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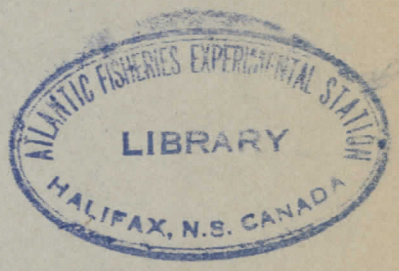

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FISHERIES RESEARCH BOARD OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No.

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FISH (SALMON) MANAGEMENT, 1949

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FISH (SALMON) MANAGEMENT

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FISH (SALMON) MANAGEMENT

1949

REPORT NO. III. Report on Tagging and Marking of Salmon

By A. G. Huntsman

The following methods are being used in tagging salmon in experiments to determine what proportion of the fish are used. It is particularly important for this purpose to rely upon the tags staying on the fish and upon the tagging not causing their death. Although it is impossible to have in any experiment exactly the same conditions as those for fish that are not experimented upon, it is desirable to have as few conditions different as possible and to try to take account of such as are different. In drawing conclusions from recaptures of tagged fish as to the use made of a particular lot of fish we should appreciate the possibilities of error; doing so, we need listen only to critics who have something more than these possibilities to advance.

I have been greatly indebted to Mr. H. C. White, who has had very much experience in tagging salmon and trout in recent years and upon whom I have long relied for critical treatment of the various tagging methods. He joined me at Wellington Station on November 9 and carried out the first of the tagging, of kelts at the Bedford Hatchery on November 10 and of 3-yr. old pond fish at the Grand Lake Ponds on November 12.

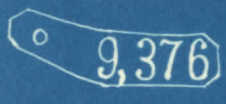
The tags are of red celluloid and were made in 1938 by

the Cruver Manufacturing Company. For the larger salmon (grilse and larger sea salmon) they were cut down to a small size, 5/8" long, 5/16" wide and .025" thick, reducing them to an average weight of 0.109 g. as compared with 0.469 g. for the original double tag. Each has a number and lettering as shown in fig. 1. Another piece of red celluloid with a hole and cut from the other end of the original tag, which is perforated for double attachment, is used to provide a bearing for fastening. A nickel pin 1½ in. long of No. 20 gauge wire is passed through the num-

bered strip, the fish and the bearing plate, and the free end bent to hold both tag and plate firmly against the fish (fig. 1). For the small salmon (3-yr.-old pond salmon 7 to 14 in. long), the tags were cut to the minimum size for retaining the number and the hole for attachment (fig. 2) and have an average weight of 0.049 g. The nickel pins were bent sharply 3/8 in. from the head, cut through 1/4 in. from the head to leave a hook at this end and bent into a U with the point higher than the hook (fig. 2). With the tag on the pin next the hook, the pin is passed through the fish, the point is bent toward the hook, and point and hook are then brought together (fig. 2). Later, the hook at the head end was bent closely against the shaft. Then it was found that these tended to become caught in the net, the thread pressing past the bent point and getting tightly wedged in the closed hook. The last had the point bent with the tip of the round-nosed pliers into a rounded hook which was brought level with the closed hook of the head end, and the two brought together so as to overlap each other closely (fig. 2). This did not seem to get caught in the net.

After this experience, the larger fish ("wild" lake fish and 4-yr.-old and 5-yr.-old pond fish) tagged at the last had the larger tags affixed in a different way from the grilse and larger sea salmon. They were intermediate in size between the latter and the 3-yr.-old pond fish. No plate was used on the opposite side of the pin from the tag. The pin for each

Fig. 1. Reduced single tag for large fish; fastened with pin through base of dorsal fin and twisted against bearing plate.



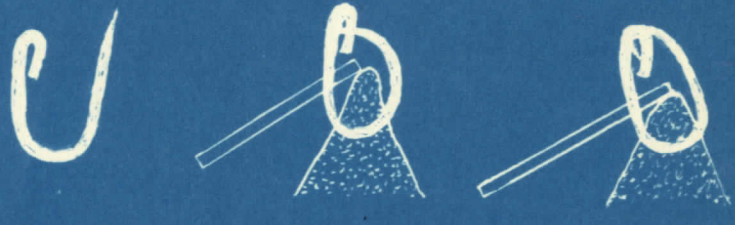


Fig. 2. Much reduced single tag for small fish; fastened with beheaded pin through base of dorsal fin; with pin ends lapped and point poorly or well bent.

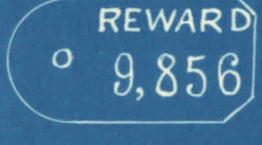


Fig. 3 Reduced single tag for medium fish; fastened with pin, both ends of which are hooked and carefully lapped.

tag had the head bent into a hook with the small end of the round-nosed pliers and the rest of the pin bent farther back on the pliers into an opposite hook with the point above the level of the other hook (fig. 3). The tag was placed on this bent pin, the point inserted through the hole made by an awl and the point bent with the small end of the pliers into a small hook brought on a level with the hook at the other end. Other pliers were then used to bend the two hooks closely together in an overlapping position (fig. 3). For ready manipulation of the pins both round-nosed and ordinary pliers are essential.

The tag is fastened to the fish just in front of the large back fin. The skin is particularly tough here and below it the first pterygiophores of the fin run forward almost horizontally, providing a very firm structure for attachment. Also, there is least movement at the central part of the fish's body, which favours this location. It is not yet known whether or not it is necessary to pass the pin under the pterygiophores in order to have a sufficiently firm attachment, and it is difficult, particularly in a small fish, to pass the pin through a precise place. The structures involved at this tagging site are shown in median section in fig. 4. When it proves possible, the actual position of the pin will be determined after the death of the fish.

For tagging, the fish is placed on a net or cloth held near the surface of the water, so that it lies in shallow water

in its normal position with its back above the water. Its head is covered with a thick cloth, perhaps in the form of a sock

which can be drawn over it. This is to cut off light to the eyes, since the salmon is very sensitive to light and stimulated by moving shadows. The cloth must not interfere with movements of the jaws and gill covers in breathing, since interference with breathing will soon cause the fish to struggle. For sure, steady work in tagging, the fish should be held in a straightjacket. It is a convenience to have this straightjacket include the cloth head cap for blinding the fish and also a scale for reading off its length. The straightjackets used changed with experience and finally the following type was developed and in two sizes, the smaller for fish from 7 to 14 in. and long/the larger for fish from 14 to 24. in. long. Each straightjacket has a basal board a few inches wide to stay flat resting with one end in the net below the water surface and the other end on the edge of the tub holding the water. The fish is held with its belly on this board and its right side against a narrow board nailed to the basal board so as to form a right-angled groove for the fish. This upright board is 1½ in. and 3 in. wide for the two sizes and is cut down to 1 in. and 2. in. wide for roughly such a distance from the head end of the fish (2 1/2 and 5 in.) as to be in front of the dorsal fin of the smallest fish and far enough back (7 and 14 in.) to be behind the dorsal fin of the largest. This is to permit strapping the fish to this upright board both in front and behind the dorsal fin where the tag is to be fastened. Each strap is fastened firmly to the board near its bottom edge on the side, where the fish is, is

carried around the fish and pressed over a projecting sharp pin on the other side of the board, which holds it taut temporarily. For measuring the fish, a stop is nailed to the end of the board and the nose of the fish comes against this stop. The top end of the board is graduated in inches for the lengths of the fish to be handled (7 to 14 in. and 14 to 24 in.). The two boards are covered with smooth table oilcloth where the fish come against them. This oilcloth serves also for the straps, which need to be renewed as damaged by being fastened to the sharp pin. The strap behind the dorsal fin needs to have its front edge turned back so that its sharp edge will not injure the skin of the fish, which slopes rather strongly against it and is much moved when the fish struggles. A conical cap or blinder for the fish is fastened to the stop and front end of the vertical board so as to cover the head of the fish loosely and permit both breathing movements and flow of water.

The fish vary considerably in sensitivity to handling. If one moves slowly and exerts no pressure, the fish can be lifted from the water without being stimulated to make any movement (as in "guzzling" trout). They are greatly stimulated by changing light, as in moving shadows visible or not visible to man. If stimulated sufficiently in any way, they perform swimming or struggling movements for a short period and then rest. Sometimes these periods of movement occur more or less periodically without reference to stimulation. The

fish will struggle in the jacket without being touched and yet after the struggle is over will show no response to rather vigorous handling in forcing the awl through the tough front base of the dorsal fin while being held firmly against the upright board of the straightjacket. Then later without being touched it will struggle again and do this repeatedly. Much of the tagging of the 3-yr.-old pond fish was done with the temperature well down toward the freezing point, water in the puddles being frozen at night. On one day the temperature was up to 44°F. and the fish moved much more, making tagging decidedly difficult. The fish were easier to handle after much exertion or when kept long in rather little water, doubtless owing to the effects of low oxygen concentration. They moved more just after it became dark in the evening, as has been observed with salmon in streams. Some tagging was done about five hours after sunset, when small salmon at least are quite inactive unless disturbed. It was thought that they might be easier to handle then. It was found, however, that they were no easier to handle, perhaps because they had been thoroughly disturbed when seined out of the pond and brought to the laboratory.

From the Bedford Hatchery, 39 sea salmon kelts were tagged on November 10th with numbers from 9,001 to 9,039 and transported to Shubenacadie lake, in which they were placed at Grand Lake Station, the middle broad and deep part of the

lake. From the Grand Lake Rearing Ponds 41 lake salmon kelts ("wild fish") were tagged on November 18th with numbers from 9,801 to 9,841, and 40 of these were then planted in the lake at the same place as were the others. From the Ponds also, 12 4-yr.-old and 8 5-yr.-old salmon kelts, reared there, were tagged with numbers from 9,842 tom9,861 and then planted in the lake at the same place. Reared 3-yr.-old salmon, which had failed to mature sexually were also tagged to the number of 709, with numbers from 9,040 to 9,751 from November 11th to 18th. Of these, 100 tagged on November 15th (9,267 to 9,366) were placed directly in a large deep pond, where they are to be kept with the larger 3-yr.-olds that are being reserved for spawning. These are to be held for a year or two to determine their mortality in comparison with the spawning reserve and for careful examination of the tag site and of the endurance of the tag in position in such as are found dead (to be preserved) or are present finally for planting in the lake. One (9,338) was found dead on November 19th and preserved.

The remainder of those first tagged (9,040 to 9,632) were held in a pond. On November 17th Mr. Cameron counted 272 of them of unknown numbers and we planted them in the lake at Grand Lake Station. One of the tags put on the first day (9,214) was found on the bottom of the pond on November 13th and put back on the fish. It had come out from the ring. Six others 9,063, 9,072, 9,184, 9,256, 9,418 and 9,585 came out of the fish with their rings during handling with nets on

November 17th. One was put back on and the others used for other fish. A lot numbering 116 (9,633 to 9,742 plus six lower numbers) was tagged on November 17th and placed directly into the mouth of the old lock which carries part of the run from Fletcher lake and is the part of Shubenacadie lake nearest the laboratory where the tagging was being done. On November 18th, the balance of those held in the pond were sought and 206 were found, leaving six fish unaccounted for. The numbers of those found were recorded and the fish were placed below the fishway and the dam in the run from Fletcher lake. In addition 9 more (9,743 to 9,751) were tagged and planted in this place.

The 3-yr.-olds measured gave the following numbers for successive quarter-inch groups, these being the spawning discards:

Inches	7½	7¾	8	8¼	8½	8¾	9	9¼	9½	9¾	10	10¼	10½	10¾
Number	1	2	4	7	21	18	35	47	82	70	91	81	78	47

Inches	11	11¼	11½	11¾	12	12¼	12½	13¼
Number	52	27	17	15	10	6	3	1

The lot of 100 being held in a large pond with the fish reserved for spawning had the following numbers in the length groups given.

Inches	8	8½	9	9¼	9½	9¾	10	10¼	10½	10¾	11	11¼	11½	11¾	12	12¼	13¼
Number	1	3	6	5	13	15	12	8	11	8	4	2	3	4	1	3	1

This tagging is a questionable practice for such small fish. The reserve lot is sufficiently representative in distribution through the various size groups to show how satusfactory

it is for our purpose.

This work already shows the need for either a simpler and surer method of tagging than what we have been using or else very expert operators. It is possible that both may be necessary. It may be that an expert operator can so affix a tag to the base of the anterior end of the dorsal fin that it will not come off under ordinary circumstances until the fish is caught and landed, and also that such fixation will not materially increase the death rate of the fish in the interim. In two years' time we will be able to report on the results of this tagging both for planted and reserved lots of fish.

In spite of certain advantages it possesses, the base of the dorsal fin may not be the best place to affix the tag. The tag placed there is conspicuous and does not interfere with the fish's activity. However, there is so much variation and change in this part of the body (these should be studied) that this part seems likely to give doubtful results as a site for the tag. Changes are associated with sexual maturity and have been well described by F. A. Davidson and O. E. Shostrom for the pink salmon (Oncorhynchus gorbuscha) in Investigational Report No. 33, 1936, of the United States Bureau of Fisheries. For a simple and sure method of attaching the tag a combination of features is desirable that this site does not possess: First, slight and little variable thickness over a considerable area. Second, hard, bony material. The gill cover, which has had some considerable use

as a tag site, seems to have this combination, but has been reported to lose tags rather quickly. With such a site, it will be feasible to use an instrument in the form of pliers for affixing the tags easily and quickly such as we used formerly in putting monel metal

and aluminium tags on the tails of cod and haddock. Mr. H. R. Bergmann, who lives beside the lake, has suggested the use of pliers such as are employed to affix eyelets to the ends of typewriter ribbons. The tag may be incorporated with the eyelet or merely held on by it. This possibility is being explored.

Only a slight beginning has been made in studying the marking of salmon, which does not present as great difficulty. A lot of 200 yearling salmon was marked by removing with scissors the entire right ventral fin to its base and the outer half of the left ventral fin. These fish were planted half-way up the Rawdon river. They should become smolts next spring (1950) and such as survive should be taken in the smolt traps operated on the river. They will be carefully examined then but the marking was done to determine whether yearlings survive better in the river when planted after the eels which prey upon them, cease to be active.

The tagging records follow.

Summary of Tagging of Salmon, November, 1949

(The tag numbers of 3-yr.-olds listed as planted at Grand Lake Station were not verified. They constitute the balance above those placed elsewhere and the count of those actually planted at Grand Lake Station was 6 short of this balance).

Kind of fish	Tagger	Tag nos.	Where planted
Bedford kelts	White	9,001 to 9,039	At Grand Lake Sta.
3-yr.-old fish	White	9,040,-1,-3,-6,-7,-9	In Fletcher run
		9,042,-4,-5,-8	At Grand Lake Sta.
		9,050,-1,-3,-4,-7,-8	" " " "
		9,052,-5,-6,-9	In Fletcher run
		9,060,-4	" " "
		9,061,-2,-5	At Grand Lake Sta.
	Huntsman	9,063	In Fletcher lock
		9,066,-7	At Grand Lake Sta.
		9,068,-9	In Fletcher run
		9,070,-1,-6,-9	At Grand Lake Sta.
		9,072	In Fletcher lock
		9,073,-4,-5,-7,-8	" " run
		9,081,-5,-6,-7,-8	" " "
		9,080,-2,-3,-4,-9	At Grand Lake Sta.
		9,091,-3,-4,-6	" " " "
		9,090,-2,-5,-7,-8,-9	In Fletcher run
		9,100,-2,-5,-6,-8	" " "
		9,101,-3,-4,-7,-9	At Grand Lake Sta.
		9,111,-2,-3,-4,-5	" " " "
		9,110,-6,-7,-8,-9	In Fletcher run
		9,120,-2,-3,-4,-6	" " "
		9,121,-5,-7,-8,-9	At Grand Lake Sta.
		9,131,-2,-3,-4,-5,-6,-9	In Fletcher run
		9,130,-7,-8	Fletcher run
		9,140,-1,-2,-3,-4,-6,-9	" "
		9,143,-5,-7,-8	At Grand Lake Sta.
		9,150,-1,-3,-4,-5,-6	" " " "
		9,152,-7,-8,-9	In Fletcher run
		9,160,-2,-3,-5,-7,-8,-9	" " "
		9,161,-4,-6	At Grand Lake Sta.
		9,170,-1,-3,-4,-5,-7	" " " "
		9,172,-6,-8,-9	In Fletcher run
		9,188	" " "
		9,180,-1,-2,-3,-5,-6,-7,-9	At Grand Lake Sta.
		9,184	In Fletcher lock
Salmon from Little Rawdon trap	Huntsman	9,190	In Fletcher run

Kind of fish	Tagger	Tag nos.	Where planted
3-yr.-old fish	Huntsman	9,191,-2,-3,-4,-7,-9	In Fletcher run
		9,195,-6,-8	At Grand Lake Sta.
		9,200,-1,-4,-7,-8,-9	" " " "
		9,202,-3,-5,-6	In Fletcher run
	White	9,211,-3,-4,-5,-7,-8,-9	In Fletcher run
	White and Huntsman	9,210,-2,-6	At Grand Lake Sta.
		9,220-2,-4,-5,-6,-8,-9	" " " "
Tag missing		9,221	In Fletcher run "
3-yr.-old fish		9,223,-7	In Fletcher run
	Huntsman	9,231,-5,-6,-7,-9	In Fletcher run
		9,230,-2,-3,-4,-8	At Grand Lake Sta.
		9,241,-3,-4,-7,-8	" " " "
		9,240,-2,-5,-6,-9	In Fletcher run
		9,250,-3,-4,-5,-8,-9	" " "
		9,251,-2,-6,-7	At Grand Lake Sta.
		9,256	In Fletcher lock
		9,262,-4,-5,-6	At Grand Lake Sta.
		9,260,-1,-3	In Fletcher run
		9,267,-8,-9	In deep pond at end
		9,270-9,366	" " " " "
		9,367,-8,-9	At Grand Lake Sta.
		9,370,-2,-4,-5,-6,-7	" " " "
		9,371,-3,-8,-9	In Fletcher run
		9,384,-6	" " "
		9,380,-1,-2,-3,-5,-7, -8,-9	At Grand Lake Sta.
		9,390,-1,-5,-7,-8	" " " "
		9,392,-3,-4,-6,-9	In Fletcher run
		9,400,-1,-4,-8,-9	" " "
		9,402,-3,-5,-6,-7	At Grand Lake Sta.
		9,412,-3,-5,-6,-7,-9	" " " "
		9,410,-1,-4	In Fletcher run
		9,418	In Fletcher lock
		9,420,-1,-2,-4,-6,-9	At Grand Lake Sta.
		9,423,-5,-7,-8	In Fletcher run
		9,431,-2,-5,-8,-9	" " "
		9,430,-3,-4,-7	At Grand Lake Sta.
Tag missing		9,436	
3-yr.-old fish		9,440,-2,-3,-4,-6,-8	In Fletcher run
		9,441,-5,-7,-9	At Grand Lake Sta.
		9,451,-3,-5,-6,-7,-9	" " " "
		9,450,-2,-4,-8	In Fletcher run
		9,464,-8,-9	" " "
		9,460,-1,-2,-3,-5,-6,-7	At Grand Lake Sta.
		9,470,-1,-2,-4,-9	" " " "
		9,473,-5,-6,-7,-8	In Fletcher run

Kind of fish	Tagger	Tag nos.	Where planted
3-yr.-old fish	Huntsman	9,481,-5,-6	In Fletcher run
		9,488,-2,-3,-4,-7,-8,-9	At Grand Lake Sta.
		9,490,-2,-3,-5,-6,-9	" " " "
		9,491,-4,-7,-8	In Fletcher run
		9,501,-7,-8	" " "
		9,500,-2,-3,-4,-5,-6,-9	At Grand Lake Sta.
		9,510,-3,-6,-8,-9	" " " "
		9,511,-2,-4,-5,-7	In Fletcher run
		9,525,-6,-8,-9	" " "
		9,520,-1,-2,-3,-4,-7	At Grand Lake Sta.
		9,531,-2,-3,-4,-6,-8	" " " "
		9,530,-5,-7,-9	In Fletcher run
		9,541,-5,-7	" " "
		9,540,-2,-3,-4,-6,-8,-9	At Grand Lake Sta.
		9,550,-1,-2,-4,-5,-8	" " " "
		9,556,-7,-9,-3	In Fletcher run
		9,561,-4	" " "
		9,560,-2,-3,-5,-6,-7,-8,-9	At Grand Lake Sta.
		9,571,-2,-4,-5,-7,-9	" " " "
		9,570,-3,-6,-8	In Fletcher run
		9,583,-4,-7,-9	" " "
		9,580,-1,-2,-6,-8	At Grand Lake Sta.
		9,585	In Fletcher lock
		9,590,-4,-8	In Fletcher run
		9,591,-2,-3,-5,-6,-7,-9	At Grand Lake Sta.
		9,600,-2,-3,-4,-5,-6,-8,-9	" " " "
		9,601,-7	In Fletcher run
		9,611,-8	" " "
		9,610,-2,-3,-4,-5,-6,-7,-9	At Grand Lake Sta.
		9,620,-1,-3,-6,-7,-8	" " " "
		9,622,-4,-5,-9	In Fletcher run
		9,630	" " "
		9,631,-2	At Grand Lake Sta.
		9,633,-4,-5,-6,-7,-8,-9	In Fletcher lock
		9,640-9,742	" " "
		9,743-9,751	In Fletcher run

Deep pond at end	100
Grand Lake Sta.	276
Fletcher lock	198
Fletcher run	205
	689

Kind of fish	Tagger	Tag nos.	Where planted
"Wild" fish from traps	Huntsman	9801-9827	At Grand Lake Sta.
		9828	Reserved for spawning
		9829-9841	At Grand Lake Sta.
4-yr.-old fish		9842-9853	" " " "
5-yr.-old fish		9854-9861	" " " "