Results of Tagging Adult Salmon in Conne River Estuary

by

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Abstract

The stock origins of Atlantic salmon (<u>Salmo</u> <u>salar</u> L.) in the estuary of the Conne River in 1987 were determined from a tagging study. In total, 495 adult salmon were caught in the estuary and, of these, 399 were tagged with Floy tags and released. The numbers of tagged salmon recaptured after adjustment for tag loss, mortalities, non-reporting, and exploitation indicated that 91.4% of the salmon in the estuary were returning to Conne River. The exploitation rate by anglers, based on tag returns in Conne River, was 0.22. Sea ages of the catch in the tagging gear were 88.1% 1-sea-winter, 11.3% previous spawners, and less than 1% 2-sea-winter salmon.

Résumé

On a fait une opération d'étiquetage pour connaître les origines du stock de saumons de l'Atlantique (<u>Salmo</u> <u>salar</u> L.) dans l'estuaire de la rivière Conne en 1987. En tout, on a capturé 495 saumons adultes dans l'estuaire : 399 ont reçu une étiquette Floy puis ont été libérés. D'après le nombre de poissons étiquetés qu'on a recapturés, on a déterminé que 91,4 % des saumons de l'estuaire retournent à la rivière Conne; on a calculé cette valeur en faisant les ajustements nécessaires pour tenir compte des étiquettes perdues, de la mortalité, des poissons étiquetés non signalés et de la pêche. D'après le nombre de saumons étiquetés qui sont revenus dans la rivière Conne, l'exploitation due à la pêche sportive se chiffre à 0,22. Selon le stade atteint en mer, les poissons capturés pour l'opération d'étiquetage se distribuent comme suit : 88,1 % avaient passé un hiver en mer, 11,3 % avaient déjà frayé et moins de 1 % avaient passé deux hivers en mer.

Introduction

In 1987, as in 1986, the Band Council of Conne River Micmacs (Band Council) set fishing gear to catch Atlantic salmon (_Salmo salar_ L.) for food in the outer estuary of Conne River, Bay d'Espoir, Newfoundland. In 1987, adult salmon were tagged to determine the proportion of salmon exploited by the food fishery that were of Conne River origin. This paper describes the results of this tagging study.

Methods

General

Salmon for the study were caught in DFO gill nets set shorefast in the Conne River estuary (Fig. 1) from 21 May to 8 July 1987. The gill nets were constructed from monofilament twine of mesh sizes 102 mm and 127 mm (length of mesh opening). Up to 100 fathoms of net were fished at one time.

Tagging was done from a 5 m open boat when weather conditions permitted safe operation of the boat. Salmon were removed from the gill nets by cutting the mesh with scissors, placed in a small tank in the tagging boat, and held for a short recovery period prior to being tagged and released. Brown Floy tags were inserted into the dorsal musculature just below the anterior base of the dorsal fin so that the T-bar of the Floy tag was firmly anchored behind the interneural spines.

Tagged fish were sampled for fork length (nearest cm) and scale samples were removed from the left side of the fish from three to six scale rows above the lateral line on a line extending from the posterior edge of the base of the dorsal fin to the anterior edge of the anal fin. Impressions of the scales were made on plastic slides and freshwater and sea ages determined.

Tagging Mortalities

To assess the mortality due to tagging, 71 salmon were held for five days prior to release. The number of mortalities and tag losses were recorded daily. The salmon were held in a small cage (2.5 m x 2.5 m x 2.5 m) that was set in Conne River estuary.

Tag Loss and Non-reporting of Tags

Tag loss was assessed by double-tagging 123 salmon with Floy tags and releasing them. The second tag was inserted just slightly posterior to the first.

Non-reporting in the angling fishery on Conne River was assessed by removing the adipose fins from all Floy-tagged fish and then examining salmon caught by anglers for these marks. Sampling teams examined salmon caught by anglers in Conne River from 13 June 1987, to 12 July 1987.

Origin of Salmon

The origin of salmon caught in the food fishery can be inferred from the distribution of recapture sites of tagged salmon. To do this it was assumed that salmon do not enter rivers other than their natal streams. Also, it was assumed that salmon caught outside of the tagging site towards the entrance of Bay d'Espoir were of non-Bay d'Espoir origin. The number of tags was adjusted for rivers and fisheries without complete counts. For tagged salmon that were angled in streams other than Conne River, the exploitation rate from the Conne River angling fishery in 1987 of 0.15 was used (pers. comm., J. B. Dempson). For commercial fisheries 0.25 was assumed. Tagged salmon recaptured at the fish counting facility on Little River were adjusted similar to other rivers in Bay d'Espoir. This is because the fence was placed only a short distance downstream from an impassable falls and there is considerable spawning area downstream from the fence site.

The rates reported in this paper were tested for completeness by a back-calculation technique. The number of salmon arriving at the counting fence and caught in other fisheries and rivers were adjusted for non-reporting of tags by anglers, tag loss, and mortalities due to tagging and natural causes. This number was then compared to the number tagged.

Results and Discussion

Distribution of Recapture Sites of Tagged Salmon

Out of 399 salmon tagged and released, two were caught by commercial fishermen outside of the Conne River estuary, one was angled in Southeast Brook in Bay d'Espoir, one was recaptured at a counting fence in Little River, and 223 were counted in the Conne River system (10 dead below fence plus 213 enumerated at counting fence) (Table 1). Because there was a fish counting fence in Conne River, the count at this fence is the total number of salmon returning to Conne River. The number of tagged fish caught by anglers in other rivers, including at the fence in Little River, are not complete counts; therefore these other recaptures were converted to total numbers using assumed exploitation rates. Therefore, total adjusted tag returns are: other rivers in Bay d'Espoir - 13, commercial fisheries - 8, and Conne River - 223. Thus, in 1987, the salmon exploited in the food fishery were 91.4% Conne River stock, 5.3% stocks from other rivers in Bay D'Espoir, and 3.3% stocks outside of Bay d'Espoir. In 1986, salmon exploited in the food fishery were 79.2% Conne River stock, 6.9% stocks from other rivers in Bay d'Espoir, and 13.9% stocks outside of Bay d'Espoir (Reddin et al. 1986).

There are several other factors that may influence the derivation of origin of salmon caught in the food fishery. For example, tagged salmon may have been caught by commercial fishermen but not reported. Also, there were several tagged salmon observed in a group of 200-300 fish below the counting fence in Conne River just prior to the fence being removed (M. Shears, pers. comm.) and there may have been other tagged salmon below the fence prior to its removal. Because a precise count of these fish was not available, they were not included.

Tagging Mortalities

In total, 71 salmon were held in the sea cage for five full days and those remaining alive on the sixth day were released. There were three trial periods: 11-17 June - 21 salmon held with no mortalities, 18-24 June - 25 salmon held with 5 mortalities, and 25-30 June - 25 salmon held with 15 mortalities. Therefore, in each trial period the mortalities were 0%, 20.0%, and 60.0%, respectively, for an average of 28.2% overall (sum of mortalities divided by total salmon held). Because the mortality rate appeared to increase over the three periods, two of the dead salmon from the third period were submitted for disease diagnosis. The results indicated that both were heavily infected with Vibrio anguillarum and that the portal of entry was possibly through net marks on the skin. Although it is not possible to say if Vibrio was the cause of death, it probably contributed to it. The mean surface water temperature increased over the three periods from 11.0°C to 13.4°C to 14.3°C, respectively. The higher temperature during the third period may partly account for the higher mortality rate. Mortality rates from an experiment conducted in 1986 were 14.6% (Reddin et al. 1986).

Another way of examining tagging mortalities is from the number of dead salmon observed in Conne River in comparison to the fence counts. In total, 223 tagged salmon were counted at or below the fence. There were 20 dead tagged salmon found in Conne River. Therefore, the mortality rate on tagged salmon in Conne River was 9.0%. If these two estimates of tagging mortality rates are independent of each other, i.e. short- and long-term mortalities, then they can be summed to give an estimate of total mortality of 37.2%. This estimate may include mortalities from tagging stress, disease, stress from low water and high temperatures.

Tag Loss and Non-reporting

There were no tag losses from salmon held in cages in 1986 and 1987.

Of the salmon that were released with two tags attached, a total of 62 were reported, of which one salmon had only one tag. Therefore, the tag loss rate is 1.6%. Tag loss rate calculated from a similar experiment in 1986 was 8.1% (Reddin et al. 1986).

Of the salmon that were released with a single Floy tag and an adipose fin clip, there were a total of 165 reported, of which 2 were missing the Floy tag. Therefore, the tag loss rate is 1.2%. Tag loss rate calculated from a similar experiment in 1986 was 5.0% (Reddin et al. 1986). These rates should be considered as minimal since not all salmon moving through the counting fence could be examined for adipose fin clips.

In total, there were 384 salmon examined out of an angling catch of 1598 salmon, thus 24.0% of the catch was examined. There were no salmon examined with an adipose finclip that did not also have a Floy tag. Therefore, the non-reporting rate by anglers on the Conne River was assumed to be 0. This is the same as the rate calculated from a similar experiment in 1986 (Reddin et al. 1986). Because observers were examining salmon catches shortly after the salmon was landed it is unlikely that the fishermen would not report these tags. There may have been other fishermen whose catch was not examined that

did not report tags. Therefore, this estimate is a minimum and may not apply to other rivers and situations.

Exploitation in the Recreational Fishery

The exploitation rate by anglers on salmon in Conne River was calculated from the number of tagged fish that passed through the fence and the number reported recaptured by anglers. Similar to 1986, it was observed that the distribution and timing of tagged salmon passing through the counting fence was different than for untagged salmon. Because of this, all of the tagged salmon would not have been available to anglers and the number of tagged salmon used to calculate exploitation rates should be adjusted so that the rate is more comparable to that for untagged fish. The number of salmon used in this calculation included only those that had passed through the fence prior to July 1. There were 99 tagged salmon that passed through the fence prior to July 1 and 20 of these were subsequently caught by anglers. If it is assumed that the non-reporting rate of tagged fish by anglers was 0, tag loss rate was 0, and natural mortality rate was 0.09, then 90 of the tagged salmon were available to anglers and the exploitation rate was 22%.

Do the rates reported in this paper for non-reporting, tag loss, and mortalities due to tagging make sense? If they do, then the reported recaptures of tagged salmon should be similar to the calculated numbers.

The number of salmon accounted for was calculated by adjusting the 223 salmon at the counting fence for tagging mortality (0.282), and tag loss (0.016), plus adjusting the 2 fish caught in other rivers by tagging mortality (0.282), and tag loss (0.016), and exploitation (0.15). In total, 346 salmon could be accounted for out of 399 tagged and released in the estuary. Therefore, 53 (13.3%) of the salmon tagged and released in the estuary were not accounted for. The unaccounted salmon may have resulted from salmon that entered Conne River but did not pass through the counting fence, unobserved mortalities from tagging, tagged salmon caught by commercial fishermen or anglers but not reported, and mortalities from natural causes, i.e. predation.

Biological Characteristics of Catch in Tagging Nets

There were 486 salmon measured for fork length and 87 for whole weight out of 495 salmon caught (Table 2). One-sea-winter salmon had a mean fork length of 51 cm and mean whole weight of 1.6 kg. Two-sea-winter salmon had a mean fork length of 68 cm and mean whole weight of 3.4 kg. Previous spawners had a mean fork length of 60 cm and mean whole weight of 2.9 kg. The total sample had a mean fork length of 52 cm and mean whole weight of 1.8 kg.

Sea age was determined for 495 salmon (Table 3). Of these, 88.1% were 1-sea-winter salmon, 0.6% were 2-sea-winter salmon, and 11.3% were previous spawners (Table 3). The river age distribution of the total sample was: 1 year, 0.21%; 2 years, 4.8%; 3 years, 67.6%; 4 years, 24.1%; and 5 years, 3.3%. In 1986, the salmon retained for food consisted of 98.2% 1-sea-winter salmon and 1.8% previous spawners. The river ages in 1986 were 4.3%, 2 years; 51.6%, 3 years; 39.9%, 4 years; 4.0%, 5 years; and 0.2%, 6 years.

There were 78 salmon for which sex was determined (Table 4). The 1-sea-winter salmon were 27.0% male and 73.0% female. The total sample was 25.6% male and 74.4% female. In 1986, a combined sample from the food fishery and tagging study was 25.0% male and 75.0% female (Reddin and Short 1986).

References

Reddin, D. G., and P. B. Short. 1986. Details on the Conne River Band Council food fishery in 1986. CAFSAC Res. Doc. 86/109. 11 p.

Reddin, D. G., P. B. Short, and G. Furey. 1986. Results of tagging adult salmon in Conne River estuary. CAFSAC Res. Doc. 86/108. 8 p.

Table 1. Distribution of tag recaptures from salmon tagged and released from gear set in Conne River estuary, Newfoundland, in 1987. This table is complete to 6 November 1987 and does not include recaptures in 1987 of salmon tagged in 1986.

	Total tagged and released	Recaptured at tagging site	Caught by commercial fishermen	Angled/ observed in other rivers	Conne River counting fence					
					Released upstream	Dead below fence	Dead in trap	Dead above trap	Angled above fence	Observed mortality rate
1 Floy tag	276	1	1	2[a]	154[b]	8	0	7	13	0.40
2 Floy tags	123	2	1	0	59[c]	2	0	3	8	0.50
Total	399	3	2	2	213	10	0	10	21	0.43

[a]Includes 1 salmon from a partial count on Little River.

[b]Includes 49 salmon for which the tag numbers were not recorded.

[c]Includes 16 salmon for which the tag numbers were not recorded.

Table 2. Fork length (cm) and whole weight (kg) of salmon caught in the Conne River estuary, 1987.

Sea age	Variable	N	Mean	Standard deviation	Standard error of mean
1-sea-winter	FL	428	51.16	2.24	0.1088
	WW	73	1.55	0.22	0.0257
2-sea-winter	FL	3	67.67	5.03	2.9040
	WW	1	3.40		
Previous spawners	FL	53	59.83	7.02	0.9643
	WW	12	2.87	1.0	0.2887
Unknown	FL	2	58.50	12.02	
	WW	1	3.60		
Total	FL	486[a]	52.24	4.37	0.1982
	WW	87[b]	1.78	0.67	0.0718

FL = fork length
WW = whole weight

[a]There were 9 salmon that were not measured for FL.

[b]There were 408 salmon from which WW was not collected.

Table 3. Sea age and river age distribution of salmon caught in Conne River estuary, 1987.

		River age						Total
		1	2	3	4	5	Unknown	
1-sea-winter	Number	1	21	299	89	14	12	436
	%	0.24	4.95	70.52	20.99	3.30	-	88.1
2-sea-winter	Number			1	2			3
	%			33.33	66.67			0.61
Previous spawners	Number		2	26	25	2	1	56
	%		3.64	47.27	45.45	3.64	-	11.3
Total	Number	1	23	326	116	16	13	495
	%	0.21	4.77	67.63	24.07	3.32	-	

Table 4. Sex ratios of salmon caught in the Conne River estuary, 1987.

	Male		Female	
Sea age	Number	%	Number	%
1-sea-winter	17	27.0	46	73.0
Previous spawners	3	21.4	11	78.6
Unknown	0	-	1	-
Total[a]	20	25.6	58	74.4

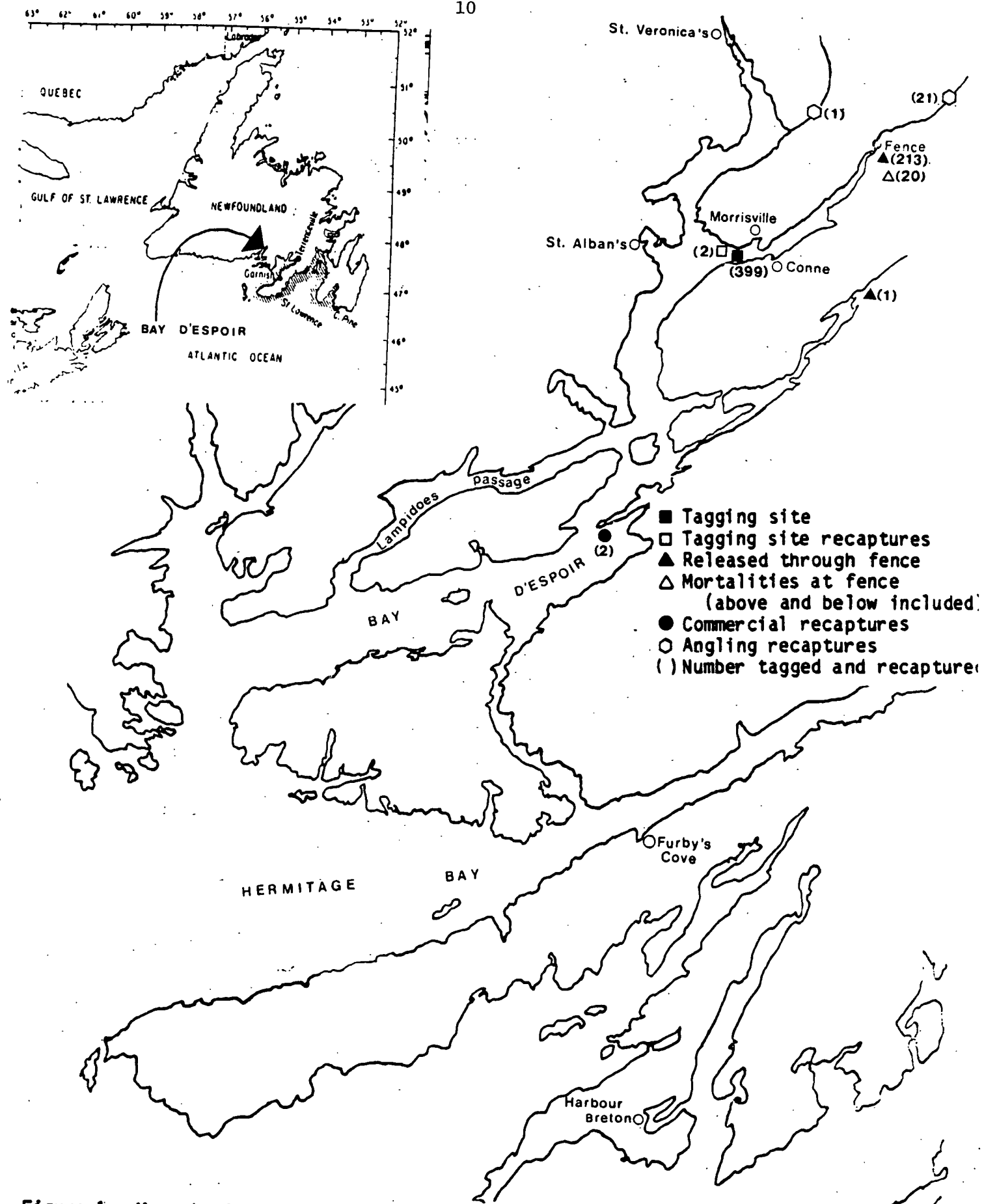[a]There were 420 salmon that were not sexed.

Figure 1. Map showing tagging and recapture sites Conne River, Bay D'Espoir, 1987