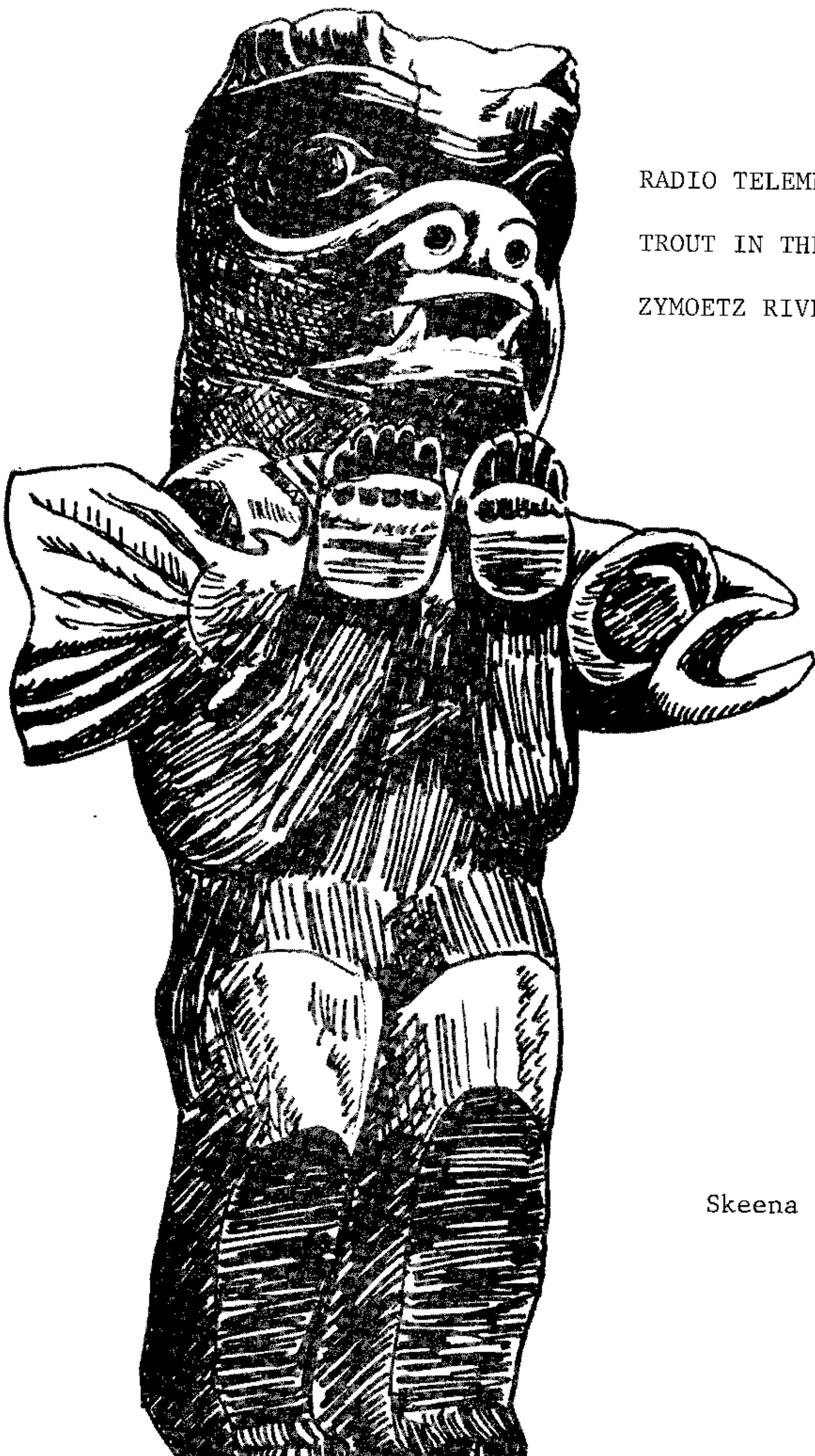
Skeena Region

British Columbia Fish & Wildlife Branch



RADIO TELEMETRY STUDIES OF SUMMER STEELHEAD TROUT IN THE CRANBERRY, KISPIOX, KITWANGA AND ZYMOETZ RIVERS AND TOBOGGAN CREEK, 1980

by

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Skeena Fisheries Report #80-04

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Smithers, B.C.

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ABSTRACT

Radio tagging studies were carried out on four Skeena River tributaries and one Nass River tributary in order to more fully understand the life history of summer run steelhead trout. During the fall of 1979, thirteen steelhead were tagged on the Cranberry River, nineteen on the Kispiox, seven on the Kitwanga, seventeen on the Zymoetz and three in Toboggan Creek. In the Cranberry River the area near McKnight Creek was heavily used for wintering and spawning. In the Kispiox, a second year of tagging showed a marked increase in mainstem spawning from the previous year. Of the fish tagged in the Kispiox, 16% left and spawned in other rivers. A portion of the Kitwanga run wintered off the mouth in the Skeena River. The major spawning area in the Kitwanga was found to be between the lake and Moonlit Creek. In the Zymoetz River there was widespread movement of steelhead in and out of the Clore River. McDonnell Lake was again used for wintering by fish that spawn in the upper Zymoetz River. Toboggan Creek steelhead wintered in the Bulkley River and entered Toboggan to spawn in early May. Management and enhancement options as identified by the study are discussed.

1.0 INTRODUCTION

In 1978, regional fisheries staff of the B.C. Fish and Wildlife Branch began a radio telemetry study of the Skeena River summer steelhead trout stocks (Salmo gairdneri Richardson). The study involved two broad objectives:

1. To monitor movements of steelhead from the Skeena estuary to their various natal streams (establishment of run timing).

2. To monitor movements of steelhead within the tributaries of the Skeena: their movements through the sport fishery, their overwintering behavior, and location and timing of spawning.

Results of the studies designed to meet the first objective have been reported by Lough (1978 and 1981). This paper reports the results of studies designed to meet the second objective; studies that involved radio-tagging and tracking steelhead in the Kispiox, Morice, Suskwa, and Zymoetz Rivers in Year One (1978-79) and in the Kispiox, Kitwanga, Zymoetz and Cranberry Rivers (a Nass Tributary) and Toboggan Creek in Year Two (Fig. 1).

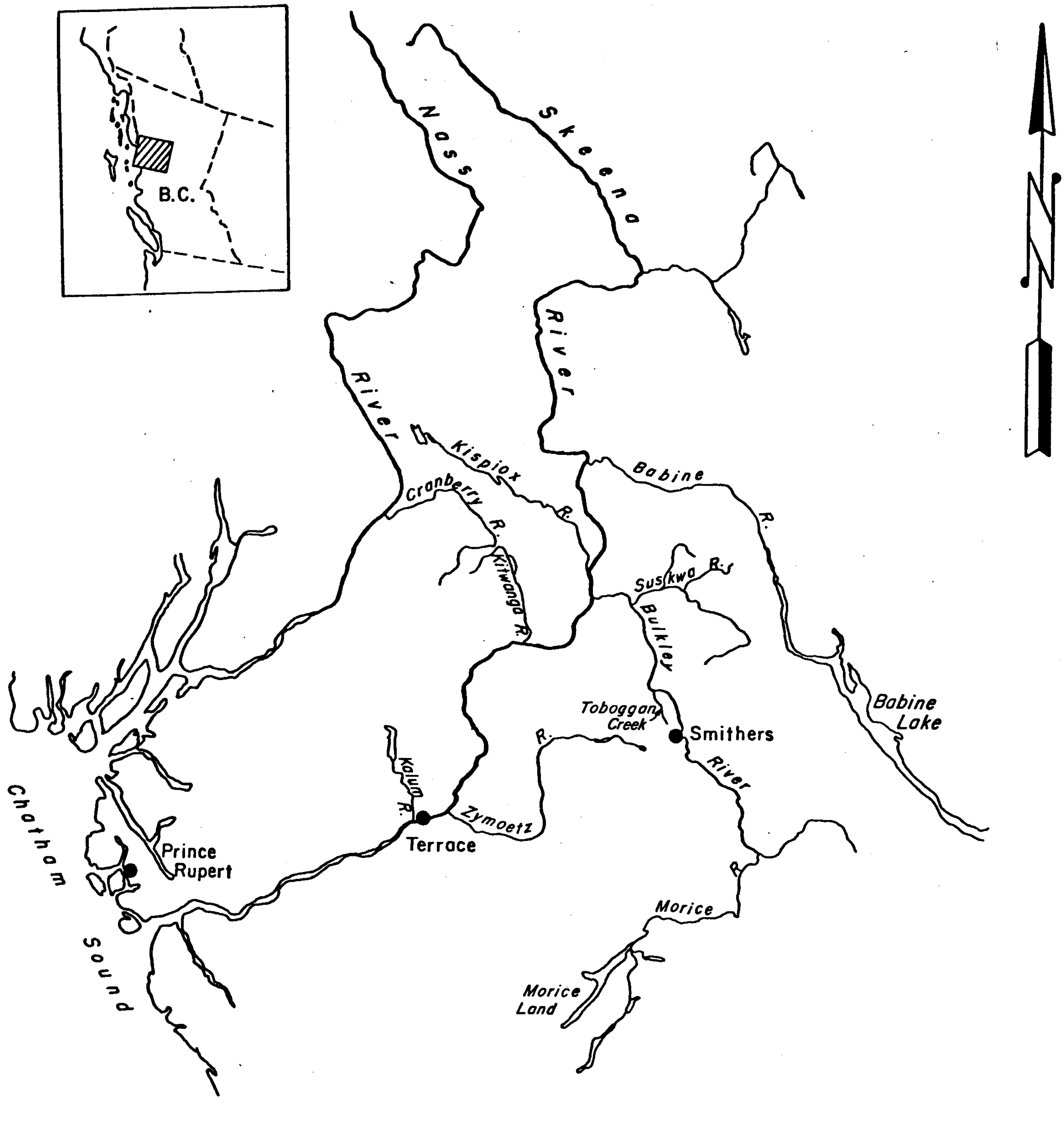

Fig 1 Radio telemetry study area, 1980.

2.0 MATERIALS AND METHODS

2.1 Telemetry Equipment

The frequency of telemetry equipment used in this study was 151 megahertz. This system required a smaller antenna than lower frequency equipment, and therefore was more adaptable to tracking from aircraft, boats and trucks. The radio tags and receivers were purchased from Wildlife Materials Inc. (R.R. #2, Carbondale, Illinois).

Two types of radio tags were used in this study, differing only in size and life of the lithium battery. The larger type was cylindrical in shape, approximately 7.0 cm long and 2.7 cm in diameter, with an expected life of about 400 days. The smaller tags were also cylindrical, but were 5.75 cm long and 1.8 cm in diameter with an expected life of about 200 days. Both types of tags were two-stage subminiature transmitters which emitted a pulsing signal at a rate set between 30 and 70 pulses per minute. They were supplied as completely self-contained units encapsulated in several layers of dental acrylic, which waterproofed the units. Removal of a small external magnet activated the tag, which was designed to be administered internally.

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2.2 Live Capture and Radio Tagging Procedure

Angling was the most productive method of live capture. A combination of lures and roe with a single hook was generally found to be the most successful.

The steelhead was 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 and a stainless steel rod was then used to set the tag down into the stomach. A coating of household margarine on the large 400 day tags allowed them to slip down the throat with ease. After tagging, the fish was held in a recovery tube to ensure that it was healthy at release.

2.3 Tracking Procedure

Radio tagged fish were identified by characteristic frequencies and pulse rates. The portable tracking receivers were adapted for use in trucks, boats and aircraft.

We found that best results in an aircraft were obtained from two portable receivers and operators. An antenna for each radio was mounted on the wing-strut of a Cessna 180 which was usually flown about 140 km/h at an altitude of 100-200 m.

When exact locations of fish were needed, a Bell Jet Ranger helicopter was used. The antenna was mounted between the skids with a specially designed attachment to the cargo hook.

3.0 RESULTS

3.1 Live Capture and Tagging

A total of 59 steelhead were radio tagged during the study (Appendix I). In addition, 102 steelhead were spaghetti tagged (Appendix 2).

3.11 Cranberry River

A total of 13 steelhead were radio tagged on the Cranberry River and an additional 36 fish were spaghetti tagged. Attempts were made to capture fish at various points throughout the system, but no fish were tagged upstream of km 26. Most of the tagged fish were captured in the section between km 18 and km 25 with two fish tagged at km 15. All 13 radio tags were put on between October 31 and November 28, 1979.

3.15 Toboggan Creek

The three radio tagged steelhead in Toboggan Creek were actually tagged in August 1979, near km 80 on the Lower Skeena River during the stock identification study previously mentioned (Lough, 1980). These fish were monitored as they wintered in the Bulkley River and throughout the spring when they entered Toboggan Creek to spawn. Individual identity of these fish could not be established because other fish were tagged with the same frequency of transmitters. Only the group of fish and their corresponding tagging dates (between August 4 and August 15) could be established. Once these fish travelled up the Skeena and entered the Bulkley River, they were individually monitored on the basis of characteristic pulse rates (Appendix 1).

3.2 Movements of Radio Tagged Fish

Tracking data for each fish was summarized in map form showing the dates that it was located at various points on the river. Interpretations were made from these maps regarding seasonal movements of fish, watching for general tendencies which could be applied to that stock of steelhead (Table 1).

Table 1. Summary of tagging results in the study rivers, 1979-80.

	Number of Fish Radio Tagged	Number of Fish Spaghetti Tagged	Fall Distribution	Winter Distribution	Peak Spawning Time	Spawning Habitat
CRANBERRY	13	36	lower Cranberry	lower 25 km Cranberry	early May	- mainstem gravel bars in McKnight and Aluk Cr. area - McKnight, Calming & Derrick Cr. - limited spawning above km 50
KISPIOX	19	14	lower Kispiox	Skeena and lower Kispiox	late May - early	- mainstem km 5 - km 41 - side channels of mainstem - Cullon, Nangese, Date Cr. - Skeena mainstem and side channels, Shegunia R.
KITWANGA	7	8	Skeena and lower Kitwanga	Skeena and lower Kitwanga	mid May	- mainstem between lake and Moonlit Cr. - lower 10 km of mainstem
ZYMOETZ	5	23	throughout Zymoetz	mainstem & McDonell Lake	late May - early June	- McDonell Lk. outlet - mainstem and side channels below Clore R. - tribs and side channels from Red Canyon to Coal Cr.
CLORE (ZYMOETZ TRIB)	12	21	lower Clore	lower Clore & Zymoetz	early June	- mainstem and side channels in lower 20 km.
TOBOGGAN	3	0	Bulkley River	Bulkley River	mid May	- upper Toboggan Cr. - mainstem downstream of Elliot Cr.

3.21 Cranberry River

The thirteen radio tagged fish in the Cranberry River were relatively inactive during the fall and winter. Most spent the winter in the area where they were tagged and no radio tagged fish moved upstream of km 25 (Calmin Creek area) until spawning time in the spring. The fish increased their activity in late April and began to move to their spawning sites during the first week of May.

Two fish spawned in McKnight Creek between May 4 and May 14. These fish entered the tributary on May 4 and May 6 when the water temperature was 7°C. The mainstem Cranberry was high and muddy at this time but McKnight and Aluk Creeks were still clear. An automatic scanning station monitored the last fish leaving McKnight on May 14, when water temperatures reached 10°C. Ten untagged steelhead were also observed spawning in McKnight at the same time as the radio fish. All these fish had passed through the Highway 37 culvert and spawned between the highway and the waterfall barrier approximately 400m below McKnight Lake outlet.

Six spawning sites were in the mainstream Cranberry. Four of these were along mainstem gravel bars in the McKnight Creek - Aluk Creek area. The other two fish moved upstream and spawned at km 40 and km 55.

Exact spawning sites were not identified for the remaining 5 radio fish. I suspect these fish entered small tributaries of the Cranberry, but were not located during their short stay. One of these fish was last seen holding near the mouth of Derrick Creek and I suspect it later entered and spawned in lower Derrick Creek (Fig. 2). The same circumstances occurred at Calmin Creek and an unnamed tributary at km 53. Both of these tributaries have suitable spawning habitat and water temperatures (Appendix 3). I suspect the last 2 fish spawned in the unnamed tributaries near km 25, just downstream of Aluk Creek. Fish began leaving the system in mid-May, but a few remained in the area until late June.

In addition, 36 steelhead were spaghetti tagged on this part of the river. Two of these fish were recaptured by sport anglers during the winter. Both fish had moved downstream about 3 - 4 km from their tagging sites but had not moved from the area around McKnight and Calmin Creeks.

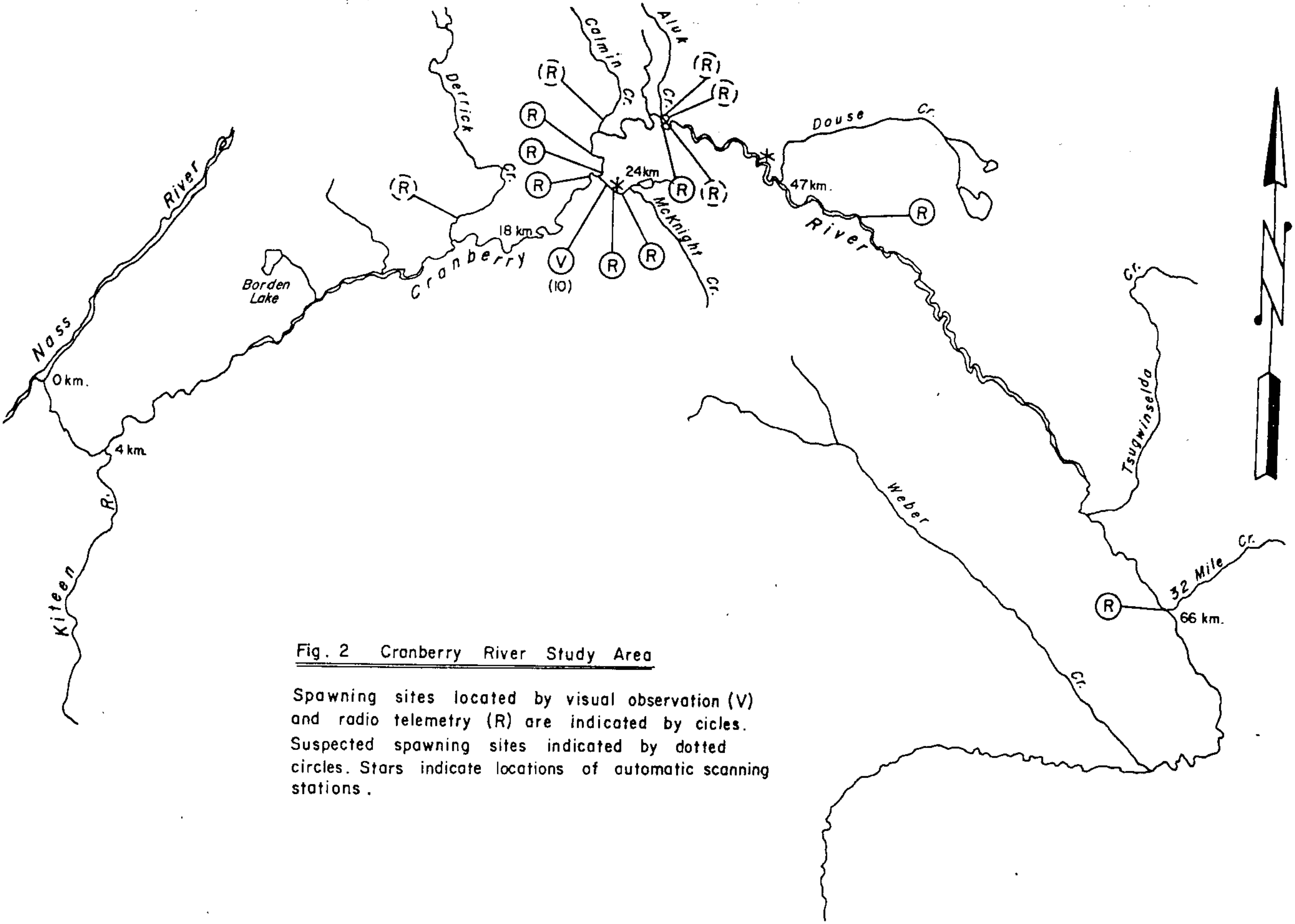

Fig. 2 Cranberry River Study Area

Spawning sites located by visual observation (V) and radio telemetry (R) are indicated by cicles. Suspected spawning sites indicated by dotted circles. Stars indicate locations of automatic scanning stations.

3.22 Kispiox River

All but 1 of the 19 radio tagged fish spend the fall and winter in the lower 25 km of the Kispiox. The fish that wintered upstream of this area moved up to km 32 during the fall and remained in the area until spawning time in the spring. Two of the fish that were tagged on the lower river moved out of the Kispiox and wintered in the Skeena, downstream of the Kispiox confluence. In addition, 1 other tagged fish moved out into the Skeena during the spring after wintering near its tagging site in the lower Kispiox.

Spawning sites were identified for 15 of the 19 fish. The remaining 4 could not be accurately pinpointed. Of the 15 identified spawning sites, 10 were in the mainstem Kispiox, 3 used side channels and 2 were in tributaries (Figure 3).

The downstream extent of the mainstem spawning was near Date Creek at km 5, and the upstream extent was at km 41. Four tagged fish spawned between km 7 and km 9 (the Potatoe Patch) during late May and early June, when Kispiox water temperatures were ranging from 9°C to 11°C. Three of the remaining fish utilized side channels of the mainstem for spawning.

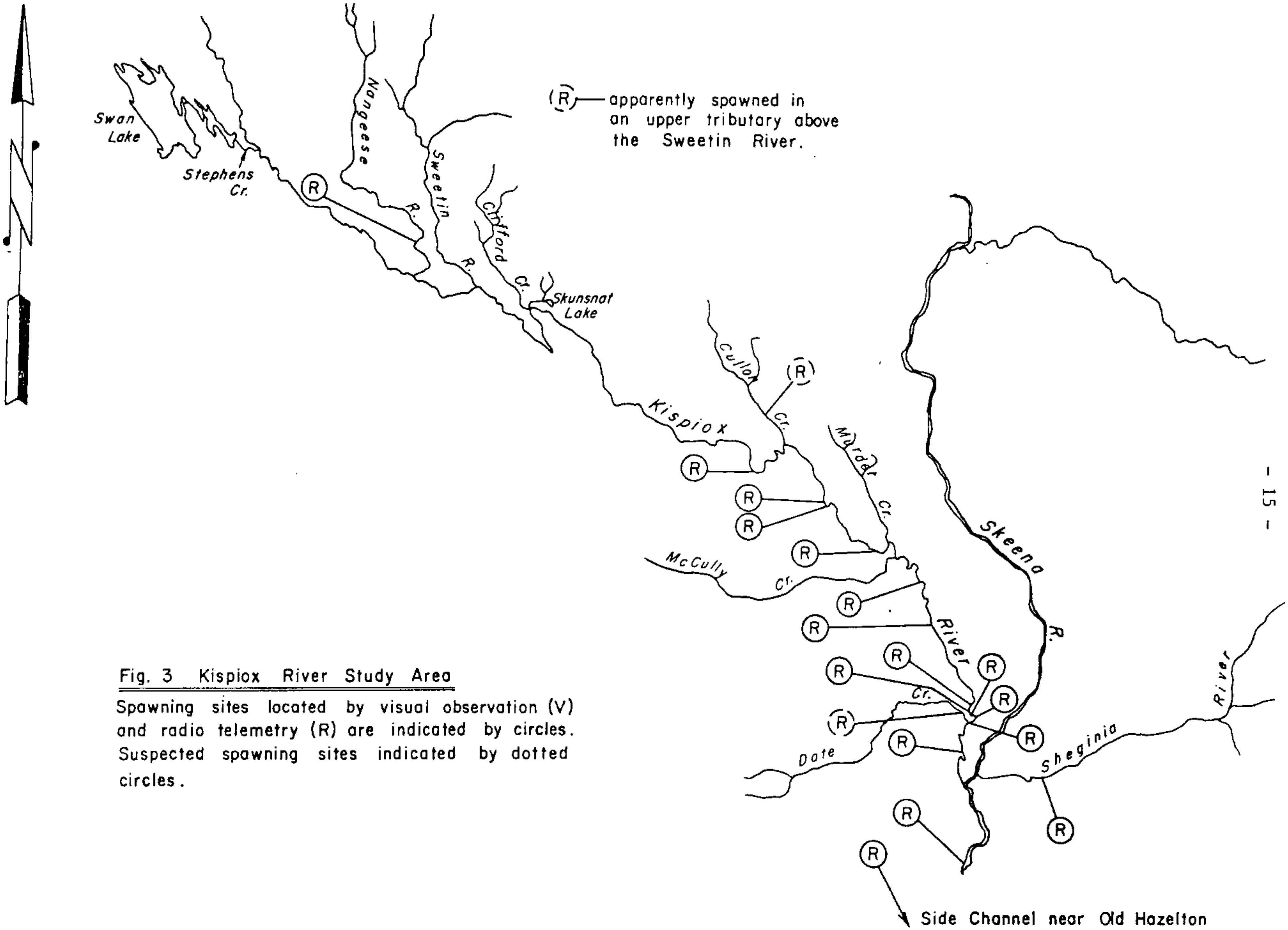

Fig. 3 Kispiox River Study Area

Spawning sites located by visual observation (V) and radio telemetry (R) are indicated by circles. Suspected spawning sites indicated by dotted circles.

Unusual behavior was noted when 3 of the 19 radio fish left the Kispiox and did not return to spawn. Two of the 3 spawned in side channels of the Skeena River during late May and early June. On June 2, the Skeena water temperature was 12.5°C. The third fish wintered in the Skeena as well, but moved into the nearby Shegunia (Salmon) River on May 19 to spawn.

Exact spawning sites were not found for 4 of the 19 tagged fish, but enough information was gathered to determine the general area of spawning. I suspect these fish spawned in lower Date Creek, Cullen Creek and one of the tributaries upstream of the Sweetin River. The fourth fish spawned in or near the mouth of Pentz Lake Creek.

Although spawning took place during mid-May to early June, kelts remained in the area for a few more weeks. Eight tagged fish stayed until June 1, 6 remained until mid-June and 2 continued to hold until July 10.

3.23 Kitwanga River

Seven steelhead were radio tagged in the Kitwanga; including 2 fish which were tagged at the confluence of the Kitwanga and the Skeena. Both of these fish wintered near their tagging sites in the Skeena, but only one of them eventually moved into the Kitwanga to spawn. The other fish eventually spawned in or near a small tributary across from the Kitwanga. (Fig. 4).

Most of the five fish tagged in the Kitwanga wintered near their tagging sites on the lower river with the exception of one fish which dropped out of the Kitwanga and spent part of the winter in the Skeena.

Fish started to move towards their spawning sites by early May and spawning peaked around mid-May. One fish moved upstream as far as Tea Creek, but eventually dropped back and spawned near km 3; an area with extensive instream gravel and debris. A second fish also spawned in this area, but did not move upstream beforehand. The remaining 4 tagged fish eventually moved upstream of Moonlit Creek and spawned in the Kitwanga mainstem below the outlet of Kitwanga. Spawning took place during the second and third week of May when water temperatures reached 12°C. Three of the kelts left this area by the end of May, but one fish remained until June 30.

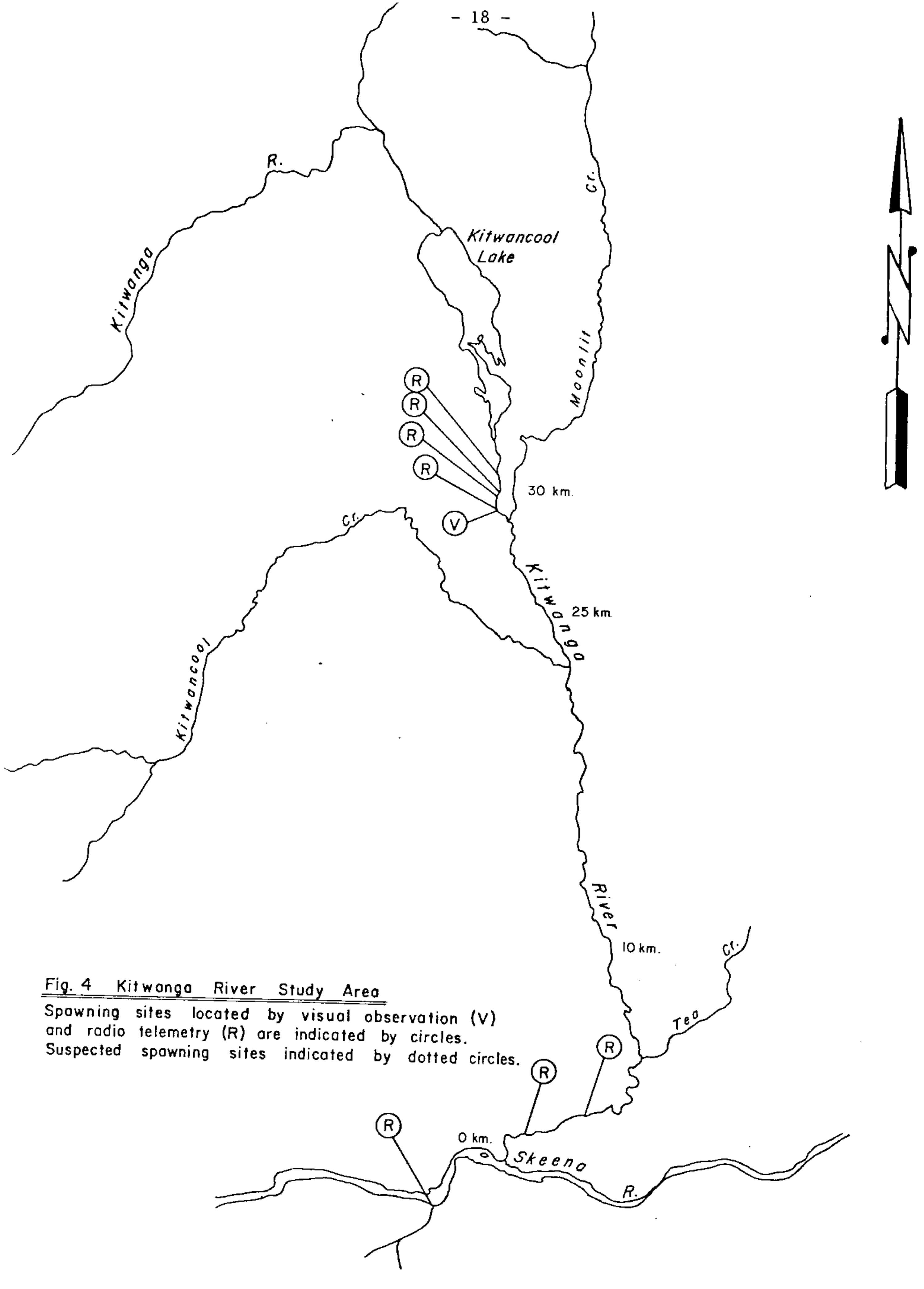

Fig. 4 Kitwanga River Study Area

Spawning sites located by visual observation (V) and radio telemetry (R) are indicated by circles. Suspected spawning sites indicated by dotted circles.

3.24 Zymoetz River

Seventeen fish were tagged on the Zymoetz system, but one fish moved downstream to the Skeena River and did not return. The remaining 16 fish were monitored until springtime and spawning sites were identified for 13 of them.

Of the 12 fish tagged in the Clore River, 5 wintered near their tagging sites and spawned in the Clore. Two tagged fish dropped downstream, wintered in the Zymoetz and the remaining fish dropped downstream to winter and spawn in the Zymoetz.

Of the 5 steelhead that were radio tagged on the Zymoetz proper, 4 were tagged at km 103 near the outlet of McDonell Lake. One of these dropped down to the Skeena and did not return, and another wintered around Red Canyon before moving back upstream in the spring to spawn near the mouth of Coal Creek (Fig. 5). Two of the fish spawned between McDonell Lake and the Serb Creek confluence at 103 km. One of these spent at least part of the winter beneath the ice of McDonell Lake before dropping back in May to spawn. The steelhead which was tagged near the mouth of the Clore River eventually moved into the Clore during the spring to spawn.

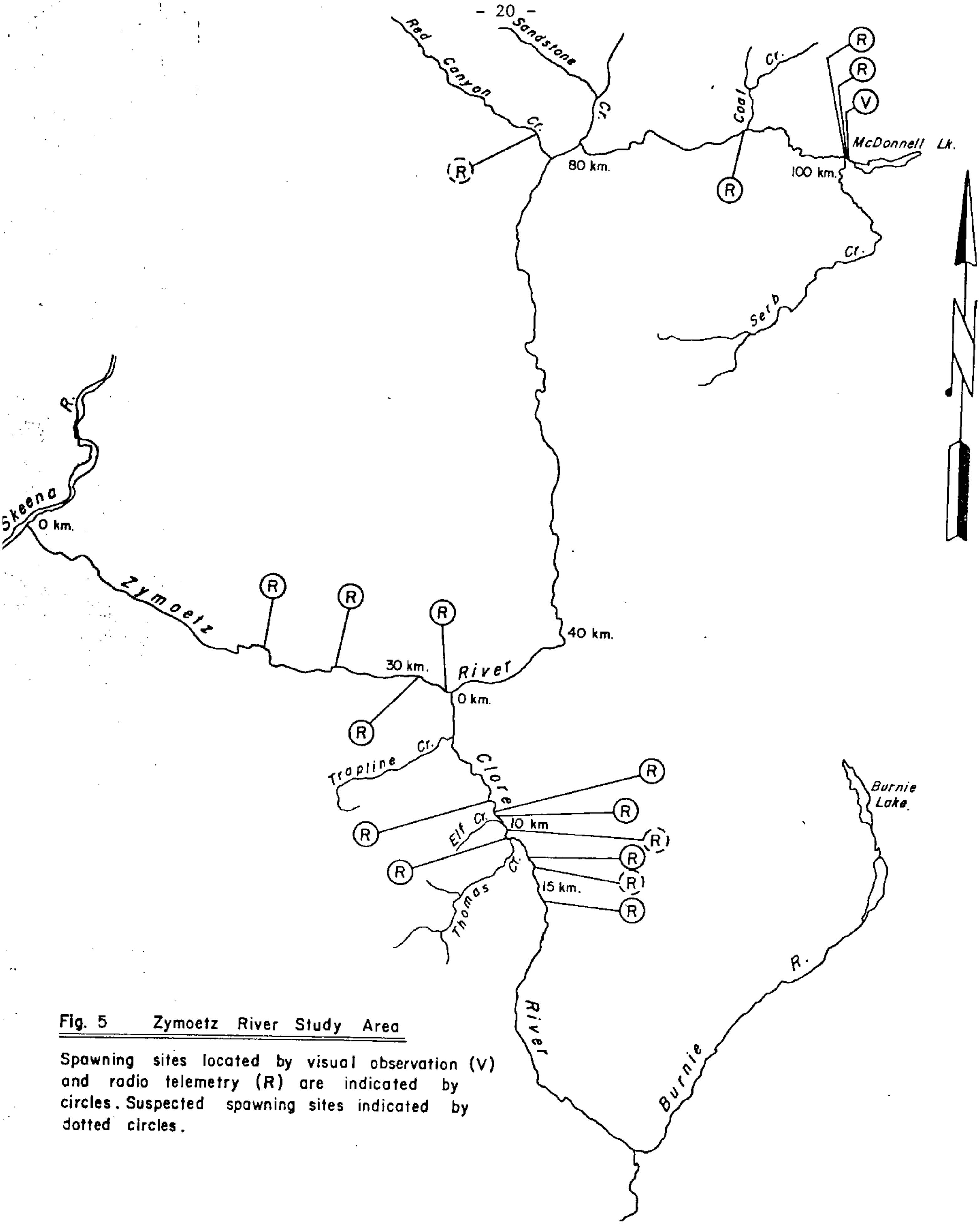

Fig. 5 Zymoetz River Study Area

Spawning sites located by visual observation (V) and radio telemetry (R) are indicated by circles. Suspected spawning sites indicated by dotted circles.

Toboggan Creek

During August, the 3 Toboggan Creek steelhead moved upstream from their tagging sites on the lower Skeena River. They entered the Bulkley River sometime between late August and early September and dispersed throughout the lower Bulkley. One of the fish wintered in the canyon area about 8 km upstream of Toboggan, near the Reiseter Creek confluence, while a second fish wintered in the canyon area about 15 km upsteam of Toboggan, near the Driftwood Creek confluence. The third fish wintered approximately 40 km downstream from Toboggan Creek.

Activity increased in late April, and by the first week of May they had moved towards the mouth of Toboggan Creek. All 3 fish entered Toboggan between May 6 and May 9 during the highest flows of spring runoff. Upstream movement was slow but steady and all fish were at their spawning sites by May 15. Two fish spawned in the mainstem, just downstream of the Elliot Creek confluence and the third fish moved into upper Toboggan Creek and spawned about 1 km above the confluence. (Fig. 6). Spawning took place between May 15 and May 18 and all fish left during the third week of May, although one kelt remained near the mouth of Toboggan until the end of May.

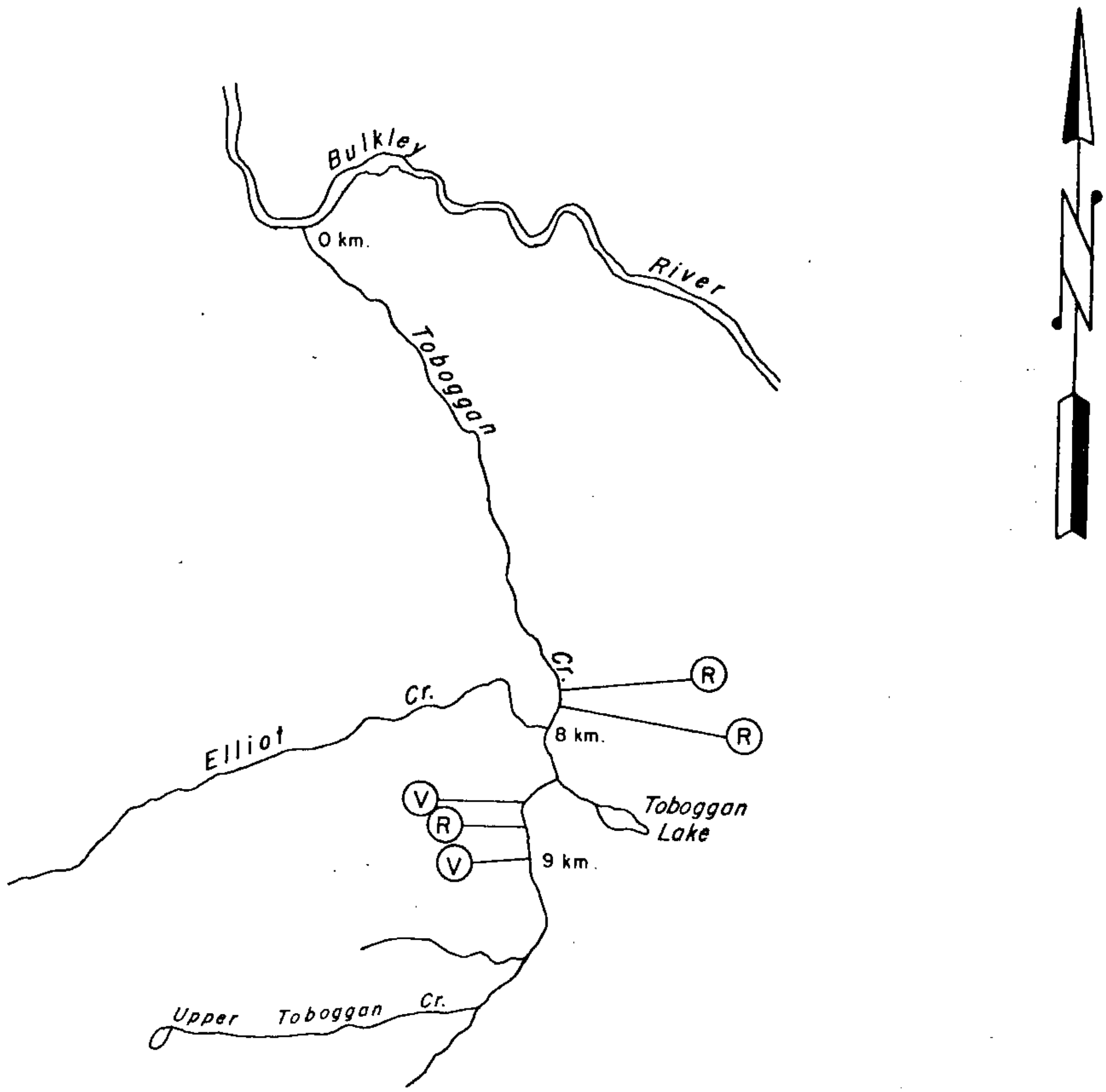

Fig. 6 Toboggan Creek Study Area

Spawning sites for steelhead located by visual observation (V) or radio telemetry (R) are indicated by circles.

4.0 DISCUSSION

Field data from radio tracking have been summarized for each fish on individual maps, indicating the dates it was found at various locations. Inspection of these maps show that there is more information for some fish than for others. This is due to the accessability of the stream; those near a road were monitored more often than those which could only be monitored by aircraft. This project however, was not geared to a study of daily movements of fish, but rather to seasonal movements with hopes of finding general tendencies to be applied to steelhead of that river.

Data on spawning locations were more complete for some fish than for others, and I occasionally made a judgement about spawning locations on what appeared to be incomplete data. In this study, I identified the spawning site through a combination of several factors. If a fish was located after an upstream movement in May, in suitable spawning habitat and water temperature as outlined in "The Probability of Use Criteria for Salmonidae" (Bovee, 1978), then it was considered to have spawned at that site.

Results of this study indicate that it is difficult to make generalizations which apply to all tributaries in the Skeena. Steelhead in various rivers appear to have evolved a life strategy that is suitable to the characteristics of that system. For this reason, results from each river will be examined individually.

4.1 CRANBERRY RIVER

Although some of the heaviest Nass River commercial gillnet interceptions of steelhead occur during August (R. Kadowaki, Pers. Comm.), steelhead generally do not appear in the Cranberry River until mid-September. As with many systems that have highly variable flows, the steelhead likely hold in the Nass or lower Cranberry canyon (km 0 - km 4) until water levels are suitable for upstream migration. At that time they appear to move into the lower 30 km of the Cranberry, but show little inclination to move upstream of this point in any numbers. Concerted efforts were made by the tagging crews to tag throughout the system, but no steelhead were angled upstream of 26 km during October and November, and hence all fish were tagged between 15 km and 26 km. Although small (less than 5 km) upstream and downstream movements of these fish were documented, they showed little or no movement from this portion of the mainstem throughout the fall and winter, dispersing only during spawning time in the spring.

This information has some management implications on the sportfishery of the Cranberry River. The river downstream of the Kiteen confluence (4 km) is canyon water so the sportfishery occurs mainly between 4 km and 47 km with intensive pressure exerted around 18 km (Cranberry Junction) and 24 km (McKnight Creek). It therefore seems that anglers are fishing the same group of fish throughout the season rather than fishing them as they go by on their way upstream. This evidence is supported by the fact that 2 of the 36 (6%) spaghetti tagged steelhead were recaptured by sport anglers later in the year at or near their tagging sites. The recapture of these fish may be a crude indication of angler harvest rates but is likely a bit low for several reasons:-

i) All steelhead were tagged after October 30; well after the peak of the steelhead fishing activity on the Cranberry.

ii) No reward system or formal advertising was in progress on the Cranberry. It may be possible that more tagged fish were caught but not reported by anglers. The prospect of illegal fishing was not considered although it is known to exist (Grubba, Pers. Comm.).

iii) The sport harvest on the Cranberry is highly dependent on water levels (water clarity) and the year of this study was not an exceptional year for water clarity. On a year that does have optimum water conditions, the harvest of these fish could be substantial.

If it becomes apparent that relief from angler pressure is required, a possible option is to reduce the length of the season by closing the river in November during low flows when the fish are most vulnerable, but in this already tightly regulated fishery (single hook, roe ban, canyon closure, December 1st closure), further regulations would likely be greeted with lack of enthusiasm.

The heaviest concentration of wintering fish was found to be in the area around McKnight Creek (21 - 26 km). This is exactly where the new Highway 37 bridge crossing will be situated, and therefore an increase in angler pressure is anticipated. I recommend that spot checks be carried out on anglers when the new crossing is completed (1983-84) in order to monitor the increased steelhead harvest. If these fish are found to be too vulnerable, steps may have to be taken to ensure this area is not overexploited.

The tagged steelhead showed an increase in activity during April and moved to their spawning sites in early May. Six of the identified spawning sites were in the Cranberry mainstem ranging from 15 km to 66 km. Four of these spawning sites were located on the gravel bars in the McKnight Creek area of the mainstem. Disturbance of these bars (i.e. downstream siltation, etc.) must be considered during the construction of the new bridge crossing proposed in this area.

On May 4, the first of the radio tagged fish entered tributaries to spawn. McKnight Creek appears to be one of the major spawning tibutaries for steelhead in the Cranberry. Radio tagged fish spawned in McKnight during the second week of May; earlier than the fish which spawned in the mainstem. The advanced spawning is probably due to the warmer, clear water of McKnight Creek as it flows from McKnight Lake. In small tributaries such as this, it is common for steelhead to move in, spawn quickly and return to the mainstem (Lough, 1980). It seems that this behavior is in response to dropping water levels rather than increasing water temperatures because of other Skeena systems such as the Kitwanga, kelts have remained at their redds until temperatures rose to 19°C. A few fish, most likely kelts, remained in the system until late June.

All fish that were observed spawning in McKnight Creek passed through the road culvert at Highway 37 and spawned between the road and the falls. This culvert doesn't appear to be a barrier to upstream adult movements, but it could present a problem to juvenile movements. The rearing potential of McKnight Creek is high because of its stable flows and warm temperatures, but the seasonal juvenile migrations in and out of the stream is not fully understood. In this regard, I recommend that Highway 37 culvert either be replaced or removed. When the new highway is opened, this section of the road will be neglected and proper culvert maintenance is questionable. At that time, the old Highway 37 should be "put to bed" and key culverts such as this should be removed. Any logging plans for the McKnight drainage (such as further treatment in the cut block adjacent to the creek) should come under very close scrutiny by our Habitat Management Section because this creek is extremely vulnerable to siltation and recommendations must take this into account.

In terms of enhancement opportunities, several areas seem to have potential. The most obvious of these is headwater stocking throughout the upper Cranberry mainstem and suitable tributaries. It seems that a vast majority of the spawning takes place on the lower Cranberry, and it may be that the upper reaches should be compared to lower Cranberry areas, and if this is confirmed, then headwater stocking may be in order.

A second enhancement opportunity appears to be stocking above barriers in the numerous creeks that have waterfalls. It must be noted however, that this does not have the potential that appears at first glance. Derrick Creek for example, has high value juvenile habitat above the falls but a heavy lake population of resident rainbow trout which no doubt seeds resident juveniles downstream from the lake to the falls. For this reason, stocking above the falls on Derrick Creek would be of limited value.

Water temperatures vary greatly in these tributaries. Some streams that appear to have suitable habitat and attractive gradients are severely limited in rearing potential because of their low water temperatures (eg: Aluk Creek).

In the event of poor water conditions during brood stock capture, one opportunity to obtain gravid adults is to install a portable upstream fence on lower McKnight Creek where the gradient is low and the flows are stable. The fence should be installed by early May or when water temperatures move above 5°C; whichever comes first. A portion of the resultant fry should be replaced in McKnight to ensure adequate fry seeding.

4.2 KISPIOX RIVER

This was the second year of radio tagging on the Kispiox. The first year of telemetry studies took place in 1978/79, during which time 15 steelhead were tagged. Those fish were captured on the lower Kispiox in late September when the sport fishery was in full swing and monitored until spawning time in the spring. Results from that work (Lough, 1980) indicated that the fish tagged in the lower Kispiox remained in the lower river throughout the fall and that most wintered in this area as well. Four of the 5 spawning sites that were located were in Nangese, Ironside and Skunsnat Creeks with another fish suspected of spawning in Murder Creek. Only 1 fish was found to spawn in the mainstem (km 27).

Everest (1973) feels that the first part of the run tends to travel the fastest through the lower river, and move further up the river than the rest of the fish. On the Kispiox it appears that these 'early' fish make up only a small portion of the total run and move up as far as the Sweetin River before stopping. This seems to be supported by the telemetry work which again showed very little movement during the fall. Of the 19 steelhead radio tagged in 1979/80, all but 1 of the fish spent the fall and winter in the lower 25 km of the Kispiox, indicating that these fish do not move through the sportfishery which therefore targets on the same group of fish throughout the season. It is therefore clear that current catch and release regulations (Aug. 15 - Sept. 30) are necessary and should remain unchanged in order to protect the early fish as well as to maintain a viable fishery in October.

Three (16%) of the fish displayed uncommon behavior when they left the Kispiox and wintered in the Skeena River. Similar situations occured on the Kitwanga and Suskwa Rivers (Lough, 1980), but the steelhead eventually returned to spawn in the springtime. In this case however, the tagged fish failed to return, and one eventually spawned in the Shegunia River (adjacent tributary of the Skeena) while the other 2 spawned in

Skeena River side channels approximately 5 km and 15 km downstream. This sort of behavior may also have occured in the first year of study but not noticed because of less intensive tracking during the spawning period. If in fact this is a standard occurance, it is conceivable that the steelhead run into the Kispiox during the fall is greater numbers (16% in this case) than the adult returns forcast from the smolt production estimates for the system; something which should be taken into account when considering smolt production on run reconstruction models. The other side of this coin however, is that these fish might be true Kispiox progeny and that they strayed from their natal stream; a well documented occurrence in steelhead (Everest, 1973). The adults would then be available in the sportfishery, but would not be included in the escapement to spawning figures and hence not available as Kispiox broodstock.

Another management implication of this straying behavior is that it suggests there is limited genetic exchange between stocks of neighbouring Skeena systems and this may allow for more flexibility when obtaining brood stock for a system with poor escapements (eg: Suskwa River).

The tagged fish began moving towards their spawning areas in early May. Only 2 (11%) of the 15 identified spawning sites were in the tributaries. In addition, 4 more fish were suspected of spawning in various tributaries, but were never actually monitored in the creeks. I suspect one steelhead spawned in Cullen Creek; another in lower Date Creek; one in an upper tributary (Stephens, Williams Creeks); and one in or near Pentz Creek at the outlet of Pentz Lake, all of which are known to contain substantial juvenile steelhead populations (Tredger, 1982). The Nangese River was the only one that was utilized for spawning by tagged fish for both years of the study.

One fish spawned in the intermittent stream across from the Kispiox Lodge at 13 km. All other identified spawning tributaries in the Kispiox have year round flows but this creek has intermittent seasonal flows. Everest (1973) found that this situation is not atypical and that fry will migrate from intermittant natal streams to larger tributaries or the mainstem when the streams dried up on the summer months. An obvious implication of this is that it underlines the importance of adequate culverts; even on seemingly insignificant streams, so that upstream and downstream migration of the juveniles is ensured.

Results from the previous year's tagging (Lough, 1980) indicated that most of the fish utilized tributaries for spawning, but this year was found to be practically a reversed situation. Ten fish spawned in the Kispiox mainstem between 5 km (Date Creek) and 41 km (above Cullen Creek), with 3 of these fish utilizing side channels for spawning. The reasons for this change in spawning behavior are unclear, but spring runoff conditions influence the water levels in the tributaries and hence the ease of fish to ascend the system to spawn. An examination of water discharge recordings for the 2 years shows that maximum flows for June, 1980 were only 60% of those recorded in 1979. (Environment Canada, 1980 - 81). Without these high flows during spawning, many of the streams could be impassable due to high beaver dams, log jams, etc. Perhaps of more importance however, is the timing of the peak flows which occured on May 13 in 1980; almost three weeks earlier than 1979. Since most of the fish spawn in late May and early June, they may have encountered difficulty in 1980 when tributaries were back to low flows at this time. As a result, a higher percentage may have spawned in the mainstem. Indications are that the ratio of mainstem spawners to tributary spawners seems to be highly variable from year to year, depending largely on environmental conditions; including water levels in the spawning tributaries.

Fry rearing habitat in the Kispiox mainstem is only about half of the total habitat available (Tredger, 1982). It may be that the tributaries are inadequately seeded during low water years and hence a reduced total fry production might be expected for the entire system. It is interesting to note that fry densities in 1981 were higher than 1980 and that 1981 had about 20% greater flows during spawning. (Environment Canada, 1980-81). This is perhaps an oversimplification of headwater seeding but this aspect should be considered when carrying out annual standing stock assesments in the Kispiox.

4.3 KITWANGA RIVER

A substantial sport fishery exists off the mouth of the Kitwanga from August until November. Peak harvests usually occur during the first 2 weeks of September, at the time when the bulk of the Skeena steelhead run moves past (Lough, 1980). It seems likely that most of these early steelhead are from other Skeena stocks, but as the main run moves upstream, a higher proportion of the harvest are Kitwanga fish that are holding at the mouth. The length of time that these fish hold off the mouth of the Kitwanga appears to depend upon water levels of the river. During periods of low water, most steelhead hold in the Skeena until fall freshets bring the river up to a suitable level for upstream migration (Tetreau, Pers. Comm.). Both of the steelhead tagged at the Kitwanga mouth remained near their tagging sites throughout the fall and winter. This evidence suggests that in years with low water during September and October, greater numbers of steelhead remain at the mouth, which probably results in a heavier harvest of Kitwanga fish in the sportfishery.

There is no indication that steelhead utilize the upper Kitwanga during the fall since intensive angling throughout the length of the system did not produce any fish upstream of 16 km. Those that were tagged in the lower 16 km of the river during the fall did not continue upsteam but instead remained downstream for the duration of the fall and winter. All of the tagged fish that wintered in the Kitwanga utilized the area between km 1 and km 12 which is largely composed of canyon type water with extensive rock outcroppings and pools. A similar situation was found with steelhead in the Suskwa River (Lough, 1980) where flows became greatly reduced during the winter and other sections of the river did not have as much deep water for wintering. Some steelhead move into the Kitwanga during the fall on a "reconnaissance run" as did one of the radio tagged fish before going back to winter in the Skeena and returning to spawn in the Spring.

There is no indication from radio tagging that the steelhead utilize Kitwanga Lake for wintering as is often found in lake-headed tributaries of the Skeena. However, if a limited number of steelhead moved as far as the upper Kitwanga during the fall it seems likely that they moved into the lake to overwinter, accounting for the lack of steelhead in the upper river during late autumn.

By early May the upstream migration to the spawning sites had started. This coincided with high water and increased water temperatures. Fish moved into the Kitwanga from the Skeena when water temperatures were between 6°C and 9°C. This is higher than the 2°C - 5°C seen in many other Skeena tributaries but is certainly within suitable limits for steelhead spawning (Bovee, 1978). In small systems such as this, it seems that the fish were waiting for increased flows to initiate their upstream movement more than increased water temperatures.

The tagged fish started spawning during the second week of May when water temperatures reached 9°C. Two (29%) fish spawned in the lower Kitwanga between 2 and 4 km; and area with plenty of instream debris for cover and adequate gravel for spawning. The most heavily utilized area however, was the Kitwanga mainstem between the lake outlet and Moonlit Creek. Apparently not all fish wintering at the mouth of the Kitwanga are Kitwanga fish because one of the tagged steelhead spawned in or near a small tributary across the Skeena River.

Spawning occurred during the second and third week of May when water temperatures at the lake outlet reached 12°C. Although most kelts left the river by the end of May, one steelhead remained at the redds until June 30 when the water temperatures rose to 19°C. This seems uncommonly late for a kelt to linger at the spawning site, but Everest (1973) occasionally found this type of behavior in males guarding the redds.

Tributaries of the Kitwanga do not appear to be extensively utilized for spawning. An examination of these systems with low water temperatures and hence not a suitable as the warmer mainstem. Some of the unnamed tributaries between Moonlit Creek and Tea Creek have limited spawning potential in the lower reaches where they flow across the Kitwanga flood plain, but flows are limited and the area is probably used only by a small number of spawners. Kitwancool and Moonlit Creeks both appear to have little spawning potential. Although both systems have suitable gradients in the lower reaches, they climb rapidly once they reach the edge of the Kitwanga flood plain and have lower temperaures than the Kitwanga River. An exception to this generalization is Tea Creek, which offers good spawning and rearing habitat in the upper reaches as well as warmer water.

I suspect that the culvert (estimated 50 m long) at Highway 37 has hampered previous spawners because it fails to meet minimum standards for culverts as laid out by Taylor (1978). Current velocities are about 2.5m/sec during high flows in May when the highest acceptable velocities are 0.6m/sec - 1.2m/sec. The vertical jump at the entrance is approximately 1 m; well over the recommended maximum of 0.3 m. This height is a total barrier to any upstream juvenile migrations for fish of any species. The minimum acceptable depth of water in the culvert should be 0.18 m but it appears that this depth may only be exceeded during high flows. Ministry of Highways has been approached by Fish and Wildlife regarding this problem culvert in 1981, and although reluctant to do major renovations, was cooperative in placement of shot rock in the plunge pool. They should be approached to provide manpower and/or financial assistance for further improvements to this culvert. Recommended changes may include juvenile upstream ladders, velocity baffles in the culvert and plunge pool improvements similar to the Toboggan Creek culvert in 1980. The culvert upstream of Highway 37 should also be examined to ensure adequate upstream and downstream fish passage.

4.4 ZYMOETZ RIVER

Although steelhead begin to enter the Zymoetz by mid-July (Chudyk, 1979) the first major run does not occur until the third or fourth week of August. Fish continue to enter during the fall with evidence that some of the upper river fish enter the Zymoetz during the third week of August (Lough M.S., 1980). By early September, fish have dispersed throughout the entire length of the Zymoetz as well as the lower Clore. It was at this stage that fish were tagged during the 1979/80 run.

The distinction between Zymoetz and Clore stocks is hazy. Not even half of the fish tagged in the Clore utilized it for both wintering and spawning. Five (42%) of the steelhead that were tagged in the Clore ended up spawning in the Zymoetz. A few fish (17%) moved out only for wintering and the remainder (42%) wintered and spawned in the Clore. The reason for this widespread movement in and out of the Clore is unclear but may be due to the high siltation caused by natural slides and cutbanks or the reduced temperatures of the Clore system. This type of movement out of the Clore must be considered if attempting any kind of population estimate because many of the Clore fish spawn elsewhere.

There is some indication that a portion of the Zymoetz run may be wintering in the Skeena and returning in the spring. In the first year of radio tagging most fish were lost during the fall and assumed to have left the system. Although 1978 was a year of extreme flooding in the fall, it may occur on a smaller scale every year. This behavior is certainly well documented in other Skeena tributaries where most such fish return to spawn in the spring.

Some local anglers (J. Culp, Pers. Comm.) are convinced that there is a spring run of steelhead that move into the lower Zymoetz during March and April. This has not been clearly documented, but it seems reasonable to also expect fresh run steelhead in the spring because both the Kitsumkalum and Lakelse Rivers are not far away, and both have a strong winter run.

Present angling restrictions allow a steelhead fishery on the lower Zymoetz (below the power lines) after January 1st. Although some of this harvest is bound to be summer run fish, there is no evidence that this section is heavily utilized by summer fish at this time of the year. This new fishery could actually be beneficial because it disperses pressure from the Kalum and Lakelse winter fishery while at the same time allowing some data to be collected on this portion of the Zymoetz run. Angler assistance should be requested so that a representative sample of scales are obtained. If these fish turn out to be mostly summer fish, then this fishery should be closed to afford them the same protection that covers the rest of the summer run.

The section of the Zymoetz between the Clore (32 km) and Red Canyon Creek (79 km) is utilized during the fall and winter as holding water, but the value of this section of river as spawning habitat appears to be minimal. Most tributaries along this section are high gradient and have steep cobble/boulder fans at the confluence with the Zymoetz, and hence are not available to spawners. The Kitnayakwa River and Limonite Creek are exceptions to this generalization and appear to have limited spawning habitat throughout the lower reaches.

Many of the tributaries between Red Canyon Creek and McDonell Lake have limited spawning habitat throughout the lower reaches and one of the tagged fish spawned in or near the lower end of Coal Creek (94 km). Coal Creek and Sandstone Creek were both found to support a juvenile rainbow population (Tredger, In. Prep.). Serb Creek is glacial and cold and appears to have low fisheries values.

The Zymoetz River between Serb Creek (103 km) and McDonell Lake (104 km) is heavily utilized for spawning. Two of the three steelhead that were radio tagged in this area during the fall ended up spawning there. As found during the previous year of telemetry work, McDonell Lake was used by one of these fish during the winter before it dropped back down to spawn below the outlet. No tagged fish were ever found to have moved above the lake.

Enhancement projects to date have included protection of the valuable lake outlet spawning area (Serb Creek Diversion) as well as fry stocking in tributaries above McDonell Lake to re-establish historic runs. Subsequent assessment (Tredger, In Prep.) of the area has indicated that these juveniles are doing well. The only other large scale enhancement opportunity that requires closer inspection is a similar project on the Clore River above the Pillars Canyon (40 km). During the telemetry study, there was no indication that any steelhead move above this canyon although no total barrier could be identified. Further investigation should be geared towards juvenile sampling in the Clore and

Burnie Rivers, and if the opportunity exists, a stocking program could be implemented. An advantage of such a project is that the brookstock is easily obtained from the Zymoetz at the mouth of the Clore before spring break-up. Also, the fish that would be produced from such a project can be utilized by the angler because tagging data indicates they spend time in the lower Zymoetz and lower Clore Rivers during the sport fishery in the fall. It should be a general policy that any fry planted in head-water stocking projects such as this, or above McDonell Lake should be marked (fin clip) for identification during follow up assessment work.

4.6 TOBOGGAN CREEK

The Toboggan Creek fish were tagged during a previous study and the data obtained in Toboggan was an unexpected bonus. Results from the previous study established that these fish would have passed through the commercial gillnet fishery at the mouth of the Skeena during the first 12 days of August (Lough, 1981). The 3 Toboggan fish moved into the Bulkley with the main part of the Bulkley run during late August and remained in sections of the Bulkley downstream of Smithers.

All 3 fish wintered in deep sections of the river; perhaps to avoid heavy icing conditions throughout the shallow parts. There appears to be a wide variation in the distance that these fish winter from their spawning tributary. One fish wintered 40 km downstream from Toboggan Creek while the other 2 fish wintered 8 km and 15 km upstream from Toboggan. In terms of brood stock collection, it has been found on other Skeena tributaries that it is common for steelhead to winter in the mainstem near the mouth of a tributary and, as was the case with the Suskwa and Kitwanga Rivers, most eventually moved into the tributary to spawn. It does not follow however, that all Toboggan fish winter near the mouth of Toboggan Creek, as seen with the fish that wintered 40 km away.

Steelhead have been observed in Toboggan Creek near the lake during January (T. Turnbull, Pers. Comm.). These fish likely move into the creek during freshets in the fall to harass spawning coho, and are trapped by dropping water levels.

All 3 radio tagged fish entered Toboggan Creek during the high flows of the first real spring runoff between May 6 and May 9. Water conditions were high and dirty with a temperature of 8°C. Several beaver dams on Toboggan Creek would be a partial or total barrier to upstream fish, but most were breached or washed away during spring runoff allowing the steelhead to move up as far as Toboggan Lake.

Two of the fish spawned in Toboggan Creek just downstream of the Elliot Creek confluence. This area has had instream improvement work done in 1979 which included gravel spawning pads but unfortunately our aircraft tracking was not able to establish whether the spawning steelhead were utilizing these pads of not. The spawning pads should be checked annually and maintained so that they remain available to fish in this spawning area. The third fish moved into upper Toboggan Creek and spawned about 1 km above the lake outlet, even though the water temperatures were only 6°C. Although well within limits for spawning steelhead, it seems unusual for steelhead to move from warmer water to cool water to spawn, suggesting that perhaps available spawning habitat in this area was already being utilized, forcing fish up into a cooler tributary.

Spawning took place in mid-May and all fish had left by the third week of May. The survival of kelts that remain longer than this was probably very low since barriers again start to appear when the spring runoff waters rapidly drop during this time.

A previous evaluation of Toboggan Creek (Tredger, 1979) suggests that Toboggan is adequately seeded with an estimated escapement of 45 steelhead spawners. In the future, if brook stock is required for this section of the Bulkley River, it may be possible to take some adults (less than 50%) from Toboggan Creek. If this is done, it is recommended that some of the resulting fry are replaced in Toboggan Creek at a density that would equal the natural production of the removed spawners.

Toboggan should only be used for a brood stock source as a last resort because it is a productive system which presently yields a healthy juvenile population and should be maintained as such.

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5.0 SUMMARY AND RECOMMENDATIONS

5.1 A total of 59 steelhead were radio tagged in 1979:
- thirteen on the Cranberry River, nineteen on the Kispiox River, seven on the Kitwanga River, seventeen on the Zymoetz River and three in Toboggan Creek.

5.2 Cranberry River
- The bulk of the Cranberry steelhead run remained in the lower 30 km during the fall and winter.
- A large portion of the Cranberry run spent the fall and winter in the mainstem between 15 km and 26 km.
- The sport fishery harvested from the same group of fish throughout the season. A rough estimate of the present sport fishery exploitation is in excess of 6%. A mark-recapture study should be considered to get a more reliable population estimate and harvest rates.
- The proposed Hwy 37 bridge crossing should be closely monitored during construction. Spot checks should be carried out to see if a change in the sport harvest is necessary.
- The heaviest concentration of wintering fish was found to be in the area around McKnight Creek (21-26 km).
Fish intered McKnight Creek during the first week of May and spawned during the second week of May.
- The McKnight culvert should be either replaced or removed to allow upstream and downstream juvenile migration.
- Enhancement could include headwater stocking and stocking above barriers (waterfalls) in some of the tributaries.

5.3 Kispiox River
- A second year of tagging confirmed that most of the sport fishery targets on steelhead that are not moving, hence current catch and release regulations are warranted and should remain unchanged.
- 16% of the fish tagged in the Kispiox spawned in other rivers.
- Unlike the first year of tagging, most of the identified spawning sites were in the Kispiox mainstem. This variation may be normal depending on spring runoff patterns.

5.4 Kitwanga River
- A portion of the Kitwanga run remains off the mouth of the Kitwanga River during the fall and winter. This proportion is likely greater in years of low water during the fall.
- There was no indication that steelhead utilized the upper Kitwanga during the fall.
- All tagged fish wintered between km 1 and km 12 of the Kitwanga River.
- The most heavily utilized spawning area was between the lake outlet and Moonlit Creek.
- Tea Creek has high fisheries potential but a problem road culvert needs to be improved for better fish passage.

5.5 Zymoetz River
- There was widespread movement of steelhead in and out of the Clore River during the fall and spring, making their distinction from Zymoetz stocks unclear.

- Scale samples should be obtained from steelhead in the winter steelhead fishery on the lower Zymoetz to ensure that they are not summer fish.
- As found during the previous year of telemetry work, McDonell Lake was used for wintering by steelhead spawning below the lake.
- Enhancement opportunities are discussed.

5.6 Toboggan Creek

- The tagged fish that spawned in Toboggan Creek passed through the commercial fishery near Prince Rupert during the first twelve days of August.
- All fish wintered in the Bulkley River and entered Toboggan Creek during the first freshet of the year in early May.
- Two tagged fish spawned just downstream of the Elliot Creek confluence and the third fish spawned about 1 km above the lake, in upper Toboggan Creek.

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APPENDIX I

Radio Tagging Data From Steelhead
Radio Telemetry Studies, 1979/80

Table I - 1:
Steelhead Radio Tagging Data - Cranberry River 1979-80

Fish No.	Weight (kg)	Sex	Date Tagged	Location of Tagging (km on Cranberry River) [a]
1	4.1	M	Oct.31/79	15 km
2	4.5	F	Oct.31/79	23 km
3	4.5	F	Nov. 1/79	26 km
4	5.0	M	Nov. 1/79	25 km
5	1.8	M	Nov. 7/79	24 km
6	1.8	M	Nov. 7/79	25 km
7	1.8	F	Nov. 7/79	25 km
8	1.8	F	Nov. 7/79	24 km
9	2.3	M	Nov.27/79	15 km
10	3.6	F	Nov.28/79	23 km
11	5.9	F	Nov.28/79	23 km
12	5.4	M	Nov.28/79	24 km
13	2.3	M	Nov.28/79	24 km

[a] Tagging location taken to nearest river kilometer and measured from the Cranberry River/Nass River confluence (0 km).

Table I - 2:
Steelhead Radio Tagging Data - Kispiox River 1979-80

Fish No.	Weight (kg)	Sex	Date Tagged	Location of Tagging (km on Kispiox River) [a]
1	6.4	F	Oct.17	23 km
2	5.0	F	Oct.17	24 km
3	7.3	M	Oct.17	17 km
4	4.5	F	Oct.22	8 km
5	5.4	M	Oct.22	7 km
6	7.3	F	Oct.23	23 km
7	10.9	F	Oct.23	17 km
8	5.4	F	Oct.24	23 km
9	6.4	F	Oct.24	24 km
10	11.8	M	Oct.24	23 km
11	6.4	M	Oct.25	25 km
12	5.9	M	Oct.30	7 km
13	5.4	F	Oct.30	7 km
14	5.0	M	Oct.30	7 km
15	7.3	M	Oct.31	10 km
16	10.0	M	Oct.31	8 km
17	9.1	M	Oct.31	7 km
18	9.1	M	Nov. 1	6 km [b]
19	5.4	F	Nov. 1	6 km

[a] Tagging location taken to nearest river kilometer as measured from the confluence of the Kispiox River and the Skeena River (0 km).

[b] Steelhead #18 was recaptured Nov.20/79 in the same area as it was tagged.

Table I - 3:
Steelhead Radio Tagging Data - Kitwanga River 1979-80

Fish No.	Weight (kg)	Sex	Date Tagged	Location of Tagging (km of Kitwanga River)[a]
1	6.4	F	Oct.3	0 km
2	8.2	M	Oct.4	0 km
3	4.5	F	Nov.21	16 km
4	5.0	M	Nov.21	8 km
5	4.0	F	Nov.22	4 km
6	5.5	M	Nov.22	2 km
7	4.5	M	Nov.23	6 km

[a] Tagging location taken to the nearest river kilometer as measured from the confluence of the Kitwanga River and the Skeena River (0 km).

Table I - 4:
Steelhead Radio Tagging Data - Zymoetz River 1979-80

Fish No.	Weight (kg)	Sex	Date Tagged	Location of Tagging (km on either Zymoetz or Clore)[a]
1		M	Nov.7	Zymoetz - 40 km
2		M	Nov.8	Clore - 15 km
3		M	Nov.8	Clore - 15 km
4		F	Nov.14	Clore - 14 km
5		M	Nov.14	Clore - 14 km
6		M	Nov.14	Clore - 14 km
7		M	Nov.14	Clore - 14 km
8		M	Nov.15	Clore - 8 km[b]
9		F	Nov.15	Clore - 8 km
10		F	Nov.15	Clore - 8 km
11		F	Nov.15	Clore - 8 km
12		F	Nov.15	Clore - 3 km
13		F	Nov.15	Clore - 3 km
14		M	Nov.20	Zymoetz - 100 km
15		M	Nov.20	Zymoetz - 100 km
16		F	Nov.20	Zymoetz - 100 km
17		F	Nov.20	Zymoetz - 100 km

[a] Tagging location taken to nearest river kilometer as measured from the mouth of either the Zymoetz or Clore Rivers.

[b] Steelhead #8 recaptured Nov.22/82 in the same area that it was tagged.

Table I-5. Steelhead Radio Tagging Data - Toboggan Creek 1979-80.

Fish No.	Weight[b] (kg)	Sex	Date[c] Tagged	Location of Tagging (separate study; August 1979)[a]
1	-	-	Aug.4-13/79	80 km (Skeena)
2	-	-	Aug.9-15/79	80 km (Skeena)
3	-	-	Aug.9-15/79	80 km (Skeena)

[a] Tagging location in km as measured from the mouth of the Skeena River at Tyee (0 km).

[b] Individual identity of these fish could not be determined because other fish were tagged with the same frequency. Once these fish entered the Bulkley River, they were identified through characteristic pulse rates.

[c] Determined by the frequency of the radio transmitter, and the dates that these were used on the lower Skeena.

APPENDIX II

Data For Steelhead That Were
Spaghetti Tagged During Radio
Telemetry Studies, 1979/1980

Table II - 1:
Steelhead Spaghetti Tagging Data Cranberry River 1979-80

Fish No.	Wt (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	4.5	M	30-10-79	00201
2	3.6	F	30-10-79	00201
3	1.8	M	30-10-79	00203
4	1.6	M	30-10-79	00204
5	1.8	M	30-10-79	00205
6	3.6	F	31-10-79	00206
7	2.3	F	31-10-79	00207
8	3.6	F	31-10-79	00208[a]
9	3.2	M	31-10-79	00209
10	2.3	F	31-10-79	00210
11	2.3	F	31-10-79	00211
12	2.3	M	31-10-79	00212
13	3.6	M	31-10-79	00214
14	2.3	M	01-11-79	00215
15	1.4	F	01-11-79	00216
16	1.4	F	01-11-79	00217
17	1.8	F	01-11-79	00218
18	3.2	M	01-11-79	00219
19	1.8	F	01-11-79	00220
20	1.8	M	01-11-79	00221
21	2.3	M	01-11-79	00222
22	4.1	F	02-11-79	00223
23	3.2	M	02-11-79	00224[b]
24	2.3	M	02-11-79	00225
25	1.8	M	02-11-79	00226

Table II - 1:

Steelhead Spaghetti Tagging Data Cranberry River 1979-80
(continued)

Fish No.	Wt (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
26	2.7	M	02-11-79	00227
27	1.8	F	02-11-79	00228
28	2.7	F	02-11-79	00229
29	3.2	M	02-11-79	00230
30	2.7	M	07-11-79	00231
31	2.3	M	27-11-79	00004
32	1.8	F	27-11-79	00036
33	1.8	M	27-11-79	00037
34	1.4	M	28-11-79	00237
35	6.4	M	28-11-79	00238
36	1.4	M	28-11-79	00239

a. Steelhead #00208 recaptured March 30, 1980 approximately 4 km downstream of tagging site.

b. Steelhead #00224 recaptured November 28, 1980 approximately 3 km downstream of tagging site.

Table II - 2:

Steelhead Spaghetti Tagging Data Kispiox River 1979

Fish No.	Wt (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	1.8	F	17-10-79	00009
2	4.1	F	17-10-79	00010
3	2.3	M	18-10-79	00008
4	2.3	M	22-10-79	00056
5	3.6	F	23-10-79	00057
6	4.1	F	23-10-79	00058
7	2.3	M	24-10-79	00059
8	2.3	M	25-10-79	00061
9	4.5	F	25-10-79	00062
10	1.8	M	26-10-79	00063
11	3.6	F	26-10-79	00064
12	1.8	M	30-10-79	00011
13	2.3	?	01-11-79	00065
14	1.8	F	02-11-79	00012

Table II - 3:
Steelhead Spaghetti Tagging Data Kitwanga River 1979

Fish No.	Wt (Kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	4.5	M	20-11-79	00232
2	5.4	F	20-11-79	00233
3	2.3	M	20-11-79	00234
4	2.7	M	20-11-79	00235
5	2.3	M	22-11-79	00236
6	4.1	F	22-11-79	00095
7	3.2	F	22-11-79	00033
8	0.9	F	22-11-79	00093

Table II - 4:
Steelhead Spaghetti Tagging Data Zymoetz River 1979

Fish No.	Wt (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	3.6	F	06-11-79	00066
2	4.1	F	07-11-79	00067
3	1.4	F	07-11-79	00068
4	2.3	M	07-11-79	00069[a]
5	1.8	M	13-11-79	00080
6	2.3	M	13-11-79	00081
7	2.3	F	15-11-79	00020
8	4.5	F	16-11079	00021
9	2.3	M	20-11-79	00100
10	4.1	M	20-11-79	00022
11	4.1	F	20-11-79	00099
12	4.1	F	20-11-79	00098
13	5.9	M	20-11-79	00024
14	8.2	M	20-11-79	00026
15	9.1	M	20-11-79	00096
16	5.0	M	20-11-79	00097
17	7.7	F	20-11-79	00095
18	6.8	M	20-11-79	00027
19	4.1	F	20-11-79	00028
20	5.4	M	20-11-79	00029
21	4.1	F	20-11-79	00030
22	3.6	F	20-11-79	00031
23	1.8	M	20-11-79	00032

a. Steelhead #00069 recaptured February 10, 1980 approximately 15 km downstream of tagging site

Table II - 4:

Steelhead Spaghetti Tagging Data Clore River 1979

Fish No.	Wt (kg)	Sex	Date Tagged	Spaghetti Tag Number (Green)
1	2.3	M	07-11-79	00072
2	2.3	M	08-11-79	00074[a]
3	2.0	F	08-11-79	00075
4	2.3	F	08-11-79	00076
5	2.5	M	08-11-79	00077
6	2.3	F	08-11-79	00078
7	3.6	F	09-11-79	00079
8	1.8	M	14-11-79	00082
9	3.2	F	14-11-79	00083
10	3.6	F	14-11-79	00085
11	2.3	M	14-11-79	00086
12	2.3	M	14-11-79	00087
13	1.8	M	14-11-79	00088
14	2.3	M	14-11-79	00089
15	2.3	M	14-11-79	00090
16	2.3	M	14-11-79	00091
17	1.4	M	15-11-79	00013
18	2.3	M	15-11-79	00014
19	2.3	M	15-11-79	00015
20	2.3	M	15-11-79	00017
21	4.5	F	15-11-79	00019

a. Steelhead #00074 recaptured November 24, 1979 approximately 1 km upstream of tagging site.

APPENDIX III

Spot Temperature Observations and Water Conditions of Study Rivers

III - 1. CRANBERRY RIVER

III - 2. KISPIOX RIVER

III - 3. KITWANGA RIVER

III - 4. ZYMOETZ RIVER

Table III - 1 Spot temperature observations (°C) and water conditions of Cranberry River and tributaries, 1980.

	Mainstem @ 49 km	Mainstem @ 18 km	McKnight	Aluk	53 km Cr.	50 km Cr.	Clamin Cr.
April 28	3.5	6	5	3	-	-	-
May 2	-	7	7	-	5	-	-
May 5	5 Lo + green	7 Lo + green	7	4 Lo	6	-	-
May 8	5	6	8	4	6	3	-
May 13	5 Dirty	7 Dirty	10	5	7 Hi & dirty	3	-
May 14	-	6	10	-	-	-	10
May 20	5	7	9	6	6	4	-
May 23	6	8	9	6	7	5	-
May 27	7 Dirty	10	11	7	9 Green	7	-
June 3	11	10	12	9	11	7	-
June 7	-	12	14	-	11	10	-
June 10	8.5	-	12	-	11	10	-
June 13	-	11 Dropping	12	-	-	-	-
June 27	-	13 Green	11	-	12 Lo + green	11	-

Table III - 2 Spot temperature observations (°C) and water conditions of the Kispiox River and some of its tributaries, 1980.

	Kispiox (Patch)	Murder	Cullon	Skunsnat	Clifford	Ironside	Sweetin	Nangeese
May 6	7 Hi	7	5	-	-	-	-	-
May 22	9 Lo	10	9	9	7	8	5	5
May 27	10 Hi	12	8	-	-	-	-	-
May 29	9 Hi	14	12	-	-	-	-	-
June 4	11 Grey	-	-	-	-	-	-	-
June 19	11 Green	-	-	-	-	-	-	-
July 2	13 Clear	-	-	-	-	-	-	-
July 10	11	-	-	-	-	-	-	-

Table III - 3 Spot temperture observations (°C) and water conditions for streams in the Kitwanga River drainage, 1980.

	Kitwanga R. mainstem	Tea Creek	Moonlit Creek	Kitwanga R. above Kitwancool
April 28	6°	6°	-	-
April 30	5° lo, green	-	-	-
May 2	6°	-	-	-
May 5	5° lo, green	6° lo, colored	-	-
May 8	7°	8°[a]	4°	-
May 13	9° hi, brown	5° colored	-	-
May 14	8° hi, grey	12° hi, colored	6° hi, grey	-
May 20	9° hi, grey	-	-	-
May 27	-	-	-	13° clear
June 7	-	-	-	16° clear
June 10	-	-	-	17° clear
June 17	-	-	9°	17° clear
June 27	-	-	-	19° lo, clear

[a] Tea Creek culvert at Highway 37 approx. 100 m long with an approx. current velocity of 2.4 m/sec on May 18, 1980 (high water) and 1.5 m/sec on May 8, 1980 (low water).

Table III - 4:
Spot temperatures observations (°C) and water conditions for streams in the Zymoetz River Drainage, 1980.

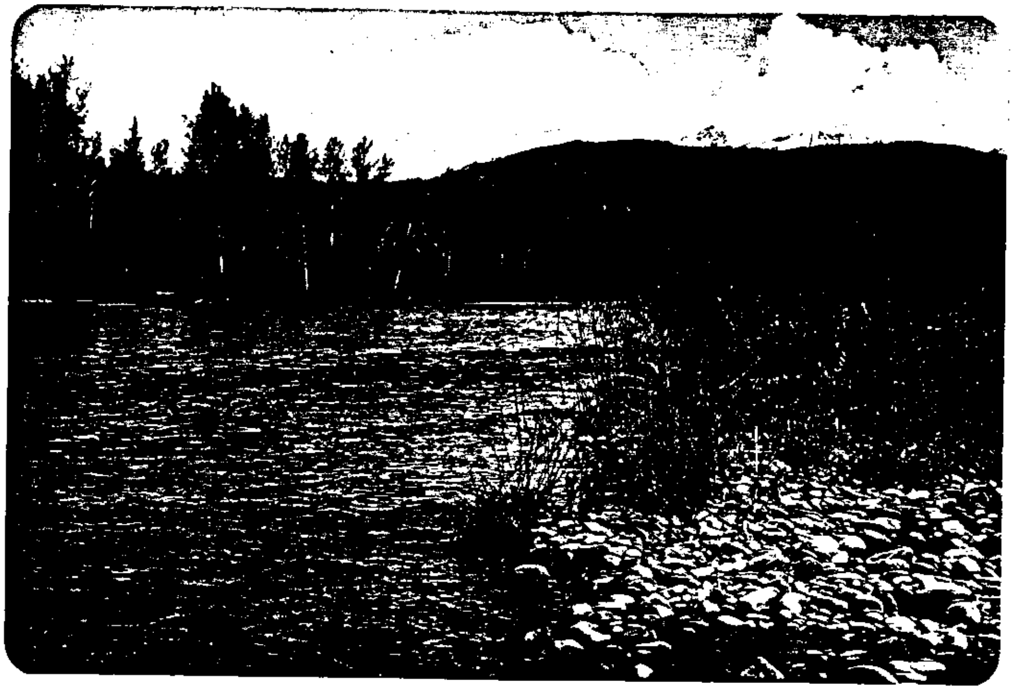
	Zymoetz above Serb	Zymoetz below Serb	Serb	Clore	Moraine	Elf	Thomas	Trapline	Kitnayakwa	Silvern Passby Willow
May 7	-	Lo + Muddy	Lo + Muddy	Lo	-	-	-	-	-	-
May 15	-	5 Muddy	-	5 Hi + Muddy	4 Clear	5 Clear	5 Clear	5 Clear	-	-
May 24	8 Clear + Lo	6 Glacial	Dropping Glacial	-	-	-	-	-	-	-
May 29	-	7 Colored	-	7 Grey	6 Clear	7 Clear	7 Clear	7 Clear	7 Colored	-
June 7	10 Clear	8 Glacial	6 Hi + Glacial	-	-	-	-	-	-	6 Dropping Clear
June 10	-	9 Hi + Muddy	-	-	8 Clear	9	7 Glacial	-	-	-
June 26	-	11 Dropping	-	12 Glacial	-	11	9 Glacial	12	-	-
July 3	-	11 Green	-	10 Glacial	11 Clear	9	-	-	-	-
July 10	-	10 Glacial	-	9 Green	-	10	7 Glacial	-	-	-

APPENDIX IV

Photographs

Cranberry River. McKnight Creek downstream of Highway 37

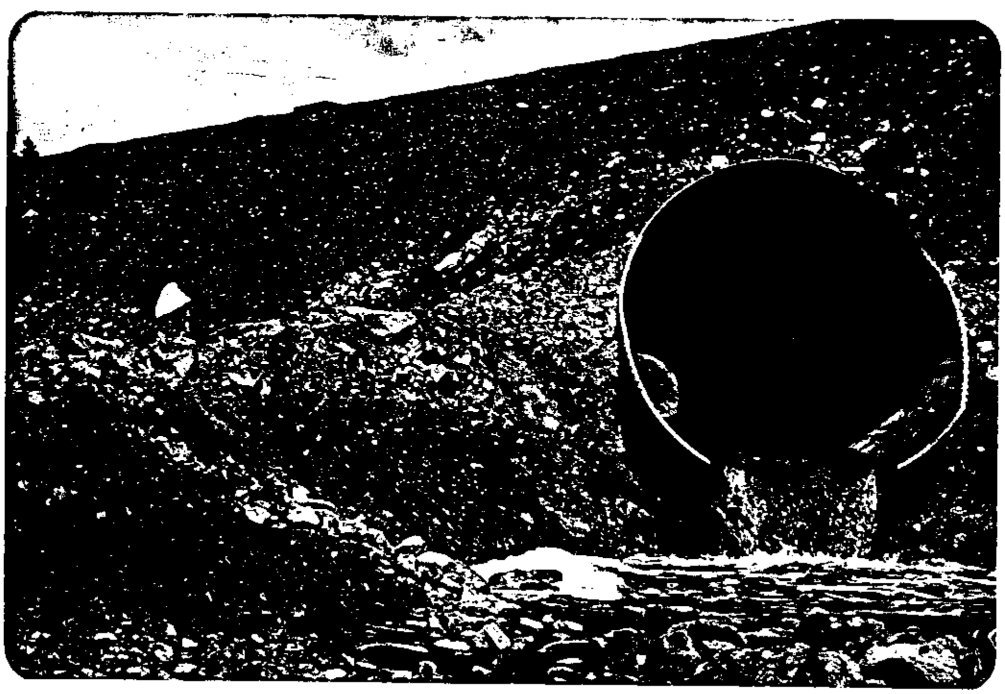
Cranberry River. Highway 37 culvert on McKnight Creek should be removed or replaced when new highway is built.



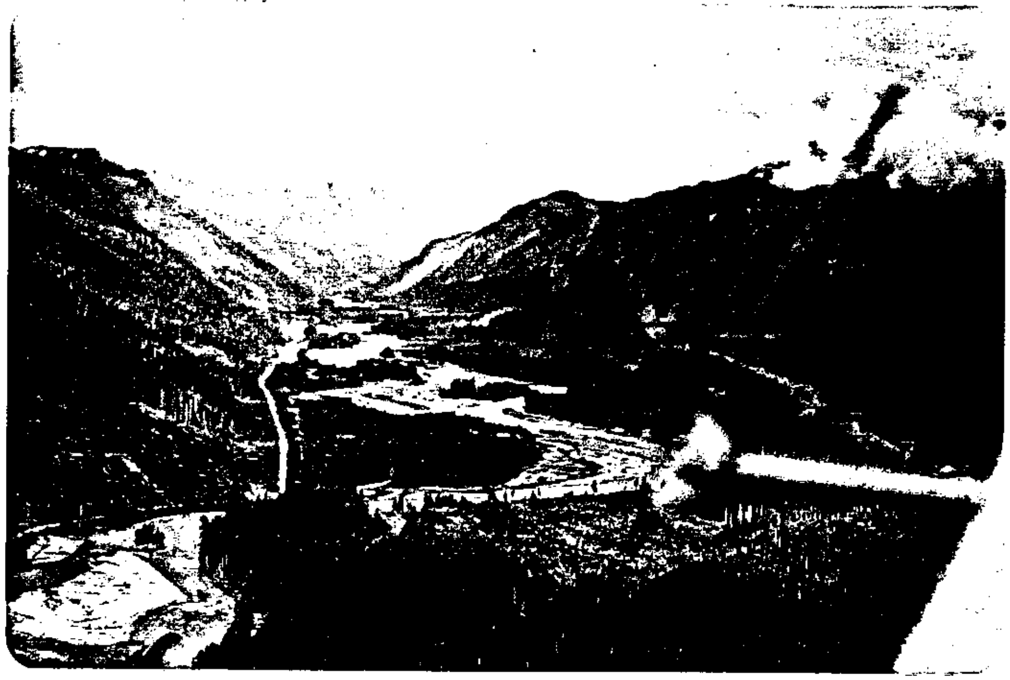
Kispiox River. Mainstem spawning site at middle Potatoe Patch on the lower Kispiox.

Kispiox River. An example of mainstem spawning habitat. A radio tagged fish spawned in the side channel at the left of the picture.

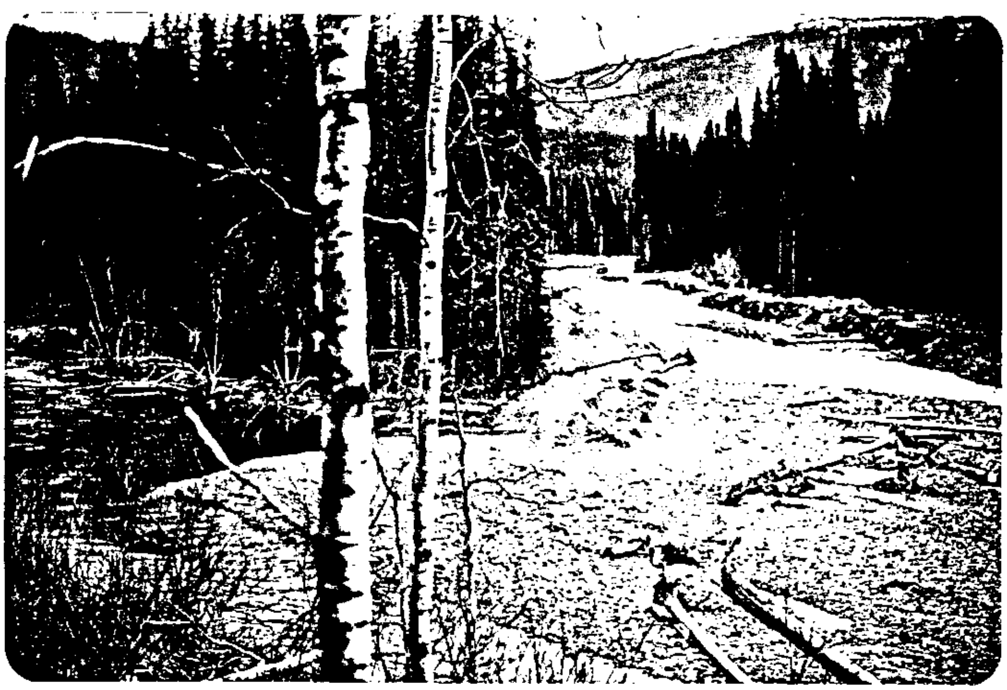
Kitwanga River. Heavy mainstem spawning was observed between the lake and Moonlit Creek.



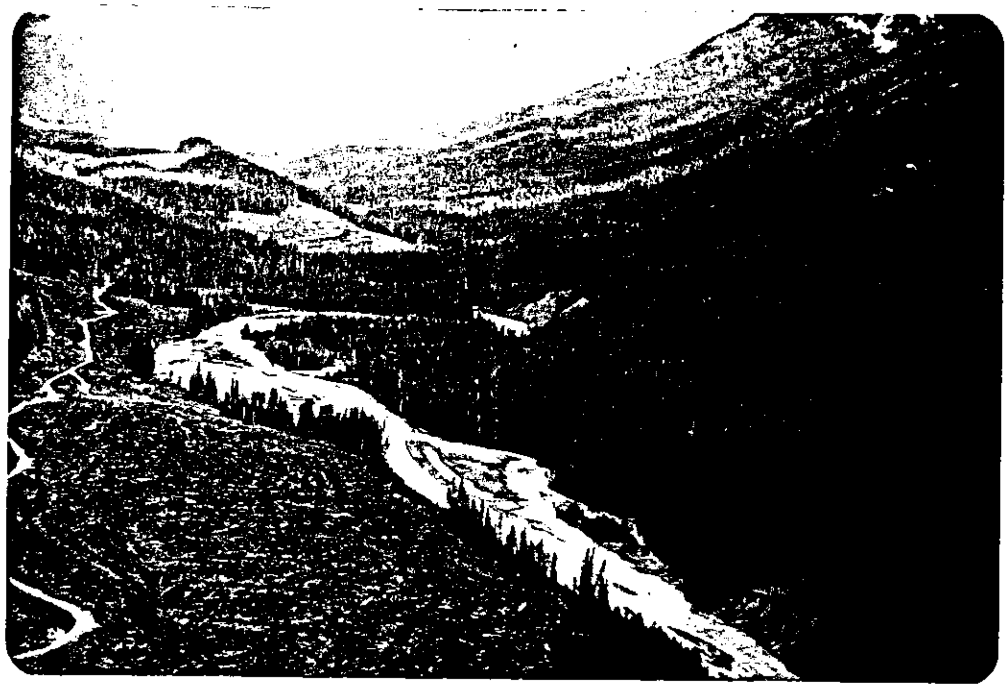
Kitwanga River. The Highway 37 culvert at Tea Creek is a barrier for adult and juvenile salmonid migrations.



Zymoetz River. Looking downstream from Clore River confluence (lower left corner) showing the area used for wintering and spawning.



Zymoetz River. Upper river below land (left)and Serb Creek (right) at confluence. Heavy spawning observed in the river upstream of the Serb.



Zymoetz River. Clore River near the mouth of Elf Creek, showing the side channels utilized for spawning.

Zymoetz River. Clore River upstream of Thomas Creek. Steep valley walls and high gradient, cold tributaries cause most spawners to utilize the mainstem Clore.

Toboggan Creek. Highway 16 culvert on lower Toboggan Creek; recently improved with velocity baffles to aid juvenile and adult migration.

Toboggan Creek. Upper Toboggan near Evelyn Creek has excellent spawning and rearing habitat. Radio fish spawned near this site.