COMMERCIAL INTERCEPTIONS OF STEELHEAD TROUT IN THE SKEENA RIVER. - - - RADIO TELEMETRY STUDIES OF STOCK IDENTIFICATION AND RATES OF MIGRATION.

BY

M.J. LOUGH

BRITISH COLUMBIA FISH & WILDLIFE BRANCH

SMITHERS, B.C.

Skeena Fisheries Report #80-01 (S.E.P.)

March 1981

TABLE OF CONTENTS

ABSTRACT

Radio transmitters were placed in 102 Skeena River steelhead during the summers of 1978 and 1979 in order to determine time of entry of specific stocks into the estuary and their potential interception by the commercial gillnet fishery. Adverse water conditions severely hampered the project in 1978; in fact, 95 of the 102 transmitters were placed in 1979. Of those 95 fish tagged, 37% entered the Bulkley-Morice system, 19% migrated to the Upper Skeena (above Bulkley-Morice), 16% remained in the Middle Skeena (Terrace to Bulkley-Morice) and 14% remained near the tagging sites in the Lower Skeena. Bulkley-Morice steelhead predominated in the late July, early August tagging, and the highest interception of this stock took place during the week ending August 12 when an estimated 1,144 fish were harvested. Upper Skeena steelhead (Babine, Kispiox) predominated during the mid to late August tagging period. A model is presented indicating proportions of steelhead stock harvested during various phases of the 1979 gillnet fishery. During the study, 22 of the 95 radio tagged fish were eventually captured in the Indian or sport fishery.

INTRODUCTION

Skeena River steelhead trout (Salmo gairdneri Richardson) are subject to intense fishing pressure as a result of the sockeye and pink salmon commercial gillnet fishery near the mouth of 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 & Evans, 1978).

Chudyk and Narver (M.S., 1976) indicated that individual stocks of Skeena steelhead move independently through the commercial fishery. In order to better manage Skeena steelhead, it was important that these stocks be identified. The method selected was radio tagging, and in 1978 a two-year study was implemented by the B.C. Fish and Wildlife Branch. The primary objective was to identify the individual stocks of steelhead as they moved through the commercial fishery at the mouth of the Skeena River and to determine their rate of movement within the Skeena drainage.

In 1978, 7 Skeena steelhead were radio tagged. Results from that small sample indicated that Babine and Zymoetz River stocks were involved in commercial interceptions (Laugh, M.S. 1979). In 1979, the second and

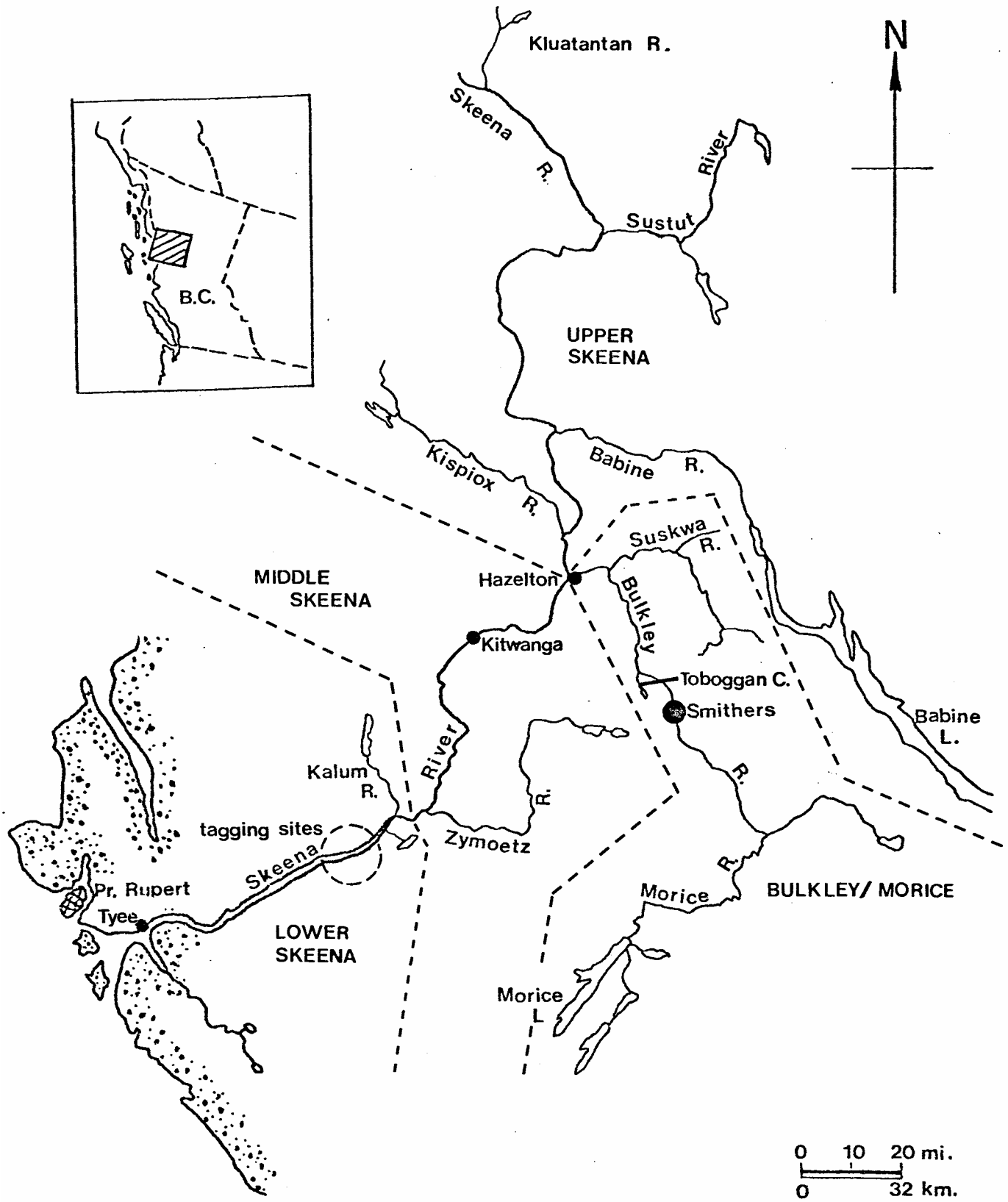


Fig. 1 Skeena River drainage Study area, showing the boundaries of the four sub-areas, 1979.

final year of radio tagging was carried out on the Skeena. Although this report combines the results of the 2 years of study, it is based almost entirely upon the 1979 data because of the much larger sample of tagged fish.

MATERIALS AND METHODS

The basic study design called for radio tagging steelhead on the lower Skeena during the period of greatest commercial fishing pressure in mid-July through August. In order to identify which individual stocks were involved in the fishery, different frequencies of radio tags were to be used each week, for 5 weeks. The early part of the run could therefore be separated from the late part when their movements were monitored throughout the fall.

Telemetry equipment and methods were largely the sane as those described in previous studies (Lough, 1980). The changes worth noting were the method of live capture and the locations of automatic scanning stations.

Several methods of live capture of steelhead were tested on the Skeena during the first year of this study and the most successful was angling. During the second year, all efforts were spent on angling at the tagging sites located about 70 km to 80 km from Tyee; at the mouth of the Skeena.

In 1978, automatic scanning stations were set up at the mouths of several key tributaries of the Skeena such as Morice, Kispiox and Zymoetz

Rivers. Early evidence from this and other telemetry studies (Lough, M.S. 1980) indicated that steelhead did not always move directly into their spawning tributary. Some fish wintered in the mainstem Skeena before moving into smaller tributaries in the springtime to spawn. Therefore, in 1979 scanners were moved to locations where they would identify fish entering one of four general areas, each of which included several major tributaries.

The four areas divided the Skeena drainage as follows:

1) Lower Skeena - includes the Skeena and tributaries from tidal waters to and including the Kitsumkalum River. Major tributaries are Kitsumkalum, Lakelse, Gitnadoix,Ecstall, Exchamsiks, Exstew, Kasiks, and Khyex Rivers.

2) Middle Skeena - includes the Skeena and tributaries upstream of the Kitsumkalum River but downstream of the Bulkley River. Major tributaries are the Zymoetz, Kitwanga and Kitsequecla Rivers.

3) Bulkley/Morice - includes the Bulkley River and tributaries upstream of it's mouth. Major tributaries are the Morice, Suskwa and Telkwa Rivers.

4) Upper Skeena - includes the Skeena and its tributaries upstream of the Bulkley River. Major tributaries include the Kispiox, Babine, Sustut, Bear, and Kluatantan Rivers.

Migration rates of the tagged steelhead were determined through a combination of 2 methods. Automatic scanning stations provided data on the time and frequency (group) of any radio fish that moved past. The second method was routine radio tracking throughout the study area, which monitored fish movements where there were no stations.

RESULTS AND DISCUSSION

Entry into the Skeena

Steelhead first begin to appear at the mouth of the Skeena River during the first week of July. Although only a few steelhead are caught in the gillnets at this time, catches increase steadily until early August when steelhead landings reach a peak (Fig. 2). During late July and early August, the commercial fishing pressure can be very intense. In 1979, the gillnet fleet reached a maximum of 685 boats in Fisheries Statistical Area 4 (Skeena mouth) during the first week of August (Fig 3). The results of this kind of harvest pressure are dramatic as seen at the federal test fishery at Tyee. This test fishery is located just upstream of the commercial fishing boundary, and is used to estimate escapement for the Skeena stocks. Immediately following a weekly opening, the catches at Tyee (the escapement) are severely reduced, indicating that when the commercial openings are in effect, very few steelhead get past the gillnets and into the Skeena (Fig. 4)

Chudyk and Narver (M. S. 1976) pointed out an apparent shift in the average peak catch of steelhead from August 2 (1962-66) to August 9 (1973—75). Recent data for the years 1976-79 indicates that this trend is continuing; the average peak catch for these years now appears on August 12 (Fig 5). The reason for the displacement of the peak catch seems to be the intensive net pressure during late July and early August. The portion of the steelhead run during this time has apparently been largely removed by the commercial fishery, and is now only a fraction of the former peak.

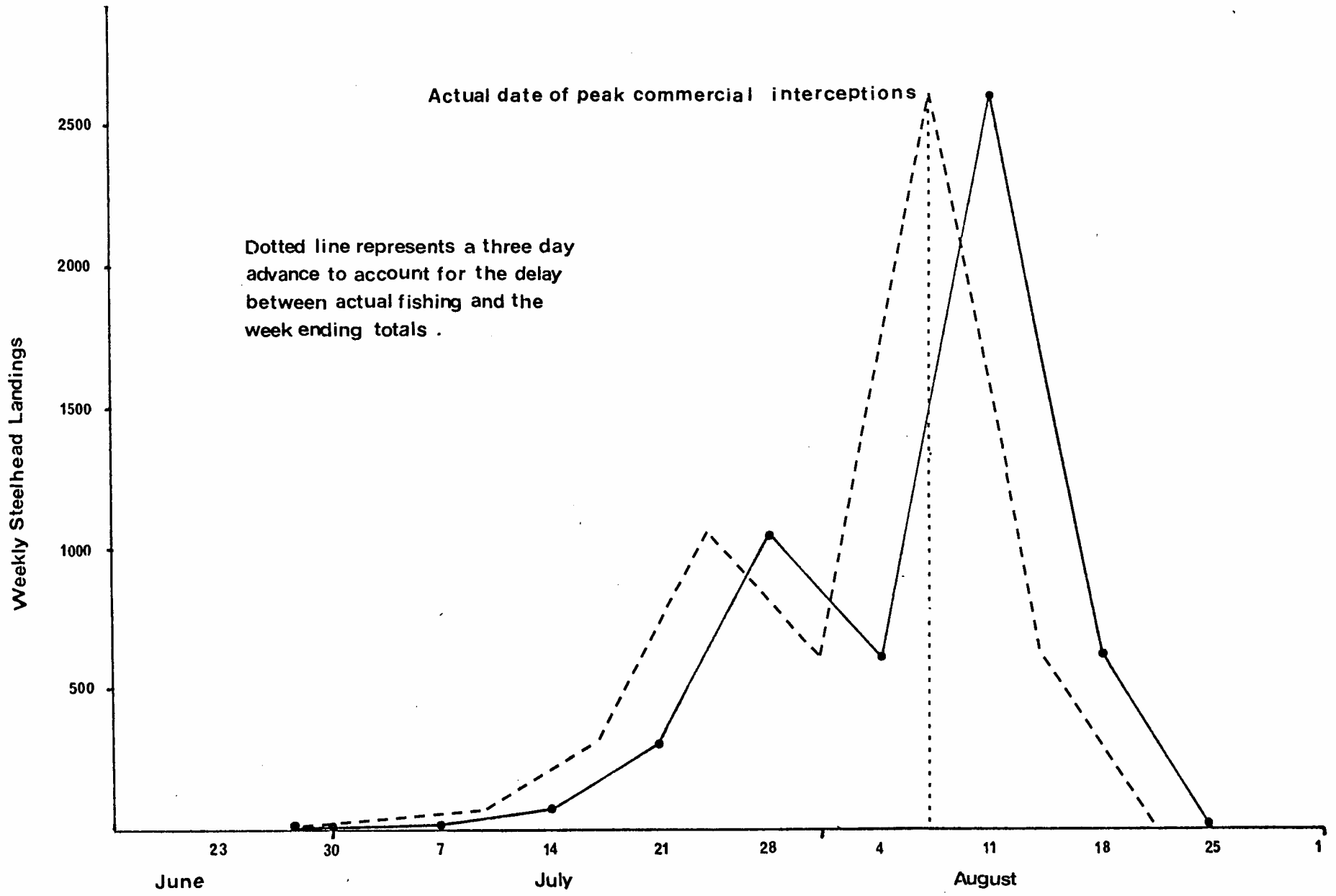


Fig. 2. Weekly Steelhead landings for Skeena River (Area IV) gillnet fishery 1979.

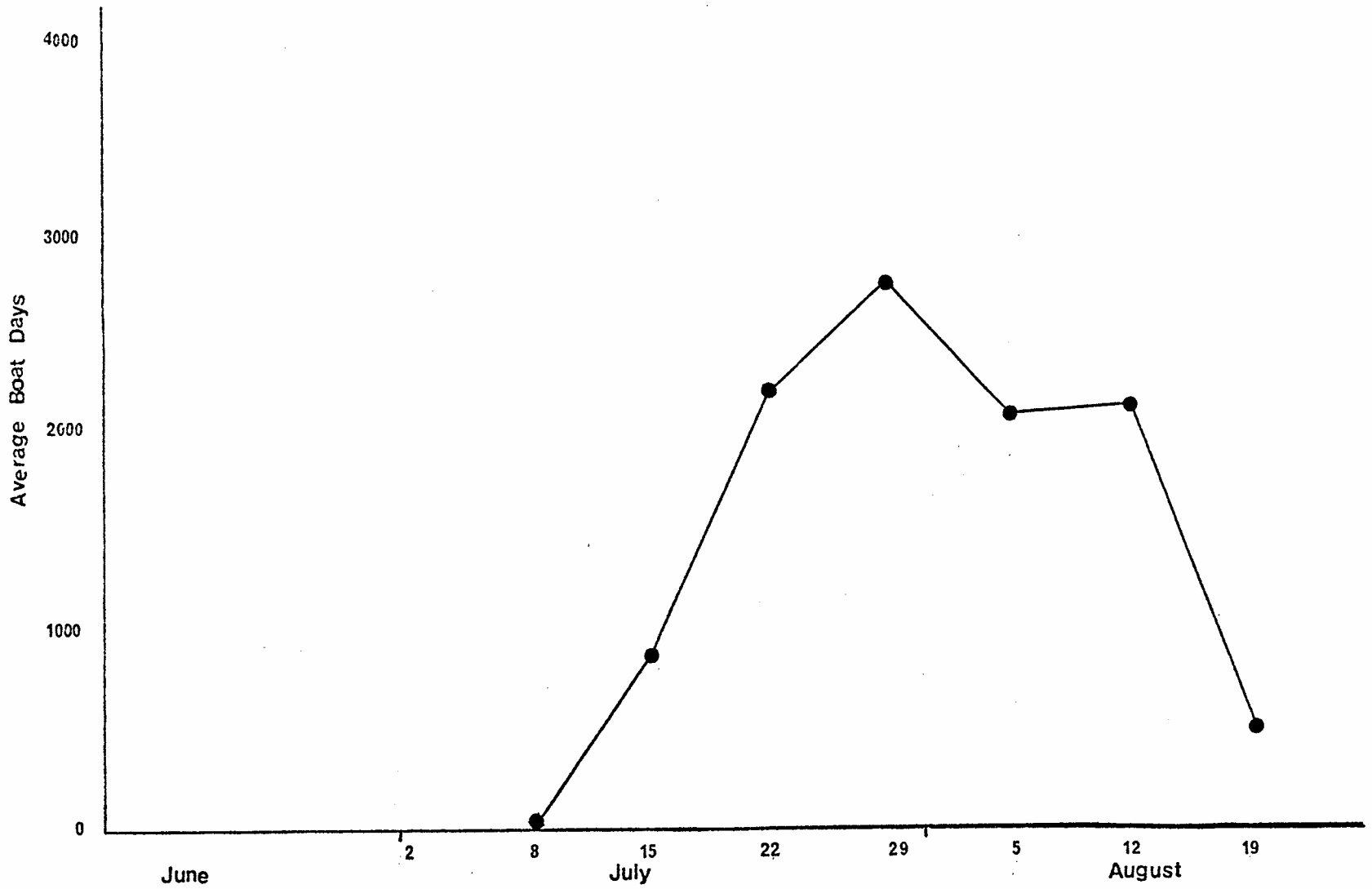


Fig.3 Average boat days (number of boats X days. of openings) for Skeena River commercial gillnet fishery, 1979.

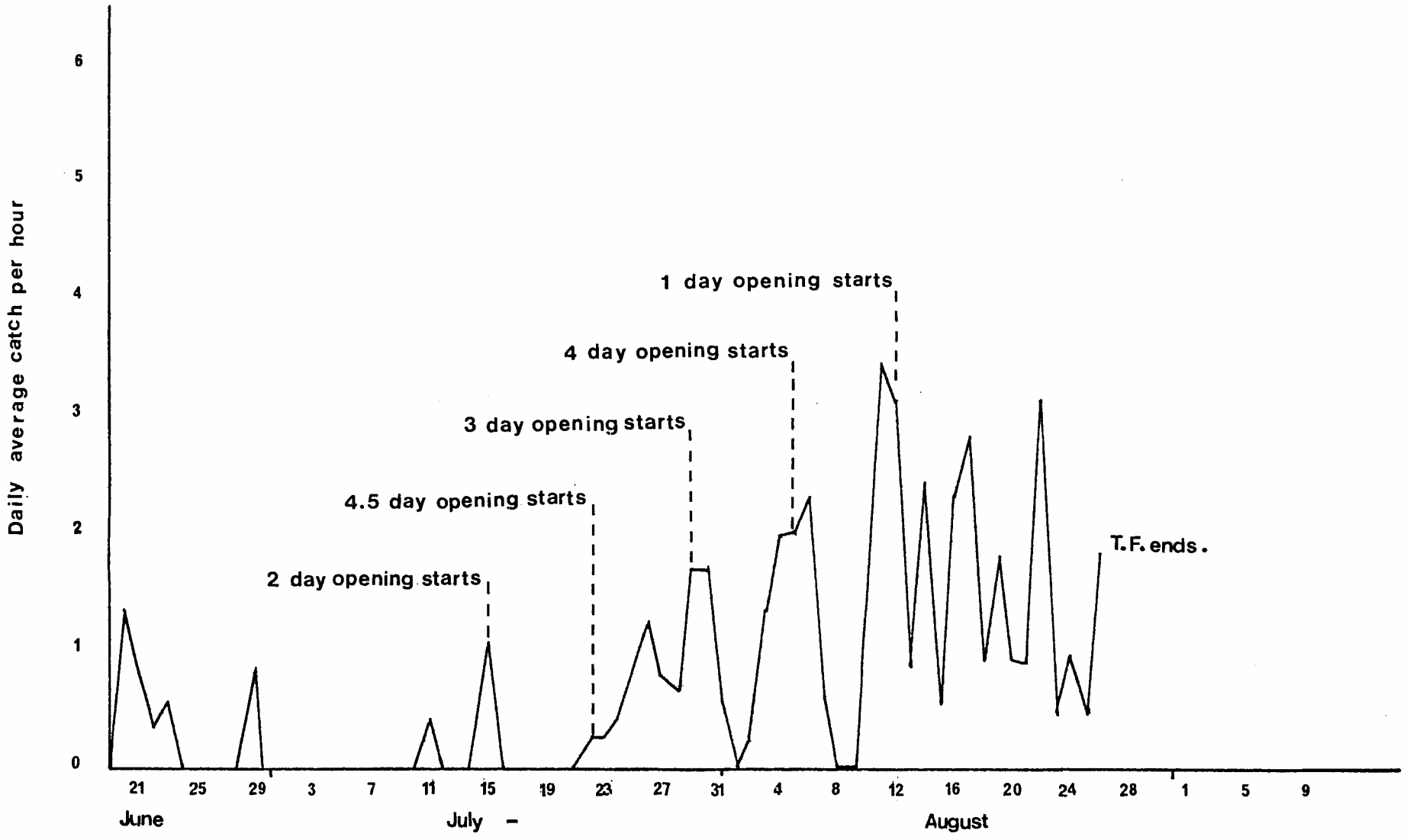


Fig. 4. Skeena test fishery daily average steelhead catch per hour for 1979. Steelhead catches in the test fishery decline immediately after commercial fishery openings.

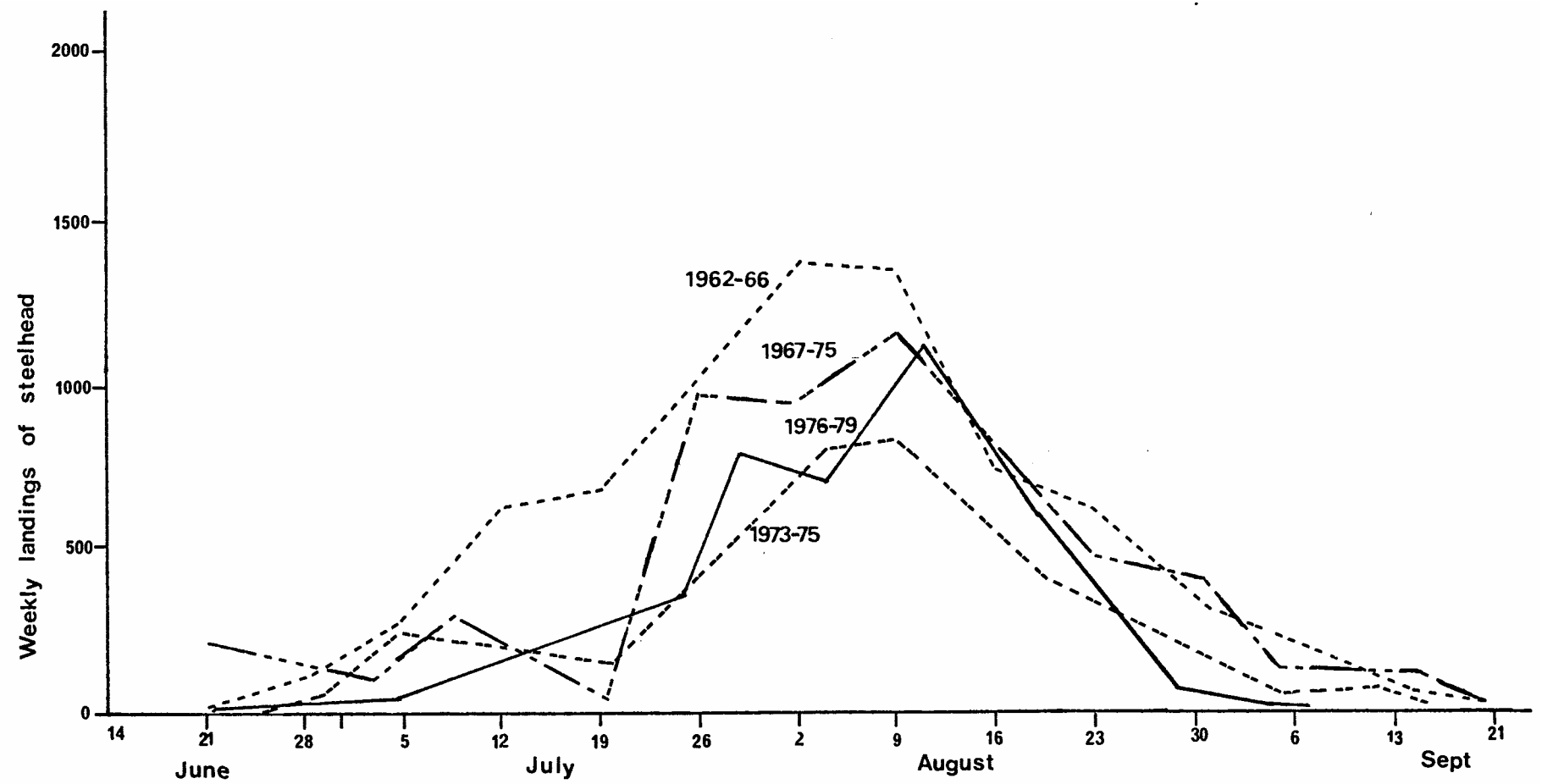


Fig. 5. Average weekly catch of steelhead in the Skeena River gillnet fishery, 1962—79.

Averaging of test fishery data for 1976-79 shows that steelhead catches at Tyee peaked on August 15 (Fig. 6). Commercial landings for the same period (standardized fishing weeks) peaked during the week ending August 12, When corrected for the delay between actual fishing and delivery totals, the true peak of commercial interceptions was found to be closer to August 8. I believe the peak of the run (not the catch) for 1979 occurred near August 11 or 12 but was not detected because of lower fishing pressure at the time. This ties in with the peak in the test fishery because Oguss and Evans (1978) demonstrated that since steelhead do not pool in the estuary, there is only a delay of about one day between the commercial and test catches (Fig. 7).

Once the steelhead actually enter the river, they wasted little time moving upstream as far as the tagging sites. Evidence indicated that steelhead may take only one to two days to travel from Tyee to the tagging sites 75 km upstream. For example, on. August 13, 1979 commercial gillnetters(W. Penner, Pers. Comm.) commented that many unusually large steelhead moved through the fishing area and two days later the radio tagging crew noticed the same thing. More evidence came to light when live sea lice (Lepeophtheirus salmonus) were observed on many steelhead being tagged. Z. Kabata (Pers, Comm.) of the Pacific Biological Station stated that these lice die after one or two days in freshwater, indicating these fish traveled the 75 km in that time. This information was useful because in order to make the tagging data relevant, it was necessary to know when the fish being radio tagged moved through the commercial fishery. The 1 or 2 day delay between the commercial and test fisheries plus the 1 or 2 day delay between the test fishery and tagging sites combine to indicate that steelhead which were radio tagged actually moved through the commercial fishery 2 to 4 days earlier.

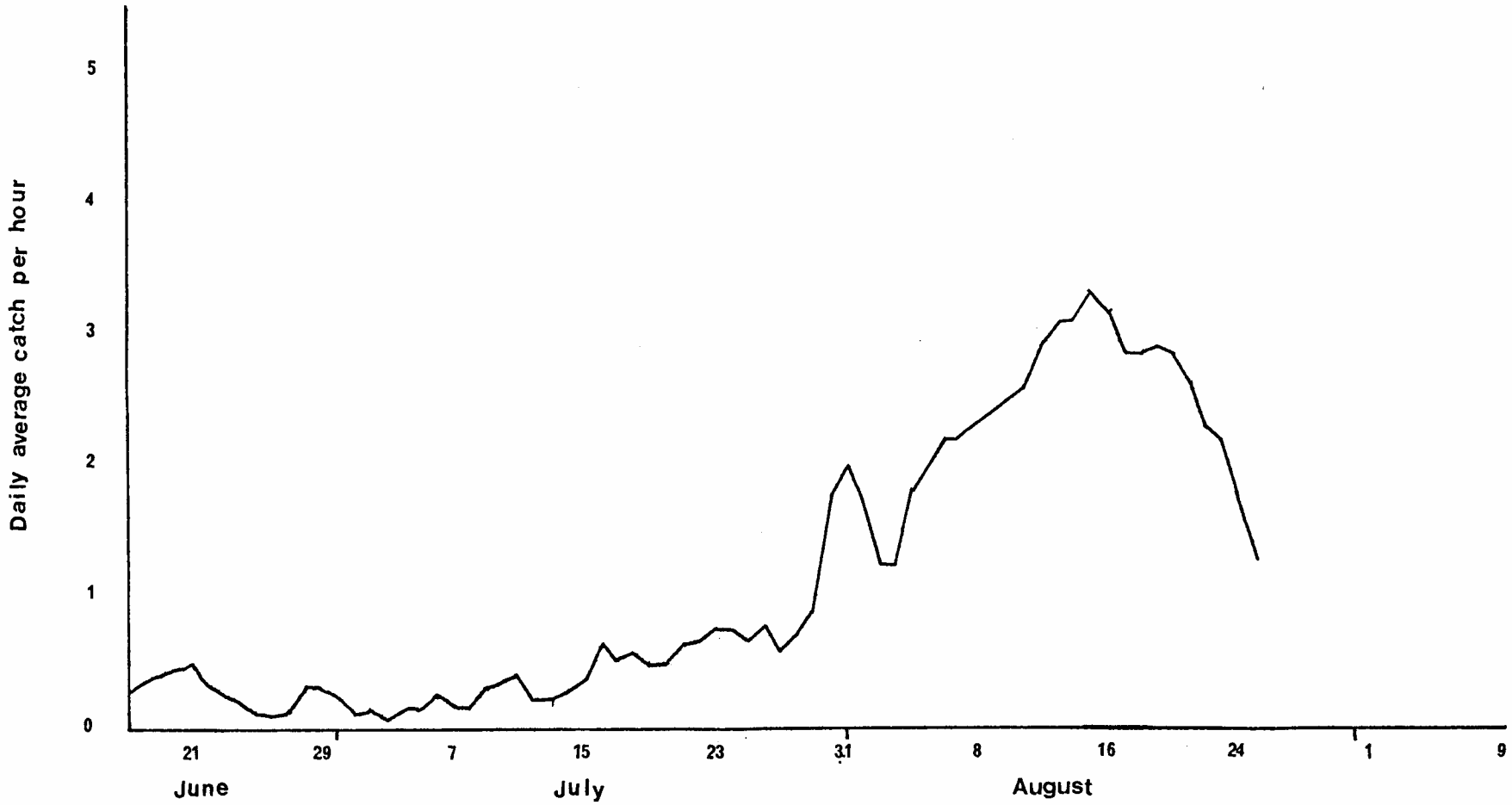


Fig. 6. Skeena test fishery daily average catch per hour from 1976 to 1979.

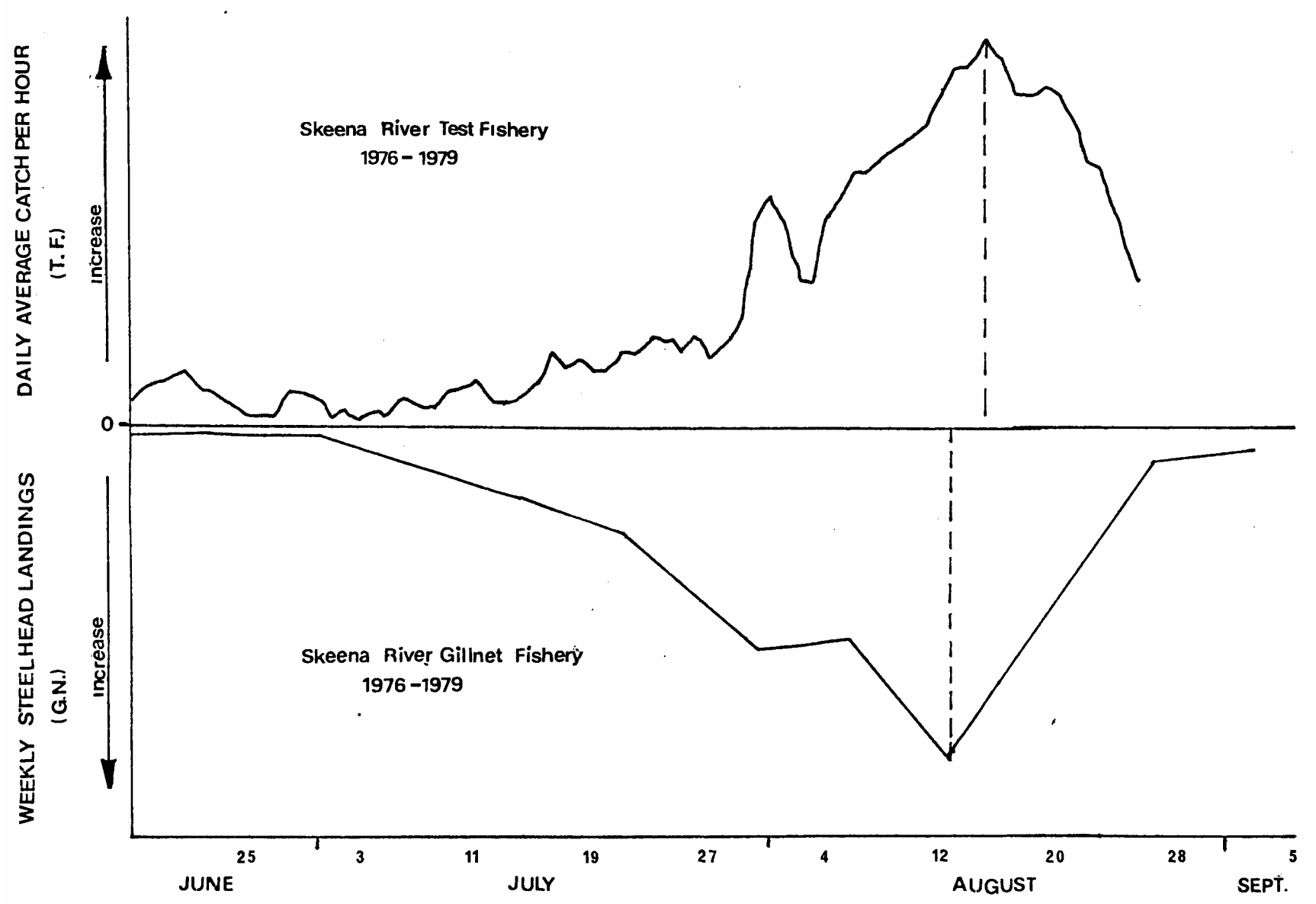


Figure 7. Comparison of Peak Steelhead landings in the Commercial and Test Fisheries on the Skeena River.

Tagging

Radio tagging depended largely on the ability to live capture steelhead. Although the study design was to use different frequencies each week for 5 weeks, under field conditions the weekly tagging periods were adjusted slightly to coincide with surges of fish moving through the tagging sites. As a result, the 5 frequencies (groups) of tags were deployed in just over 4 weeks (Fig. 8).

Group 1 was comprised of 14 steelhead tagged between July 26 and August 3. Group 2 had 18 steelhead tagged between August 4 and August 10. Group 3 included 19 fish tagged between August 9 and 15. Group 4 had 19 steelhead which were tagged on August 16 and 17. The latter portion of the run was represented by Group 5 fish; the 25 steelhead between August 20 and 24 (Table 1).

Rates of Migration

Mean rates of migrations were calculated for steelhead which passed the scanners as they entered the Bulkley/Morice (162 km from tagging sites) and the upper Skeena (175 km from tagging sites). Although the mean rates of migration for individual fish ranged from 2.1 km/day to 27 km/day the mean rates of all fish to pass these scanners was 8.6 km/day (Table 2). There was no significant difference between the rates of fish destined for the Bulkley/Morice and the upper Skeena at the 0.05 confidence level (t=l.29, D.F.=43).

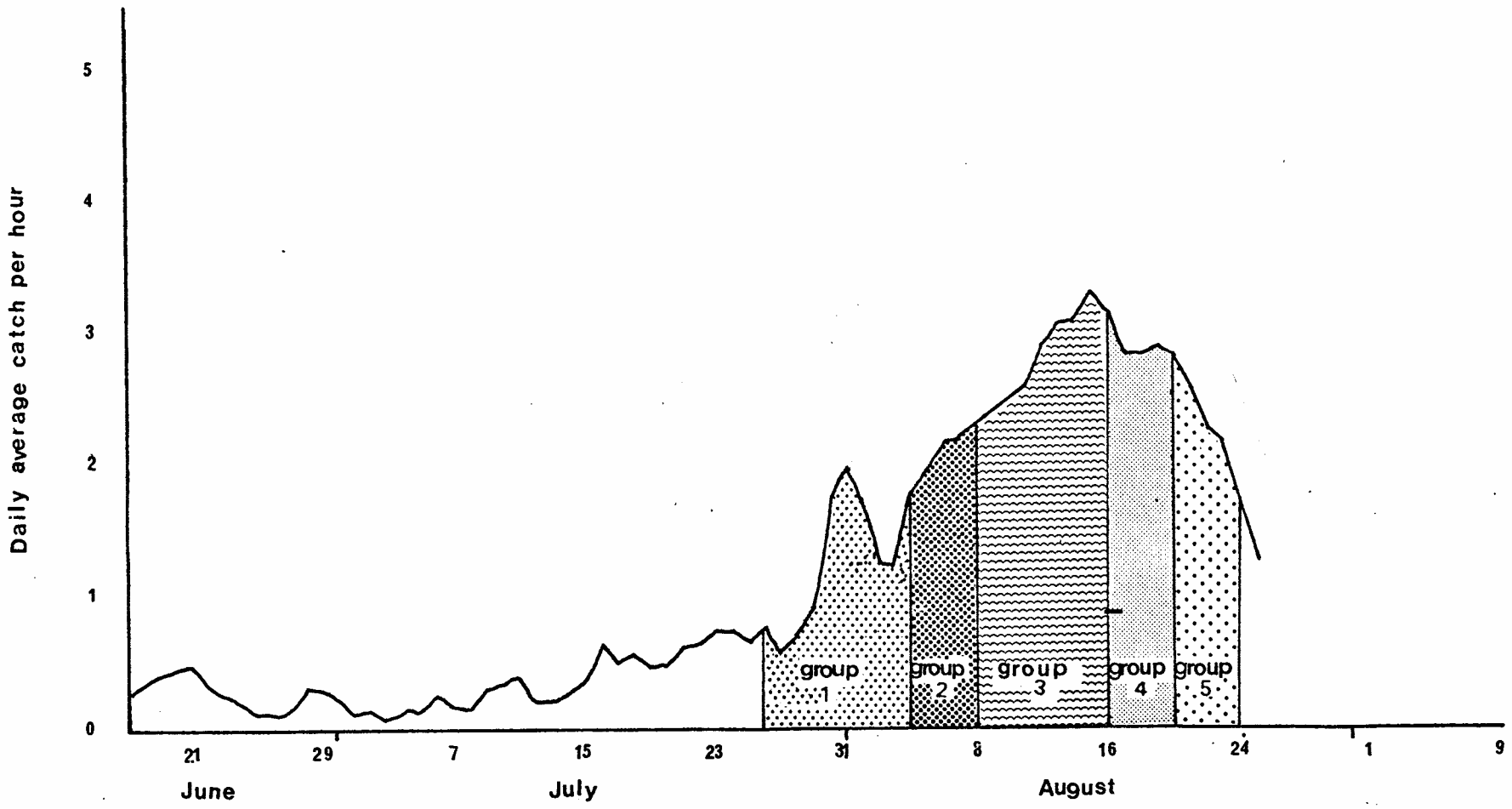


Fig. 8. Tagging data for each of the five groups of steelhead, with the corresponding peak catches in the test fishery (i.e. group 1 tags represents the early portion of the Skeena run).

Table 1. Radio tagging results for Skeena River steelhead, 1979.

Tagging Date	Group	No. Of Steel-Head Tagged	Males	Females
July 26	1	2	1	1
28	1	1	1	0
30	1	1	1	0
31	1	2	1	1
Aug. 1	1	3	1	2
3	1	5	3	2
4	2	3	3	0
5	2	3	1	2
6	2	2	2	0
7	2	4	2	2
8	2	2	2	0
9	2 & 3	4	2	2
10	2	2	1	1
13	3	5	2	3
14	3	4	0	4
15	3	8	3	5
16	4	12	9	3
17	4	7	2	5
20	5	2	0	2
21	5	8	5	3
22	5	12	6	6
23	5	1	1	0
24	5	2	2	0
Totals		51	95	44

Table 2 Mean migration rates of radio tagged steelhead which travelled from tagging sites to scanning stations located upstream, 1979.

	Migration rate (km/day) To Bulkley/Morice scanner[1]		Migration rate (km/day) To Upper Skeena scanner[2]	
	Mean	(range)	Mean	(range)
Group 1	12.8	(7.3-27)	10.9	(10.2-11.6)
Group 2	9.5	(4.8-17.8)	7.4	(4.7-10.0)
Group 3	6.4	(2.1-9.8)	8.2	(6.3-10.0)
Group 4	8.8	(2.2-21.7)	5.4	(3.9-9.0)
Group 5	8.1	(5.5-21.8)	6.7	(3.6-10.7)

1. Bulkley/Morice scanner located at mouth of Bulkley River, 162 km from the tagging sites.

2. Upper Skeena scanner located on Skeena mainstem, 174 km from the tagging sites.

Rates of migration were also calculated for fish that travelled beyond the scanning stations and for fish that were captured in sport and native fisheries. The rates of travel for these 18 fish were slightly higher (10.1 km/day). The fastest steelhead travelled 144 km at a mean rate of 72 km/day before being caught in a native gillnet. Another fish travelled 306 km at a mean rate of 21.9 km/day before being caught on the Morice River by a sport angler. One steelhead was found in Kluayaz Lake (Kluatantan River), 444 km from the tagging site; travelling at a mean rate of 5.1 km/day. All these figures represent minimum rates of travel because any of these fish could have arrived at their destination before they were captured.

It is interesting to note that tagged fish first appeared in the Bulkley/Morice on August 7, but did not appear in the upper Skeena until August 15. On the other hand, the number of fish that entered the Bulkley/ Morice dropped off (less than one tagged fish/week) after September 11, but in the upper Skeena this drop was not noticed until October 2. This evidence seems to indicate that most of the Bulkley/Morice steelhead move past Hazelton about two weeks before the upper Skeena run moves into the Skeena above Hazelton.

Destinations of Tagged Fish

Data from both scanners and radio tracking was used to provide data on the final destinations of tagged fish. During the winter however, a

flaw in the study design began to appear. All of the steelhead had been tagged with radio transmitters that had an expected life of 6 months because it was thought that the fish would have arrived at their natal streams within this time. At 6 months however, some tagged fish had still not entered a tributary, but had remained in the Skeena mainstem. Although these fish were last recorded in the lower and middle Skeena, any of these fish could have proceeded upstream to the Bulkley/Morice or upper Skeena in the months following the life span of the tag.

The data were summarized so that the destinations of any of the five groups of tagged fish could be examined by area (ie: Which stocks were involved in the early or late portion of the run?)

Results show that most (57%) of the early steelhead (Group 1) moved into the Bukley/Morice. A smaller portion of these fish (29%) remained in the lower Skeena, and only 14% entered the upper Skeena (Fig. 9).

The largest portions (44% and 47%) of the early—mid August fish (Groups 2 and 3) also moved into the Bulkley/Morice. Less fish (11%) remained in the lower Skeena but an increasing portion (5% and 11%) moved into the middle Skeena. Only 17% and 11% respectively of the tagged fish entered the upper Skeena.

Groups 4 and 5 represented the late portion of the run, which showed a

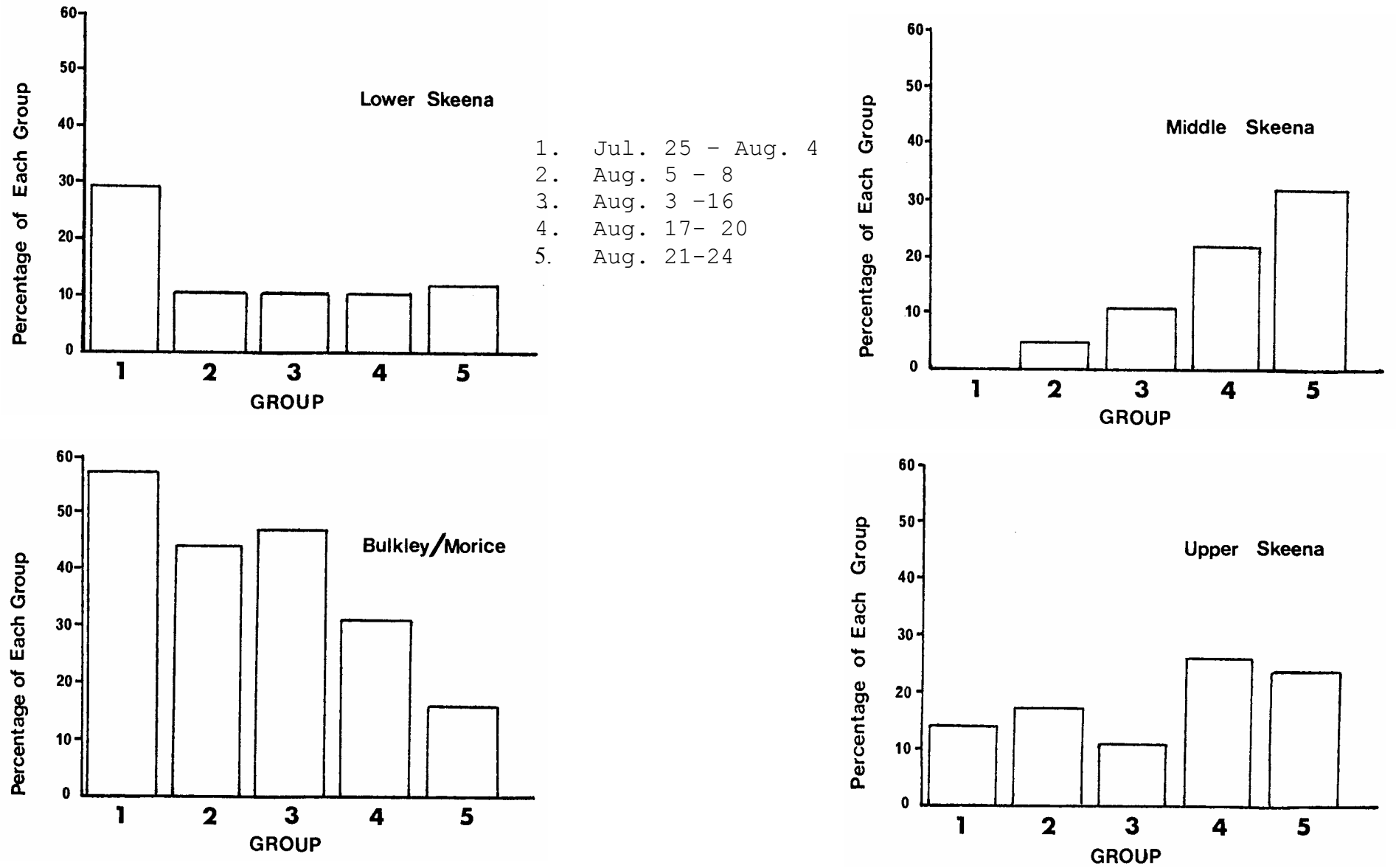


Fig. 9. Destinations of the five groups of radio tagged steelhead. The percentage of each group found in any area is indicated by the bar graphs.

marked decline in the fish destined for the Bulkley/Morice (32% and 16%). The lower Skeena showed no real change, but more fish were seen moving into the middle Skeena (22% and 32%) and upper Skeena (26% and 24%).

When these figures are graphed trends can be seen for each Area. The early part of the run (Group 1) contained a high percentage of Bulkley/Morice fish, but this percentage steadily decreased near the end of the run. This indicates that the percentage of Bulkley/Morice steelhead travelling through the fishery was highest during late July and early August, and declined steadily throughout August (Fig. 10).

Although the percentage of Bulkley/Morice fish is highest during the early part of the fishery, the maximum harvest of this stock may not occur until the second week of August. The commercial steelhead landings reached a peak around August 8, when 44% of the fish tagged proved to be Bulkley/Morice fish. If the tagging is assured to have sampled fish at random, it follows that 44% of the commercial catch for the week ending August 12 were Bulkley/Morice fish. Since 2,602 steelhead were reported in the landings, this indicates an estimated harvest of 1,144 Bulkley/Morice fish for that week alone. During the week ending July 28, 57% of the tagged fish were Bulkley/Morice fish, but since only 1,059 steelhead were caught the estimated harvest from Bulkley/ Morice stocks would have been 604 fish. An estimated total of 2,250 Bulkley/ Morice steelhead were harvested during 1979. Although this calculation is crude, it likely represents a minimum because it is derived from recorded landings which are known to be low (Oguss and Evans, 1978). This estimate does not include those fish which were harvested before radio tagging began (July 26) because the proportion of Bulkley/Morice fish is unknown.

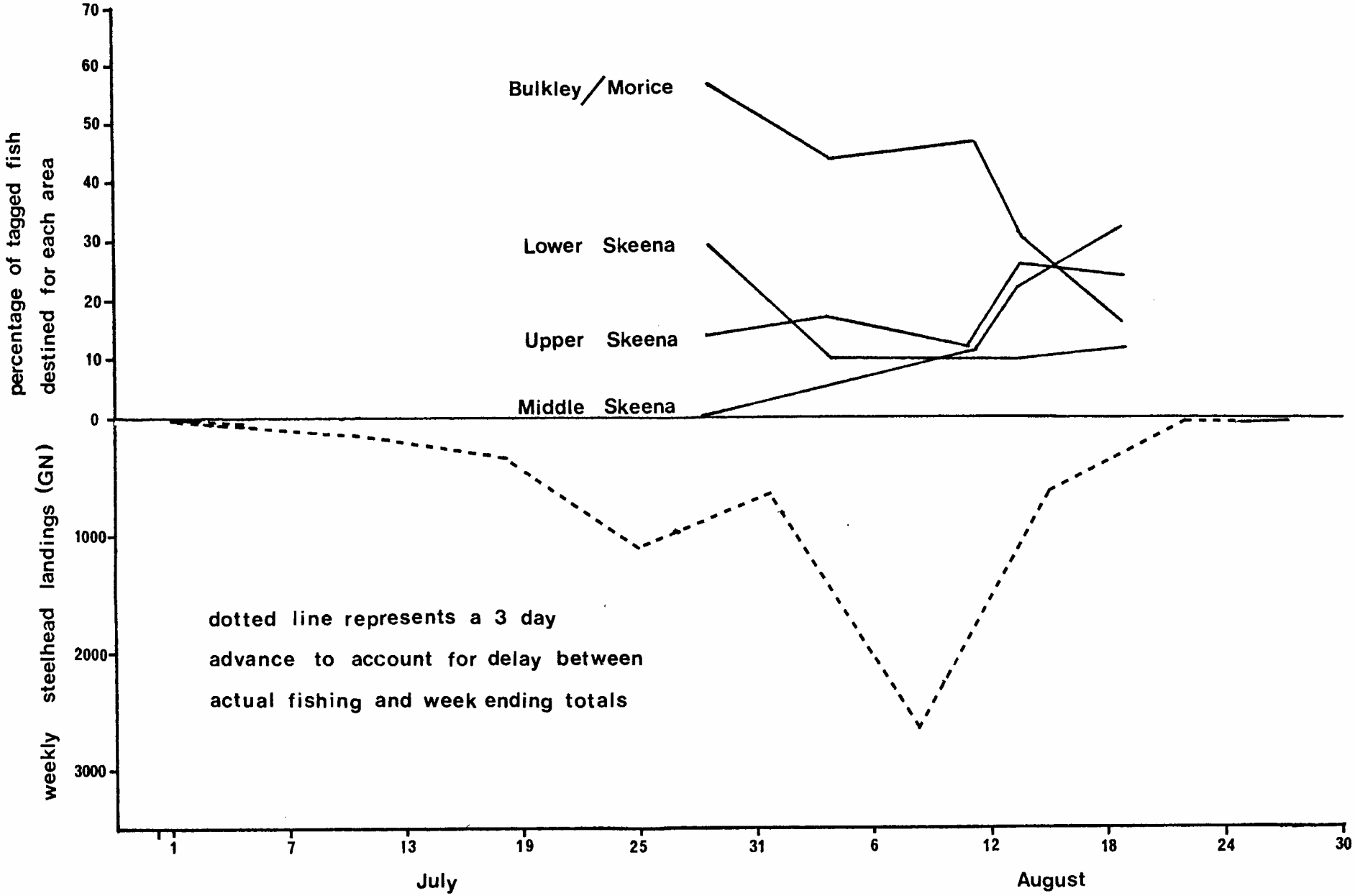


Fig. 10. Relationship between commercial gillnet interceptions, and the timing of steelhead destined for each area, as they move through the fishery.

The trend for the upper Skeena is just the opposite. Only a low percentage of the early tags were destined for the upper Skeena. The highest percentage of upper Skeena fish were tagged in mid to late August, indicating that these stocks were intercepted during the latter part of the run from August 10 to late August.

A similar trend was seen in the middle Skeena where the highest proportion of fish recorded to this area were tagged in late August. However, a closer examination of the data reveals that a large portion (50%) of the fish were actually killed there, and may have been destined elsewhere (upper Skeena).

I suspect that many of these fish were eventually destined for the upper Skeena for three main reasons:

i) The upper Skeena stocks move through the middle Skeena beginning later and ending later than the Bulkley/Morice run.

ii) Most of the fish that did enter the upper Skeena were from the same tagging groups as the fish killed in the middle Skeena.

iii) The runs in middle and upper Skeena both increase steadily through August, but a drop during the late part of the upper Skeena run occurs at the sane time as high mortalities in middle Skeena; a further indication these fish were actually destined for the upper Skeena.

Most of the tagged fish that stayed in the lower Skeena were from the early part of the run (Groups 1 and 2). Few fish (11% - 12%) tagged during later August remained in the lower Skeena. It is interesting to note that the fish in the Kitsumkalum River was the only lower Skeena fish that was actually found in a tributary. Two others were observed hanging off the mouth of tributaries (Kitsumkalum and Lakelse Rivers), where I suspect they eventually spawned. The remainder moved about the Skeena mainstem until their transmitters died. They may have moved into any of the numerous tributaries in the lower Skeena or into the side channels of the Skeena mainstem. It is also possible that these fish moved upstream into the other three areas.

In some cases, the radio transmitters lasted longer than the expected 6 months and continued radio tracking of the rivers provided data for stocks within the four major areas. The one fish in the Kitsumkalum (and the one suspected fish) were late run fish; tagged between August 20 and 24. All of the three fish that entered the nearby Zymoetz River were also tagged at this tine, suggesting that at least part of these stocks move through the commercial fishery during the third week of August. On the other hand, the fish suspected of entering the Lakelse River was an early fish; tagged in late July or early August.

The three fish that spawned in Toboggan Creek near Smithers would have moved through the commercial fishery during the first 12 days of August (Fig. 11).

All of the fish found in the Babine River were tagged after August 8,

with most of these being tagged between August 16 and 24. This is strong evidence that the Babine stocks began to move through the commercial fishery around the second week of August, and continued through the third week of August. I suspect that the run of large fish which gillnetters noticed on August 12 may well have been a strong showing of Babine fish moving through the fishery.

Radio tag data was compared to other data collected on migrating steelhead. During the past years, the Fish and Wildlife Branch has carried out several studies in the Skeena drainage involving spaghetti tagging. One such study was on the Babine River and in 1979, 7 tagged Babine fish were reported at various sites in the ocean and in the Skeena drainage (Table 3).

The first Babine fish was caught near the Queen Charlotte Islands on July 27. This may be an indication that Babine fish are still at sea when the Bulkley/Morice run is moving into the Skeena. A tagged Babine fish appeared in the Skeena estuary August 14. In the following two weeks, 5 more fish were caught in the Skeena and Babine Rivers; another strong indication that these fish begin to show about mid August.

Data from the first year of radio tagging (tough, M.S. 1979) suggests there could be some variability in run timing. Of the 7 fish tagged between July 30 and August 18 in 1978, 3 proved to be Babine fish and 1 was a Zymoetz fish. With such a small sample, it is difficult to say whether these were just early Babine and Zymoetz fish, or whether run timing is a variable event which may change . from year to year.

Table 3. Date of recapture for Babine River steelhead as they entered the Skeena River 1979.[1]

Location of Tagging	Date of Tagging	Location of Recapture	Date of Recapture
Babine River	Mar. 10/78	Statistical Area 1 (Q.C.I.)	July 27/79
Babine River	Apr. 19/78	Statistical Area 4 (Skeena)	Aug. 14/79
Babine River	Mar. 10/78	Lower Skeena River	Aug. 15/79
Babine River	Apr. 7/78	Skeena River	Aug. 15/79
Babine River	Apr. 19/78	Babine River	Aug. 20/79
Babine River	Apr. 12/7 8	Babine River	Aug. 20/79
Babine River	May 12/78	Lower Skeena River	Sept. 2/79

1. Steelhead were spaghetti tagged during a previous study on the Babine River.

Tag Returns

During the course of the study, 22 of the 95 radio fish were recaptured in the native and sport fishery. Of these fish, 15 were killed; 12 of them in the native food fishery. Although 11 fish were also captured in the sport fishery, only four were killed and the other seven fish were released unharmed. Therefore, of the 15 fish killed, the native food fishery accounted for 73% of the total kills (Fig. 12). The high percentage of fish released by sport anglers may have been influenced by the $50.00 reward offered for release of unharmed steelhead and only $5.00 for a dead fish. Native net fisherman did not have the option of release because gill-netted steelhead are usually dead.

Of the 11 fish captured in the native fishery, eight were netted in the Skeena between Kitwanga and Hazelton. All but one of these were tagged after August 16. Since the largest percentage of these late fish turned out to be destined for the upper Skeena, it appears that the native fishery may be primarily harvesting the upper Skeena stocks; a large part of which have been identified as Babine fish. This may partially explain the slight drop in the numbers of Group 5 fish that entered the upper Skeena, which occurs at the same tine as the heavy gillnet mortalities in the middle Skeena (Fig. 11).

Only one tagged steelhead was taken in the native gaff fishery at Moricetown even though several hundred steelhead are harvested per season (Palmer, 1967). The fish killed was an early fish, taken in the intensive gaff fishery which targets on chinook during late July and early August.

Of the 11 tagged fish caught in the sport fishery, seven were taken on

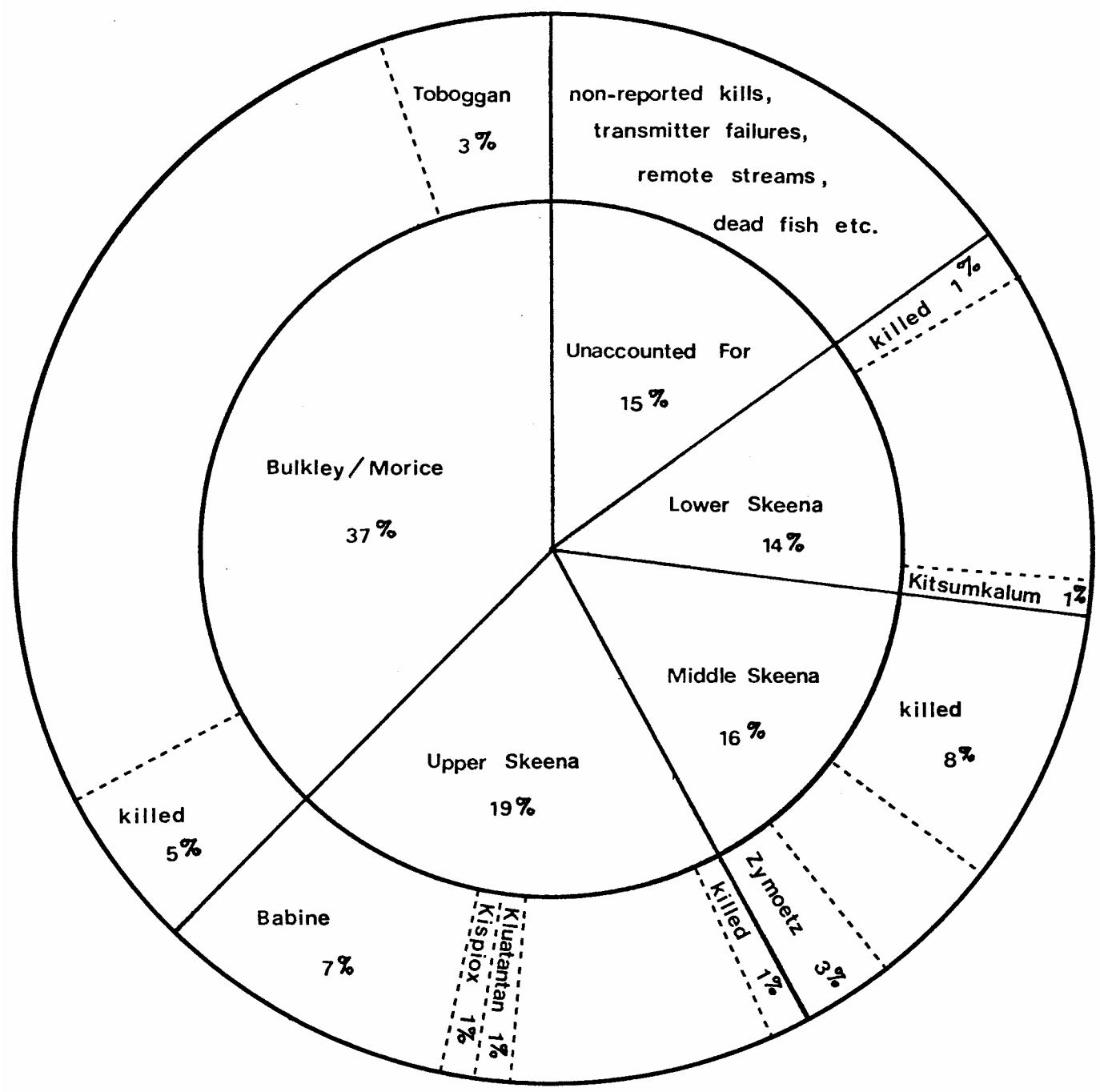
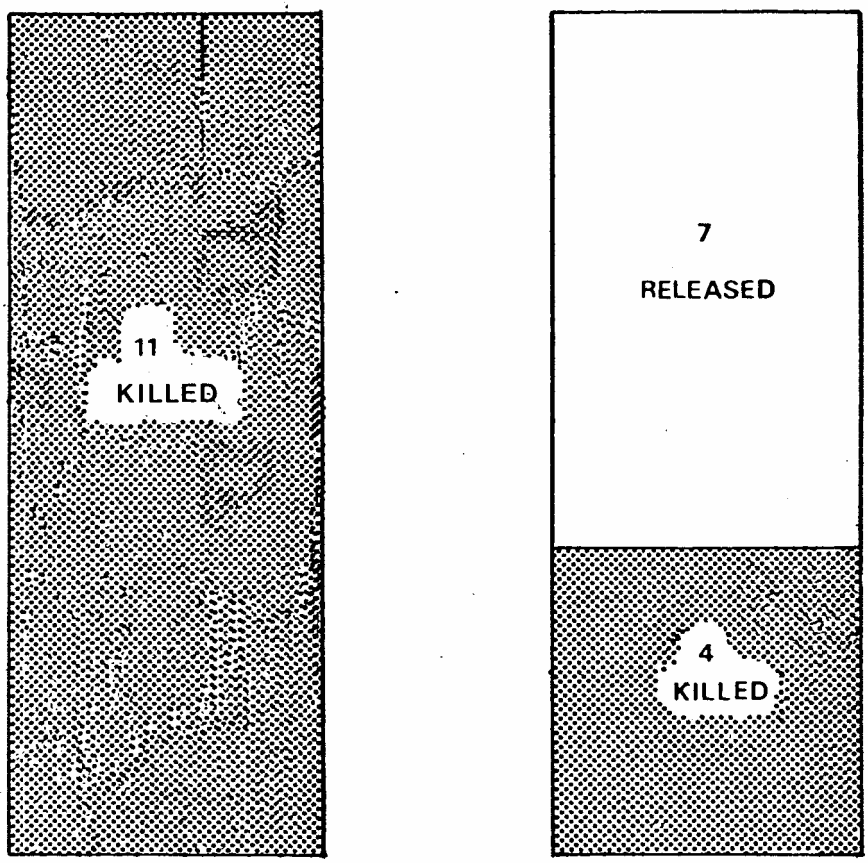


Fig. 11. Summary of the last known locations of ninety-five summer steelhead, radio tagged upon entering the Skeena River, 1979.



- 22 RADIO TAGGED FISH WERE RECAPTURED IN THE NATIVE AND SPORT FISHERY
- OF THESE FISH, 15 WERE KILLED; 11 OF THEM IN THE NATIVE FOOD FISHERY
- ALTHOUGH 11 FISH WERE CAPTURED IN THE SPORT FISHERY, ONLY 4 WERE KILLED. THE OTHER 7 FISH WERE RELEASED UNHARMED
- THEREFORE, OF THE 11 + 4 = 15 FISH KILLED, THE NATIVE FOOD FISHERY ACCOUNTED FOR 73% OF THE TOTAL KILLS

FIG. 12. SUMMARY OF RECAPTURES AND KILLS OF RADIO TAGGED STEELHEAD IN THE SKEENA DRAINAGE, 1979.

the Bulkley/Morice. This sport fishery is apparently well dispersed because tag returns cone from lower, middle and upper sections of the Bulkley/Morice. Two steelhead were caught in the upper Babine River and 1 fish was caught in each of the Kispiox and Kitsumkalum Rivers during the fall sport fishery. The intensive lower Skeena fishery is largely dependent upon water clarity, and since the Skeena becomes clearest during mid to late August, fishing success appears to increase at that time. For this reason, I believe that this fishery tends to harvest the late stocks (mid-late August) which are predominately upper Skeena River and Zymoetz River fish.

SUMMARY AND CONCLUSIONS

A previous study established that 10,000 steelhead were harvested in the 1977 commercial gillnet fishery at the mouth of the Skeena River. In 1979 the commercial gillnet fleet reached a maximum of 685 boats in Area 4 during the first week. of August, and peak commercial landings occurred about August. 8. Test fishery data shows that the steelhead run entering the Skeena peaked on August 16, indicating that the heaviest commercial interceptions occurred during the part of the run before the peak. It seems that this part of the run has been largely removed in recent years as a result of the increased fishery for Babine Lake sockeye.

During July and August 1979, radio tags were put on 95 steelhead in order to determine tine of entry for specific stocks in the Skeena drainage. Automatic scanning stations and routine surveillance were used to determine migration rates and destinations of tagged fish.

Rate of Migration

- Rates of migration were determined for steelhead which passed the scanners located 162 km and 175 km above the tagging site. Individual fish ranged from 2.1 km/day to 27 km/day, but the mean rate of all fish to pass the scanners was 8.6 km/day.

- The fastest steelhead travelled 144 km at a mean rate of 72 km/day.

- The steelhead which travelled the furthest was found in Kluayaz Lake (Kluatantan River), 444 km from the tagging site and had moved at a minimum rate of 5. 1 km/day.

— There was no significant difference between rates of migration for fish destined for the Bulkley/Morice or the upper Skeena.

- Most Bulkley/Morice fish appear to move into that system about two weeks before fish move into the Skeena above Hazelton.

Destinations of Tagged Fish

- 37% of the tagged steelhead entered the Bulkley/Morice, 19% entered the upper Skeena, 16% remained in the middle Skeena and 14% in the lower Skeena. The remaining 15% were not found.

- Most of the fish tagged in late July and early August were found to be Bulkley/Morice fish. The highest interceptions of these fish took place during the week ending August 12, when an esti-mated 1,144 Bulkley/Morice steelhead were harvested.

- The highest proportion of fish tagged during mid to late August were upper Skeena fish; a large part of which were destined for the Babine River. This indicates that the highest interceptions of these stocks occurred after August 10.

- Zymoetz River stocks peaked sharply during the late part of the steelhead run and therefore were subjected to the relatively. light commercial harvesting between August 16 and 22.

- A model is presented which indicates proportions of steelhead stocks harvested during various phases of the 1979 gillnet fishery. Although this model fits known data for returning Babine stocks, it should be considered with caution since run timing is dynamic in nature and could vary from year to year.

Tag Returns

- During the study, 22 of the 95 radio tagged fish were recaptured in the native and sport fishery.

- Of the 15 fish killed, the native food fishery accounted for 73% of the total kills.

- The heaviest food fishery occurs between Kitwanga and Hazelton and appears to be harvesting mainly upper Skeena stocks, a large part of which have been identified as Babine fish.

- Seven of the 11 sport fishery recaptures came from the Bulkley/Morice; 2 fish were caught in the Babine and one each in the Kitsumkalum and Kispiox Rivers.

REFERENCES

Chudyk, W.E. and D.W. Narver M.S. 1976. Commercial Interceptions of Steelhead Trout in the Skeena River. A Preliminary Review. B.C. Fish and Wildlife Branch. 25 pp. Unpublished manuscript.

Lough, M.J. M.S. 1979. Radio Telemetry Studies of Summer Run Steelhead in the Skeena River, 1978, With Particular Reference to Equipment and Capture Methods. B.C. Fish and Wildlife Branch. 16 pp. Unpublished manuscript.

Lough, M.J. M.S. 1980. Radio Telemetry Studies of Summer Run steelhead Trout in the Skeena River, 1979, With Particular Reference to Kispiox Morice, Suskwa and Zymoetz Stocks. B.C. Fish and Wildlife Branch. 78 pp. Unpublished manuscript.

Oguss, E. and L.K. Evans. 1978. Incidental Catches of Steelhead Trout in the Commercial Salmon Fisheries of Barkley Sound, Johnstone Strait, and the Skeena and Fraser Rivers. Fish Mgnt. Report No. 14 B.C. Marine Resources Branch, Victoria, B.C.

Palmer, R.N.M.S. 1967. An Assessment of Salmon Migration and the Native Food Fishery at Moricetown Falls in 1966. Dept. of Fisheries Canada. Vancouver, Unpublished manuscript.

ACKNOWLEDGEMENTS

I wish to thank fisheries technician R. Tetreau, G. Wadley, G. Schultze and G. Sojka who took special interest and worked long hours on this study. Thanks also to M. Whately for his patience, valuable advice and review. This report was ably typed by M. Darini.