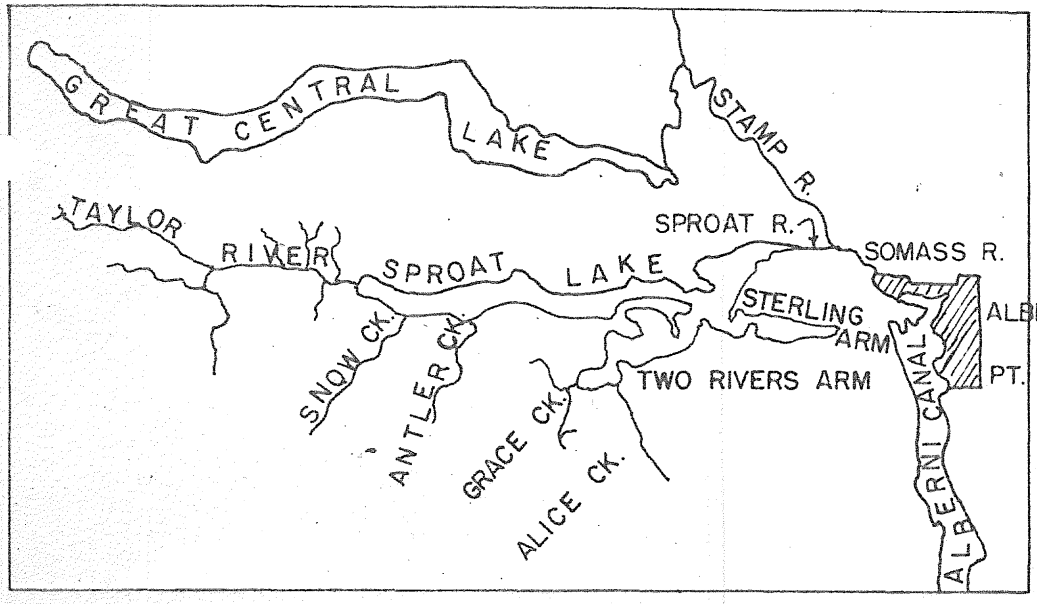
SPROAT FALLS REPORT

1950

APRIL, 1951

SPROAT FALLS TAGGING PROGRAM

APRIL, 1951



DRAWN:	DEPARTMENT OF FISHERIES, CANADA	DATE:
CHECK:	LOCATION MAP OF SPROAT LAKE	SCALE:
APPROVED:		DWG. No.

FIG. 1

INTRODUCTION.

The existence of an obstruction to migrant salmon may be realized by periodic or daily observations. However the actual seriousness of such an obstruction cannot be determined without a thorough investigation of the existing situation.

This was the case at Sproat falls on the Somass river system. The obstruction had been observed by several "generations" of Departmental Officers. Frequent recommendations for remedial measures had been submitted, however circumstances had never permitted the installation of facilites for assisting the fish over the obstacle. With the knowledge of the existence of a major obstruction a tagging program was undertaken in 1950 to investigate the seriousness of the delay to the migrant salmon.

GEOGRAPHIC LOCATION.

Barkley Sound is centrally located on Vancouver Island's west coast (Fig 1.). The innermost section of the "sound" is known locally as the Alberni Canal and from the head of this canal the Alberni Valley runs in a north-westerly direction. The valley and the surrounding mountains are drained by a complex fluvial system which is divided into two principal parts. The northerly Stamp and the more southerly Sproat. These two systems unite five miles above the river's point of entry into the head of the Alberni Canal to form the Somass river.

Great Central and Sproat lakes are the main reservoirs for these two watersheds of the Somass drainage (Fig. 1). Both systems support valuable salmon runs which spawn in the many

accessible streams of this vast area. With the exception of the pink salmon, spawning stocks of all species are represented in the Somass and its tributaries.

HISTORY OF THE OBSTRUCTION.

The species attempting to reach the upper tributary streams, viz: coho, sockeye, spring and steelhead, frequently encounter obstructions, the seriousness of which varies with the conditions of the river.

Prior to the installation of a fishway at Stamp falls in 1928 the salmon runs to that system were seriously depleted. At proper river levels the salmon runs now have little difficulty in passing over these falls.

A similar situation exists on the Sproat river where a series of falls, lying a short distance below the outlet of the lake, have long been recognized as a major obstruction to migrating salmon. As early as 1903 a channel was cut through the middle of the cascade in an effort to assist the upstream migration of the spawning runs. A description of this cut appears in a report presented by the Departmental Engineer, Mr. McHugh, in 1934 who stated that this passage did more harm than good since it formed a chute of fast water with hazardous cross currents at the upper end. At that time recommendations were made to install a fishway that would be operative over a limited range of water levels. The recommendations were put to one side due to limited funds for construction work available at that time. Mr. McHugh's report was followed by numerous other requests for improvement of the conditions for salmon migrants at Sproat falls.

COMMERCIAL FISHERY

The salmon fishery of Vancouver Island's west coast is rivaled in importance only by the lumbering industry. A large portion of the successful salmon fishing is centered in and around Barkley Sound. Trolling, seining and gillnet fishing are all practiced, the former is carried on in "open waters" in contrast with the latter methods which take place in the more sheltered "in shore waters".

The numbers of sockeye, coho and spring salmon caught from 1930 to 1950 are presented in Table I. The catch figures include fish from all the district streams as well as transient fish landed in the Barkley Sound area. The sockeye totals give a more representative picture of the Barkley Sound returns than the other species since they are all net-caught fish and are therefore captured in the vicinity of their "home streams". A large percentage of the sockeye catch are Somass river fish since it is the major producer of this species in the area.

The escapement of the major species to the Somass watershed are presented in Table II. These figures were obtained from the annual spawning reports of the district Fishery Officer. Approximately half of these estimated Somass fish pass up the Sproat river to Sproat lake.

It can be seen from these figures of escapement that extremely valuable runs spawn in the upper tributary streams of the Somass system. Every effort should be made to assist these salmon runs in arriving at the spawning grounds in the best possible condition since obstructions delaying these fish will lower their degree of productivity and consequently reduce the future runs.

TABLE I

CATCHES OF SOCKEYE, COHO AND SPRING SALMON IN THE BARKLEY SOUND AREA FOR THE YEARS 1930 to 1950

YEAR	SOCKEYE	COHO	SPRING
1930	58,600		
1931	59,260		
1932	105,000		
1933	80,500		
1934	81,500		89,500
1935	71,020	201,900	85,400
1936	94,580		
1937	61,000	82,700	96,500
1938	47,300	91,100	67,500
1939	51,000	172,800	81,900
1940	26,580	192,500	64,500
1941	25,000	212,200	67,200
1942	29,200	78,200	47,900
1943	38,860	97,500	63,100
1944	14,600	126,200	70,500
1945	11,800	264,000	61,300
1946	13,980	68,900	98,500
1947	5,440	140,900	106,000
1948	9,560	95,700	75,700
1949	35,720	96,600	108,100
1950	55,190		

NOTE: Coho average 9#. Spring average 19#. Figures used in reducing pounds of fish to numbers of fish.

Reduced catches during the war years is partially due to a reduction in the fishing effort.

TABLE II

ESTIMATED ESCAPEMENTS OF SOCKEYE, COHO AND SPRING SALMON TO THE SOMASS RIVER SYSTEM - 1940-1949

YEAR	SOCKEYE	COHO	SPRING
1940	5-10,000	20-50,000	2-5,000
1941	20-50,000	20-50,000	5-10,000
1942	20-50,000	10-20,000	5-10,000
1943	10-20,000	5-10,000	5-10,000
1944	5-10,000	20-50,000	2-5,000
1945	90,000	20-50,000	5-10,000
1946	20-50,000	10-20,000	5-10,000
1947	50-100,000	20-50,000	2-5,000
1948	150,000	40,000	5-10,000
1949	200,000	10-20,000	5-10,000

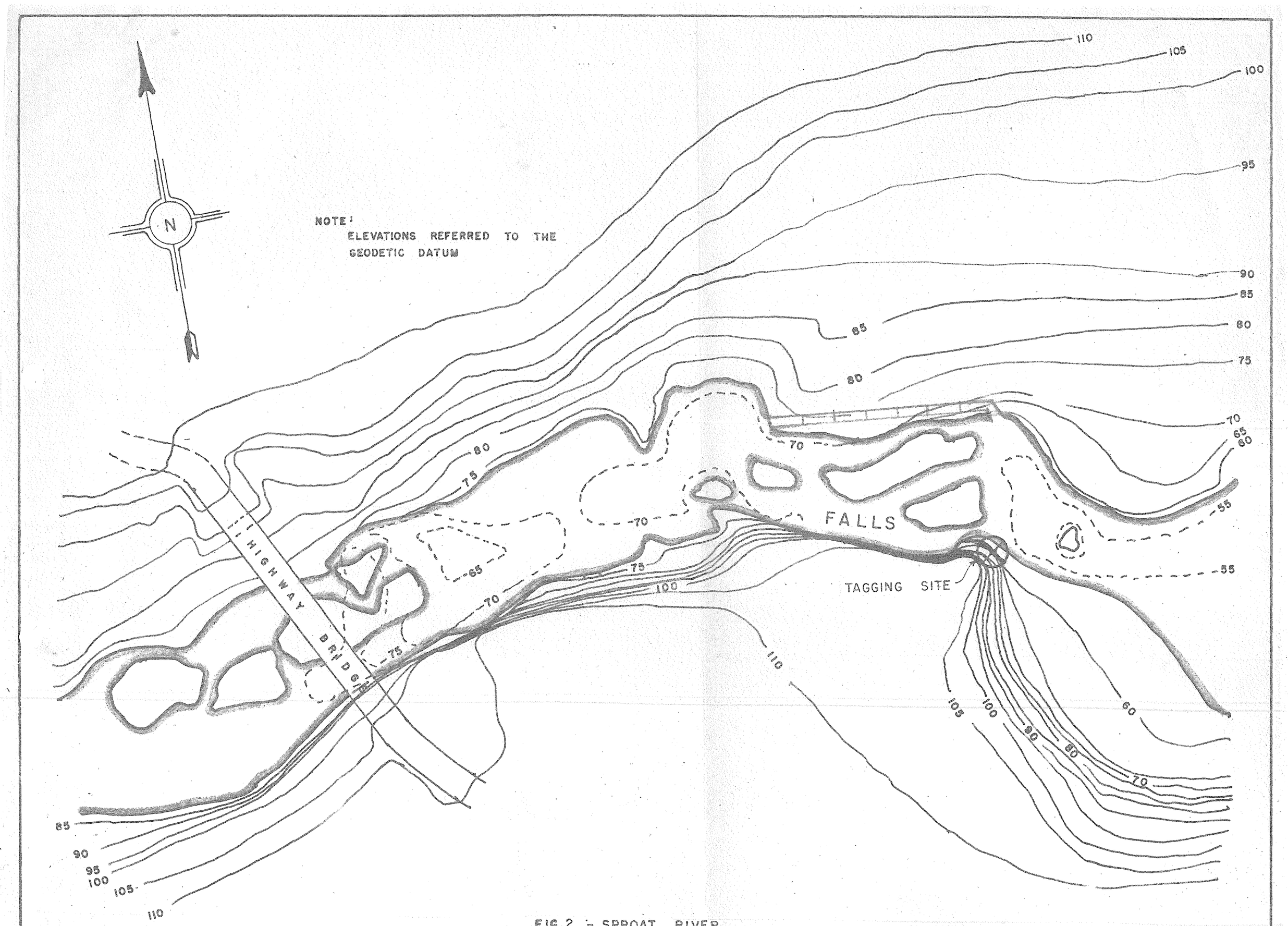


FIG.2 - SPROAT RIVER

Scale - 1 inch = 60 feet

BIOLOGICAL PROGRAM

A biological study of the seriousness of the obstacle created by Sproat falls was undertaken by the Fish Culture Development Branch of the Department of Fisheries during the summer and fall of 1950. The program consisted of the following:

1. Tagging.
2. River temperatures.
3. Water levels.
4. Spawning area surveys.

1. Tagging:

A two man tagging crew was located at Sproat falls from the middle of May till the early part of September. During the first weeks of the investigation, before the sockeye were present in large numbers, a survey of the falls was made in order to locate a satisfactory site for netting and tagging. The most satisfactory dip-netting site was found to be a "white water" pool on the right bank directly below the main fall (Fig.2).

Daily netting, using Indian-type dip-nets, was practised to determine when the sockeye run was at the falls in sufficiently large numbers, in order that tagging operations could be commenced at the earliest possible date. A good concentration of fish were present by the early part of June at which time tagging was begun.

FIG. 3 - WATER LEVEL READINGS 1949-50, TEMPERATURE READINGS 1950 AND THE DURATION OF SOCKEYE RUN AT SPROAT FALLS 1950.

After a fish had been successfully trapped in the net it was removed and placed in a "tagging box" and tagged (see photo). Petersen type tags were used in this program. These consist of a pair of small (13.5mm diameter), white celluloid discs one of which is numbered for recording purposes. The two discs are attached to the back of the fish, one on either side below the dorsal fin, by means of a non-corrosive nickel pin. After the fish had been tagged and sampled it was immediately released into a quiet pool in the river. Sampling consists of collecting scales for age determination, obtaining the length, sex, condition, and degree of sexual maturity. The complete operation takes an experienced two man tagging crew 20 seconds.

Tagging was carried on whenever possible from early June till the latter part of July when the run was in progress (Fig. 3). Operations were discontinued during week ends when work was encumbered by large numbers of tourists and during the construction and operation of an air lift by Departmental Officers to aid the fish in getting over the falls. During this latter period the assistance of the taggers was required in the capture of the fish which were being passed up over the falls on the "lift".

2. River Temperatures.

Throughout the summer daily water temperatures were taken in the river just above the falls by means of a Taylor maximum-minimum thermometer. This thermometer was checked periodically for accuracy.

3. Water Levels.

A daily record was kept of the water levels above and below the falls. Gauges were set at fixed points, the elevations of which had previously been determined by an engineering survey party.

4. Spawning Area Surveys.

Frequent trips were made up the lake to various tributary streams and to shore line areas which were reportedly the most heavily spawned. During these surveys of the spawning areas, temperatures and photographs were taken, fry samples were collected and general observations were made of the nature of the streams. Any obstructions to the passage of fish were also recorded and recommendations for clearance of these were submitted.

The following major streams, shore line areas, and several of the lesser creeks were examined:

1. Taylor river.)
2. Snow creek.) Taylor arm streams.
3. Antler creek.)
4. Grace creek.)
5. Alice creek.) Two Rivers arm streams.
6. Shore line area of Sterling arm.

RESULTS

1. Tagging.

The field party tagged and sampled 1357 sockeye (Table III.) during June and the early part of July when the majority of the run was at the falls. Of these tagged fish 86 were recovered either in the lower river by the Indian fishery, on the shores of Sproat lake, at the falls by the tagging party, or out in the "canal" by the commercial fishermen. Reports indicated that a large number of recovered tags were not returned by the commercial fishermen since no reward was offered. Of the 86 recovered tags only 43 were included in the graphical presentation of the results (Fig. 4) since the other recoveries lacked the complete information.

The tagging crew had originally planned to recapture the tagged fish above the falls. Unfortunately the river at this point lacked a suitable netting site at which recoveries could be made. Once a fish was successful in passing over the falls it entered a large, deep pool below the exit of the lake. The only recoveries made at the falls were those recaptured by the crew while netting fish for tagging. The numbers of fish tagged and recovered during the run are recorded in Table III.

2. River Temperatures.

The water temperature rose steadily throughout the period the sockeye run was in progress. The temperature curve for the summer months of 1950 is presented in Fig III.

3. Water Levels

The water levels during the summer of 1950 were extremely high particularly during the period of the upstream migration of the sockeye run. The relatively high water levels throughout June and July of 1950 are illustrated in Fig. III and compared with the levels for the same period of 1949. The continued high run off during 1950 resulted from the abnormally heavy winter snows and the late hot spring.

4. Spawning Area Surveys.

Taylor river was visited several times during the summer, fall and winter. This appears to be an extremely good stream with numerous gravel bars, riffles and deep resting pools in the lower section. Snow fields in the surrounding mountains provide an adequate flow of water throughout the dry season. The mouth of the Taylor river breaks up into a maze of sloughs and side channels in which the flow is comparatively slow, however the bottom is composed of gravel ideal for spawning. According to annual spawning reports, the majority of sockeye that migrate to the head of the lake spawn in this area.

The water temperatures ranged from 37°F in May to 50°F in August and back down to 38°F by mid November. There was never any indication of turbidity or silting in the river, even when the river was in flood during early November.

Snow and Antler creeks are small streams that flow into Taylor arm and are not recognized sockeye spawning streams, however they support numerous coho spawners. These creeks are characterized by a short flat stretch of good gravel beyond which lies a rapidly rising section which is unsuitable for spawning.

Alice and Grace creeks, located on Two Rivers arm, are both relatively small streams with several miles of ideal spawning area. At the time they were visited during the summer, the mouths of both had dried up due to low water conditions. This factor is not serious since both streams are utilised only by coho which do not spawn till the late fall when the water levels have risen sufficiently to enable fish unobstructed entry to the streams.

The shore line area, which reportedly supports the majority of the Sproat lake sockeye run, lies on the southern shore of Sterling arm. The bottom slopes off gradually from the shore line and is composed of small clean gravel. Similar shore line characteristics are common on Sproat lake. The attraction to spawning in this area likely exists in the probable presence of springs in the gravel since it is at the foot of steep wooded slopes.

DISCUSSION

1. Tagging.

The data used in preparing the graph illustrating the tagged fish recoveries (Fig 4) were obtained from recaptures made at the falls plus some tags obtained from the Indian fishery in the lower river. The recoveries from the commercial fishery were not included since exact dates of capture were not submitted with the tags. The 43 tag returns which make up the graph illustrate quite clearly the fact that a delay existed throughout the duration of the run.

Each horizontal line in the graph (Fig. 4) represents a recovered, tagged fish. The left end of the line indicates the date on which the fish was tagged and released where as the right end of the line indicates the date on which the fish was recovered. The length of the line therefore represents the period that the fish was delayed before being recovered.

The tagged fish should represent a typical cross-section of the total sockeye run in the Sproat river since the fish were randomly netted from a pool in which they were not visible, due to the extreme turbulance of the water. Assuming that this is a random sample of the total population it would be expected that the total run and the tagged group would be affected similarly by the falls. The graph (Fig. 4) illustrates that 67% of the recovered, tagged fish were detained from 10 to 31 days and of this group 68% were delayed two week or more. It is evident from this that 67% (2/3) of the total Sproat lake sockeye run could have been delayed for ten days or more. One tagged fish remained below the

falls when the coho were ascending in the middle of September approximately three and a half months from the time the run entered the river.

It is unlikely that fish remaining in the river for such long periods periodically battling the falls, would have much success in reaching the spawning area in satisfactory spawning condition. By the end of August these fish were bright red and the males had developed the noticeable humped backs and large protruding teeth characteristic of sexually mature sockeye.

2. Water Levels

The water levels for 1949 and 1950 are plotted on one graph (Fig.3) to illustrate the difference in levels for the two years during the migration period. The 1950 water levels, although constant, were abnormally high for the duration of the sockeye run.

The temporary delay which normally exists at Sproat falls results from low water. The high water of 1950 caused a more serious delay than had been reported in previous years. The continued unsuccessful attempts of the migrant salmon to ascend the falls resulted in an accumulation of dead fish in the lower pool, described below.

Proof of the existence of a block is illustrated by the graphic presentation in Fig.4 described above. Assuming that a lower and presumably more passable water level had occured during the time of the run an entirely different picture would have prevailed. The occurence of a passable level would have

caused a temporary shortening or absence of horizontal lines on the graph indicating successful passage over the obstruction.

3. River Temperatures.

The mean daily temperatures for the summer of 1950 are plotted in Fig.3. The existence of unfavorable water temperatures during the migration period are illustrated in this graph by the inclusion of the approximate duration and abundance of the sockeye run. Temperatures ranged between 55°F and 70°F during the time of migration in the Sproat river. Salmon research scientists maintain that optimum water temperatures for spawning and prespawning sockeye range from 45°F to 55°F. Assuming that the characteristics of the Sproat "race" of sockeye are not too remote from those under observation, temperatures of 55°F to 70°F could easily have been partially responsible for the resulting mortality.

The accumulation of dead fish in the pool at the foot of the lower falls had become quite noticeable during the latter part of the run. Twenty-seven carcasses were counted in this pool on June 27. Dead and seriously weakened fish also appeared in the Indian fishery in the lower river. Some were tagged, consequently tagging was immediately blamed for the mortality by the Indians. However, during the latter part of the run, when comparatively few tagged fish remained in the river, dead and mutilated untagged fish continued appearing in the Indians' net. Reports were also received

from residents on the lake of the considerable number of dead sockeye that were being washed up on the lake shore. Tags from three of these fish were received by mail. Numerous carcasses were discovered by members of the tagging crew all of which were unspawned. On July 10 fifteen carcasses were counted on a few miles of lake shore near the river's point of exit.

The majority of these carcasses lacked any serious scars that could be considered fatal. It is therefore felt that the cause of death in most cases was due either directly or indirectly to the considerable time the fish were exposed to the unfavorably high water temperatures. The continued activity of the salmon migrants at the falls may have required greater amounts of oxygen than were present.

The fish that survived the passage up the river apparently became adapted to the abnormally high temperature which existed in the river at this time. The sudden change in temperature these fish encountered when they entered the lake and moved to the "deeps" could have been severe enough to cause death through shock.

4. Spawning Area Surveys.

From the observations made of the various reported sockeye spawning areas, it would seem that there are two groups of spawners. During an early summer trip to Taylor river in June several sockeye were present in the river and off the mouth. In August only a few ragged specimens remained in the river, indicating the existance of an early summer spawning.

Several visits were made during early September to check the river for spawning sockeye, however there was no indication of spawning fish at this time. During early November substantial numbers of spawning and spawned out sockeye were present in the sloughs indicating a reasonably good seeding of that area. A later trip was made in the middle of November, but by this time the sockeye spawning had been completed and the coho were moving into the river in appreciable numbers.

Coho were also observed in and off the mouths of Antler and Snow creeks during mid November. Good numbers of coho were reported in Grace and Alice creeks during early November by the Department Officers.

No sockeye were observed on the Sterling arm shoreline spawning area. Unfortunately it was impossible to visit this area during October which appears to be the peak of the sockeye spawning season.

CONCLUSION.

Considering the difficulty encountered by migrant salmon at Sproat falls it is recommended that consideration be given to provide facilities for less difficult passage over the falls. This would tend to reduce the mortality now present in the spawning run as well as increase their productivety by enabling them a comparatively simple ascent to the lake.

The above mentioned facilities would provide the fish with comparatively unobstructed passage to their spawning areas. The advantages arising from this would be as follows:

1. Assurance of better physical and physiological condition of the fish by:-

-less bruising and mutilation at present caused by persistent attempts to ascend the falls.

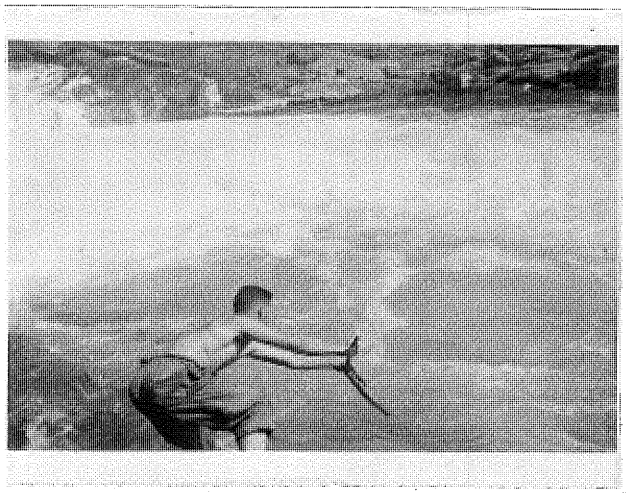
-a shorter time in the warm water of Sproat river. This would reduce the possibility of the fish becoming adapted to high temperatures before returning to lower lake temperatures.

2. Assurance that a greater number of salmon will be successful in reaching the spawning grounds by:-

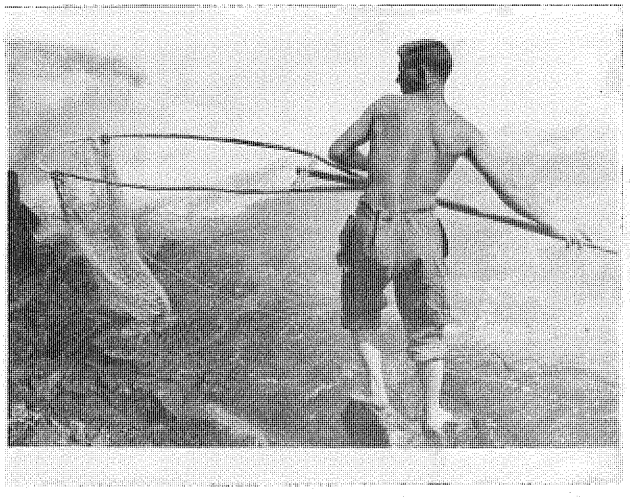
-a reduction of the present mortality in weaker fish which are unable to ascend the falls when difficult water levels prevail.

3. Reduce the number of fish obtained by poachers:-

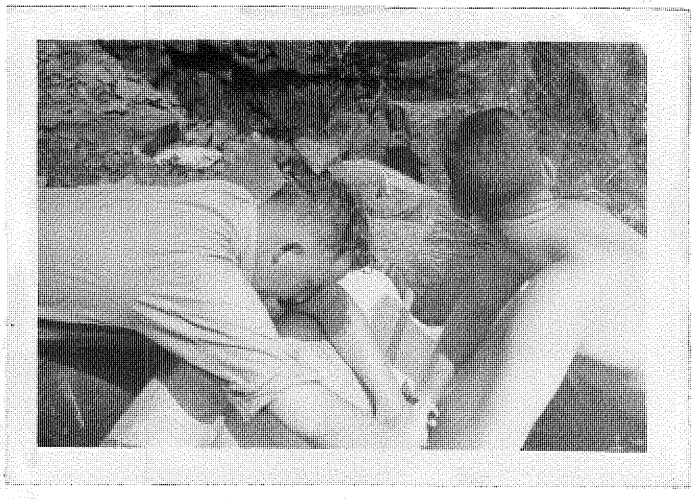
-as the fish will move more directly past the obstruction to the lake therefore reducing the time they are exposed to human predation.



Fishing in pools below falls
June 15 - 1950



"The Catch" - June 15, 1950



Tagging sockeye - June 15, 1950

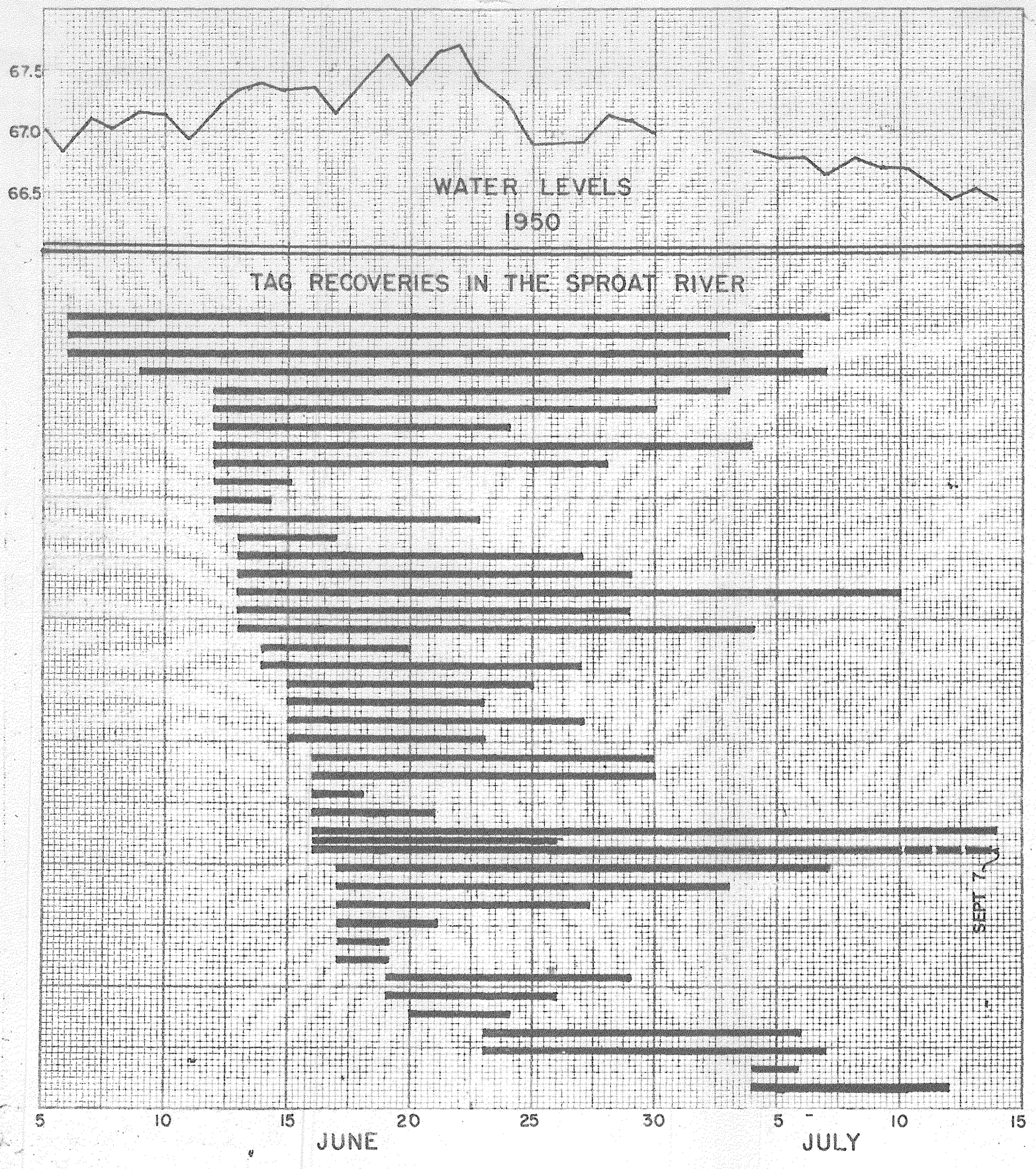


FIG.4 - TAG RECOVERIES AT TAGGING STATION SPROAT RIVER COMPARED WITH WATER LEVELS, 1950. EACH RECOVERY REPRESENTED BY A LINE. LENGTH OF LINE SHOWS NUMBER OF DAYS BETWEEN TAGGING AND RECOVERY.