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A STUDY OF CHINOOK SALMON IN SOUTHEAST ALASKA

PAUL D. KISSNER

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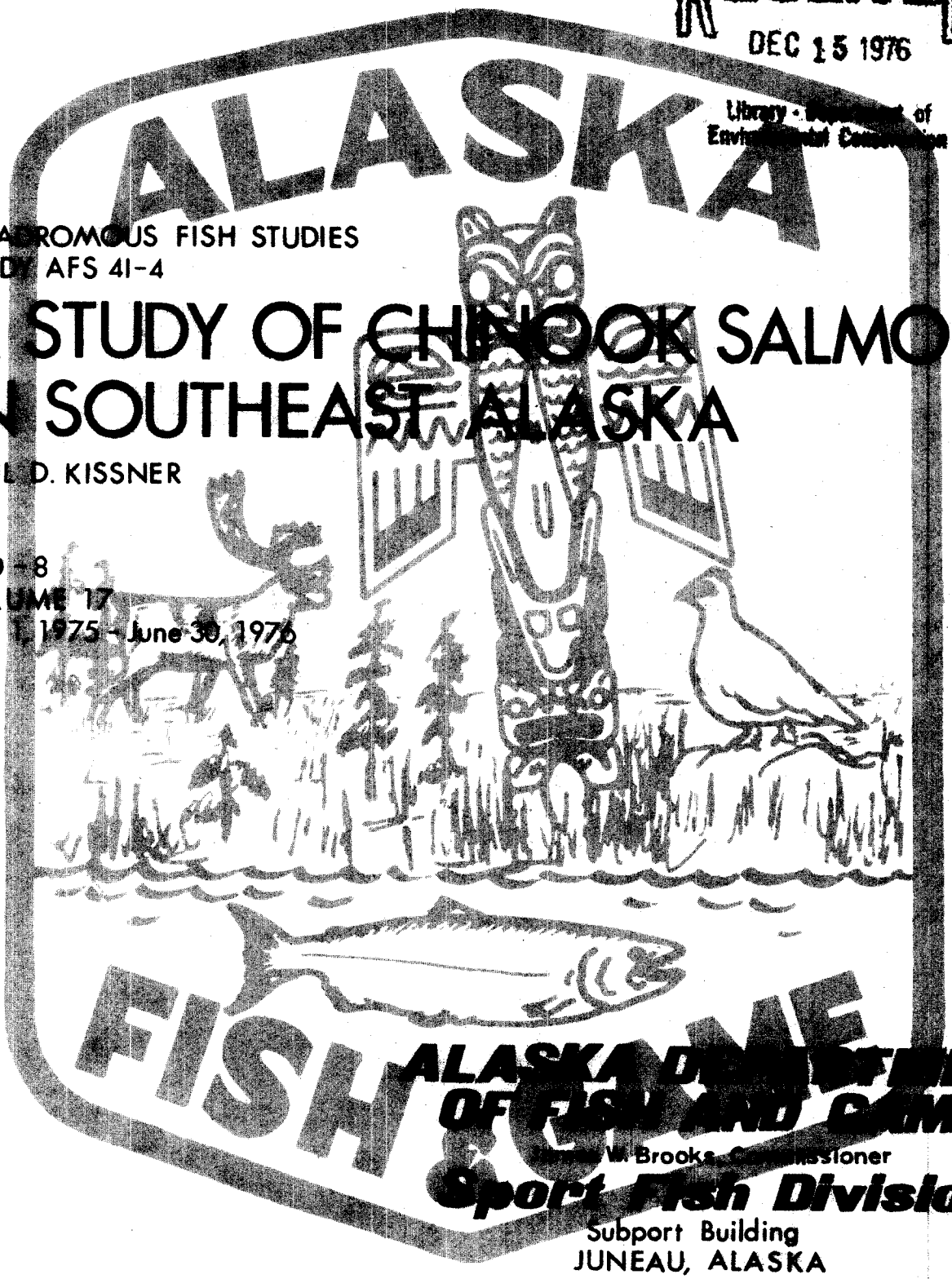

ALASKA DEPARTMENT OF FISH AND GAME
James W. Brooks, Commissioner
Sport Fish Division
Subport Building
JUNEAU, ALASKA

Volume 17 STUDY AFS 41-4

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

A STUDY OF CHINOOK SALMON IN SOUTHEAST ALASKA

by

Paul D. Kissner

ALASKA DEPARTMENT OF FISH AND GAME
James W. Brooks, Commissioner

SPORT FISH DIVISION
Rupert E. Andrews, Director
W. Michael Kaill, Chief, Sport Fish Research

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RESEARCH PROJECT SEGMENT

State:	ALASKA	Name:	Sport Fish Investigations of Alaska
Project No.:	F-9-8		
Study No.:	AFS 41	Study Title:	A STUDY OF CHINOOK SALMON IN SOUTHEAST ALASKA
Job No.:	AFS 41-4-B	Job Title:	Status of Important Native Chinook Salmon Stocks in Southeastern Alaska

Period Covered: July 1, 1975 to June 30, 1976.

ABSTRACT

Gill nets of 5 3/8" and 6 3/8" stretched measure nylon mesh were fished in the Taku Inlet drift gill net fishery during "king season" and compared with catches from 8" to 8 1/2" stretched measure nylon mesh gill nets that are commonly used. The 5 3/8" and 6 3/8" mesh gill nets caught a broader size range of the population and; therefore a reduction in mesh size would be of benefit to the stock and quite possibly to the fishermen.

Because of a weak return of maturing Taku River chinook salmon, Oncorhynchus tshawytscha (Walbaum), drift gill netting and commercial trolling were closed in Area 111 after three 24-hour fishing periods and did not reopen until June 15. The saltwater bag limit was reduced to one sport caught chinook per day and a closure was put in effect near the Taku River to protect the returning spawning run.

The resulting escapement of chinook into the clearwater tributaries of the Taku River was disappointingly low. Sampling indicated that all brood years that composed the 1975 escapement were weak. Sport and commercial regulatory changes to protect the Taku chinook salmon were proposed, and adopted by the Alaska Fisheries Board.

Young-of-the-year chinook salmon were captured in the Nahlin River by minnow traps, temporarily marked, and released.

Highest densities of juvenile chinook were found on the steep side of S-curves associated with cover and moderate current. Population estimates of rearing juvenile chinook were as high as 8,948 per 1/4 river mile (.4 kilometer) section.

Escapement estimates from other important Southeast Alaska chinook systems are presented.

RECOMMENDATIONS

Research

1. The Stikine gill net fishery should be monitored to determine the age, sex and size of maturing chinook salmon harvested by 8", 8 1/4", and 8 1/2" stretched measure mesh nets. The large mesh sizes, used in this and other chinook gill net fisheries, selectively harvest only a small segment of the available population. Selective breeding studies indicate that this practice may be genetically detrimental to the stock.

2. The Alsek gill net fishery should be monitored to determine the age, sex and size of maturing chinook harvested in 5 1/8", 5 1/4", 5 3/8", 5 1/2", 8", 8 1/4", and 8 1/2" stretched measure mesh nets.

3. Research should be continued to determine the effect of 6 3/8" stretched measure mesh nylon gill nets by comparing catches from this mesh size with the larger mesh gear commonly fished. The age, sex and size of maturing chinook caught by the various mesh sizes will be compared with data collected on the spawning population.

4. Escapement of chinook salmon into the Taku and Stikine rivers should be emumerated by aerial and ground surveys in established areas during the peak of chinook spawning. Carcass weirs should be constructed to determine the age, size and sex ratio of the escapements.

5. It should be determined if a new regulation to prohibit commercial trolling in Area 11-A before August 14th would be successful in reducing the harvest of chinook salmon.

6. The escapement of chinook salmon in other important spawning tributaries of Southeast should be monitored. Helicopter surveys should be conducted in early August on major spawning tributaries of the Unuk, Chickamin, Keta, Blossom and Chilkat rivers and ground surveys should be conducted on the Situk and King Salmon rivers.

7. Coded wire tagging of juvenile chinook salmon should be conducted on the Nahlin and mainstem Taku rivers. Because of the reduced population level of Taku River chinook salmon, marine migration patterns should be determined to give maximum stock protection.

OBJECTIVES

1. Determine the current status of the Taku River chinook salmon stock.

2. Determine the escapement of chinook salmon in other important spawning tributaries of Southeast Alaska.

3. Determine the characteristics of the troll harvest of chinook in Area 111.

TECHNIQUES USED

Gill nets of 5 3/8" and 6 3/8" stretched measure nylon mesh were fished by chartered commercial fishermen during open commercial fishing periods. Each "Uroko Monoply Gill Net" was 150 fathoms long and 60 meshes deep. The 5 3/8" mesh gill net was made of size 38 twine and the color was alternating panels of UR-38, 24, and 23B (dark, medium, and candy apple green), while the 6 3/8" mesh gill net was made of size 33 twine and was UR-19 (glacial blue) in color. The catches from these two nets were compared with the 8"-8 1/2" stretched measure nylon mesh gill nets commonly in use. They are made of size 63 twine and are UR-19 in color. To attempt to eliminate any biases involved with individual fishermen, the experimental nets were exchanged between the two chartered boats after each fishing period.

Commercial chinook salmon harvest data were taken from statistical runs which were compiled from individual fish tickets.

Chinook salmon scales, lengths and weights were collected from various sport and commercial fisheries throughout Southeast Alaska. To determine the percentage of Alaskan chinook harvested in Area 111, scales from known origin spring chinook were collected from the Alsek, Chilkat, Taku and Stikine rivers in Southeast Alaska and compared with scales previously collected from fish in the Nass, Skeena, Fraser, Bella Coola, Cheakamus and Kitimat rivers in British Columbia and the Columbia River in Washington. Scales were taken in the preferred area, two rows above the lateral line and slightly posterior to the insertion of the dorsal fin. Because of the high occurrence of regeneration in chinook scales, five extra scales were taken from each side of each fish near the preferred area and placed in a numbered coin envelope.

Scales were later examined under a binocular microscope and the first complete scale was soaked in detergent, cleaned and mounted on a numbered gum card. They were then pressed in cellulose acetate and analyzed under an Eberback micro-projector at a magnification of 80 X.

Circulus counts were made along the 20° dorsoradial line of the scale. The following procedure was used to count circuli:

1. The last freshwater circulus before the annulus was determined.

2. Circuli were counted from the focus to the last freshwater circulus before the annulus.

Since only minor variations in freshwater scale patterns occur by brood year and sex in Southeast Alaska (Kissner, 1973) and Washington chinook systems (Bohn and Jensen, 1971), data were combined during analysis.

The sample size was weighted in each river during catch simulation to approximate the population magnitude of spring chinook salmon in each system. Since escapement and catches of individual stocks in distant

areas were lacking for most systems, the weighing factor was based on the average commercial harvest in the vicinity of each river over a six year period.

Mid-eye to fork of tail measurements were made in the gill net fisheries and on the spawning grounds, and total length measurements were made in the troll fisheries.

During August 1975, a weir was operated on the Nakina River approximately 137 meters above the Silver Salmon River. Chinook, spawning above the weir, were enumerated after they could no longer maintain station in the river and floated against the weir face. The structure was cleaned of carcasses at 10 a.m. and 7 p.m. daily. All species were enumerated, and length data and scale samples were collected from the chinook.

Upriver surveys of both banks of the river were made every other day to enumerate and sample spawned-out chinook which had not floated downriver to the weir. The survey area extended approximately 2.4 kilometers above the weir.

All escapement surveys were conducted by foot or by "Aloutte II", "Huges 500" or "Hiller 12E" helicopters. Only three and four ocean chinook (660 mm total length or larger) were enumerated during aerial or foot surveys.

Gee minnow traps baited with fresh salmon roe were used exclusively to capture rearing salmonidae. During the Nahlin River Study each trap was checked and rebaited daily. Fish captured were anesthetized with M.S. 222, enumerated by species and the juvenile chinook temporarily marked by removal of the upper or lower edge of the caudal fin. After recovering from the anesthetic, the fish were released within 15.2 meters of the location of capture. A physical description of each trap location, including amount of cover, current and water depth, was made. Samples of juvenile chinook were taken for age, growth and racial determinations. Fish were measured from the tip of the snout to the fork of the tail to the nearest mm. and several scales were taken from the preferred area at the posterior edge of the dorsal fin, two rows above the lateral line.

Population estimates of juvenile chinook were made in the four Nahlin study areas using a Schnabel or Schnabel and Petersen estimate, as follows:

In Study Area 1 a Schnabel estimate was used.

In Study Area 2 a Schnabel was used to estimate total population, excluding migratory fish marked in Area 1. Then by assuming a Peterson relationship and that the marked-unmarked ratio for rearing chinook migrating from Area 1 equalled the ratio in Area 1, estimates of marked and total migratory migrants from Area 1 were calculated. The migratory marked population estimate was then added to the Area 2 Schnabel to give a total population estimate for Area 2.

In Area 3 the procedures used in Area 2 were followed except that it was additionally assumed that fish migrating from Area 1 to Area 2 continued to migrate to Area 3 at the same rate. This assumption made possible an estimation of numbers migrating from Area 1 to Area 3.

The same procedures were extended to obtain Area 4 estimates.

During mid-September and mid-October minnow trapping was conducted throughout the Taku River Drainage to determine inter-stream migration and rearing habitat of juvenile chinook salmon. Approximately 100 minnow traps were set per trip in the Nakina, Nahlin and mainstem Taku rivers. Traveling by Aloutte II helicopter permitted coverage of the 352 kilometer distance in two or three days. Traps were left to soak in all areas for at least 24 hours.

FINDINGS

1975 Drift Gill Net Mesh Study

Gill net mesh studies were conducted in the Taku Inlet gill net fishery during 1975 to attempt to harvest the various size ranges and age classes of maturing chinook salmon in proportion to their abundance. The 8" and larger mesh gill nets, which have been fished during "king season" for the last 80 years are highly selective to chinook from 660 to 900 mm mid-eye to fork length (Figure 1). This subjects nearly 99% of the female Taku chinook population to the gill net fishery but only about 16.6% of the males. The harvest of large numbers of female chinook from this declining stock is unacceptable and studies indicate the chinook that mature at a younger age have a tendency to pass the trait to their progeny (Ellis and Noble, 1961). Therefore by annually allowing the escapement of large numbers of these small males, the age, size and reproductive potential of the run will decrease. During 1975 over 75% of the escapement into the Nakina River were one-and two-ocean precocious males. In other years between 48.1% and 73.8% of the escapement have been precocious males.

If a gear could be developed that would harvest the majority of these small males and allow most of the females to escape, the gill net fishery would be beneficial to the Taku chinook population.

The 5 3/8" stretched measure nylon mesh gill net was most efficient in catching chinook salmon from 500-599 mm mid-eye to fork length. Chinook over 700 mm were mostly caught when they become entangled by their teeth or mouth parts. Figure 2 indicates the length frequency of chinook harvested by this net compared to the length frequency of chinook collected on the Taku River spawning grounds during 1974 and 1975. The length frequency of chinook on the spawning grounds was probably not greatly altered by the fishing of mature stocks during either of these years because early closures of the gill net and troll fisheries, which were designed to protect the returning runs, were put into effect.

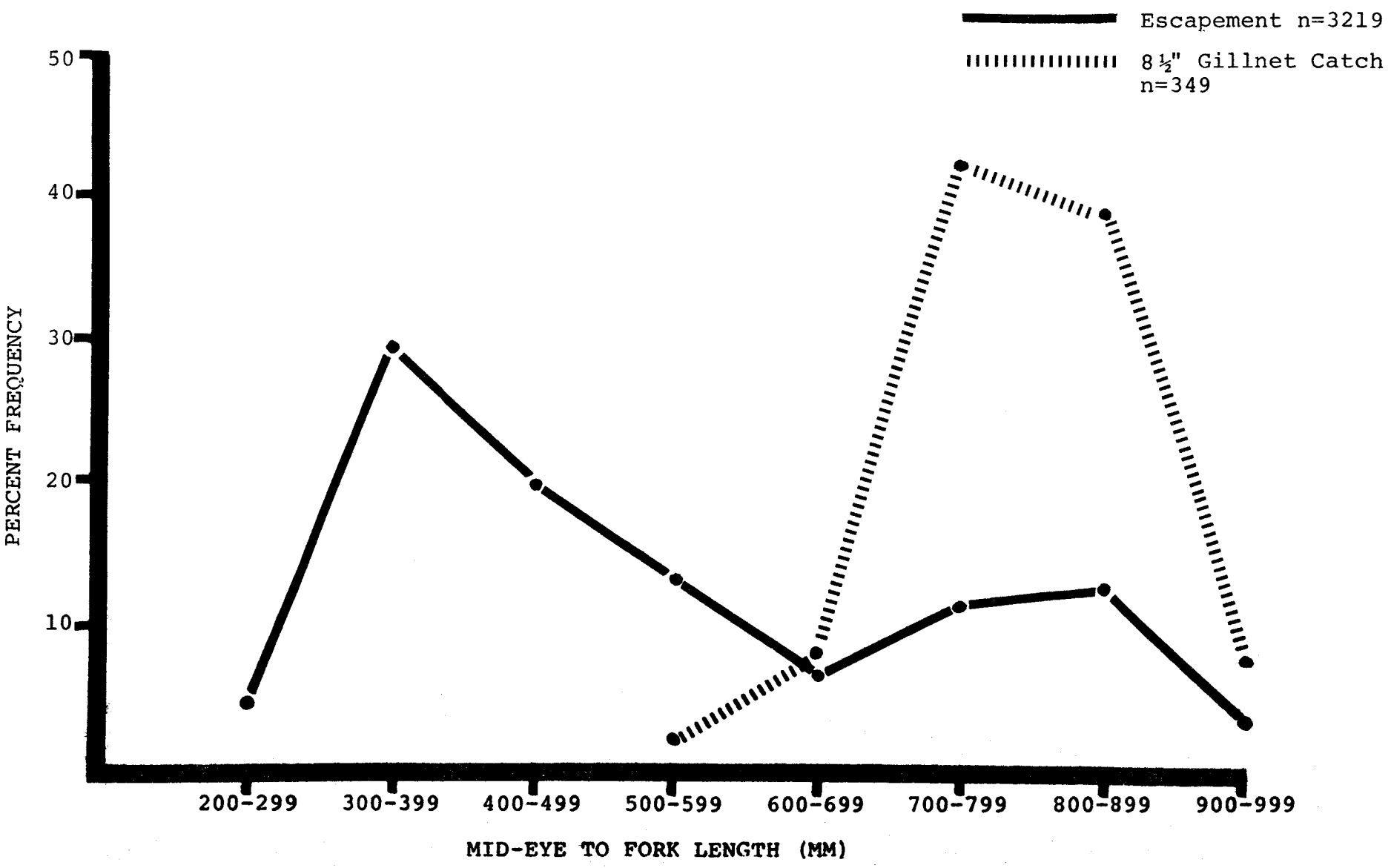

Figure 1. Length Frequency Comparison of Taku River Chinook Salmon Caught by 8½" Stretched Measure Nylon Gillnets and the Escapement.

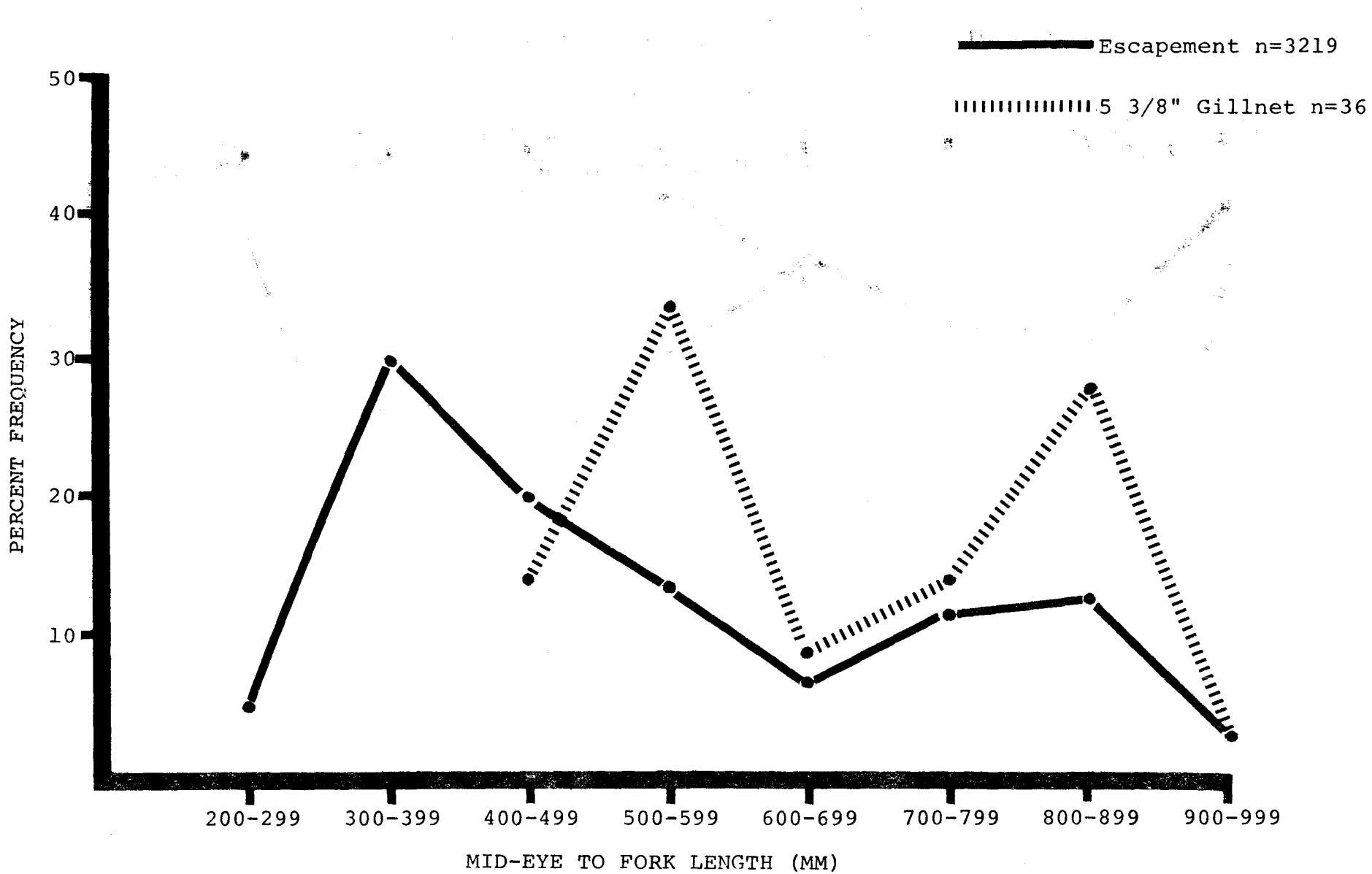

Figure 2. Length Frequency Comparison of Taku River Chinook Salmon Caught by 5 3/8" Stretched Measure Nylon Gillnets and the Escapement.

Average kilograms per boat per 24-hour fishing period of boats using the 5 3/8" gear was slightly higher than the 8 1/2" mesh gear (Table 1). However, relative efficiency of this gear cannot be directly compared to the 8 1/2" mesh fished. Small chinook passed through the 8 1/2" gear but were available for capture by the 5 3/8" gear. This would not be the case if all nets were 5 3/8" mesh.

The major problem with the 5 3/8" gear during the study was that 36.1% of the chinook captured were immature.

The 6 3/8" mesh net was most efficient in capturing chinook from 700-799 mm mid-eye to fork length. Figure 3 indicates the frequency of harvest of various size ranges of chinook salmon captured by this net compared to the population length frequencies collected on the Taku River spawning grounds during 1974 and 1975. This gear caught more kilograms per boat per 24-hour period than the other two mesh sizes tested during each of the three open fishing periods. Eighteen percent of the chinook harvested were immature and 53.1% of the matures were males.

Table 1. Data from Chinook Salmon Harvested by Various Mesh Size Gill Nets Fished in Taku Inlet, 1975.

Mesh Size	Chinook Caught	$\bar{X}$ Length Mid-eye Fork mm.	Total Dressed Weight (Kg)	Percent Mature	Sex of Matures		Kilograms Per 24 Hours
					M	F	
5 3/8"	35	671.4	149.5	63.9	12	11	49.9
6 3/8"	43	731.7	253.6	78.0	17	15	84.5
8 1/2"	322	796.5	2603.2	93.4	31	37	47.9

The 5 3/8" and 6 3/8" stretched measure nylon mesh gill nets harvested a broader size range of maturing chinook salmon than the 8 1/2" mesh gill nets; however, over 45% of the maturing chinook captured in the two smaller meshed nets were females. This is too great a harvest of female Taku chinook at the present depressed population level. The 5 3/8" mesh appears to capture too high a percentage of immature chinook to be of value in an ocean chinook fishery.

In other long standing chinook gill net fisheries throughout the state where large mesh sizes have been utilized, it is probable that gear selectivity has caused distorted sex ratios similiar to those of the Taku River chinook population. In chinook gill net fisheries where stocks are in good general condition, a mesh size of 6 3/8" would be of benefit to the stock and might possibly be of benefit to the fishermen

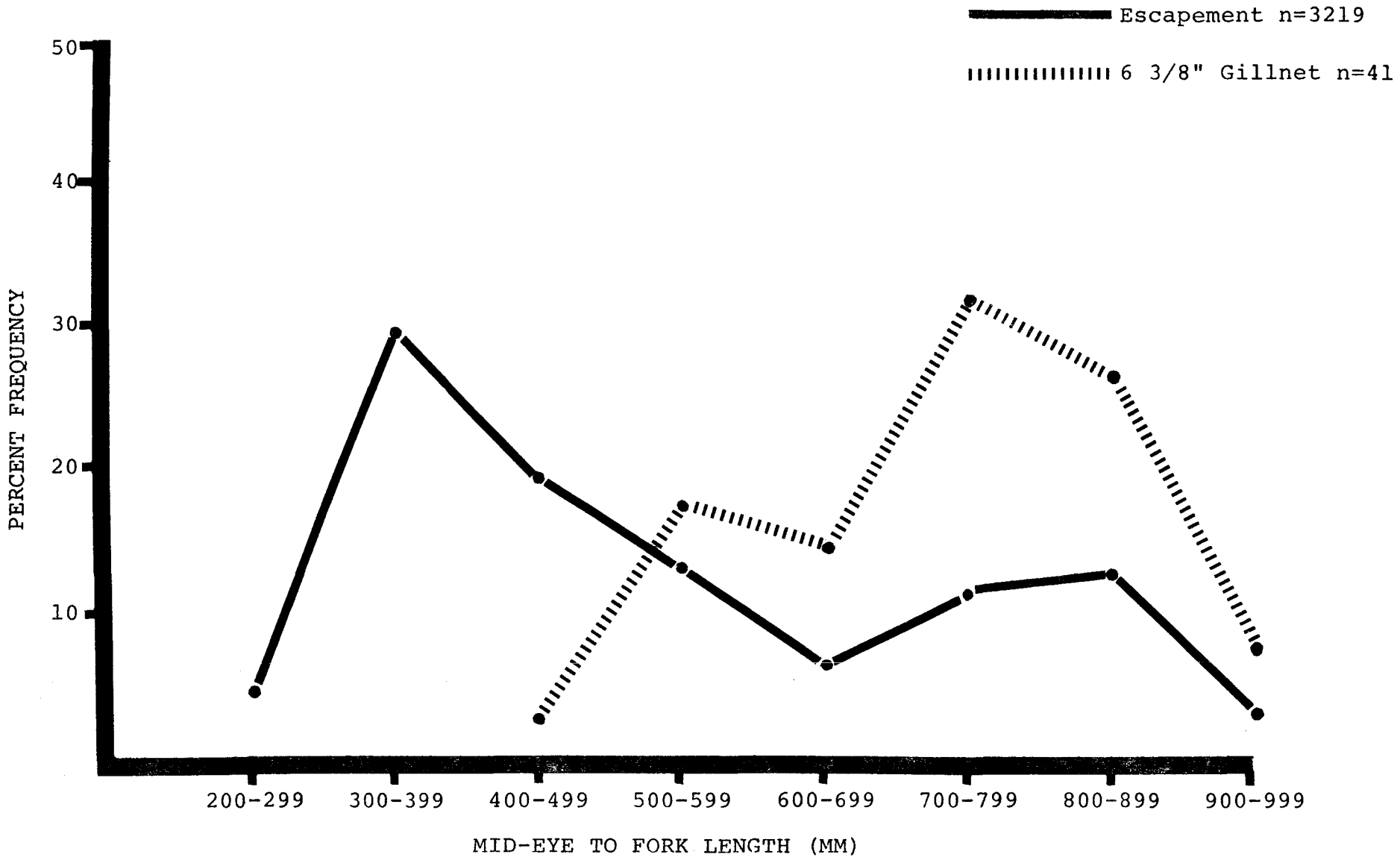

Figure 3. Length Frequency Comparison of Taku River Chinook Salmon Caught by 6 3/8" Stretched Measure Nylon Gillnets and the Escapement.

through increased poundage. Study of this mesh size should continue during 1976 to determine its effect on various gill net fisheries and spawning escapements. The 1975 sample was quite small because of early closures associated with poor returning runs.

The problem of chinook salmon dropout with use of the 6 3/8" gear would be very difficult to evaluate. In the drift gill net fisheries it quite possibly would be less severe than in other salmonid species fished because smaller numbers of fish are harvested and because many fishermen "cruise the net" and/or pick up when one to several fish "show".

1975 Drift Gillnet Fishery in Taku Inlet

The catch of chinook salmon per boat per 24-hour fishing period was below average during the first three drift gill net openings in Taku Inlet in late April and early May of 1975. Commercial drift gillnetting was thus closed in Area 111-32 to protect the returning run of maturing Taku River chinook salmon.

Age analysis of the chinook harvested with 8 1/2" mesh gill nets in the Taku gill net fishery and comparison with the Alsek and Stikine gill net fisheries is presented in Tables 2 and 3.

The Taku drift gill net fishery reopened on June 15th, and from that point the percentage of immature chinook harvested increased weekly. These feeders are taken incidentally to the much larger harvest of the other four species of salmon. The number of mature and immature chinook harvested in the fishery is presented in Table 4. It appears that large numbers of immature chinook are only taken during years when large amounts of feed are present in the area, such as occurred during 1973.

Table 2. *Total Age of Gill Net Caught Maturing Chinook Salmon in Taku Inlet by Percent.

Year	III	IV	V	VI	VII
1951	--	.1	17.2	80.6	2.1
1952	--	9.0	38.7	49.8	2.6
1953	--	2.9	49.3	45.2	2.6
1954	.8	10.0	22.3	64.9	2.1
1955	--	7.6	40.6	48.7	3.1
1956	.5	12.9	44.4	40.2	1.9
1957	--	6.6	45.4	46.3	1.8

Table 2. (Con't) *Total Age of Gill Net Caught Maturing Chinook Salmon in Taku Inlet by Percent.

Year	III	IV	V	VI	VII
1958	.4	12.3	52.8	33.3	1.2
1959	--	--	50.6	49.4	--
1961	--	4.2	63.8	30.3	1.7
1972	--	2.1	64.3	30.3	3.4
1973	--	2.8	14.9	78.0	4.2
1974	--	--	24.4	70.3	5.5
1975	--	3.3	45.9	47.6	3.2

*Total age refers to the combined freshwater and ocean age. Over 95% of Taku River chinook spend one year of rearing in freshwater after emergence; the remainder spend two years. Thus, a chinook designated in this table as total age V would have spent one year rearing in freshwater and three years in the ocean or two years rearing in freshwater and two years in the ocean.

Table 3. Age Analysis of Gill Net Caught Chinook Salmon in the Taku, Stikine and Alsek Rivers.

Taku River

	1.2	1.3	1.4	1.5	2.2	2.3	2.4	n
1961	4.2	63.8	26.6	--	--	3.7	1.7	519
1972	2.1	64.3	26.5	1.7	--	3.8	1.7	238
1973	2.8	14.9	78.0	3.5	--	--	.7	141
1974	--	23.0	68.9	4.1	1.4	1.4	1.4	74
1975	3.3	45.9	44.3	1.6	--	3.3	1.6	61

Table 3. (Con't) Age Analysis of Gill Net Caught Chinook Salmon in the Taku, Stikine and Alsek Rivers.

Stikine River								
1972	--	35.1	63.2	1.8	--	--	--	57
1973	1.1	22.0	71.4	5.5	--	--	--	91
1974	--	32.0	60.2	5.8	--	1.9	--	103
1975	3.3	20.0	70.0	5.0	--	1.7	--	120
Alsek River								
1960	12.3	53.2	23.0	--	--	9.8	1.6	122
1961	19.2	71.2	4.8	--	--	4.1	.6	542
1973	5.0	43.3	50.0	--	--	1.7	--	60
1974	1.8	24.6	70.2	--	--	1.8	1.8	57
1975	2.1	42.7	50.0	--	--	2.1	3.1	96

Table 4. Number and Percentage of Mature and Immature Chinook Salmon Harvested in the Taku Inlet Drift Gill Net Fishery, 1975.

Week	Total Chinook Catch	Mature Chinook	Immature Chinook	Percentage Mature	Percentage Immature
18	127	121	6	95.0	5.0
19	172	163	9	95.0	5.0
20	108	103	5	95.0	5.0
21	Closed	0	0	*	
22	Closed	0	0	*	
23	Closed	0	0	*	
24	Closed	0	0	*	
25	713	588	125	82.4	17.6
26	451	285	166	63.2	36.8
27	257	0	257	0.0	100.0
28	215	0	215	0.0	100.0
29	55	0	55	0.0	100.0
30	Closed	0	0	*	
31	Closed	0	0	*	
32	Closed	0	0	*	
33	Closed	0	0	*	

Table 4. (Con't) Number and Percentage of Mature and Immature Chinook Salmon Harvested in the Taku Inlet Drift Gill Net Fishery, 1975.

Week	Total Chinook Catch	Mature Chinook	Immature Chinook	Percentage Mature	Percentage Immature
34	Closed	0	0	*	
35	Closed	0	0	*	
36	Closed	0	0	*	
37	Closed	0	0	*	
38	Closed	0	0	*	
39	1	0	1	0	100.0
40	Closed	0	0	*	
TOTAL	2,099	1,260	839	60.0	40.0

1975 Troll Harvest In Area 111

Sport and commercial trolling for chinook salmon was restricted north of a line from Station Point to the south entrance of Limestone Inlet to a line from Piling Point to the beacon on the north end of Portland Island to Point Louise, including Taku Inlet, Gastineau Channel and Auke Bay, from May 17 through June 15 to protect the weak spawning return of Taku River chinook salmon. This closed area has been shown by past tagging and maturity studies to be the major schooling area for maturing chinook salmon of Taku River origin. In addition, commercial trolling was closed and the sport bag limit was reduced to one chinook salmon per day or in possession in the remainder of District 11, District 12, north of the latitude of Point Couverden and in Section 15C.

On June 16, all sport and commercial restrictions made to protect the Taku spawning run were rescinded, as the majority of the run had entered the river. From this time on, the troll catch was composed mostly of immature chinook one or more years from maturity. Past unpublished tagging data on file, and recent racial studies (Kissner, 1973, 1974, 1975) have shown that Areas 111 and 115 are important rearing areas for immature chinook of Taku, Stikine and Chilkat rivers origin.

An additional closure of commercial trolling was made in the area from August 15 to September 1.

The preliminary 1975 commercial troll harvest of chinook in Area 111 was 4,060. Over 75 percent of the harvest was by power trollers.

Analysis and computer comparison of known origin chinook scales with chinook scales collected during 1975 in Areas 111 and 115 indicate that approximately 70.6 percent of the chinook salmon harvested were of Taku, Chilkat and Stikine rivers origin. This means that the commercial troll

harvest was 2,866 Alaskan chinook. Harvest of these immature feeders should be reduced in Areas 111 and 115 to help rebuild the Taku chinook stock.

Taku River Escapement

Nakina River:

The Nakina River, which is the major clearwater chinook salmon spawning tributary of the Taku River, originates in interior northwestern British Columbia (lat. 59° 15'N., long. 132° 30'W.) approximately 64.3 kilometers southeast of Atlin, B.C. (Figure 4). The 96.5 kilometer river flows north from Nakina Lake and joins the glacial Sloko River at Canoe Landing, B.C. Historically this area has been the hunting and fishing territory of Athabascan and Tlingit speaking groups. "Tahltan and Tlingit informants tell stories of many bitter wars fought over the right to control this region, important as a trade route to the Coast and Interior, and rich in fishing resources" (French, 1974).

Access to the region above Canoe Landing is by helicopter or foot. The river nas not been altered from its natural condition by any land use practices, although human activity in the form of hunting and fishing camps has resulted in increased utilization of the available resources.

Only the lower 35.4 kilometers of the river are accessible to anadromous salmonidae. Approximately a 152 meter increase in elevation in 402 meters of river, blocks further migration at a point about 4.8 kilometers below the old Nakina Telegraph Station.

Most chinook salmon spawning in the Nakina occurs in the area between Grizzly Bar (a promiment gravel bar eight kilometers below the Silver Salmon River) and a narrow canyon about 3.2 kilometers above the Silver Salmon River. Foot or aerial surveys above this point are extremely dangerous because of sheer 305 meter cliffs and deep water. Escapement enumeration of this area was made in 1974 and 1975 by a jet boat, which was transported to the Nakina camp by helicopter. In both years, only small numbers of spawning chinook were observed.

Information on the distribution of spawning chinook which was collected only during 1952, 1953, and 1972 through 1975, indicates:

Area I - Grizzly Bar to the heavy rapids approximately 2.4 kilometers upstream

The area from Grizzly Bar upstream for about 550 meters is always well seeded, while the area above is only well utilized during years of good escapement.

Area II - 2.4 kilometers upstream from Grizzly Bar to Silver Salmon River

This area appears only to be well utilized during years of good escapement.

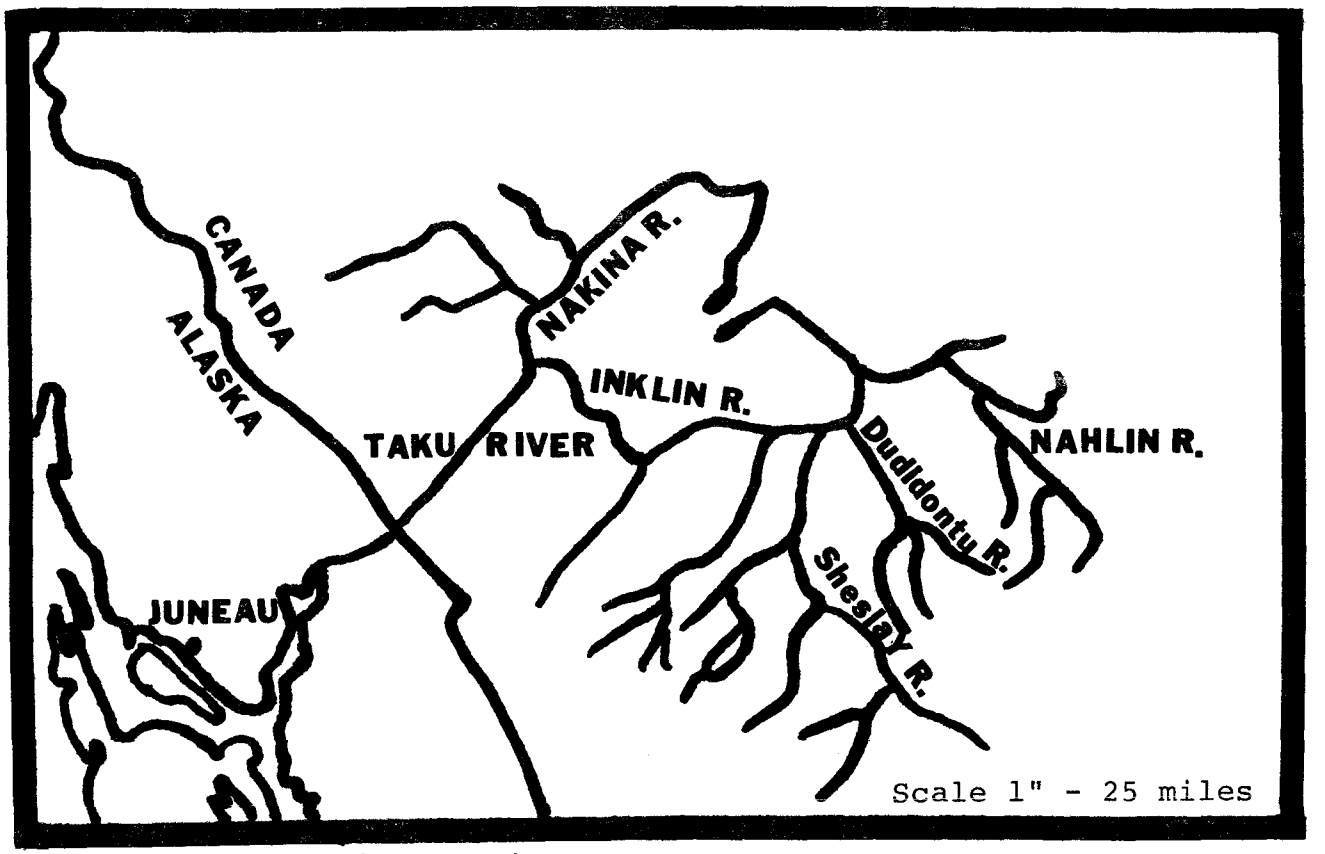

Figure 4. Taku River Drainage.

Area III - Above Silver Salmon River

During an average year about 40% of the chinook enumerated in the Nakina are in this area.

For the fourth year in succession, escapement of chinook salmon into the Taku River drainage was low. In the Nakina River, 1,800 chinook were enumerated by helicopter and foot on August 3, during the peak of spawning. Escapements during the years 1972 through 1975 have averaged only 1,650 chinook; while during the period 1951 through 1955, when the last series of ground counts of the total river was conducted, the escapement varied between 3,000 and 9,000, and average 6,100. Escapements were probably below average even during that time since the largest harvests of maturing Taku River chinook salmon in history occurred in the vicinity of Taku Inlet.

Escapements vs. return data (Kissner, 1975) indicate that the Nakina can support at least 3,500 female chinook annually. During the last four years the number of spawning females has averaged only 848 and never exceeded 1,200.

A carcass collecting weir has operated on the Nakina River from 1956 to 1959 and from 1973 to the present. The weir is located 137 meters upriver from the junction of the Silver Salmon and Nakina rivers. Past escapement records have shown that the 3.2 kilometer area above the weir usually contains the highest density of chinook spawners in the Taku River System.

The carcass weir is a valuable tool in collecting unbiased biological data. For instance, the small one-and two-ocean precocious males, which may indicate future returns of three-and four-ocean spawners from the same brood year, are extremely difficult to observe during aerial and ground enumeration but are effectively taken at the weir. The carcass weir also has shown a difference in the timing of die-off after spawning between male and female chinook. Therefore any sampling of carcasses over only a short period of time would give a distorted sex ratio.

The 1975 escapement of chinook salmon into the area above the carcass weir can only be described as a disaster. The combined weir and upriver carcass count of 956 chinook salmon is more than 50% lower than the previous low, which was recorded in 1974 (Table 5). Only 7.2% were females, while 76.7% were precocious males less than the minimum commercial size of 660 mm total length.

The number of chinook by age class, sampled at the weir, compared to past carcass weir counts, indicates that all brood years that composed the 1975 escapement (i.e. 1969, 1970, 1971, 1972) were weak (Table 6). Good escapement estimates are unavailable for 1969 to 1971 but a foot survey of the Nakina in 1972 during the peak of spawning August 8-10 revealed the lowest escapement ever recorded. The return of age 1.1 chinook above the carcass weir from the 1972 escapement is also the lowest on record.

Based on the weak return of all year classes in the 1975 escapement, it appears that strict curtailment of fishing mortality will be necessary for an extended period of time to build this stock to historical levels.

Table 5. Total Chinook Enumerated By Sex at the Nakina Carcass Weir and Upriver.

Year	Female	Male	Total	Sex Ratio
1956	424	2,353	2,777	1: 5.55
1957	403	2,327	2,730	1: 5.77
1958	644	4,423	5,067	1: 6.88
1959	1,202	2,890	4,092	1: 2.40
1973	617	1,713	2,330	1: 2.78
1974	420	1,842	2,262	1: 4.39
1975	69	887	956	1:12.86

Table 6. Number and Age of Male and Female Chinook Salmon Sampled at the Nakina Carcass Weir, by Year.

MALE

Age	1956	1957	1958	1959	1973	1974	1975
1.1	754	699	1,335	838	336	730	228
1.2	1,201	1,249	2,404	1,132	853	718	505
1.3	312	242	561	611	273	267	90
1.4	86	110	123	298	242	124	63
1.5	0	0	0	0	7	3	1
n	2,353	2,300	4,423	2,879	1,711	1,842	887

FEMALE

	1956	1957	1958	1959	1973	1974	1975
1.2	8	0	0	3	0	0	0
1.3	287	274	469	778	210	197	38
1.4	129	122	175	410	404	223	31
n	424	396	644	1,191	614	420	69

Table 6. (Cont'd) Total Chinook Enumerated by Age Class at the Nakina Carcass Weir and Upriver.

	COMBINED						
Age	1956	1957	1958	1959	1973	1974	1975
1.1	754	699	1,335	838	336	730	228
1.2	1,209	1,249	2,404	1,135	853	718	505
1.3	599	516	1,030	1,389	483	464	128
1.4	215	232	298	708	646	347	94
1.5	0	0	0	0	7	3	1
n	2,777	2,696	5,067	4,070	2,325	2,262	956

Inklin Drainage

Aerial enumeration of the index areas (Kissner, 1974) in the Nahlin and Dudidontu rivers was conducted by Aloutte II helicopter on August 8, 1975. Survey conditions were fair; the water level was above normal and the sky was overcast. Counts were disappointingly low in both tributaries (Table 7).

The Dudidontu River, which is a clearwater tributary of the Nahlin River, has recorded chinook escapement counts as high as 4,500. The upper 32 kilometers of this system, from Camp Island Lakes to 6.4 kilometers below Matsatu Creek, contain excellent chinook spawning and rearing habitat. Below this area is a 19.2 kilometer long canyon which is characterized by steep mud, boulder and shale slopes with no vegetation. The river through this area is almost continuous heavy rapids.

During low level helicopter flights through the canyon conducted during 1974 and 1975, no obvious barriers were detected although several old land slides were noted. Ground surveys of this area were not possible because of the topography.

In the index area, which is approximately 8 air miles long (12.8 kilometers), 20 chinook were enumerated in 1974 and 15 in 1975.

Minnow trapping was conducted on September 1 and October 16 with a total of only three chinook and one coho salmon young captured in 25 minnow traps.

It appears that a partial barrier that would be extremely difficult to remove exists in the Dudidontu Canyon. Additional slides are possible at any time in this unstable canyon. Because of the extensive rearing habitat available, the possibility of introducing chinook fry into this system should not be overlooked.

Table 7. Peak Escapement Counts of Chinook Salmon into the Inklin Drainage of the Taku River.

	Dudidontu River	Nahlin River
1951	400	1,000
1958	4,500	2,500
1962	25	216
1965	100	37
1966	267	300
1967	600	300
1968	640	450
1969	No survey	No survey
1970	10	26
1971	165	473
1972	103	280
1973	200	300
1974	20	900
1975	15	274

Regulatory Changes to Protect Taku River Chinook Salmon

During the fall of 1975 considerable time was spent presenting and discussing data on the decline of the Taku River chinook salmon stock with various groups and individuals.

The following regulation changes were adopted in the fall of 1975 by the Alaska Board of Fisheries to protect the Taku River chinook salmon.

1. A minimum sport size limit of 26" (660 mm) total length for chinook salmon in all marine waters of Southeastern Alaska was required, and a reduction was made in the bag limit to one chinook salmon daily or in possession north of a line at the latitude of the south entrance of Limestone Inlet and north of a line at the latitude of Point Couverden to a line at the latitude of Point Sherman.

   This would reduce the harvest of chinook salmon by about a third and would mean an increase of 400 chinook of Alaskan origin annually, using presently available data. However, because of the commercial trolling closure, a great increase in sport effort and harvest is forseeable. Therefore the effects of a 26" total length minimum and reduction to one chinook per day in the Juneau area could be quite significant.

2. Chinook salmon fishing was closed between a line at the latitude of the south entrance to Limestone Inlet north to a line from Point Lousia to Piling Point from April 15 to June 15.

   Tagging and maturity studies have indicated that this is a schooling area for maturing Taku River chinook salmon. A closure in this area could save 200-500 maturing Taku River chinook salmon annually and yet allow a limited fishery on chinook bound for other areas.

3. Commercial drift gill-netting was closed in Taku Inlet during the "king season".

   Escapement data collected over the last four years on the Nakina River indicate that all year classes within the six year life cycle of Taku River chinook salmon are at a low level. All maturing fish are needed on the spawning grounds. A gill net closure through mid-June in Taku Inlet could save 1,500-3,000 maturing Taku River chinook salmon.

4. Commercial trolling was closed in the remainder of District 11, District 12, north of the latitude of Point Couverden, and District 15, Sections 15-B and C from April 16 to June 14.

   This could save from 200-1,000 Alaskan chinook during the two month closure.

5. Commercial trolling was closed in District 11-A from April 15 to August 15.

   Almost complete protection of the maturing segment of the Taku River chinook stock has been made during the last two years in the Juneau vicinity but corresponding escapements have still been poor. The only other management tool available is the protection of the stock throughout its life history. Racial analysis and tagging studies indicate that from 50% to 60% of the chinook harvested in these areas are of Southeast Alaska origin. Closure to commercial trolling could save about 5,000 immature chinook of Alaskan origin annually. Mortality of immature chinook, other than fishing mortality, would be low. Additionally, an undetermined number of sublegal chinook "shakers" would also be saved.

Distribution of Juvenile Chinook Salmon in the Taku River

During the summer and fall of 1975 a study was conducted of juvenile chinook salmon in the Taku River to determine habitat preference, species associations, and number of rearing chinook which could be captured by minnow traps for future coded wire-tagging and population-dynamics studies.

Nahlin River

The Nahlin River, which is one of the major clear water chinook salmon spawning tributaries in the Taku River Drainage, originates in the arid interior of Northwestern, B.C. (lat. 58° 45' N., long. 131° 45' W.) (Figure 4). The main river is approximately 97 kilometers long and has two major chinook spawning tributaries, the Dudidontu River and Tseta Creek. The river is uninhabited and has not been altered from its natural condition. The drainage is bisected by the historical Telegraph Trail which was largely used as a route to the Klondike and Atlin gold fields in the late 1890's.

Foot travel along the lower 56 kilometers of river is limited by steep cliffs except at low water, and riverboat travel is impossible because of large bouldered riffles.

Major emphasis was therefore placed on a 10 air mile (16 kilometer) long section of the Nahlin above this area, where riverboat travel was possible. This part of the river flows through a broad valley; it is typically deep, slow moving and meandering with numerous oxbows and beaver dams. Immediately above and below this section are the most concentrated chinook spawning areas in the Nahlin system.

Four study sections, were distributed within this 10 air mile (16 kilometer) area and each was intensively minnow trapped for five to eight days.

Study Area 1

This one-quarter river mile (.4 kilometer) long section of river was located near the upper end of the valley and was a transitional area between the swift, shallow headwater spawning area and the slow moving meandering area used primarily for rearing. Minnow trapping above this area in 1974 and 1975 revealed very low densities of rearing chinook salmon.

The river in Area 1 averages about 6 meters wide with water depths varing between .45 and 1.5 meters. Because of the meandering nature of the river, the current is constantly cutting one bank which is typically steep with overhanging willow. The other bank is shallow and sandy with no cover and little current. The highest densities of juvenile chinook were found on the steep sides of S-curves below riffles. Traps set on the opposite side of the river were usually empty. Good numbers were also found in a 9.1 meter wide pool among beaver litter and sloughed banks. Visual observations made in the study area indicated similiar distribution.

Area 1 was intensively minnow trapped for eight days. A total of 4,075 unmarked young-of-the-year chinook salmon were captured in 509 minnow trap sets, an average of 8.0 chinook per trap per 24-hour period (Table 8). The percentage of unmarked juveniles decreased daily, so during the last three days over 35% of the chinook enumerated had been previously captured.

The Schnabel estimate indicated that at the time of tagging and recovery there was a mean rearing juvenile chinook salmon population of 8,948 in Study Area 1, with a 95% confidence interval of between 8,444-9,512.

Table 8. Nahlin River Minnow Trap Data, 1975.

Study Area #1 (Section Markers 20-22)(Upper Caudal Clip)

Date	Unmarked Chinook	Upper Caudal Clip	Lower Caudal Clip	Total Clip	# Traps	Coho	Burbot	Rainbow	Other
7/18	11	Ø	Ø	Ø	1	2	Ø	Ø	Ø
7/19	570	1	Ø	1	35	43	6	2	1 DV
7/20	1170	85	Ø	85	88	48	10	1	1 DV
7/21	653	167	Ø	167	74	9	10	6	1 DV
7/22	622	254	Ø	254	78	39	11	4	Ø
7/23	279	153	Ø	153	77	30	14	6	1 DV
7/24	392	223	Ø	223	81	72	8	2	Ø
7/25	378	212	Ø	212	75	26	4	1	Ø
TOTAL/	4075	/1095	/ Ø	/1095	/509	/269	/ 63	/ 22	/ 4 DV

Study Area #2 (Section 23-24) (Lower Caudal Clip)

Date	Unmarked Chinook	Upper Caudal Clip	Lower Caudal Clip	Total Clip	# Traps	Coho	Burbot	Rainbow	Other
7/29	337	4	Ø	4	50	98	15	5	Ø
7/30	366	9	42	51	50	95	14	4	Ø
7/31	292	9	78	87	50	105	8	3	Ø
8/1	258	8	95	103	50	85	17	1	Ø
8/2	273	9	89	98	50	64	18	2	Ø
8/3	177	5	76	81	50	57	7	3	Ø
8/4	201	6	81	87	25	42	13	3	Ø
TOTAL/	1904	/ 50	/461	/ 511	/ 325	/ 546	/ 92	/ 21	/ Ø

Table 8. Con't. Nahlin River Minnow Trap Data, 1975.

Study Area #3 (Section 25-26) (Upper Caudal Clip)

Date	Unmarked Chinook	Upper Caudal Clip	Lower Caudal Clip	Total Clip	# Traps	Coho	Burbot	Rainbow	Other
8/5	184	4	5	9	25	22	15	5	Ø
8/6	289	10	12	22	51	51	25	3	Ø
8/7	288	28	11	39	48	50	34	3	Ø
8/8	358	36	1	37	50	38	21	3	Ø
8/9	375	72	3	75	51	42	24	4	Ø
8/10	349	134	Ø	134	50	67	36	5	Ø
8/11	331	128	Ø	128	50	45	22	3	Ø
TOTALS/	2174	412	32	444	325	315	177	26	Ø

Study Area #4 (Section 27-28) (Lower Caudal Clip)

Date	Unmarked Chinook	Upper Caudal Clip	Lower Caudal Clip	Clip Total	# Traps	Coho	Burbot	Rainbow	Other
8/18	375	12	4	16	50	38	11	9	Ø
8/19	267	5	61	66	50	28	5	4	1 Longnose sucker
8/20	199	2	88	90	50	21	7	8	Ø
8/21	161	1	80	81	50	22	4	14	Ø
8/22	118	3	71	74	50	5	12	4	1 DV
TOTALS/	1120	23	304	327	250	114	39	39	1 DV, 1 longnose sucker

Area 1 produced the largest estimate of mean juvenile chinook population during the period of tagging and recovery although the rearing habitat in Areas 2, 3, and 4 appeared superior. Quite possibly the lower densities in Areas 2, 3, and 4 may be due to a combination of downstream movement of juveniles, which was detected, and natural mortality, as Area 1 was trapped earliest in the year.

Study Area 2, 3, 4

These three study areas, each about one-half river mile (.8 kilometer) long, were spaced about 3.2 kilometers apart. Rearing habitat and general topography throughout the three areas were similar. The river averaged about 5.5 meters wide and .9 to 2.4 meters deep with no riffles and little current. The meandering river is somewhat slough-like with tall over-hanging grass and steep banks on both sides of the river. Cover in these sections of the river is limited to beaver dams and litter, and the banks are undercut and sloughing.

Traps were usually set in indentations in the bank, which were made by beavers, or on irregularities or shelves along the shoreline.

Highest densities of juvenile chinook were always found on S-curves. Straight stretches of the river between curves, although habitat was very similar, supported only small numbers of juveniles.

Trap catches were affected by weather. Generally, as the river rose the catch per trap decreased, and after several days of clear weather the catches improved.

Population estimates of the various study areas utilizing the Schnabel or a combination of the Schnabel and Peterson methods are presented in Table 9.

The mean population of juvenile chinook during the time of tagging and recovery in Study Area 2 was 4,584, of which 232 had migrated from Study Area 1.

Study Area 3 had a mean population at the time of tagging and recovery of 6,256. Of this total, 10 juveniles had migrated from Study Area 1 and 210 from Study Area 2.

In the last study area, which was located furthest downstream, there were 2,357 young of which 11 had migrated from Study Area 2 and 131 from Study Area 3.

Length Frequency of Nahlin Juvenile Chinook

Young-of-the-year spring chinook salmon become capturable in minnow traps at about 45 mm (FL). This size is usually obtained in Southeastern Alaska chinook systems by mid-July. Growth of juvenile chinook in the Nahlin River was very rapid during July and August when mid-day water temperatures

averaged 52°F and was mostly completed by mid-September when water temperatures declined to 40°F (Table 10). By mid-October the annulus was beginning to form.

It appears that little growth occurs between mid-October and May of the following year as Meehan and Siniff (1962) determined that the average fork length of out-migrant chinook in the Taku River in 1961 was 73.3 mm.

Table 9. Estimates of Nahlin River Rearing Chinook Salmon Populations, 1975.

		Number from Study Area			
Study Area	Total	1	2	3	4
1	8,948	8,948	-	-	-
2	4,584	232	4,352	-	-
3	6,256	10	210	6,036	-
4	2,357	0	11	131	2,215

- Not applicable

Table 10. Mean Length and Circuli Counts of Juvenile Chinook Salmon Sampled in the Nahlin River during 1975.

Date	7/21/75	8/11/75	8/20/75	10/15/75
Number	20	20	28	10
Mean Fork Length mm.	49.6	60.4	65.7	68.6
Mean Circuli Count	4.0	5.5	7.1	7.5

Mainstem Taku and Glacial Nakina Rivers

The importance of the mainstem glacial Taku and Nakina rivers to juvenile chinook salmon rearing is now documented. Excellent trap catches (11.2 per trap) of young-of-the-year chinook were made in the two glacial rivers during both surveys. Juvenile chinook were closely associated with log jams and cover in the main channels and in places where the

river braided and the water was shallow; large numbers were captured in log jams and at the base of riffles with no cover present. As a general rule, the more braided the area, and the more log jams present, the greater the catch of rearing chinook.

Clearwater Nakina River

The Nakina River, which is the major clearwater chinook salmon spawning tributary in the Taku River drainage, is not an important chinook rearing area. The river is typically fast moving and deep with little cover available for juveniles to escape the strong current. Most of the population migrates downriver within several months of emergence and must rear in the glacial Taku River. Grizzly Bar, about 11.2 kilometers upriver from the junction of the Nakina and Sloko rivers, is an exception. In this area, an anabranch about 91 meters long with little current, several dead falls, and deeply undercut banks, supports the highest density of juvenile chinook found anywhere in the Taku Drainage.

Escapement in Other Areas of Southeast

Stikine River

In past years only small numbers of chinook salmon have been observed in various tributaries of the Stikine River. Local Tahltan natives of Telegraph Creek, B.C., indicated that the Tahltan River was the major chinook spawning tributary of the Stikine; however, chinook were not observed during previous surveys because visibility was impaired by glacial runoff.

An aerial survey of the Tahltan Drainage was made on August 13 by Aloutte II helicopter. Conditions for observing the escapement were perfect because cool weather during several previous days had greatly reduced the silt load. On the afternoon of the survey the weather cleared and the wind was moderate.

In the Little Tahltan River 700 chinook were observed between the headwaters and the junction of the Main Tahltan River. The Tahltan Lake area was surveyed from the outlet of the weir creek, about 16.1 kilometers below Tahltan Lake, to the junction of the Little Tahltan. A total of 202 chinook were observed in this section of river with about 90% of them below the partial barrier on the tributary. The river was surveyed from the junction of the Tahltan and Little Tahltan rivers down to the junction of the Stikine River. Escapement was uniformly excellent for 25.7 kilometers with each good riffle being utilized by 50 to 100 chinook. The fish were well distributed throughout the entire river and 2,706 chinook were enumerated. The survey was made several days after the peak of spawning as quite a few dead fish were enumerated and the live ones were fungused and mostly spawned out.

Andrews Creek, which is the major chinook spawning tributary in the Alaska portion of the Stikine River, was partially surveyed by David Gibbons, USFS, during August 17 through 20 and 180 chinook were observed in the lower 1.2 kilometers of this stream.

King Salmon River (Admiralty Island)

This unique stock of chinook is the only population in Southeast Alaska that has adapted to an island watershed.

Four ground and helicopter surveys were conducted during late June and July to determine entry timing of maturing adults. The majority of the escapement is nearly ripe upon entry into the river and spawning begins within two weeks. The peak of spawning occurs during the last week of July.

The 1975 escapement is the lowest on record (Table 11).

Chilkat River

Surveys conducted on Big Boulder Creek indicate that washouts along the lower reaches of this tributary, below the highway bridge, and subsequent work to stabilize the area have probably contributed to a reduced spawning population (Table 11).

An interview with a longtime resident of the area indicates that the major chinook spawning area in the Chilkat System is near the junction of the Tahini and Flemer rivers.

Unuk River

The Unuk River was surveyed August 7 and escapement into Eulachon Creek was found to be about 50% lower than that observed in 1974 or 1975 (Table 11). Several other tributaries of the Unuk were surveyed and only about 25 chinook were observed.

Chickamin River

Helicopter surveys to enumerate spawning chinook in various tributaries of the Chickamin River were conducted several times during 1975. Peak aerial estimates of various tributaries are presented in Table 11.

Wilson-Blossom River

Aerial surveying of the Wilson River should be discontinued as less than 10 chinook have been observed in this fork of the drainage during the last two years. Surveys of the Blossom River (right fork) should continue as this is an excellent chinook system with good spawning riffles and abundant rearing habitat. Escapement surveys are presented in Table 11.

Keta River

Escapement data is presented in Table 11. Chinook enumerated during 1955-1957 were probably chum salmon, Oncorhynchus keta (Walbuam).

Situk River

The Situk River had a good escapement in 1975 (Table 11). Alex Brogle, area management biologist who conducted the foot survey indicated that a combination of high water, reduced commercial fishing time and a reduced sport fish bag limit were the main reasons for one of the better chinook escapements observed in recent years.

Table 11. Peak Escapement Counts of Chinook Salmon in Southeast Alaska Rivers.

King Salmon River (Admiralty Island)

Year	Chinook	Method
1961	117	Foot
1971	94	Foot
1972	90	Foot
1973	211	Foot
1974	104	Foot
1975	42	Foot, Helicopter

Chilkat River (Big Boulder Creek)

Year	Chinook	Method
1960	316	Foot
1966	330	Foot
1967	150	Foot
1968	259	Foot
1970	176	Foot
1974	0	Foot
1975	21	Foot

Unuk River (Eulachon Creek)

Year	Chinook	Method
1950	1,100	Air
1951	200	Air
1952	244	Air
1953	510	Air
1955	600	Air
1956	200	Air

(Con't)

Unuk River (Eulachon Creek)

Year	Chinook	Method
1957	500	Air
1961	270	Foot
1973	64	Helicopter
1974	68	Helicopter
1975	20-25	Helicopter

Chickamin River

Tributary	Chinook	Method
South Fork	141	Helicopter
Indian	90	Helicopter
Butler	66	Helicopter
King	30	Helicopter
Humpy	7	Helicopter
Barrier	9	Helicopter
Leduc	6	Helicopter
Above Indian	11	Helicopter

Wilson- Blossom River

Year	Chinook	Method
1963	825	Air
1972	500	Air
1974	166	Helicopter
1975	153	Helicopter

Keta River

Year	Chinook	Method
1948	500	Foot
1950	210	Foot
1951	120	Foot
1952	462	Foot
1953	156	Foot
1954	300	Air
1955	1000*	Air
1956	1500*	Air
1957	500*	Air
1975	203	Helicopter

* Probably chum salmon

Table 11. Cont. Peak Escapement Counts of Chinook Salmon in Southeast Alaska Rivers.

Situk River

Year	Chinook	Method
1928	1,224	Weir
1929	3,559	Weir
1930	1,455	Weir
1931	2,967	Weir
1932	1,978	Weir
1933	---	---
1934	1,486	Weir
1935	638*	Weir
1936	816	Weir
1937	1,290*	Weir
1938	2,668*	Weir
1939	2,117	Weir
1940	903	Weir
1941	2,594	Weir
1942	2,543	Weir
1943	3,546*	Weir
1944	2,906	Weir
1945	1,458	Weir
1946	4,284	Weir
1947	5,077	Weir
1948	3,744	Weir
1949	1,978	Weir
1950	2,011	Weir
1951	2,780	Weir
1952	1,459	Weir
1953	1,040	Weir
1954	2,101	Weir
1955	1,571	Weir
1971	964	Weir
1972	400	Float
1973	510	Float
1974	702	Float
1975	1,180	Foot

* Weir out part of the time

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Prepared by:

Paul D. Kissner, Jr.
Fishery Biologist

Approved by:

s/W. Michael Kaill, Chief
Sport Fish Research

s/Rupert E. Andrews, Director
Division of Sport Fish