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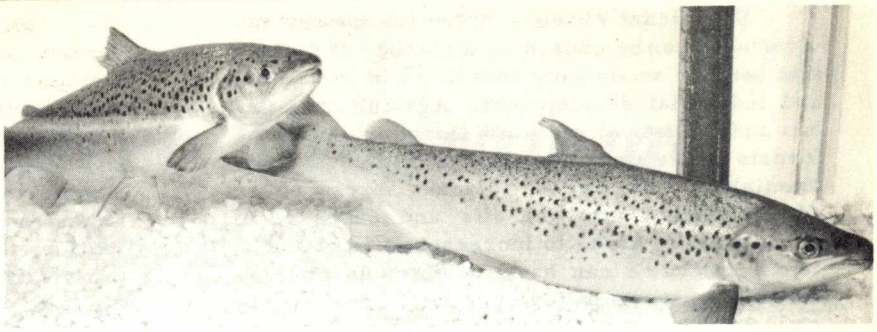
CANADIAN FISHERIES NEWS

COVER PHOTOGRAPH: Adult salmon counting fence on Little Rattling Brook, Norris Arm, Newfoundland. See articles pp. 3-18.

1956

INVESTIGATION and MANAGEMENT of



THE ATLANTIC SALMON

SINCE 1949, Canada's research and management programme for the betterment of the country's Atlantic salmon resources has been carried out under the direction of the federal-provincial Co-ordinating Committee on Atlantic Salmon. The articles on the following pages review the present situation and the progress made in the investigational and management activities during 1956.

The first article, beginning on this page, is a statement made by Dr. J.L. Kask, Chairman of the Fisheries Research Board of Canada, at a meeting in Ottawa on February 5, 1957, of the members of the Co-ordinating Committee and their advisers.

The two succeeding articles constitute the report of the Scientific Sub-committee on the progress made during 1956. That starting on page 5 deals with the research programme and is by Dr. C.J. Kerswill of the Research Board's Biological Station at St. Andrews, N.B. The second half of the report, starting on page 15, is by Dr. W.M. Sprules, Special Assistant to the Deputy Minister of Fisheries of Canada, Ottawa.

The Changing Environment

By J.L.KASK

Atlantic Salmon ("Salmo salar") spawn in rivers occurring in restricted latitudes of Western Europe and North America. On the North American side the original distribution extended from southern New England to mid-Labrador. With increase in population and industrialization the southern extremity of distribution has been progressively pushed northward. Salmon still occur in fluctuating numbers in some 300 streams and rivers of Canada's Atlantic Provinces. It is estimated however that more than 75 per cent of remaining salmon run to about six principal river systems of New Brunswick and Newfoundland.

Salmon have a complicated life history and they are very delicately adjusted to their varied environmental requirements. Their survival depends on the availability of a number of demanding conditions in the salt water of the sea, the brackish water of estuaries and in the clear, cold, fresh water of certain streams. Of these environments the streams are the most easily vulnerable.

Adult salmon lay their eggs, and their young are born and reared, in restricted areas of some streams. If conditions in the rivers of their birth are substantially changed, or even slightly changed for some characteristics, they cannot survive for long.

Because salmon come from their ocean feeding grounds, at appropriate seasons, to their chosen streams to spawn, they can be seriously reduced in numbers by unrestricted fishing. It is doubtful, however, that they can be exterminated entirely by fishing so long as even a very few escape to spawn. But by changing their fresh water environment so that they cannot survive or make a living, the population of a whole river system can be completely wiped out.

Most of the rivers in North America that formerly supported salmon runs and no longer do, have lost their runs more from adverse changes in the very restricted and demanding freshwater environment in which they are born

and spend the first half of their life, than from overfishing.

Significant changes in the freshwater environment can be caused by a number of factors that usually accompany increases in population and industrial development. Agricultural, urban and industrial pollution (including spraying forests and waters with DDT) contribute substantially. Removal of adjacent forest cover with attendant fast run-offs and exposure of critical river areas to increases in light and in temperature can have deleterious effects. Multiple water uses for irrigation, power, navigation, etc., and physical interference with the river itself such as often accompanies logging, mining or roadbuilding all can, and do, affect the river as an environment for living organisms.

Just when an effect or a combination of effects becomes a limiting factor to salmon survival and growth is often difficult to determine. These effects can be the more dangerous as they frequently creep up slowly and defy positive detection.

PRICE OF DEVELOPMENT

No responsible person can deny that Canadian salmon rivers have undergone, and are undergoing, serious changes of the kind just reviewed. As Canada develops some of the prices of development will have to be paid, as has been the case in other areas. We should, however, be able to learn some things from previous mistakes, so that the price we have to pay may be kept to a minimum.

It is my view that the eventual loss of the Atlantic Salmon from its principal streams does not have to be included in this price, but some sizable sacrifices will have to be made if we are to keep our salmon rivers worthy of the salmon.

What more can be done, then, in addition to the excellent work already being carried out by the federal and provincial Governments in research and regulation, and by the untiring efforts of the various salmon and natural history associations that are vitally interested in the continuance and the increase of this remarkable resource?

The simple answer, it appears to me, is that we must keep our salmon rivers in such a state that salmon will continue to be attracted to come back to them from the sea to lay their eggs, and that their young can make a pleasant living in the streams during the years they are preparing for their trip to sea and ultimate return. Of course provision must be made, too, to allow the best number and best quality of salmon to escape the fishery (both rods and nets) to provide an adequate spawning stock.

Much good effort is already being expended on the latter requirement. Research workers are defining the races of salmon, are determining the productivity of waters and the best numbers of salmon to utilize the productive capacity. Regulatory officers determine fishing seasons and see that adequate numbers reach the spawning grounds. It is to the first matter, that of guarding the salmon's all important freshwater environment, that small importance is being attached, and where much can and should be done.

If 75 per cent of Canada's present salmon stocks spawn in the waters of a half-dozen principal river systems, then these most important rivers must be attended to first. The rivers themselves and the land for an appropriate distance from the river must be declared a forest and wildlife refuge, the inviolability of which must be carefully guarded. The amount and effect of all pollutants which are constantly being poured into rivers in ever-increasing amounts, must be carefully measured and controlled and their ill effects neutralized. Forest spraying in the area of streams must be carefully controlled and more specifically carried out even if extra costs are considerable, or else less damaging sprays must be quickly developed. The activities of man must be carefully supervised not only in his fishing, hunting and firebuilding, but in the disposal of wastes, building of barriers and river manipulation as well.

Nothing less than this will prove adequate to save the salmon.

Although the above few recommendations appear simple and acceptable, they will require some doing to be effective. Rivers are put to so many uses and competition for their use is ever increasing. If we want to preserve the rivers for salmon as well as to put their waters to other uses, then each new use will have to be examined and modified if necessary to suit the salmon's requirements. This, with the setting aside of "sanctuary" streams, is a big job, much more than can be done by the federal Government alone or even in co-operation with provincial and other governments. It is a job that will require the burning desire and the continuous effort of all interested people. And it has a high priority. Increases in the number of patrol officers, further restrictions on fishermen, increased hatchery services or even increased researches into life history and habits will be of little avail if the salmon's freshwater environment is allowed to deteriorate and become progressively less conducive to survival.

Investigation & Management of Atlantic Salmon in 1956

Part 1 - -

The Research Programme

By C.J. KERSWILL

THE OBJECT of the research programme is to get facts that will allow the Atlantic salmon fisheries to be managed to give the best possible catches for everyone concerned. Such management may be by regulations controlling the catch of the fish and by various fish culture and development practices. In planning and carrying out such a research programme on Atlantic salmon many complicating factors must be taken into account. Some of these are: (1) The great popularity of the fish among both commercial fishermen and anglers so that adequate supplies are needed by many groups of people over a wide area; (2) the salmon's complicated life history involving part time in fresh water and part in the ocean; (3) the natural variations in living conditions for the fish in different parts of the coastal region; (4) the changes in these environmental conditions in the rivers, which are constantly being made by man.

Our present research programme was organized in 1950 and revised slightly in 1954. Plans were finalized only after a careful review of the information already obtained by scientists in Canada and other countries, including the British Isles and other parts of Europe, where the same species of salmon occurs. The programme is always subject to revision as new problems develop, as some projects are completed, or as techniques are developed to allow new kinds of study to be started. At present it includes the following projects: (1) to collect and analyse statistics on commercial landings and angling catches; (2) to learn the size of spawning runs and the success of the resulting spawnings at all stages of the salmon from egg to smolt; (3) to learn how many salmon are contributed to the various fisheries by typical rivers; (4) to develop effective ways of increasing smolt production through the use of hatchery stock; (5) to learn the value of controlling predatory birds in improving smolt production; (6) to learn the extent of damage to salmon by aerial spraying of DDT and ways of overcoming these harmful effects.

In 1956 these projects were carried forward by the Fisheries Research Board of Canada mainly on the Pollett and Miramichi Rivers in New Brunswick and the Little Codroy River in Newfoundland, and by the province of Quebec on the Port Daniel River in the Gaspe peninsula. The federal Department of Fisheries was responsible for the actual removal of mergansers in experimental bird control operations on the Miramichi River, N.B., and the St. Mary's River, N.S. Valuable assistance was provided also by the provinces of Nova Scotia and New Brunswick. The success of many phases of the programme, for example, the reporting of marked and tagged salmon, resulted from excellent cooperation of fishery officers and the public.

The following review discusses briefly the highlights of some of the research projects on which interesting information was obtained in 1956.

STATISTICS

There are records of salmon catches by commercial fishermen in various areas of the Atlantic provinces (not including Newfoundland) for the past 80 years. The total landings show many ups and downs with several peak years when production exceeded 3,500,000 pounds and several examples of low production, falling below 2,000,000 pounds. For Newfoundland the commercial landings, indicated by salmon export figures for the past 40 years, show similar fluctuations in the total annual catch from 3,000,000 pounds to over 6,000,000 pounds. The most recent peak year of production was 1930, when over 13,000,000 pounds were landed by commercial fishermen on the whole Atlantic coast. Since then there has been a gradual decline in catches by commercial nets and this has been mainly responsible for the recent widespread concern over the Atlantic salmon stocks.

Reliable statistics on salmon catches in eastern Canada by anglers are not available for such a long period. The information which is available fails to show that fewer fish are being angled nowadays than many years ago. There is good reason to believe that even more salmon are angled now because the sport has gained popularity. A natural outcome is that the experienced individual angler cannot expect to catch as many fish per day or week as in earlier times.

Starting in 1954 we have shown in this annual review graphs of the commercial and angling catches since 1949 for the Maritime region. In figures 1 and 2 these are brought up to date by the addition of the 1956 statistics. The extent of the three areas into which the Maritime region is divided has been described in previous reports. Also

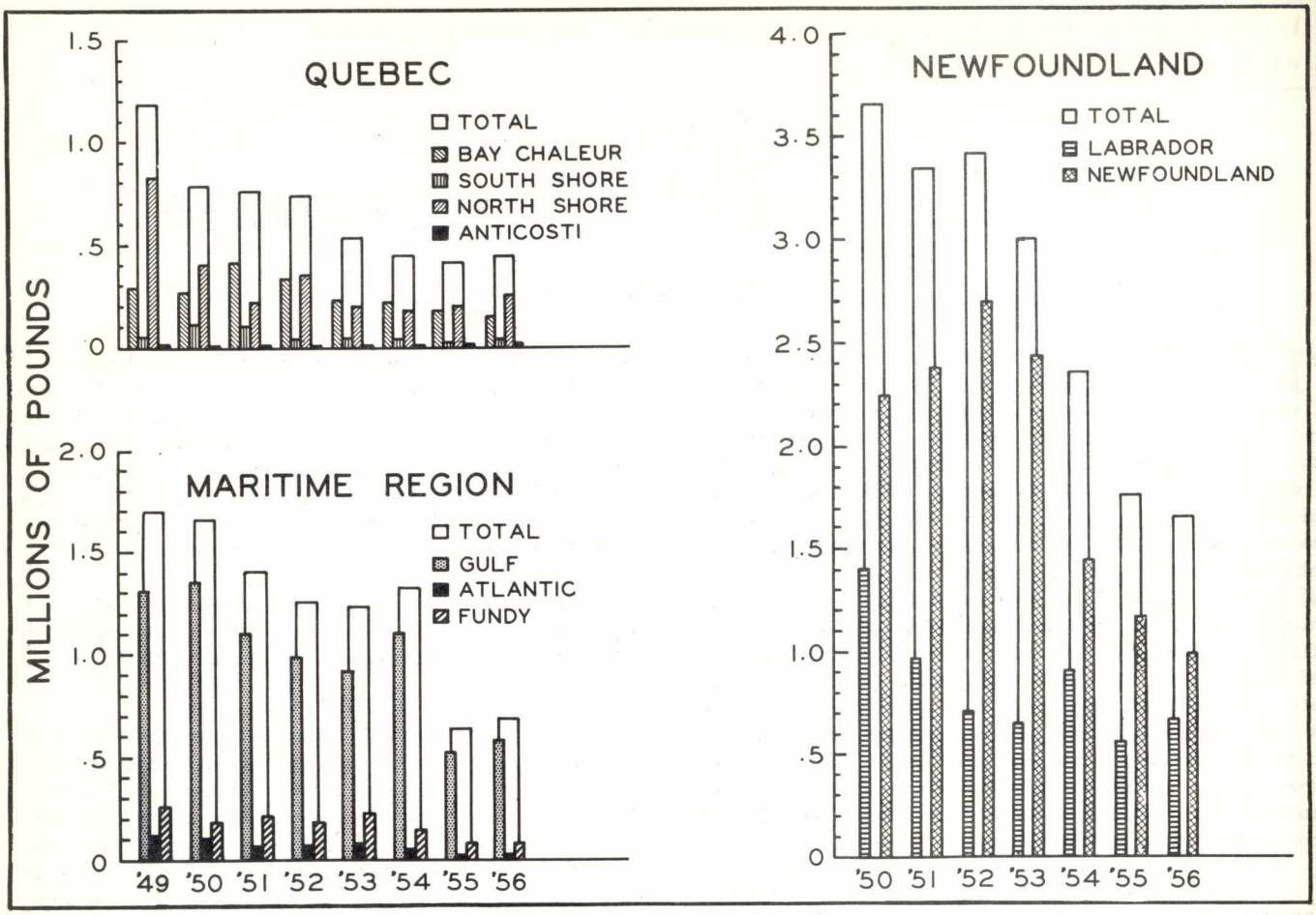


Figure 1. Commercial landings of Atlantic salmon in Canada.

included in figure 1 are commercial landings in the provinces of Quebec and Newfoundland. The Quebec landings are from the published reports of the province of Quebec; all the other statistics were provided by the federal Department of Fisheries.

Commercial Landings

Commercial fishing for Atlantic salmon is allowed only in salt water, where it is carried on by offshore floating drift nets in a few places, fixed trap nets along the shores of bays and estuaries, and set gill nets. As shown in figure 1, the total catch by nets operated in waters bordering Quebec and the Maritime provinces was about 15 per cent higher in 1956 than in 1955. These increases resulted from larger catches on the north shore of the St. Lawrence River in Quebec, and in the Gulf area of the Maritime region. The landings in the Gulf area were made mostly by fisheries in the Miramichi River and vicinity.

Total Newfoundland landings were slightly lower in 1956 than in 1955, according to the preliminary 1956 statistics. It is of interest that landings on the Labrador coast were considerably higher than in 1955.

It is encouraging to note that everywhere, with the possible exception of Newfoundland, the downward trend of recent years has halted. Still, total landings for the whole Canadian Atlantic coast were just over $2\frac{1}{2}$ million pounds in 1956, or about half the average level of the past 25 years. In 1956 retail prices were quite high at over one dollar per pound at many centres in eastern Canada. Landed values were around 50 cents per pound and sometimes higher, which partly compensated for the relatively low level of production.

Angling Catches

Salmon angling was again a very popular recreation on the freshwater sections of a great many rivers. On most rivers the 1956 season was good by comparison with recent years, as indicated by figure 2, which shows total catches in the Maritime region and on some of the individual rivers in it since 1949. These statistics are for salmon of all sizes including grilse and kelts or black salmon which can be taken in early spring in New Brunswick under special permit. Most of the kelts are taken in the Miramichi River, N. B., and the proportion of the catch which they represent as well as the proportion of the total Miramichi catch which are grilse are discussed below.

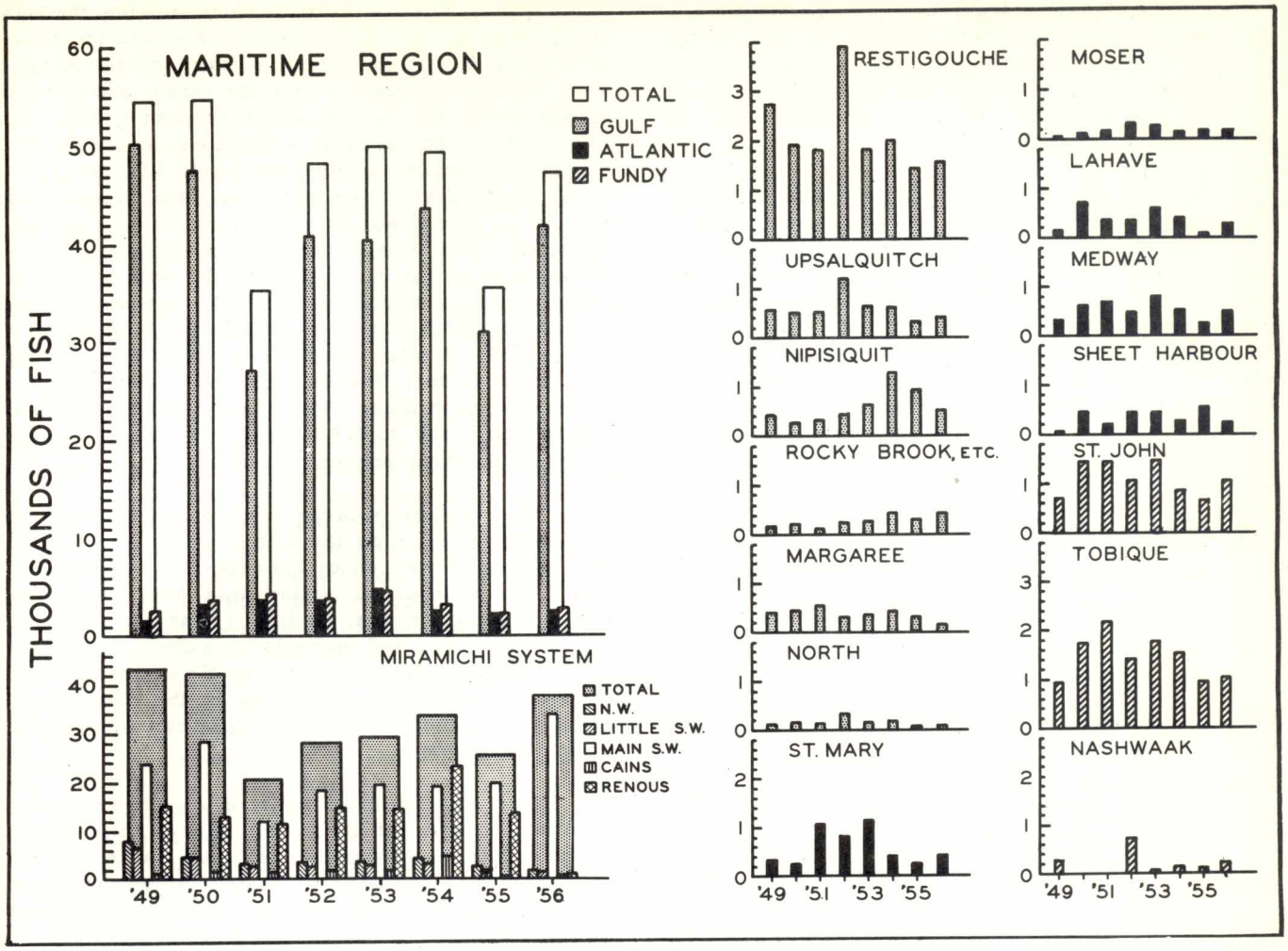


Figure 2. Angling catches of Atlantic salmon in the Maritime Region of Canada.

The outstanding feature of the 1956 sport fishing season in the Maritime region was a phenomenal abundance of both grilse and large salmon in the Main Southwest Miramichi River, N. B., during September. In this final month of the angling season 4,900 grilse and 10,400 large salmon with a weight of 56 tons were caught in this one tributary. This large catch was responsible for the increase in the total Miramichi River catch to almost 38,000 fish, 30 per cent higher than in 1955 and the highest recorded since 1950. Of these 38,000 fish, 7,600 or 20 per cent were kelts taken during the regular spring season which ends on May 24. Only 51 per cent of all the bright salmon angled between June 5 and September 30 were grilse, the balance being large salmon of which most were 2-sea-year fish.

In recent years anglers have often expressed concern about the supply of early-run salmon, fearing that they were almost extinct in the Miramichi River. Yet in June and July, 1956, Miramichi anglers caught over 1,000 large salmon and over 4,000 grilse; in August over 1,300 large salmon and over 4,200 grilse were caught. So the total catch of salmon which may be classified as "early-run" exceeded 10,000 fish on the Miramichi in 1956.

In most of the other rivers of the Maritime provinces more salmon were caught by angling than in 1955, but the catches were somewhat below the average level of the past eight years except on the St. John River system and Rocky Brook in New Brunswick and the Medway River in Nova Scotia. The total catch of 47,312 fish in 1956 resulted from an effort of 154,924 rod-days by the anglers as compared to an effort of 147,447 rod-days which produced the 35,988 fish caught in 1955.

In Newfoundland over 17,000 salmon were angled in 1956 according to preliminary report, as compared to about 15,000 in 1955. Visiting sportsmen are reported to have been pleased with angling conditions there in 1956. It is expected that interest in angling will increase greatly in Newfoundland as transportation facilities improve, making more rivers accessible.

MIRAMICHI SALMON RUNS IN 1956

In these annual reviews the runs of salmon into the Miramichi River are given special attention because it is the only river in eastern Canada having large commercial and sport fisheries for sal-

mon, where sampling traps and counting fences are operated by research staff through the open water season. Information obtained here is a useful guide for solving salmon management problems on other streams where special research studies cannot be undertaken at present.

In 1956 an unusually large number of grilse and large salmon entered the Miramichi River. This was shown by our commercial type sampling trap which is now operated from spring to fall every year in the estuary just below Chatham. This trap net resembles the regular gear used by local commercial fishermen except for the size of the mesh which is $3\frac{1}{2}$ inches extension measure instead of five inches, so that grilse can be retained. All captured fish are released after being counted and examined for marks or tags. The following table shows the total number of fish caught by this trap in the past three years, as well as the number taken during the regular commercial season.

	Large Salmon	
	Total	During Commercial Season (June 5-Aug. 31)
1954	2,080	333
1955	2,787	72
1956	3,360	234
	Grilse	
	Total	During Commercial Season (June 5-Aug. 31)
1954	1,832	905
1955	1,790	668
1956	3,534	1,143

As in previous years only a small number of large salmon was caught during the commercial trap net season but a great increase occurred after the season closed. In 1956 this fall run was the largest since the trap has been operating. On September 20 the highest count was made -- 268 large salmon. This was higher than the total catch during the whole commercial season. The movement of grilse through the estuary was more evenly distributed so that fair numbers occurred throughout the regular commercial season, but these could not be taken by the regular trap nets.

The movement of salmon through the trap net fishing area into fresh water seems to depend partly on water temperatures in the estuary. The summer of 1955 was hot and dry and few fish were caught in the sampling trap for several weeks in July and August when water temperatures were consistently over 68°F. In 1954 and 1956 summer water temperatures in the estuary were lower and large salmon and grilse were taken throughout the summer.

Although more salmon were moving through the estuary in 1956 than in previous years the numbers recorded at the counting fence on the Northwest Miramichi River about six miles above head of tide were the lowest since recording began in 1950. Small runs of large salmon and grilse passed through the fence in June and early July and again in October, but during most of July, August and September almost no upstream movement occurred. This may have been caused by low water and a lack of freshets in the river during the summer. Another explanation may be the DDT spraying of the forests in the region of the Northwest Miramichi in June, 1954. A total of only 775 grilse was counted as compared to 2,756 in 1955 and counts of over 2,100 each year since 1950. Large salmon totalled 587 as compared to 778 in 1955 and counts of over 1,000 in the three preceding years.

The number of large salmon passing through the counting fence on the Dungarvon River in 1956 was 305 which was about average for the past few years; the number of grilse was 404, which was slightly below average. A light grilse run occurred in June and July, and many large salmon and grilse passed through the fence in late September and October. Low water conditions in the river were likely responsible for little upstream movement during the summer.

This was the final year of operation of a counting fence on the Dungarvon River. At the close of the season in November, 1956, all the Dungarvon equipment was transferred to the vicinity of Camp Adams on the upper Northwest Miramichi. A fence will be installed here in 1957 to provide a second checking point for ascending fish about 30 miles above the lower fence which has been operated since 1950.

Unusually large numbers of sea lice were observed on salmon entering the Miramichi estuary in 1956. Grilse seemed to be more heavily infested than large salmon. In many cases lice were so numerous on the head and gill covers of the fish that the skin in affected areas became loosened. When the lice fell off in fresh water large patches of the weakened skin also fell off exposing the underlying flesh. Infestation reached a peak in August when many anglers complained of catching salmon with large raw sores on the head. Although this parasite is common on Atlantic salmon it seldom occurs in such large numbers in our waters. A similar heavy infestation occurred, however, in the Moser River, N.S., in 1939.

SMOLT-MARKING EXPERIMENTS ON FIVE SALMON RIVERS

Since the development of an expanded research programme for Atlantic salmon under the Federal-Provincial Co-ordinating Committee which was formed in 1949, the marking of smolts by fin-clipping has been undertaken at four new counting

fences in addition to the Pollett River, N.B., fence where all smolts produced in experiments since 1942 have been marked. These new operations started on two tributaries of the Miramichi River system in 1950, on the Port Daniel River on the Gaspe coast of Quebec in 1953, and on the Little Codroy River in southwestern Newfoundland in 1954. The Port Daniel programme is operated by the Quebec Government and all the others by the Fisheries Research Board. The work in the Maritime provinces is part of the programme of the St. Andrews, N.B., Station; the Little Codroy project is operated by staff of the St. John's Newfoundland Station.

The object of the experiments is to learn the annual production of smolts by a series of typical salmon streams, and to estimate their contribution to the various commercial and sport fisheries over the whole Atlantic coast and to the spawning escapement. To do this large numbers of descending smolts are trapped each year on all the streams, marked by fin-clipping with the same fins removed every year on a particular stream, and released. As many as possible commercially caught and angled salmon are examined for marks in the various fishing areas each season, and records are made of numbers of marked and unmarked fish. Scale samples are required for all marked fish, to permit classification into years of smolt run. Scale samples are obtained also from large representative samples of unmarked salmon in various fishing areas so that the relative strengths of various age-classes in the catches can be estimated. Records of marked and unmarked fish are kept throughout the season at up-traps maintained in the various counting fences and in other research sampling traps, such as in the Miramichi estuary.

The table at the foot of this page gives the number of smolts marked and released each year on the five streams.

To date the recoveries of marked adults reported to the St. Andrews Station by special observers and fishery officers from catches by commercial fishermen and anglers total 2,640. About 290,000 of the smolts marked so far will have reached catchable size as grilse or large salmon. So the returns indicate that at least 0.9 per cent of the marked smolts have survived to be taken by the fisheries. This is a minimum estimate of the actual utilization of smolt production by the fisheries because of the possibility of considerable marking mortality and because all the catches are not examined completely for marks. When allowance is made for incomplete checking of catches, based particularly on data for the Newfoundland area, at least 2 per cent of the total smolt production appears to be taken ultimately by the fisheries.

The following picture of salmon movements and utilization is coming from these experiments. Adult salmon are usually taken in fresh water by anglers only in the rivers from which they came as smolts. But many may be caught by commercial nets in the sea far from their rivers of origin. For example, smolts leaving the Miramichi River in June of one year, say 1956, may stay in the sea for two years and thus survive to be 8- to 12-pound salmon by June 1958. While swimming along the shores of Newfoundland, perhaps on their way back to New Brunswick, some may be caught in the commercial nets. Others will return to the New Brunswick coast and wander into other estuaries than the Miramichi, for example, into Bay Chaleur, and be caught there in commercial trap nets. Many will eventually enter the Miramichi estuary and although some will be taken there by commercial gear many will reach fresh water. Some of these will be caught by anglers and those escaping will provide the spawning stock of the Miramichi.

Information of this kind, supported by estimates of the percentages of fish which may be expected to be used in various ways, is needed as a background for setting up the most effective regulations for the salmon fisheries. The object of such regulations is to assure that (1) there is a sufficient supply of adult fish in each river for spawning, to give the most suitable smolt production in two or three years' time; (2) the best use is made of the

	Number of Smolts Marked and Released						
Site	1950	1951	1952	1953	1954	1955	1956
N.W. Miramichi R., N.B.	7,969	33,407	848	25,218	25,660	25,735	13,057
Dungarvon R., N.B.	253	14,966	461	19,966	20,254	12,733	9,130
Pollett R., N.B.	13,190	25,187	26,297	3,639	23,751	8,052	4,897
Port Daniel R., Que.	-	-	-	4,063	1,847	923	2,379
Little Codroy R., Nfld.	-	-	-	-	12,210	11,136	14,400
Total	21,412	73,560	37,606	52,886	83,722	58,579	43,863

salmon not needed for spawning, by permitting their capture by commercial fishermen and anglers.

PRODUCTION OF YOUNG SALMON

The studies discussed above have dealt principally with salmon at the adult stage when they are useful either for capture by various fisheries or for spawning in the rivers. Now some of the results of investigations of the salmon's early life history in fresh water will be outlined. These studies are being undertaken to provide a sound basis for future management techniques. Such management must always be aimed at assuring that the best quantity of smolts is produced each year by all salmon rivers, either by natural reproduction or artificial propagation or a combination of both.

Change to Smolts Depends on Parr Length

One of the puzzles of salmon production has been why in some streams the young change to smolts and migrate to sea at two years of age, while in others they may wait until they are three or four years old or more. Older smolts were known to come usually from colder streams, where growth is slower. But information on the amount of growth required before the transformation would take place, was lacking. Research during the past year shows that in several areas in Canada as in Europe, about 95 per cent of the smolts had one feature in common. All reached a length of about four inches (10 cm.) some time during the year before they became smolts. If they reached it early and grew fast, they became big smolts; if they reached it late and grew slowly, they made little smolts. If they did not reach a 4-inch length before fall they stayed in fresh water for an additional year or more. Such information helps explain why production in some streams may take longer than in others. But it can also assist the fish-culturist in planning how to get the best smolt production from particular streams through controlled plantings of available hatchery stock.

Year-to-year Variation in Smolt Production

At first thought it seems obvious that the way to get more salmon for use is to have more young salmon, or more salmon eggs, placed in our streams. But the situation is not quite so simple. It should be no mystery that a salmon stream is much like a farm in that it can support just so much stock.

The amount may vary, of course, because of favourable or unfavourable years. For example, the Pollett received ample stocking of young in five different years. The average production over the five subsequent years was about 20,000 smolts. But one year it fell as low as 14,000, and another year rose as high as 25,000. So far this is our best clue to the amount of normal variation to expect in smolt production. Note that the extreme high value (25,000) comes close to being double the extreme low value (14,000).

Rearing Capacity of Streams

As indicated in the 1955 report, the maximum rate of production for the Pollett was five to six smolts per 100 square yards of stream bottom. This is an average value for the streams as a whole, not a precise number which might be expected to occur in any particular spot. Physically, the Pollett is a relatively good stream for young salmon. So the number given can be thought of as a satisfactory yardstick for many salmon streams. Not many Canadian streams can give better production than this; in cold or infertile streams it will not be as good. Among the streams where salmon research is being or has been done, the Miramichi in New Brunswick, Little Codroy in Newfoundland and probably the Lahave and Margaree in Nova Scotia appear to fit the same category as the Pollett. The Port Daniel, in Quebec, is apparently much less productive, probably being able to produce only about half as many smolts per average area.

Strict American Merganser Control Needed

Even with the best management man can yet apply, there is bound to be loss from the time that salmon eggs are deposited in the river gravel until the smolts migrate to sea. Fortunately some of this loss can be avoided. In order to get five or six smolts per unit area from the Pollett it was necessary to have about 10 large parr for each similar area in the preceding summer. It was only possible to get this number of large parr when strict control of mergansers was applied throughout the year. In the Maritimes, these fish ducks are one of the worst enemies of young salmon over three inches long. Such control has now been applied to the Pollett for nine consecutive years. At first glance the records make it appear that the birds have recently been getting scarcer, perhaps because control removed the breeding stocks. But this has not actually happened. Analysis of the data (Figure 3) show that in reality the birds have been scarcer only in years when parr were scarcer. Hence we must conclude that on a small area, like the Pollett drainage basin, control does not noticeably affect the general stock of birds, but must be carried on year after year at about the same intensity.

Up to the present merganser control in the Miramichi area seems to have helped parr populations. On the Northwest Miramichi, with thorough control, eight to 10 large parr per 100 square yards were obtained in the years 1951-53. Thereafter parr were reduced as a result of DDT spraying as shown in Figure 4. The Dungarvon and Renous failed to show high parr populations after general bird control was started in 1954. This, too, seems largely to be the effects of spraying on these streams. Control undoubtedly saved from mergansers many of the parr which did survive spraying.

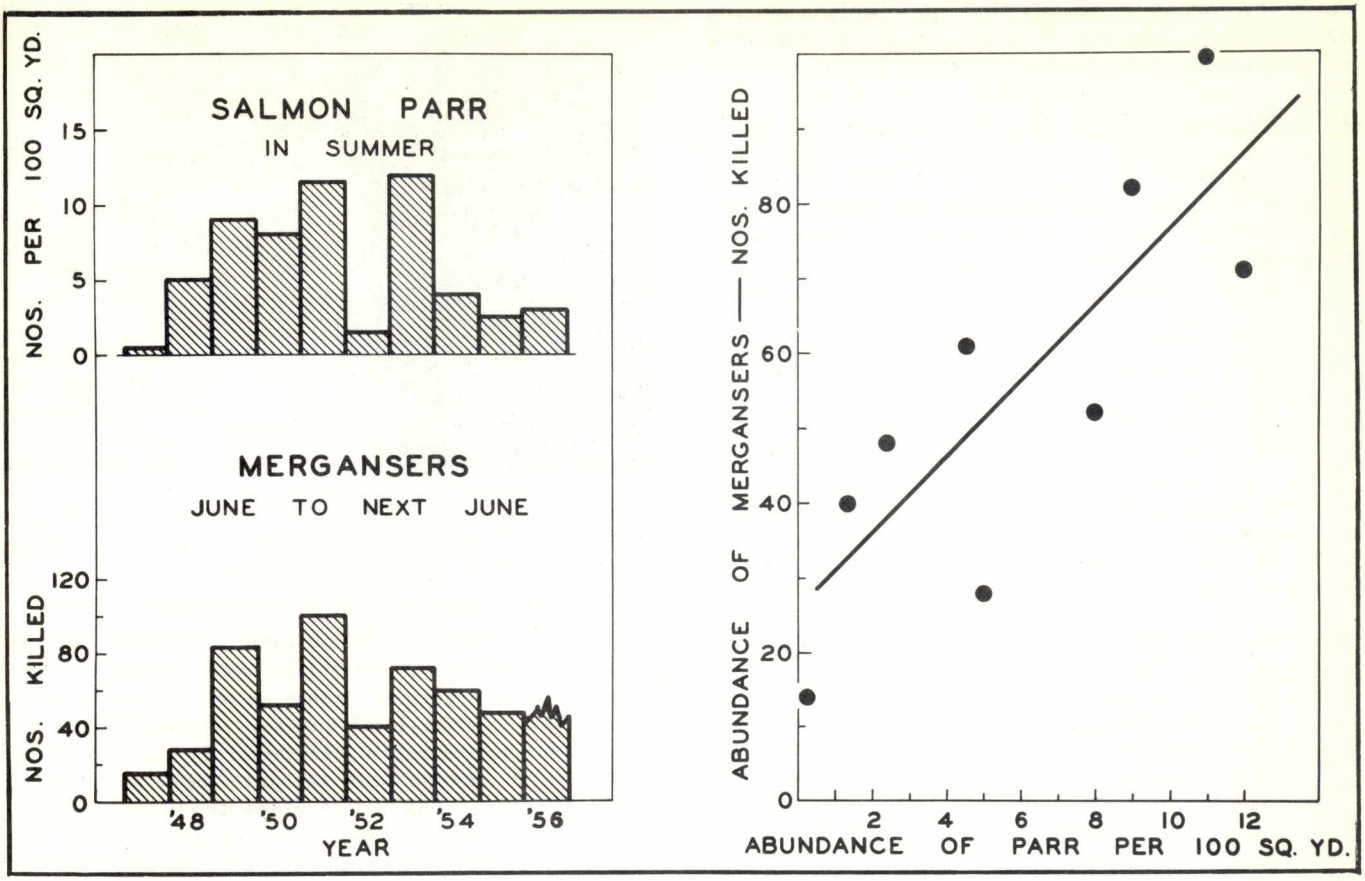


Figure 3. The relationship between abundance of mergansers (as indicated by number killed in bird control experiment) and salmon parr (from seining operations); showing Pollett River data in two different ways.

On the Cains, with no spraying, parr have increased to about five per unit area. Control on this stream has not yet been as thorough as on the Northwest Miramichi or the Pollett Rivers. A detailed analysis of the Pollett results indicates that control must be quite thorough to give the kind of result indicated earlier. Whether useful results can be obtained with a more economical level of operations is one subject of the Miramichi investigations.

Good Stocking From Hatchery Plantings

In general, our studies have indicated that where streams are reasonably fertile and mergansers are scarce, about 35 hatchery fingerlings per 100 square yards are needed for streams giving mostly 2-year smolts, and about 60 for streams giving mostly 3-year smolts. But if the streams are in barren country or if many mergansers have free use of the water, fewer smolts will be forthcoming. In such cases there would be no advantage in planting more than 10 and 15 fingerlings per 100 square yards respectively. Additional fish would be wasted because either they would starve to death, or mergansers would eat them, before they became smolts. Whether these same basic rates should be used for reinforcing inadequate native populations with hatchery stock is being investigated on the Pollett now. Preliminary results indicate that such planting rates may properly be used.

Good Stocking From Natural Spawning

How many mature salmon, or salmon eggs, are needed to get the best production of smolts? In the Pollett River there have now been four years of natural spawning -- natural except that the number of adults has been manipulated to give various spawning intensities, from very light to fairly heavy. In the course of the next three years all these spawnings will have been followed through to the smolt stage. So far, the survival rate from eggs to fry has been about six per cent from light spawnings. Light spawnings mean no undue waste and hence the highest value to be counted on with safety. Survival rates from fry to parr have been high -- around 80 per cent. It is possible to make a tentative calculation that to get maximum smolt production, eggs should be brought into the stream at a rate of about 200 per 100 square yards. With similar survival rates, streams producing 3-year smolts could use about 250 eggs per 100 square yards, but need less than this if mergansers are going to remove a large proportion of the parr, anyway, before they become smolts. Note that these numbers for eggs have been based on fish entering

the river but still subject to regular inland fishing effort. They are higher than the actual numbers required to be deposited in spawning redds.

Present Status of Miramichi Stocks of Young Salmon

The table at the foot of this page shows the general abundance of Miramichi young salmon observed under four different sets of conditions which have existed here since 1949. All figures are average rates per 100 square yards of stream.

One fact stands out. Judging by egg and fry requirements suggested by the foregoing section the river system seems to have received about as much natural stocking as it could convert to smolts under favourable conditions. Under unfavourable conditions, such as heavy merganser predation, or extensive spraying of DDT, a considerable increase in natural stocking should not be expected to add many smolts. It would simply result in still greater waste of fish.

Whether the heavy population of young fish in the first year after spraying will counterbalance some of the harmful effects of spraying remains to be seen. The numbers look promising; but as will be discussed below the fish are actually in very poor physical condition as the result of a second spraying in 1956, and may not survive to become smolts.

At the present time it looks as though carefully planned stocking of hatchery-reared fry and parr might be the best way to assure a good smolt run where stream drainage basins must be sprayed with DDT to preserve the forests.

Young Salmon in Ellerslie Brook, P.E.I.

On Prince Edward Island a counting fence was installed 10 years ago at the mouth of Ellerslie Brook, a small $4\frac{1}{2}$ mile long tributary to Malpeque Bay, for the trout investigations of the Fisheries Research Board. The populations of all species of fish in the brook are studied each year by seining with electrofishing. Interesting information has been obtained on Atlantic salmon because a few adults have usually entered the brook in November. These have spawned successfully and produced good numbers of young in the 2,000 yards of stream length available to them.

Seining with electrofishing to estimate populations of young salmon at one sampling station on Northwest Miramichi River, September, 1956.

From 1947 to 1954 a total of 100 salmon entered the brook, but since 1955 none can ascend because of a dam built to create an experimental trout pond. In 1956 the total number of salmon parr in the 2,000-yard stretch was found by electrofishing to be 2,654, and besides the parr there were 3,053 fingerling trout and 3,923 older trout in the same section. This means that the parr averaged 44 per 100 square yards of available stream area so the population level of young salmon was considerably higher than has been found in New Brunswick study streams.

In other years the total numbers of salmon fry in the available area twice exceeded 4,000 per year, and the total number of salmon parr has often exceeded 1,000 per year. Over a five-year period the number of smolts moving through the counting fence into the estuary varied from 215 to 653 per year and averaged 400.

The relatively high production of young salmon as well as trout by this small area of brook is associated with the high fertility of Prince Edward Island streams.

Unfortunately adult salmon enter all Prince Edward Island streams so late in the fall that they cannot be utilized by fisheries. The young salmon

Conditions	Eggs estimated brought into river	Resulting fish		
		Fry	Small parr	Large parr
Natural	250	22	12	4
With control of mergansers	250	21	17	8
Merganser control and DDT spraying	180	5	4	3
One year after spraying	150	42	18	to be measured in 1957

leaving as smolts likely contribute significantly to fisheries outside the province.

EFFECTS OF DDT SPRAYING ON MIRAMICHI SALMON

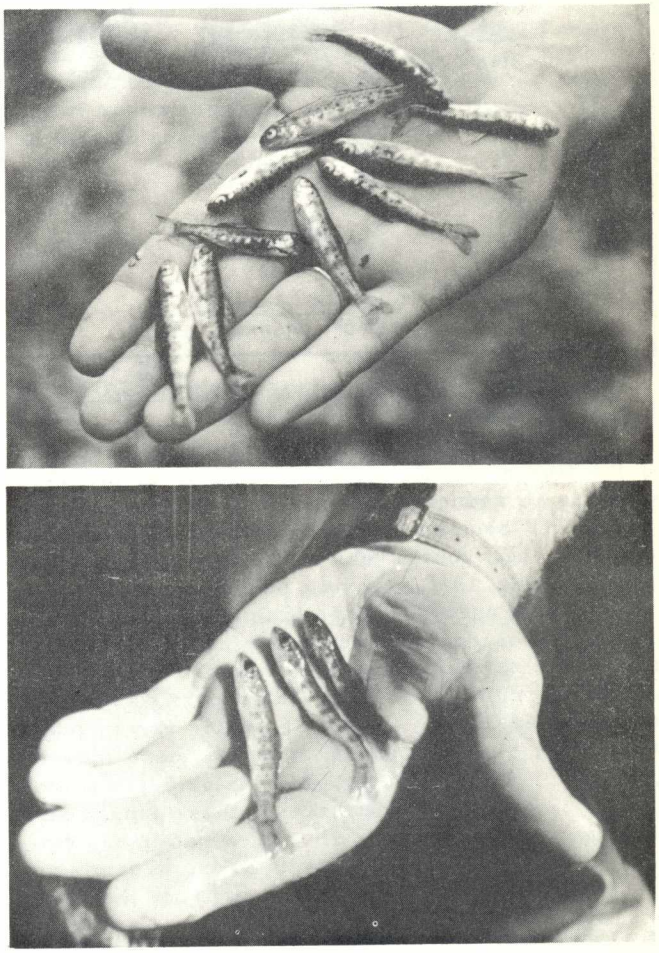
The spraying of woodland with insecticide from aircraft to control insect pests has become standard forestry practice. Recently a severe outbreak of the spruce budworm in eastern Canada has threatened vast stands of balsam, fir and spruce. When the epidemic moved eastward into northern New Brunswick, spraying with DDT was undertaken by Forest Protection Limited. In 1952, an area of 200,000 acres was sprayed as an experiment to test the technique, and since then the area has increased steadily as the budworms spread into new areas. By 1955 a total of over 4,000,000 acres had been sprayed in New Brunswick, and the programme now calls for the spraying of 2,000,000 acres or more each year. These operations include re-spraying of large areas, since the budworms cannot be eliminated by spraying and it appears that the pest can be controlled only by repeated applications of DDT every two or three years, or sometimes every year.

It has been known for many years that DDT in extremely low concentration in water can kill fish coming in contact with it, but there was no well-documented evidence of serious effects on salmon or trout in streams through aerial spraying of adjacent woodland. The opportunity to get such facts arose in 1954 when part of the Miramichi River system was included in the spraying programme of Forest Protection Limited. Since 1950 the populations of young salmon in the Northwest Miramichi had been followed closely each autumn by seining on sample areas extending from the headwaters to near head of tide, a distance of about 45 miles. The 1954 census, starting two months after completion of spraying in June, showed that the number of young salmon was much below the level of the preceding years. The youngest fish which were fry of the year were practically absent, and parr in their second year were more seriously affected than large parr in their third year. Observations on young salmon held in cages inside and outside the sprayed area, and the finding of large numbers of dead young salmon along the river within a few days of spraying led to the conclusion that the mortalities were mainly the result of a direct lethal effect of the DDT. Besides these direct effects on the fish, serious reductions were observed in the stream insects which are their main food. Observations up to November, 1955, on the effects of the 1954 spraying were summarized in last year's report, published in the April, 1956, issue of "Trade News".

Woodland around the lower part of the Northwest Miramichi was sprayed again in June, 1956. Observations on the effects of both the 1954 and 1955 sprayings on young salmon and stream insects were continued through the 1956 season. Advantage was taken of the opportunity for further study of the effects of the 1954 spraying in areas not sprayed since 1954, and for observations on the areas re-sprayed in 1956.

Effects on Salmon

Figure 4 summarizes the facts obtained since 1950 on populations of young salmon in the Northwest Miramichi, before and after the two DDT sprayings. The heights of the bars represent the numbers of fish of the three size groups per 100 square yards of stream, averaged for the 10 seining stations. Looking from top to bottom of the diagram along the different columns shows the average numbers of fish of these three sizes obtained by the autumn seinings in each year since 1950. Looking from left to right along each row shows our information on what happened to the three size groups of young salmon produced by the spawnings of adult fish each fall since 1949.



The top photograph shows salmon parr of normal appearance picked up immediately after being affected by DDT in Northwest Miramichi River, June, 1954. Lower photograph shows salmon parr, very thin but still alive, from sample seined in Northwest Miramichi River, September, 1956.

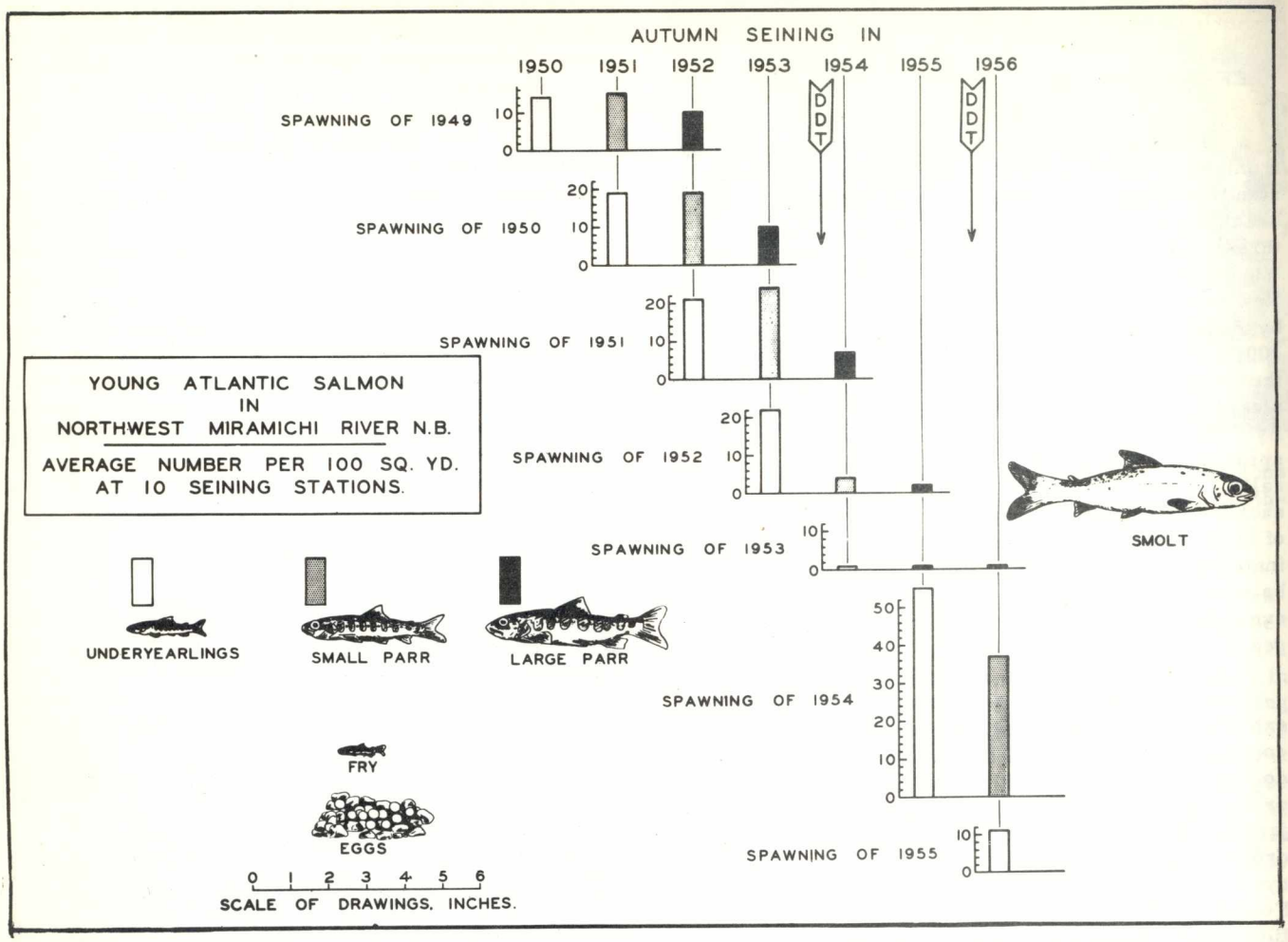


Figure 4. Effect of aerial spraying of DDT on young salmon in the Northwest Miramichi River, N.B.

The unusually low bars in the middle section of the figure clearly show the effects of the 1954 spraying in reducing the numbers of young salmon that would become smolts. Parr usually become smolts in their fourth year of life in this area. The effect of the 1956 spraying on the unusually high population of underyearlings produced by the spawning of 1954 is not so obvious as far as number of small parr per unit area in 1956 is concerned. Although the number of these small parr was unusually high, averaging 33 per 100 square yards, many were very thin at seining time and there may be poor survival over the 1956-57 winter. The photographs on page 13 show three of these small parr picked at random from a sample seined in September, 1956, and still alive, compared to a sample of small parr of normal appearance, from the same area in June, 1954.

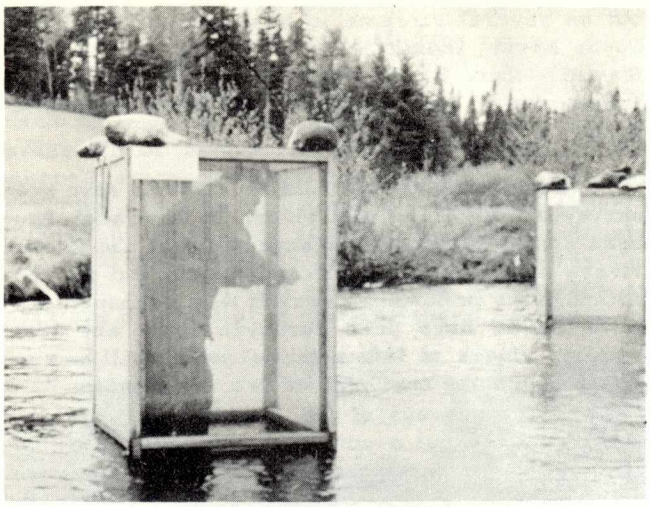
Only the lower seven stations were affected by the 1956 spraying, so the average numbers of underyearlings and small parr shown for the autumn seining in 1956 are higher than occurred on the sprayed sections of the river alone. On the sprayed sections of the river, the average number of underyearlings was under two per 100 square yards in 1956. So the young salmon produced by the spawning of 1955 were practically reduced to extinction, in the same way as the underyearlings produced by the spawning of 1953 were reduced by the 1954 spraying.

Seining data for each year since 1950 are available also for the Dungarvon River, a tributary to the Southwest Miramichi. In 1955 and 1956 seining stations were added to the general Miramichi programme, on two other tributary streams, the Renous and Cains, of which the latter has not yet been sprayed. These data confirm those for the Northwest Miramichi and show that the young salmon in sprayed streams are very scarce as compared to the populations in unsprayed areas.

Effects on Stream Insects

In 1956, cage-traps were used again on sprayed and unsprayed streams in the Northwest Miramichi area, to learn how the production of various kinds of stream insects was affected by the 1954 and 1956 sprayings of DDT. These cage-traps (see photograph) cover one square yard of stream

bottom and allow the emerging adult insects to be collected daily for identification, counting, and volume measurement.



Cage traps used in 1955 and 1956 to determine daily emergence of adult stream insects from sample square yards of river bottom in Miramichi area.

The results of the 1956 study confirm those of 1955, in that both the number and kinds of stream insects in the sprayed area were reduced. The greatest reduction occurred among the larger insects, including the caddis flies and the large forms of mayflies and stoneflies, while the small-sized forms, particularly midges, showed better survival and were actually quite numerous. The large insects have failed to return by the second year after spraying.

In the past two years studies have been made of the feeding habits of young salmon, by examining stomach contents of samples of fish taken in unsprayed and sprayed areas. The normal diet of the underyearlings consists largely of small insects, particularly midges. Older salmon (small parr and large parr) normally have a diet of larger caddis flies, mayflies and stoneflies and do not appear to utilize the small forms, even when the latter are particularly abundant.

The great reduction in numbers of larger stream insects and their failure to be re-established in sprayed areas within two years, must mean drastic loss in food for the larger sizes of young salmon, which may affect their survival to the smolt stage. Experiments to show the possibility of re-establishing some of the missing species of insects are planned for 1957.

Investigation & Management of Atlantic Salmon in 1956

Part 2 - -

The Management Programme

By W.M. SPRULES

THE MAIN OBJECTIVE of the Atlantic salmon management programme is to maintain and develop the important Atlantic salmon stocks, which frequent the waters of the northwestern Atlantic ocean off the coast of Canada and the coastal streams from southern New Brunswick to northern Labrador, in order that a regulated annual catch may be taken both by commercial and sport fishermen without depleting essential spawning runs.

Although many separate management techniques are used to reach the objective referred to above these fall into two main categories, namely: protection of the stocks through enforcement of regulations, made under the Fishery Act, designed to ensure efficient use and sufficient escapement to unspoiled spawning areas; and environmental improvement designed to increase the productive capacity of certain waters for salmon. In Labrador, Newfoundland, Nova Scotia, New Brunswick and Prince Edward

Fishery protection officers checking size of mesh of commercial salmon trap-net.

Island these techniques are applied by officers of the Conservation and Development Service of the Department of Fisheries of Canada while in Quebec officers of the provincial Department of Fisheries are responsible for such application.

Fundamental research is essential to the development of sound management practices. The results of such research provide the basis for scientific regulation of the various fisheries and indicate the fish cultural techniques which should be applied to increase the size of the salmon stocks. The research and management programmes are closely co-ordinated to insure that each research finding may be immediately translated into an experimental management technique through controlled application in the field followed by broad application if the original field experiment shows promising results.

SURVEYS OF SALMON RIVERS

Systematic surveys of selected salmon rivers have been made each year since 1953 in order to provide an inventory of certain physical characteristics of the rivers which limit salmon production. In addition to general observations on the abundance of food organisms, existence of predators and water conditions, detailed information on the extent and location of barriers to migration, physical and chemical pollution, spawning areas, and nursery areas is recorded. Recommendations for management such as stream improvement and regulation of the fishery are based on analysis of the data obtained during the surveys.

In 1956 surveys were completed on seven rivers in New Brunswick including the St. Croix, Tabusintac, Jacquet, Nipisiguit, Nashwaak, Keswick and Pocologan; on six rivers in Nova Scotia including the Liscomb, Jordan, Salmon (Jeddore), Wallace, Salmon (Guysboro) and River Phillip; on seventeen rivers in Quebec including the Ours, Corneille, Little Piashti, Piashti, Veronique, Washishou, Little Washishou, Pashashibou, Nabesipi, Aguanizh, Natashquan, Kegaska, Musquaro, Musquanousse, Washicoutai, Olomane and Wastawaka. Aerial surveys by helicopter were carried out on several streams in Newfoundland including South Brook, Indian River, Middle Arm Brook, Western Arm Brook, Main River and all eastern tributaries of the Exploits River below Red Indian Lake.

To date nearly 200 salmon streams have been surveyed. All important rivers in Labrador have been completed and it is expected that the Quebec rivers will have been covered by the end of 1957. Although the important rivers in New Brunswick and Nova Scotia have been surveyed there are other smaller rivers of fair potential which will be surveyed within the next year or two. In Newfoundland preliminary surveys of the largest river systems are completed but a continuing programme will be required for some years in order to obtain essential data on the many smaller but none the less important salmon rivers.

In addition to the inventory developed by stream surveys counting traps have been operated in several rivers to determine the size and time of the salmon runs to specific areas. The data obtained from these counts provide information on annual changes in the run and are used to correlate the features of the run with environmental conditions existing from year to year such as temperature, water level and the effect of industrial developments on the specific rivers. An example of the counts obtained is contained in Table 1, at the foot of this page.

These data coupled with future counts will prove of considerable value in assessing the effect of the new power development at Beechwood on the Saint John River and the efficiency of the fish passage facilities proposed for this development since salmon will have to pass the Beechwood structure before reaching the Tobique Narrows fishway.

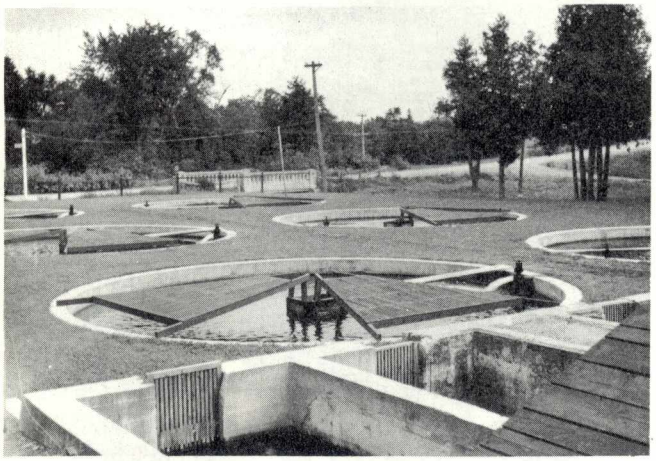
TABLE 1: Number of salmon released from counting trap at the head of the fishway in the power dam at Tobique Narrows on the Tobique River, N.B.

	NUMBER OF SALMON							
YEAR	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	TOTAL
1953	58	1,866	1,979	228	106	384	35	4,656
1954	79	1,052	1,542	1,288	836	184	5	4,986
1955	13	682	1,376	858	270	555	21	3,775
1956	2	376	1,326	751	731	467	70	3,723

Period trap operated: 1953 May 24 to November 8; 1954 May 20 to November 16; 1955 May 20 to November 21; 1956 May 7 to November 26

HATCHERY PRODUCTION

The important role of the salmon hatchery in the management of this resource should not be overlooked at this time when the value of hatcheries in general, as a means of maintaining specific commercial fisheries, has been proved of little significance. The products of the salmon hatcheries are used to augment the populations of young fish in areas where natural reproduction is limited but where rearing conditions are favourable; to provide essential stock of known age and origin for experiments; and to provide stock for seeding previously barren areas once these have been made accessible to adult runs through construction of fishways at barriers or removal of obstructions to migration.



Fish hatchery in New Brunswick

More than 8,100,000 Atlantic salmon were distributed in selected rivers during 1956 from the hatcheries in New Brunswick, Nova Scotia and Prince Edward Island. At this time a record of the salmon production of Quebec hatcheries is not available but significant numbers were produced and distributed in that province.

Although most of the hatchery production is distributed as advanced fry or fingerlings up to approximately three inches in length, provision was made in 1955 to carry approximately 600,000 young salmon through the winter for distribution as yearlings in 1956. Unfortunately the heavy freshets that occurred in Nova Scotia during January flooded a number of ponds in which these salmon were being retained and serious losses resulted. However, approximately 400,000 were carried through the winter successfully and many had already assumed smolt dress when distributed as post-yearlings.

Some 1,250 three-year-old salmon ranging from $1\frac{1}{2}$ to 4 pounds in weight were distributed in Big Salmon River, N.B. These salmon were progeny of adults from the selective breeding experiments that have been carried on for several years at the Saint John hatchery. Each fish was tagged with a distinctive loop of coloured Flexite Polyethylene and released in specific sections of the river so that data on survival, migration and behaviour may be obtained.

EARLY - LATE RUN EXPERIMENT

Once again ample stocks of ova were obtained for the experiment designed to determine whether or not the tendency for salmon to run early or late is inherited or a result of environmental conditions prevailing in the rivers. Some 426,000 eggs were obtained from late run stock in River Phillip, N.S., and a total of 329,000 ova from early run parents from Rocky Brook, N. B. and the Nictaux River, N.S. The young salmon that hatch from these eggs will be retained until they become yearlings in 1958, at which time they will be marked and distributed. Progeny of the early run stock will be released in River Phillip which carries a late run of salmon while the late run River Phillip progeny will be released in the LaHave river which is fundamentally an early run river.

Only a few thousand yearlings of known origin were available for distribution in connection with the early-late run experiment in 1956 since very few eggs were obtained in the fall of 1954 as a result of adult losses brought about by damage to retaining fences following the hurricanes of that year. In addition the floods which occurred during the early part of 1956 resulted in the loss of many small salmon which had developed from the eggs collected in 1954. A total of 5,498 marked yearlings of early run origin was distributed in River Phillip and 3,232 marked yearlings of late run origin were distributed in the LaHave river.

The first returns from this experiment may appear in the rivers during 1957 when grilse resulting from the yearling releases made in 1955 could return from the sea. A total of 35,759 yearlings from early run Rocky Brook stock was marked by removal of the left ventral fin and distributed in River Phillip between September 27 and October 1, 1955. At this time the salmon averaged $4\frac{1}{2}$ inches in length and 0.4 ounces in weight. Similarly 59,661 yearlings from late run River Phillip stock were marked by removal of the right ventral fin and distributed in the LaHave river between April 7 and May 5, 1955. These fish averaged approximately 6-3/4 inches in length and 1.1 ounces in weight when released. Every effort will be made during 1957 and subsequent years to locate these marked salmon wherever they may appear in order to determine whether they retain the characteristics of the parents with regard to time of run or whether they assume the characteristics of the run native to the rivers in which they were released.

EXPERIMENTAL PREDATOR BIRD CONTROL

American merganser populations were controlled once again during the summer of 1956 on the Miramichi river system in New Brunswick and the St. Mary's River in Nova Scotia, by means of organized shooting carried out by several two-man

crews making regular sweeps down the rivers. This project is being carried out as an experiment to assess the benefits to the salmon production of these rivers resulting from control of the American merganser populations and to determine whether or not this particular technique can be applied on a large scale. Authority to kill American mergansers on these experimental rivers was obtained from the Canadian Wildlife Service of the Department of Northern Affairs and National Resources, which administers the Migratory Birds Convention Act in Canada.

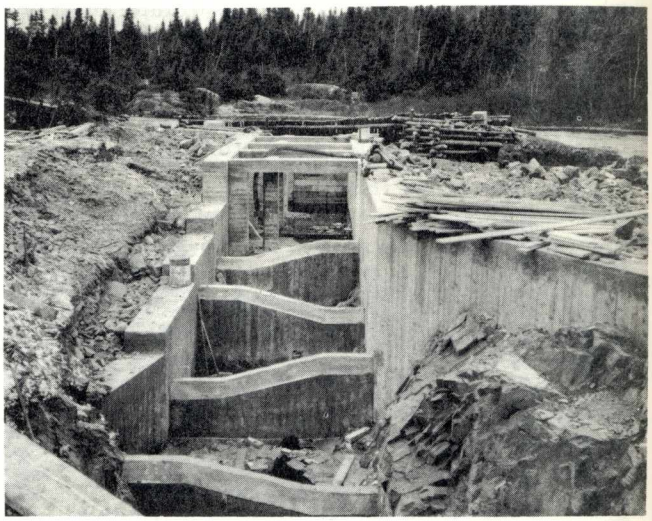
The results obtained from this experiment have been encouraging since the number of birds killed each year has decreased on both rivers although the shooting effort has remained relatively constant. Further, the number of young salmon observed in these rivers has increased since predator bird control was undertaken but this has proved difficult to assess accurately, particularly in the Miramichi river where the deleterious effect of DDT offsets the beneficial effect of predator control. It is expected that returns of grilse and adult salmon to the St. Mary's river fisheries within the next year or two will clearly demonstrate the value of predator bird control in improving Atlantic salmon stocks. The number of American mergansers killed each year is summarized below:

	1954	1955	1956
Miramichi R., N.B.	1028 (revised)	436	178
St. Mary's R., N.S.	424 (revised)	240 (revised)	113

Analyses of the stomach contents of 100 American mergansers have been made each summer during 1954, 1955 and 1956. The results of this study show that salmon parr constitute the most important single food item during the summer months. In 1954 an average of 3.7 salmon per stomach were found in the sample analysed and 4.0 and 3.9 respectively in the 1955 and 1956 samples. It was found that the diet consisted almost exclusively of fish although crayfish, aquatic insects and vegetative debris were found occasionally. Six species belonging to the minnow family were identified in the stomach analyses. Considered as a single food item an average of 2.3, 1.9 and 2.3 minnows per stomach were found in the 1954, 1955, and 1956 sample respectively. Less than one sucker per stomach was found each year. Other species which occurred in relatively small numbers in the stomachs included sticklebacks, smelts, trout, sculpin, eel, tomcod, gaspereau and killifish.

STREAM IMPROVEMENT

General stream improvements were carried out on several salmon rivers during the year and these were designed to ease the passage of migrating salmon, particularly during periods when critical water levels prevail. Improved channels were bulldozed in sections of North River, Salmon River and Gold River in Nova Scotia. New channels were blasted in the rock at minor obstructions located in Cape Roger River, Bay de l'eau River, Little Salmonier River and Northwest Brook in Newfoundland. Several unused timber dams were breached and accumulations of logs and debris removed from important salmon rivers.



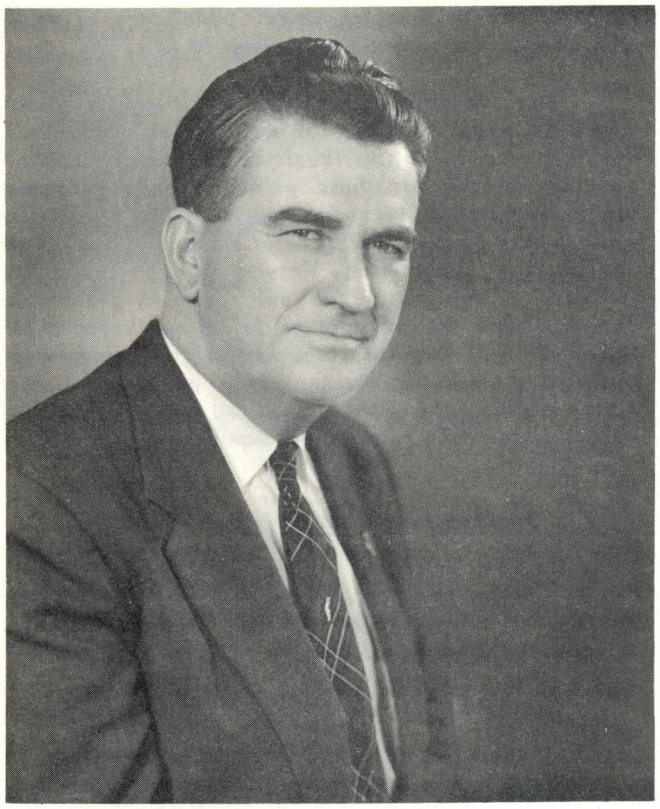
Fishway under construction

Three fishways were constructed during 1956 including one on Harry's River at Pinchgut Lake in Newfoundland and two on the LaHave River in Nova Scotia at Zwicker's Dam and Parnell's Dam. At the Parnell site a pool-type fishway 270 feet long was constructed to provide passage for salmon over a combined natural falls and mill dam 31 feet in height. This makes approximately 280 square miles of good salmon producing water available for the first time. Although a few adult salmon may use the fishway immediately an intensive stocking programme is planned for these waters to ensure early development of a substantial salmon run in this branch of the LaHave River.

Biological and engineering surveys were completed and analyses made of the fisheries problems presented by many proposed industrial developments involving the use of water in important salmon rivers. Minor modifications were suggested in the design of fish collection facilities and the skip hoist which will carry salmon over the power dam which is under construction at Beechwood on the Saint John River in New Brunswick. Analysis of the salmon problem associated with construction of a power project on Little Rattling Brook in Newfoundland was completed and it has been recommended that attempts be made to transfer the run to a nearby river which is understocked. Many other problems such as the passage of fish through aboiteaux and the effect of industrial effluents on resident and migrant fish populations were investigated as they arose and solutions presented for necessary action.

Minister of Fisheries

Hon. J. Angus MacLean, Member of Parliament for Queens, Prince Edward Island, has been appointed Minister of Fisheries of Canada by Prime Minister John Diefenbaker. Mr. MacLean succeeds Hon. James Sinclair, who had served as Minister since October 15, 1952.



Mr. MacLean.

Born at Lewis, Prince Edward Island, in 1914, Mr. MacLean is the descendant of emigrants from Scotland who came to Canada in 1837, and continues to make his home at Lewis, where he operates a farm. He holds a Bachelor of Science degree from Mount Allison University, Sackville, N.B., and also attended the University of British Columbia. He is a member of the Board of Regents of Mount Allison.

Mr. MacLean served with the R.C.A.F. from 1939 to 1947, and during the war won the D.F.C. He is at present a Wing Commander in the R.C.A.F. (Reserve).

After unsuccessful candidatures in the federal elections of 1945 and 1949, he was elected Member of Parliament in a by-election on June 25, 1951, and was re-elected on August 10, 1953 and June 10, 1957. He is married and has three children.

Assess Spraying Results

Federal and Game Commission fisheries biologists in British Columbia have teamed in a carefully planned programme to minimize and assess fish losses which could result from timber spraying operations near Port Hardy, Vancouver Island, scheduled for early June.

Announcement of spraying plans to protect timber in an air war against black headed budworms aroused deep concern among fishery interests. Records of similar operations in eastern Canada and various parts of United States show that heavy losses of fish life occurred when the deadly mixture of DDT and oil contaminated fish streams.

The area of planned spraying on northeastern Vancouver Island covers approximately 133,000 acres of timber land. In this area also are 18 salmon streams, including the important Nimpkish system.

Examining the plans of the timber interests, first publicized last fall, fishery biologists found the proposed concentration of DDT would be dangerous to fish in the area if allowed to permeate rivers and lakes. Both fish and the food organisms on which fish depend for existence could be wiped out unless adequate protection measures are taken.

Original plans of the spraying company were modified at the suggestion of Fisheries men who found from records that in other spraying operations on this continent rivers had been used as sectional boundaries. This resulted in overlapping and in many cases the stream area received double dosage of the insecticide.

Officials in charge of the spraying have agreed to carry out the operation on a grid system and to do everything possible to avoid spraying in the vicinity of rivers or lakes.

Spraying aircraft will fly at 250 feet elevation and at a speed of 180 miles per hour. In some sections pilots will be able to operate on courses parallel to streams, leaving a safe margin on either bank. In others, where the terrain will not permit such manoeuvres, they will shut off the spray controls until the stream area has been bypassed. All lake areas will be avoided. Fishery officers will accompany planes as observers throughout the entire operation.

Fisheries biological teams have set up testing stations throughout the projected spray area. These consist of pens of fish, some native to the stream

and some from a mainland fish hatchery, both inside and outside the spray area. During spraying operations a constant watch will be kept on fish in these pens. Mortalities of fish in the spray area, both in pens and in the streams, will be checked against those outside. Close observation will be kept on aquatic life before, during and after spraying runs. A biological team will remain in the area for further studies for several months after conclusion of the spraying.

Most difficult protection problem, biologists say, is the area surrounding the Keogh river system, where comparatively level terrain carrying heavy timber stands makes timely recognition of streams difficult for aircraft pilots.

On the other hand the fisheries men expressed cautious optimism over the important Nimpkish area, where stream recognition is easier and Nimpkish lake, the chief sockeye salmon rearing area, is clearly discernible at any altitude. However they say that records of other spraying operations indicate that in spite of all precautions some fish mortality seems almost inevitable.

Great Lakes Commission

The new chairman of the Great Lakes Fishery Commission is L.P. Voigt, of Milwaukee, Wisconsin, who was appointed at the meeting held in London, Ont., June 4. He succeeds John L. Farley of Arlington, Virginia, who resigned some time ago.

Also appointed, as executive secretary, was N. R. Baldwin, of Toronto, who will take up his duties later in the summer at the commission's headquarters in Ann Arbor, Mich.

The June meeting was principally concerned with administrative and operative matters such as contracts for scientific work this year and consideration of estimates for the year 1958-59.

The Great Lakes Fishery Commission was set up in 1955 and was organized last year at Ottawa. It is a joint United States-Canadian body, whose aim it is to rid the lakes of the sea lamprey and to develop a programme of research on the lakes' fisheries of common concern. The commission is spending about $1,500,000 each year on its lamprey control work.

Mr. Baldwin, a graduate of the University of Toronto in biology, is presently head of the section of fisheries research of the Ontario Department of Lands and Forests' research division. Dr. James Moffett, of the U.S. Fish and Wildlife Service, has been acting secretary of the commission to date.

Attending the meeting were Commissioners Dr. A.L. Pritchard, Ottawa, Director of the Conservation and Development Service of the Department of Fisheries of Canada, who is vice-chairman of the commission and chairman of the Canadian section; Dr. W.J.K. Harkness, Chief of the Division of Fish and Wildlife of the Ontario Department of Lands and Forests; Dr. A.C. Blackhurst, Manager, Ontario Council of Commercial Fisheries, Port Dover, Ont.; Mr. Voigt, Dr. Moffett, and Mr. Baldwin.

Salt Assistance

Fisheries Minister J. Angus MacLean has announced that the federal Government would continue to pay to Atlantic Coast producers of salted fish products a rebate on the cost of salt.

The minister pointed out that these fishermen who depend on markets for salted fish products do not have access to the fresh and frozen fish plants and that prices for their products have remained low in the face of increased costs. The assistance will be paid in the provinces of Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and Quebec. It applies to all salt used by fishermen except where the product is to be marketed in the United States. The minister stated that prices were higher for those products which go to the United States and that the government did not wish there to be any suggestion of assisted exports to that country.

B.C. Salmon Catches

British Columbia sport fishermen last year caught eleven per cent more salmon than in 1955, although in the same period the commercial catch of salmon showed a decline.

The sport catch of spring and jack salmon totalled 64,000 fish, an increase of nearly 20 per cent, while grilse increased from 142,000 fish in 1955 to 168,000 last year. The sport catch of coho declined about 10 per cent from the previous year with a total catch of nearly 71,000 fish.

Greater fishing activity from rental establishments and a sharp increase in private boat ownership was stated as the probable reason for the heavier sport fishing catch.

The main feature of sport fishing in the individual areas of the province was the increase in the catch of springs in the Comox-Courtenay, Nanaimo-Crofton, Cowichan Bay and Howe Sound areas. Counteracting this increase was the drop in the catch of large spring salmon in Rivers Inlet. The catch in that area was only one-quarter of the number reported in the two previous years as fishing was curtailed due to the presence of blackfish.

Coho catches were down in most places but in the Courtenay, Comox and Howe Sound areas substantial increases were reported.

Fishery Figures For April

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May - Apr. 1956		May - Apr. 1957	
	'000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	1,975,779	79,743	1,834,755	84,017
ATLANTIC COAST - Total	1,281,924	49,360	1,304,629	50,984
Cod	570,453	14,160	606,934	15,116
Haddock	159,259	4,895	143,354	4,504
Pollock, Hake & Cusk	59,810	970	68,499	1,159
Rosefish	40,774	927	55,435	1,210
Halibut	4,748	1,026	6,012	1,486
Plaice & Other Flatfish	81,233	2,598	80,761	2,545
Herring & Sardines	186,936	2,097	171,927	2,035
Mackerel	26,946	1,083	21,805	825
Swordfish	4,564	1,100	4,153	1,169
Salmon	2,604	871	2,608	947
Smelts	4,240	481	3,732	461
Alewives	17,365	153	16,194	160
Other Fish	40,780	469	39,933	469
Lobsters	48,256	16,713	50,695	16,675
Clams & Quahaugs	9,909	427	7,974	432
Scallops	1,843	793	2,793	966
Other Shellfish	22,204	597	21,820	825
PACIFIC COAST - Total	693,855	30,383	530,126	33,033
Pacific Cod	8,284	585	10,348	733
Halibut	18,960	2,469	22,745	4,923
Soles & Other Flatfish	7,664	370	8,725	400
Herring	503,280	7,197	355,794	5,214
Salmon	129,754	18,437	111,197	20,670
Other Fish	9,839	253	8,228	214
Shellfish	16,074	1,072	13,089	879
BY PROVINCES				
British Columbia	693,855	30,383	530,126	33,033
Nova Scotia	420,458	23,049	415,849	22,863
New Brunswick	159,912	6,563	180,438	7,481
Prince Edward Island	35,274	3,184	40,108	3,740
Quebec	105,918	2,629	116,866	3,508
Newfoundland	560,362	13,935	551,368	13,392

MID-MONTH WHOLESALE PRICES, Apr., 1957

		Montreal	Toronto
		$	$
Cod fillets, Atl. fresh, unwrapped	lb.	.271	.300
Cod fillets, Atl. frzn., cello 5's	lb.	.205	.248
Cod fillets, Atl. smoked	lb.	.312	.332
Haddock fillets, fresh, unwrapped	lb.	.336	.372
Herring kippered, Atl.	lb.	.233	.259
Mackerel, frzn., round	lb.	.158	.178
Lobster canned, fancy	case 48-½s	38.14	38.80
Sardines, canned	case 100-¼s	8.96	9.00
Halibut, frzn., dr., Pacific	lb.	.418	.400
Silverbright, frzn., dr.	lb.	.484	.451
Coho, frzn., dr.	lb.	.598	.585
Sockeye, canned, gr. A	case 48-½s	22.30	21.73
Pink, canned, gr. A	" "	12.81	12.92
Whitefish, fresh	lb.	.410	-
Lake Trout, frzn.	lb.	.418	.404

PRICES PER CWT. PAID TO FISHERMEN

(Week ending Apr. 20th.)

	1956	1957
	$	$
Halifax		
Cod Steak	3.50	3.25
Market Cod	3.50	3.25
Haddock	5.00	4.00-5.00
Plaice	3.50	3.25
Yarmouth		
Haddock	5.00	5.00
Black's Harbour		
Sardines	2.50	2.00
St. John's, Nfld.		
Cod	2.25	2.00
Haddock	-	3.00
Rosefish	2.00	2.00
Vancouver		
Ling Cod	8.00	8.00-12.00
Gray Cod	6.00	3.75- 6.00
Soles	6.00	6.00- 8.00
Salmon (Redspring)	35.00	30.00-48.00

Fishery Figures For April

STOCKS AS AT END OF APRIL

	1956 ('000 lbs)	1957 ('000 lbs)
TOTAL - Frozen Fish, Canada	36,286	44,835
Frozen - Fresh, Sea Fish - Total	16,129	21,344
Cod Atlantic, fillets & blocks	3,476	3,815
Haddock, fillets & blocks	6,066	4,324
Rosefish, fillets	354	540
Flatfish (excl. Halibut), fillets	824	1,084
Halibut Pacific, dressed & steaks	750	2,971
Other Groundfish, dressed & steaks	965	1,267
Other Groundfish, fillets & blocks	467	935
Salmon Pacific, dressed & steaks	1,050	4,282
Herring Atlantic & Pacific	628	347
All Other Sea Fish, all forms	796	929
Shellfish	753	850
Frozen - Fresh, Inland Fish - Total	4,039	5,193
Perch, round or dressed	71	386
Pickerel (Yellow), fillets	181	106
Sauger, round or dressed	268	221
Tullibee, round or dressed	181	197
Whitefish, round or dressed	135	619
Whitefish, fillets	361	256
Other, all forms	2,842	3,408
Frozen - Smoked Fish - Total	2,857	2,384
Cod Atlantic	1,602	1,319
Sea Herring, kippers	534	378
Other, all forms	721	687
Frozen for Bait and Animal Food	13,261	15,914
Salted and Pickled Fish, Atl. Coast		
Wet-Salted - Total	8,623	14,876
Cod	6,864	11,574
Other	1,759	3,302
Dried - Total	6,719	17,586
Cod	6,133	16,668
Other	586	918
Boneless - Total	401	915
Cod	369	902
Other	32	13
Pickled - Total (barrels)	15,545	6,909
Herring "	4,998	2,149
Mackerel "	2,489	199
Alewives "	8,058	4,561
Bloaters (18 lb. boxes)	37,904	32,341

CANADIAN EXPORTS VALUE OF FISHERY PRODUCTS, MAY-MARCH

(Value in Thousands of Dollars)

		1956		1957
Total Exports		121,361		122,237
By Markets:				
United States		88,658		88,441
Caribbean Area		16,529		15,500
Europe		12,435		14,077
Other Countries		3,739		4,219
By Forms:				
Fresh and Frozen		70,245		73,003
Whole or Dressed	24,859		26,887	
Salmon, Pacific	5,186		5,401	
Halibut, Pacific	2,727		3,495	
Cod, Haddock, Pollock, etc.	536		664	
Swordfish	1,352		1,683	
Other Seafish	2,932		3,611	
Whitefish	5,206		5,186	
Pickerel	2,791		2,645	
Other Freshwater Fish	4,129		4,202	
Fillets	27,853		28,775	
Cod, Atlantic	8,975		9,639	
Haddock	5,536		4,646	
Rosefish, Hake, Pollock, etc.	1,874		2,746	
Flatfish	5,084		4,632	
Pickerel	3,407		3,752	
Other	2,977		3,360	
Shellfish	17,533		17,341	
Lobster (live, Meat)	15,984		15,883	
Other	1,549		1,458	
Cured		22,579		20,784
Smoked	1,475		1,626	
Herring	1,032		1,107	
Other	443		519	
Salted, Wet or Dried	17,626		16,097	
Cod	15,849		14,184	
Other	1,777		1,913	
Pickled	3,478		3,061	
Herring	1,723		1,552	
Mackerel	995		816	
Other	760		693	
Canned		18,012		17,253
Salmon	14,406		12,679	
Sardines	1,563		2,084	
Lobster	1,642		2,059	
Other	401		431	
Miscellaneous		10,525		11,197
Meal	5,513		6,253	
Oil	1,966		1,455	
Other	3,046		3,489	

Current Reading

"A Creel of Willow," by W.H. Canaway (Wm. Collins Sons and Co.,Canada, Ltd., Don Mills, Ont. $4.00).

This book is primarily for fishermen but it can also hold a good deal of interest for anyone who has an interest in conservation of wild life. Mr. Canaway uses his fishing experiences on a small river as a background for observations on all aspects of nature and on people, and the result is a well written and interesting book containing a good deal of information about the ways of a trout stream and the creatures which inhabit or come into contact with it. The author is not a fanatical fisherman but he has made a keen study of the ways of fish and he hates to see anything threaten the continued existence of good trout water. He puts forward good theories on fishing and fishery improvement generally and is an implacable foe of those whose selfishness or thoughtlessness result in harm to fish populations.

"Albacora," by Eugenie Marron, edited by Roger Kahn, (Random House, Toronto, Ont. $4.75).

Mrs. Marron and her husband, Lou Marron, well known to many Canadians by virtue of their big game fishing exploits off Nova Scotia, are both holders of world records for the catching of giant fish. They have been fishing for thirty years, but their interest in the avocation is no longer limited to its sporting aspects; they follow some of the strongest and fastest creatures of the oceans not only for the thrill of taking them, but for the advancement of science. Expeditions which the Marrons undertake always include biologists and cameramen.

"Albacora," which is sub-titled "The Search for the Giant Broadbill," is Mrs. Marron's account of a voyage to the Humboldt current off the west coast of South America. A scientist from the Marine Laboratory of the University of Miami was on hand to measure and dissect each catch in order to increase the knowledge of marlin, broadbill swordfish and giant squid. The author's pleasant style of writing makes the book easy reading. There is adventure and excitement, and the discomforts and even dangers of the expedition are treated with humour.

The Marrons and their companions did their fishing from a 40-foot cruiser, the "Explorer," and they chose the waters of the Humboldt because it was there that they thought they might find some clues to the main breeding ground of the Pacific albacora and marlin. Giant squid were taken so their nerve sheaths, larger than those of other animals, could be sent to the Massachusetts Institute of Technology for work on the chemistry of nerves.

Mrs. Marron is filled with admiration for the commercial fishermen of Chile, Ecuador and Peru who, with scant equipment, go as far as a hundred miles out to sea in small boats, sometimes lingering for days on the ocean, almost naked to the elements, in their pursuit of big fish. The harpoon men of the Pacific coast of South America learn to throw in their childhood, just as North American boys learn to hurl a baseball, and they can control their weapons with great accuracy. Sometimes they fight their primitive battles from tiny balsam rafts.

An instructive as well as a highly entertaining book, "Albacora" shows how successful a blending of unmethodical sport with disciplined science can be. The Marrons declare that today's finest non-commercial fishing people are all advocates of conservation, and they themselves never kill a fish unless it is to be used for food or for scientific investigation. A well selected group of photographs adds to the book's value.

"The Selection and Care of Nylon Gill Nets for Salmon," by P.J.G. Carrothers (Fisheries Research Board of Canada, Technological Station, Vancouver, B.C. Industrial Memorandum No. 19).

This informative and useful manual goes into great detail on the subject of nylon. The first section discusses the many different forms of this synthetic fibre and points out how their different properties adapt nylon to different jobs. Other sections deal with the strength and weight of nylon nets, the way in which nets should be ordered in view of the fact that all brands are not marked the same, the kinds of dyes to use and their application, the manner in which nets may become weaker, the various kinds of lines, floats and leads, and other materials for gill net web, such as terylene, silk, glass fibre, orlon, rayon and saran.

"Electric Screens for Adult Salmon," by F.J. Andrew, P.C. Johnson and L.R. Kersey, (a progress report by the International Pacific Salmon Commission, published by the Commission at New Westminster, B.C.).

This report presents the results of tests conducted in Sweltzer Creek at Cultus Lake, British Columbia, to investigate the effectiveness of certain types of electric screens for deflecting and guiding adult sockeye and pink salmon.

THE ROSEFISH is found in abundance off Canada's east coast. The Department of Fisheries reports that exploratory fishing by the Fisheries Research Board of Canada indicates still greater stocks to the north.

A rose is a bream is a perch—

THE ROSEFISH, variously called Red Bream and Ocean Perch, was, until recent years, of little or no commercial or food value. Turning point in its importance came with advancements in fish freezing and handling. The rosefish were automatically scaled and filleted, then quick frozen and sent to market as Ocean Perch. Their mild flavour and relatively low price won them instant popularity.

At the same time the growth of *otter trawling* with huge, open-mouthed nets made the catching of rosefish in large quantities a commercial possibility.

The Fisheries Research Board of Canada, the Department's scientific arm, has discovered many of the important grounds which are being fished today and others still untapped. The rosefish typifies the role—one of many—that the Department plays in developing Canada's vast and valuable fish resources.

Virtually all the rosefish catch is filleted and quick frozen. The by-products are made into high-vitamin-content meal and oil.

DEPARTMENT OF FISHERIES

OTTAWA CANADA