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STATUS OF ATLANTIC SALMON IN THE BUCTOUCHE RIVER IN 1993

by

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¹This series documents the scientific basis for the evaluation of fisheries resources in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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¹La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte Atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

ABSTRACT

Angling effort is very low in this river and is not usually sufficient to estimate catches and 1993 was the first year since 1990 that an estimate was possible. Catch of small salmon was 55 while 22 large salmon were estimated to have been released. The Buctouche First Nation did not harvest salmon in 1993 because of suspected low returns to the river. A mark-recapture experiment was used to estimate total returns and spawning escapement. Angling and a net seized during an enforcement patrol served as the recapture sites for tags. Total returns were estimated as 79 large salmon and 62 small salmon. Spawning escapement was estimated as 28 large salmon and 18 small salmon. These numbers were about 15% of the spawning targets of 215 large salmon and 126 small salmon. There is no forecast available for the Buctouche River in 1994.

RESUME

L'effort de pêche à la ligne dans la rivière considérée est faible et généralement insuffisant pour estimer les prises. Mais pour la première fois depuis 1990, il a été possible de procéder à une évaluation en 1993. Les prises étaient de 55 petits saumons et on a estimé à 22 le nombre de grands saumons remis à l'eau. Les autochtones de Bouctouche n'ont pas pêché le saumon parce qu'ils escomptaient de faibles remontées dans la rivière. Une expérience de marquage-recapture a servi à estimer les remontées totales et les échappées de reproducteurs. Les étiquettes ont été récupérées par les pêcheurs à la ligne et aussi dans un filet saisi durant une patrouille de surveillance. On a estimé à 79 grands saumons et 62 petits saumons les remontées totales, et à 28 grands saumons et 18 petits saumons les échappées de reproducteurs. Ces chiffres correspondent à environ 15 % de l'échappée cible de grands et de petits saumons, qui est de 215 pour les premiers et de 126 pour les seconds. On ne dispose pas de prévision pour la rivière Bouctouche en 1994.

STOCK: Buctouche River, SFA 16

TARGET: 1.1 million eggs (215 large salmon, 126 small salmon)

REARING AREA: 446,000 m², 1% of SFA 16, <1% of Gulf New Brunswick

| | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | MIN ¹ | MAX ¹ | MEAN ¹ |
|-------------------------------|------|------|------|------|------|------|------------------|------------------|-------------------|
| Angling | | | | | | | | | |
| Large | | 52 | 47 | | | 22 | 22 | 52 | |
| Small | | | 16 | | | 55 | 13 | 55 | |
| First Nations' Harvest | | | | | | | | | |
| Large | | | | | 12 | 0 | | | |
| Small | | | | | 0 | 0 | | | |
| Spawning escapement | | | | | | | | | |
| Large | | | | | | 28 | | | |
| Small | | | | | | 18 | | | |
| Total returns | | | | | | | | | |
| Large | | | | | | 79 | | | |
| Small | | | | | | 62 | | | |
| % egg target met | | | | | | | | | 13 |

¹Min and Max for the period from 1984 to 1993. The mean was not calculated because angling catches are not estimated for this river on a consistent basis.

Landings: First Nations did not harvest in 1993 because of suspected low spawning escapement. Angling effort on this river is very small and catch cannot usually be estimated. Estimates of angling catch were possible for 4 out of the last 10 years.

Data and assessment: Population estimates are made using mark-recapture techniques. In 1993, for the first time two trapnets were installed, one as a marking trap and one as a recapture trap. The recapture trap was installed late in the season and did not recapture enough tags for a population estimate. Angling and a gillnet seized by the Provincial Department of Natural Resources during an enforcement patrol served as the recapture sites.

State of the stock: Numbers of spawners were estimated to be only about 14% of the spawning target for this river.

Forecast: No quantitative forecast is possible for 1994.

INTRODUCTION

The purpose of this document is to provide an assessment of the Atlantic salmon stock in the Buctouche River in 1993.

The Buctouche River is situated in Kent County, New Brunswick and flows in an easterly direction to Northumberland Strait (Statistical District 77, Salmon Fishing Area 16) (Figs.1, 2). Although a few salmon may enter the river in June and July, the main run is believed to occur during September and October.

Kelts are angled from April 15 to May 15; brights from July 1 to October 31. Prior to 1984 kelts and bright fish 63 cm or over (large salmon) could be kept. In 1984 large kelts could be kept but all large bright salmon had to be released. Since 1984, regulations have required all large salmon to be released, and only fish less than 63 cm (small salmon) could be retained. In 1992 the season limit for small salmon was reduced from ten to eight. This regulation remained in effect in 1993. Buctouche First Nation has harvested salmon by gillnet to a limited extent in the past; no gillnet fishery was carried out in 1993. There has been no commercial harvest in Salmon Fishing Area 16 from 1984 to 1993.

MATERIALS AND METHODS

Landings

Recreational catch estimates were obtained from the New Brunswick Department of Natural Resources and Energy (DNRE). Estimates of catch are based on a random survey of approximately 15 percent of license purchasers: in the case of the Buctouche, the rate of survey return is often not high enough to estimate catch accurately. DNRE 1993 estimates are preliminary and probably underestimate catch. Large salmon removals were calculated as 3% of large salmon releases (Currie 1985), and small salmon removals as kept fish plus 3% of releases.

First Nation harvest from the Buctouche River has not been previously recorded. In 1993 Buctouche First Nation agreed to report harvest to the Resource Allocation Section of DFO in accordance with the Aboriginal Fisheries Strategy agreements.

Commercial landings for Salmon Fishing Area 16 (1967-1983) are reported; the fishery was closed in 1984.

Spawning Requirements

The required number of spawners for the Buctouche was calculated using the method (Method 2) recommended by Randall

(1985) for the Miramichi River, as described below. The number of spawners required to meet egg deposition requirements was calculated presuming that all egg deposition came from large salmon. The numbers of small salmon required were calculated assuming that at least one male spawner was needed for each female large salmon.

Assuming fecundity to be equivalent to Miramichi stock, based on similar mean length, the characteristics used to determine the spawning requirements were as follows:

Egg deposition rate = 2.4 eggs/square meter (Elson 1975)

Rearing area = 446,000 square meters (Anon 1978)

Mean length = Large salmon- 76cm; Small salmon- 54cm

Fecundity = Large salmon- 6816 eggs; Small salmon- 2908 eggs

(Randall 1985)

Sex ratio = Large salmon- 75% female; 25% male

= Small salmon- 15% female; 85% male

Eggs/large salmon = $6816 \times 0.75 = 5112$

Eggs/small salmon = $2908 \times 0.15 = 436$

Eggs required = 2.4 eggs/sq m x 446,000 sq m

= 1.1 million eggs

Large salmon required = 1.1 million eggs / 5112 = 215

Large salmon females = $215 \times 0.75 = 161$

Large salmon males = $215 - 161 = 54$

Small salmon males required to balance sex ratio = $161 - 54$

= 107

Small salmon required (total) = $107 / 0.85 = 126$

Total Returns, Spawning Escapement, and Egg Deposition

Two trapnets, in cooperation with Buctouche First Nation, were operated in the tidal portion of the river to mark and recapture salmon. The lower (mark trap) was situated 3 km upriver (west) of the Route 11 bridge in Buctouche, the upper (recapture trap) was located approximately two km upstream from this point. The box portion of the traps measured 3.7 m (12') wide by 18.3 m (60') long and was constructed with 5.7 cm (2.25") mesh knotless nylon. A single leader of approximately 60 m (200'), extending from shore into a door in the middle of the long side of the box, was made from 11.4 cm (5.5') mesh polypropylene. All salmon caught in the traps were marked with small blue Carlin tags attached with a single wire through the back immediately in front of the dorsal fin.

Tags were recaptured in the upper trap, and above this trap by anglers and from fish recovered by DNRE wardens from a seized gillnet. Catch for these recapture methods was obtained from trap logbooks, telephone calls to anglers who returned tags, and seizure reports.

An estimate of the total returns to the river was obtained using a Bayesian estimator as described by Gazey and Staley (1986). 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. This estimate was then partitioned into small salmon and large salmon components using the proportion of each observed in the trapnet.

Spawning escapement was then calculated as follows:

Spawners = Total returns - Removals (First Nation, angling,
poaching)

Egg deposition was calculated as the number of small salmon or large salmon spawners times the eggs per small or large salmon, as calculated above.

Biological Characteristics

Fork length of all fish trapped was measured, and scale samples were taken for ageing. Sex was determined on external features. Fecundity has been assumed based on mean size similarity to Miramichi stock (Randall 1985). In future, sampling of First Nation catch is expected to provide verification of sex ratio, fecundity and length/weight relationship.

Forecast

At present there is no reliable method of forecasting returns of Atlantic salmon to the Buctouche River.

Other species

Gaspereau, striped bass, flounder, eels, tomcod, smelt, mackerel, and white perch were caught and enumerated at the trapnets.

RESULTS AND DISCUSSION

Landings

Commercial landings for Salmon Fishing Area 16 (1967-1983) are presented in Table 1; since this fishery was closed in 1984 it no longer affects returns of spawning fish. Because this is the first assessment of the Buctouche River, the table is included as an historical document. The DNRE angling catch (1984-1993) appears in Table 2. There is probably no significant kelt angling on this river. For six of the ten years shown, an accurate estimate of catch could not be made based on angler surveys returned, hence comparing 1993 to the previous five year mean was not considered useful. However, total bright catch was up 38% from the mean of the other four years for which catch statistics are shown. A significant increase in angling effort of 239% over the previous five year average was observed.

First Nation harvest from the Buctouche River was not reported prior to 1992, and in that year was estimated at 12 large salmon. Although Buctouche First nation agreed to a maximum harvest of 20 large and 40 small salmon, no fish were taken in 1993.

Total Returns and Spawning Escapement

The lower trap was operated from July 24 to November 4, and the upper from October 6 to November 4. Daily catches of small and large salmon at both traps are presented in Figure 3, and a summary by standard week in Tables 3 and 4. Tagging effort and recaptures may be summarized as follows:

Tags applied

| <u>Location</u> | <u>Large</u> | <u>Small</u> |
|-----------------|--------------|--------------|
| Marking Trap | 29 | 23 |
| Recapture Trap | 11 | 3 |
| Total | 40 | 26 |

Tags recaptured

| <u>Location</u> | <u>Large</u> | | <u>Small</u> | |
|-----------------|--------------|--------------|--------------|--------------|
| | <u>Recap</u> | <u>Catch</u> | <u>Recap</u> | <u>Catch</u> |
| Recapture Trap | 2 | 13 | 0 | 3 |
| Angling | 1 | 6 | 4 | 8 |
| Seized Net | 3 | 7 | 0 | 0 |

Due to late installation, too few tags were caught in the recapture trap to estimate returns. Consequently, both traps were considered as marking sites and tags from angled fish were pooled with those returned from a seized gillnet to estimate total returns.

Estimated removals from the population were as follows:

| <u>Location</u> | <u>Large</u> | <u>Small</u> |
|-----------------|--------------|--------------|
| Angling | 1 | 44 |
| Poaching | 50 | 0 |

Angling removals were fish retained plus release mortalities. Poaching removals have been estimated by DNRE game wardens based on seizures; this is considered to be a significant problem on this river.

Weekly (Tables 3, 4) and daily (Fig. 3) counts at the trapnets indicate that peaks in run-timing to the river occurred from September 18 to October 14 for both grilse and salmon.

Total returns were estimated using the data described above and using the adjusted Petersen method (Ricker 1975) and the Bayesian method of Gazey and Staley (1986). Tags returned from angling were considered to have a 100% reporting rate because all anglers returning tags were telephoned to obtain total catch information. A tag loss rate of 0.9% per day as determined for the

Margaree River (Chaput et al. 1993) was applied to the mean number of days a fish was at large (13) before recapture.

The distribution for estimates of total returns to the river indicated that the most probable is 62 for small salmon and 79 for large salmon (Figs. 4, 5). Subtracting removals (above) indicated that spawning escapement for small salmon was 18 and for large salmon was 28 (Figs. 4, 5).

These results indicate that small salmon spawning escapement was only 14% of spawning requirements, and large salmon escapement only 13% of requirements. Although some early-run fish may have entered the river prior to trap installation, this component is thought to be very small and probably unable to withstand low, warm summer water conditions in such a small river. These fish would likely have left freshwater before spawning, possibly returning with the fall component when temperature and water conditions were more suitable.

Biological Characteristics

The length frequency distribution of salmon trapped in 1993 is presented in Figure 6. The modal length of small salmon was 52 cm and of large salmon 76 cm. The age distribution of the sample from 1992 is shown in Table 5. Of known-age fish, 2+ smolts made up 75% of the sample and 3+ smolts 23%; there was one 4+ smolt. Repeat spawners accounted for 6% of large salmon. The mean length of large salmon was 76 cm; 75% were females and 25% males. Mean length of small salmon was 54 cm; 15% were females and 85% males. The large salmon proportion of the catch in 1993 was 61%, small salmon making up 39%.

Other species

Total counts of other species caught in the traps are as follows:

| <u>Species</u> | <u>Count</u> |
|--------------------|--------------|
| Gaspereau | 2339 |
| Striped Bass | 1856 |
| Flounder | 648 |
| Eels | 74 |
| Tomcod | 620 |
| Smelt | 36 |
| Mackerel | 21 |
| <u>White Perch</u> | <u>6</u> |

Literature Cited

- Anonymous, 1978. Biological conservation subcommittee report. Prepared for the Atlantic Salmon Review Task Force.
- Chaput, G., R. Jones, L. Forsyth, and P. LeBlanc. 1993. Assessment of Atlantic salmon in the Margaree River, Nova Scotia, 1992. DFO Atlantic Fisheries Research Document 93/14.
- Currie, B. 1985. North Pole Stream hook and release program. Proceedings of the 1985 Northeast Salmon Workshop, Moncton, NB.
- Elson, P.F. 1975. Atlantic salmon rivers. Smolt production and optimal spawning - an overview of natural production. Int. Atlantic Sal. Found. Spec. Public. Ser. 6:96-119.
- Gazey, W.J., and M.J. Staley. 1986. Population estimation from mark-recapture experiments using a sequential Bayes algorithm. Ecology 67: 941-951.
- Randall, R.G. 1985. Spawning potential and spawning requirements of Atlantic salmon in the Miramichi River, New Brunswick. CAFSAC Res. Doc. 85/68.
- Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. No. 191. 382p.

Table 1. Commercial salmon landings for Salmon Fishing Area 16 (1967-1983) in kg.
 The commercial fishery was closed in SFA 16 from 1984 on. The Buctouche R. is in District 77.

| Fisheries Statistical District | | | | | | | | | | |
|--------------------------------|--------|--------|--------|---------|--------|--------|-----|-------|-------|---------|
| Year | 70 | 71 | 72 | 73 | 75 | 76 | 77 | 78 | 80 | Total |
| 1967 | 37,621 | 21,913 | 10,314 | 324,802 | 31,670 | 23,805 | 56 | 8 | 0 | 450,188 |
| 1968 | 18,233 | 19,790 | 6,435 | 150,614 | 13,916 | 8,505 | 29 | 0 | 0 | 217,523 |
| 1969 | 12,388 | 20,674 | 12,195 | 116,097 | 14,464 | 7,051 | 5 | 61 | 0 | 182,935 |
| 1970 | 12,763 | 20,307 | 12,460 | 104,595 | 13,443 | 11,618 | 6 | 12 | 0 | 175,205 |
| 1971 | 5,741 | 12,628 | 7,928 | 51,343 | 1,635 | 1,899 | 4 | 2 | 0 | 81,180 |
| 1972 | 0 | 5 | 682 | 10,034 | 0 | 227 | 227 | 1,555 | 91 | 12,820 |
| 1973 | 114 | 136 | 45 | 2,732 | 545 | 364 | 150 | 0 | 114 | 4,200 |
| 1974 | 159 | 152 | 0 | 3,318 | 136 | 0 | 59 | 16 | 84 | 3,925 |
| 1975 | 108 | 117 | 0 | 2,503 | 556 | 1,775 | 69 | 325 | 227 | 5,680 |
| 1976 | 138 | 129 | 45 | 6,464 | 315 | 591 | 105 | 909 | 1,023 | 9,718 |
| 1977 | 0 | 153 | 0 | 27,645 | 1,927 | 685 | 227 | 1,364 | 136 | 32,137 |
| 1978 | 2,112 | 11 | 0 | 36,561 | 655 | 674 | 656 | 445 | 0 | 41,114 |
| 1979 | 2,486 | 9 | 0 | 16,053 | 886 | 342 | 84 | 230 | 0 | 20,090 |
| 1980 | 26,586 | 0 | 0 | 29,607 | 1,134 | 606 | 0 | 0 | 0 | 57,933 |
| 1981 | 3,534 | 10,463 | 2,029 | 20,179 | 1,502 | 483 | 0 | 0 | 0 | 38,190 |
| 1982 | 3,454 | 8,581 | 652 | 28,699 | 2,819 | 1,127 | 0 | 34 | 0 | 45,366 |
| 1983 | 4,498 | 5,735 | 763 | 33,069 | 1,540 | 847 | 0 | 0 | 0 | 46,452 |

Table 2. Atlantic salmon angling catch on the Buctouche River, 1984-1993. Estimates provided by New Brunswick Department of Natural Resources and Energy. Large salmon kelts could be retained in 1984, after which all large salmon angling was catch-and-release. Small salmon numbers include released fish. Dashes (-) indicate insufficient data to calculate; 1993 values are preliminary.

| Year | Kelts | | | | Bright Salmon | | | | All Salmon | | |
|-------------|-------|-------|-------|---------|---------------|-------|-------|---------|------------|------|-------|
| | Small | Large | Total | % Large | Small | Large | Total | % Large | Total | Rods | CPUE |
| 1984 | - | - | - | - | 13 | - | 13 | - | 13 | 13 | 1.000 |
| 1985 | - | - | - | - | - | - | - | - | - | - | - |
| 1986 | - | - | - | - | 60 | 34 | 94 | 36.2 | 94 | 94 | 1.000 |
| 1987 | - | - | - | - | - | - | - | - | - | 53 | - |
| 1988 | - | - | - | - | - | - | - | - | - | 31 | - |
| 1989 | - | - | - | - | - | 52 | 52 | - | 52 | 192 | 0.271 |
| 1990 | - | - | - | - | 16 | 47 | 63 | 74.6 | 63 | 213 | 0.296 |
| 1991 | - | - | - | - | - | - | - | - | - | 308 | - |
| 1992 | - | - | - | - | - | - | - | - | - | 314 | - |
| 1993 | - | - | - | - | 55 | 22 | 77 | 28.6 | 77 | 717 | 0.107 |
| Mean(88-92) | - | - | - | - | - | - | - | - | - | 212 | - |
| +/- Mean | - | - | - | - | - | - | - | - | - | 239% | - |

Table 3. Weekly catches of large and small salmon at Buctouche River traps
 Recapture trap began fishing in week 40.

| Week | Both traps | | Mark trap | | Recapture trap | |
|------|------------|-------|-----------|-------|----------------|-------|
| | Large | Small | Large | Small | Large | Small |
| 37 | 2 | 2 | 2 | 2 | 0 | 0 |
| 38 | 4 | 7 | 4 | 7 | 0 | 0 |
| 39 | 4 | 2 | 4 | 2 | 0 | 0 |
| 40 | 8 | 9 | 7 | 9 | 1 | 0 |
| 41 | 16 | 6 | 7 | 3 | 9 | 3 |
| 42 | 6 | 1 | 5 | 1 | 1 | 0 |

| Week | Cumulative total | | | | | |
|------|------------------|-------|-----------|-------|----------------|-------|
| | Both traps | | Mark trap | | Recapture trap | |
| | Large | Small | Large | Small | Large | Small |
| 37 | 2 | 2 | 2 | 2 | 0 | 0 |
| 38 | 6 | 9 | 6 | 9 | 0 | 0 |
| 39 | 10 | 11 | 10 | 11 | 0 | 0 |
| 40 | 18 | 20 | 17 | 20 | 1 | 0 |
| 41 | 31 | 26 | 24 | 23 | 10 | 3 |
| 42 | 32 | 27 | 29 | 24 | 11 | 3 |

Table 4. Standardized weeks used to describe timing.

| Week | Month | Days |
|------|-----------|-------|
| 34 | August | 20-26 |
| 35 | August | 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 |

Table 5. Age distribution of Buctouche R. salmon, 1992.

SW = sea winter. Repeat spawner categories indicate total sea age, followed by sea ages at which the fish spawned

| Smolt Age | 1SW | 2SW | 3SW | Repeat Spawners | | | | Total |
|-----------|-----|-----|-----|-----------------|-----|-----|-----|-------|
| | | | | 2.1 | 3.1 | 3.2 | 4.2 | |
| 2 | 4 | 50 | 1 | 1 | 0 | 1 | 1 | 58 |
| 3 | 14 | 3 | 0 | 0 | 1 | 0 | 0 | 18 |
| 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ? | 2 | 5 | 1 | 0 | 0 | 0 | 0 | 8 |
| Total | 21 | 58 | 2 | 1 | 1 | 1 | 1 | 85 |

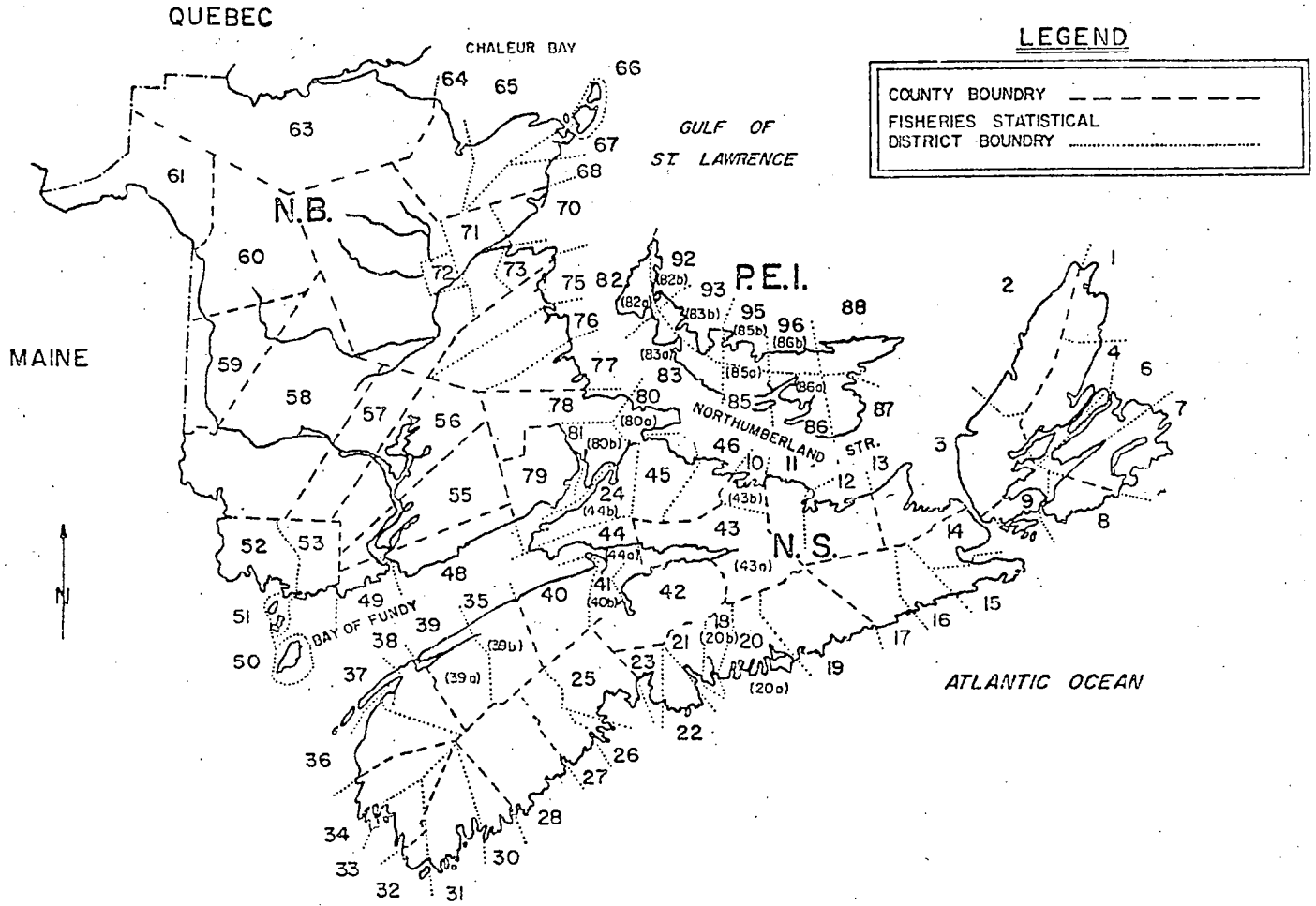


Figure 1. Fisheries Statistical Districts in Atlantic Canada.

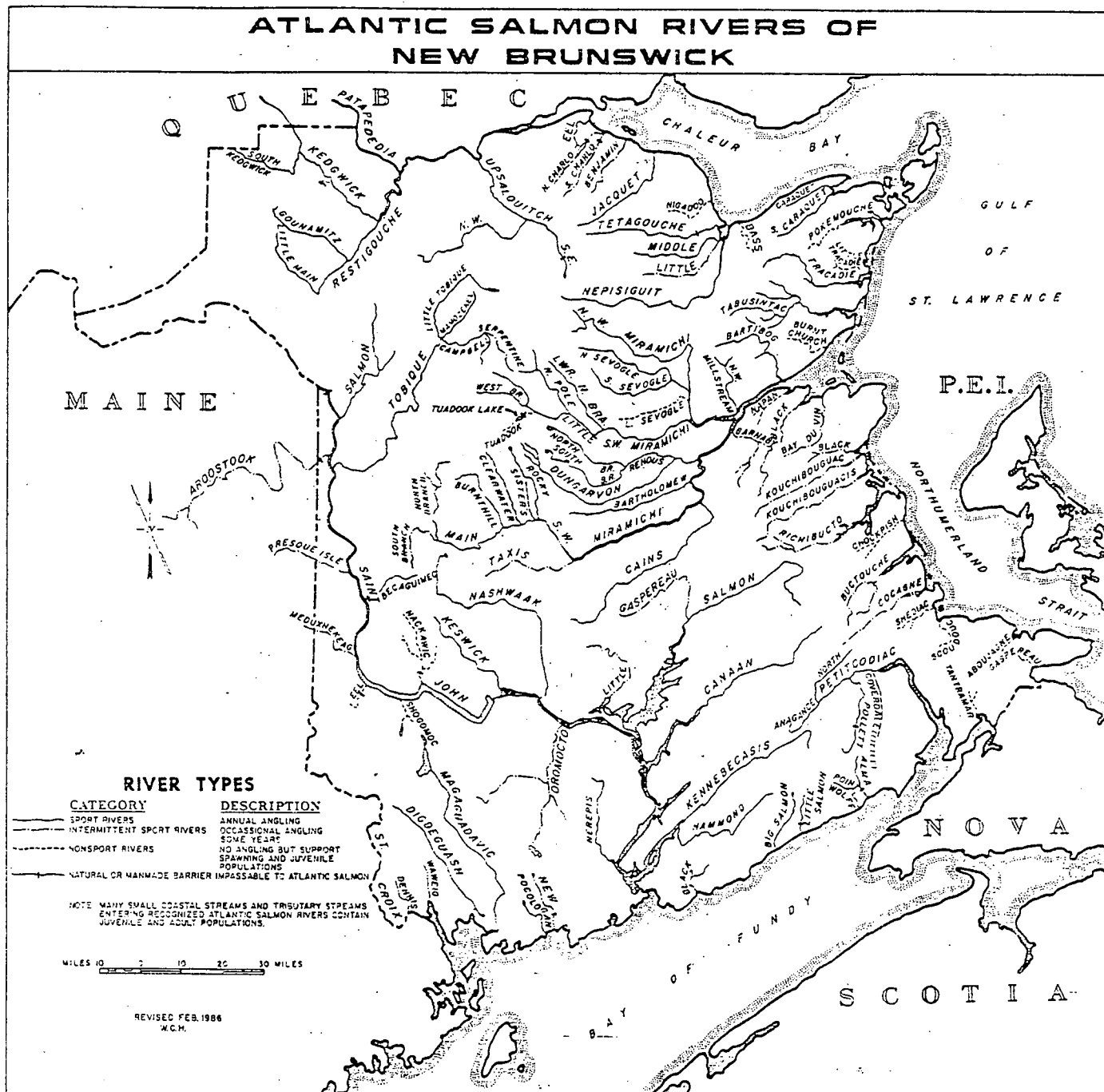


Figure 2. Atlantic salmon angling rivers of New Brunswick.
(Map prepared by DNRE.)

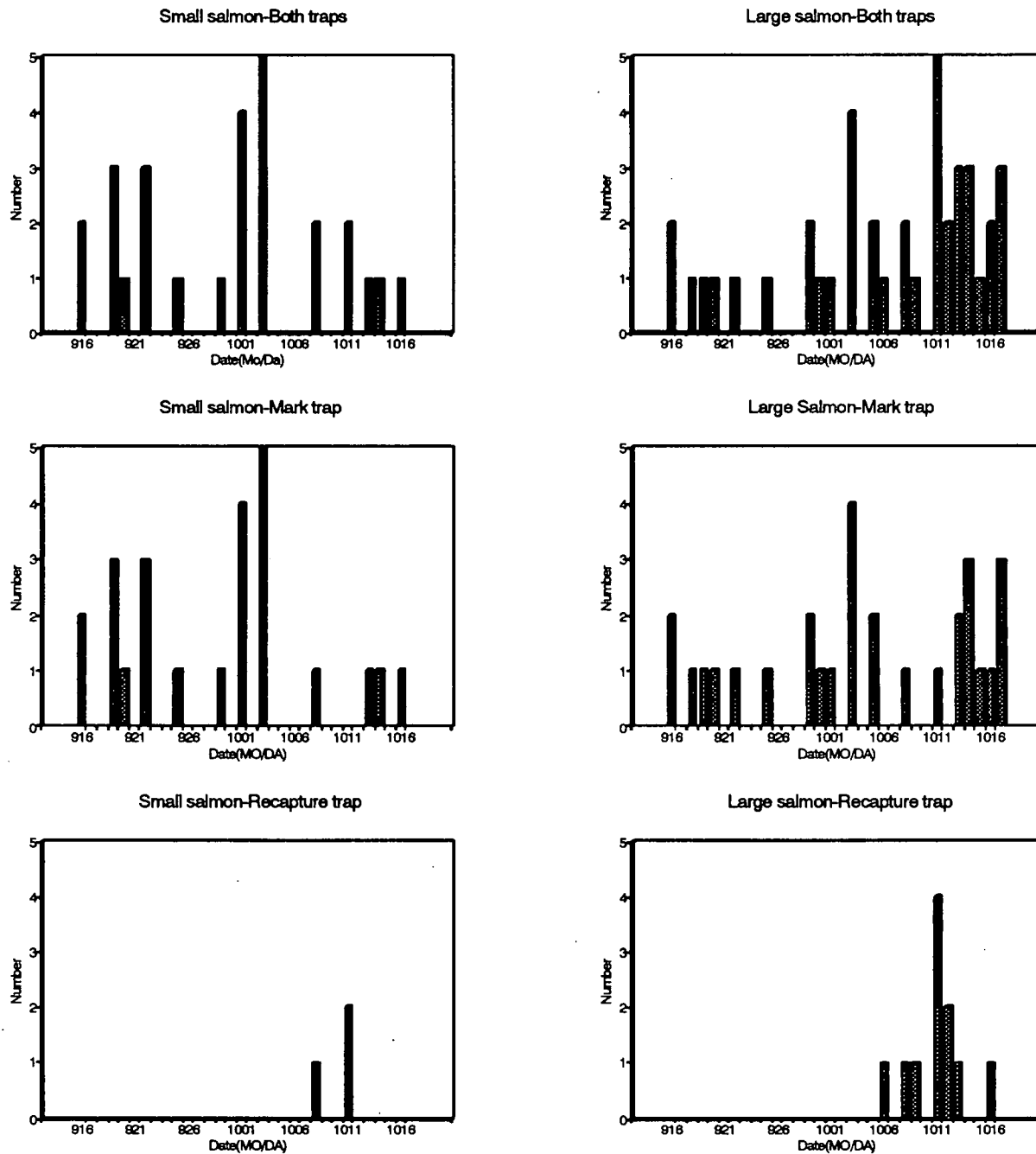


Figure . Daily catches of small and large salmon at Buctouche River traps, 1993.
 Mark trap operated 724-1104; Recapture trap 1006-1104.

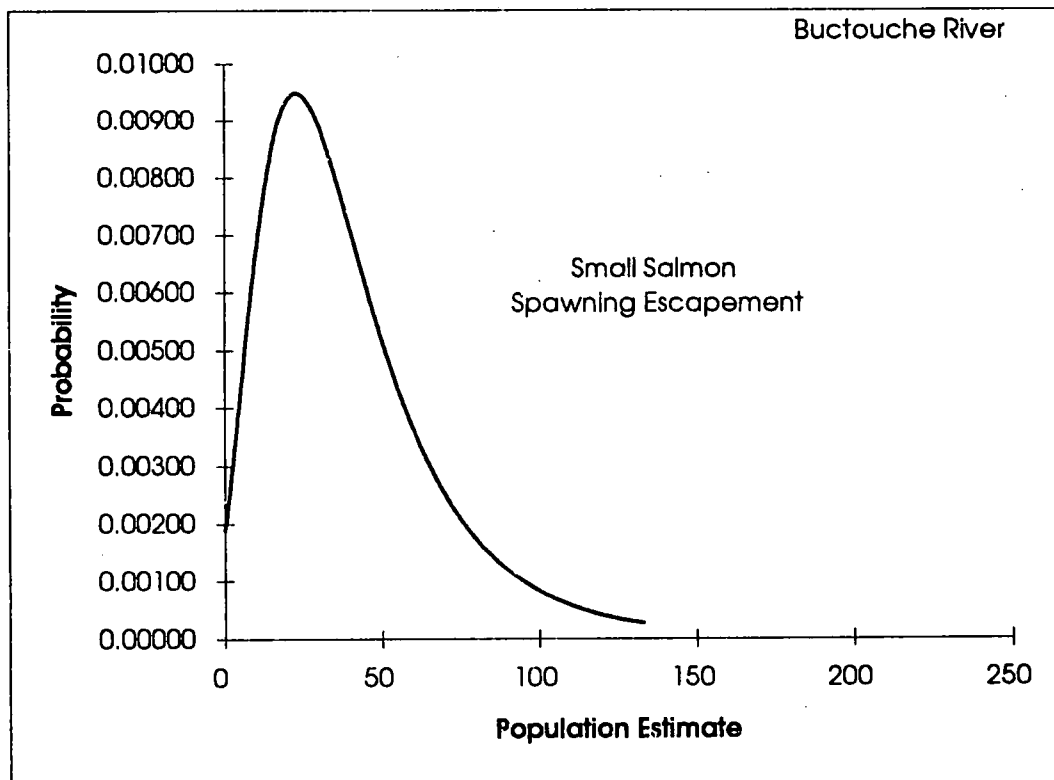
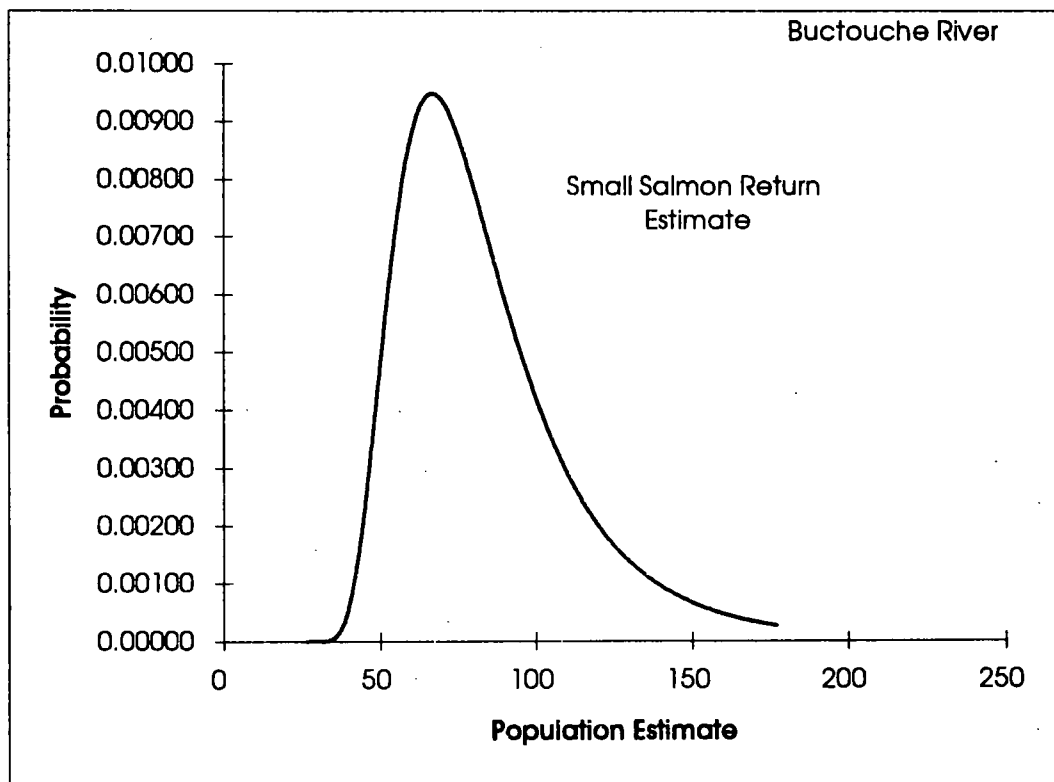


Fig. 5. Small salmon population estimate and spawning escapement for the Buctouche River in 1993.

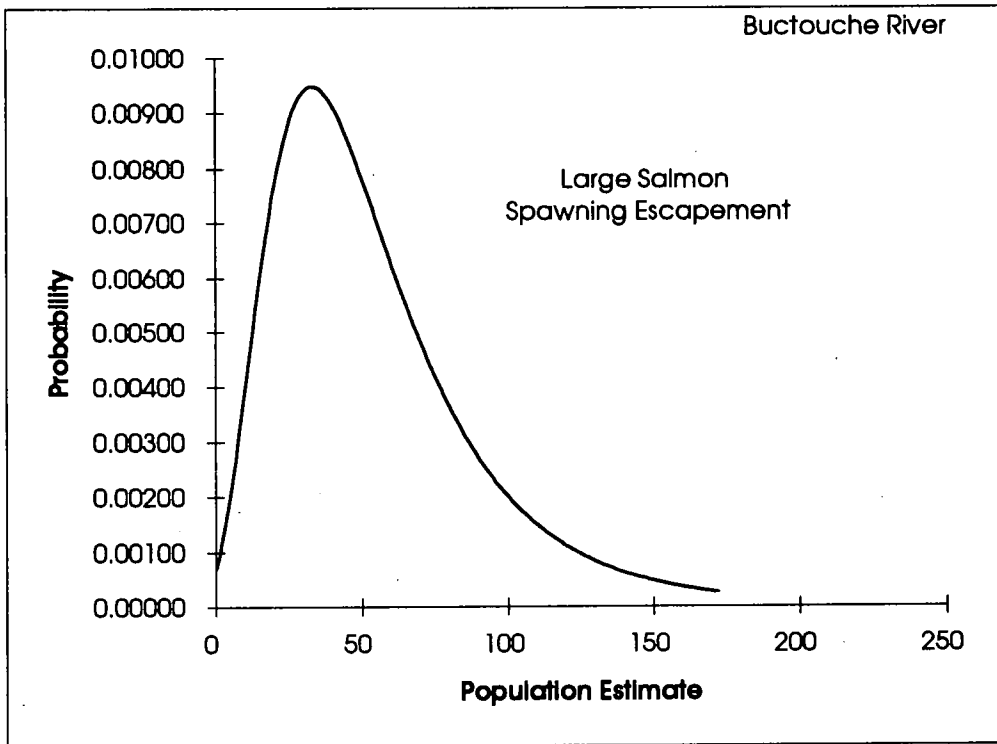
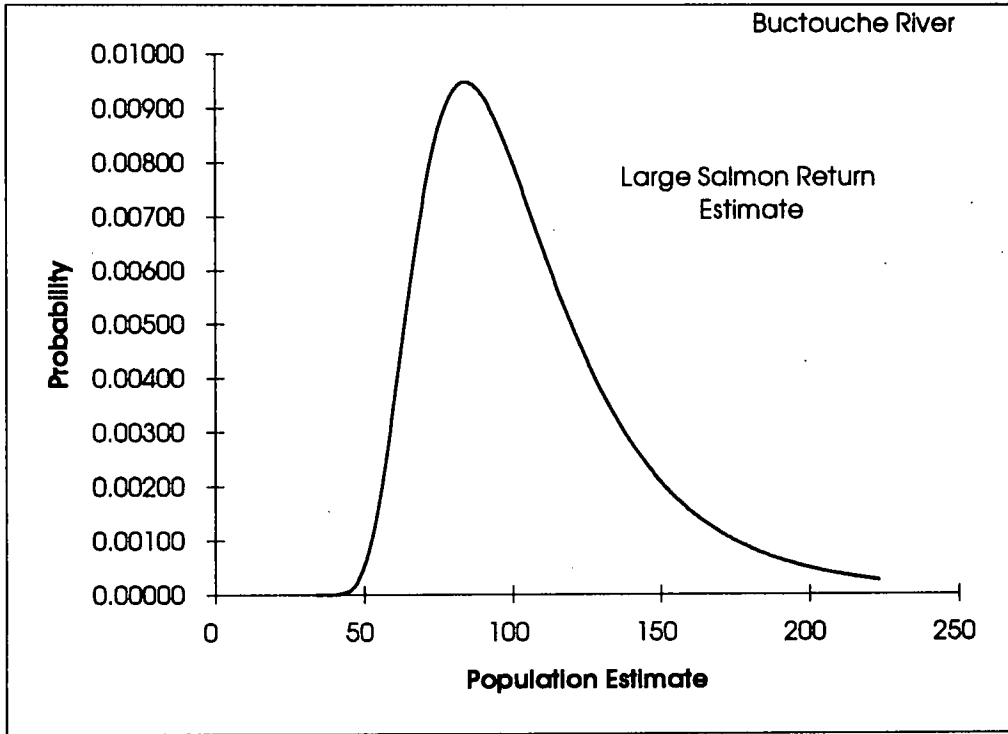


Fig. 6. Large salmon population estimate and spawning escapement for the Buctouche River in 1993.

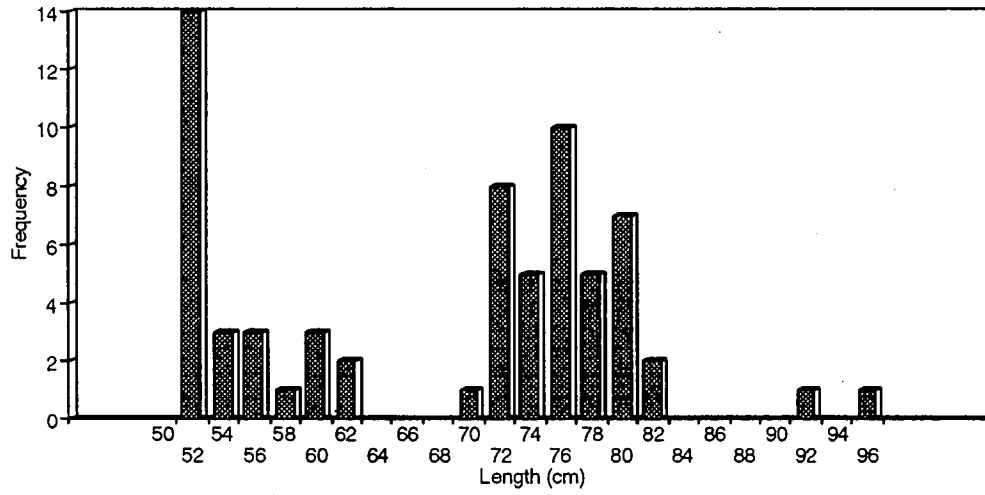


Figure 6. Length frequency of salmon caught in Buctouche R. traps, 1993.