RADIO-TELEMETRY STUDIES OF SUMMER RUN STEELHEAD TROUT IN THE SKEENA RIVER, 1978, WITH PARTICULAR REFERENCE TO EQUIPMENT AND CAPTURE METHODS

BY

M.J. LOUGH

BRITISH COLUMBIA FISH & WILDLIFE BRANCH
SMITHERS, B.C.

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INTRODUCTION

Skeena River steelhead trout (*Salmo gairdneri* Richardson) are subject to intense commercial fishing pressure as a result of the sockeye and pink salmon gillnet fishery in Area 4; the Skeena River (Fig. 1). Although incidental to the salmon target species, it was estimated that 10,000 (± 1,000) steelhead were harvested in the 1977 Skeena River gillnet fishery (Oguss and Evans, 1978).

Present information (Chudyk and Narver, M.S. 1976) indicates that discrete stocks of steelhead move separately through the commercial fishery with the resulting harvest pressure. In order to effectively manage Skeena steelhead, it is important that these stocks be identified. This information can be obtained by several different methods. Nose tagging juvenile steelhead or perhaps stock specific electrophoretic analysis are only some of the available options, but these methods require several years before results can be realized. The method which seemed to offer the most immediate results was radio-tagging studies. In the summer of 1978, such a study was implemented by the B.C. Fish and Wildlife Branch. The primary objective was to identify the specific stocks of steelhead as they enter the Skeena and determine their rate of movement within the Skeena River drainage. Methods of live-capturing fish in large rivers were also evaluated.

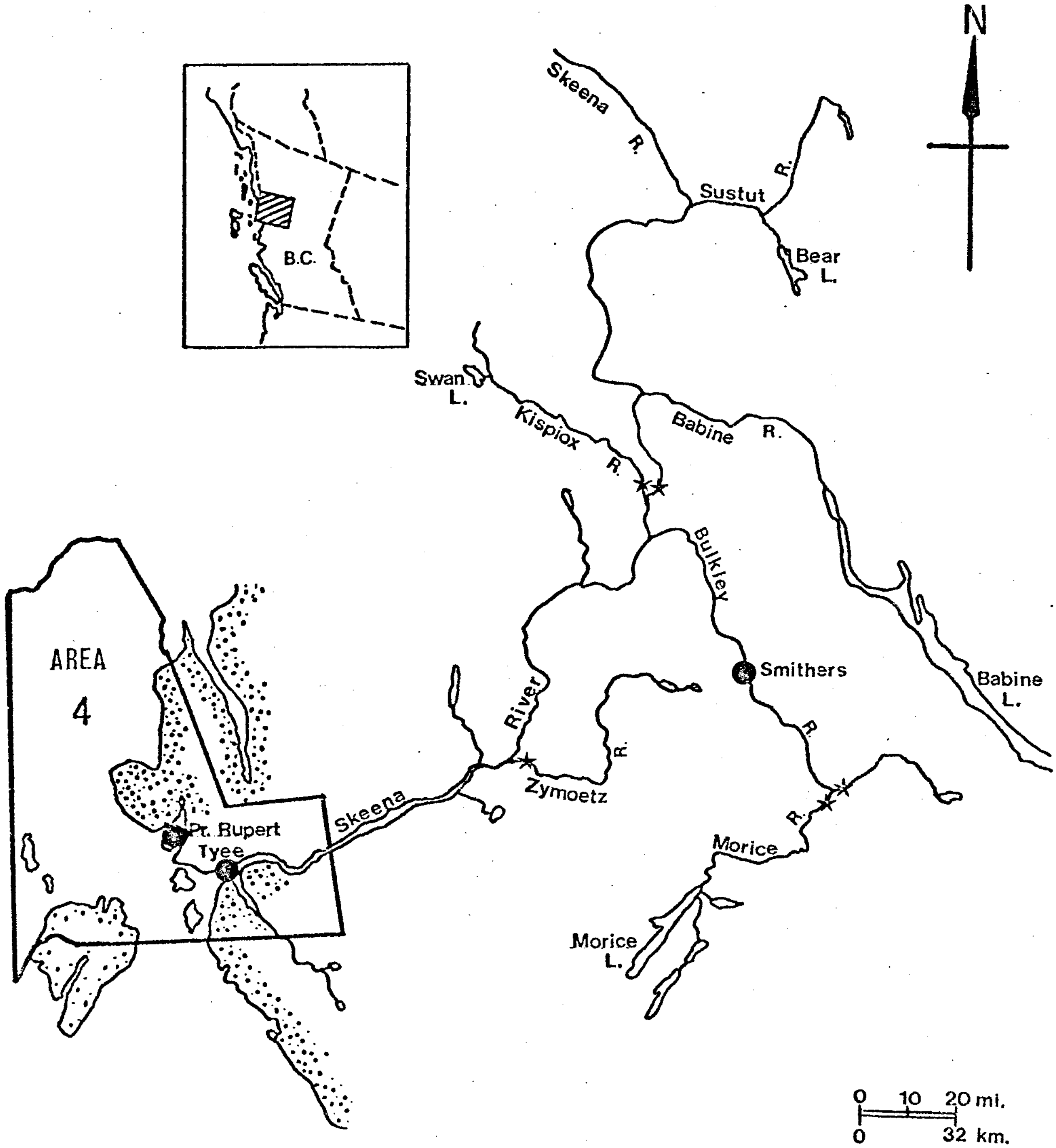


Fig. 1. The Skeena River drainage showing federal fisheries area 4. Stars indicate location of scanning stations.

MATERIALS AND METHODS

TELEMETRY EQUIPMENT

The frequency of telemetry equipment used in this study was 151 megahertz. The radio tags and receivers were purchased from Wildlife Materials Inc. (R.R. 2, Carbondale, Ill.).

Radio Tags

The radio tag is a two stage subminiature transmitter powered by a 1200 milliamp hour lithium battery. It emits a pulsing signal at a rate which is set between 30 and 60 pulses per minute. The expected life of these transmitters is about 200 days. The tag is cylindrical in shape, about 5.75 cm long and 1.8 cm in diameter, with an average weight of 25 g. It is supplied as a completely self—contained unit encapsulated in several layers of dental acrylic, which waterproofs the unit. Removal of a small external magnet activates the tag, which is designed to be administered internally.

Stationary Scanners

The stationary scanner is designed to be installed at the mouth of a stream to detect radio-tagged fish as they enter. It is pre-set to scan the entire 100 Kilohertz range which covers the five frequencies of tags being used.

The centres of the various frequencies are spaced about 20 KHz apart in order to increase discrimination. The scanner unit is connected to a command-print Model 288 Rustrak recorder (Gulton Industries, Rhode Is.) which prints out the frequency on a time calibrated strip chart. The entire system is linked to a three element yagi antenna (9 decibel gain) and is powered by a 12-volt snowmobile battery. The station must be located on the stream so that it covers a shallow riffle. This ensures that the fish is in shallow water as it passes, producing a strong, clear signal.

Scanners were located 123 km above the commercial fishing boundary at Tyee (on the Zymoetz River), 243 km above Tyee (on the Kispiox River) and 357 km above Tyee (on the Morice River). In addition, scanners were placed on the Skeena River upstream of the Kispiox River confluence (247 km above Tyee) and the Bulkley River upstream of the Morice River confluence (360 km above tyee) (Fig. 1).

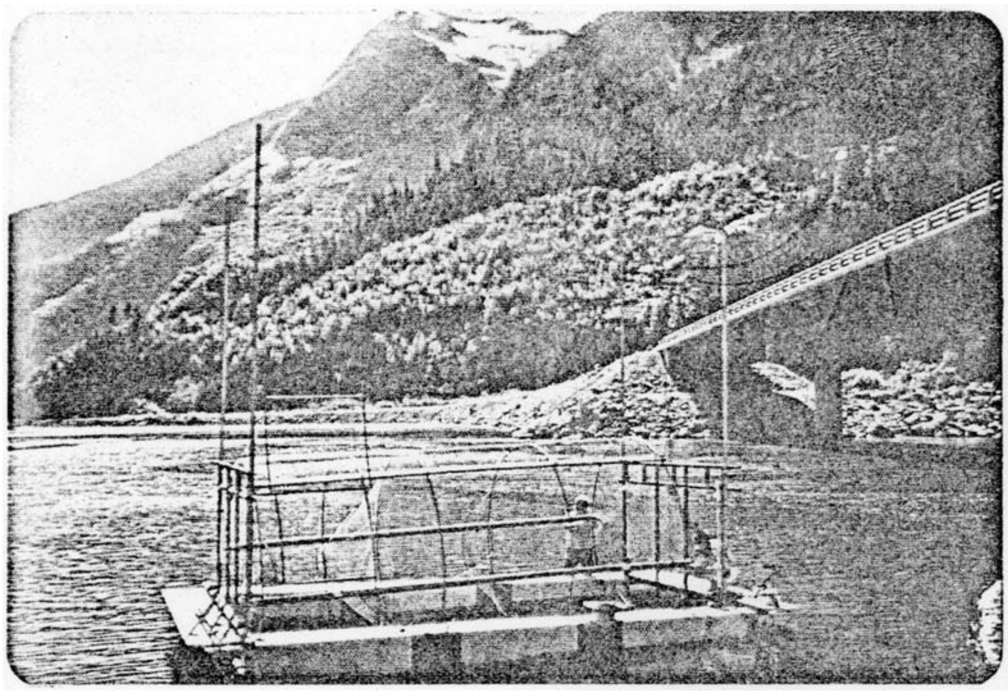
LIVE CAPTURE

California Fyke Trap

A large, wire mesh fish trap was tested which was patterned after traps formerly used by commercial fishermen on the Sacramento River. It is cylindrical in shape, about 6.0 m long and 3.1 m in diameter. Basically, it consists of a pair of wire mesh funnels that point upstream. Fish moving upstream pass through these funnels and are contained in a chamber at the end of the cylinder. Trap construction and operation are described in detail by Hallock (1957).
Several modifications were required to make the trap useable in the Skeena River. A raft assembly was used which allowed the trap to be

lifted from the water and transported anywhere on the river (Fig. 2).

Fig. 2. California fyke trap on the Skeena River. Once in position, the float is anchored and the trap is lowered by winch.



Gillnets

An 8.9 cm (3.5 inch) stretched mesh monofilament gillnet was tested in the hopes of avoiding injury to the steelhead by entagling them by their jaws and fins. This net was used as either a set net with one end secured on shore, or as a drift net with the net suspended between two skiffs while drifting with the current.

Beach Seining

A 100 m seine net was used to beach seine some sections of the Skeena River. The net was laid with a skiff and retrieved by hand.

Angling

An angling crew intensively fished some of the areas on the lower Skeena that were known to be productive for sports fishermen. We found that due to turbid water conditions ‘bar fishing’ was the only productive technique. A combination of lures and roe on sport gear was generally found to be the most successful.

RADIO TAGGING PROCEDURE

The tagging procedure used was fast and relatively simple. The steelhead was first immobilized with 2-phenoxyethanol or exhausted by playing on hook and line. The radio tag was pushed down the throat of the fish as far as possible with a finger (Fig. 3). A stainless steel rod was used to set the tag down into the stomach. After tagging, the fish was held in a recovery tube to ensure that it was healthy at release.

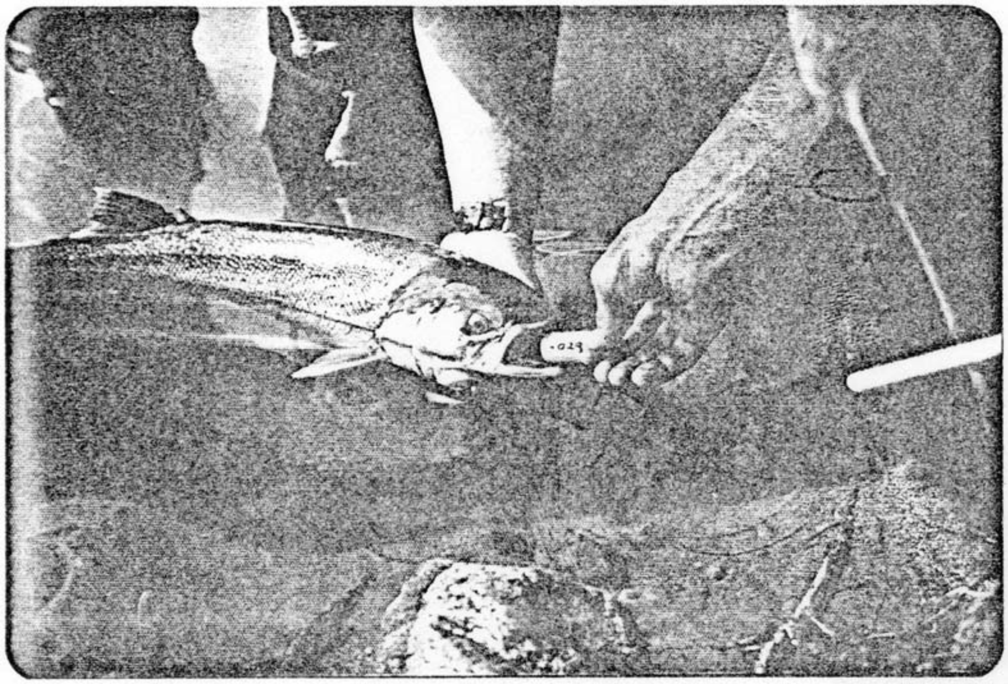


Fig. 3 Radio—tagging a Skeena River steelhead. Transmitter is inserted by hand, and eased into stomach with a stainless steel rod.

RESULTS

LIVE CAPTURE

California Fyke Trap

The trap was operated continuously between July 8/78 and July 26/78. We concentrated the six trap sites about 44 km upstream of Tyee, at a point where the Skeena is restricted to a single channel.

In 406 trap hours, 128 fish were trapped. More Dolly Varden (67) were trapped than any other species, with cutthroat trout (24) ranking second. No steelhead were captured (Table 1).

Gillnets

We tested a set net along the edge of a back eddy, about 44 km above Tyee. An initial trial set was left overnight and produced two dead steelhead. One of these fish was held by the gills, with the other entangled only by its jaw but because the net was unattended, it was dead. The net was watched continuously for the remainder of the sets, and one steelhead was caught without injury. The mesh however, was gilling smaller coho jacks and chinook jacks and it became difficult to keep the net clear. Approximately 100 smaller salmon (mostly jacks) were killed in order to live capture one steelhead (Table 2).

We used a drift net to fish the faster current of the main channel. Mortality of the netted fish was lower and 22 sockeye salmon were caught. No steelhead were caught in drift nets (Table 2).

Table 1. Trapping duration and numbers of each species caught at various trap sites with California Fyke Trap (Total 128 fish in 406 trap hours).

	Trapping Hours	Steelhead	Dolly Varden	Cutthroat	Whitefish	Sockeye	Chinook	Rainbow	Sucker	Pink
Trap Site #1	91	0	17	2	9	1	0	0	1	0
#2	48	0	0	0	0	4	0	0	0	0
#3	90	0	9	0	2	2	1	0	0	0
#4	78	0	13	1	4	1	0	1	0	0
#5	72	0	26	21	1	4	1	0	1	1
#6	40	0	2	0	3	0	0	0	0	0
Totals	406	0	67	24	19	12	2	1	2	1

Table 2. Summary of set and drift gillnet results in the lower Skeena River, 1978.

	Hours netted (approx.)	St.	Pk.	So.	Co.	Jacks of Various spp.
Set gillnet	18	3	19	3	3	100 (approx.)
Drift gillnet	10	0	4	22	0	20 (approx.)

Beach Seining

Although we were able to capture salmon of various species with a beach seine, no steelhead were caught (Table 3). A total of 209 salmon were seined, of which 190 were pink salmon.

Table 3. Summary of beach seining results on the lower Skeena River August 10, 1978 August 15, 1978.

	Number	Species
	190	Pink
	12	Coho
	6	Sockeye
	1	Chinook
Total	209	

Angling

In the seven days between July 30, 1978 and August 5, 1978, our crew was able to catch a total of 90 fish by angling. Twenty-four of these were fatally hooked, but the remaining 66 fish were captured without injury.

A total of 20 steelhead were caught of which 12 were uninjured (Table 4). Only six of these were large enough to radio tag. These fish were released at their point of capture to continue their upstream migration.

Table 4. Summary of lower Skeena angling results for the period July 30, 1978 August 5, 1978. (Total 90 fish in seven days).

	Steelhead	Chinook	Coho
Number of fish angled without injury	12	46	8
Number of fish fatally hooked while angling	8	13	3
TOTALS	20	59	11

MOVEMENTS OF RADIO TAGGED FISH

A total of seven steelhead were radio-tagged between July 30, 1978 and August 18, 1978. During the first week in October, one of these fish was caught in an Indian gillnet at Kisgegas, on the Babine River. This fish was tagged at Kwinitsa, on the lower Skeena River on August 5, 1978 which indicates that it travelled 258 km upstream at an average rate of 4 km/day. This must be considered a minimum rate since the fish could possibly have arrived at Kisgegas well before it was caught. This fish did not move past the stationary scanner at 247 km before August 25, 1978.

Due to service logistics and expense however, this station was not operated past that date because the few tagged fish did not seem to warrant such effort. Since this fish did not pass the scanner within 20 days of tagging, it seems the average distance travelled per day did not exceed 11 km.

A second fish was caught on the Babine River near Babine Lake on March 11, 1979. This fish was tagged on the Skeena River, 96 km upstream of Tyee on August 1, 1978 and therefore moved 368 km upstream. A third radio tagged steelhead was found on the Babine River at Kisgegas on March 19, 1979. Since only the frequency of the radio-tag was determined, it was not possible to individually identify this steelhead. We know only that this fish was tagged on the Skeena River 96 km upstream of Tyee, between July 30, 1978 and August 18, 1978 and hence travelled upstream 291 km.

Another radio-tagged fish was picked up by the stationary scanner on August 18, 1978 as it entered the Zymoetz River. Once again, we were not able to individually identify this steelhead. We know only that this fish was tagged on the Skeena River 96 km upstream of Tyee, between July 30, 1978 and August 2, 1978 and hence travelled 28 km. The average distance travelled per day was therefore between 1.4 km and 1.8 km/day.

The remaining 3 radio tagged fish were not found after release.

DISCUSSION & CONCLUSIONS

Seven steelhead were radio tagged on the lower Skeena River. Three of the four fish later found were in the Babine River, and the fourth was in the Zymoetz River. This adds to the evidence indicating that individual stocks of Upper Skeena steelhead move through the peak of the commercial fishery in the lower Skeena River (Chudyk and Narver, M.S. 1976). The tagged fish were caught in the lower Skeena in late July - early August, hence they would have moved through the fishery at Tyee during the period of heaviest gillnet harvesting. It also indicates that Babine River steelhead are one of the stocks which are subjected to commercial fishing interceptions. Conclusions drawn from a sample of only seven steelhead are of course statistically weak. It would be more useful to add the results to existing evidence, and follow with a second year of study which hopefully will be dealing with a larger sample.

Useful information about rates of upstream migration could only be obtained from two of the four fish which were found. One of these fish travelled 270 km upstream at an average rate between 4 and 11 km/day. The second fish travelled upstream 28 km at an average rate between 1.4 and 1.8 km/day.

The remaining two fish were not located until March and probably wintered with little upstream movement (Lough, in preparation) making calculation of migration rates difficult.

It may be significant that three of the seven radio tagged fish were not found after release. It is possible that some of these fish entered tributaries that were not monitored by stationary scanners or that some were subject to various mortality factors within the system (Indian gill-nets, seals, sport fishery, etc.). Present information (Lough, in prep.) however, indicates that steelhead winter in the mainstem Skeena and Bulkley Rivers, hence it is possible that the radio tagged fish will not enter their natal tributaries until spring. If this is the case, this aspect is important in determining rates of migration and warrants further investigation

It is interesting to note that the steelhead which entered the Zymoetz River held in the run directly opposite the stationary scanner for just over 40 hours before continuing its migration. If this type of upstream travel is common, it would help explain why the average upstream rate of migration is so low (1.4 - 11 km/day). Constant radio surveillance of individual fish would clarify this aspect of migration and should be considered in future studies.

We found the stationary scanning unit valuable as a tool for monitoring fish movements, but it must be used with caution. As with any mechanical recording mechanism, it is subject to occasional malfunctions such as chart feed problems and must be periodically checked to ensure continuous recording. In addition, interpretation of the strip chart is partly subjective and requires practice. Other radio transmissions, outboard motor interference or a tagged fish stopping near the station are all recorded on the print out, making analysis of the tape difficult.

More emphasis should be placed on continuous surveillance of radio tagged fish which can be geared to compliment the data from stationary scanners.

Successful radio tagging of steelhead relies largely on the ability to obtain uninjured fish. This can be difficult in a large river such as the Skeena where turbid waters, multiple channelling and high current velocity all combine to hamper capture attempts.

We put considerable effort into testing a California fyke trap because it was successful on the Sacramento River. I feel that the main factors in its ultimate failure were that it covers such a small portion of the river, and that we were not able to operate the trap in the types of water that steelhead utilize. This same explanation probably accounts for the poor returns of beach seining. These methods of live capture were labour intensive and because of their low returns, they were discontinued.

Gill netting was one of the methods tested which produced steelhead. In the case of a set net, we found that the net had to be manned continuously so that the steelhead could be removed before it injured itself or drowned. This method was eventually abandoned because smaller fish were clogging the gillnet, but this can be reduced by changing the size of the mesh.

The advantage of a drift net is that it could be used in the fast water of the main channel as opposed to a set net which can only be used at the edge of a back eddy or pool. We found drift nets to be effective but hazardous when used in the lower Skeena because of the high current velocity and turbid waters. The numerous underwater snags can entangle a drifting net, resulting in damage to the net as well as creating an obvious hazard to boats and operators. For this reason drift gillnetting was also discontinued.

One crew member accompanied the federal test fishery boat at Tyee on the Skeena in the hopes of obtaining an uninjured steelhead from the variable mesh gillnet which is in use there. Although uninjured steelhead are caught at the test fishery, such an event is rare and did not warrant keeping a man on the test fishery boat.

We found angling to be the most productive of the methods tested. It also immobilizes the steelhead by exhaustion, making them suitable for radio tagging without the use of an anaesthetic. The main disadvantage of angling is that the returns are dependent upon water clarity. Heavy rainfall and the high water experienced during the peak of the 1978 steelhead run made this method totally unproductive. In this particular situation, the river remained high for several weeks, and angling was discontinued for this period.

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