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Assessment of the Atlantic Salmon Population  
of Conne River, Newfoundland, 1986

by

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## ABSTRACT

An assessment was conducted of the Atlantic salmon population in Conne River, Newfoundland, in 1986. Total adult production size was estimated to be 11,400-17,100 salmon. Total returns to the river (after the food fishery) were 7,536 salmon < 63 cm and 398 salmon  $\geq$  63 cm. Egg deposition in 1986 was estimated to be  $14.7 \times 10^6$  eggs which is 93% higher than the recommended target egg deposition of  $7.6 \times 10^6$  eggs (equivalent to 3,000 spawners < 63 cm). Landings in the sport fishery have been relatively stable over the past 6 years. It is anticipated that returns to the Conne River estuary in 1987 will be about 8,500, similar to that observed in 1986. This would provide a surplus of approximately 5,500 salmon.

## RESUME

En 1986, une évaluation de la population de saumons atlantiques de la rivière Conne, Terre-Neuve, a été réalisée. La taille de la population adulte a été estimée à 11 400-17 100 saumons. Les retours totaux à la rivière (après la pêche de subsistance) s'élevaient à 7 536 saumons de taille < 63 cm et à 398 saumons de taille  $\geq$  63 cm. La ponte en 1986 a été estimée à  $14,7 \times 10^6$  oeufs, ce qui représente une augmentation de 93 % par rapport à l'objectif recommandé de  $7,6 \times 10^6$  oeufs (équivalent à 3 000 reproducteurs d'une taille < 63 cm). Les prises dues à la pêche sportive ont été relativement stables au cours des 6 dernières années. On prévoit que les retours dans l'estuaire de la rivière Conne en 1987 seront d'environ 8 500, nombre comparable à celui de 1986, ce qui donnerait un surplus d'environ 5 500 saumons.

## INTRODUCTION

The Conne River, Bay D'Espoir, Salmon Management Zone 11 (Fig. 1), is one of the largest producers of Atlantic salmon in insular Newfoundland. In 1986, there were three authorized user groups prosecuting fisheries on the Conne River salmon population. These were commercial, recreational and native food fisheries. The commercial salmon season in Zone 11 was June 5 to July 10. The recreational fishery operated from June 7 to September 1. The recreational fishery was prohibited from retaining salmon  $> 63$  cm. The native food fishery operated in the outer estuary of Conne River (Fig. 2). Its season was June 5 to July 30. The food fishery utilized one modified cod trap with a mesh size not exceeding 8.9 cm. The quota for the food fishery was 1,200 salmon  $< 63$  cm with a maximum allowable retention of 200 fish per week. Retention of salmon  $\geq 63$  cm was prohibited.

This document provides an evaluation of the status of the Conne River salmon population and a prognosis for 1987.

## METHODS

### Landings

Data on landings in the recreational fisheries were collected by Department of Fisheries and Oceans (DFO) Fisheries Officers. Landings in the native food fisheries were obtained from the Conne River Native Band Council. Landings in the commercial fisheries in Statistical Section 36 (Fig. 1) were obtained from the Fisheries Statistics and Systems Branch of DFO. The landings were recorded from buyer purchase slips and estimates made by Fisheries Officers of local sales.

### Population Size - 1986

Upstream Atlantic salmon migrants were enumerated at a fish counting fence near the mouth of Conne River which operated from May 12 to September 10, 1986.

Population sizes of salmon  $< 63$  cm and salmon  $\geq 63$  cm were calculated separately, then summed.

Two estimates of the size of the Conne River anadromous salmon population were obtained using two levels of exploitation in the commercial fisheries in the formula:

$$P = [C + a (f_f + t_n)] / 1 - m$$

where P = population size  
 C = number of untagged salmon enumerated in the Conne River  
 a = proportion of salmon caught in food fishery and research nets which were of Conne River origin = 0.792 (Reddin et al. 1986)  
 $f_f$  = number of salmon caught in food fishery  
 $t_n$  = number of salmon caught in research nets

$m$  = commercial exploitation rate. Rates of 0.50 and 0.25 were assumed. The rate of 0.50 was used by Porter (1986). However, data collected at the fish counting fence in 1986 indicated that about 70% of the salmon entered the river by June 30 and since the commercial fishery did not open until June 5 an exploitation rate of 0.50 is considered an upper limit. A rate of 0.25 is considered to be a lower limit of exploitation. No differential exploitation is anticipated for salmon  $< 63$  cm or  $\geq 63$  cm.

### Egg Deposition - 1986

Biological characteristics of upstream migrants were obtained from sampling salmon caught in the sport fishery. Gonads were collected from salmon  $< 63$  cm which were angled in Conne River in 1986. Fecundity was determined from the relationship presented in Fig. 3. The logarithmic form of this equation is  $\log_e Y = 2.2313 \log_e X - 0.6474$ .

The number of spawners was calculated as follows:

$$\text{Spawners} = \text{salmon released at the fence} - \text{unrecorded mortalities} - \text{angling catch.}$$

Unrecorded mortalities would include natural mortality in the river prior to spawning and unrecorded illegal removals. Since no data were available to estimate unrecorded mortalities, an assumed value of 5% of the upstream migrants was used.

Egg depositions by salmon  $< 63$  cm and salmon  $\geq 63$  cm were calculated separately and then summed.

Egg deposition = spawners x % female x fecundity at mean length.

### Target Spawning Requirements

Surveys, in 1986, of 18 lakes, distributed in the headwaters and lower sections of the three major branches of Conne River (Fig. 2), indicated that all lakes accessible to sea-run salmon were extensively used for rearing by salmon parr. No landlocked salmon were identified in the lakes accessible to sea-run salmon.

The spawning requirement for Conne River was recalculated similar to the method used by Porter (1986) taking into consideration parameter values derived from data collected in 1986 and assuming that the estimated population size for 1986 represents the optimum production for Conne River.

Porter (1986) used 240 eggs/100 m<sup>2</sup> (Elson 1975) as the target egg deposition required for the fluvial habitat. He then calculated the number of recruits to the fisheries which would be expected to be produced from the fluvial habitat.

Recruits = parr rearing units (100 m<sup>2</sup>) x 3 smolt/unit  
(O'Connell 1986) x 0.18 sea survival (Reddin 1981).

A ratio of eggs per recruit was developed for the fluvial habitat. This ratio was then applied to the population size estimated for 1986 to obtain the total number of eggs required to seed Conne River. This technique assumes similar survival rates from egg to recruits for stream and lacustrine production.

The number of parr rearing units used by Porter (1986) were revised upwards to take into account the first and second order streams which were omitted from the original aerial survey in 1978. The additional rearing area was calculated by measuring on a map the length of unsurveyed streams and multiplying by an assumed average width of 3 m.

The target number of spawners to seed Conne River was calculated by attributing all egg deposition to salmon < 63 cm. The numbers of salmon > 63 cm entering the river in 1986 was about 5% of the total upstream migrants. Any spawning occurring from these fish would provide a buffer to spawning requirements.

$$\text{Target number of spawners} = \frac{\text{target egg deposition}}{\text{mean fecundity} \times \% \text{ female}}$$

## RESULTS

### Landings

The landings in the sport fishery and Native food fishery in 1986 are shown below and in Table 1.

	Salmon < 63 cm	Salmon <u>&gt;</u> 63 cm
	-----	-----
Sport fishery	2,060	0
Food fishery	519	3*

\*Dead in trap and given to DFO for sampling.

The nominal landings in Statistical Section 36 was 29.0 t (61% small) (Table 2). The proportion of these fish which are of Conne River origin cannot be calculated with available data. There is no statistically significant relationship between the commercial landings in Statistical Section 36 and the angling catch in Conne River 1974-85.

### Population Size

There were 7,536 salmon < 63 cm and 398 salmon > 63 cm counted at the fish counting fence on Conne River. Mortalities found in the river downstream from the fence are included. Of the salmon that entered the river 178 salmon < 63 cm and 4 salmon > 63 cm were tagged. There were 967 salmon < 63 cm and 18

salmon > 63 cm tagged and released or killed in the food fishery and research nets (Reddin, pers. comm.). Population size based on a commercial fisheries exploitation rate of 0.50 would be:

$$\begin{aligned} \text{for salmon} < 63 \text{ cm} &= [7,358 + 0.792 (967)]/1-0.50 = 16,248 \\ \text{for salmon} > 63 \text{ cm} &= [394 + 0.792 (18)]/1-0.50 = 817 \\ \text{Total population size} &= 17,065. \end{aligned}$$

Population size based on a commercial fisheries exploitation rate of 0.25 for salmon < 63 cm would be 10,832 and for salmon  $\geq$  63 cm it would be 545, for a total population size of 11,377 salmon.

### Egg Deposition - 1986

There were 7,488 salmon < 63 cm and 396 salmon  $\geq$  63 cm released upstream at the fish counting fence.

The mean fork length of female salmon < 63 cm was 50.6 cm, which gives a mean fecundity of 3,321 eggs per female. The percentage female was 76.2% (n = 272). No fecundity-length data were available for salmon > 63 cm. However, since the mean length of salmon > 63 cm (n = 8) which were sampled was 66.0 cm which is only slightly outside the range of the data used in the fecundity-length regression, the regression for salmon < 63 cm was used. The mean fecundity for salmon  $\geq$  63 cm was 6,009 eggs. The percentage of salmon  $\geq$  63 cm which were female was 83%.

$$\begin{aligned} \text{Number of spawners} < 63 \text{ cm} &= 7,488 - (7488)(0.05) - 2060 = 5054 \\ \text{Number of eggs deposited by salmon} < 63 \text{ cm} &= 5054 \times 3321 \times 0.762 = 12.8 \times 10^6 \\ \text{Number spawners} > 63 \text{ cm} &= 396 - (396)(0.05) - 0 = 376 \text{ salmon} \\ \text{Egg deposition by salmon} > 63 \text{ cm} &= 376 \times 6009 \times 0.003 = 1.9 \times 10^6 \\ \text{Total egg deposition} &= 12.8 \times 10^6 + 1.9 \times 10^6 = 14.7 \times 10^6 \text{ eggs.} \end{aligned}$$

### Target Spawning Requirements

Estimated parr rearing habitat in the fluvial portion of Conne River is 13,180 units (1 unit = 100 m<sup>2</sup>). Egg deposition requirements for the fluvial habitat at 240 eggs/100 m<sup>2</sup> = 3.2 x 10<sup>6</sup> eggs. The number of recruits to the fisheries which can be attributed to production in fluvial habitat is:

$$13,180 \times 3 \times 0.18 = 7,117 \text{ fish}$$

The number of eggs per recruit is 444 eggs.

Assuming the population size in 1986 represents optimum production for the Conne River, the target egg deposition for a production of 17,100 salmon would be:

$$17,100 \times 444 = 7.6 \times 10^6 \text{ eggs}$$

and the target number of spawners would be  $7.6 \times 10^6 / 3,321 \times 0.762 = 3,003$  salmon < 63 cm.

### Forecast

There were no data collected which could be used to calculate a forecast of the population size in 1987. However, an evaluation of the landings in the sport fishery 1980-1986 (Table 1) indicates that the population size was relatively stable (C.V. = 17%).

Thus, it is anticipated that the population size in 1987 would be between 11,400 and 17,100, similar to 1986. The number of salmon expected to arrive back to the Conne River, assuming commercial fishing mortality remains similar to recent years would be 8,500 salmon. Available harvest in Conne River would be about 5,500 salmon.

### DISCUSSION

The landings (2,060 fish) of salmon < 63 cm in the sport fishery (Table 1) is about 22% lower than the previous 5-year mean of 2,651 salmon. A contributory factor to the lower angling catch was the effect that the fish counting fence had on upstream adult salmon migration and on the fishery. The fence was located just above the first angling pool in the river and this area was closed to angling. The fish counting fence also caused delays in upstream migration which may have reduced the catchability of the salmon after they were released upstream.

Since there were insufficient data available to calculate the exploitation rates, the estimated population size (17,100 and 11,400) in 1986 was calculated using two values for the exploitation rate in the commercial fisheries, 0.50 and 0.25. In this assessment the higher population size prior to the commercial fisheries was assumed to be the optimum production for Conne River and used to calculate the target egg deposition requirements and target spawners. This provides a conservative estimate of the number of eggs ( $7.6 \times 10^6$ ) required to seed Conne River. We recommend  $7.6 \times 10^6$  eggs be considered the target egg deposition and 3,000 salmon < 63 cm be considered the target spawner requirements until better information is available on optimum production for Conne River. The forecast of adult salmon returns to Conne River after the commercial fisheries, in 1987, is 8,500. This forecast is based on the observed returns to the estuary and river in 1986. Until more detailed information is available the annual variation in abundance of salmon  $\geq$  63 cm, it is recommended that harvest be restricted to salmon < 63 cm.

The estimated egg deposition in 1986, of  $14.7 \times 10^6$  eggs, is 93% higher than the target egg deposition requirements of  $7.6 \times 10^6$  eggs. This is equivalent to about 2,800 salmon < 63 cm surplus to that required for spawning in 1986.

## REFERENCES

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Table 1. Atlantic salmon landings (in numbers of fish) in the sport fishery 1955-86, and in the Native Food Fishery, 1986, for the Conne River.

Year	Sport Fishery				Native Food Fishery			
	Effort Rod Days	Salmon			Quota	Salmon		
		<63 cm	≥63 cm	Total		<63 cm	≥63 cm	Total
1953	445	138	26	164				
1954	134	120	23	143				
1955	99	303	37	340				
1956	308	476	36	512				
1957	413	369	23	392				
1958	610	480	55	535				
1959	555	393	18	411				
1960	89	387	0	387				
1961	644	491	0	491				
1962	769	873	11	884				
1963	855	1,007	10	1,017				
1964	1,073	1,296	25	1,321				
1965	1,242	983	39	1,022				
1966	1,436	879	43	922				
1967	1,629	570	3	573				
1968	2,379	1,724	49	1,773				
1969	2,909	1,751	38	1,789				
1970	2,909	1,673	66	1,739				
1971	3,483	1,707	33	1,740				
1972	3,194	2,509	42	2,551				
1973	3,427	2,139	10	2,149				
1974	4,033	1,988	17	2,005				
1975	3,800	1,903	17	1,920				
1976	3,894	1,931	27	1,958				
1977	3,375	1,665	5	1,670				
1978	3,122	1,735	7	1,742				
1979	2,147	1,010	0	1,010				
1980	3,512	2,238	14	2,252				
1981	5,029	2,691	2	2,693				
1982	5,268	3,302	24	3,326				
1983	6,972	2,192	21	2,213				
1984	6,709	2,343	0	2,343				
1985	5,202	2,729	0	2,729				
1986	6,038	2060	0	2,060	1,200	519	3 <sup>a</sup>	522
Mean								
1981-85	5,836	2,651	-	-				
1976-85	4,523	2,184	-	-				

Note: Conne River Micmac Indian Band Council reports taking 2000 to 3000 salmon for food each year prior to 1986.

<sup>a</sup>Dead in trap.

Table 2. Commercial landings (t) in Statistical Section 36, 1974-8

Year	Small (t)	Large (t)	Total (t)
1974	14.2	37.5	51.7
1975	22.5	24.3	46.8
1976	20.1	51.8	71.9
1977	3.3	13.0	16.3
1978	1.3	3.9	5.2
1979	3.6	8.7	12.4
1980	13.2	8.0	21.3
1981	2.9	8.7	11.7
1982	9.1	12.4	21.5
1983	5.5	7.2	12.7
1984	4.8	6.7	11.5
1985	14.8	23.9	38.7
1986	17.6	11.4	29.0
Mean			
1978-85	6.9	10.6	17.5
1974-77	15.0	31.6	46.6

**ZONES DE GESTION POUR  
TERRE-NEUVE ET LE LABRADOR**  
**MANAGEMENT ZONES FOR  
NEWFOUNDLAND AND LABRADOR**

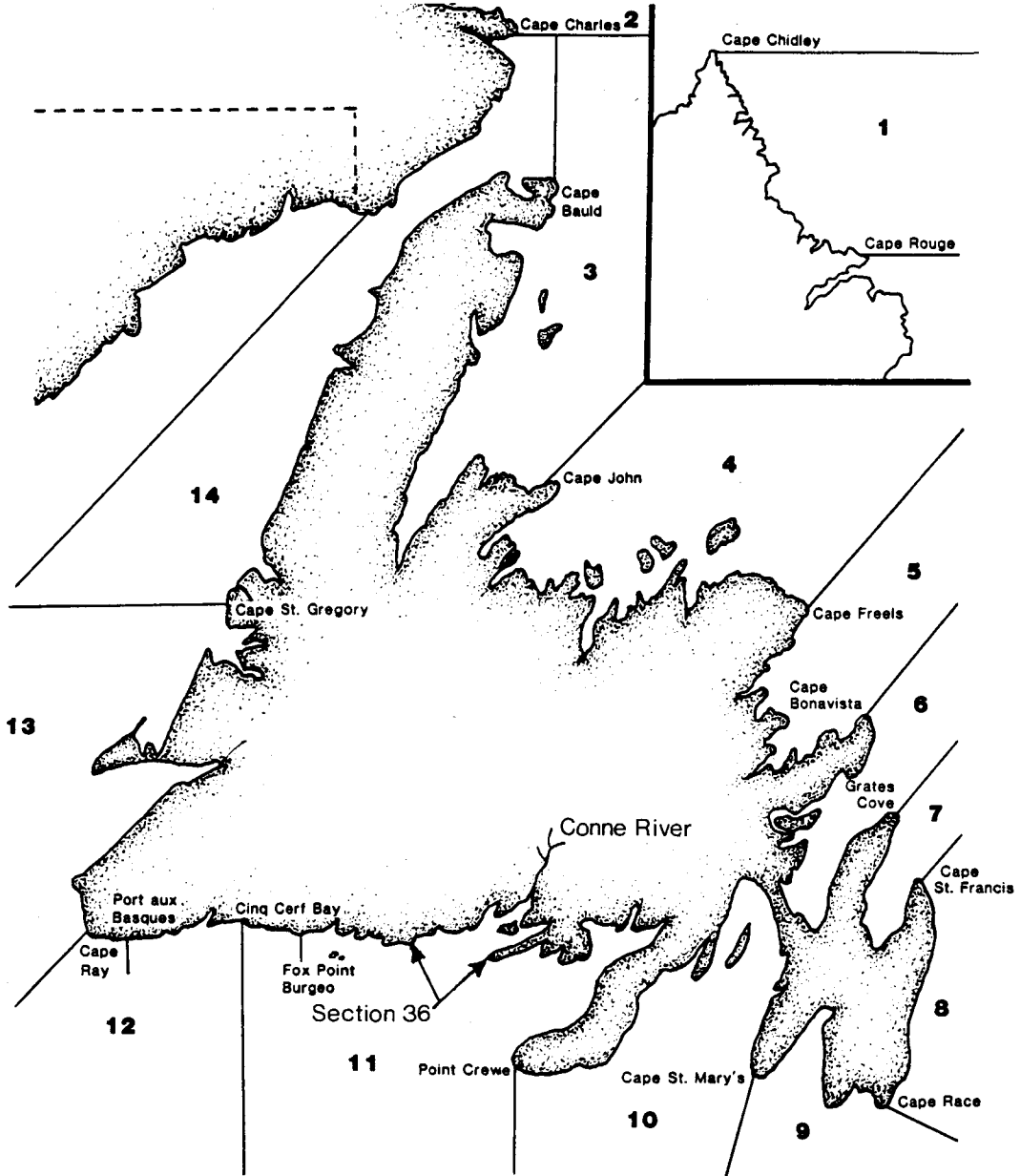


Fig. 1. Map of Salmon Management Zones and Statistical Section 36. Location of Conne River is also shown.

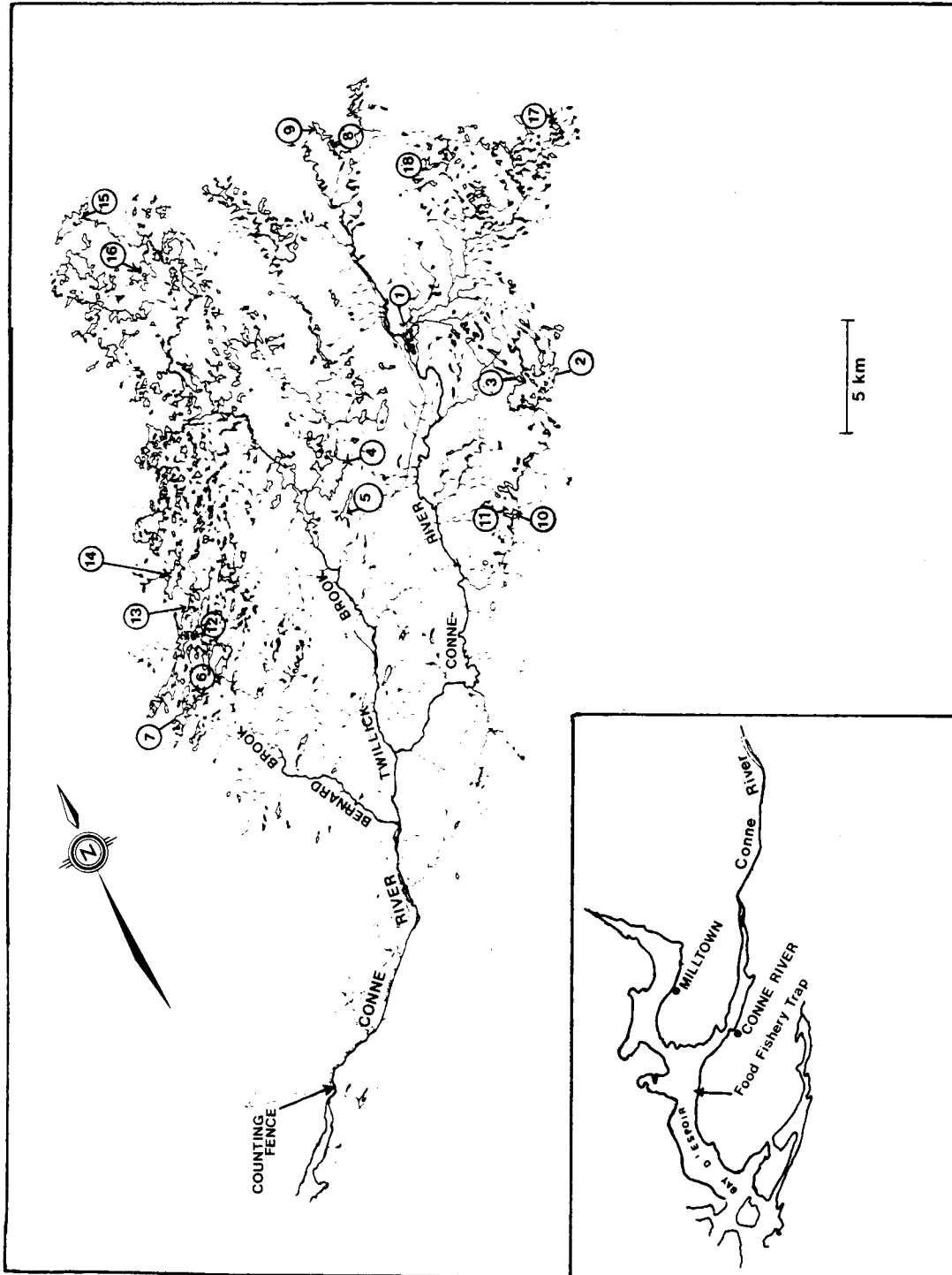


Fig. 2. Map of Conne River showing the locations of the Native food fishery trap (inset), the counting fence and the lakes sampled, 1986.

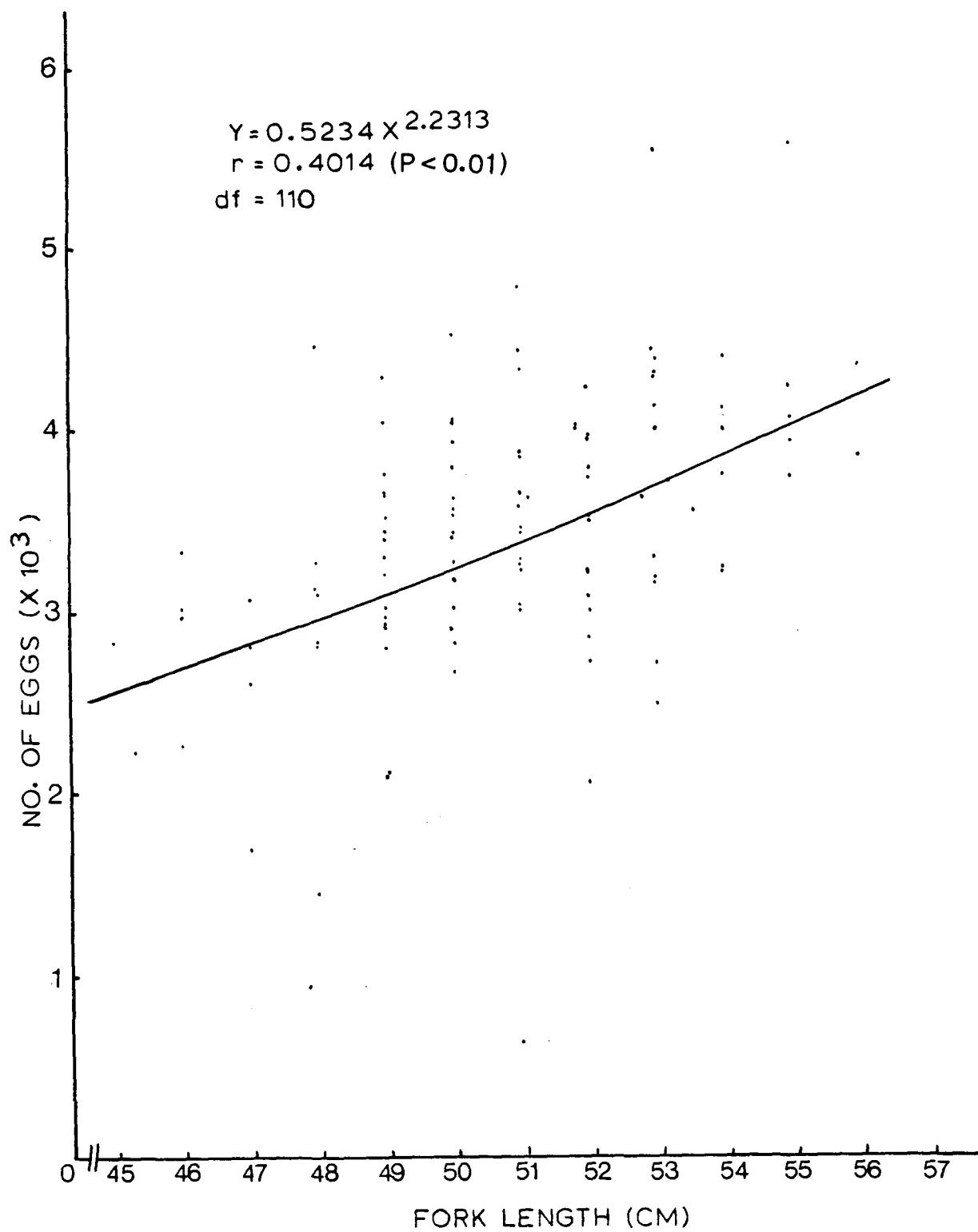


Fig. 3. Fecundity-length relationship for salmon <63 cm for Conne River, 1986.