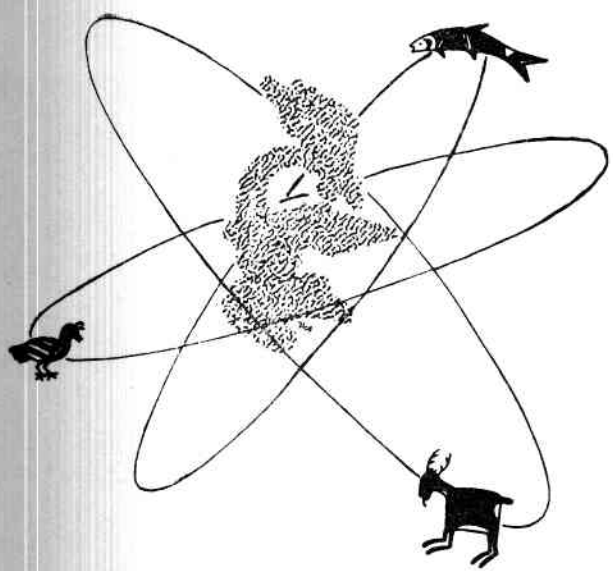
FEDERAL AID PROGRESS REPORTS
FISHERIES
1978



RESEARCH AND DEVELOPMENT SECTION

Oregon Department of Fish and Wildlife
Fish Division

AFC-76-2 Salmon River Project

ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Salmon River Project

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Prepared by: Robert E. Mullen

Oregon Department of Fish and Wildlife
506 S. W. Mill Street
P. O. Box 3503
Portland, Oregon 97208

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INTRODUCTION

The Salmon River Project is one of three segments of an Anadromous Fish Act (PL 89-304) contract entitled "Anadromous Fish Research in Oregon's Coastal Watersheds" administered in the Oregon Department of Fish and Wildlife's Research and Development Section. Other projects in the FY 1978 contract include the Fall Chinook Ecology and Coastal Fall Chinook Stock Assessment projects. Research in FY 1978 in these projects is summarized in separate progress reports.

The projects were partially financed with federal funds granted by the National Marine Fisheries Service under provisions of the Anadromous Fish Act. The total contract amount was $255,400 in FY 1978. The federal share was $127,700 and the state's matching share was $127,700. Approximately $106,800 of the contract cost was allocated to support the Salmon River Project in FY 1978. Remaining funds supported the Fall Chinook Ecology and Coastal Fall Chinook Stock Assessment projects.

The prehatchery evaluation of the stocks of salmonids in Salmon River was completed in 1977. This completed the initial stage of research on the Salmon River Project which began in 1975. Future research efforts at Salmon River will concentrate on the distribution and contribution of Salmon River Hatchery stocks to ocean and river fisheries. This report summarizes the field activities for 1977.

ADULT STUDIES

Primary objectives in 1977 were to document the wild salmonid species that utilize Salmon River as a spawning area, to determine their spatial and temporal distributions, and to measure the abundance of each species.

Estuarine Tagging

As in the previous 2 years, adult salmon were seined and gillnetted in tidewater in 1977. Tagging was conducted from mid August through mid October. Fish were tagged with Petersen disc tags to estimate the population of each species and to determine the time of entrance of each species into the river. Each fish was also sampled for scales, length, and sex.

Tagging locations were limited within the Salmon River estuary due to shallow water and snags. In 1977, sampling effort was concentrated at Booth's Hole, Pixie Land, and Green Barn Hole (Fig. 1). These sites, particularly Green Barn Hole, were productive seining localities for chinook salmon in 1976. A few gill nets were also set above tidewater to augment the seining effort.

The success of capturing adult salmon in 1977 was the poorest experienced in Salmon River. Only 24 chinook salmon and 7 coho salmon were captured and tagged. The poor success in capturing and tagging fish occurred at essentially the same time that the Salmon River sport fishery was successfully harvesting chinook salmon immediately downstream from Salmon River Hatchery. I believe that fall chinook salmon, and to a lesser extent coho salmon, did not hold in tidewater as they had in 1976 (a very low water year), but instead moved almost immediately upstream where they were temporarily blocked by the electric barrier at Salmon River Hatchery.

Hatchery Tagging

Since the electric barrier at Salmon River Hatchery was designed to shunt the entire salmon run into the hatchery ladder, an opportunity existed to tag excess fish at the hatchery before they were returned to the river. These tagged fish served a dual purpose for research. First, they increased the number of tagged fish in the population and therefore increased the accuracy of

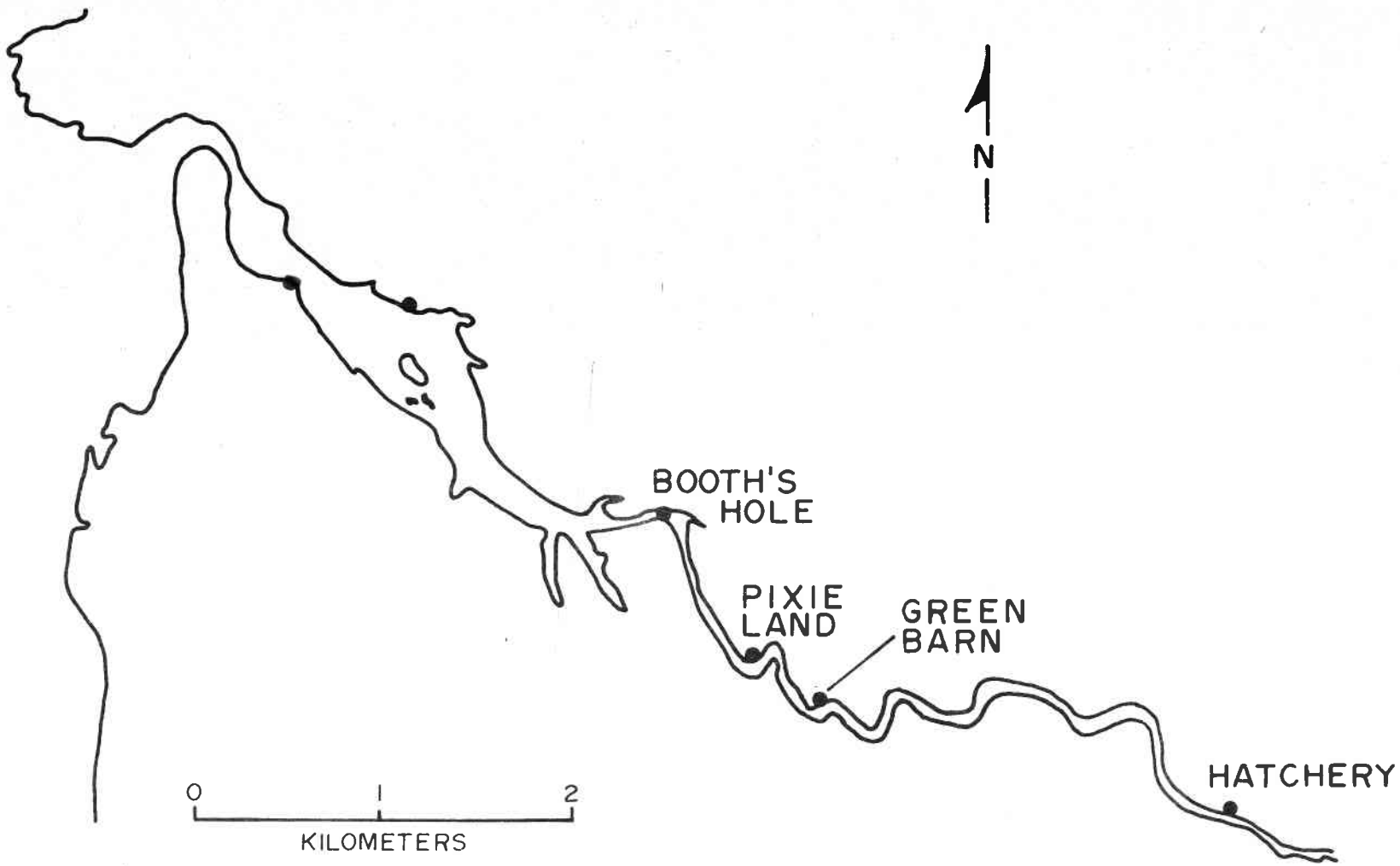

Fig. 1. The principal locations where adult salmon were tagged in Salmon River, 1977.

the population estimate. Second, they allowed us to test the effectiveness of the electric barrier as a fish counting station by looking for untagged fish above the barrier and fish that "recycled" through the hatchery a second time.

Because most of the salmon run failed to enter the hatchery in 1977, few fish were tagged and released at the hatchery. Only 25 chinook salmon (24 were jacks) and 226 coho salmon were tagged and released at the hatchery. These numbers, coupled with the few fish tagged in the estuary, precluded population estimates in 1977.

None of the fish released from the hatchery in 1977 re-entered the hatchery. This agreed with observations made in 1976 that indicated the recycle rate for fish released from the hatchery was negligible.

Electric Barrier

The electric barrier at Salmon River Hatchery was designed to prevent the migration of salmon past the hatchery so all salmon could be counted at the hatchery prior to be being released upstream. A total count of salmon released above the hatchery would eliminate the need to tag fish, and provide an accurate evalution of hatchery returns and an evaluation of status of the wild stocks in Salmon River.

Fish did not readily enter the hatchery ladder in 1977. Only 64 chinook salmon (primarily jacks) and 437 coho salmon entered the ponds. The number of chinook salmon in particular was alarmingly low because, even though few chinook entered the hatchery, their presence immediately downstream from the electric barrier attracted a sizeable sport fishery.

The electric barrier was effective in blocking upstream migration even though the fish did not enter the hatchery. Counts were made at random time intervals by an observer stationed on the shore to estimate the number of fish attempting to pass the electric barrier during freshets. The wooden barrier

apron was arbitrarily divided into four sections for counting purposes to document whether fish could get past only certain sections. Of the 316 fish observed challenging the barrier in 21.5 hours of observations, none were observed passing the barrier (Table 1). Spot checks made on the spawning grounds before the electric barrier was turned off further confirmed that the barrier was very effective in blocking fish. No fish were found on the spawning grounds other than spring chinook which passed before the electric barrier was activated.

Table 1. Numbers of fish observed attempting to pass the electric barrier in 21.5 hours of observations in 1977.

Species and approximate age	Adjacent to ladder entrance	North third of apron	Middle third of apron	South third of apron
Chinook salmon				
Adults		20	23	48
Jacks		4	4	13
Unknown		1		1
Coho salmon				
Adults	1	5	5	10
Jacks	1	3		
Chum salmon			1	3
Steelhead trout				1
Unknown salmonids				
Adults	2	30	13	27
Jacks		30	8	35
Unknown	2	17		8

Injuries to fish resulting from the electric barrier were of concern in 1976 and were further documented in 1977. We had no means of counting actual deaths caused by the barrier. Carcasses of fish collected on the spawning grounds and at the hatchery were filleted and the vertebrae examined for evidence of hemorrhaging (Table 2). We assumed damaged vertebrae were the result of the electric barrier. In order to determine if injuries were merely an

artifact from handling the fish in the hatchery, we examined 44 chinook carcasses and 2 coho carcasses at Trask River Hatchery which had no electric barrier. None of the Trask River fish showed evidence of hemorrhaging.

Table 2. Numbers of salmon carcasses examined for spinal injuries and the number of injuries observed in 1977.

Location and species	Number examined	Number of injuries
Downstream from hatchery		
Chinook	17	1
Coho	5	2
Spawning grounds		
Chinook	13	1
Coho	11	2
Hatchery		
Chinook	27	1
Coho	178	16

Although we found a number of fish with damaged vertebrae, these fish obviously did not suffer immediate mortality. Fish examined at the hatchery and on the spawning grounds had spawned and showed no external signs of injuries.

If the electric barrier is used in the future, it must function more effectively. The injuries would probably be reduced if fish readily entered the hatchery, assuming that repeated attempts to pass the barrier increased the probability of injury. One possible explanation for why fish were reluctant to enter the hatchery is that the electric barrier is close to the entrance of the ladder and deters fish from ascending the ladder. We tested the voltage levels near the ladder in April 1978 (Table 3). Even though nearly two-thirds of the probes were missing as a result of flood damage and the remaining probes were barely submerged, there was a small electric field immediately in front of the ladder entrance. We plan to move the probes that

are immediately adjacent to the ladder entrance, install an isolation transformer, and install a rheostat to allow the voltage to be experimentally varied.

Table 3. Voltages measured around the electric barrier at Salmon River Hatchery, April 1978.

Location	Voltage (v/cm^2)
Near probes	7.5-47.0
Near ladder entrance	0.2-3.5
Background level	0.1

Spawning Ground Surveys

Spawning ground surveys were conducted throughout the watershed at predetermined standard sites in 1977. The counts of salmon were low, as they were in 1975 and 1976. The peak count of live chinook salmon was only 6.4 fish/km in 1977 and the average was considerably lower (Fig. 2). The chinook salmon observed in September and early October were spring or summer chinook which spawn in the main stem of the river. Spot checks of the river after that time failed to show any fish above the electric barrier until the second week in November when the barrier was intermittently operated.

Chinook salmon were observed in the main stem of Salmon River below the electric barrier throughout October. River flows were too high to make counts but chinook were observed spawning on several occasions. Fall chinook salmon were also observed spawning in Salmon Creek, a small tributary entering Salmon River below the electric barrier. No chinook salmon were observed spawning in Salmon Creek in 1975 or 1976.

Counts of spawning coho salmon were extremely low in 1977. Our highest count was less than one live coho/km surveyed. The number of spawners was reduced by collecting fish at the hatchery, but 1977 was a poor year for ocean catches of coho salmon and coast-wide escapements were also below average.

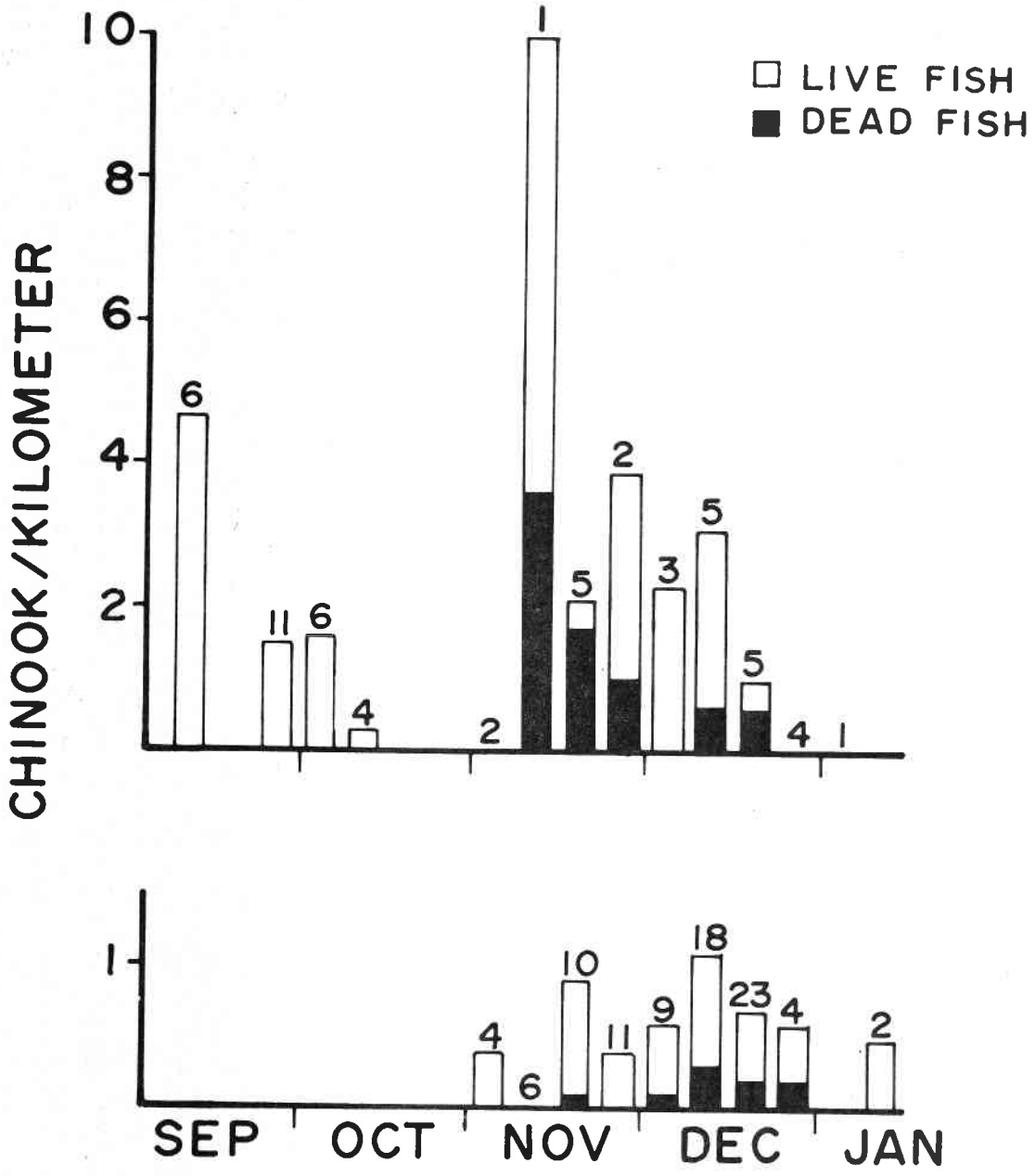

Fig. 2. The numbers of adult salmon counted per kilometer of spawning area surveyed in 1977. Chinook counts are for the main river, Bear Creek, and Slick Rock Creek. Coho counts are for all tributary survey sections. The number over each bar is the total kilometers surveyed that week.

JUVENILE FIELD STUDIES

The primary objective of the juvenile field work was to further document the spatial and temporal distribution of wild salmonids. Initial hatchery releases were planned to mimic wild fish migrations and to reduce the impact on wild fish populations as much as possible. We concentrated on the distribution of chinook salmon in the estuary in 1977 because the ultimate goal for Salmon River Hatchery is to develop a mid-coast chinook stock. Our work in 1975 and 1976 had shown the estuary to be the major chinook rearing site in Salmon River.

We seined in the estuary from April through October with a 38-m bag seine. The estuary was arbitrarily divided into three sections (Fig. 3) with two or three sites seined at least semimonthly in each area. The upper estuary was not seined regularly until July.

Chinook salmon apparently reared through the summer throughout the estuary (Fig. 4). Catches in the upper and middle estuary were smaller than in the lower estuary but juvenile chinook were present, at least into September, in the upper estuary, and into October in the middle and lower estuary.

As in previous years, a peak in the catch rate was observed in the lower estuary in August. Although the peak appeared about 2 weeks later in 1977 than in 1975 and 1976, it apparently represented an increase of juvenile chinook smolts in the estuary prepared to migrate to the ocean. When the peak catch occurred in the lower estuary, catches in the upper estuary became very small.

Growth of juvenile chinook was monitored in each area of the estuary (Figs. 5-7). Ranges in length were usually large for any given sample date, particularly in the lower estuary where ranges of 80 to 90 mm were common. In the upper estuary ranges were much smaller, usually around 30 mm. Even though

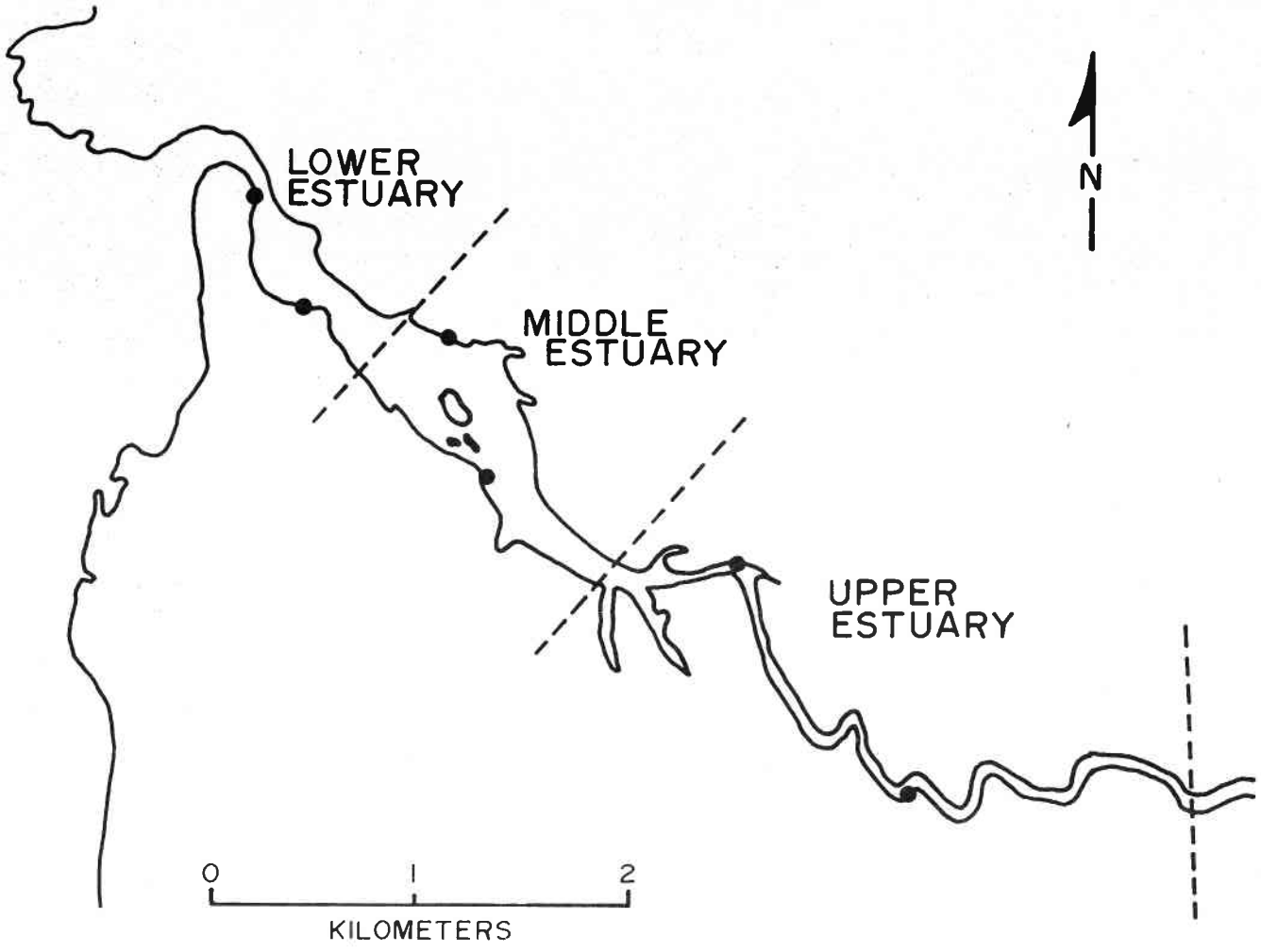

Fig. 3. Three sections of the Salmon River Estuary used for describing catches and growth of juvenile chinook salmon. The principle seining sites are shown as dots.

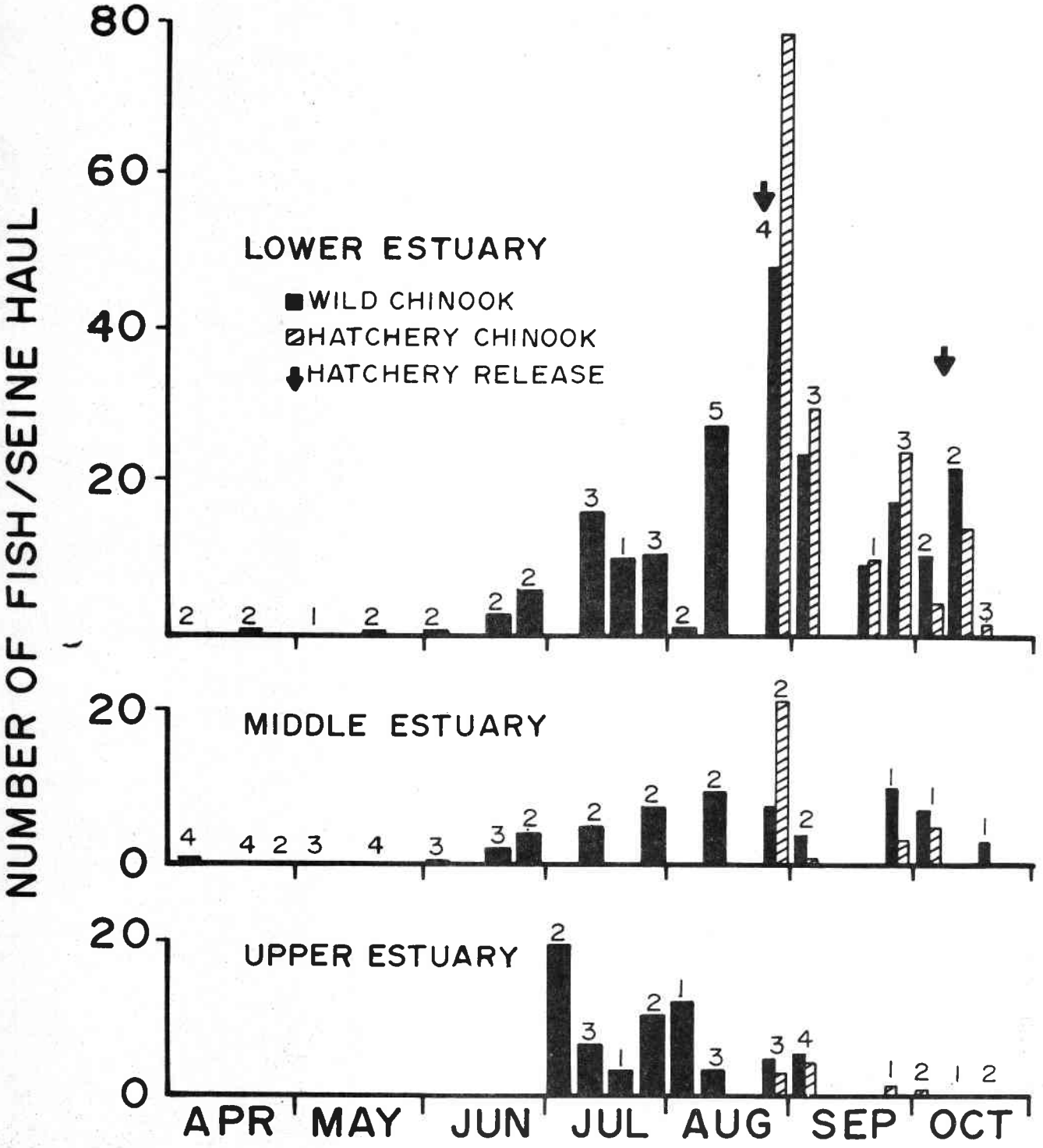

Fig. 4. The catch per seine haul of juvenile chinook in three sections of Salmon River estuary in 1977. The numbers over each bar represent the number of seine hauls.

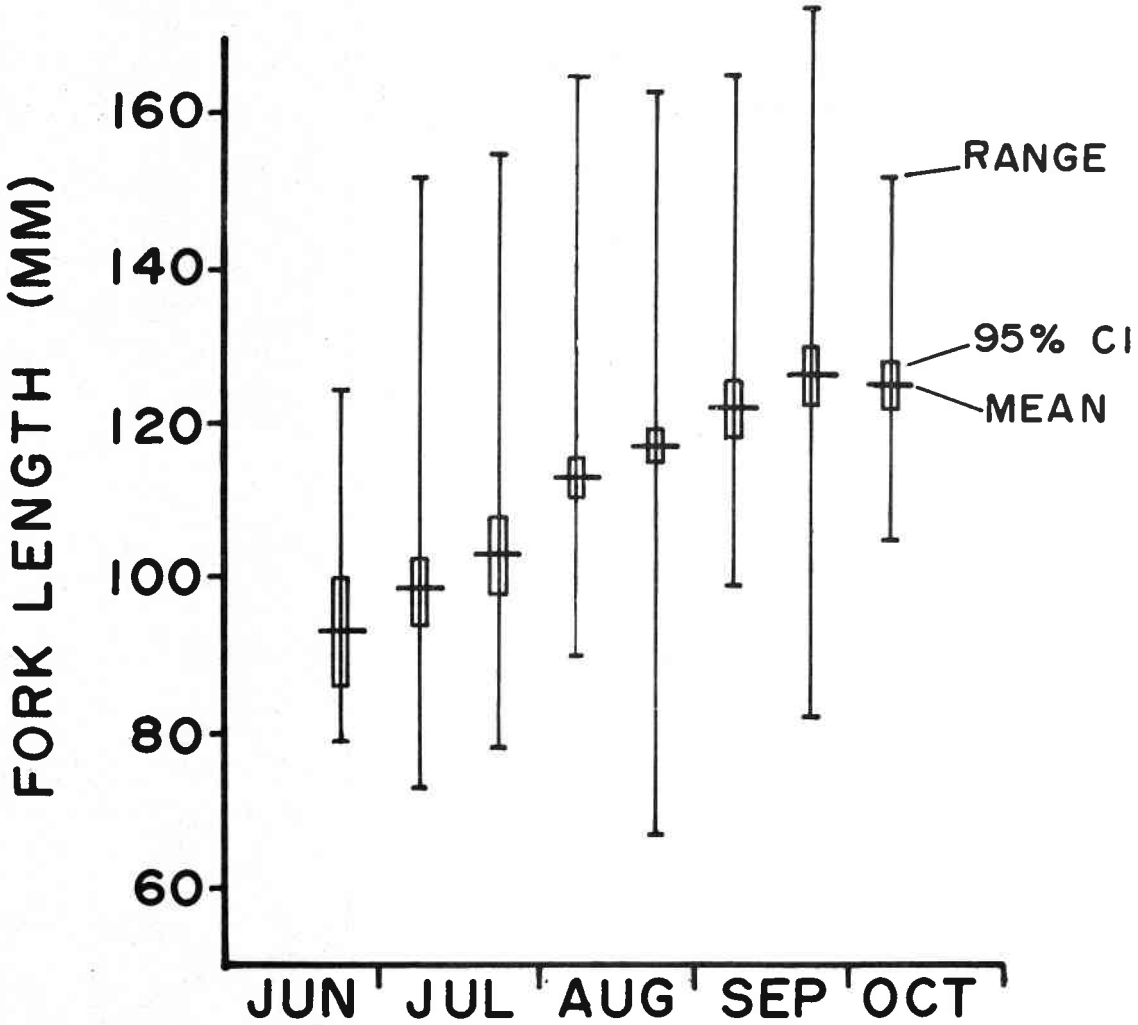

Fig. 5. Lengths of juvenile chinook salmon seined in the lower Salmon River estuary in 1977.

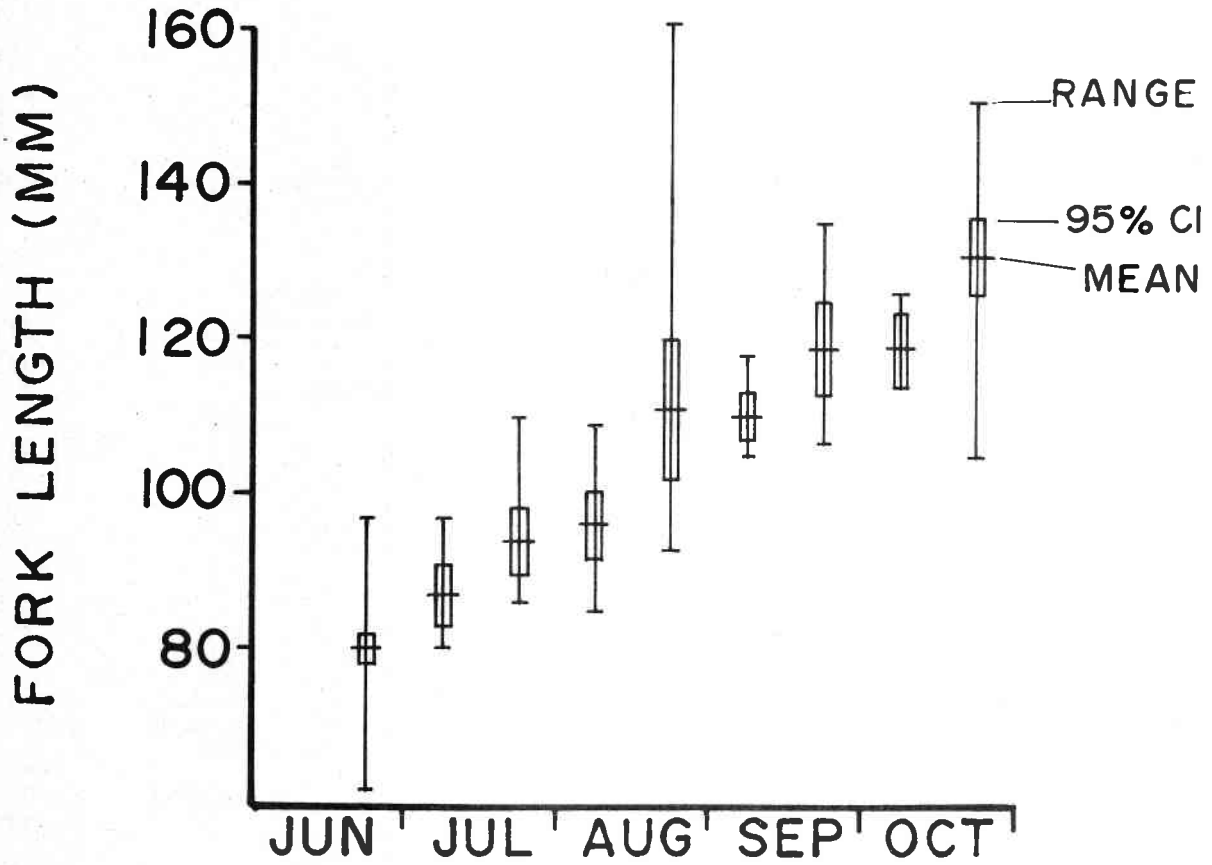

Fig. 6. Semimonthly lengths of juvenile chinook salmon seined in the middle Salmon River estuary in 1977.

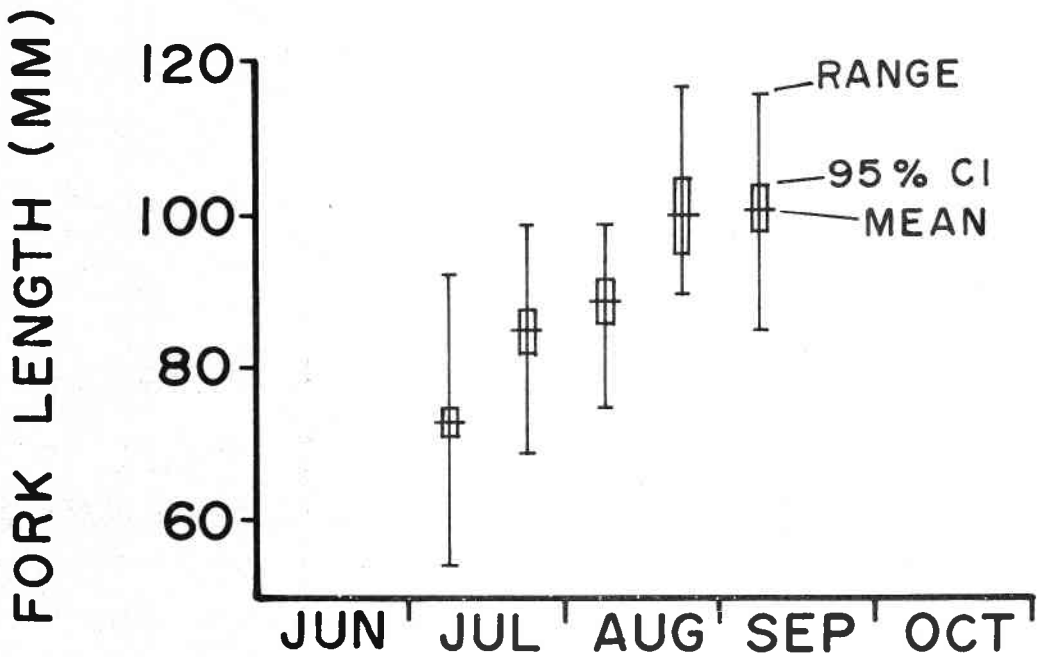

Fig. 7. Semimonthly lengths of juvenile chinook salmon seined in the upper Salmon River estuary.

the range of sizes was large, the mean size of juvenile chinook in the lower estuary was consistently larger than the fish in the middle estuary, which in turn were larger than the fish in the upper estuary. There was approximately a 10 mm size difference between fish in each adjacent area.

CREEL SURVEY

The success of Salmon River Hatchery will ultimately depend upon its ability to contribute fish to the ocean and river fisheries. The catch of hatchery fish in the river sport fishery will be estimated by conducting a statistical creel survey. Such a survey was conducted in 1976 and 1977, prior to the return of hatchery fish, to resolve any sampling problems and to evaluate the status of the river sport fishery prior to the return of hatchery fish.

The river was divided into five areas for the purpose of estimating angler effort and catch (Fig. 8). Area I extended upstream to the bridge at Otis. Areas I and II included all the estuary of Salmon River and the portion of Salmon River included in the Cascade Head Scenic-Research Area. Area III extended upstream to the Salmon River Hatchery and Area IV extended from the hatchery upstream to the mouth of Slick Rock Creek. Area V included the remaining portions of the main stem of Salmon River upstream to the Van Duzer Corridor Rest Area.

Prior to 1976, there was no definitive information on the locations of the sport fishery. By dividing the river into separate areas we could make separate estimates in each area. We were particularly interested in the magnitude of the sport fishery within the boundaries of the Cascade Head Scenic-Research Area.

The sport fishery was sampled 4 days each week, beginning in September and continuing into December until we determined that the salmon fishery had ended for the year. Both weekend days and two randomly chosen weekdays were

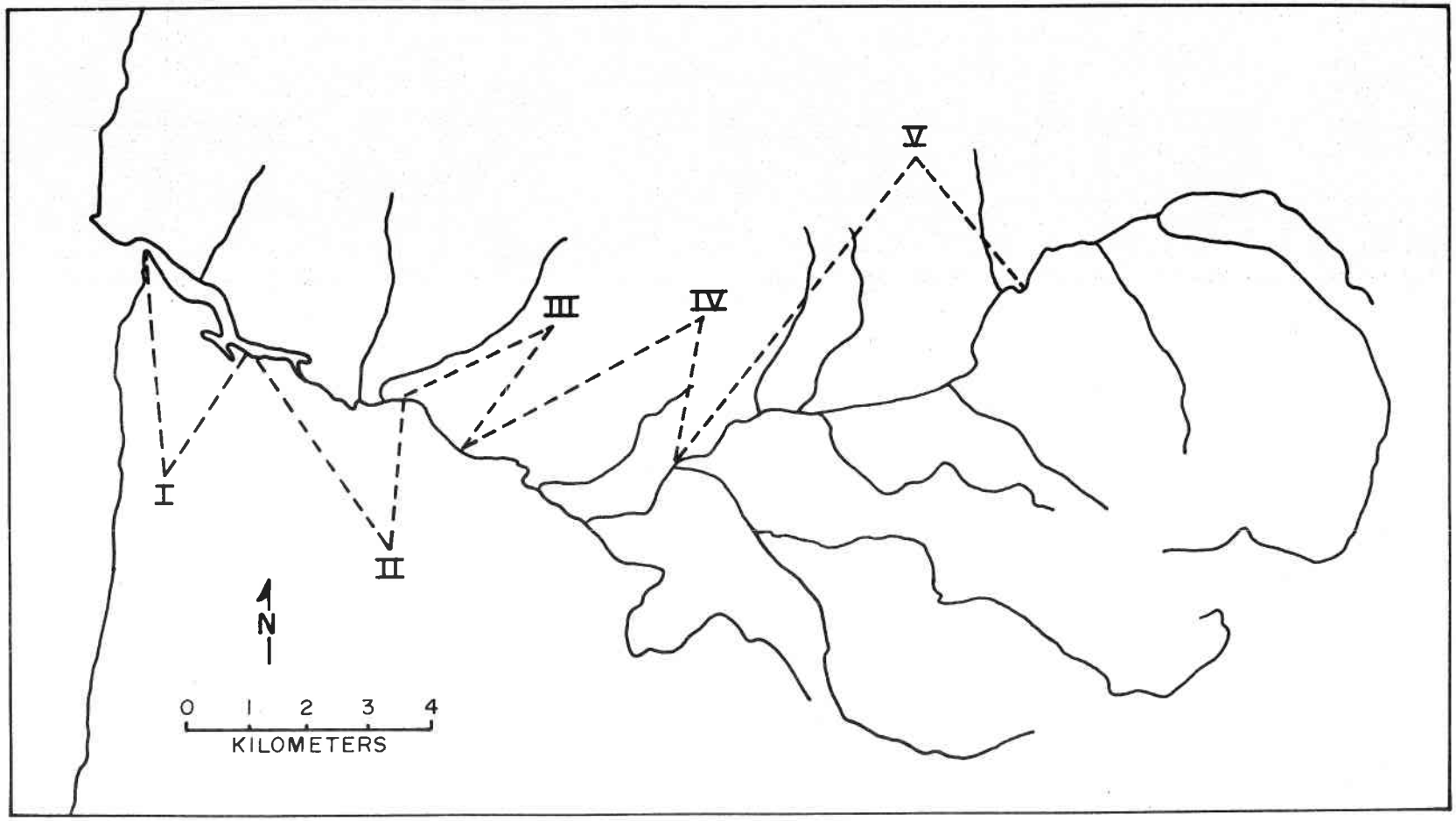

Fig. 8. The five river sections used for estimating the sport fishing harvest in Salmon River.

sampled each week. All estimates were stratified by weekends and weekdays since it was assumed that the catch rates and effort might differ for these two day types. Estimates were further stratified by months so that the temporal distribution of the sport fishery could be evaluated.

The creel sampler worked an 8 hour day but randomly varied the starting times so that angler interviews were collected over the entire fishing day. Pressure counts (4 hours apart) were made three times each day the creel was sampled. Pressure counts were made while driving through each area and counting from suitable vantage points; boats (in the estuary) and anglers were counted.

In 1976, anglers fished 8,806 hours and caught 321 salmon consisting of 210 chinook and 111 coho (Table 4). Angling effort was 8,071 hours in 1977 and the catch totaled 368 salmon consisting of 231 chinook and 137 coho (Table 5). The estimates for the 2 years were similar although the distribution of effort and catch shifted between areas. In particular, the catch that was observed in Area II in 1976 (100 salmon) was virtually non-existent in 1977 (4 salmon). This agreed with the poor success in capturing adults in 1977 compared with 1976 when fish were successfully captured in Area II.

Table 4. The catch statistics for the Salmon River sport fishery in 1976.

Area	Anglers	Angler hours	Adult chinook	Jack chinook	Adult coho	Jack coho
1	106	220	0	0	0	0
2	961	1,673	19	48	15	18
3	1,579	4,438	59	15	57	4
4	863	2,047	56	5	5	0
5	277	428	7	1	7	5
Total	3,786	8,806	141	69	84	27

Table 5. The catch statistics for the Salmon River sport fishery in 1977.

Area	Anglers	Angler hours	Adult chinook	Jack chinook	Adult coho	Jack coho
1	170	451	0	0	0	0
2	477	967	0	0	0	4
3	2,927	6,163	131	98	99	33
4	273	399	2	0	1	0
5	58	81	0	0	0	0
Total	3,905	8,061	133	98	100	37

The sport fishery in Salmon River apparently harvested few fish. The sizes of the runs of salmon into Salmon River were no doubt small which was reflected in the small catches. Our estimates were considerably lower than the estimates derived from salmon-steelhead tag returns ("punch cards"). In 1976, the tag return estimate for adult salmon was 572 fish while in 1977 it was 1,289 fish. We are presently reviewing the assumptions and calculations used to arrive at the estimates to make sure no obvious errors or computer program problems accounted for the discrepancy.

HATCHERY PROGRAM

Beginning with the 1976 brood year, coho and fall chinook salmon eggs have been collected at the Salmon River Hatchery from wild Salmon River stocks. Rearing schedules have been developed which approximately mimic life histories of wild Salmon River stocks. For instance, early (August) and late (October) releases of fall chinook smolts closely correspond with the two apparent peak migrations of wild chinook smolts through the estuary. A late (June) release of coho smolts corresponds with the observed migration of wild coho smolts while an early (March) release is the more common hatchery practice in Oregon. Size of fish is not being controlled in either time of release experiment.

The first group of tagged chinook (26,281) was liberated into Salmon River on August 23, followed by a second group (20,881) on October 5, 1977. On March 21, 39,395 tagged coho salmon smolts were released into Salmon River followed by 37,225 in the second tagged group on June 5 (Table 6). Replicate releases were planned for 1977-brood fall chinook and coho salmon smolts reared at Salmon River Hatchery.

Table 6. Experimental releases of marked 1976-brood chinook and coho salmon from Salmon River Hatchery.

Species	Size at release (fish/lb)	Date released	Number released[a]	CWT code
Chinook	11.6	8/23/77	26,281	9-16-38
	7.1	10/05/77	20,881	9-16-37
Coho	16.6	3/21/78	39,395	9-16-39
	12.0	6/05/78	37,225	9-16/40

[a]*Corrected for tag loss before release.*

Post Office Box 59
Portland, Oregon 97207