THE RETURN OF SOCKEYE SALMON MARKED AT BABINE AND LAKELSE LAKES

The marking of young migrant salmon by removing certain fins is a well-established practice. The recapture of such individuals may provide information on times and routes of migration; the degree to which fish return to their. "home" streams or "wander" elsewhere; the percentage of young fish which survive to become adults; the percentages which are taken by the fishery or which escape to the spawning grounds.

Fin clipping programmes of this type were initiated by the Pacific Biological Station in 1944 at Babine Lake and in 1945 at Lakelse Lake. Migrant sockeye were captured at the lake outlets by means of seines and traps. Using sharp nail clippers, the marking was accomplished by removing the two ventral fins at Lakelse Lake and the adipose and both ventral fins at Babine Lake. The total number of yearling sockeye marked each year was as follows:

Year	Babine Lake	Lakelse Lake		
1944	24,890			
1945	5,283	5,788		
1946	88,972	100,967		
1947	106,377	100,019		
1948	103,906	4,709		

Since 1946, the time when the first returns were expected, the returning spawners passing through the counting weirs to the spawning grounds at both Babine and Lakelse Lakes have been examined for marked individuals. In addition the commercial landings in the Skeena gill-net area have been examined since 1948. The last large returns are expected in 1951 as fiveyear-old fish from the 1948 markings.

The present report is a review of the experiments to date and indicates the potential extent and significance of the findings. After the 1951 data have been obtained a final report will be prepared.

Extent and distribution of recoveries. The numbers of marked adult sockeye recovered to date from the commercial fishery and from the spawning grounds are as follows:

Sec	Babine	Babine sockeye		Lakelse sockeye	
Year	Commercial fishery	Spawning grounds	Commercial fishery	Spawning grounds	
1946		19 161		and the second	
1948	328	64*	75	9*	
1949	353	319 716	145	142 92	

* The floods of 1948 rendered the counting weirs inoperative causing the recoveries from the spawning grounds to be incomplete.

In all years the sockeye from both Babine Lake and Lakelse Lake were caught over a wide area, from the mouth of the Skeena River to the islands which make up the ocean boundaries of the Skeena gill-net fishery. Some marked fish were found in catches landed from the Nass River, Banks Island and Mink Trap Bay. The capture of Babine and Lakelse fish in these areas is not surprising, as tagging experiments have shown that some of the Skeena River sockeye migrate through these regions. The discovery of a sockeye with Lakelse markings in landings from Smith Inlet in 1948 and of another with Babine markings in landings from Rivers Inlet in 1950 indicates a slight degree of wandering.

Time of return. The return of marked sockeye has demonstrated the time of arrival of the Babine and Lakelse Lake runs in the commercial fishing areas. Sockeye marked at Babine Lake were caught throughout the entire sockeye fishing season but appeared in greatest concentration during the middle and latter part of July when the sockeye fishery has its largest catches. Marked Lakelse sockeye, however, arrived early, the fish being caught in greatest numbers in late June, although some were taken right to the end of the season. Tagging experiments conducted at the mouth of the Skeena River from 1944 to 1948 had indicated that the sockeye migrating to Lakelse Lake were early-running, many of them probably missing the fishery entirely.

Percentage return. Owing to the fact that the sockeye run to the Skeena River is composed of three-, four-, five- and six-year-old fish, it has been necessary to separate mark returns each year into the several age-classes. Some difficulty has been encountered with the recoveries from the spawning grounds because the absorbed condition of the scales makes age determinations difficult. However, the returns have been tentatively allotted to the various age-classes and percentage survivals have been calculated. The number of marked adults returning to Babine Lake constituted from 0.2 to 0.7% of the total number of sea-going migrants marked each year. At Lakelse Lake the returns are lower, ranging from 0.05 to 0.3% of the total number of sea-going migrants marked annually.

Degree of commercial exploitation. The marked returns have given some indication of the percentage exploitation of the Babine and Lakelse runs by the commercial fishery. As the number of marked sockeye in 1949 at both Babine and Lakelse Lakes was nearly the same as the number caught in the commercial fishery, it would appear that both runs received approximately 50% exploitation. In 1950, however, the mark returns indicate that the runs were utilized to a much greater degree. The calculated rates of exploitation were approximately 60 and 75% respectively for Babine and Lakelse sockeye. Exploitation figures cannot be calculated from the mark returns for years prior to 1949 because the returns for those years were not complete.

Pacific Biological Station

K. V. Aro

CREEL CENSUS STUDIES AT LAKELSE LAKE, SKEENA RIVER

Sockeye salmon usually spend one year in fresh water before going to sea. Shortly after their spring emergence from the gravel of the spawning areas they proceed to the adjacent lake which is their nursery area during the summer, fall and winter. The following spring they pass on down-river to the ocean.

During the year's residence in the lake the young sockeye population suffers heavy mortality. At Cultus Lake, on the Fraser River system, Dr. R. E. Foerster found this loss to be as high as 96% and it was suggested that a large part of this loss was due to the activities of predaceous fish, principally squawfish and trout. Further studies by Drs. Foerster and Ricker showed that by control of the predator populations, that is, by reducing them to a low level, a substantial decrease in mortality and hence a greater production of young sockeye could result.

At Lakelse Lake, a sockeye salmon producing area of the lower Skeena River, studies had shown that populations of trout, squawfish and peamouth (chub) were resident and might have an important influence on sockeye production, either as predators or as competitors for food. An important trout fishery exists at Lakelse and therefore it was decided to use the anglers' catches to collect pertinent information on:

- (1) the amount of trout taken from the lake during the angling season;
- (2) the variations in the annual catch from year to year and their possible relation to the lake production as a whole as well as to sockeye production;
- (3) the food (stomach contents) of the trout of various sizes and ages and at various seasons of the year.

With this information available it would be possible to determine the relations of the trout populations to those of young sockeye; also to indicate to what extent the angling effort acted as a good control on the abundance of trout.

As a means of collecting the desired information, a creel census programme was put into operation at Lakelse Lake from May 1st to September 15th, 1950. Fishermen were contacted while fishing on the lake or on the river and the following data collected and recorded: type of bait or lure used, area in which fish were caught, number of fish caught, species, number of hours fished, time of day fished, weather conditions. In order to obtain the co-operation of the anglers and also in order to get a scale sample, size data, and the stomachs of the fish for food analyses, all the fish in each catch examined were cleaned by the operator.

Fishing activity

The accompanying table shows the break-down by month and by fishing locality of the catches of the 428 anglers contacted during the season. Their total catch of 1454 fish included 1245 cutthroat trout, 8 rainbow trout, 32 dolly varden char, 122 squawfish, 20 peamouth or chub, 16 sculpins, 8 Rocky Mountain whitefish and 3 lake shiners. The table also shows the total number of fishing hours expended by the anglers contacted and the average catch per fisherman hour. The catch per unit of effort (the number of fish caught divided by the number of hours fished) was highest in both lake and river during May. The greater availability of fish at this time may have been dependent upon the downstream migrations of sockeye and coho fry into the lake and of sockeye and coho yearlings and pink fry down-river to the sea.

Month		Lake			River		
	Total No. of anglers	No. of fish caught	No. of hours fished	Catch per hour	No. of fish caught	No. of hours fished	Catch per hour
May June	47	85 326	47.0	1.81 1.16	202 157	105.0 113.5	1.92 1.39
July	198	336	277.0	1.21	199	123.0	1.62
August	56	61	43.5	1.40	86	68.5	1.26
September	1	. 2	1.0		×		
Total	428	810	647.0		644	410.0	

During June the catch per unit of effort decreased in both lake and river. This may have been due to the dispersion from the creek mouths and a general distribution throughout the lake and river following completion of the young salmon migrations. It may also have resulted from the inability of the fish to see the artificial fly on the surface of the water because of the turbidity resulting from high lake and river levels during the first three weeks of June.

In July the catch increased again in both lake and river. Most of the fishing was concentrated on the west shore of the lake, probably because of a gathering of the fish in this area to feed upon the large numbers of mayflies present there.

In August the catch per unit of effort increased on the lake and decreased on the river. During this period adult sockeye moved into the tributary streams. This migration may have attracted some of the trout from the river into the lake and caused greater activity among the fish in the lake.

During the first two weeks of September angling decreased to a minimum, only one contact being made in the whole period.

Food studies

From the 739 cutthroat trout sampled, analyses were made of the contents of 47 stomachs, three of which were found to be empty.

During May practically the entire diet of the trout was made up of salmonids. At this time of year it is probable that the trout concentrate around the mouths of the creeks and down the river to feed on migrating salmon fry and yearlings. One stomach contained 15 pink salmon fry. In others the pink fry consumption was so heavy that fry spilled out of the mouths of the trout when sampled. Sockeye and coho fry were found in the stomachs of cutthroat caught near the creek mouths and two sockeye yearlings were taken from the stomach of a trout caught in the river. In June, stomachs contained mainly insects. Large swarms of flying ants were observed on the lake and were also found in abundance in the stomachs. Mayfly nymphs also occurred in large volume.

During July, mayfly adults were the principal food item. Sticklebacks were found in three stomachs and sculpins in one. Salmonid remains occurred in only one stomach of the 20 inspected.

In August a miscellaneous assortment of organisms was found in the 5 stomachs containing food. One mouse, 9 sticklebacks, fish eggs and fish remains were noted. Only a small volume of insects was observed.

The initial creel census operations and collection of data were reasonably successful during 1950. Much useful information was obtained. Much of the success is due to the good co-operation of the anglers from Terrace and elsewhere and the author wishes to express his grateful thanks to them for their interest and contributions.

Pacific Biological Station

T. H. Bilton

Oceanographic Study of the Northern British Columbia Inlets

During the summer, a party of scientists from the Institute of Oceanography of the University of British Columbia and the Pacific Biological Station will study the inlets of the B. C. coast from Bute Inlet northward to Portland Canal. The main emphasis of the work will be on the temperature, salinity and current conditions existing in the inlets. In conjunction with the oceanographic work, the distribution of the plankton animals, important as fish food, will be studied. Hauls with a small otter trawl and dredge will provide information on the numbers and kinds of bottom fish and invertebrates present.

The party, consisting of five scientists, will be headed by Dr. G. L. Pickard of the University of British Columbia ,and will leave Vancouver on the C.N.A.V. *Ehkoli* in the middle of May, returning about the beginning of August.