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Utilization of three stocks of Atlantic salmon tagged and liberated as smolts in the Northwest Miramichi River from 1964 to 1967

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Returns from 149,398 tagged Atlantic salmon smolts liberated in the years 1963-1966 were summarized in ICES/ICNAF Salmon Doc. 68/14. Of the 1,929 returns (1.3% overall recovery rate), 12% were recorded from the West Greenland area and 88% from Canadian waters. As noted in ICES/ICNAF Salmon Doc. 69/10 ("Canadian tagging data for Atlantic salmon to February 28, 1969"), these tagged smolt releases involved fish of different stock origins and rearing histories, liberated in different rivers. Survival rates varied considerably between groups of fish. Meaningful year-to-year comparisons of dispersal patterns and return rates should take account of the different groups of fish and places of liberation.

Year-to-year comparisons do have validity for three stocks of fish liberated in the Northwest Miramichi River, New Brunswick, in the years 1964 to 1966. Similar kinds of tagged smolts were also liberated in this stream in 1967, but for these the important returns as 2-sea-winter fish will not be available until the end of the 1969 season: data on returns of these fish before completion of their second sea winter are, however, included in the tables with some interpretation of their significance given as footnotes.

The three stocks include wild, native Northwest Miramichi smolts; hatchery-reared smolts from a mixture of grilse and salmon parents which ascended five miles into Northwest Miramichi fresh water after September, and regarded

as late-run; and hatchery-reared smolts from a mixture of grilse and salmon parents which ascended five miles into Northwest Miramichi fresh water before August 1, regarded as early-run.

The hatchery-reared smolts were reared in hatcheries offering warmer water, hence faster growth, than the Miramichi area. They were mostly tagged and liberated as 2-year-old smolts. Tagging was done at the rearing hatchery in March. Liberation was in the Northwest Miramichi in late May, the height of the local season for smolt descent. Fish were released five miles or farther above tidehead, in fresh water. Returns showed nearly all freshwater recaptures in the river of liberation. That dispersal at sea was similar to that for wild smolts from the same stream is shown in Figures 1 and 2 (see also Saunders, R.L. 1969. J. Fish. Res. Bd. Canada, 26: 269-278).

Wild, native smolts

Wild smolts are produced mostly in the upper 50 miles of the 70-mile-long river. The lower 20 miles is periodically subjected to copper-zinc pollution at levels lethal to young salmon. The uppermost 30 to 40 miles is populated mostly by grilse and salmon entering before August 1 (Saunders, R.L. 1967. J. Fish. Res. Bd. Canada, 24: 21-32), but many late fish spawn in the lower reaches including about 20 miles immediately above the source of pollution.

Most of the native smolts are 3 years old, thus most 1964 smolts were derived from the 1960 autumn spawning. In that year the ratio of large salmon:grilse entering the river was 1:7; other such ratios were 1961 - 1:1, 1962 - 1:10, 1963 - 1:20, the latter resulting in most of the 1967 wild smolts.

The above facts would seem of little import except that evidence is accumulating which appears to point to genetic constitution having some influence on behaviour patterns as regards both season of return and age at maturity.

Table 1 gives summarized data on returns from wild smolts.

Comparatively low returns as grilse from the 1965 smolts, together with high returns from Greenland, where most tagged Canadian fish are entering their second sea winter, is in keeping with a hypothesis that a high salmon component among the spawners (in 1961) should contribute fish older than grilse. However, the grilse returns for the 1964 and 1966 smolts, though higher than for 1965 smolts, suggest that any such relationship is far from precise.

Late-run, hatchery-reared smolts

Table 2 gives summarized data on returns from hatchery-reared smolts of late-run parentage.

As with the wild smolts, the 1964 run yielded a relatively high proportion of grilse, although these smolts (from 1961 spawners) were a year younger than most of the wild smolts of 1964; the 28 returns are, however, low and do not merit much emphasis. The late-run smolts of 1966 gave a relatively small proportion of grilse although the wild smolts of 1966 gave many grilse. Both wild and hatchery-reared smolts of 1966 arose from spawning populations with high grilse:salmon ratios.

Early-run, hatchery-reared smolts

Table 3 gives summarized data on returns from hatchery-reared smolts of early-run parentage.

The first substantial planting of such fish was made in 1965. The first two plantings yielded a higher proportion of grilse than the wild and late-run smolts tagged in these two years.

Utilization of large salmon

In Canada, other than in Newfoundland, commercial fisheries for Atlantic salmon depend largely, though not entirely, on salmon older than grilse. Salmon making their first return after 2 winters at sea are the mainstay. In Newfoundland grilse

contribute variably but always substantially, forming perhaps half of the fish caught. The larger fish, too, are much more prized by anglers than are the grilse.

Most of the salmon of known Canadian origin taken in the new fisheries of the West Greenland-Davis Strait area are in their second sea winter. If a substantial portion of these fish would otherwise have returned to Canadian waters, then the exploitation rates to which they are subjected in distant waters will have bearing on the success of Canadian fishermen. This is particularly liable to be the case if exploitation rates in home waters are high (Allen, K.R., and R.L. Saunders. 1967. ICNAF Redbook, Pt. III, pp. 159-180).

The overall data available for each year's recaptures of tagged smolts show sufficient variability to give cause for wondering whether, in some recent years more than others, more Canadian fish appeared in these northern waters. Some variability may be an artifact based on the use of different kinds of fish for studying comparative values for utilization.

Examination of Tables 1 to 3 shows that much of the variability has no obvious relationship to year of smolt descent, but is rather associated with different survival and migratory patterns of different groups of fish.

The data do pertain to eight groups of fish liberated over three different years. They appear to have merit for indicating mean values, with standard deviations, for capture of Canadian fish in the Greenland area versus returns, as 2-sea-winter and older fish, to home waters.

Combining the three right-hand columns of the three tables, about 20 $\pm$ 8% were exploited in Greenland, about 77 $\pm$ 9% were removed by Canadian fisheries and a little over 3% (3.5 $\pm$ 3) were recorded as spawning escapement in the home river.

Considering only those large salmon recorded from Canadian waters, 76 $\pm$ 16% were used in commercial fisheries; 20 $\pm$ 13% in sport fisheries and 4 $\pm$ 4% were recorded as spawning

escapement. By way of contrast, of the fish recorded as grilse only 75% were used in fisheries and 25% were recorded as spawning escapement.

The recently observed exploitation rate for large salmon appears to be much higher than the approximately 70% suggested in one study (Elson, Paul F. 1962. Atlantic Salmon Journal, No. 2, pp. 16-18, June, 1962) as admissible for year-classes of better than average strength. If there is no genetic influence on age and size at maturation, then it may only be necessary to maintain a sufficient escapement of grilse. If there is such genetic influence, then present stocks of large salmon in the Northwest Miramichi and perhaps other Canadian rivers may now be critically low. Many Canadian freshwater Atlantic salmon environments, including the large Miramichi and Saint John systems, are now subject to deterioration resulting from industrialization. Year-classes of better than average strength should probably be expected less frequently than even 10 years ago.

Table 1. Returns from tagged, wild Northwest Miramichi smolts. (Escapement = fish recorded in counting weirs and brood stock collections but not subsequently in fisheries.)

Year tagged	Number tagged	Total returns % of tagged number	Total returns % of tagged smolts	Grilse reported in Canada as % of total adult returns	2-sea-winter and older fish as % of total large salmon returns: Greenland fisheries	Canada fisheries	Canada escapement
1964	12,996	267	2.1	65	10	88	2
1965	15,361	429	2.8	38	27	70	3
1966	8,450	225	2.7	48	21	74	5
1967	11,763	80*	0.7*	-	(13 fish)**	-	-

* Grilse in Canada and 2-sea-winter fish in Greenland (to Feb. 28, 1969) compare with 1.4, 1.5 and 1.6% returns from 1964, 1965 and 1966 liberations.

**Ratio of grilse in Canada:2-sea-winter fish in Greenland for smolts of 1964 - 25:1, 1965 - 2:1, 1966 - 5:1, 1967 - 5:1.

Table 2. Returns from tagged, hatchery-reared smolts from late-run mixed grilse and salmon parentage, liberated in the Northwest Miramichi River. (Escapement = fish recorded in counting weirs and brood stock collections but not subsequently in fisheries.)

Year tagged	Number tagged	Total returns		Grilse reported in Canada as % of total adult returns	2-sea-winter and older fish as % of total large salmon returns		
		number	% of tagged smolts		Greenland fisheries	Canada fisheries	Canada escapement
1964	11,533	28	0.2	64	30	60	10
1965	4,797	120	2.5	45	15	80	5
1966	18,314	248	1.4	18	22	77	1
1967	14,440	66*	0.5*	-	(7 fish)**	-	-

*Grilse in Canada and 2-sea-winter fish in Greenland (to Feb. 28, 1969) compare with 0.2, 1.3 and 0.5% returns from 1964, 1965 and 1966 liberations.

**Ratio of grilse in Canada: 2-sea-winter fish in Greenland for smolts of 1964 - 6:1, 1965 - 5:1, 1966 - 1:1, 1967 - 8:1.

Table 3. Returns from tagged, hatchery-reared smolts from early-run mixed grilse and salmon parentage, liberated in the Northwest Miramichi River. (Escapement = fish recorded in counting weirs and brood stock collections but not subsequently in fisheries.)

Year tagged	Number tagged	Total returns number	Total returns % of tagged smolts	Grilse reported in Canada as % of total adult returns	2-sea-winter and older fish as % of total large salmon returns: Greenland fisheries	Canada fisheries	Canada escapement
1965	10,026	330	3.3	58	25	75	0
1966	13,802	236	1.7	61	10	88	2
1967	15,517	150*	1.0*	-	(2 fish)**	-	-

* Grilse in Canada and 2-sea-winter fish in Greenland (to Feb. 28, 1969) compare with 2.2 and 1.1% returns from 1965 and 1966 liberations.

**Ratio of grilse in Canada:2-sea-winter fish in Greenland for smolts of 1965 - 6:1, 1966 - 16:1, 1967 - 74:1.

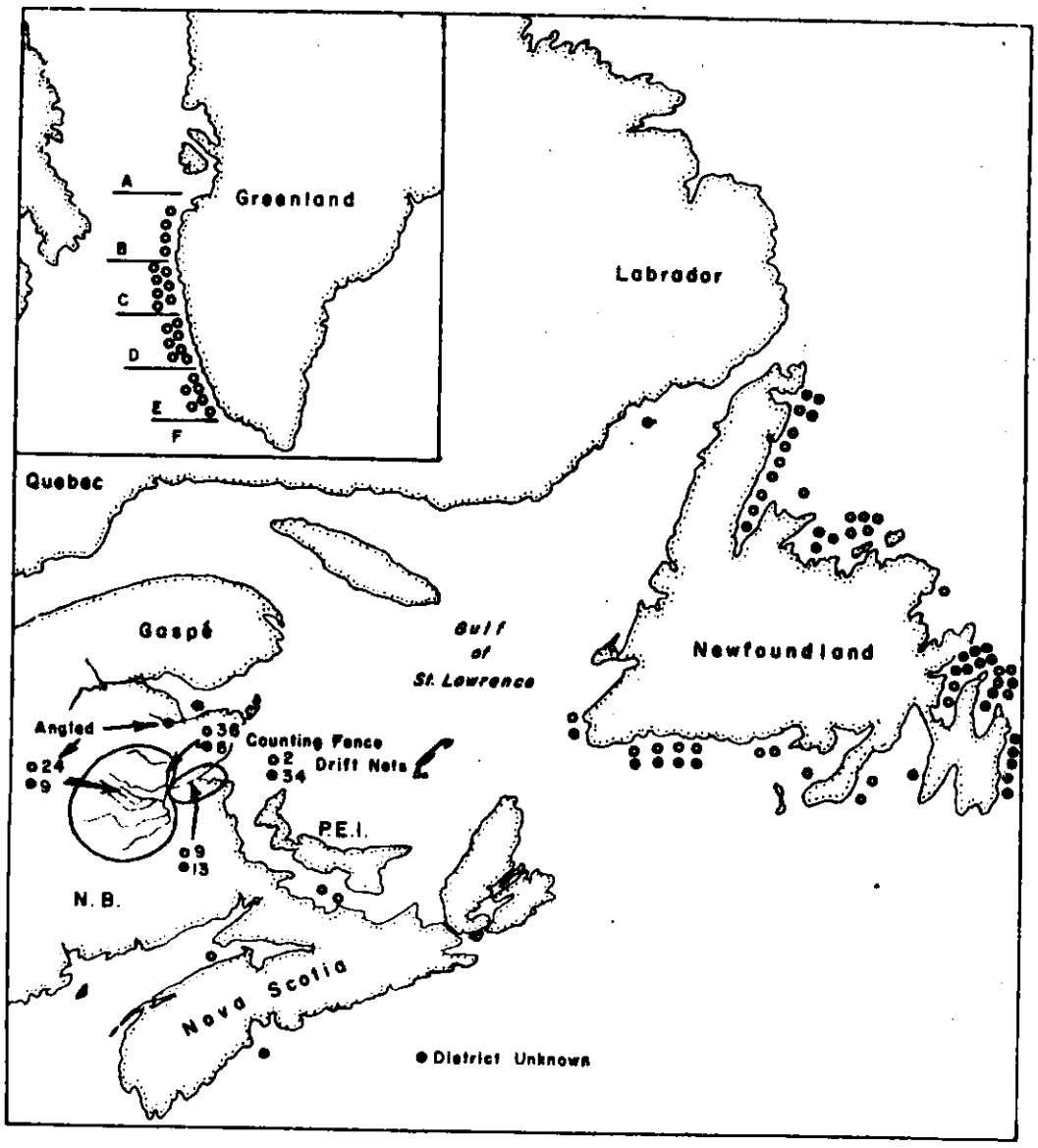

Figure 1. Recaptures from 8,450 Atlantic salmon tagged as wild, native smolts at a counting fence while descending the Northwest Miramichi River, New Brunswick, in May and June, 1966. Open circles - taken as 1-sea-winter fish (130); solid circles - taken as 2-sea-winter or older fish (93).

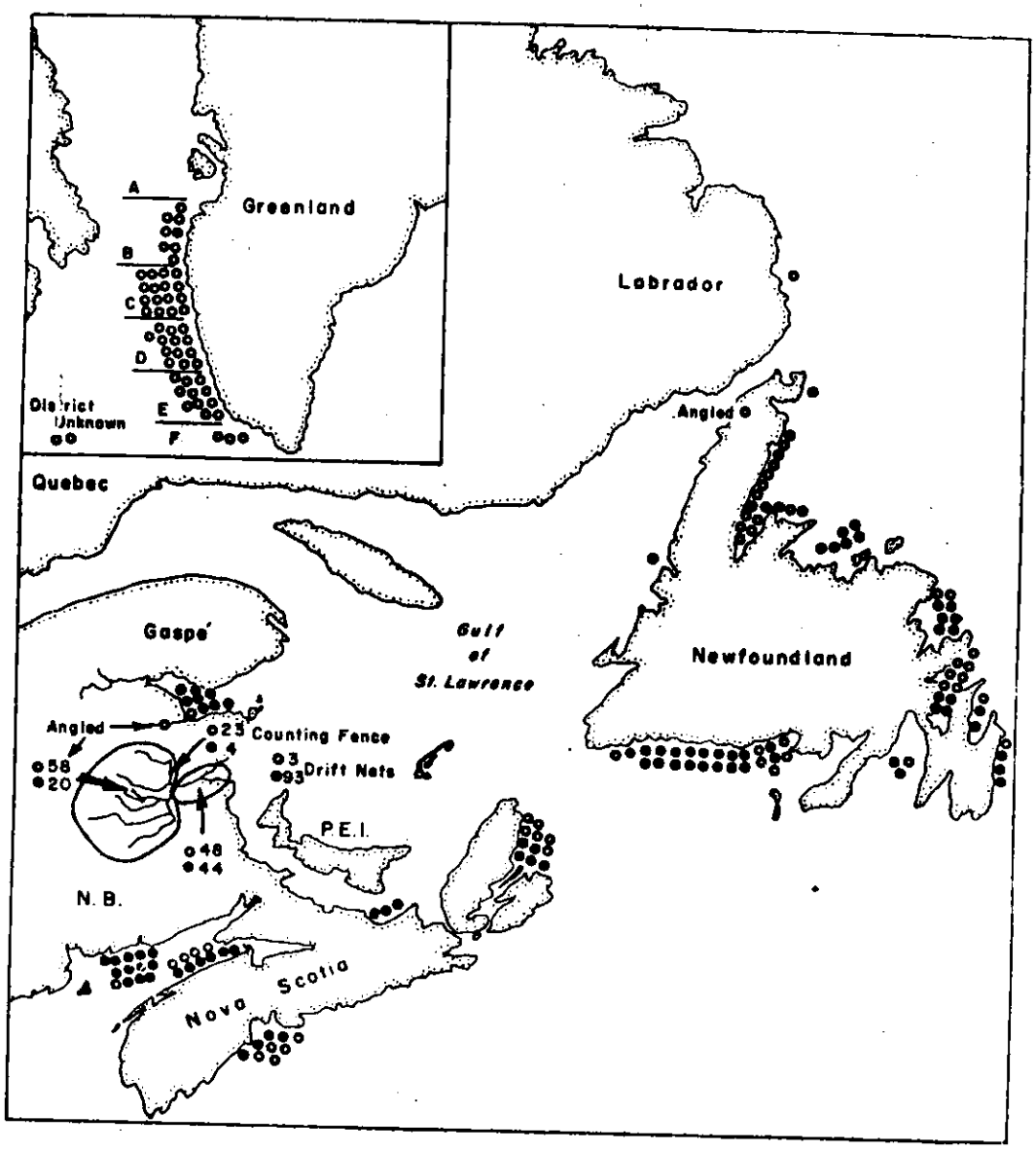

Figure 2. Recaptures from 18,314 Atlantic salmon hatchery-reared smolts of late-run mixed grilse and salmon parentage and 13,802 hatchery-reared smolts of early-run mixed grilse and salmon parentage, liberated in the Northwest Miramichi River, New Brunswick, in late May 1966. Open circles - taken as 1-sea-winter fish (243); solid circles - taken as 2-sea-winter or older fish (241).