

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

DESHKA RIVER CHINOOK AND
COHO SALMON STUDY

by

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations
of Alaska

Project No.: AFS-49 Project Title: INVENTORY AND CATALOGING

Segment No.: AFS-49-1 & 2 Segment Title: Deshka River Chinook and
Coho Salmon Study

Cooperators: Kevin Delaney, Kelly Hepler, Kent Roth

Period Covered: July 1, 1979 to November 1, 1980

ABSTRACT

Due to the growing demands in recent years on the Upper Cook Inlet chinook and coho stocks by sport, subsistence and commercial user groups, a life history study of the rearing phases of chinook, Oncorhynchus tshawytscha, and coho, Oncorhynchus kisutch, salmon became imperative to proper management.

For the purposes of this study, the Deshka River drainage was divided into six study sections. Six millimeter wire mesh traps baited with salmon roe were the primary sampling gear used to capture juvenile chinook and coho. General descriptions of the habitat (i.e., depth and velocity) were recorded at each trap site.

Results indicate that Age 0+ chinook salmon undertake a general pattern of dispersal from the areas of emergence. The dispersal of Age 0+ chinook into all suitable Deshka River habitat appears to have been completed by late June at a time when the majority of fish were in the 50 to 60 millimeter size range.

Analysis of the data indicates that a substantial outmigration of Age 0+ chinook salmon averaging 80 to 90 millimeters total length occurred in late August and September. Physical conditions remaining essentially equal, data collected in 1978, 1979 and 1980 indicate that on years with a large spawning run of pink salmon, Oncorhynchus gorbuscha, a majority of juvenile chinook salmon outmigrate from the Deshka River at Age 0+.

Juvenile coho salmon outmigrate as smolts over an extended period of time beginning prior to ice-out in April and continuing through July. The majority of coho smolts are Age II+. There were low densities of Age I+ coho salmon present in the mainstem Deshka throughout the summer. The results indicate that these coho seek rearing habitats in lateral tributaries and sloughs as the summer progresses.

A limited spacial separation exists between juvenile chinook and coho salmon inhabiting the Deshka River. Juvenile chinook preferred shallow fast water habitats whereas juvenile coho exhibited a preference for slower water habitats.

An experimental radio telemetry program involving coho salmon was initiated in August 1980. Coho salmon were captured by hook and line and Smith-Root Inc., Model L0378 radio tags were inserted in the gullet. The tags operated with a 40 MHz frequency and had a 90-day life. The tagged salmon were monitored by both riverboat and aerial tracking using a Smith-Root Inc. Model F-40 receiver, Model BP-40 battery pack and a directional loop antenna.

In this year's radio telemetry study, immigration patterns could not be defined; however, data concerning productive tagging and tracking procedures were developed.

BACKGROUND

The Deshka River, referred to as Kroto Creek on United States Geological Survey (USGS) maps, is located on the west side of the Susitna River in the Matanuska/Susitna Valleys of southcentral Alaska. The Deshka, together with its two major tributaries, Moose Creek and Kroto Creek, drains a large lowland area, between the Susitna River and the Peters Hills, comprised of lakes, bogs, beaver ponds and tributary streams. The majority of the Deshka River is accessible only by riverboat, raft or float plane; however, the Petersville Road and other local seasonal roads traverse Moose and Kroto Creeks. Figure 1 shows the Deshka River drainage.

As a biologically productive system, the Deshka River supports large populations of anadromous and freshwater resident fish species. A list of fish species encountered in this study is presented in Table 1. Chinook and coho salmon are of particular importance because of the sport fishing opportunities they provide. The Deshka River has the largest run of chinook salmon in Upper Cook Inlet and probably one of the largest runs of coho salmon as well (Kubik and Delaney 1980). In 1979, a postal survey of recreational anglers who fished in Alaska revealed approximately 13,000 man-days were spent sport fishing in the Deshka River (Mills 1980); nearly 6,500 man-days occurred during the 43-day long chinook season (Table 2) accounting for a harvest of 2,954 chinook salmon. In 1980, nearly 8,500 man-days of recreational angler effort and a harvest of 4,000 salmon were recorded during the chinook salmon season alone and the yearly total will probably exceed 14,000 man-days (see Figure 2 for location of streams open to sport fishing). In 1980 the Deshka River accounted for almost 38% of the total Upper Cook Inlet sport fishing effort for chinook and over 45% of the total harvest. In addition to providing an extremely successful sport fishery, Deshka River salmon stocks contribute to the commercial and subsistence fisheries of Cook Inlet.

These multiple demands have made Upper Cook Inlet chinook and coho salmon stocks the subject of intense controversy in recent years. Allocations of

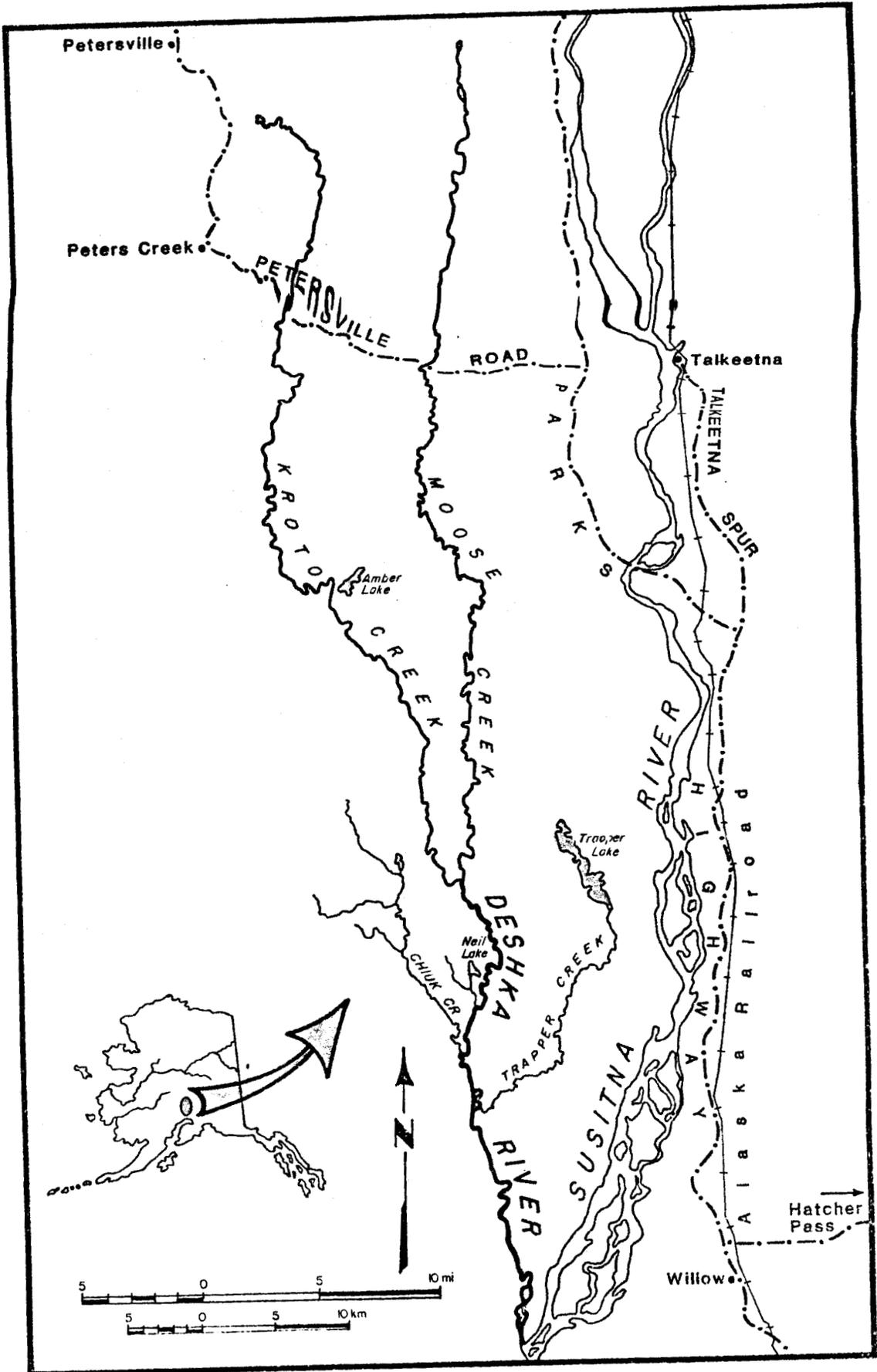


Figure 1. Deshka River drainage.

Table 1. List of Common Names and Scientific Names of Fishes encountered in the Deshka River Drainage.

Common Name	Scientific Name & Author
Coho salmon	<u>Oncorhynchus kisutch</u> (Walbaum)
Chinook salmon	<u>Oncorhynchus tshawytscha</u> (Walbaum)
Pink salmon	<u>Oncorhynchus gorbuscha</u> (Walbaum)
Rainbow trout	<u>Salmo gairdneri</u> Richardson
Dolly Varden	<u>Salvelinus malma</u> (Walbaum)
Arctic grayling	<u>Thymallus arcticus</u> (Pallas)
Burbot	<u>Lota lota</u> (Linnaeus)
Round whitefish	<u>Prosopium cylindraceum</u> (Pallas)
Longnose sucker	<u>Catostomus catostomus</u> (Forester)
Slimy sculpin	<u>Cottus cognatus</u> Richardson
Threespine stickleback	<u>Gasterosteus aculeatus</u> Linnaeus
Arctic lamprey	<u>Lampetra japonica</u> (Martens)

Table 2. Deshka River Adult Chinook Salmon Sport Fishery Creel Census Results, 1979-1980.

Deshka River	1979	1980
Angler Harvest	2954	4023
Angler Days Effort	6451	8397
Upper Cook Inlet Stream Total*		
Angler Harvest	7927	8768
Angler Days Effort	22,715	22,274
Deshka River % of Total		
Angler Harvest	37.3%	45.9%
Angler Days Effort	28.8%	37.7%

* Total of eight streams open to chinook salmon sport fishing. (Figure 2)

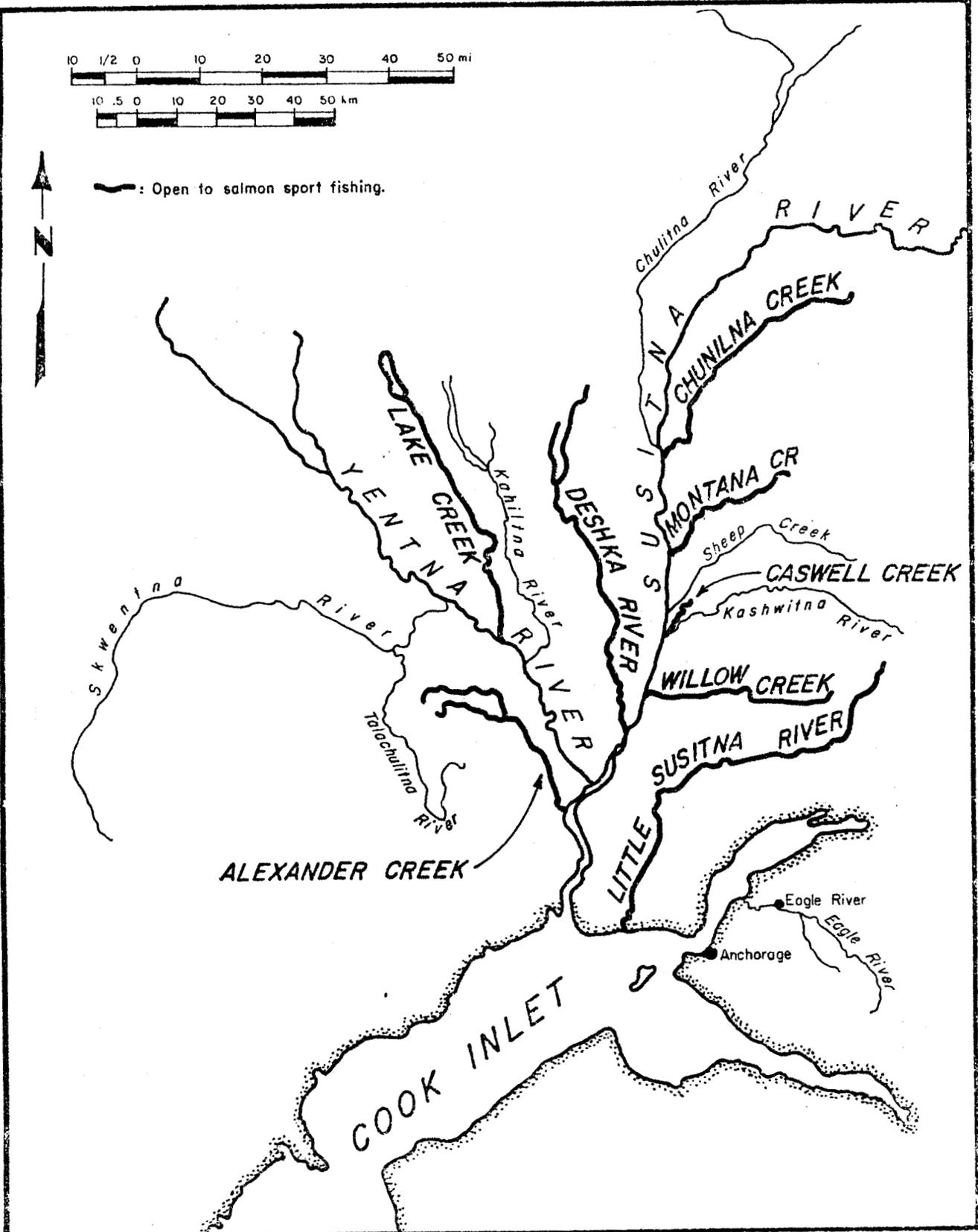


Figure 2. Streams open to chinook salmon sport fishing in Upper Cook Inlet, 1980.

the limited number of salmon to each has been a point of disagreement between sport, subsistence and commercial interests. As a result, harvest restrictions have been instituted which affect all user groups. In fact, chinook salmon populations in Upper Cook Inlet were only reopened to sport fishing in 1979 following a 6-year closure; after a 16-year closure, the village of Tyonek was granted a subsistence fishery specifically for chinook salmon in 1980. Commercial fishing in northern Cook Inlet for chinook has been closed since 1964 and there has been constant pressure every year for the area to be reopened.

The Deshka River also provides a variety of boating experiences and is the site of extensive streamside cabin development. Large tracts of land in the Deshka drainage are slated for disposal under the Alaska Department of Natural Resources, Division of Lands remote parcel and subdivision program.

Due to the growing popularity of the Deshka River to sport anglers, the controversial nature of the allocation and use of its chinook and coho salmon stocks and the potential for adverse impacts through streamside uses, a life history study of all life phases of chinook and coho salmon was deemed imperative to proper management.

Portions of these studies are long term in nature and will require several years to complete.

RECOMMENDATIONS

1. Continue to monitor intrasystem migrations of juvenile chinook and coho salmon with the use of minnow-trapping and supplemental sampling equipment; i.e., seines, shockers and gill nets, in 1981 to obtain comparative data from an expected low pink salmon escapement cycle.
2. Monitor outmigration and smoltification of juvenile chinook and coho salmon through the operation of a downstream migrant trap near the mouth of the Deshka River, to determine the size range, timing and duration of the runs.
3. Expand sampling efforts in lateral tributaries, beaver ponds, lakes and the headwater reaches of Moose and Kroto Creeks to determine relative abundance and distribution of juvenile salmon, especially coho salmon utilizing habitats outside the 1980 study area.

OBJECTIVES

1. To determine abundance of adult chinook and coho salmon.
2. To determine major spawning areas for chinook and coho salmon.
3. To determine the rearing requirements, behavioral characteristics and areas of rearing preferences for coho and chinook salmon.

4. To identify the timing, size and migrational patteredus of coho and chinook salmon smolts.
5. To determine if a relationship exists between the number of rearing juvenile salmon, the number of smolts and, subsequently, the number of adult returns.

TECHNIQUES USED

The Deshka River from the forks of Kroto Creek and Moose Creek downstream approximately 30 miles to its confluence with the Susitna River was divided into six study sections (Figure 3). The study sections were numbered (I-VI) in a downstream direction; Kroto Creek and Moose Creek, from one-half mile above to one-half mile below the Petersville Road, were included as additional study sections. Study section descriptions are found in Table 3.

A sampling schedule was designed, dividing May 1 through October 31 into 10 seasonal periods. The first and tenth seasonal periods, May and October respectively, were each 4 weeks long; seasonal periods two through nine each comprised 2 weeks. Priority was placed on sampling Study Sections I, IV V and VI because of the available historical data.

Six millimeter wire mesh minnow traps were the primary sampling gear used to capture juvenile chinook and coho salmon. The traps were baited with salmon roe suspended in a perforated container and fished overnight (18-24 hours). Forty to 60 traps were set in each study section sampled during each seasonal period; no attempt was made to repeatedly fish the same sites.

An attempt to obtain a representative subsample consisting of at least 50 individuals of each species of juvenile salmon was made during every seasonal period for size and age determination. Juvenile chinook and coho salmon were anesthetized with MS 222 and measured in millimeters from the tip of the snout to the tip of the tail. Age class determination for juvenile chinook and coho salmon was made by total length comparison and periodic scale analysis. Scales were mounted on standard laboratory slide plates and viewed with 3M Model 277 Enlarger Printer.

Beginning in June, a general habitat description was recorded for each trap set. For these purposes, stream habitats were broken into five categories: (1) riffle, fast water with the presence of some standing wave action; (2) pool slow, shallow water depth 0 to 2.0 ft, still water or moderate water velocities up to 1.0 fps; (3) pool, slow deep, water depth greater than 2.0 ft, water velocity less than 1.0 ft per second; (4) pool, fast shallow water depth less than 2.0 ft, water velocity greater than 1.0 ft per second but no standing wave action; and (5) pool, fast, deep, water depth greater than 2.0 ft, water velocity greater than 1.0 ft per second.

Water velocity and depths were initially measured using a Price AA current meter attached to a top setting wading rod, after which visual observations were used to distinguish various habitat types.

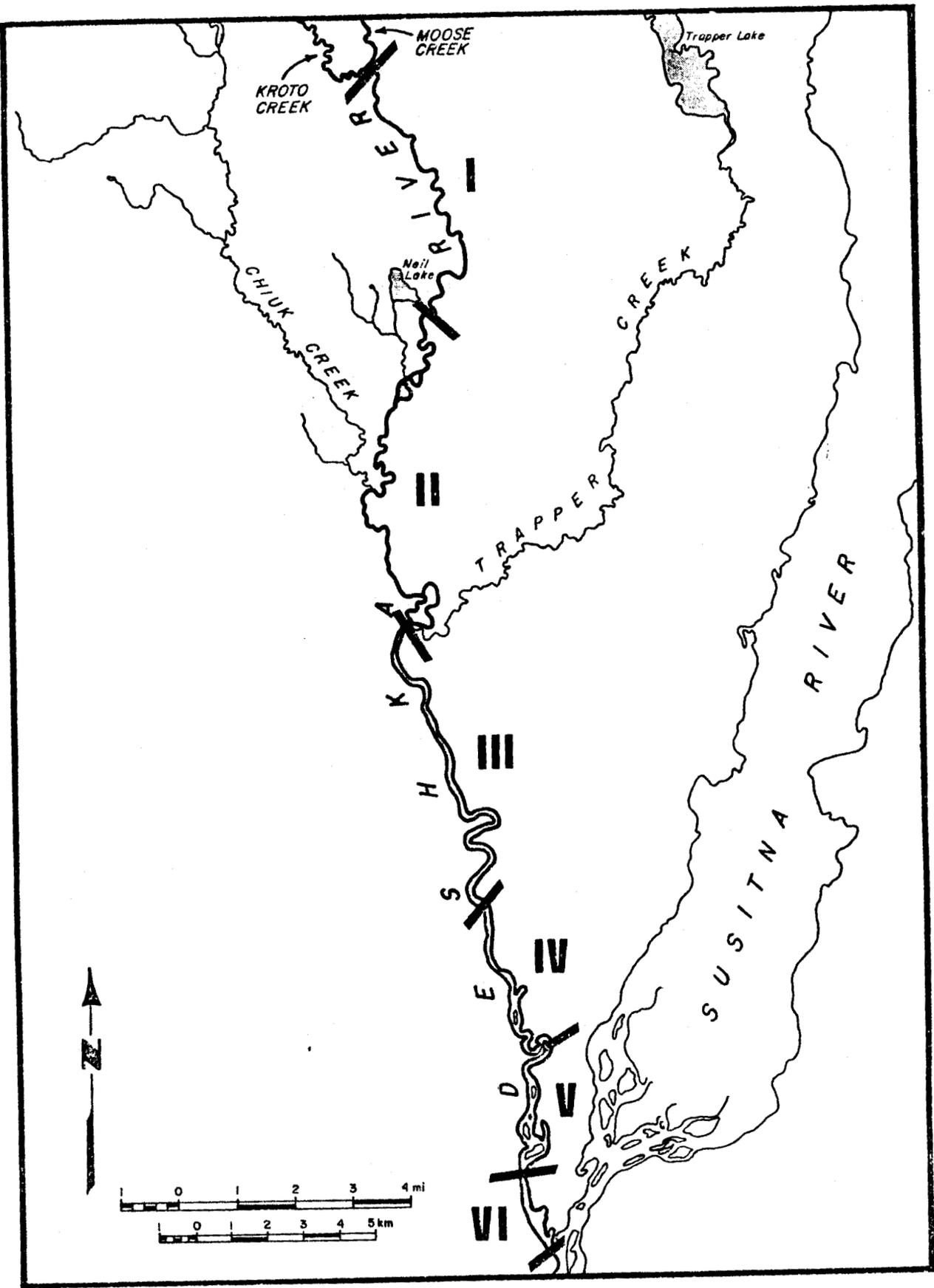


Figure 3. Deshka River study sections, chinook and coho salmon research, 1980.

Table 3. Deshka River, Description of Study Sections, 1980.

Section	Description, Seward Meridian
Moose Creek	From one-half mile above to one-half mile below the Petersville Road. T26N, R6W, S29B to S30A.
Kroto Creek	From one-half mile above to one-half mile below the Petersville Road. T26N, R7W, S7C.
Deshka I	From the confluence of Moose and Kroto Creeks downstream to 0.25 miles below Neil Lake. T22N, R6W, S21B to T21N, R6W, S10B.
Deshka II	From 0.25 miles below Neil Lake downstream to the mouth of Trapper Creek. T21N, R6W, S10B to T20N, R6W, S4D.
Deshka III	From the mouth of Trapper Creek downstream to 0.75 miles above Laub's homesite. T20N, R6W, S4D to S34D.
Deshka IV	From 0.75 miles above Laub's homesite downstream to the Silver Hole, 4.50 miles upstream from the mouth of the Deshka River. T20N, R6W, S34D to T19N, R6W, S11P.
Deshka V	From 4.50 miles upstream from the mouth of the Deshka River downstream 3.75 miles to Farmer's homesite. T19N, R6W, S11D to S26B.
Deshka VI	From Farmer's homesite downstream to the mouth of the Deshka River. T19N, R6W, S26B to S35D.

An experimental radio telemetry program involving adult coho salmon was initiated in cooperation with the United States Fish and Wildlife Service (USF&WS). Coho salmon were captured by hook and line near the mouth of the Deshka River. The salmon were anesthetized with MS 222 and radio tags were inserted into the gullet of the fish, following procedures outlined by Carl Burger (pers. comm. 1980). The antennae were secured to the roof of the mouth with #6 fish hooks and Peterson disc tags were attached below the dorsal fin to complete the tagging operation. Smith-Root model L0375 tags with an operating frequency of 40 MHz were used in the study. These transmitters had a 90-day life and were powered by 3-volt lithium batteries. The tags measured 7 cm in length and 1.5 cm in diameter and weighed 21 gm in water. Tagged salmon were located by both boat and plane. Tracking equipment used included: Smith-Root Inc. Model RF-40 receiver, Model BP-40 battery pack and a directional loop antenna.

Additional study information was collected in cooperation with the Department of Fish and Game management staff. Helicopter surveys were flown during the peak of the spawning seasons to enumerate chinook and coho salmon, and a creel census program was conducted during the May 24-July 6 chinook salmon sport fishing season.

RESULTS

Juvenile Chinook Salmon

Sampling efforts first took place September through December 1979 when three sets of data were collected. Minnow traps were fished in Deshka River Study Sections I, V and VI. Age 0+ chinook salmon were present in each case and ranged in average length from 74.1 mm to 78.7 mm (Table 4). When sampling efforts resumed in the spring of 1980, these juvenile chinook, now Age 1+ were still present in the Deshka River but in very small numbers as evidenced by the average catch per trap shown in Table 5. The average lengths of fish captured in May 1980 were still in the 70-80 mm range.

Small number of Age 1+ chinook (generally in the 80-90 mm length range) continued to appear in the trap catches through the last 2 weeks of July.

It appears that the Age 0+ juvenile chinook salmon present in the Deshka River during the summer and fall of 1979 had completed their outmigration by the end of July 1980. Because of the extremely low trap catches logged in May and June of 1980, it appears that a majority of this migration occurred prior to our spring sampling efforts. The size of outmigrants was most commonly in the 80 to 90 mm range, however, a few have been as large as 100 mm (Table 6).

The 1980 population of Age 0+ chinook salmon was present in all study sections sampled in May. However, their small size (average length less than 45 mm) allowed most of them to escape through the mesh of the minnow traps. Juvenile salmon must be at least 45 mm total length before they can be captured by the mesh. Essentially, all Age 0+ chinook had reached a

Table 4. Deshka River Age 0+ Chinook Salmon Average Size * by Study Section and Date, Fall 1979.

Date	9/27	10/10	12/6
Study Section			
I	...	74.1	...
V	75.1	73.4	...
VI	73.8	...	78.7

* Total length (mm)
 ... No sampling occurred

Table 5. Deshka River Age 1+ Chinook Salmon Average Catch per Trap by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15
Study Section						
Moose Cr.*	...	0.64	1.18	...	...	0
Kroto Cr.*	...	0	0	...	...	0
Deshka I	0.10	0.07	0.50	...	0.19	0
Deshka II	...	...	0.23	...	0.13	...
Deshka III	0.44	...	0.31	0.67	0.17	...
Deshka IV	0	0.67	0.19	0.57	0.23	0
Deshka V	0.19	1.64	0.17	0.76	0.08	0
Deshka VI	0.35	2.48	0.10	0.55	0	0

* at Petersville Road
 0 No fish captured
 ... No sampling occurred

Table 6. Deshka River Age I+ Chinook Salmon Average Size * by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15
Study Section						
Moose Cr.**	...	87.0***	91.4	...	...	0
Kroto Cr.**	...	0	0	...	...	0
Deshka I	76.7	87.0***	84.7***	...	87.5	0
Deshka II	...	...	89.0	...	89.5	...
Deshka III	0	...	96.1	80.8	90.1	...
Deshka IV	0	78.5	94.2	82.6	84.9	0
Deshka V	0	79.2	84.3	83.1	91.0***	0
Deshka VI	70.0***	81.4	85.8	80.8	0	0

* Total length (mm)
 ** at Petersville Road
 *** Sample size <5
 0 No fish captured
 ... No sampling occurred

length greater than 45 mm by mid-June thereby increasing minnow trap efficiency and making it possible to determine relative abundance in addition to distribution.

The average catch per trap recorded for June 16 to June 30 shows that, by this time, Age 0+ chinook occupied suitable habitats throughout the entire area (Table 7). Deshka River Study Section I had the highest catch rate at 85.70 Age 0+ chinook per trap while Study Section II was next with 69.07. Moose and Kroto Creeks at their junction with the Petersville Road had the lowest average catches at 23.45 and 28.91 per trap, respectively. Age 0+ chinook were predominantly in the 55-65 mm length range (Table 8).

It is interesting to note that Study Section I has consistently been a high density spawning area for Deshka chinook. Table 9 shows that in 1979, 20% of the escapement was counted in this 7-mile-long reach.

The average catch rate for 0+ chinook varied but remained relatively high through late July in all sections, and the average size was in the 65-75 mm range.

In the first 2 weeks of August, catch rates for Age 0+ chinook salmon decreased dramatically in all study sections. The average size of captured fish ranged from 71.5 mm in Moose Creek at the Petersville Road to 77.1 mm in Deshka River Study Section IV. This drop in catch rate occurred in conjunction with an influx of large numbers of adult pink salmon and coho salmon migrating to their respective spawning grounds. We believe that our trapping ability was drastically reduced by the presence of these adult salmon and the introduction of their eggs and carcasses into the system.

For comparison, juvenile chinook were captured through the use of a beach seine beginning in early July. Table 10 shows Deshka River beach seine results. Although minnow trap catches dropped in August, we were still able to capture comparable numbers of juvenile chinook with the beach seine until the first 2 weeks of September, at which time the Age 0+ chinook averaged 80-85 mm total length. Willow Creek, an eastside tributary of the Susitna River located about 7 miles northeast of the lower Deshka River was minnow-trapped periodically throughout the season. Table 11 shows that Age 0+ chinook salmon were captured in Willow Creek in both June and August but, during the first 2 weeks of September, no catches occurred. Willow Creek also received an exceptionally large run of pink salmon in July and August of 1980.

In May through August of 1978, a preliminary study was carried out in Deshka River Study Sections IV, V and VI to determine aspects of juvenile chinook and coho salmon life history (Kubik and Wadman, 1978). The seasonal pattern of average minnow trap catches by 2 week periods from May through August compares closely to the 1980 trapping results (Table 12). A large run of pink salmon spawned in the Deshka River in 1978, similar to 1980.

Minnow-trapping and beach-seining efforts continued through October 1980. Catches continued to decline with time until finally a total of 80 minnow traps fished in Deshka Study Sections II, IV, V and VI failed to capture

Table 7. Deshka River Age 0+ Chinook Salmon Average Catch per Trap by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.*	...	0.27	23.45	...	...	15.63	...	2.40	0.70	0.30
Kroto Cr.*	...	3.00	28.91	...	...	33.10	...	9.78	2.30	2.70
Deshka I	0.57	1.33	85.70	...	24.63	0.67	...	...	0	0.05
Deshka II	...	...	69.07	...	30.80	...	...	...	0.04	0
Deshka III	2.50	...	43.10	34.73	17.77	...	...	...	...	...
Deshka IV	1.06	10.16	37.94	56.20	35.95	18.50	0.03	0.75	0	0
Deshka V	0.34	3.71	35.23	41.03	28.27	8.53	0.37	0.16	0.13	0
Deshka VI	1.36	5.47	42.27	31.59	9.91	10.38	1.13	0.20	0.13	0

* At Petersville Road
 ... No sampling occurred
 0 No fish captured

Table 8. Deshka River Age 0+ Chinook Salmon Average Size * by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.**	...	45.7**	53.6	...	...	71.5	...	78.8	80.9	81.7***
Kroto Cr.**	...	38.5	53.2	...	...	75.8	...	81.3	79.7	82.9
Deshka I	38.9	43.0	56.9	...	66.7	71.8	...	...	0	87.0***
Deshka II	...	...	61.4	...	71.3	...	...	...	83.0***	0
Deshka III	...	...	64.7	61.7	69.1	...	...	...	...	...
Deshka IV	37.8	48.5	66.8	64.7	70.2	77.1	87.2	86.3	0	0
Deshka V	...	48.4	60.0	65.4	70.4	76.8	80.0	76.3***	81.5***	0
Deshka VI	38.1	51.1	61.0	64.6	70.3	76.4	80.0	88.3***	83.8***	0

* Total length (mm)
 ** at Petersville Road
 *** Sample size <5
 0 No fish captured
 ... No sampling occurred

Table 9. Deshka River Adult Chinook Salmon Escapement By Study Section, 1979.

Study Section	Chinook Salmon Escapement
Moose Creek	8559
Kroto Creek	7908
Trapper Creek	283
Chiuk Creek	1220
Deshka River I	5373
Deshka River II	2830
Deshka River III, IV, V, VI	<u>1212</u>
Total	27,385

Table 10. Deshka River Age 0+ Chinook and Coho Salmon Beach Seine Results by Study Section and Date, 1980.

Study Section	Date	# Seines Hauls	Age 0+ Chinook		Age 0+ Coho	
			# Captured	#/Haul	# Captured	#/Haul
III	7/4	7	37.0	5.3	0	0
IV	7/4	17	127.0	7.4	0	0
III	8/21	5	14.0	2.8	0	0
IV	8/21	9	80.0	8.9	9.0	1.0
IV	8/22	3	0	0	0	0
IV	9/8	8	7.0	0.9	1.0	0.1
I	9/18	6	0	0	0	0
V	9/22	4	3.0	0.8	3.0	0.8

0 No fish captured

Table 11. Willow Creek * Age 0+ Chinook Salmon Average Catch per Trap by Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Catch per trap	...	1.92	...	...	...	20.00	...	0	7.33	5.25

* at Parks Highway
 0 No fish captured
 ... No sampling occurred

Table 12. Deshka River Age 0+ Chinook Salmon Average Catch per Trap Study Sections IV, V, VI Combined by Seasonal Period, 1978.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31
Study Section							
IV, V, VI	0	2.8	10.6	34.1	39.6	6.8	0.8

0 No fish captured.

a single juvenile chinook. By this time all pink salmon had concluded spawning and died, and only a small number of coho salmon were still spawning.

Trapping efforts on Willow Creek where, in early September, no catches occurred were now once again producing consistent catches of Age 0+ chinook. The average length of Age 0+ chinook in Willow Creek in October was approximately 10 mm smaller than the average length of chinook in the Deshka River (Table 13).

The dispersal of Age 0+ chinook salmon into all suitable Deshka River habitat appears to have been completed by late June at a time when the majority of fish were in the 50-60 mm size range. The highest densities as evidenced by the catch per trap, were found in Deshka River Study Section I, a section of high adult spawning density in 1979. As large numbers of adult pink and coho salmon entered the Deshka River in late July and began spawning, catch rates dropped significantly. In October, after pink and coho salmon spawning was completed, sampling efforts yielded negative results in Deshka River Study Sections II through VI and only a small number of Age 0+ chinook could be located in Deshka River Section I or in Moose and Kroto Creeks at the Petersville Road. Indications are that a substantial outmigration of Age 0+ chinook salmon averaging 80-90 mm total length occurred in late August and September. Throughout the outmigration time period, there were numerous stage fluctuations. The discharge levels ranged from 720 cfs in early August to over 2500 cfs during the third week of September. (Jack McKechney, pers. comm. 1980). Specific temperature data were not available but past records indicate that temperatures normally peak during this time period. Becker (1973) found that seasonal increases and decreases in discharges accompanied by rising temperatures are the main physical factors correlated with seaward migration. Minnow-trapping efforts in the mainstem Susitna River were limited but a total of 48 trap sets were made during August and September 1980. Only five Age 0+ chinook were captured, all of which were in the 80-90 mm size range. Chinook smolts Age 0+, in the 37-80 mm size range have been documented by Becker (1973), Lister and Genoe (1970) and Reimer (1968). Chinook salmon smolts from the Little Susitna River in 1979 were determined to be of an average total length of 90 mm; they were, however, believed to be Age 1+.

Although a majority of the 0+ age class appear to have moved from the Deshka River in 1980, small numbers of this age class remained to overwinter in tributaries and probably in the mainstem Deshka as well. During winter months the amount of suitable habitat is limited but Bustard (1973) found that juvenile chinooks will utilize the cover offered by small cobbles (10 cm) in the substrate, providing there was adequate interstices between the rocks to allow fish movement.

Data collected in 1978 and 1979 indicate that an outmigration of 0+ chinook may have happened in 1978 but probably to a lesser extent or not at all in 1979.

Physical conditions remaining essentially equal, data collected in 1978, 1979 and 1980 indicated that on years with a large spawning run of pink

Table 13. Willow Creek* Age Of Chinook Salmon Average Size by Seasonal Period, 1980

Date	5/1	6/1	6/16	7/1	7/16	8/1	8/16	9/1	9/16	10/1
	5/31	6/15	6/30	7/15	7/31	8/15	8/31	9/15	9/30	10/30
Total										
Length (mm)...	43.3	...	...	...	...	61.6	...	0	74.2	76.2

* at Parks Highway
 0 No fish captured
 ... No sampling occurred

salmon, the nutrients added to the system probably allow for increased growth and an earlier date of outmigration. The size samples taken in October, November and December 1979, shows Deshka River Age 0+ chinook averaged only about 75 mm total length, a size which the average Age 0+ chinook had attained by August 15 in 1980. In Willow Creek where consistent trap catches were made in October after catching nothing in September, the average size of fish captured again was approximately 75 mm.

Apparently, a varied situation exists. During years with large pink salmon runs in the Deshka, because of the availability of nutrients, there may be more if not most Age 0+ smolts than on low pink years when there are fewer nutrients. The population density of juvenile chinook salmon in the system may also affect the timing of migrations and also such physical factors as water temperature and instream flow (Thomas, 1975). Willow Creek Age 0+ chinook did not grow as rapidly as Deshka River fish and for this reason will overwinter in fresh water prior to outmigrating as Age 1+ smolts.

Juvenile Coho Salmon

Initial sampling efforts in September, October and December of 1979 indicated that Age 1+ juvenile coho salmon were present in Deshka River Study Sections I, V and VI. The average length of Age 1+ coho captured ranged from 107.9 mm to 129.8 mm (Table 14). When sampling resumed in May of 1980 this age class of coho, now Age II+, were present in low numbers in all study sections sampled as evidenced by the average catch per trap (Table 15). Age II+ coho continued to be found in low concentrations from May through the end of July, with the lower study sections recording the most consistent catches. Low trap catches and small sample size made relative abundance and average size difficult to assess; however, the majority of Age II+ coho captured were in the 120 mm to 140 mm length range (Table 16). There were no Age II+ coho captured in any study sections after July 31. All Age II+ coho salmon in the Deshka River were considered to be nearing smoltification or actually smolts since no juvenile coho salmon older than Age II+ were found. The data indicate that the coho smolt emmigration begins prior to May 1, probably in conjunction with increased instream flow and ice break-up and continues on a low level until the end of July.

During the fall of 1979, Age 0+ coho salmon were found in all the study sections sampled. The average size ranged from 69.4 mm to 83.8 mm (Table 17). When spring sampling was initiated in 1980 this age class of now Age I+, were found throughout Study Sections I-VI as is indicated by Table 18. The average catch per trap ranged from a low of 0.05 in Study Section IV to 0.45 in Section V. The size of Age I+ coho was generally 75-85 mm with Study Section VI having the largest average size at 85.2 mm (Table 19).

The catch data show that variable small numbers of Age I+ coho were present in the Deshka River, Moose and Kroto Creek study sections throughout June, July and early August. Steady growth was observed during this period as evidenced by the increase in average size from 75-85 mm in early June to about 105-115 mm in mid-August.

Table 14. Deshka River Age 1+ Coho Salmon Average Size * by Study Section and Date, Fall 1979.

Date	9/27	10/10	12/6
Study Section			
1	...	117.0	...
5	126.2	129.8	107.9
6	123.0	...	...

* Total length (mm)

... No sampling occurred

Table 15. Deshka River Age II+ Coho Salmon Average Catch per Trap by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31
Study Section							
Moose Cr.*	...	0.18	0	...	...	0	...
Kroto Cr.*	...	0	0.09	...	...	0	...
Deshka I	0.10	0.82	0	...	0	0	...
Deshka II	...	...	0.10	...	0	...	...
Deshka III	0.06	...	0.28	0	0.02	...	...
Deshka IV	0	1.43	0.03	0.03	0.03	0	0
Deshka V	0.18	1.38	0.27	0.04	0.05	0	0
Deshka VI	0.25	0.66	0.23	0.09	0	0.08	0

* at Petersville Road

0 No fish captured

... No sampling occurred

Table 16. Deshka River Age II+ Coho Salmon Average Size * by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31
Study Section							
Moose Cr.**	...	153.0***	0	...	...	0	...
Kroto Cr.**	...	0	137.0***	...	...	0	...
Deshka I	130.5	103.9	0	...	0	0	...
Deshka II	...	...	130.0***	...	0	...	...
Deshka III	0	...	116.7	0	132.0***	...	...
Deshka IV	0	115.2	124.0***	120.0***	123.0***	0	0
Deshka V	0	113.1	112.3	0	128.0	0	0
Deshka VI	0	110.9	122.6	124.2	0	124.0	0

* Total length (mm)
 ** at Petersville Road
 *** Sample size <5
 0 No fish captured
 ... No sampling occurred

Table 17. Deshka River Age 0+ Coho Salmon Average Size * by Study Section and Date, Fall 1979.

Date	9/27	10/10	12/6
Study Section			
1	...	69.4	...
5	83.8	73.6	77.7
6	78.2	...	...

* Total length

... No sampling occurred

Table 18. Deshka River Age I+ Coho Salmon Average Catch per Trap by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.*	...	0.91	1.18	...	...	0.53	...	0.10	0	0
Kroto Cr.*	...	0	0.09	...	...	0.10	...	0.10	0	0
Deshka I	0.34	0.55	0.04	...	0.10	0.27	...	...	0	0
Deshka II	...	...	0.10	...	0.03	...	...	...	0.04	0.15
Deshka III	0.38	...	0.03	0	0	...	...	...	...	...
Deshka IV	0.05	0.38	0.39	0.08	0.13	0.40	0	0.04	0.33	0
Deshka V	0.45	0.64	0.47	0.16	0.12	0.67	0.17	0.32	0.43	0
Deshka VI	0.32	0.19	0.27	0.16	0.05	0.10	0.03	0	0.07	0

* at Petersville Road
 0 No fish captured
 ... No sampling occurred

Table 19. Deshka River Age 1+ Coho Salmon Average Size * by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.**	...	74.3***	89.3	...	...	111.5	...	122.0***	0	0
Kroto Cr.**	...	0	106.0***	...	...	113.0***	...	0	0	128.0***
Deshka I	84.8	74.9	87.8	...	105.8	116.5	...	...	0	0
Deshka II	...	...	95.0***	...	106.0***	...	...	...	116.0***	111.3***
Deshka III	0	...	104.0***	0	105.0***	...	...	...	...	...
Deshka IV	78.7***	84.4	90.4	94.2	100.0	115.3	0	136.6	125.8	0
Deshka V	0	77.5	95.9	88.4	102.2	116.2	110.0	132.0	129.3	0
Deshka VI	85.2	75.6	89.8	93.4	113.7***	103.8	107.0***	0	136.0***	0

* Total in length (mm)
 ** At Petersville Road
 *** Sample size <5
 0 No fish captured
 ... No sampling occurred

Catches declined substantially in all study sections during the last weeks of August and first weeks of September, coinciding with the spawning activities of adult pink and coho salmon. The catch rate dropped to below 0.32 Age I+ coho per trap in all study sections. The average size of Age I+ coho captured ranged from 107.0 mm to 136.6 mm.

The catch increased toward the end of September with the highest catches recorded in Study Sections IV, V and VI. The average size remained essentially unchanged from early September with the largest average size Age I+ coho found in Study Section VI, at 136.0 mm.

In the month of October the catches decreased yielding low numbers in the upper study sections and a zero catch of Age I+ coho in the lower study sections. In the 1978-1979 Little Susitna River study both Age 0+ and Age I+ coho salmon moved from the mainstem Little Susitna River into lateral tributary systems as the summer progressed.

The 1980 Deshka River data indicate that this same process may have taken place. Intrasystem migrations into lateral tributaries by juvenile coho have also been recorded by Skeesick (1970) and Bustard (1973).

From June to August a small amount of additional sampling was conducted in lateral sloughs and beaver ponds to define additional areas utilized by juvenile coho. These habitats yielded the highest catch per unit effort for Age I+ coho in the system, in some cases as high as 4.0 fish per trap. The slough and beaver ponds provide nearly optimum rearing conditions as described by Gray (1978) with adequate cover, low water velocities and moderate water temperatures.

The 0+ age class of Deshka River juvenile coho were rarely encountered in May or early June. A size sample of the captured fish indicated that the majority of the population was not yet 45 mm in total length and therefore were capable of easily escaping through the mesh of the standard minnow traps. By June 30, Age 0+ coho were present in trap catches from the Petersville Road downstream through Study Section VI (Table 20), however, catches were very low ranging from 0.06 to 0.36 fish per trap. The average size ranged from 45 mm to 55.0 mm (Table 21).

The average catch per trap and average size continued to increase through the first two weeks of August although catches were never large when compared to the 0+ Age class of chinook salmon in the same areas. By the middle of August Age 0+ coho were in the 60-70 mm size range.

Following the second week of August, the catch rates of Age 0+ coho salmon generally decreased. The trapping efforts were continued through October at which time only three Age 0+ coho were captured in a total of 120 minnow traps fished from the Petersville Road downstream to the mouth of the Deshka. The average size of Age 0+ coho captured varied between sections and with time from 65.8 mm in Moose Creek during the first two weeks of September to 91.6 mm in the Deshka River Study Section V at the end of September. As Table 21 illustrates, no patterns describing increase in size over time or stratification by size with regard to the study sections can be seen after the second week of August.

Table 20. Deshka River Age 0+ Coho Salmon Average Catch per Trap by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.*	...	0.36	0.36	...	...	3.42	...	0.80	0	0
Kroto Cr.*	...	0	0.18	...	...	3.55	...	5.00	0.80	0.20
Deshka I	0	0	0	...	0.37	1.20	...	...	0.03	0.05
Deshka II	...	...	0.13	...	0.18	...	...	...	0.04	0
Deshka III	0	...	0.07	0.20	0.18	...	...	...	...	...
Deshka IV	0.04	0	0.06	0.15	0.10	0.95	0	1.10	0.03	0
Deshka V	0.02	0	0	0.11	0.31	1.12	0.77	1.11	0.06	0
Deshka VI	0	0	0.07	0.38	0.53	1.12	0.50	0.20	0.17	0

* at Petersville Road
 0 No fish captured
 ... No sampling occurred

Table 21. Deshka River Age 0+ Coho Salmon Average Size * by Study Section and Seasonal Period, 1980.

Date	5/1 5/31	6/1 6/15	6/16 6/30	7/1 7/15	7/16 7/31	8/1 8/15	8/16 8/31	9/1 9/15	9/16 9/30	10/1 10/30
Study Section										
Moose Cr.**	...	49.5***	55.0***	...	...	58.0	...	65.8	0	0
Kroto Cr.**	...	0	45.0***	...	...	60.9	...	69.5	73.5	65.0***
Deshka I	0	0	0	...	60.3	75.6	...	...	99.0***	86.0***
Deshka II	...	...	49.3***	...	61.7	...	...	...	80.0***	0
Deshka III	0	...	50.5***	57.0***	60.1	...	...	...	...	...
Deshka IV	0	0	51.5***	58.0	67.3	73.2	80.0	92.4	80.0***	0
Deshka V	0	0	0	57.0***	66.7	74.1	77.0	79.6	91.6	0
Deshka VI	0	0	55.0	59.2	62.0	68.2	72.6	86.5***	77.0***	0

* Total length (mm)
 ** at Petersville Road
 *** Sample size <5
 0 No fish captured
 ... No sampling occurred

Although the decline in catch rate for Age 0+ coho salmon in late August can be attributed to the influx of spawning pink and coho salmon the continued low catches and variations seen in the size samples may indicate a movement of Age 0+ coho out of the study sections.

Age 0+ coho salmon in the Little Susitna River were found to move into lateral tributaries as the summer progressed. A similar movement from the mainstem Deshka River into the many lateral tributaries or sloughs could account for the lowered catch rates and variations in average size since this age class of coho is not known to migrate to sea as smolts.

Habitat Preference

Water velocity and depths were recorded at each trap site in an effort to define juvenile chinook and coho habitat preferences. The 0+ age class juveniles were selected for comparison because they represented the largest percentage of the catch.

Since most of the sampling effort occurred in the predominantly slow waters of Study Sections IV, V and VI, a majority of the traps were fished in general habitat types II and III. In most cases, trap sites were selected from areas which appeared to have suitable rearing habitat, and few traps were fished in areas which consistently yielded no catch of juvenile salmon. Large numbers of spawning pink salmon drastically reduced the efficiency of the minnow traps in seasonal periods 7 and 8 by literally flooding the system with an alternate food source. For comparative purposes, the habitat data from seasonal periods before and after the immigration of pink salmon were analyzed separately.

Juvenile chinook were generally found in all five habitat types but showed a preference for shallow fast water (Figures 4 and 5). Juvenile coho exhibited a preference for slow shallow waters and generally did not utilize as wide a range of habitats as juvenile chinook salmon (Figures 6 and 7). Age 0+ coho salmon displayed a marked preference for lateral tributaries and sloughs, while juvenile chinook preferred the mainstem, as was also observed in the Little Susitna River (Delaney and Wadman, 1979). Both species of juvenile salmon increased their utilization of slow deep pools in seasonal periods 7 through 9. Possible factors influencing this behavior are low water level conditions and spacial competition with spawning pink salmon. Another possible factor is that the juvenile salmon exhibit an increased preference for deeper water with an increase in size as proposed by Lister, and Genoe, 1970.

Radio Telemetry

A cooperative study between ADF&G and USF&WS was initiated to test the feasibility of radio telemetry studies on adult coho salmon. Tracking and tagging procedures outlined by Winter, et al. (1978) and Carl Burger (per. comm., 1980) were synthesized and tested for use in the Deshka River drainage.

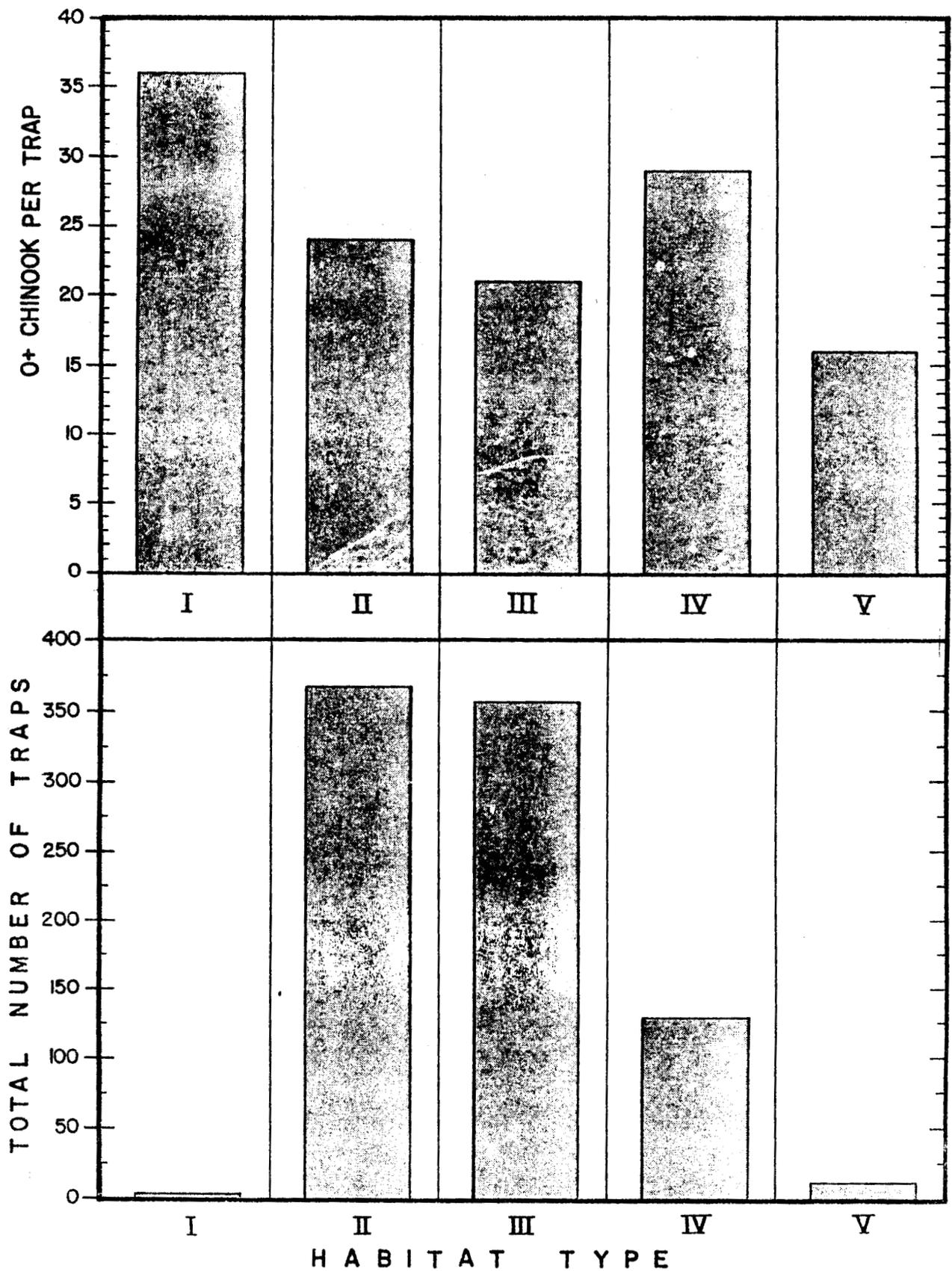


Figure 4. Total number of traps and age O+ chinook per trap by habitat type for seasonal periods 4, 5 and 6.

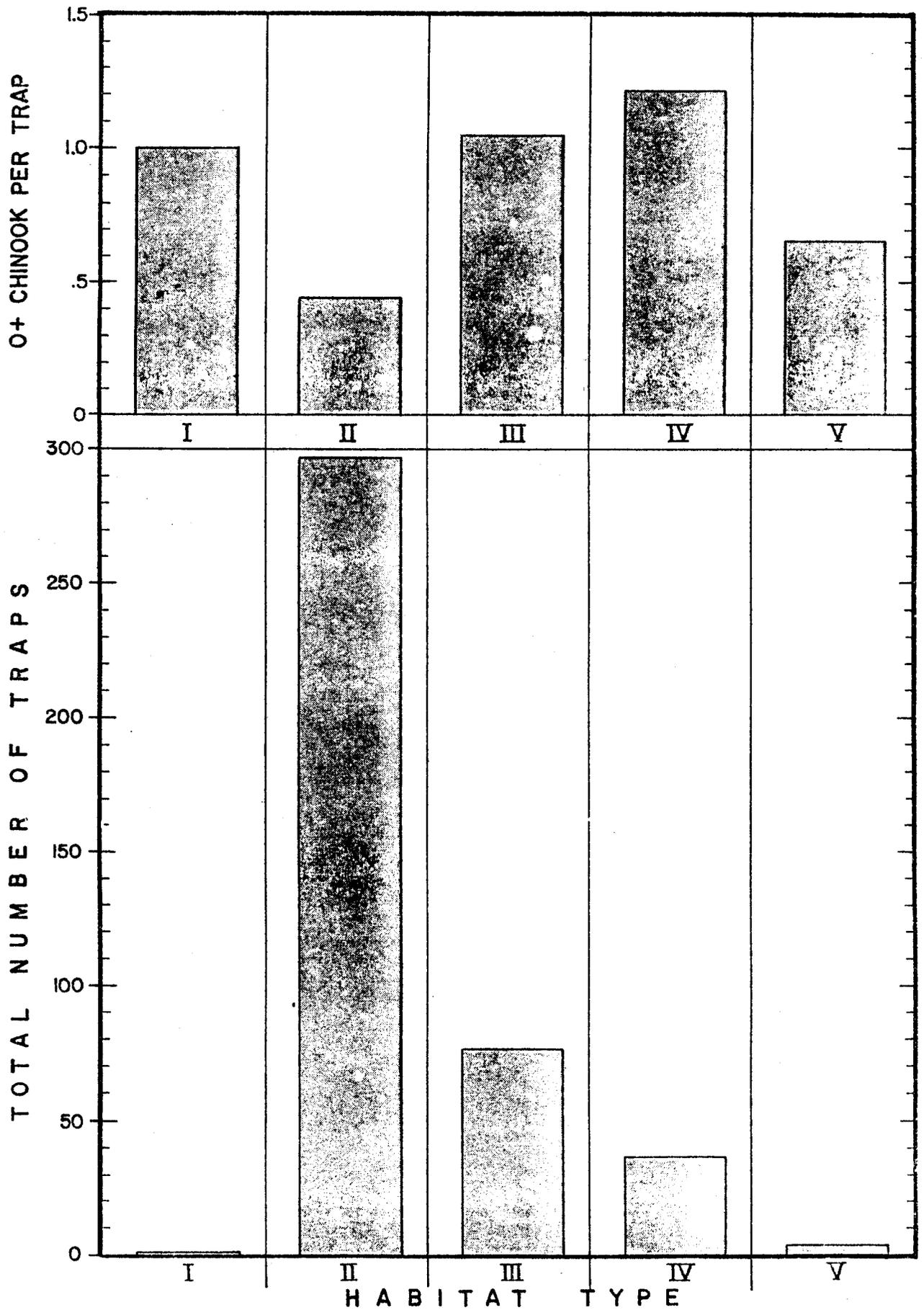


Figure 5. Total number of traps and age O+ chinook per trap by habitat type for seasonal periods 7, 8 and 9.

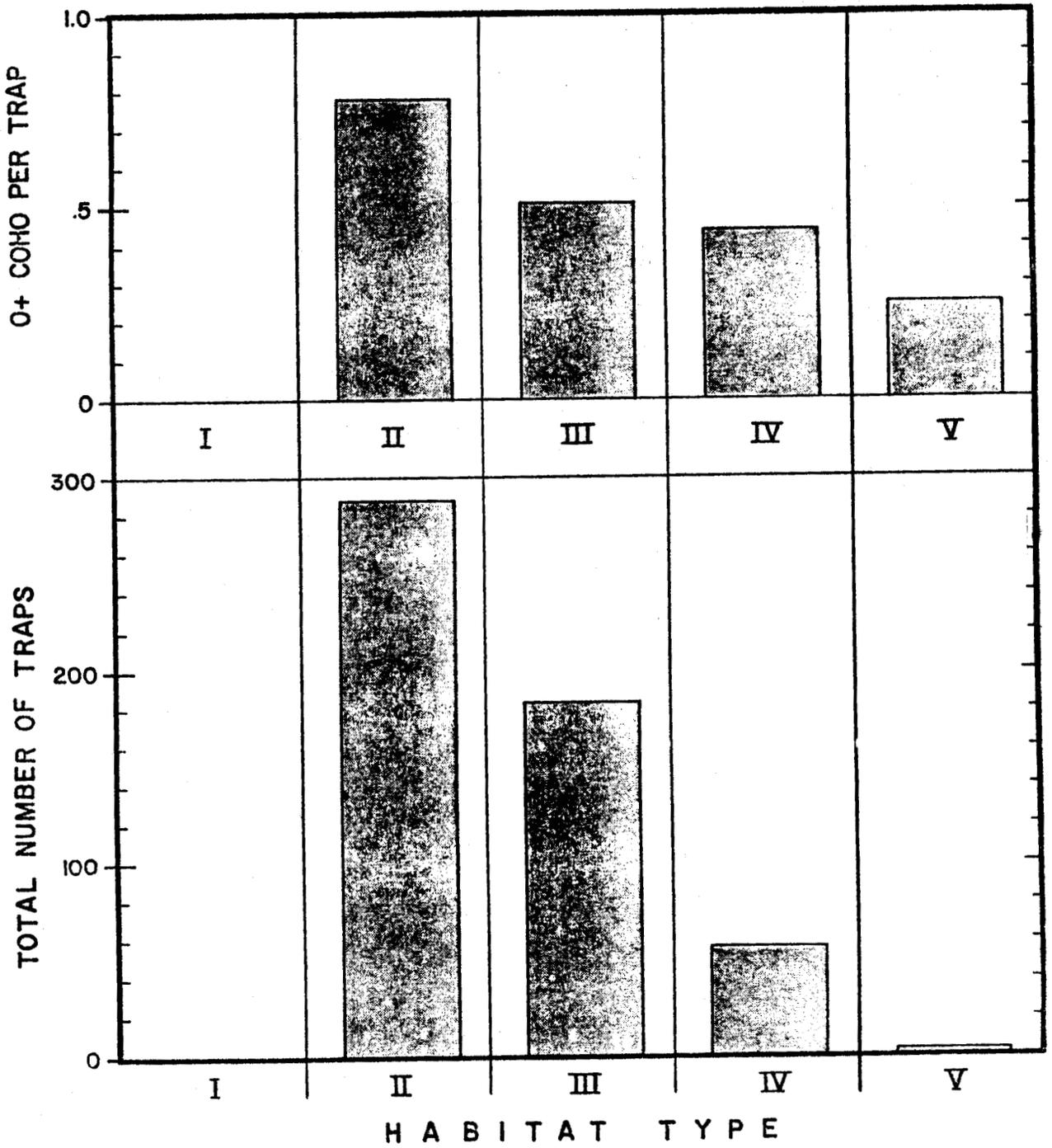


Figure 6. Total number of traps and age O+ coho per trap by habitat type for seasonal periods 4, 5 and 6.

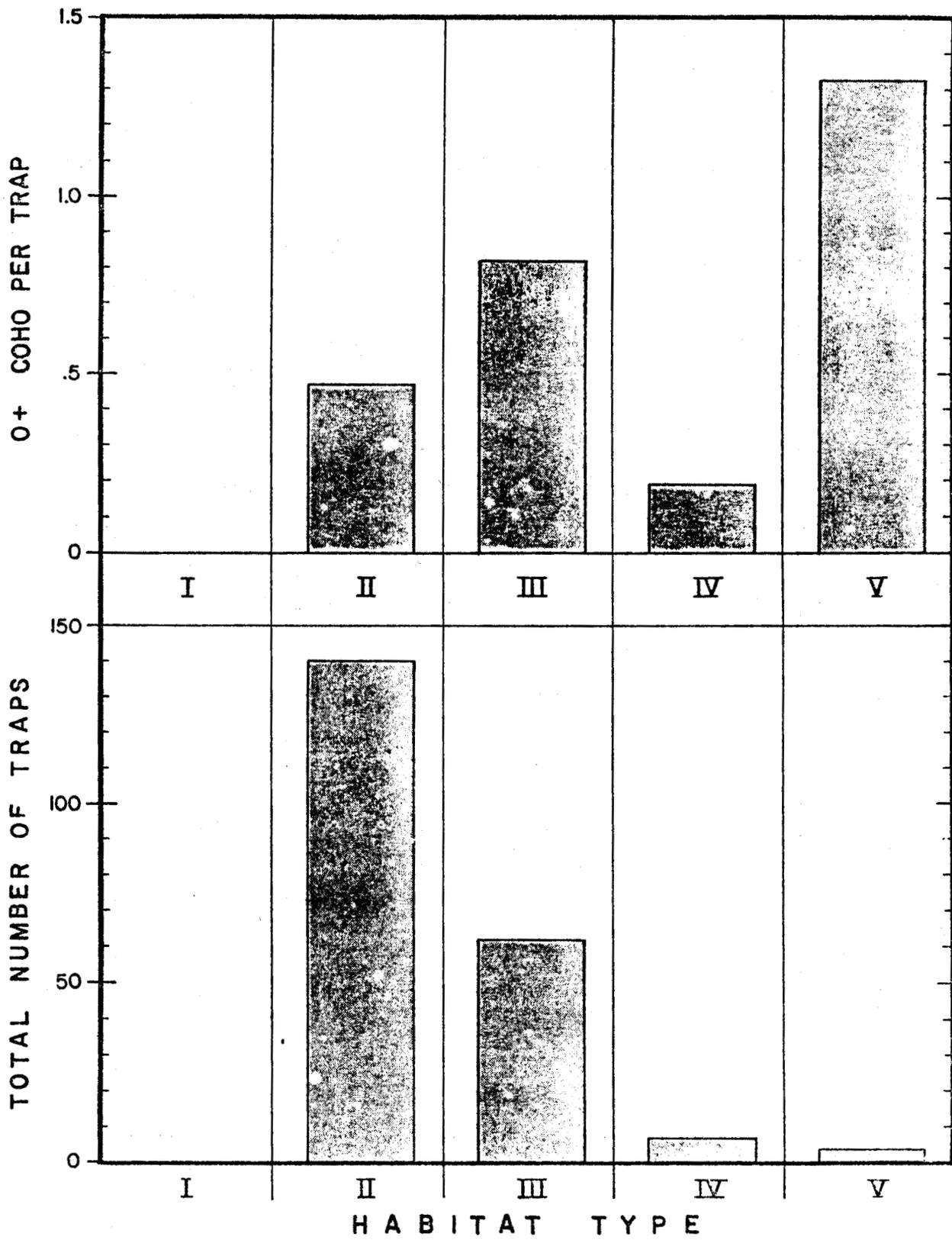


Figure 7. Total number of traps and age 0+ coho per trap by habitat type for seasonal periods 7, 8 and 9.

Hook and line was found to be an effective capture method for coho salmon. Netting was found to be ineffective due to the large numbers of adult pink salmon in the system.

When tagging coho salmon, it was found that stomach insertion could be done quickly with only a short recovery time required. An autopsy was performed on a number of coho, after tag placement, to check insertion techniques and to determine the minimum size of fish which could be tagged. A total of five coho salmon were subsequently tagged and released at the mouth of the Deshka River. The movement of tagged salmon was monitored by aerial and riverboat surveys. From the air, the transmitter had a range of approximately 1 mile and transmitter locations were determined as accurately as a quarter mile radius. Maximum transmitter range was better at higher altitudes but locations were determined more accurately at lower altitudes. When riverboat tracking, the transmitter had a range of approximately a quarter mile and transmitter locations could be determined to a radius of 10 yards.

Table 22 outlines the timing and movement of the tagged salmon. Tag frequencies 740-1 and 760-2 provided the most consistent data points of the five salmon. These frequencies were monitored for over 40 days and exhibited variable rates in movement. Tag frequencies 730-1 and 730-2 were tracked for 18 to 20 days respectively. Frequency 730-1 was the only coho found that immigrated up the Deshka, only to move back down into the Susitna River. This tag was later found at river mile 21. Tag frequency 600-1 was only monitored for 7 days but exhibited the fastest rate of movement of the tagged salmon. All five coho remained in the mainstem Deshka and the majority of tags were found in the Chiuk Creek area at last contact. Internal tag failure was the suspected cause for frequency 600-1 short tag life and capture by sport fishermen and tag regurgitation are possibilities for frequencies 730-1 and 730-2 missing data points. Regurgitation of tags by coho has been documented in the Kenai River by the USF&WS (Carl Burger, pers. comm., 1980).

Radio telemetry studies within the Deshka River drainage was found to be feasible and could be productive in terms of defining spawning areas and timing of intrasystem migration. In this year's study, with only five tagged salmon, data concerning possible spawning areas could not be discerned, but probable behavioral characteristics were observed (Figure 8).

Table 22. Deshka River Radio Telemetry Studies of Adult Coho Salmon, 1980.

Radio tag Frequencies	600-1	730-1	730-2	740-1	760-1
Date					
8/04	**tagged D + 0.5	tagged D + 0.5	...	...	...
8/05	---	D + 3.5	...	tagged D + 0.5	tagged D + 0.5
8/06	D + 0.5	---	tagged D + 0.5	D + 0.4	D + 0.5
8/08	---	---	---	---	D + 0.5
8/09	---	---	---	---	D + 0.5
8/10	---	---	---	---	D + 0.5
8/11 *(A)	D + 19.0 Chiuk Creek	Susitna River 2 miles below D	D mouth	D + 9.0	---
8/19 *(A)	---	---	---	D + 20.0	D + 4.5
8/21	---	---	---	---	D + 10.5
8/22	---	D + 21.0	D + 22.0	19.5	D + 15.5 Trapper Creek
8/23	---	---	D + 21.0	D + 20.5	---
8/26 *(A)	---	---	D + 21.0	D + 20.5	D + 21.5
9/03	---	---	---	D + 20.0	D + 30.0
9/11 *(A)	---	---	---	D + 20.0	D + 27.5
9/17	---	---	---	D + 20.0	D + 28.0

**D + .5 From the confluence of the Deshka River with the Susitna River upstream 0.5 miles.

*(A) Aerial Survey. All other surveys conducted by riverboat.

--- No contact.

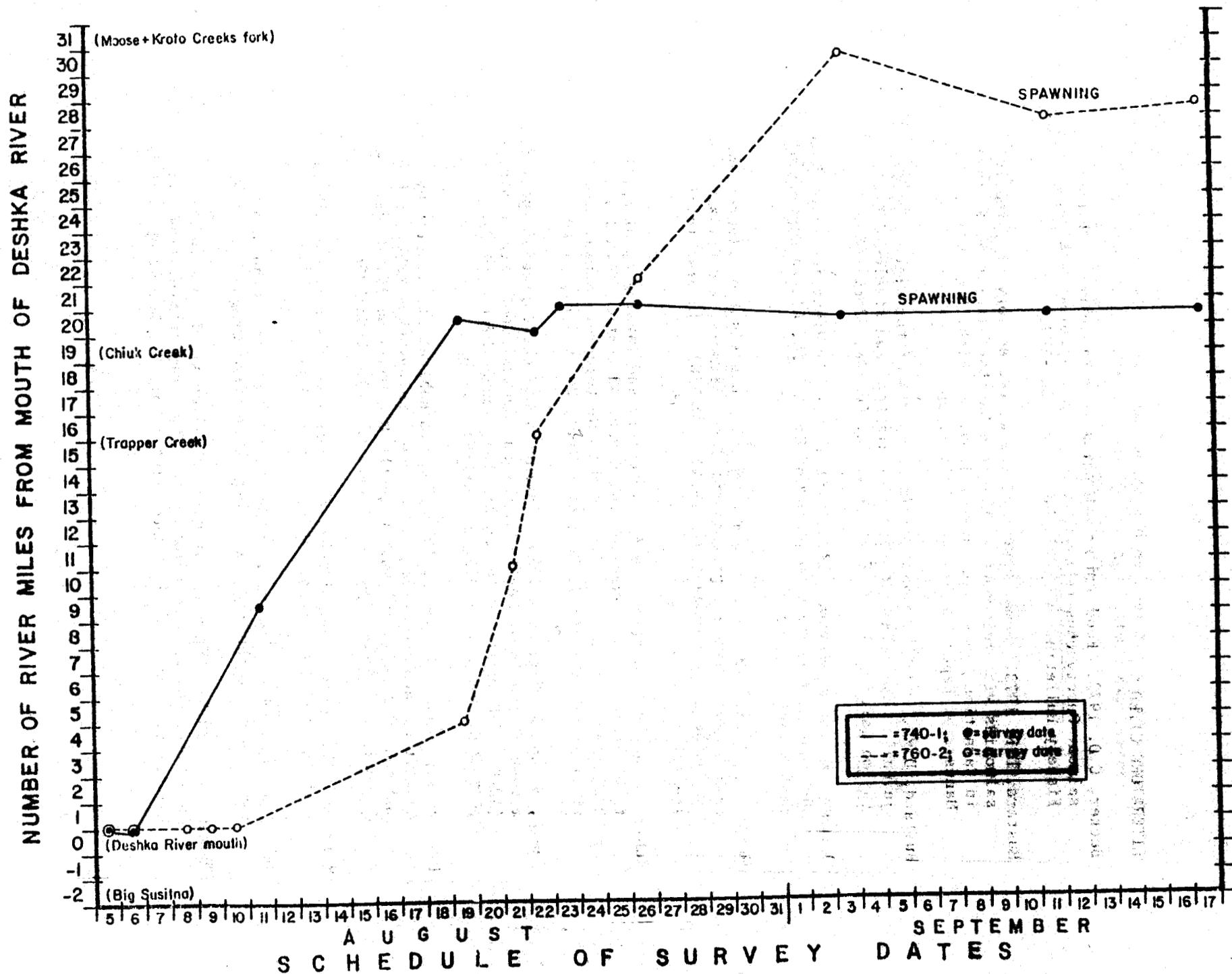


Figure 8. Timing and movement of coho tag frequencies 740-1 and 760-2 in the Deshka River, 1980.

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