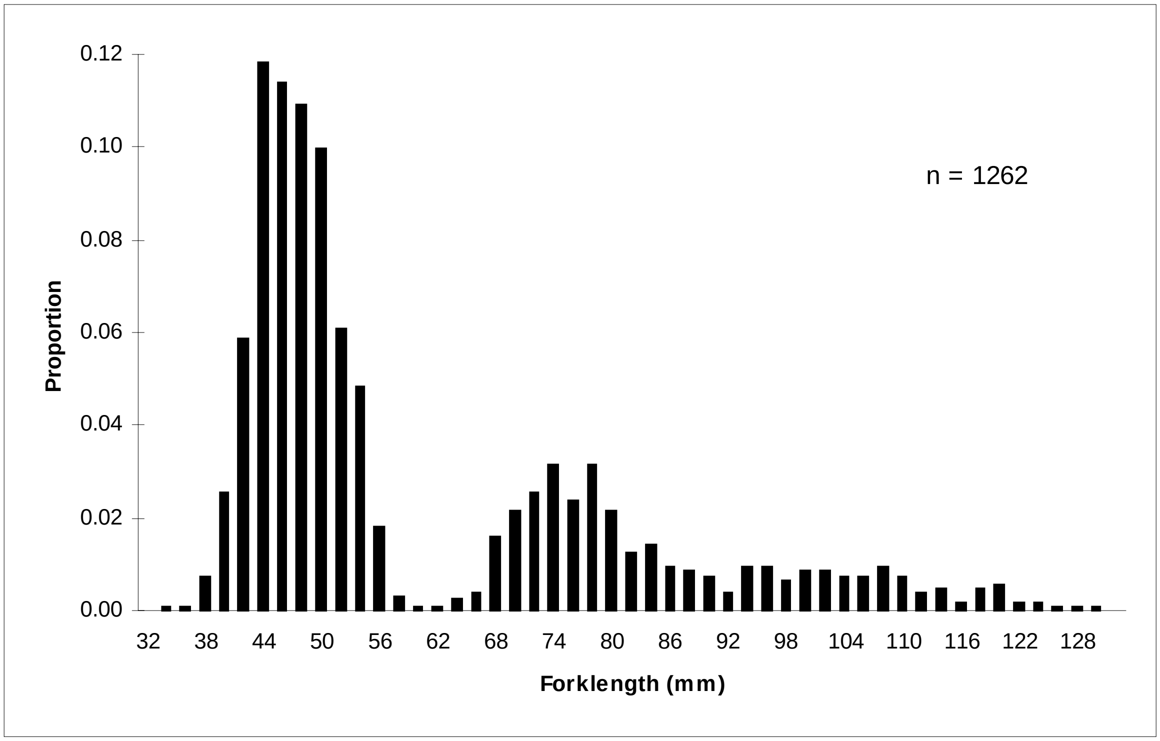


Figure 4. Length frequency distribution of juvenile Atlantic salmon caught during the electrofishing survey on the Tabusintac River, August 1999.

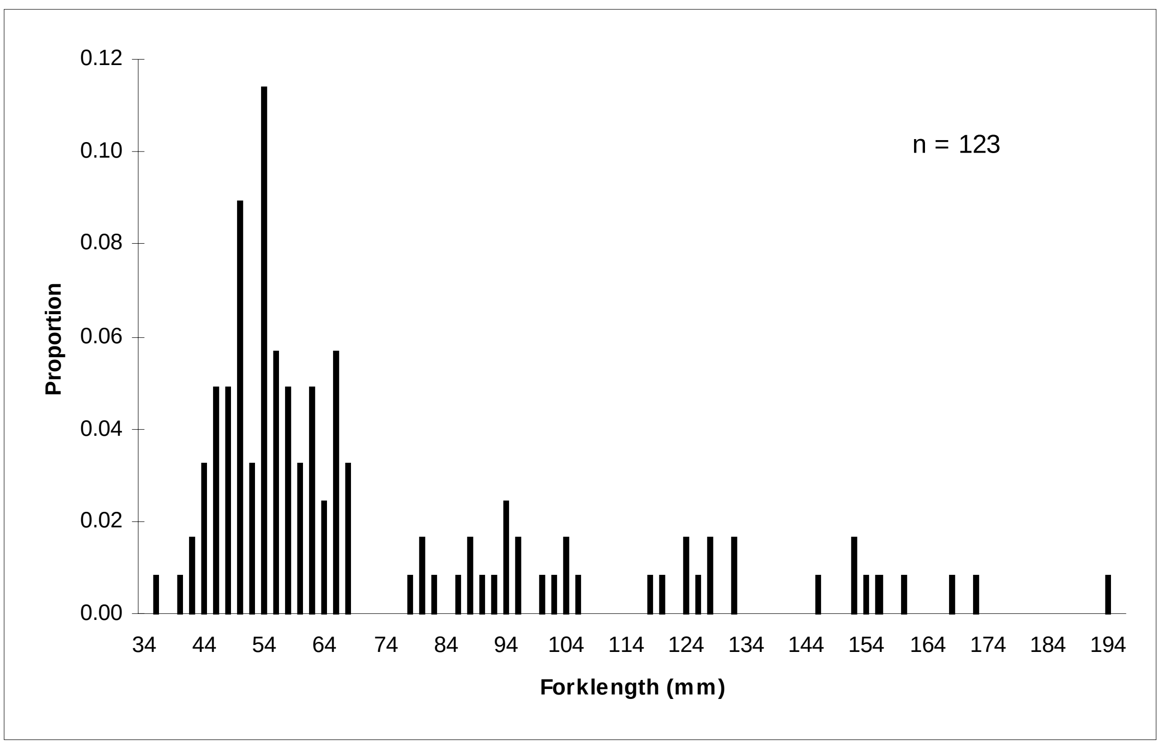
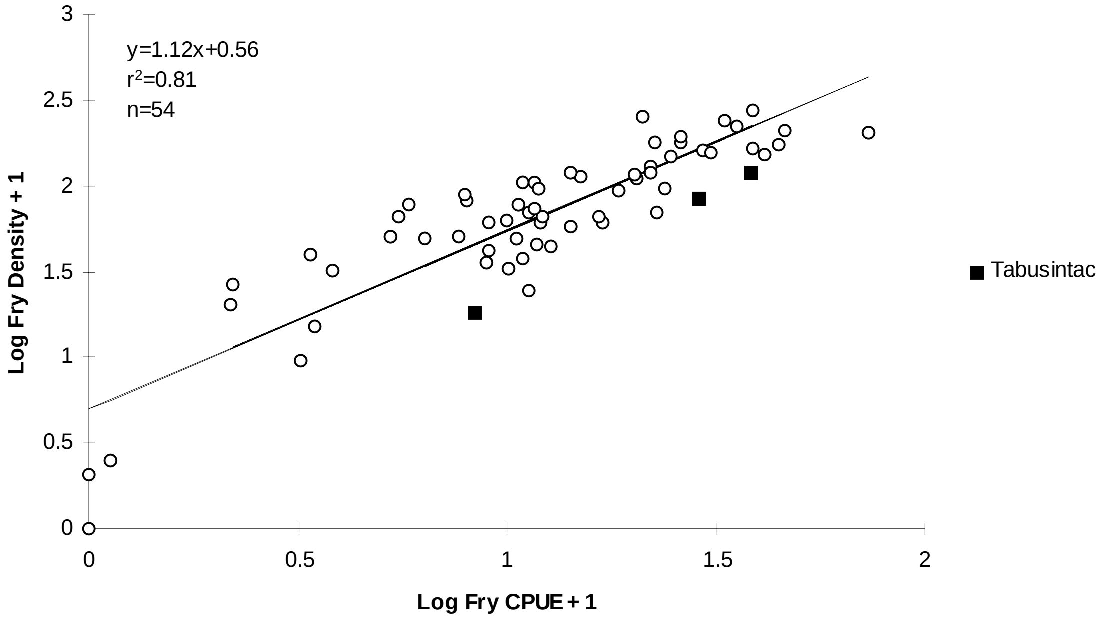


Figure 5. Length frequency distribution of juvenile brook trout caught during the electrofishing survey on the Tabusintac River, August 1999.



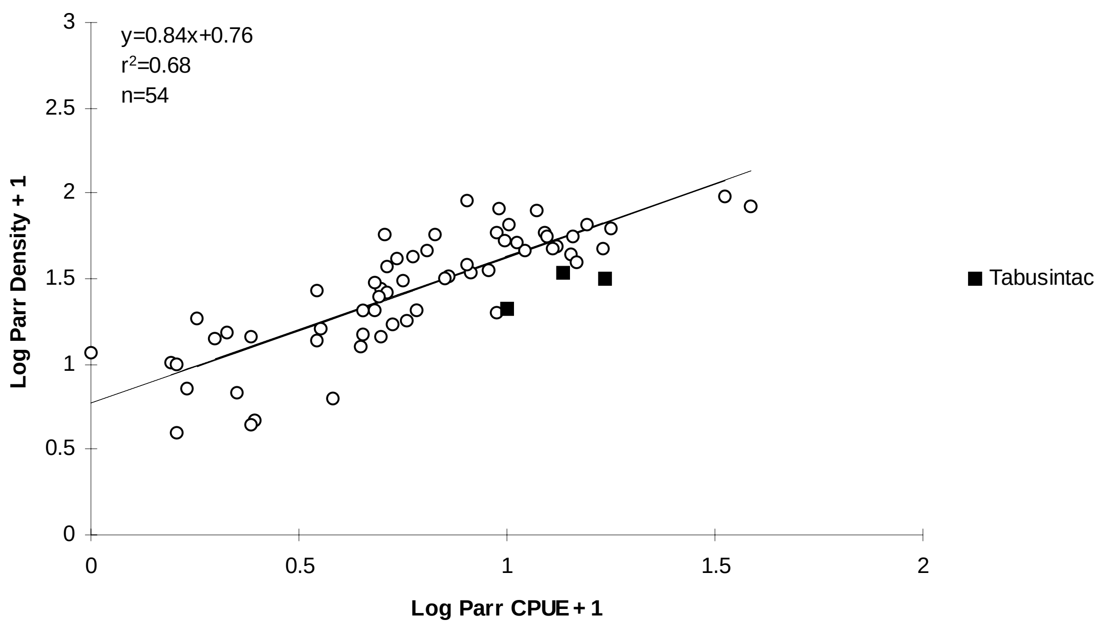


Figure 6. Borrowed Miramichi calibration for open sites within closed sites and the added 3 closed sites from the Tabusintac River in 1999. Upper and lower panels are fry and parr calibrations respectively. CPUE is expressed as fish per 180 seconds of fishing effort, density as fish per 100m^2.

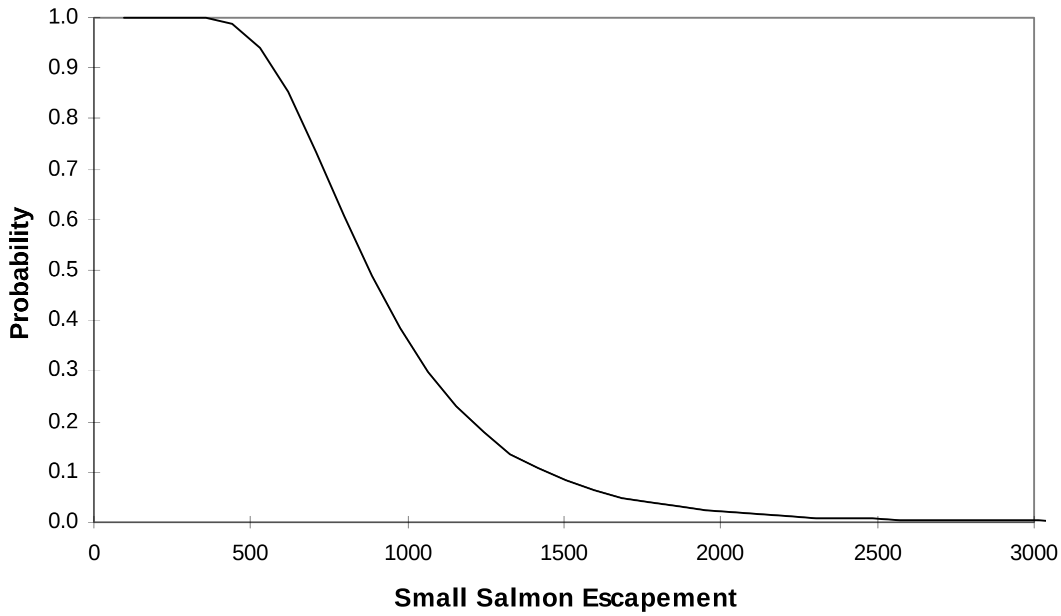


Figure 7. Probability of achieving spawning escapement for small salmon (175 fish: 1.00) in the Tabusintac River, fall 1999.

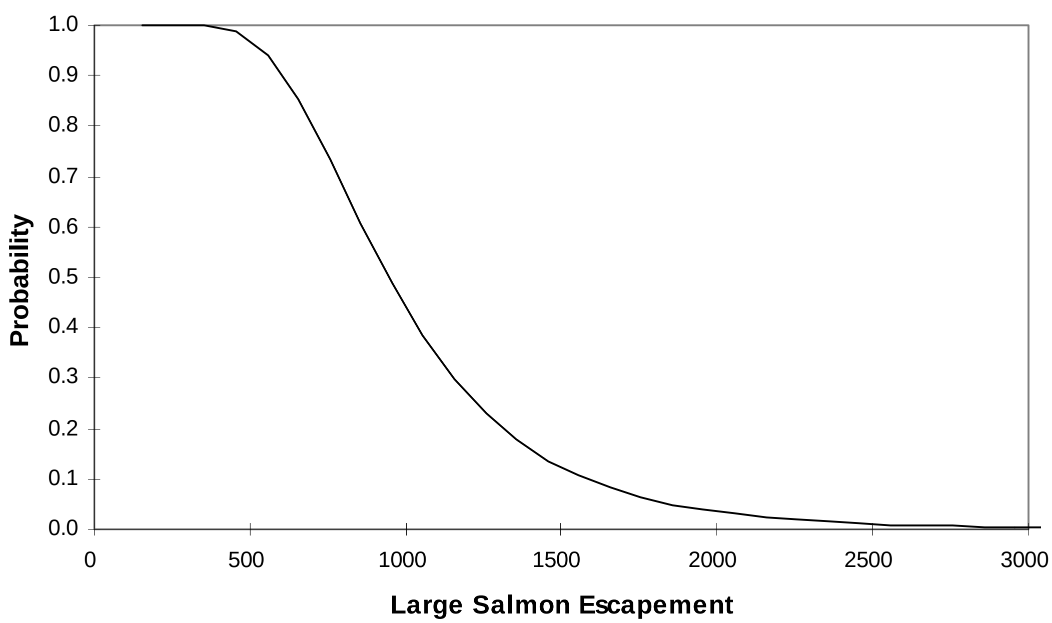
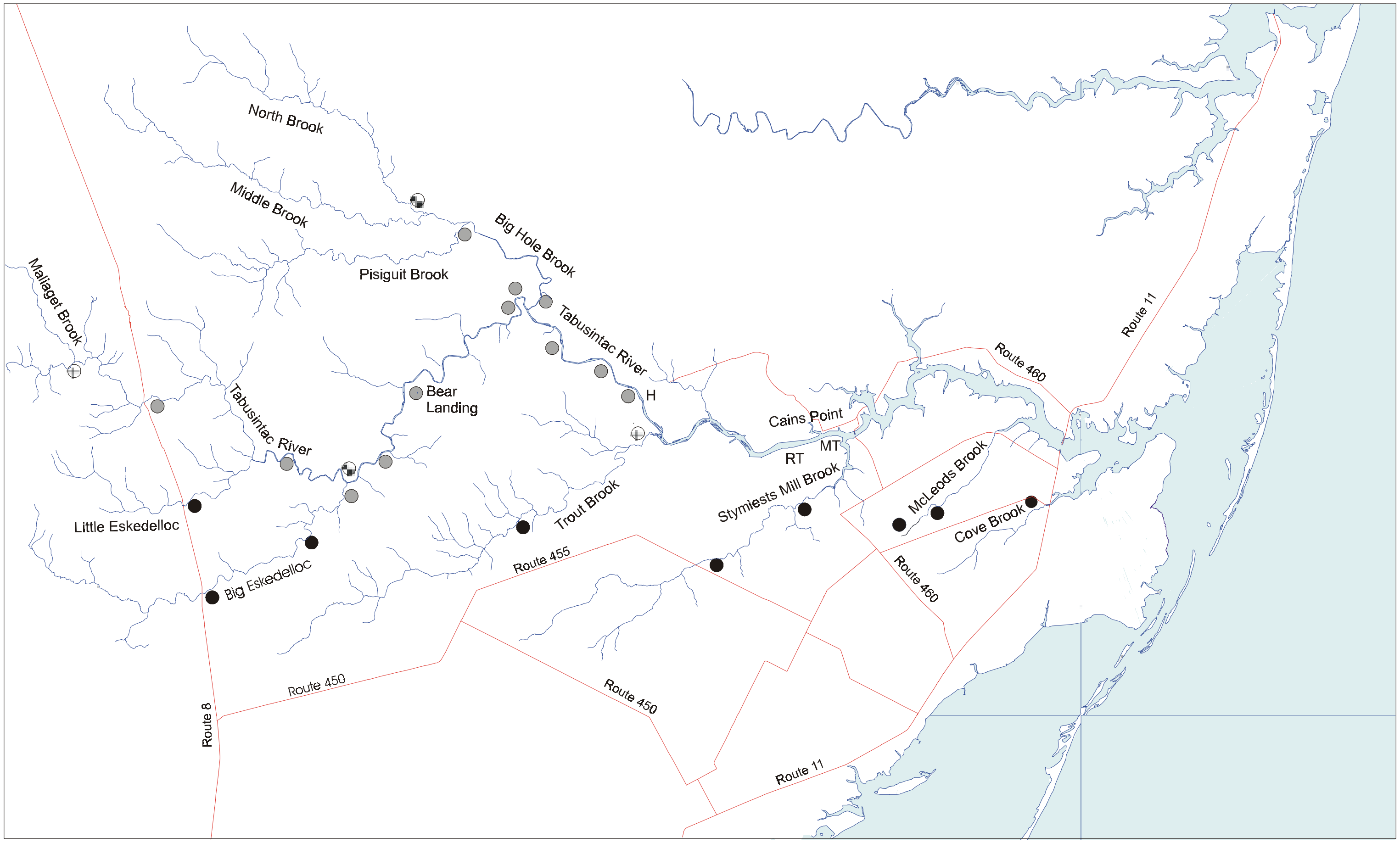


Figure 8. Probability of achieving spawning escapement for large salmon (329 fish: 1.00) in the Tabusintac River, fall 1999.



Salmon Fry Density (# / 100 sq. Meters)

> 50 30 - 50 10 - 30 < 10

Figure 9. Atlantic salmon fry densities from the Tabusintac River,1999.

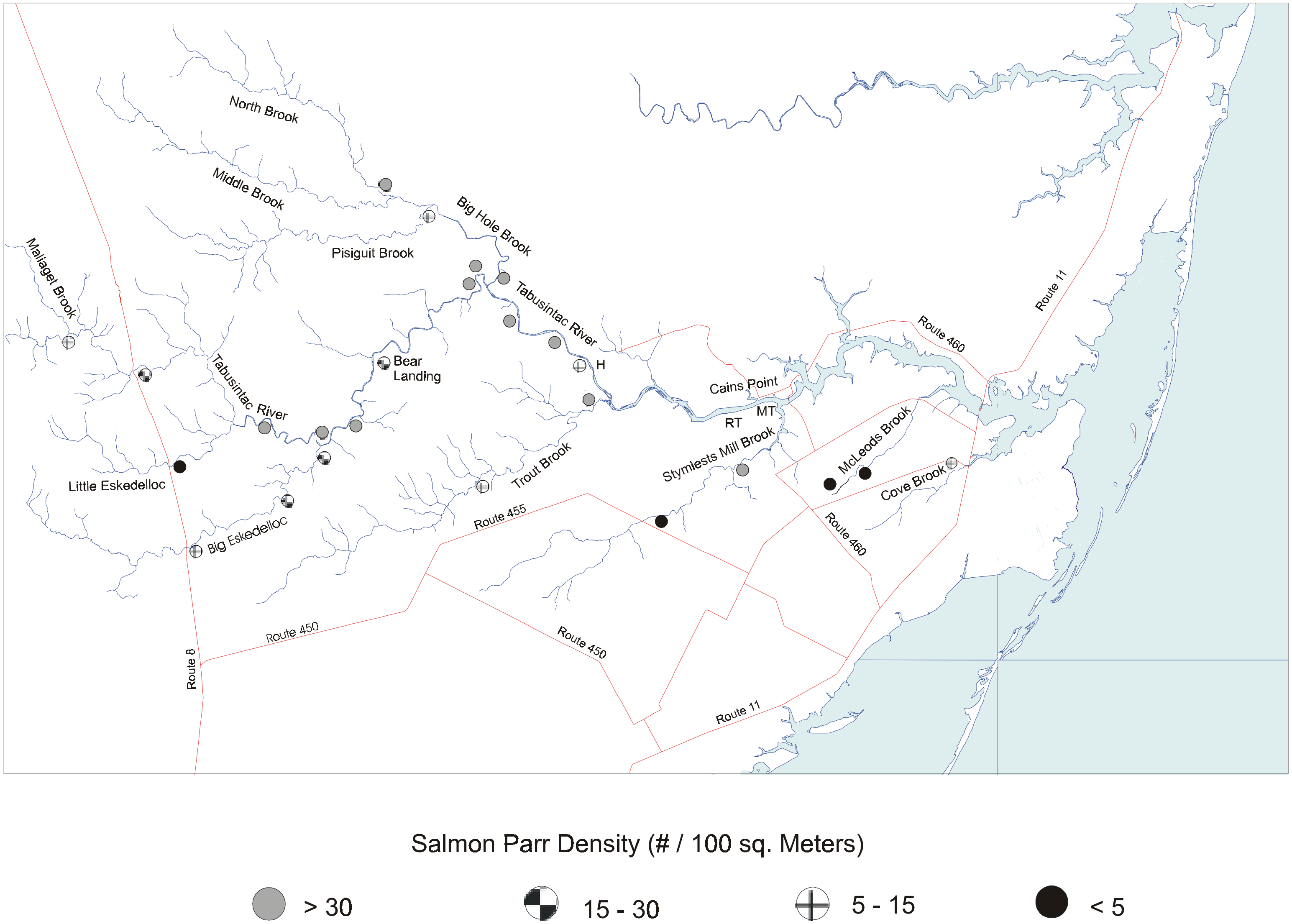
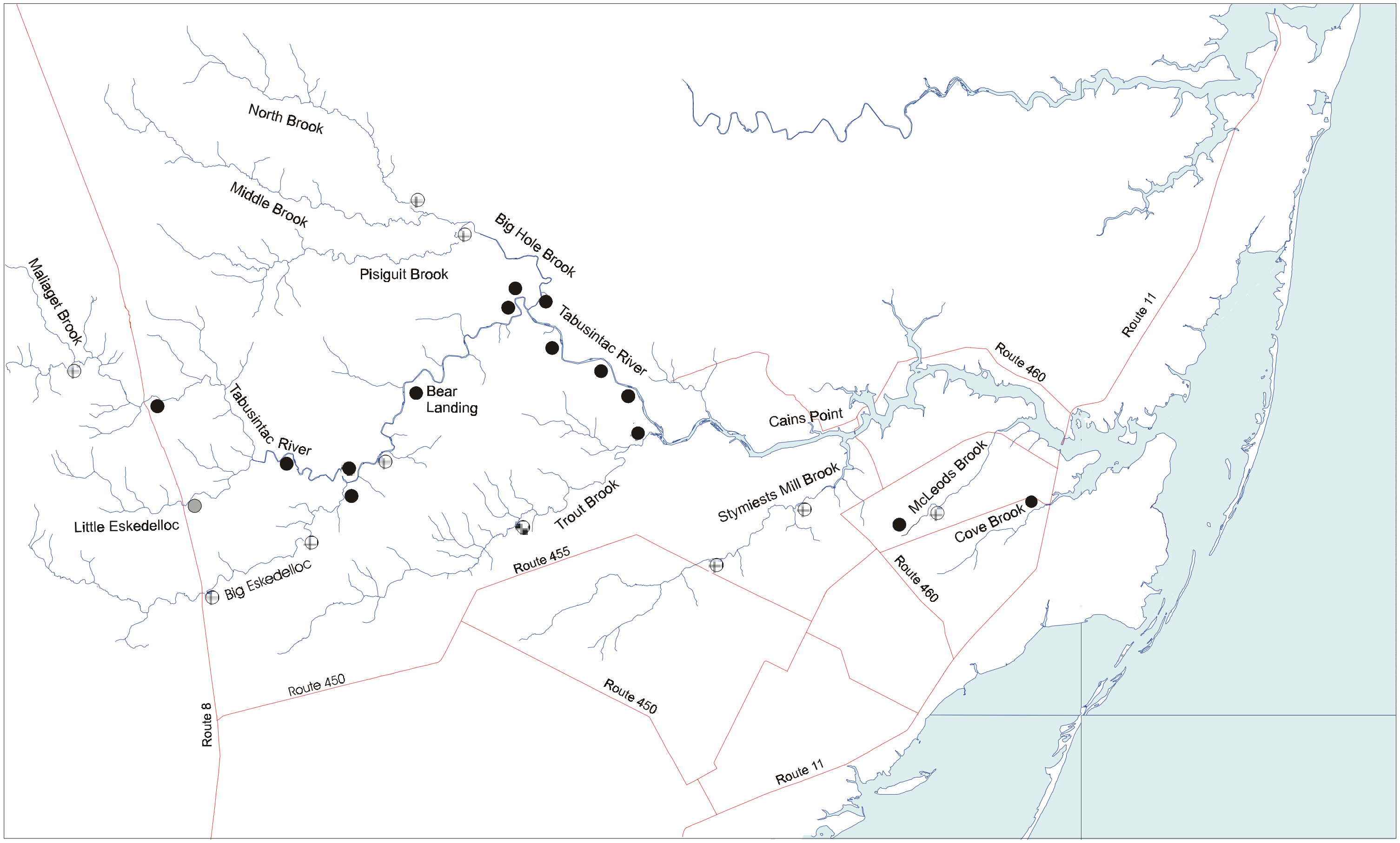


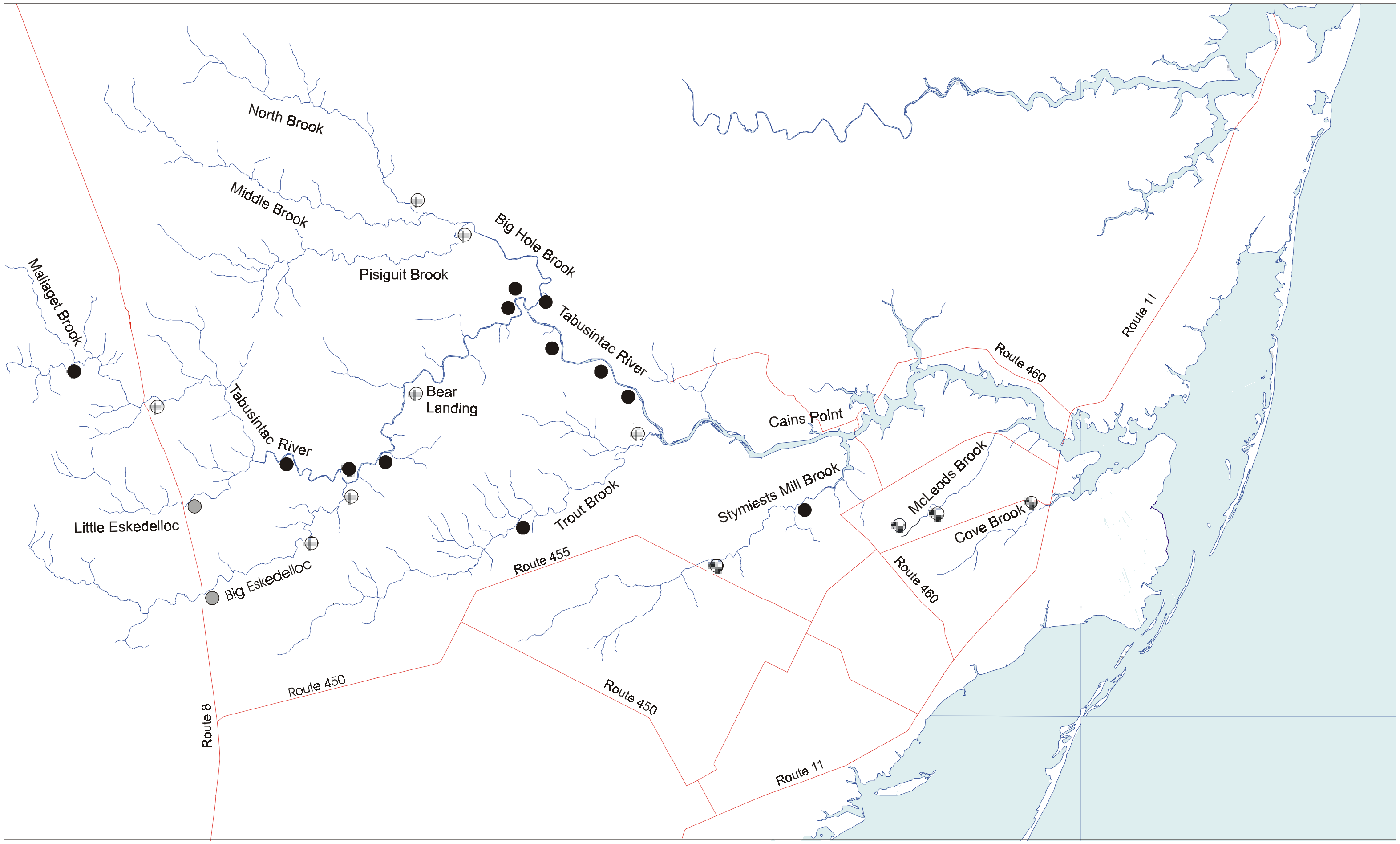
Figure 10. Atlantic salmon parr densities from the Tabusintac River,1999.



Brook Trout Fry Abundance (catch per 180 seconds of fishing effort)

> 10 5 - 10 0.5 - 5 < 0.5

Figure 11. Brook trout fry abundance from the Tabusintac River,1999.



Brook Trout Parr Abundance (catch per 180 seconds of fishing effort)

> 5 | 2 - 5 | 0.5 - 2 | < 0.5

Figure 12. Brook trout parr abundance from the Tabusintac River,1999.