DATA TO BE PRESENTED BEFORE THE AFS MEETING IN JUNEAU ON NOVEMBER 12-15,1984
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Topic: The Distribution and Abundance of Rainbow Trout in the Susitna River as Ascertained by Radio Telemetry

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INTRODUCTION

The resident fishery study began on the Susitna River during the winter of [illegible]. The primary objectives of this study determined in 1979 was to determine the seasonal distribution and relative abundance of selected fish species ,with rainbow trout being the primary selected species, and to characterize the seasonal habitat requirements of these species. In 1983 these objectives were expanded to also include quantifying the important habitat parameters associated with spawning and rearing of these species and measure fish density in spawning and rearing habitats to provide an estimate of habitat quality.

The radio tagging program was first proposed by Christopher Estes in 1977. With input from Dana Schmidt of T.E.S. and Carl Burger(USFWS) the program was funded in 1981 as an experimental program to radio tag five rainbow trout and five burbot. These tags were dispensed into fish captured below Talkeetna (river mile, RM, 97.0) between late September 1981 and mid-October, freeze-up, 1981 to determine winter movement. While Floy tag-recaptures presented some movement data of resident fish during the summer 1981, little winter movement was available from 1980-81 since few fish were captured. The reason so few fish were captured,except for burbot on trotlines, was because few places were found to set gillnets. Either the water velocity was to fast or when a back eddy was found a layer of slush ice was nearly always present. It was hoped that with the use of radio telemetry we could ascertain migrational trends and winter rearing areas, and in these wintering areas if these were areas where fish congregated. While 1981 tagging was below Talkeetna, in 1982 and 1983 tags were dispensed between Talkeetna and Devil Canyon (RM 152.0). In 1984 tagging was in both areas. Primary tagging emphasis has been above Talkeetna since most of the anticipated changes due to the dam construction would affect that area of the river. The main tributaries in this reach of river are Fourth of July Creek (RM 131.1), Indian River (RM 138.6), and Portage Creek (RM 148.8).

METHODS AND EQUIPMENT

Equipment used was developed by Smith-Root in Vancouver, Washington. The recieving equipment consisted of a low frequency (40 MHz) reciever (Model RF-40) which monitors individual frequencies, a scanner (Model SR-40) which was capable of monitoring 15 frequencies simultaneously, a loop antenna (Model LA-40), and a paddle antenna for pinpointing fish.

Radio tags of different frequencies, between 40.600 and 40.770 MHz, or pulse rates or both were used to differentiate between the tags. During the course of the study, three types of radio transmitters were used. Since Susitna River rainbows are seldom found over 450mm (18 inches) in length, small tags were required. However, these radio tags were requested to be built to last preferably 9 months to observe migrational trends. In 1981 Smith-Root Model.P40-500L 3v radio tags were used. These tags were cylindrical in shape with dimensions of 16mm in diameter , 53mm in length, had a 170mm whip antenna,

weighed 13 grams, and had a life expectancy of 6 months. In 1982 we asked Smith-Root if this tag or one smaller could be made to have a life expectancy of 9 months. In 1982 we deployed 10 of these experimental tags,as well as 8 six month tags, but many failed. In 1983 we became familiar with another radio tag manufacturor, Advanced Telemetry System's (ATS) of Bethel, Minnesota. The radio tag (Model BEI 10-35) they developed required no special modifications and would function for 6-10 months depending on the pulse rate. The shape and dimensions of the ATS tag was similiar to the Smith-Root tag except the diameter was smaller, 12mm. Both the ATS and the Smith-Root tags were internally implanted with the ATS tag being much easier to implant because of the smaller diameter. In 1983 two ATS tags were also implanted subcutaneously but this practice was stopped after one of the tags apparently fell off the fish.

In 1984 greater emphasis was made to radio tag pre-spawning rainbow trout for determining timing and areas of spawning. Since the condition of many of these fish would be unacceptable for internal transplants, an external tag was used. This tag, model RM625, was also developed by ATS and was rectangular in shape with a 240mm whip antenna. This tag measured 30mm in length, 15mm wide, and 9mm high, weighs 9.5 grams, and had a life expectancy of 3 months.

Fish were primarily captured by boat electrofishing or by angling. In addition, several were captured by drift gillnet or baited trapnets. Whenever possible, fish that were electroshocked were held overnight in a live box and examined before tagging. No lethargic fish were radio tagged. Based on personal communications with Carl Burger (USFWS) in 1981, it was believed rainbow trout with fork lengths above 350mm could be internally radio tagged. After 1981, the minimum size of fish was increased to 380mm or 15 inches because this size of fish appeared to tolerate the tag better. Fish found suitable for tagging were anesthized in a cooler using MS-222. For fish internally tagged, a 3.0 cm incision was made between the pectoral and pelvic fins. Before the tag was inserted, the antenna was inserted into plastic tubing so the tip of the antenna would not injure the fish. The tag was then inserted and closed by 4-7 individual sutures of commercial silk. Several types of suture material were used, however, the most efficient and applicable one found for this study was one that had braided silk attached to a cutting needle. The size of the silk was 2-0 and 18 inches long, the manufacturer is Ethicon of Sommerville, New Jersey. The reason this type of suture was found to be the best was because the silk wouldn't slip when tieing and the needle remained sharp for as long as the 18 inches of silk lasted.

For external tags used, two Peterson disc needles were epoxied to the sides of the tag before use. Attachment of tags to fish was similiar as attaching Peterson discs. The tag was attached below the dorsal fin and Peterson discs were attached to the needles to secure in place.

Fish radio tagged were also Floy anchor tagged (Model FD-67) to identify in case of recapture. After tagging, fish were held overnight in a live box whenever possible. The next day the sutures were examined before the fish was released. Tracking was primarily done by fixed wing or by riverboat with helicopters used occasionally. Snowmobiles were used during the winter. When aerial tracking was conducted one loop antenna was attached to each of the two wing struts. Tracking was then done with two people, one monitoring a scanner and the other a reciever. Aerial tracking was done at approximately 700 ft. above the river.

Micro-habitat data collected in areas of fish locations include measurements of water chemistry, velocities, depths, ice and slush thickness, as well as characterizing substrate.

RESULTS AND DISCUSSION

In 1983 29 tags were dispensed and good results were obtained from 26 of them. In 1984 6 external and 31 internal tags were dispensed into rainbows above Talkeetna. Nineteen of these 37 tags were dispensed before June 5 of which 12 were placed into pre-spawning fish.

Results of 1983 taggings show rainbows are seasonally distributed by macro-habitat in the Susitna River. Two hundred thirty-one locations of 26 fish were made between April and December 1982. These locations were separated into three macro-habitats where they were found: in tributary or sloughs, in the mainstem at tributary mouths, and elsewhere in the mainstem (Figure 1). Between April and June 67% of the locations were associated with tributaries, the majority being in tributaries (52%). During July through September, 61% of the tagged fish were associated with tributaries. By October 1, all radio tagged fish had outmigrated from tributaries and sloughs into mainstem influenced areas. About 33% of the radio tagged fish remained at tributary mouths from October to December. Besides the high incidence of rainbows using tributaries from July to September, 10% used sloughs.

During summer rearing, often tagged fish used tributary mouths. This association coincides with the timing of spawning chum and pink salmon. The concentration of rainbow trout at tributary mouths is believed to be due to the abundance of food (salmon eggs) in these areas. Rainbow trout presumably feeding on salmon eggs, were observed being chased from spawning redds by chum salmon. Several radio tagged rainbows were also found in tributaries near spawning chum and pink salmon. The use of sloughs during the summer by radio tagged rainbows is also believed to occur because they are feeding on salmon eggs. Radio tagged rainbows were observed holding in Moose Slough (RM 123.5), A' (RM 124.6), 8A (RM 125.3), and 9 (RM 128.3).

While the mainstem was also used during the summer of 1983, it appears to be more of a migrational path between tributaries and sloughs for rainbows rather than as a rearing area.

In 1983 often radio tagged rainbow trout moved from one tributary or slough to another tributary or slough. For example, five fish migrated 7.5 miles downriver from the mouth of Indian River (RM 138.6) to the mouth of Fourth of July Creek (RM 131.1). In addition, a rainbow moved 6.5 miles upriver from the mouth of Skull Creek (RM 124.7) to the mouth of Fourth of July Creek, and then 2.6 miles downriver to Slough 9. Another rainbow outmigrated from Fourth of July Creek (tributary river mile, TRM, 1.5) and moved 7.5 miles upriver and into Indian River (TRM 4.5). Taggings from 1984 also show rainbow trout often migrate between tributaries particularily between Fourth of July Creek, Indian River, and Portage Creek (RM 148.8) (Figure 2).

Taggings from 1984 show a similiar summer movement as 1983 taggings. More fish were tagged, however, earlier in summer 1984 than in 1983 and their movement coincides with the earlier adult king salmon movement (Figure 3 and 4). This movement was most evident at Indian River and Portage Creek which have the greatest number of

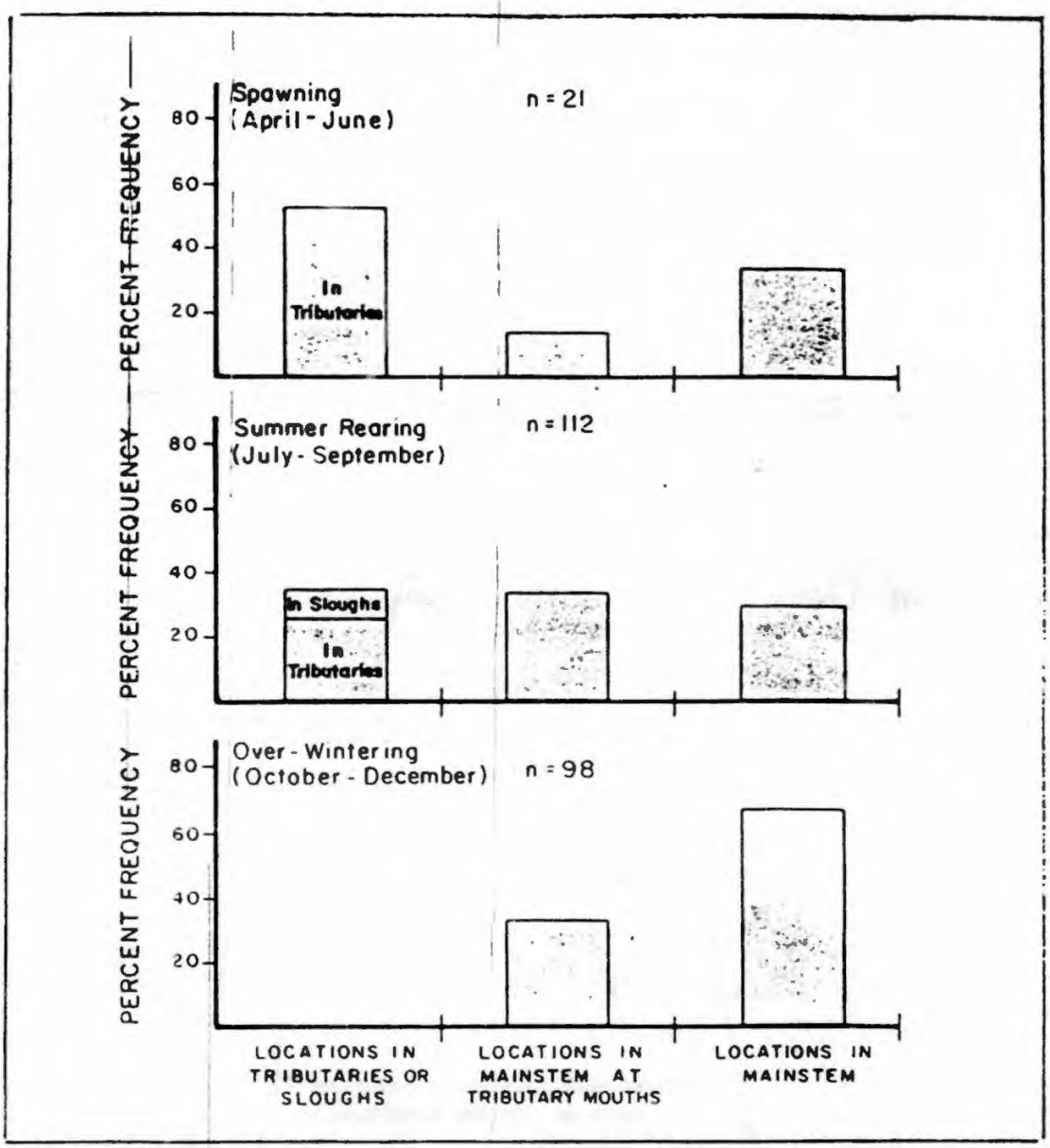


Figure 1. Frequency distribution of radio tagged rainbow trout locations in tributaries, at tributary mouths, and in the mainstem Susitna River during 1983.

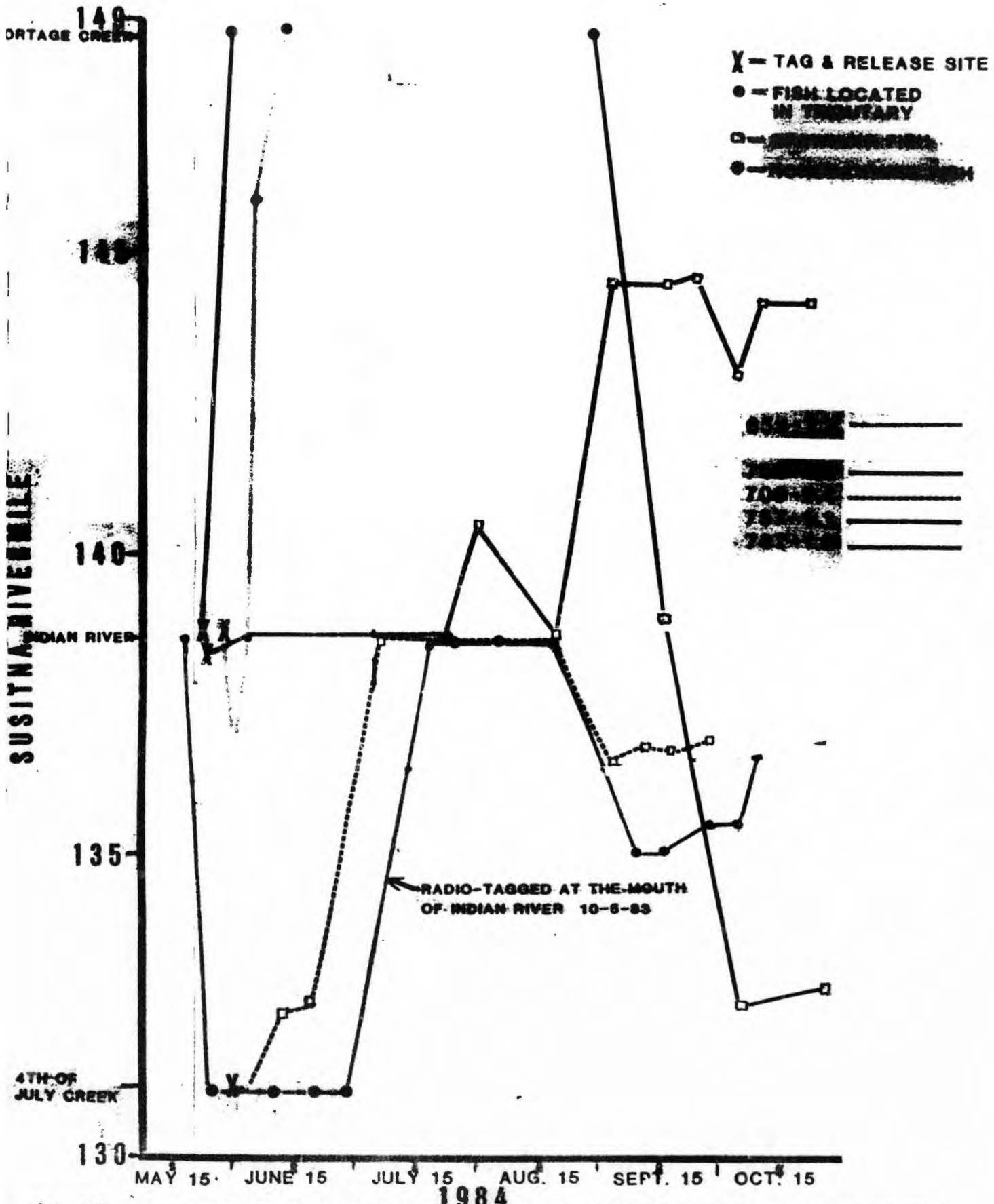
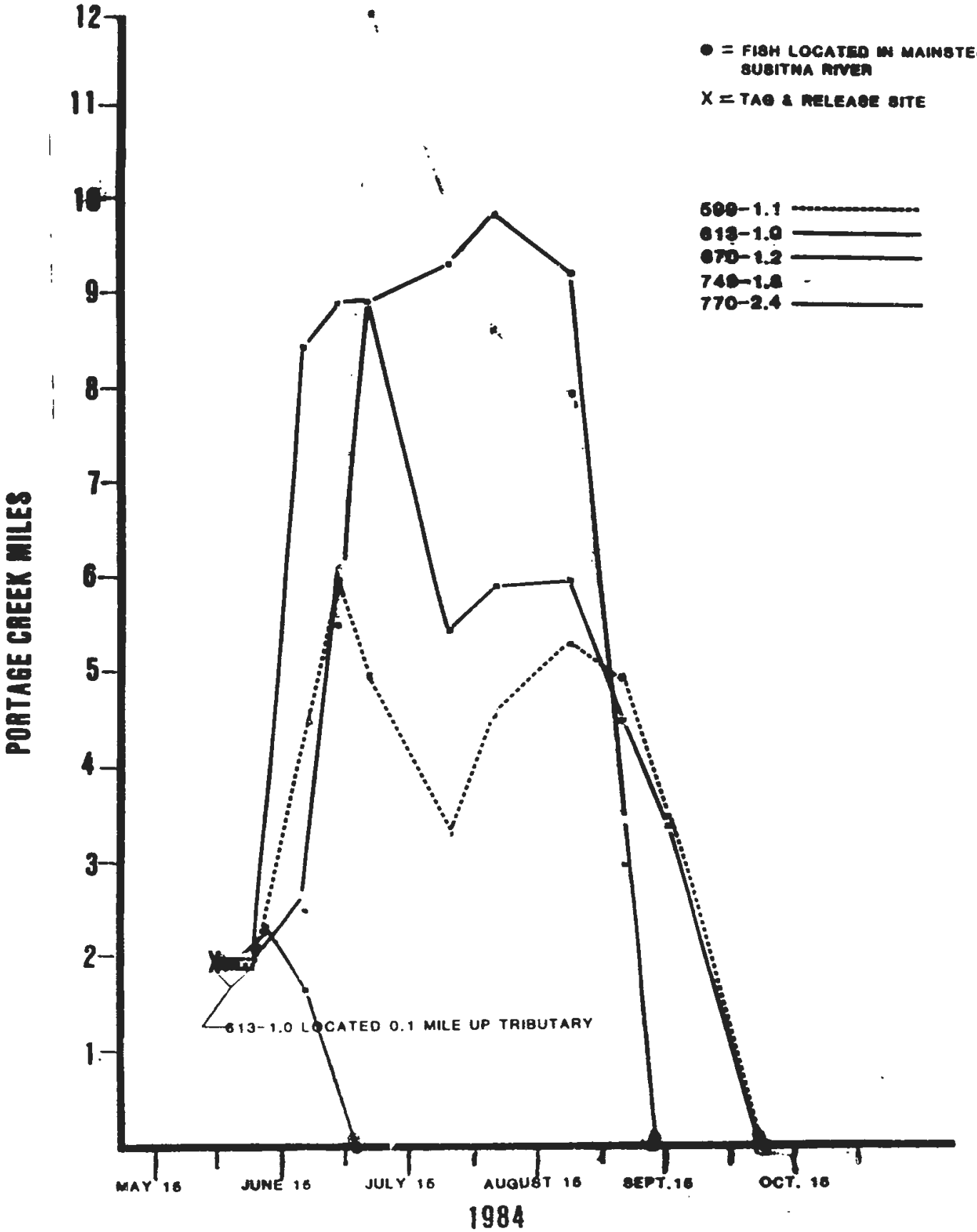
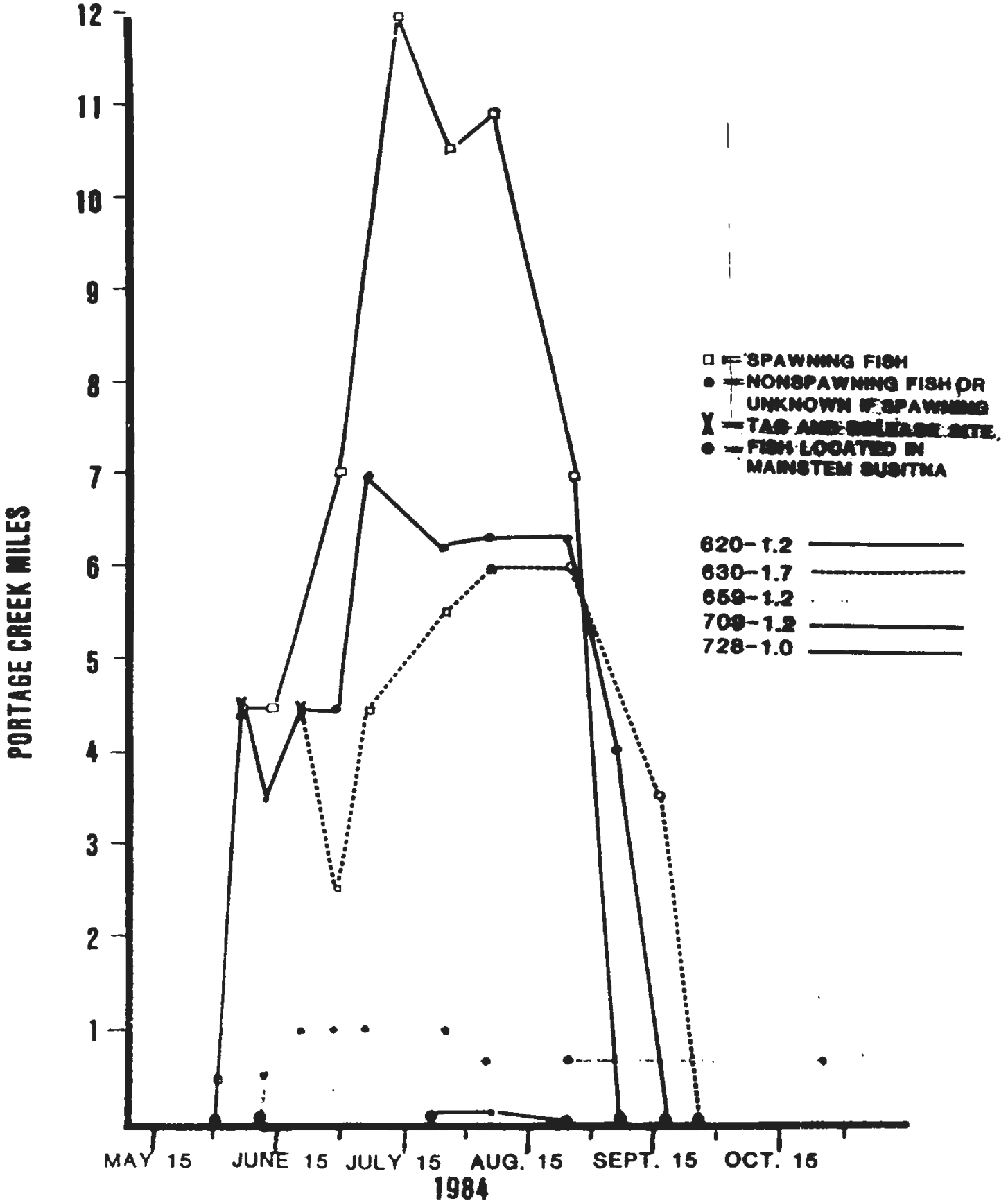


FIGURE 2. MOVEMENT OF SIX RADIO-TAGGED RAINBOW TROUT IN THE SUSITNA RIVER BELOW DEVIL CANYON, MAY TO OCTOBER 1984.



MOVEMENT OF FIVE RADIO-TAGGED SPAWNING RAINBOW TROUT IN PORTAGE CREEK, MAY TO OCTOBER 1984.



MOVEMENT OF FIVE RADIO-TAGGED RAINBOW TROUT IN PORTAGE CREEK, MAY TO OCTOBER 1984

spawning king salmon above Talkeetna (escapement in 1984 was over 1500 fish in each river).

By October, in both 1983 and 1984, all of the tagged fish had outmigrated from the tributaries or sloughs into the mainstem. Winter monitoring movement of fish tagged in 1983, 1982 and 1981 show that nearly all moved slightly downstream (0.1-4.0 miles) after October before holding (Figure 5). This downstream movement is believed to occur because they are searching for acceptable overwintering areas. During all three years, however, several radio tagged fish have remained all winter near a tributary where they were tagged at. From 1984 taggings it appears that fish from Portage Creek may overwinter near that mouth.

During the winters of 1981-82, 1982-83 and 1983-84, ground surveys were conducted in areas where the radio tagged fish were found. Fish were pinpointed to areas of a diameter of 10 ft. then ice augars were used to drill over them. While several of the radio tagged fish moved from 10-300 ft., for others no movement was detected. For the fish which did not move, it was believed they died during the interim period (fall-winter sampling) and supports the theory that there is a heavy overwintering mortality. In some cases this hypothesis may be incorrect, however, and some fish are more sedentary than others. For example, in January 1984 we ascertained fish 670-1.4 was dead because we detected no movement. During a February survey, we thought it moved but were unsure. This tag failed after February; however, during May 1984 it was electroshocked 12 miles upriv r.

During winter sampling in 1981-82 it was found that while none of the radio tagged fish were recaptured, a high catch per unit effort was recorded for other rainbows in the vicinities of the tagged fish. Due to this reason, it is suspected that rainbow trout concentrate in small numbers and use specific areas of the mainstem Susitna for overwintering. Habitat data collected in these areas varies except for conductivity. In all cases where radio tagged fish have been found in the winter, the conductivity was relatively high , above 125 uhos/cm, indicating that the areas they seek out are influen ed by groundwater.

In May and early June 1984 fish radio tagged showed that Fourth of July Creek and Portage Creek are heavily used for spawning. One school of approximately 30 pre-spawners were observed in Portage Creek (TRM 2.0) and 5 were radio tagged. Monitoring of these fish showed that four probably spawned at this location (Figure 3). At this location, TRM 2.0, a smaller tributary empties into Portage Creek; this tributary is the outlet of a lake 1.0 miles away. The remaining fish moved up the tributary, 0.5 miles, and spawned there. At the mouth of Fourth of July Creek 3 pre-spawning rainbows were captured and tagged. Monitoring indicated they spawned at TRM 0.7. This TRM is similiar to TRM 2.0 of Portage Creek since it also has an outlet from a lake flowing into it. In addition, one pre-spawning rainbow was captured at TRM 0.5 of the outlet. It is suspected that rainbows in both Portage Ck. and Fourth of July Ck. use the confluences of the lake outlets to spawn at because of the outlets warmer water temperatures. The mainstem of both Portage Ck. and Fourth of July Ck. during the first week of June was approximately 8 C, while both outlets were 12 C. Spawning in both tributaries probably occurred during the first week of June.

Follow-up studies in 1984 on the lakes which flow into Portage Ck. and Fourth

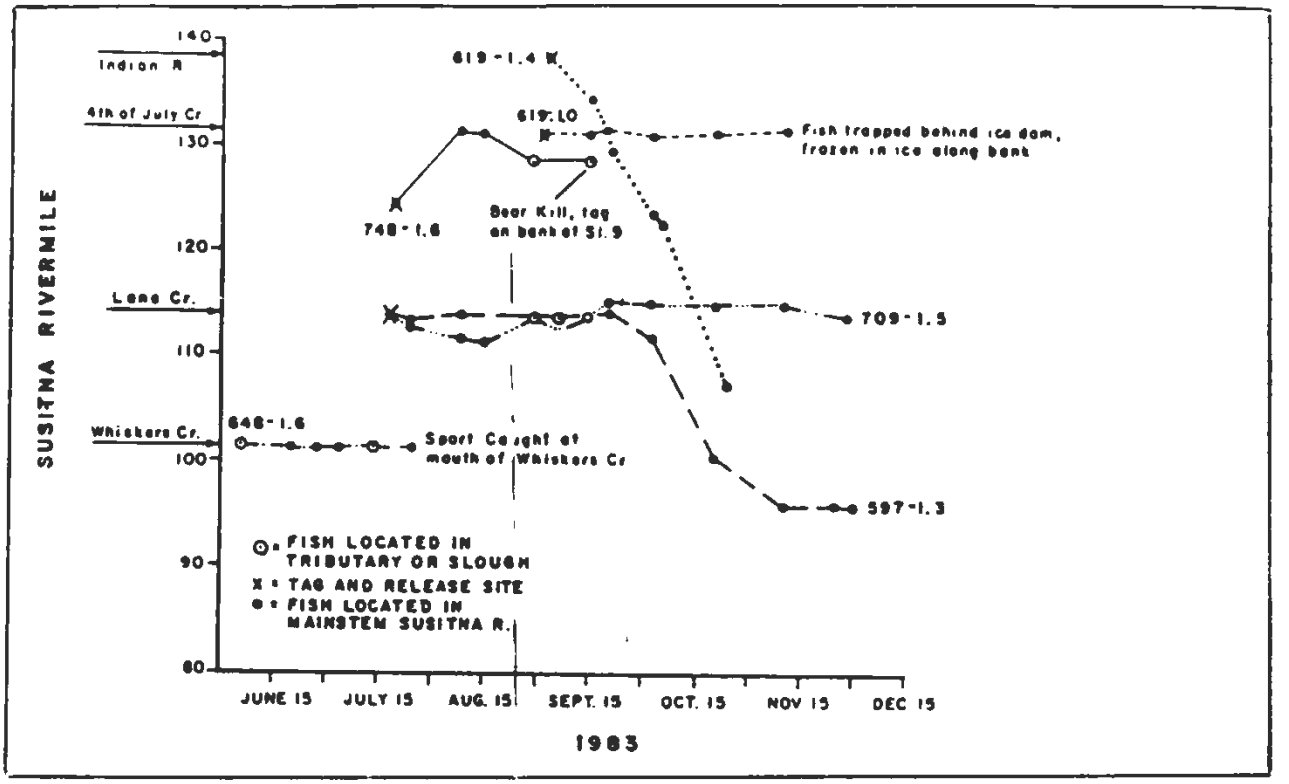


Figure 4. Movement of six radio tagged rainbow trout in the Susitna River below Devil Canyon, June to December 1983.

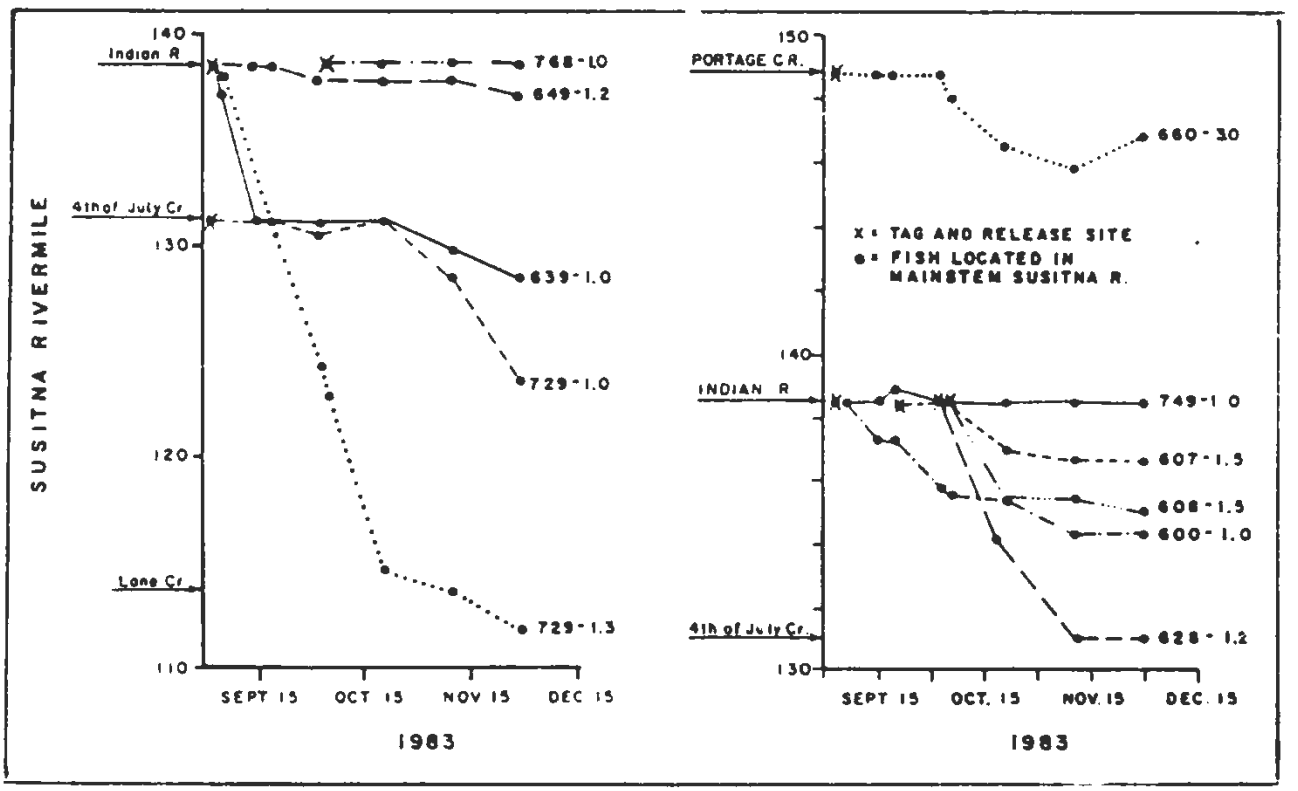


Figure 5. Movement of eleven radio tagged rainbow trout in the Susitna River below Devil Canyon, September to December 1983.

of July Ck. show that they are abundant with rainbow trout. Since few juvenile rainbows have been captured in Portage Ck., it is suspected that the lake which flows into Portage Ck. at TRM 2.0 acts as a nursery. Although there have been many juveniles captured in Fourth of July Ck., it is also suspected that the lakes which feed into this tributary contribute heavily to the rainbow trout population in the mainstem Fourth of July Ck. Little spawning gravel has been found in Fourth of July Ck. between TRM 0.0-1.8(a fish barrier is located at this location).