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SOME ASPECTS OF CANADIAN ATLANTIC SALMON FISHERIES IN RELATION
TO THE NEW GREENLAND AND HIGH SEAS FISHERIES

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The Fisheries Research Board of Canada has had continuing research programs on Atlantic salmon which involved marking seaward migrating smolts since 1950. About 1960 the marking technique was altered from clipping fins to application of small external tags. In 1961 a tagged smolt from the Miramichi was taken in Greenland - the first record of a Canadian salmon caught there. In the next 3 years 8 more salmon were taken there. This period saw the rapid development of a commercial fishery for salmon along the West Greenland coast.

In 1965 the Board sent a scientist (Dr. R.L. Saunders) to Greenland as a first step in getting acquaintance with the fishery. In 1966, with recognition that the fishery was becoming well established and took fish from both North America and Europe, arrangements were made with the Danish and Greenlandic governments to send another St. Andrews scientist (Mr. J. Pippy) to study parasitology of salmon in the Greenland fishery. Similar studies were carried on in home waters. The objective was to determine, through their parasites, the relative abundance of North American and European salmon in Greenland. These studies were coordinated with similar studies by European scientists.

In 1967 the St. Andrews Station sent another scientist (Dr. P.F. Elson) in a large research vessel (the *A.T. CAMERON*) to explore the feasibility of tagging salmon in

coastal and offshore waters using Pacific coast drift-netting techniques.

In 1968 the program of Greenland-high seas salmon research was transferred to the Board's St. John's Station, under Dr. A.W. May. Each year since the *CAMERON* with one or more scientists has been in the Greenland area during the season of active salmon fishery. Using North Atlantic techniques of drift-net fishing over 500 salmon have been tagged and liberated in the last 3 years. There have now been over a dozen recaptures in home waters of North America and Europe, about evenly divided between each continent.

Studies of comparative parasitology have continued and also indicate that about half (perhaps up to 60%) the salmon in Greenland are of North American (this means largely Canadian) origin, and the balance from Europe.

Biochemical studies, developed at the St. John's Station in the last 3 years, also indicate that about half the salmon in Greenland are of North American origin, and tend to confirm results from parasitology.

Meantime smolt-tagging studies have continued at St. Andrews, and have also been extended to include other agencies in Canada and in Maine.

Records of tag recaptures, like/morphometric and results from aging studies in the Greenland area, indicate that nearly all Canadian fish taken there are post-grilse, i.e., would mostly return as 2-sea-year salmon, or "large" salmon as contrasted to grilse, which are often most abundant in home waters.

Tag returns from the shore-based Greenland fishery are believed to be fairly complete. But it is a fact of life that the high seas fishery has not returned tags proportionate to its catch. At the same time some skippers have frankly admitted reluctance to turn in tags because of possible implications for restricting their fishery. This is to be kept in mind in considering some of the figures which follow.

For tagged wild Northwest Miramichi smolts liberated from 1964 through 1968:

52% of the returns were as grilse in Canada
(18% escapement, 19% angled, 15% commercial)
for fish older than grilse.

10% were taken in the Greenland area.

38% in Canada (2% escapement, 3% angled, 33% commercial).

In another analysis of the same data, but for smolts tagged in 1965 through 1968, and considering only recaptures as large salmon:

24% were taken in the Greenland area.

9% were taken in Newfoundland (1% in Port aux Basques).

27% in the Miramichi drift-net fishery.

25% in the Miramichi set-net fishery.

4% in Maritime and Quebec commercial fisheries more than 50 miles from the Miramichi.

7% were taken in fresh water (mostly angling).

4% were recorded as potential spawning escapement.

The figure for Greenland is minimal because of lack of returns from the drift fishery and should perhaps be almost twice as high as indicated because in recent years the drift fishery has accounted for about half or even more of the landings there.

To understand the full significance of these returns it is necessary to consider the results of tagging experiments dealing with hatchery-reared smolts of selected parentage (fish taken in Greenland are counted as large salmon rather than grilse):

For smolts of virgin 2-sea year parentage (5 lots)

40,838 smolts tagged; 648 returns - 37% as grilse; 63% as salmon

For smolts of 1-sea-year (grilse) parentage (4 lots)

16,588 smolts tagged; 389 returns - 61% as grilse; 39% as salmon

The above data indicate a tendency for age at maturation to be at least partly dependent on the age of parent stocks at maturation. Hence commercial fisheries which select large salmon and permit escape of grilse pose a threat of altering natural grilse-salmon ratios towards increased grilse and fewer salmon. This is the situation for the Greenland salmon fishery and all Canadian drift-net Atlantic salmon fisheries, as well as the New Brunswick inshore salmon fishery.

In some rivers with almost pure grilse populations the sex ratio is about 1:1. But in those with a natural mixed population male grilse are often more abundant than females. In the Miramichi the sex ratio for grilse is about 2 males to 1 female, but Miramichi large salmon are about evenly divided between the sexes, or even have a slight preponderance of females. Fisheries which select for large salmon among such populations are likely to reduce the potential egg-escapement and thus effect spawning potential more than mere counts of escaping fish would indicate.

Such a condition appears to have been developing on the Northwest Miramichi since 1964 or perhaps even 1962. In the last 7 years total runs counted into the river have averaged 2,223 (95%) grilse and 122 (5%) salmon; in the previous 14 years the comparable figures were 2,663 (78%) grilse and 740 (22%) salmon. There is other evidence that Northwest Miramichi spawning escapement was sufficient to utilize the productive capacity of the river in earlier years, but recently falls substantially below that level. A parallel situation has been recognized on other Miramichi streams during at least the last 2 years.

There is reason to believe that some of this change may be the result of environmental degradation in home waters. Forest spraying with poisonous insecticides and mining effluents have damaged some rearing grounds. There is evidence that industrial pollution of large estuaries such as the Miramichi

may slow the riverward migration of adults.

If catch trends in selected Canadian fisheries are examined in relation to the Greenland catch there are hints of an inverse relationship. Studies of parasitology showed that Gulf of St. Lawrence large salmon had a parasite fauna closely resembling that of Greenland salmon, but Bay of Fundy large salmon tended to support a different parasite fauna. Commercial salmon catches in the Maritime portion of the Gulf (Cape Gaspé to Fourchu) show a tendency towards a decreasing trend from 1965 on, while from 1964 on (affecting the same year-classes) the Greenland catch shows an increasing trend and very high catches. Perhaps even more interesting is a comparison between Greenland catches and angling catches of large salmon in the Miramichi for equivalent periods. From 1965 on the angling catch dropped when the Greenland catch was high in the previous year, and rose in years immediately after the Greenland catch dropped. Again, trends of the two fisheries appear to have an inverse relation.

While causes and effects are by no means firmly established, there is firm evidence that Miramichi production of large salmon has diminished in recent years. For most Maritime large salmon there is a span of 6 to 7 years between spawning of the parents and return of progeny. Large salmon production will probably continue at a comparatively low level until some years after remedial measures are recognized and implemented.

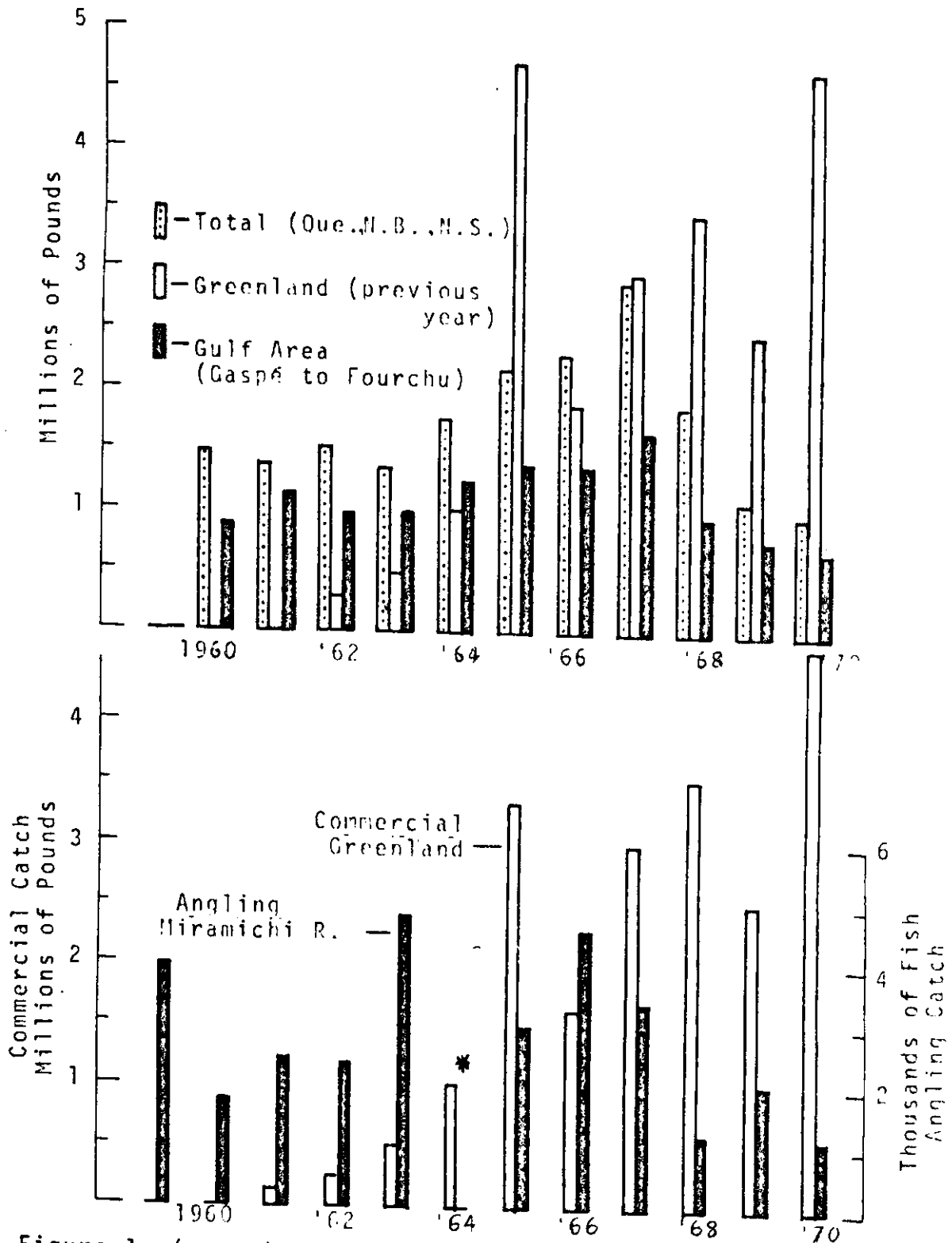


Figure 1. (upper) Comparison between commercial landings of Atlantic salmon in Canada (excluding Newfoundland) and in Greenland the year before. (lower) Comparison between angling catches of Atlantic salmon older than grilse in that part of the Miramichi River system lying in Northumberland County, New Brunswick, and Greenland commercial landings the year before.

*No breakdown into grilse and salmon