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Jay S. Hammond, Governor

Completion Report for

A STUDY OF CHINOOK SALMON IN SOUTHEAST ALASKA

by

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Study AFS 41-5

A Study of 'Chinook Salmon in Southeast Alaska

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COMPLETION REPORT

State:	ALASKA	Name:	Sport Fish Investigations of Alaska
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Job No.:	AFS 41-5	Job Title:	Status of Important Native Chinook Salmon Stocks in Southeastern Alaska.

Period Covered: July 1, 1976 to June 30, 1977.

ABSTRACT

Survey work on the Taku River system in presented, including regulation, the fishery, the minimum total run, rationale for the decline in the run, and catch and escapement data. The Nakina River, which is the major clearwater tributary of the Taku River, is described. Information is presented on escapement, sex ratio and spawning areas, along with studies of the Nahlin, Kowatua, Tatsatua, Hacket and Dudidontu Rivers, Tseta Creek and several minor producers.

Regulatory changes, increased commercial fishing effort, and increased gear efficiency were responsible for overharvest of Taku River spring chinook salmon, Oncorhynchus tshawytscha (Walbuam). Restrictions designed to protect the spawning run, recommended as a result of this study, were successful in increasing the 1976 escapement to the highest level observed since 1959. These recommendations and the reasons for them are discussed.

Chinook salmon escapement was monitored in a number of rivers in Southeast Alaska. Escapement counts are listed and chinook salmon systems are identified. Escapement of chinook salmon into the Stikine, Chilkat, King Salmon, Unuk, Chickamin, Blossom and Keta rivers was low while the Situk River escapement was average.

Young-of-the-year spring chinook salmon were captured in various tributaries of Taku River by baited minnow traps to determine areas of rearing, habitat preference and number of juveniles which could be captured for coded wire tagging. One-check smolts were captured in May near the estuary. Results indicate that minnow traps baited with salmon roe are an effective method of capturing large numbers of juvenile chinook.

Gill nets of 6 3/8" and 6 1/2" stretched measure nylon mesh were fished in the Stikine River gillnet 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 smaller mesh gear fished a broader segment of the population and harvested a much higher percentage of the available males, but income derived from the smaller gear size was about 15% less than the average of the larger mesh size.

The freshwater life history of chinook salmon in Southeast was investigated. By comparison of juvenile length frequency and circuli count data it was determined that the young emerge from the gravel in April and May, rear in various tributaries until the following spring, and migrate from the river as 1-check smolts.

Analysis and comparison of the freshwater growth zone of known origin spring chinook salmon scales from Alaska, British Columbia, and Washington indicate that partial stock separation is possible. The differences are not great enough to classify stocks from individual rivers but are of sufficient magnitude to separate Alaskan from non-Alaskan chinook in various mixed stock fisheries.

Native spawning populations of spring chinook salmon are at such a low level that utilization of escapement for artificial propagation would seriously jeopardize most populations; therefore, various methods of securing native brood stock for future enhancement programs have been attempted. Based on low hatchery returns of spring chinook in Washington and Oregon it is recommended that a large scale chinook enhancement program should not be attempted until large, high quality smolts can be produced and returns from them evaluated.

BACKGROUND

Tagging studies were conducted by the Alaska Department of Fisheries from 1950-1955 to determine the origin of chinook salmon, *Oncorhynchus tshawytscha* (Walbaum), harvested in various Southeast Alaska fisheries. Tag recovery information indicated that stocks in outside waters (off the west coast of Southeastern Alaska) were highly dependent on river systems in British Columbia, Washington and Oregon, while inside waters contained a mixed population, mainly of Alaska and British Columbia origin (Appendix I).

Since the peak commercial catches of the 1930's, the 10 year average chinook harvest has declined about 100,000 per decade (Appendix II). In inside waters the harvests declined from nearly 300,000 chinook in the early 1950's to 90,072 in 1972. Because a method of apportioning the origin of the commercial chinook catch had not been devised, it was not possible to determine if the reduced harvests were caused by declining native populations or depletion of river systems to the south.

In the past the only indication of the condition of our native chinook stocks had been from several gillnet fisheries and limited aerial estimates conducted during spawning.

The Chinook Salmon Project was thus developed to determine the present status of our native chinook stocks in Southeastern Alaska. A secondary objective was to develop techniques to enhance chinook stocks in inside waters.

RECOMMENDATIONS

Management

1. In Southeastern Alaska saltwater chinook gillnet fisheries, mesh size should be restricted to a maximum of 6 1/2" stretched measure.

2. During "king season" Southeastern chinook gillnet fisheries should be limited to a small area near the mouth of individual rivers to decrease the catch of incidentally caught immature chinook.

3. Brood stock should be developed utilizing one or two native stocks in Southeast.

4. The brood source should come from as near to the area where future enhancement will be attempted as possible.

5. Because of the poor success with spring chinook enhancement in Washington and Oregon, large scale chinook enhancement programs should not be attempted until results of recommendation #3 are known.

Research

1. Coded wire tagging of chinook salmon smolts should be conducted during May in the Taku, Stikine, Chickamin and Unuk rivers to determine marine migration patterns and areas of harvest at various life history stages. Detection of these areas is important to give added protection to these depleted stocks.

2. Escapement of chinook salmon in the major and medium size chinook salmon spawning systems in Southeast should be monitored by aerial, ground and weir enumeration.

3. Delayed release of native Taku chinook smolts should be attempted to determine how this would affect migration.

4. Sampling of hake populations should be conducted near the mouth of the Taku River during May to determine if they are a significant predator on outmigrant salmonids.

5. Experiments should be conducted releasing various size and age smolts to determine the cost versus return of the various lots.

OBJECTIVES

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

2. Determine the current status of the Stikine River chinook salmon stock.

3. Determine the catch of chinook salmon in the Alsek River gillnet fishery.

4. Determine the escapement of chinook salmon in other important spawning rivers of Southeast Alaska.

5. Determine the effect of an August 15 commercial troll opening in Area 111 on Alaskan chinook salmon stocks.

TECHNIQUES USED

Gill nets of 6 3/8" and 6 1/2" stretched measure nylon mesh, 150 fathoms long and 60 meshes deep were fished by chartered commercial fishermen during open commercial fishing periods. The 6 3/8" net was a "Uroko monoply gill net" made from size 30 twine and the colors were alternating panels of UR 19 (blue-green) and UR 33 (glacial blue). The 6 1/2" net was a "Morishita I" (glacial blue) made also from size 30 twine. 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.

Commercial chinook salmon harvest data were taken from statistical runs which were compiled from individual fish tickets. Mid-eye to fork of tail measurements were made of chinook salmon in the gill net fisheries and on the spawning grounds, and total length measurements were made in the troll fisheries.

During August 1976, weirs were operated on the Nakina and Little Tahltan rivers. Chinook, spawning above the weirs, were enumerated after they could no longer maintain station in the river and floated against the weir face. The structures were cleaned of carcasses at 10 a.m. and 7 p.m. daily. All species were enumerated, and length data, scale samples and sex determination were collected from the chinook.

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 and foot surveys.

Gee minnow traps baited with fresh salmon roe were used exclusively to capture rearing salmonidae. Fish captured were anesthetized, enumerated by species and released at 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.

To determine the percentage of Alaskan chinook harvested in various areas, 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 the 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.

FINDINGS

TAKU RIVER SYSTEMS STUDIES

The Taku River originates in the high plateau country of Northwestern British Columbia and drains an area of approximately 6,400 square miles (Figure 1).

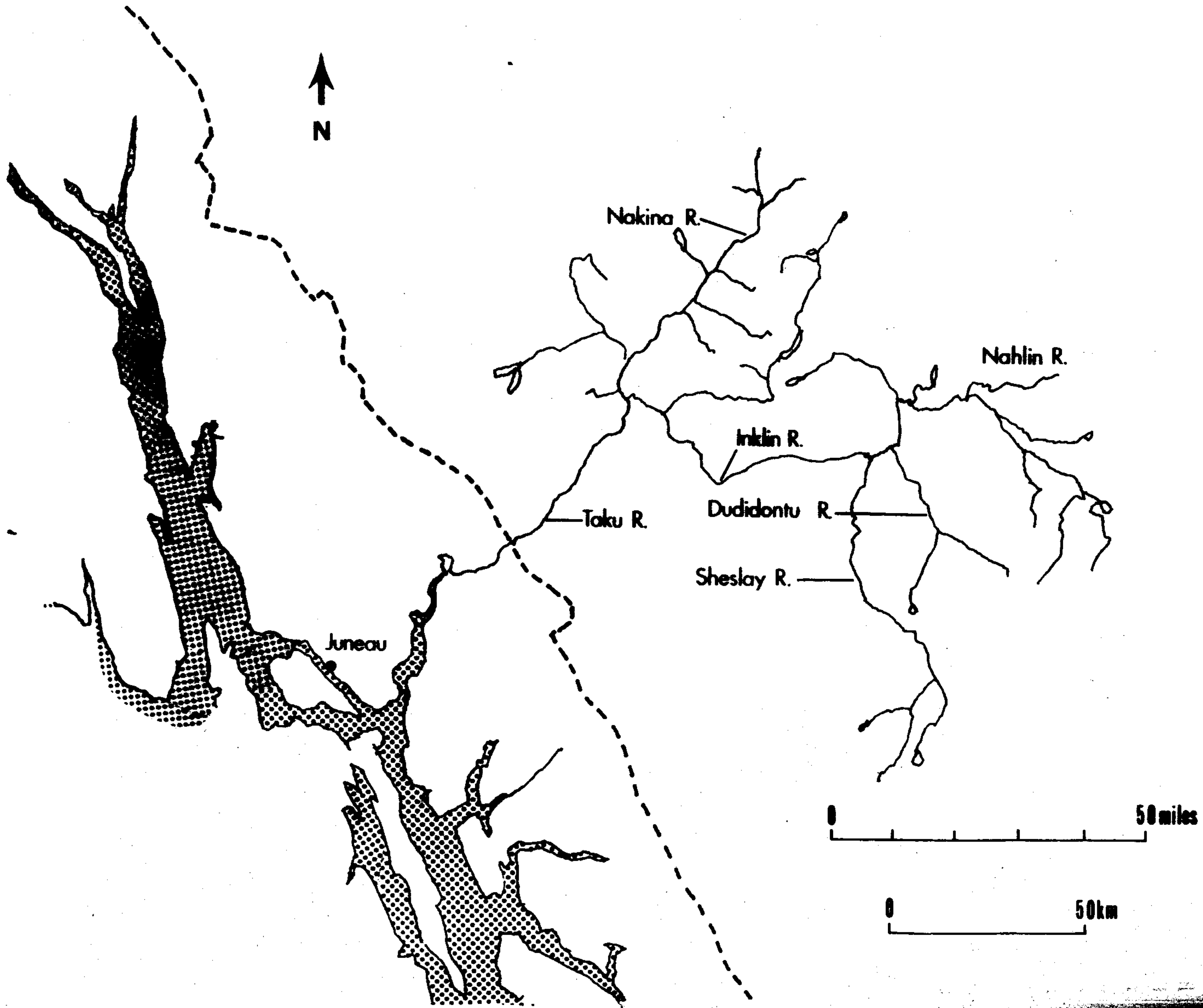


Figure 1. Taku River Drainage

The river above Tulsequah, B.C. remains in pristine condition as logging, mining or other land use activities have never been permitted. The area is among the most remote in British Columbia with the nearest highway access to the drainage over 20 miles from the Nakina River. Only George Bacon, who lives at Tulsequah during the summer, and the Wiseman family at Hatin Lake presently inhabit the drainage.

The two major clearwater tributaries, the Nakina and Nahlin rivers, contribute less than 25% of the total discharge with most of the remainder originating from the ice fields on the eastern slope of the Coast Range. The turbid mainstem Taku River penetrates the Pacific Coast 30 miles east of Juneau, Alaska.

Maturing chinook salmon enter the river from mid-April through July 15 and most spawning occurs from late July to mid August in the head water tributaries.

A commercial fishery has operated in Taku Inlet since the late 1800's. Moser (1898) states that "as soon as the ice breaks up in the river the fishing for king salmon commences, and all that are packed at Pyramid Harbor are taken in the Taku, except for a few stragglers that appear around the Chilkat very early in the season, which can hardly be called a run... These fish are all taken with drifting gill nets by white fishing crews."

Regulatory Changes

Prior to 1945 commercial drift gillnetting for chinook salmon opened on or before May 10, and fishing time was limited only by weather and the general regulation of 1906 which provided for a weekly closure from 6 p.m. Saturday to 6 a.m. Monday.

During 1945 the fishing season extended from May 10-31 with 5.5 days of fishing per week and a complete closure was in effect from June 1-25.

From 1946 to 1952 fishing was permitted from May 1-31 for 5.5 days per week with the June 1-25 closure.

The fishing periods were reduced in 1953-1954 to four days per week with no June closure, 1955-1961 to three days per week, 1962-1975 to one day per week, and at the present time commercial drift gillnetting is not permitted until the third Monday in June.

The boundaries of commercial drift gillnetting have changed many times over the past 80 years as shifts in the sandbars at the mouth of the river have been caused by the rapid advance of the Taku Glacier. The furthest upstream markers on record were located midway between Barrel (Sockeye) Point and Swede Point near the rock pile on the west side of the river.

The maximum amount of gear fished during "king season" has been reduced. Before 1948, 50 to 250 fathoms of gillnet were permitted and from 1949 to present 50 to 150 fathoms. The gill nets became more efficient with a general switch from linen to nylon web in 1953 (Weberg and Garceau, 1955).

The mesh size has varied somewhat but generally before mid-June, king gear (8-9 inch stretched measure mesh) was utilized. After mid-June the mesh size is reduced to harvest primarily sockeye salmon, O. nerka (Walbau and with this reduction in mesh size the catch of immature chinook increases.

Drift Gillnet Fishery in Taku Inlet

Reliable statistics on drift gill net catch and effort in the Taku Inlet chinook fishery have been recorded since 1945 (Appendix III). Catch per unit of effort as an indicator of the condition of the Taku chinook stock appears to be of limited value, as regulatory changes have caused variation in gear, location and effort. The change-over to nylon gill nets in 1953 increased the efficiency of the gear, the location of the fishery varied with bar shifts in the river's mouth, and the boat days (number of days fished times number of boats) have ranged between 1,302 and 61.

Clancy Henkins, a long time Taku River gillnetter, states that "in the early years of the fishery when the boundaries were near Taku Point, and four to five and one-half days of fishing were permitted, we fished only 8-10 hours per day, from about two hours before each low tide to two hours after each low tide. When fishing time was reduced to three days per week and the boundaries were moved below Flat Point we started fishing the whole period."

Direct comparisons between a three or four day per week and a one day per week fishery are extremely difficult as the more hours a gill net is fished, the less efficient it becomes. During a 24 hour period the gear can be kept at maximum efficiency while during a 72 or 96 hour period some efficiency is lost by the tendency to let more fish and debris accumulate before the net is picked, and thus increase the drop out rate. Therefore, the CPUE data has been grouped to compare like types of gear and comparable fishery effort, thereby eliminating part of the variability. The data was divided into three periods, 1945-1952 to group linen gillnet, 1953-1961 to compare nylon nets and three or more days fishing per week, and 1962-1975 with nylon gear and one 24-hour period per week (Table 1).

A low CPUE for a given year does not necessarily mean that the chinook production was low, but possibly that harvest occurred at some other location. Comparisons of CPUE were made only through June 15 as gill net mesh size is reduced after this time period and immatures enter into the catch.

The weighted CPUE was lowest during the period linen gill nets were utilized. During the next nine year interval the annual CPUE varied between 10 and 17 chinook per boat day until 1960 and 1961 when the effort climbed to its highest level in 26 years and the CPUE decline to about six chinook per boat day.

In 1962, the fishing periods were reduced to a single 24 hour period per week and about one half of the fishermen withdrew from this early fishery.

Table 1. Taku River drift gill net catch of chinook salmon per boat per day through mid-June, 1945-1975.

Year	Days Fished	Weighted Average # Boats	Maximum # Boats	Chinook Catch	Average Catch Per Boat Per Day
1945	17.0	18.6	24	4,109	13.0
1946	20.5	29.9	41	6,704	10.9
1947	24.5	23.3	33	3,572	6.3
1948	22.0	25.2	38	5,320	9.6
1949	23.5	23.1	33	5,801	10.7
1950	24.5	21.8	29	7,342	13.7
1951	20.0	34.1	43	9,059	13.3
1952	20.5	39.9	69	10,119	12.4
1953	23.5	37.5	63	15,207	17.3
1954	19.0	47.4	67	13,668	15.2
1955	17.0	53.9	74	9,753	10.6
1956	17.0	53.7	65	9,963	10.9
1957	19.0	31.9	53	7,637	12.6
1958	18.0	54.7	72	12,847	13.0
1959	18.0	59.2	65	15,312	14.4
1960	15.0	86.8	94	7,756	6.0
1961	16.0	65.1	72	6,480	6.2
1962	7.0	30.3	40	3,488	16.4
1963	4.0	35.3	44	796	5.6
1964	7.0	17.6	24	1,217	9.9
1965	8.0	16.0	32	2,378	18.6
1966	7.0	15.0	21	1,394	13.3
1967	7.0	24.9	33	3,471	19.9
1968	7.0	33.1	40	3,242	14.0
1969	5.5	26.9	31	2,363	16.0
1970	4.0	27.5	36	804	7.3
1971	6.0	29.8	33	2,328	13.0
1972	6.0	29.2	34	2,500	14.3
1973	7.0	35.9	43	3,073	12.2
1974	2.0	30.5	32	343	5.6
1975	3.0	20.7	23	423	6.8

Since 1962, the weighted CPUE has actually been the highest since good statistics became available. This is probably caused by increased efficiency of the gear, shortened fishing periods and the location of the fishery. In the 1950's when much of the fishing was conducted above Flat Point comparable numbers of chinook were caught throughout the three day fishing period, but at present the gillnetter's feel that they harvest almost all available chinook in one day of fishing and increasing the fishing time would not increase the catch.

Minimum Total Run

Gillnet catch trend as an indicator of production of the Taku River chinook stock is of value only if there is little or no variation in the percentage of the resource that is available for it to harvest. It is probable that the percentage of the population taken at an immature stage by various fisheries will vary annually; therefore, catch trend is of value only to give a rough estimate of the number of fish available for escapement and a minimum estimate of what the Taku River system is capable of producing (Table 2).

By combining the 1953 gillnet and troll harvest of maturing chinook in the Taku Inlet vicinity, plus observed escapement into the Nakina River, it is evident that the Taku River system can produce at least 32,000 maturing chinook. Adding harvest at various immature stages, plus unobserved glacial spawning, it seems quite possible that the drainage is capable of producing a total run in excess of 75,000 chinook salmon.

Probable Reasons for Decline

It appears that the Taku River chinook salmon stock was overharvested during the period 1950-1961 as the maturing adults approached Taku River. In this schooling area an average of nearly 50 drift gillnetters and in some years nearly the same number of power trollers fished from 3.0 to 5.5 days per week and harvested in certain years in excess of 24,000 maturing chinook salmon.

A regulatory change in 1953 also appears to have played an important part in the decline of the stock. Before that year fishing was permitted from May 1 to May 31, and a 25 day closure was made during June to provide for escapement. In 1953 fishing periods were reduced 1.5 days per week and fishing was permitted throughout the season. The reduction in weekly fishing periods probably had little effect on the escapement as chinook mill in the vicinity of Taku Inlet for an average of 8.6 days (Kissner 1975), and commercial fishing was thus permitted on a segment of the run which had been protected in the past.

In summary it appears that for a number of years prior to 1950 catches were of a magnitude to permit adequate escapement onto the Taku River. During the 1950's the good runs, which were caused by the escapements of the 1940's, were overharvested, thus not permitting adequate escapements and this led to severe curtailment of the fishery in 1962. The three major reasons for the overharvest appear to have been: (1) fishing throughout the season for three days per week, (2) increased effort, and (3) increased efficiency of nylon net over linen.

Table 2. Minimum total run of chinook salmon in the Taku River, 1944-76.

Year	Harvest Method Through mid-June		River Escapement		Minimum Total Run
	Gillnet	Troll	Inklin	Nakina	
1944	3,610				3,610
1945	4,109				4,109
1946	6,704				6,704
1947	3,564				3,564
1948	5,320				5,320
1949	5,801				5,801
1950	7,342				7,342
1951	9,059	5,750*	1,500	5,000	21,309
1952	10,119	No Fishery		9,000	19,119
1953	15,207	9,020*		7,500	31,727
1954	13,668	7,502*		6,000	27,170
1955	9,753	3,250*		3,000	16,003
1956	9,963			1,380	11,343
1957	7,637			1,500	9,137
1958	12,847		7,000	2,500	22,347
1959	15,312			4,000	19,312
1960	7,756			Poor	7,756
1961	6,480			Poor	6,480
1962	3,488		322		3,810
1963	796				796
1964	1,217				1,217
1965	2,378		405	3,050	5,833
1966	1,394		881		2,275
1967	3,471		1,500		4,971
1968	3,242		3,220		6,462
1969	2,363		4,100		6,463
1970	804		1,791		2,595
1971	2,328		2,358		4,686
1972	2,500		763	1,000	4,263
1973	3,073		800	2,000	5,873
1974	343		1,279	1,800	3,422
1975	423		274	1,800	2,497
1976	0		1,726	3,000	4,726

* Mature Taku River chinook salmon.

I feel that with strict curtailment of fishing mortality during all phases of the stock's life history that it is possible to return the stock to its' former magnitude.

Catch of Immature Chinook

After the third Monday in June most of the Taku drift gillnetters fish 5 3/8" - 5 1/2" stretched measure nylon mesh to harvest primarily sockeye salmon, *O. nerka* (Walbaum). The incidental catch of immature chinook with this reduced mesh size in the drift gillnet fishery has increased since 1960. Before that time the fishery was restricted to Taku Inlet, but in 1960 the area was extended south into Stephens Passage and the southern terminus became the latitude of the Midway Island light.

Fishermen indicate that the best catches of immature chinook occur at night and certain areas such as Doty Cove are consistent producers. In some years a high percentage of these immatures are wasted as they often become soft before being processed.

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. The catch of immature chinook salmon in the Taku Inlet gillnet fishery from 1973-76 have been:

Year	Catch
1973	6,551
1974	1,408
1975	839
1976	400

If problems exist, night closures in the Doty Cove vicinity would reduce the catch.

Escapement

Preliminary aerial surveys to determine chinook salmon spawning areas in the Taku River were conducted during August, 1950. Ground, aerial and weir enumerations of chinook salmon have been conducted intermittently on various tributaries since that time (Table 3).

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. 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

Table 3. Escapement of Chinook Salmon in the Taku River, 1951-1976.

Year	Nakina	Kowatua	Tatsamenie	Dudidontu	Tseta	Nahlin
1951	5,000			400	100	1,000
1952	9,000					
1953	7,500					
1954	6,000					
1955	3,000					
1956	1,380					
1957	1,500					
1958	2,500			4,500		2,500
1959	4,000					
1960	Poor					
1961	Poor					
1962				25	81	216
1963						
1964						
1965	3,050	200 G	50 G	100	18	37
1966		14 G	150 G	267	150	300
1967		250 G	---	600	350	300
1968		1,100 E	800 E	640	230	450
1969		3,300 E	800 E			
1970		1,200 E	530 E	10	25	26
1971		1,400 E	320 E	165		473
1972	1,000	130 G	170 G	103	80	280
1973	2,000	100 G	200 G	200		300
1974	1,800	235 G	120 G	20	4	900
1975	1,800	---		15		274
1976	3,000	341 G	620 E	40		725

G = water glacial
E = water clear

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 has 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.

Foot and/or helicopter surveys of the Nakina River were conducted during: early August from 1951 to 1956; in 1965; and from 1972 to 1976, to enumerate spawning chinook salmon. A carcass collecting weir was operated on the Nakina River above the junction of the Silver Salmon River in conjunction with upriver surveys during 1956 to 1959 and from 1973 to 1975, to be utilized as an index of escapement. From 1960 to 1971 intermittent aerial surveys were made by Super Cub or Cessna 180. These fixed wing aerial estimates are of little value as annual counts cannot be compared. Factors affecting the reliability of these aerial surveys includes turbulent flying conditions, high murky water, missing the peak of spawning and questionable species composition.

Comparision of chinook salmon escapement data in the Nakina River indicates that the average number of returning spawners has been reduced over 60% between the 1950's and the 1970's (Table 4). Escapements during 1972 to 1976 have varied between 1,000 and 3,000 and averaged 1,920; while during 1951 to 1956, when the last series of ground counts of the total river were conducted, the escapement varied between 1,380 and 9,000 and averaged 5,300. Escapements were probably below average even during that time period, since the largest harvests of maturing Taku River chinook salmon in history occurred in the vicinity of Taku Inlet.

Analysis of data collected during the 1950's suggests a relationship between female escapement into the Nakina and return to the fishery and spawning grounds five and six years hence (Kissner, 1975). It appears that the Nakina River spawning grounds should have at least 3,500 females annually. When escapements in the Nakina dropped below 2,000 female chinook, the return to the fishery and spawning grounds from these brood years was unsatisfactory and this led to the strict curtailment of commercial fishing time in 1962. During the past four years the number of spawning females in the Nakina River has averaged only 1,042 and never exceeded 1,600.

The carcass weir has been 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.

Table 4. Escapement of chinook salmon into the Nakina River.

Date	Total Chinook (excludes jacks)	Carcass Weir (excludes jacks)	Jacks At Carcass Weir
1951	5,000		
1952	9,000		
1953	7,500		
1954	6,000		
1955	3,000		
1956	1,380	814	1,963
1957	1,500*	748	1,948
1958	2,500*	1,328	3,739
1959	4,000*	2,097	1,973
1960	Poor		
1961	Poor		
1965	3,050		
1972	1,000		
1973	2,000	1,136	1,189
1974	1,800	814	1,448
1975	1,800	223	733
1976	3,000	720[a]	476

* Counts of total river not conducted - comparison made from carcass weir enumeration.

a Carcass weir moved about 5 miles downriver because of Village Falls Barrier.

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 distribution of spawning chinook salmon in the Nakina River during 1975 and 1976 was atypical. In 1975 it was evident that the majority of the chinook spawning in the Nakina were concentrated in the Grizzly Bar vicinity, and only about 12% of the spawning run was above the carcass weir. In previous years from 45 to 59% of the run had spawned in the area above the weir.

During July, 1976 helicopter surveys of the Nakina indicated that a barrier was present as good numbers of chinook were seen in the Grizzly Bar area but the upper river (above Silver Salmon River) was almost devoid of spawners.

The barrier was located at Village Falls (Humpy Block) about 2 miles below Silver Salmon River. Above this area only 10 chinook were observed spawning, while below it about 3,000 spawned. During a three week period in late July and August a school of approximately 750 sockeye salmon were concentrated below this barrier attempting to negotiate the falls. It is unknown how many were successful but in late August many sockeye were observed spawning below this area.

Apparently the barrier at Village Falls has been caused by rock slides restricting the flow of the river to a narrow channel. Only a small vertical rise was evident but the water velocity in this area was extreme.

The Department of the Environment, Fisheries Service was notified of the problem and we met with their inspection team on site to determine what actions were necessary. The engineers felt that removal of several rocks in the area of high velocity coupled with a small channel being opened to the left of this area should allow fish passage. They will conduct the work during low water, sometime in the spring of 1977.

During 1976, because of the barrier at Village Falls blocking upstream migration into the area where the carcass weir had been operated in the past, the weir was moved down river about 5 miles and was built 25 yards below the lower end of Grizzly Bar. The weir was relocated to determine the age composition and sex ratio of the escapement. We also wanted to determine the accuracy of our escapement estimates as spawning was much more dense than normal because of the barrier upstream.

Several problems were encountered during weir operations in the Grizzly Bar vicinity. Predation on chinook carcasses by Grizzly Bears, *Ursus arctos*, was severe and the bears in their feasting did much damage to the weir. Almost daily, sections of the wire had to be replaced and often tripods were knocked over and stringers between tripods broken. In addition, large numbers of spawned out pink salmon, O. gorbuscha (Walbaum), plugged the weir and caused washouts, which were difficult to approach by wading because of strong water velocity.

After five days of continual problems part of the weir was removed. It is felt that the bears did not selectively fish for certain sizes or sex of chinook at the weir, thus information on age and sex of the escapement should be valid (Tables 5 and 6).

In summary, the Nakina River is the most important chinook spawning tributary in the Taku drainage. For chinook enumeration a helicopter should be utilized because the river is wide and deep. The survey area for the Nakina River should be from Grizzly Bar (a prominant gravel bar 8 km below the Silver Salmon River) to and a narrow canyon about 3.2 km 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. The river should be surveyed between August 1 and 7, usually about August 4. Large numbers of pink salmon are spawning at the same time as chinook. Sockeye salmon are present but are still schooled in the holes.

Information on the distribution of spawning chinook which was collected only during 1952, 1953, and 1972 through 1976, 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.

Area III — Above Silver Salmon River.

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

Nahlin River:

The Nahlin River, which is the other major clearwater 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.). 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

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
1976*	418	889	1,307	1: 2.13

* Partial weir at Grizzly Bar.

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	1976*
1.1	754	699	1,335	838	336	730	228	64
1.2	1,201	1,249	2,404	1,132	853	718	505	412
1.3	312	242	561	611	273	267	90	236
1.4	86	110	123	298	242	124	63	95
1.5	0	0	0	0	7	3	1	4
n	2,353	2,300	4,423	2,879	1,711	1,842	887	z 811
				FEMALE				
Age	1956	1957	1958	1959	1973	1974	1975	1976*
1.2	8	0	0	3	0	0	0	0
1.3	287	274	469	778	210	197	38	206
1.4	129	122	175	410	404	223	31	179
n	424	396	644	1,191	614	420	69	385

* Partial weir at Grizzly Bar.

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.

Escapement surveys have been conducted on the Nahlin intermittently since 1951. During most years the aerial surveys were conducted after the peak of spawning and therefore the counts are of little value. Since 1974, the counts have been conducted by helicopter during the peak of spawning.

The Nahlin is the second most important chinook spawning tributary. It should be surveyed by helicopter from July 26-30, from Nahlin Crossing (outlet of Tedideech Creek) upriver through the beaver dam valley to the latitude of Granite Lake. Over the past four years the most concentrated spawning has occurred for several miles above and below the beaver dam valley. Sockeye salmon spawn in the area above the beaver dam valley in the same area as chinook during the same time period. Sometimes there are as many sockeye present as chinook.

Kowatua River:

The Kowatua River is a large glacial stream that flows from the outlet of lower Trapper Lake to the Inklin River. The river carries a heavy silt load until glaciers in the headwaters of this system stop melting, usually between August 20 to 30. In 1968 an aerial survey was conducted after the water had cleared, and good numbers of chinook were enumerated for the first time. During the following eight years when water clarity was good, over a 1,000 chinook could be counted, and when the water was glacial, only a few hundred chinook would be visible on the shallow riffles.

The Kowatua is the third most important chinook spawning tributary. It should be surveyed by helicopter from August 12-17 from the outlet of Lower Trapper Lake downstream for about 5 miles, to the place where a glacial tributary flows in from the south. Because this is a glacial tributary, surveys cannot be conducted until the weather cools and glacial melting ceases at the head of this system. This usually occurs between August 20 to 30 which is too late to enumerate the majority of the run. Large numbers of sockeye salmon spawn at the same time in the same area as the chinook.

Tatsatua Creek:

Tatsatua Creek is a small glacial stream that flows from Tatsamenie Lake. The system is glacial in the summer and usually clears about mid-August. This is the fourth most important chinook spawning tributary. Surveys should be conducted by fixed wing aircraft or helicopter from the outlet of Tatsamenie Lake downstream through a smaller lake to the junction of the glacial water at the main Tatsatua Creek. The fish spawn in the outlet of Big Tatsamenie Lake outlet and the inlet (1 mile) of Little Tatsamenie about 1/4 mile above the junction with glacial water, adjacent to an open meadow. Best times for survey are between August 12-17. The river is sometimes glacial but usually clears before Kowatua River. Sockeye spawn at the same time as chinook, but few are ever seen.

Hacket River:

The Hacket River is a small clearwater tributary of the Sheslay River. The river is difficult to survey by any method other than ground survey because of tall trees along its bank. This is the fifth most important chinook spawning tributary. Surveys should be conducted on the ground or by helicopter between August 1-7 from the junction of the Sloko River upstream. Sockeye salmon are also present in good numbers and coho are present in the fall.

Tseta Creek:

Tseta Creek is a clearwater tributary of the Nahlin River. It is extremely difficult to survey because of continuous meanders. Most chinook observed in this system have been seen upriver about 15 miles. This is the sixth most important chinook spawning tributary. It should be surveyed by helicopter. Most fish spawn in the upper part of the system. When flying upstream this area can be observed just before a sharp left turn is made towards Victoria Lake. No other fish have been observed.

Dudidontu River:

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 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 and 1976, 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, 15 in 1975, and 40 in 1976.

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.

This system is not rated at present because of the partial barrier, however, there is much spawning potential. It should be surveyed by fixed wing or helicopter between August 7-12, from the canyon head, adjacent to Hatin Lake upstream to the junction of Matsatu Creek. Matsatu and Kakuchuya creeks should be included in the surveys. Only small numbers of spawning chinook have ever been seen farther upstream than the junction of Matsatu Creek, except in 1958 when 4,500 chinook were enumerated in the Dudidontu. During that year good numbers were seen almost all the way to Camp Island Lake. Small numbers of sockeye salmon also utilize the Dudidontu for spawning.

Minor Producers:

Kawdy, Yeth and King Salmon creeks are minor systems that produce chinook salmon. Spawning magnitude would in most cases be less than several hundred chinook. The extent of chinook spawning in the glacial Sheslay, Sloko, Mainstem Taku and Mainstem Inklin rivers is unknown.

Age of Outmigrant Chinook Salmon

Considerable controversy has existed in past years over the freshwater life history of chinook salmon in Southeast.

Parker et. al. (1954) interpreted from adult Taku River chinook scales that fry were migrating to saltwater shortly after emergence. This was accepted until Meehan and Siniff (1962) examined outmigrant chinook from the Taku River and felt that they all had stream-type nuclei. Their sample indicated that 94% migrated in their second year of life as 1-check smolts, and the remainder in their third year.

Later correspondence by Meehan indicated that the interpretation made in 1962 was somewhat questionable.

On examination of several thousand adult scales collected in the Taku Inlet gillnet-fishery and on the spawning grounds, it appeared that they all had stream-type nuclei. To verify that the correct interpretation was being made, collections of juvenile chinook were made from July through May.

By comparison of juvenile length frequency and circuli count data it is now obvious that the young emerge from the gravel in April and May, rear in various tributaries until the following spring, and migrate from the river as 1-check smolts at an average size of 72 mm (fork length).

Distribution of Juvenile Chinook Salmon

During 1974, 1975, and 1976 young-of-the-year chinook salmon were captured in various tributaries of the Taku River to determine areas of rearing, habitat preference, species associations, and numbers of juveniles which could be captured for coded wire tagging and population dynamics studies.

In May and June 1976 outmigrant chinook smolts were captured near the mouth of Taku River to determine the feasibility of capturing large numbers of smolts with baited minnow traps for coded wire tagging.

Coded wire tagging will permit us to follow the migratory routes of Taku River chinook salmon during marine rearing and determine areas of exploitation.

Nakina River:

The Nakina River, which is the major clearwater chinook salmon spawning tributary of the Taku River drainage is not an important rearing area for juvenile chinook. The river is typically fast moving and deep with very little cover available for juveniles to escape the strong current. Most of the population migrates downstream shortly after emergence and must rear in the glacial Nakina and mainstem Taku rivers. 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. Catch data is presented in Table 7.

Nahlin River:

The Upper Nahlin River is a major rearing tributary for juvenile chinook salmon. Preliminary sampling, which was conducted in 1974, indicated the possibility of good numbers of juveniles. An intensive study was thus conducted during the summer of 1975 to determine if large numbers of juvenile chinook could be captured by baited minnow traps for future coded wire tagging, population dynamics studies, and to attempt to estimate the population (Kissner, 1976).

Foot travel along the lower 56 kilometers of the Nahlin is limited by steep cliffs except at low water, and river boat travel is impossible because of large bouldered riffles. Major emphasis was therefore placed on a 10 air mile (16 kilometers) 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. Over 9,200 young-of-the-year chinook salmon were captured, anesthetized, temporarily marked and released by a two man crew in four weeks.

Dudidontu River:

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 rearing habitat. Below this area there 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 to 1976 no obvious barriers were detected, although several old land slides were noted. Ground surveys of this area were not possible because of the topography.

Minnow trapping was conducted on September 1 and October 16, 1975 with a total of only three chinook and one coho salmon young captured in 24 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

Table 7. Juvenile Taku River Chinook Salmon Minnow Trap Catch and Sample Summary, 1972-1976.

River	Date	No. Traps	Catch Per Trap	Sample Size	$\bar{X}$ Fork Length mm	$\bar{X}$ Circuli Count
Nakina	08/08/72	--	--	46	56.2	--
Nakina	08/09/74	14	6.1	--	--	--
Nakina	09/16/75	42	5.4	--	--	--
Nakina	10/15/75	17	2.9	19	66.5	8.2
Glacial Nakina	09/16/75	10	7.4	--	--	--
Glacial Nakina	10/15/75	5	15.6	6	63.8	8.5
Glacial Nakina	10/15/76	4	42.5	--	--	--
Glacial Taku	09/16/75	19	6.2	--	--	--
Glacial Taku	10/15/75	15	14.6	13	61.4	7.3
Glacial Taku	05/17/76	25	7.0	24	72.2	--
Glacial Taku	05/24/76	40	6.9	21	72.1	--
Glacial Taku	09/21/76	45	3.7	53	63.3	--
Glacial Taku	10/15/76	25	32.8	19	64.2	--
Nahlin	07/18-25/75	509	8.0	20	49.6	4.0
Nahlin	07/29-04/75	325	5.9	--	--	--
Nahlin	08/05-11/75	325	6.7	20	60.4	5.5
Nahlin	08/18-22/75	250	4.5	28	65.7	7.1
Nahlin	09/16/75	30	7.4	--	--	--
Nahlin	10/15/75	15	7.5	10	68.8	7.5
Nahlin	07/26/76	11	17.0	--	--	--
Dudidontu	09/01/75	14	0.2	--	--	--
Dudidontu	10/15/75	10	0	--	--	--

habitat available, the possibility of introducing chinook fry into this system should not be overlooked.

Mainstem Taku River:

The glacial mainstem Taku River is the major overwintering area for juvenile chinook salmon, and good numbers are also found rearing in the mainstem during the summer and fall.

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, the more log jams present, the greater the catch of rearing chinook.

During minnow trapping in 1975 and 1976 a large increase in juvenile chinook population was noted between mid-September and mid-October. It appears that as water levels and temperatures drop in the headwater rearing tributaries juveniles migrate into the mainstem to overwinter.

During May, 1976 chinook salmon smolts were captured with baited minnow traps in the mainstem Taku River from Canyon Island to 1/2 mile below Taku Lodge to determine if large numbers of outmigrant chinook could be captured for future coded wire tagging. An average of seven chinook per trap were captured with the highest densities near the intertidal area below Johnson Creek. Quite possibly the outmigrants mill in this area as they are adapting to the marine environment. As with rearing juveniles, the smolts were closely associated with cover.

Studies conducted during the last five years on juvenile Taku River king salmon have revealed the following:

1. Large numbers of rearing juveniles can be captured by baited minnow traps from late July (when chinook grow to a size [< 50 mm fork-length] where they cannot pass through the mesh of a minnow trap) through freeze-up in certain headwater tributaries and in the mainstem Taku; and good numbers of smolts can be captured in the spring near the intertidal zone.

2. Chinook salmon fry emerge primarily during May.

3. Timing of downstream movement of juveniles from various tributaries into the mainstem is variable.

4. The density of juveniles in the mainstem increases rapidly after mid-September.

5. The mainstem Taku is the most important overwintering area in the drainage.

The homing mechanism that guides Taku chinook salmon into some headwater spawning tributaries, such as the Nakina River, appears to be extremely complex. The majority of Nakina River chinook fry migrate from the tributary shortly after emergence and rear for nearly a year in the mainstem river, yet return to the Nakina at maturity.

Summary of Taku Rearing Areas

<u>Major</u>:
1. Taku River
2. Nahlin River
3. Tseta Creek
4. Hackett River
5. Dudidontu River (if barriers removed, much potential)

<u>Minor</u>:
1. Nakina River
2. Yeth Creek
3. King Salmon Creek
4. Tatsatua Creek
5. Kawdy Creek

<u>Unknown</u>:
1. Sheslay River
2. Kowatua River
3. Sloko River
4. Inklin River mainstem

STIKINE RIVER SYSTEM STUDIES

The Stikine River drainage (Figure 2) encompasses approximately 19,400 square miles and discharges its flow into the Pacific Ocean 12 miles northeast of Wrangell. Barriers to anadromous migration such as waterfalls, rock slides and velocity blocks prevent access to over 50% of the watershed. The fourth salmon cannery in Southeastern Alaska was constructed 8 miles above the mouth of the river in 1887. It soon became evident that this large glacial river did not support sizeable runs of salmon, so the cannery was moved to Wrangell Island in 1889. Rich and Ball (1933) stated that the chief importance of the Stikine River lies in its chinook salmon fishery.

A severe restriction was placed on the fishery in 1963 with removal of the upriver markers, thereby closing the shallow tideflats. In the past a large percentage of the chinook catch had been made by gear fished in shallow tidal channels or drifted along the edge of sand bars. This closure drastically reduced the catch.

Escapement

Tahltan informants from Telegraph Creek, British Columbia, in past interviews have indicated that the Tahltan River is the major chinook spawning tributary of the Stikine River. However, chinook had not been observed during aerial surveys of the mainstem Tahltan as visibility was always impaired by glacial runoff. An aerial survey by Aloutte II helicopter on August 13, 1975 confirmed the importance of the mainstem Tahltan River. Conditions for viewing the escapement were excellent as

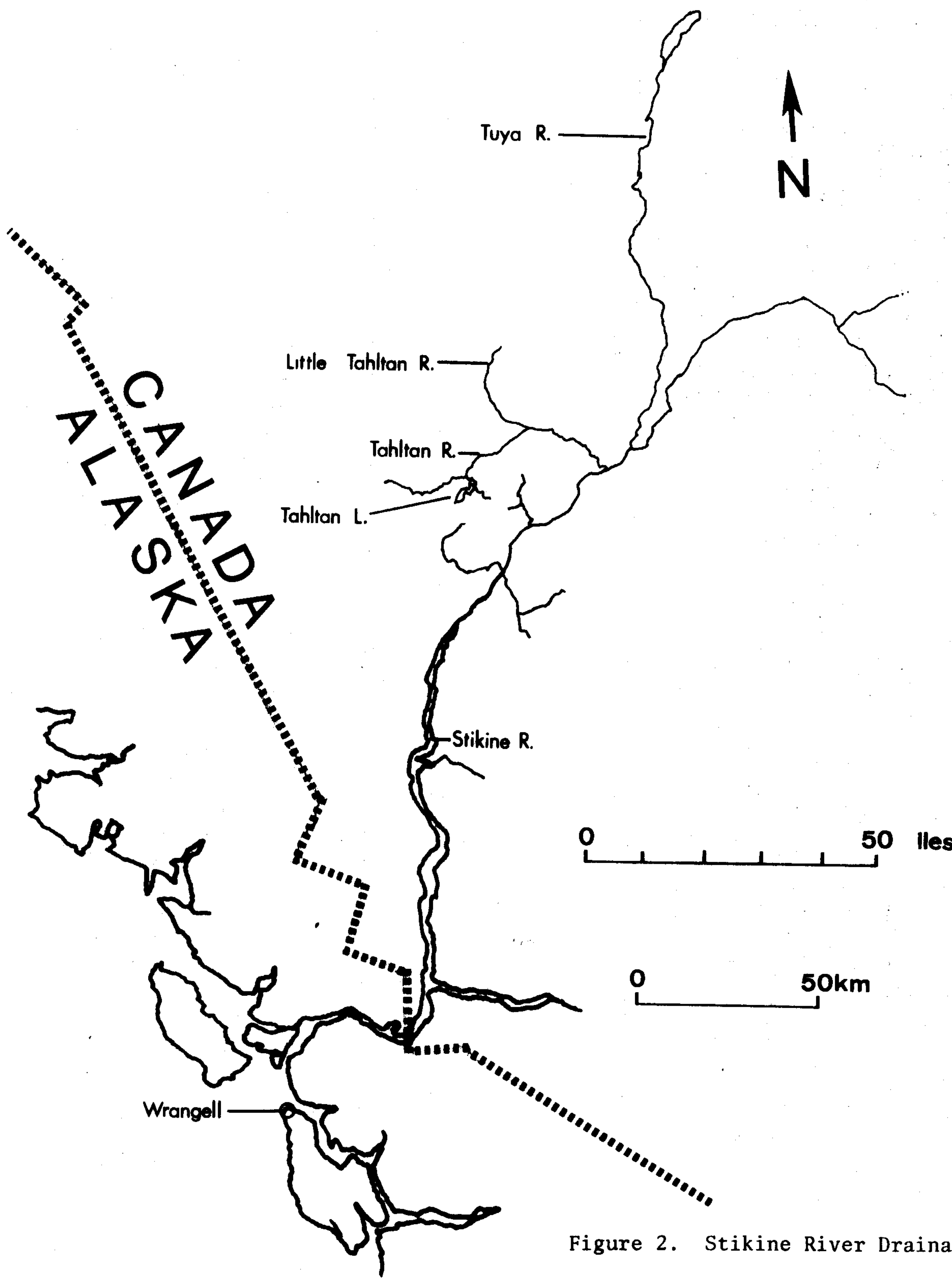


Figure 2. Stikine River Drainage

cool weather during the previous several days had greatly reduced the silt load. From the junction of the Stikine River to the junction of the Little Tahltan River 2,706 chinook were enumerated. In addition, 700 chinook were counted in the Little Tahltan River and 202 between the junction of the Little Tahltan River and the junction of the outlet stream from Tahltan Lake. The survey was 4-7 days late as quite a few dead fish were enumerated and the live ones were fungused and mostly spawned out.

During 1976 the mainstem Tahltan River remained high and glacial most of the summer. By August 20th the water had dropped and cleared and a survey was conducted by Aloutte II helicopter. Only 120 chinook were enumerated from the junction of the Tahltan and Little Tahltan to a point 3 miles below Beatty Creek. The survey was about 10 days late; but from the condition of the spawning gravel and number of redds observed, the escapement was rated as being very poor.

The Little Tahltan River was surveyed three times during 1976; but because of poor visibility, a good estimate was not obtained until the third survey, on August 7.

Previous ground surveys to estimate the escapement into the Little Tahltan were conducted by the Alaska Department of Fisheries from 1956-1960. This information, which had been lost, was located in an old Fish and Wildlife Service file in Wrangell during May, 1976 while there sampling the Stikine gillnet fishery (Table 8).

The Little Tahltan River should be monitored annually to index the Stikine chinook escapement. Water clarity and stream visibility are usually adequate for helicopter surveys; and ground surveys would not be of great expense because Saloon Lake, which is accessable by float plane, is only 1 mile from the river.

This system should be surveyed by helicopter or foot from Hyland Ranch to the junction of the Little Tahltan and Tahltan rivers. Dates of survey should be August 1-7; the best date is about August 4. The majority of the spawning occurs from Saloon to the junction of the Little Tahltan and Tahltan rivers. Besides chinook, a small number of sockeye salmon have been observed.

Little Tahltan Weir

A carcass weir was operated during August, 1976 on the Little Tahltan River, about 1 mile below the outlet of Saloon Lake, to determine the sex ratio and age of the chinook escapement. Only small numbers of chinook were enumerated at the weir because of the minimal escapement into this tributary.

The lack of chinook in their fifth year (1.3) indicates that the return of six year olds to the Tahltan in 1977 may be weak. This appears very possible as a large landslide (Cannery Slide) blocked access into the Tahltan during 1965 and only 85 chinook were airlifted over the barrier.

Table 8. Little Tahltan River Chinook Escapement.

Year	Date	Chinook	Remarks
1956	August 11	334 jacks 493 adults	Hyland Ranch to Tahltan River
1957	July 21	199	Too early-fish schooled
1958	August 6	790	3/4 mile below Hyland to 1 1/2 miles below Saloon
1959	August 7	198	Fish in poor condition-survey too late
1960	August 5	346	1/4 mile below Hyland Ranch to a mile or two below Saloon
1967		800	Canadian Survey
1975	August 13	700	Many spawned out
1976	August 7	400	Conditions fair

Since six year olds are predominate in the female component of the escapement, 1977 will be the second cycle return from the 1965 brood year.

Drift Gill Net Mesh Studies

Gill net mesh studies were conducted in the Taku River gillnet fishery during 1975 and the Stikine River gillnet fishery during 1976 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 at least the last 80 years on the Taku and Stikine rivers are highly selective to chinook from 660 to 900 mm, mid-eye to fork length. Over 98% of the female segment of the Taku and Stikine River chinook populations are within this size range, while only from 16.6% to about 25% of the males are. Thus the large mesh gear harvests a disproportionately high percentage of the females and a low percentage of the males. Selective breeding studies have indicated that 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 small males, the age, size and reproductive potential of the run will decrease.

If a gear size could be developed that harvests the majority of the small males and also takes the larger size groups, the stock would be in better condition and the fishermen may actually make more money.

Gill nets of 5 3/8" and 6 3/8" stretched measure nylon mesh, which were fished in Taku Inlet during 1975, indicated that a reduction in mesh size would significantly alter the size range, age composition and sex ratio of the harvest (Kissner, 1976).

The evaluation was continued during 1976 to gather additional information on fall gear (6 3/8" and 6 1/2" mesh) and to attempt to persuade the fishermen that a mesh size reduction would not greatly alter their income during "king season."

The sample size collected during 1976 was smaller than anticipated because of a weak spawning run to the Stikine River and the resulting emergency closure necessary to provide for adequate escapement.

Length frequency of chinook captured with fall and king gear were compared with the escapement length frequency which was collected at the Little Tahltan River carcass weir (Figure 3). As expected the fall gear fished a broader segment of the population than the 8 1/2" gear and harvested a much higher percentage of the available males (Table 9).

Although neither of the fishermen chartered to fish the fall gear had participated in the Stikine chinook fishery in the past, their seasonal income was only $100 to $125 below the average for fishermen utilizing "king gear." We feel that if the fishermen had known the area when they started fishing and the fishery had remained open in June, when smaller chinook are always more abundant, their income would have been much higher.

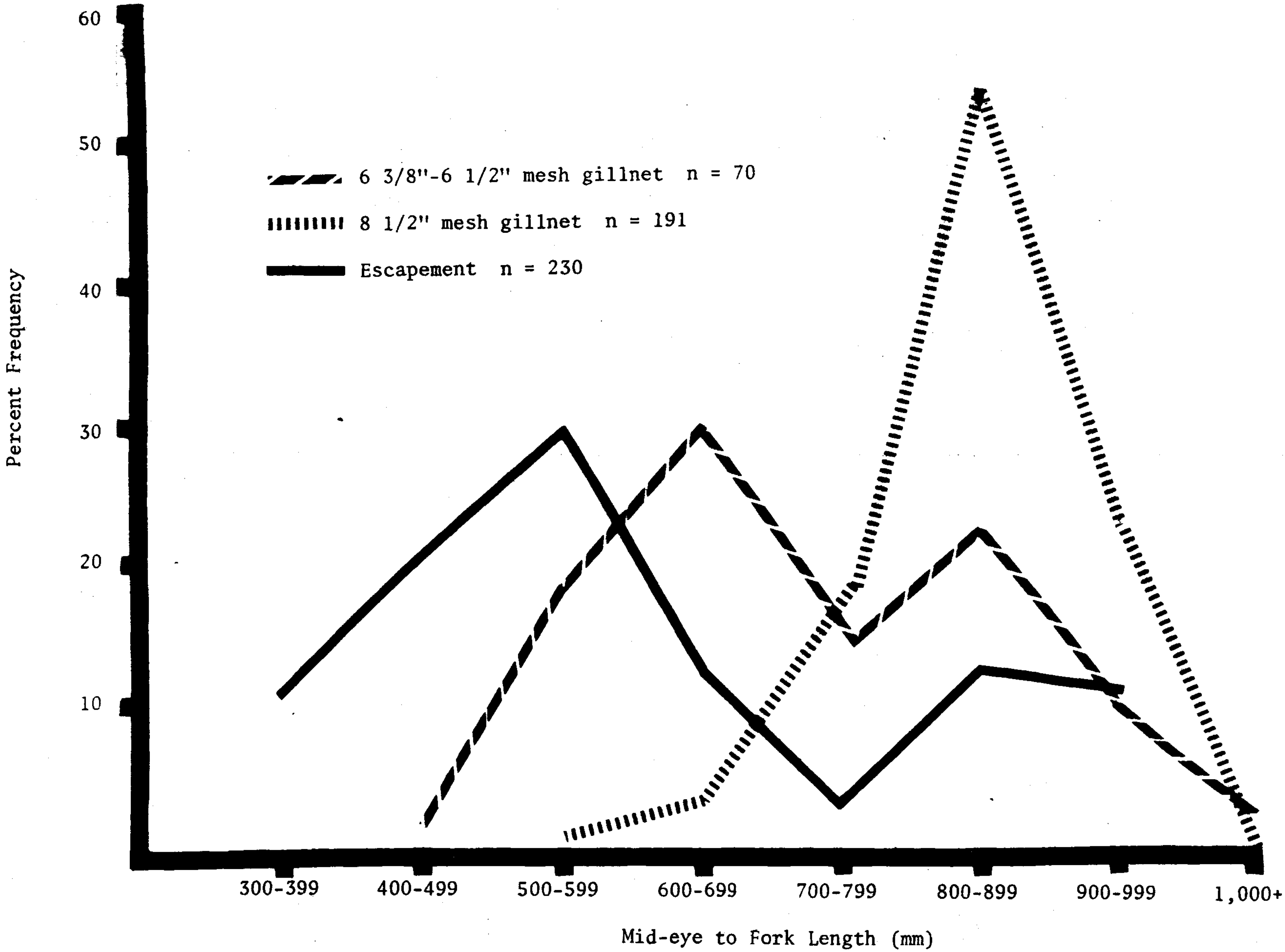


Figure 3. Length and frequency comparison of Stikine River chinook salmon caught by 6 3/8", 6 1/2" and 8 1/2" stretched measure nylon gillnets and the escapement, 1976.

Table 9. Comparison of chinook caught in 6 3/8", 6 1/2" and 8 1/2" stretched measure mesh in the Stikine River gillnet fishery.

Fisherman #1 6 3/8" gear	n=35
Average mid-eye fork length	733.7 mm
% Female	32.4
% Male	67.6
% Mature	97.1
% Immature	2.9
Total $ Earned	$647.89

Fisherman #2 6 1/2" gear	n=35
Average mid-eye fork length	730.9 mm
% Female	35.7
% Male	64.3
% Mature	80.0
% Immature	20.0
Total $ Earned	$663.29

Rest of Fleet 8 1/2" gear	n=191
Average mid-eye fork length	839.5 mm
% Female	51.7
% Male	48.3
% Mature	83.6
% Immature	16.4
Average $ Earned	$772.76

During several of the fishing periods the income from the fall gear was higher than all but two of the boats fishing the 8 1/2" gear, and during 1975 the 6 3/8" gear averaged almost twice as many kilograms per 24 hours as the 8 1/2" gear.

Recommendations

1. During "king season" all Southeast Alaska gillnet fisheries should be limited to a maximum mesh size of 6 1/2" stretched measure.

2. To avoid the taking of incidentally caught immature chinook the fisheries should be confined to a small area near the mouths of the various rivers.

ALSEK RIVER SYSTEM STUDIES

The Alsek River system, 50 miles southeast of Yakutat, is a typical southeast Alaska chinook system in that it is largely turbid with clear headwaters in the Yukon Territory of Canada. Like the other major chinook producing systems in Southeastern, barriers block anadromous migration to a sizeable portion of the drainage. A commercial set net fishery has operated in the mouth of the river and upstream since the early 1900's.

Catch

The chinook catch in the Alsek River has been extremely variable in the last 63 years (Table 10). The catch has ranged from 22,882 to 125. Part of the variability was caused by the lack of a market in some years. Since 1950, the largest catch has been 4,382 and has averaged 1,305 chinook. A regulatory change initiated in 1950 delayed the opening of the season from May 15 to June 1; this is part of the reason for reduced catches. To determine if this later opening had increased the stock, an experimental early opening occurred in 1961 and 1962. The catches were low and it was concluded that the Alsek chinook stock was "at a low level of abundance." The present fishery, with about 15 fishermen catching 1,200 chinook annually, is hardly comparable to the 1930 fishery which was utilized by 98 fishermen catching 10,305.

The Alsek River was monitored and samples were collected during June 1976 to determine the age, sex and size of maturing chinook harvested by chinook (8 - 8 1/2") and sockeye (5 3/8" - 5 1/2") gear. Direct observations and interviews with various fishermen indicated that very few chinook were caught by the smaller mesh size net. Samples collected during 1975 and 1976 indicated that a smaller percentage of the stock matures after one or two ocean years than in the Taku and Stikine Rivers.

Escapement

Escapement records of chinook in this system are extremely limited. No more than several hundred have ever been observed during aerial surveys

Table 10. Set net catch of chinook salmon in the Alsek River, 1908-1975.

1908 - 6,769	1933 - 12,427	1958 - 896
1909 -	1934 - 16,893	1959 - 967
1910 - 2,340	1935 - 6,869	1960 - 525
1911 - 316	1936 - Poor catch	1961 - 2,120
1912 - 2,098	1937 - Light catch-good escapement	1962 - 2,278
1913 - 4,066	1938 - 5,863	1963 - 125
1914 - 11,500	1939 - 6,318	1964 - 591
1915 - 8,340	1940 - 1,775	1965 - 719
1916 - 386	1941 - 3,858	1966 - 934
1917 - 14,372	1942 - No Fishing	1967 - 225
1918 - 11,708	1943 - No Fishing	1968 - 215
1919 - 13,031	1944 - 2,173	1969 - 685
1920 - 22,882	1945 - 10,662	1970 - 1,128
1921 - 10,683	1946 - 8,579	1971 - 1,222
1922 - 7,257	1947 - 6,391	1972 - 1,827
1923 - 14,228	1948 - 8,363	1973 - 1,754
1924 - 19,055	1949 - No cannery	1974 - 1,162
1925 - 19,130	1950 - No cannery	1975 - 1,379
1926 - 16,824	1951 - 184	
1927 - 8,153	1952 - 2,165	
1928 -	1953 - 1,534	
1929 -	1954 - 1,833	
1930 - 10,305	1955 - 2,881	
1931 -	1956 - 4,382	
1932 -	1957 - 1,800	

conducted by the Alaska Department of Fish and Game. A Canadian Fisheri agent reported a count of 1,700 chinook in the Klukshu River in mid-July of 1968, and a weir that was operated in 1976 revealed 1,277 chinook.

ESCAPEMENT IN OTHER AREAS OF SOUTHEAST ALASKA

Spring chinook systems are limited to the mainland rivers of Southeastern Alaska with the exception of a small, unique run into the King Salmon River on northern Admiralty Island (Figure 4). Information on chinook salmon escapements into many of the 33 known chinook systems (modified after Finger and Armstrong, unpublished) is extremely limited, as chinook counts are often incidental to enumeration of species present in greater abundance.

A summary of systems monitored annually follows:

King Salmon River (Admiralty Island)

This stock of chinook salmon is the only population in Southeast that has adapted to an island watershed and is nearly ripe upon entry into the river. The chinook begin entering the system about July 1 and peak entry appears to be between July 10 and 15. Peak spawning is between July 22 and 24. Escapement enumeration is presented in Table 11.

Chilkat River

A helicopter survey of the Chilkat drainage was made on August 6, 1976 to enumerate spawning chinook salmon. From past interviews with long-time residents of the area, it was determined that the major chinook spawning tributaries were the Tahini and Kelsall rivers. Both of these systems carried an extremely heavy silt load during the survey and no chinook were observed. A total of 25 chinook salmon were enumerated in Big Boulder Creek (Table 11). All of the chinook observed were spawned out and it appeared that peak spawning was about August 1.

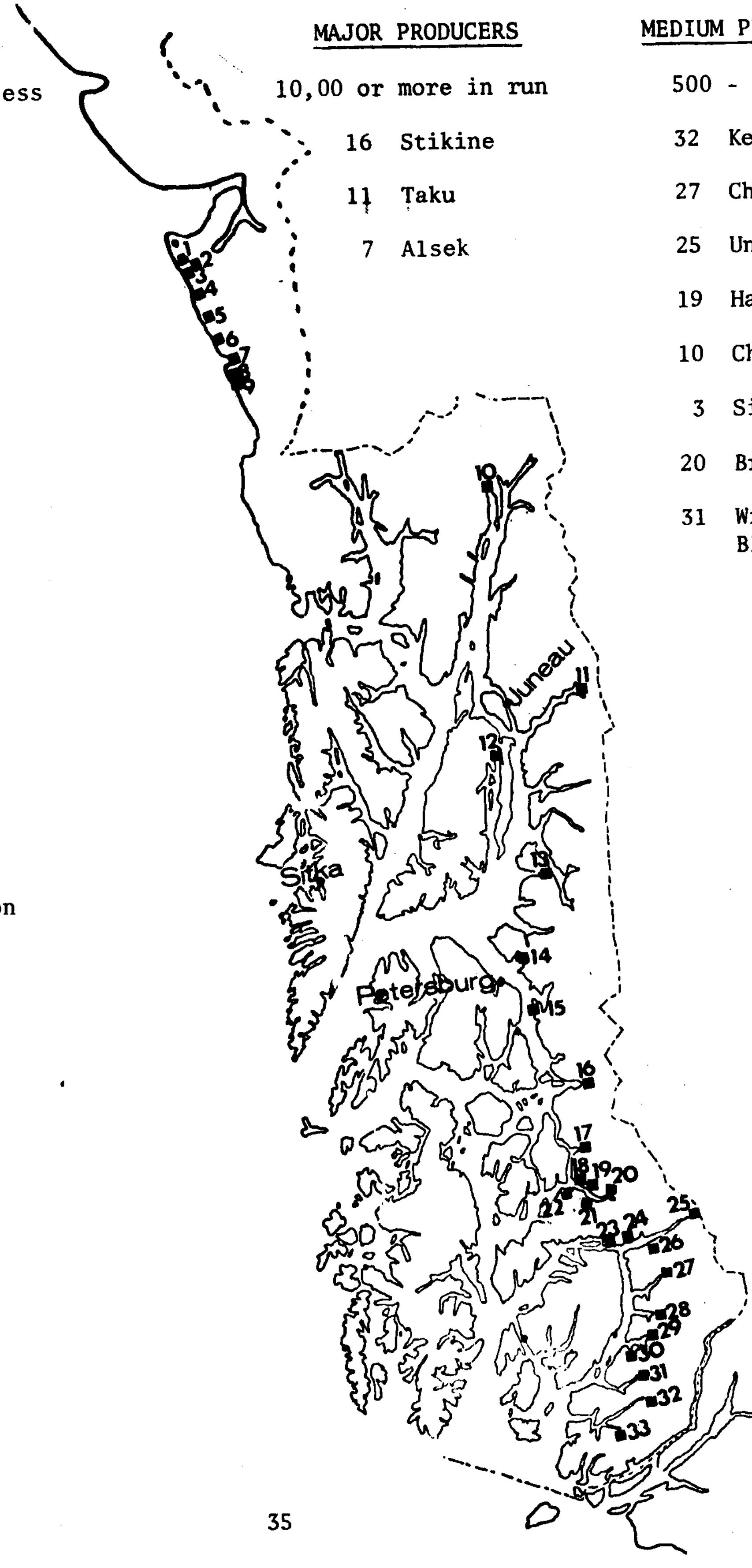
Unuk River

Periodic aerial surveys have been conducted on various tributaries of this large glacial river system (Table 11). Annual monitoring of Elulachon Creek, Clear Creek, Kerr Creek, Genes Lake, Sawmill Slough and Cripple Creek should be conducted during August 10-15 to determine the effect of regulations adopted by the Board of Fisheries in 1976 to protect Behm Canal chinook stocks.

Chickamin River

Aerial estimates of chinook salmon spawning in Humpy, King, Grizzly, Indian, Butler, Fly and South Fork creeks should be conducted from August 10-15. Past escapement data are presented in Table 11.

ure 4. Chinook salmon systems in Southeastern Alaska.



MINOR PRODUCERS

veral hundred or less

33 Martin
30 Big Goat
29 Rudyard
28 Walker
26 Klahine
24 Grant
23 Herman
22 Anan
21 Eagle
18 Tom
17 Aaron
15 Muddy
14 Farragut
13 Chuck
12 King Salmon
9 Dohn
8 East
6 Akwe
5 Italio
4 Dangerous
2 Lost
1 Ankau

MAJOR PRODUCERS

10,00 or more in run

16 Stikine
11 Taku
7 Alsek

MEDIUM PRODUCERS

500 - 5,000

32 Keta
27 Chickamin
25 Unuk
19 Harding
10 Chilkat
3 Situk
20 Bradfield
31 Wilson-Blossom

Table 11. Peak escapement counts of chinook salmon in Southeast Alaska rivers.

King Salmon River (Admiralty Island)

Year	Chinook	Method
1957	200	Foot
1961	117	Foot
1971	94	Foot
1972	90	Foot
1973	211	Foot
1974	104	Foot
1975	42	Foot
1976	65	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
1976	25	Foot, helicopter

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
1957	500	Air
1961	270	Foot
1973	64	Helicopter
1974	68	Helicopter
1975	20-25	Helicopter
1976	15	Air

Table 11. Peak escapement counts of chinook salmon in Southeast Alaska rivers (cont'd).

Chickamin River

Tributary	1975 Chinook	1976 Chinook	Method
El Paso	0	30	Helicopter
South Fork	141	46	Helicopter
Indian	90	5	Helicopter
Butler	66	15	Helicopter
King	30		Helicopter
Humpy	7		Helicopter
Barrier	9		Helicopter
Leduc	6	12	Helicopter
Above Indian	11		Helicopter
	360	108	

Wilson - Blossom River

Year	Chinook	Method
1961	68	Ground
1963	825	Air
1972	500	Air
1974	166	Helicopter
1975	153	Helicopter
1976	68	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	1,000*	Air
1956	1,500*	Air
1957	500*	Air
1961	44	Ground
1975	203	Helicopter
1976	84	Helicopter

Table 11. Peak escapement counts of chinook salmon in Southeast Alaska rivers (cont'd).

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	Float
1976	1,942	Weir

* Probably chum salmon
** Weir out part of the time

Wilson-Blossom Rivers

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 are presented in Table 11. Chinook enumerated during 1955-1957 were probably chum salmon, *Oncorhynchus keta* (Walbaum).

Situk River:

A weir was utilized to enumerate chinook salmon in the system during 1976. Escapement data are presented in Table 11.

STOCK SEPARATION

Racial studies were conducted to attempt to determine if reduced harvests of chinook salmon in Southeast Alaska were caused by declining native populations or depletion of stocks in British Columbia, Washington, and Oregon (Kissner, 1973, 1974, 1975, 1976).

Scale Analysis

The mean count of circuli to the first freshwater annulus of known origin, spring chinook salmon scales increased in river systems sampled from north to south. The mean circuli count in individual Southeast Alaska systems ranged from 7.53 to 9.27, while in rivers to the south the range was between 11.28 and 15.62. These differences were not of sufficient magnitude to separate stocks from individual river systems, but were great enough to determine the percentage of Alaska and non-Alaskan chinook in various mixed stock fisheries (Kissner, 1974).

Major overlap of counts between systems occurred only at 10-12 circuli, thus counts of less than 10 circuli would have a high probability of being of Alaskan origin and greater than 12 circuli of non-Alaskan origin.

Circuli counts of Alaskan and non-Alaskan chinook were compared with circuli counts of chinook caught in various saltwater fisheries in Southeast. A biometrician analyzed the data by simulated sampling via computer. Simulated sampling basically involves drawing repeated samples from the theorectical probability distributions, which represent the actual distributions of the variables involved. With simulated samples of 10,000 chinook salmon each, he varied the proportion of Alaskan salmon from 1.00 to 0.00 in increments of 0.10 and calculated the relative frequencies of the number of circuli in the combined sample of

Alaskan and non-Alaskan salmon that resulted in each of the 11 cases. He also calculated the relative frequencies of number of circuli for the various mixed stock fisheries and compared these frequencies to the frequencies simulated in each of the 11 cases by calculating an average difference ("average error") of the frequencies in each circuli class for each of the 11 cases considered. This statistic indicates how closely the relative frequencies of individual mixed stock fisheries are matched by the 11 simulated catch frequency distributions for the various assumed proportions of Alaskan chinook salmon. The best match occurs where the average error has its minimum value.

Since a portion of chinook from each area sampled were of the fall run variety, and thus of non-Alaskan origin (Alaska has only spring run chinook); and since the computer simulation determined only the percentage of spring chinook of Alaskan origin, an adjustment was made in each area sampled.

Results of simulated sampling during 1974-1976 indicated that from 50% to 72% of the chinook harvested in Area 111 were of Alaskan origin. Analysis also indicated that during 1972 the Sitka sport harvest was composed of 100% non-Alaskan chinook salmon, the Ketchikan sport harvest was composed of about 28.5% Alaskan chinook during 1973 and a commercial troll sample from the Fairweather Grounds indicated that no chinook of Alaskan origin was present.

The results of the study agree closely with tagging studies conducted in inside and outside waters of Southeast during the early 1950's (Parker and Kirkness, unpublished).

Reproductive Tracts

During 1972 reproductive tracts were collected in various fisheries in the inside and outside waters of Southeast to determine if maturing spring and fall chinook could be reliably separated. Spring chinook are usually sub-2, spending one year in freshwater after emergence and fall chinook are commonly sub-1, migrating to the estuary normally within 90-120 days of emerging. Classification of subtype in a mixed fishery by scales alone is often extremely difficult (Jensen, personal communication). Parker and Kirkness (1956) in their study of the offshore troll fishery state, "considerable room for doubt of correct interpretation exists, particulary in distinguishing a stream type from an ocean type nucleus." Since only the spring, or sub-2, are produced in Alaskan river systems, correct interpretation would achieve partial stock separation.

The results of this study indicate that separation of maturing chinook of various subtypes is possible if samples are collected in various areas over an extended time period and compared (Kissner, 1973).

BROOD STOCK DEVELOPMENT

With a long-range goal of enhancing chinook salmon fisheries in certain areas of Southeast Alaska, various methods of securing native brood stock were investigated. From escapement surveys conducted since 1972 it was apparent that no population of chinook salmon in Southeast was of sufficient magnitude to tolerate the large scale egg takes necessary to make significant contributions to local fisheries. Spawning stocks were at such a low level that utilization of escapement for artificial propagation could seriously jeopardize most populations. Therefore, we felt that a reliable brood source must first be developed, which would take at least one life cycle or six years, before we attempted to enhance certain chinook fisheries.

During 1973 an attempt was made to collect brood stock for the Crystal Lake Fish Hatchery in Petersburg by capturing maturing chinook salmon in Taku Inlet during an open commercial fishing period and transplanting the catch to the hatchery to be held till maturation. Nineteen chinook were transplanted but none survived to maturity (Kissner, 1974).

During 1974 permission was obtained for Environment Canada to utilize a maximum of 50 female chinook salmon from the Nakina River, a clearwater tributary of the Taku River, to aid in establishment of a brood stock. Subsequent escapement surveys of this drainage indicated an extremely weak spawning run; and it was decided that an egg take could possibly place several year classes in jeopardy and, therefore, no Taku chinook spawn was taken (Kissner, 1975).

In August 1975 approximately 273,000 spring chinook eggs were taken from three stocks of Southeast origin. Mortality from coagulated yolks in the alevin stage (white-spot disease) and infertility were severe, and survival from egg to smolt was less than 10% (Kissner, 1976).

During 1976 approximately 280,000 spring chinook eggs from Andrews Creek and the Chickamin and Unuk rivers were taken. As in 1974 and 1975 the number of females spawned was based on the magnitude of the escapement. Survival of egg to fry to date has been encouraging.

From past literature review and corresondence with individuals in Washington, Oregon and British Columbia, it was determined that returns of hatchery reared spring chinook salmon were almost always very poor.

There have been indications, Royal (1972) and Hager (personal communication), that a successful hatchery program for spring chinook salmon requires that smolts be reared to 10 to the pound or larger.

REGULATORY CHANGES

Results of studies conducted by the Chinook Salmon Research Project have indicated that regulatory changes were necessary to protect and attempt to rebuild various depleted native chinook stocks.

Following are proposals subsequently adopted by the Board of Fisheries:

1. Reduction of the sport fishing bag limit to one chinook salmon per day or in possession in the Situk River.

2. Closure of the Taku River gillnet and sport fisheries through mid-June to allow for adequate escapement of maturing chinook salmon.

3. Placement of a 28" (711 mm) total length minimum size on sport caught chinook salmon in Southeast Alaska.

4. Reduction of the sport fishing bag limit to one chinook salmon per day or in possession in the Juneau area.

5. Partial closure of commercial trolling in the Juneau area to protect immature Alaskan chinook salmon.

6. Area closure in the vicinity of Taku Inlet to sport and commercial trolling during the spring to protect maturing Taku River chinook salmon.

7. Sport and commercial closures and sport bag reduction in the Ketchikan vicinity to protect maturing Behm Canal chinook stocks.

Troll Fishery in Area 111

The commercial trolling closure in Area 111-A was effective in reducing the catch of Alaskan chinook salmon. We felt that since the area was closed from April 15 to August 14 that a "build up" might occur and large numbers of chinook might be taken after the opening. This was not the case as only 59 chinook salmon were taken from August 15 through December 31, 1976.

DISCUSSION

Native chinook salmon stocks are at a low level in all Southeast chinook systems monitored annually. It appears that the major reason for population declines in most stocks is due to overharvest. The chinook salmon is the only salmon species which is available to sport and commercial troll fisheries for three or four years; and in addition, is often subjected to net fisheries near their river of origin. We chastise other nations for harvesting immature salmon on the high seas yet permit our fishermen to take immature chinook.

To keep native spring chinook stocks from continued decline, it seems imperative that harvest of immature chinook must be controlled. Coded wire tagging of important Southeast chinook stocks will permit us to follow the migratory routes of immature chinook during marine rearing and thereby determine areas of exploitation.

Protection of our native stocks, by such means as spring closures to protect spawning runs to the Taku and Stikine rivers plus protection of immatures for one or two life cycles, has the potential of returning the stocks to their former abundance.

I believe we should attempt to rebuild our chinook stocks through better management before attempting to rebuild them through a large scale enhancement program. Other states have attempted spring chinook enhancement for many years, with little success.

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APPENDIX I SUMMARY OF CHINOOK SALMON TAGGED IN VARIOUS WATERS OF SOUTHEAST ALASKA

Location - Behm Canal, Bradfield Canal, Clarence Strait, Ketchikan Area

Tagging dates - September through June 1950, 1951, 1953, 1954

Number tagged - 732

Number recovered - 99

	Year	+1	+2	Total
Recovered within 10 miles of tagging site	32	27	3	62
Inside waters Southeastern Alaska >10 miles	5	3		8
Outside waters Southeastern Alaska	10	2		12
River recoveries Southeastern Alaska (Taku-2) (Unuk-1)	2	1		3
Outside waters British Columbia	4	2	1	7
River recoveries British Columbia	6	1		7

Location - Stephens Passage, Chatham Strait, Inner Icy Strait

Tagging dates - June through November 1950, 1951, 1952, 1953

Number tagged - 1,052

Number recovered - 107

	Year	+1	+2	Total
Recovered within 10 miles of tagging site	59	21	4	84
Inside waters Southeastern Alaska >10 miles	6	1		7
Outside waters Southeastern Alaska	1	2		3
River recoveries Southeastern Alaska*	2	3		5
Outside waters British Columbia	3			3
River recoveries British Columbia	3	1		4
River recoveries Washington	1			1

* (Chilkat-3) (Taku-1) (Stikine-1)

Location - <u>Cape Spenser to Cape Fairweather</u>

Tagging dates - May, June, 1950; June, July, August, 1951; May, June, 1952

Number tagged - 365

Number recovered - 57

	Year	+1	+2	+3	Total
Recovered within 10 miles of tagging site		2			2
Outside waters Southeastern Alaska >10 miles	2	5	4		11
Inside waters Southeastern Alaska	1				1
River recoveries Southeastern Alaska (Taku)	2				2
Outside waters British Columbia	3	7	2	1	13
Inside waters British Columbia		1			1
River recoveries British Columbia (Fraser)	3				3
Washington Coast	1	1			2
River recoveries Washington*	7	11	4		22

* (Columbia-21) (Willapa-1)

Location - <u>Stephens Passage, Funter Bay, Taku Inlet</u>

Tagging dates - May, June, 1950, 1951, 1952, 1953, 1955

Number tagged - 1,258

Number recovered - 211

	Year	+1	+2	Total
Recovered within 10 miles of tagging site	18	5	1	24
Inside waters Southeastern Alaska >10 miles	7	2		9
Outside waters Southeastern Alaska	5	1		6
River recoveries Southeastern Alaska*	162		1	163
Outside waters British Columbia	2			2
River recoveries British Columbia	5	2		7

* (Taku-156) (Chilkat-4) (Stikine-3)

Location - Sitka to Cross Sound

Tagging dates - May, June, July, August, September, 1950; June, 1951

Number tagged - 380

Number recovered - 74

	Year	+1	+2	Total
Recovered within 10 miles of tagging site	3	3		6
Outside waters Southeastern Alaska >10 miles	6			6
Inside waters Southeastern Alaska		1		1
Outside waters British Columbia	10	1		11
Inside waters British Columbia	2			2
River recoveries British Columbia*	16			16
Inside waters Washington	3			3
River recoveries Washington	20	1	1	22
Oregon Coast	1			1
River recoveries Oregon	6			6

* (Fraser-12) (Skeena-3) (Nass-1)

Location - Warren Island to Cape Felix

Tagging dates - May, June, July, 1950

Number tagged - 173

Number recovered - 26

	Year	+1	Total
Recovered within 10 miles of tagging site	3		3
Outside waters British Columbia	6		6
Inside waters British Columbia	2		2
River recoveries British Columbia	6		6
River recoveries Washington	6	2	8
Oregon Coast	1		1

APPENDIX II SOUTHEASTERN ALASKA COMMERCIAL CHINOOK CATCH BY GEAR 1911-1975

Year	Seines	Gillnet	Trap	Line	Total
1911	396	81,797	18,418	174,441	275,052
1912	1,061	83,779	41,054	197,952	323,846
1913	963	47,271	18,289	327,675	394,198
1914	6,336	45,767	24,377	275,637	352,117
1915	11,436	77,631	22,903	226,853	338,823
1916	7,184	34,421	21,299	379,154	442,058
1917	6,461	31,777	36,757	326,588	401,583
1918	16,765	20,935	31,667	371,719	441,086
1919	9,516	19,053	43,963	564,606	637,138
1920	6,540	60,297	54,080	366,510	487,427

10 Year Range 1911-1920
High = 637,138
Low = 275,052
Diff = 362,086

10 Year Total = 4,093,328
Average = 409,333

Year	Seines	Gillnet	Trap	Line	Total
1921	7,477	37,355	13,710	546,392	604,934
1922	2,705	73,884	32,223	506,852	615,664
1923	17,772	48,176	23,420	426,183	515,551
1924	9,568	79,538	24,058	483,819	596,983
1925	1,902	39,772	14,878	524,664	581,216
1926	1,503	17,679	15,147	330,296	364,625
1927	905	21,914	25,999	624,918	673,736
1928	1,440	24,522	11,270	347,349	384,581
1929	625	24,082	6,138	424,646	455,491
1930	978	23,671	9,403	575,952	610,004

10 Year Range 1921-1930
High = 673,736
Low = 364,625
Diff = 309,111

10 Year Total = 5,402,785
Average = 540,279

Year	Seines	Gillnet	Trap	Line	Total
1931	780	27,550	8,605	423,260	460,195
1932	288	25,963	4,847	595,747	626,845
1933	1,026	20,624	7,655	397,884	427,189
1934	1,357	32,294	7,198	298,183	339,032
1935	22,164	18,093	5,697	595,503	641,457
1936	1,717	25,793	6,908	646,645	681,063
1937	3,390	21,791	8,146	846,151	879,478
1938	21,439	22,702	7,124	705,852	757,117
1939	1,575	6,708	3,860	639,923	652,066
1940	875	6,871	3,172	417,483	428,401

10 Year Range 1931-1940
High = 879,478
Low = 339,032
Diff = 540,446

10 Year Total = 5,892,843
Average = 589,284

Year	Seines	Gillnet	Trap	Line	Total
1941	8,480	6,211	2,587	595,572	612,850
1942	10,663	7,340	3,316	537,087	558,406
1943	4,982	1,181	4,174	388,463	398,800
1944	2,224	3,961	2,758	319,347	328,290
1945	24,028	27,542	3,232	383,312	438,114
1946	22,192	18,125	1,733	526,438	568,488
1947	5,264	14,744	1,136	474,954	496,098
1948	227	20,514	271	459,084	480,096
1949	492	7,399	13	472,159	480,063
1950	12,905	12,288	408	353,071	378,672

10 Year Range 1941-1950
High = 612,850
Low = 328,290
Diff = 284,560

10 Year Total = 4,739,877
Average = 473,988

Year	Seines	Gillnet	Trap	Line	Total
1951	1,751	20,400	1,029	451,180	474,360
1952	1,625	79,323	583	446,816	528,347
1953	4,921	28,812	1,960	462,652	498,345
1954	9,449	42,613	1,450	344,108	397,620
1955	9,874	35,095	1,344	325,960	372,273
1956	4,702	31,220	5,775	197,451	239,148
1957	3,975	24,375	2,363	269,333	300,046
1958	5,330	31,699	2,204	285,921	325,154
1959	4,549	41,686	17	318,488	364,740
1960	6,799	19,548	48	282,678	309,073

10 Year Range 1951-1960
High = 528,347
Low = 239,148
Diff = 289,199

10 Year Total = 3,809,106
Average = 380,911

Year	Seines	Gillnet	Trap	Line	Total
1961	5,791	16,910	27	204,276	227,004
1962	12,053	17,171	7	173,578	202,809
1963	6,765	7,096	-	243,679	257,540
1964	16,819	9,423	-	328,944	355,186
1965	15,166	12,013	-	258,586	285,765
1966	11,876	12,631	-	281,484	305,991
1967	9,056	16,501	-	273,225	298,782
1968	13,335	13,005	122	301,351	327,813
1969	6,730	15,640	-	285,825	308,195
1970	5,957	11,759	-	304,245	321,961

10 Year Range 1961-1970
High = 355,186
Low = 202,809
Diff = 152,377

10 Year Total = 2,891,046
Average = 289,105

Year	Seines	Gillnet	Trap	Line	Total
1971	4,799	17,759		311,420	333,978
1972	16,800	27,609	135	242,285	286,829
1973	8,751	27,199	25	307,648	343,623
1974	6,759	17,690	15	322,129	346,593
1975	2,056	11,311	3	287,337	300,707

APPENDIX III

Gillnet Catch of Chinook Salmon in Taku Inlet

-May-
1932-1946

Day	1932	1933	1935	1945 Boats	1945 Chinook	1946 Boats	1946 Chinook
01						5	30
02						14	93
03						19	172
04						24	208
05						--	---
06						28	137
07						21	142
08						32	290
09						38	340
10			79	7	115	35	298
11			142	11	108	27	213
12	240		---	12	180	--	---
13	240		60	--	---	23	172
14	240		78	17	178	28	214
15	240		87	20	265	32	223
16	240		190	21	198	30	241
17	240		209	22	253	36	410
18	240		196	23	222	38	878
19	240		---	20	151	--	---
20	240		101	--	---	29	363
21	220		133	20	168	41	461
22	220		184	23	110	38	687
23	220		268	23	104	39	324
24	220		348	24	237	40	237
25	220		686	24	270	28	133
26	220		---	23	760	--	---
27	220	17	171	--	---	23	80
28	220	--	314	22	307	32	111
29	220	39	81	24	353	32	153
30	220	30	192	24	75	26	94
31	220	26	194	17	55	--	---

Gillnet Catch of Chinook Salmon in Taku Inlet (cont'd)

-May-
1947-1950

Day	1947 Boats	1947 Chinook	1948 Boats	1948 Chinook	1949 Boats	1949 Chinook	1950 Boats	1950 Chinook
01	14	33	1	3	--	---	10	38
02	18	48	--	---	12	50	14	83
03	21	46	--	---	14	81	16	102
04	--	---	5	21	11	51	17	107
05	12	62	12	99	16	102	18	159
06	23	84	14	68	17	204	17	265
07	25	88	14	136	11	92	--	---
08	23	87	19	191	--	---	17	165
09	21	86	--	---	13	74	24	189
10	18	86	22	132	25	139	20	264
11	--	---	27	364	27	281	18	203
12	18	97	28	292	24	263	25	256
13	24	101	27	346	23	180	23	287
14	32	113	32	282	21	143	--	---
15	28	244	29	226	--	---	17	395
16	32	258	--	---	23	345	21	477
17	32	289	25	124	32	430	27	447
18	--	---	29	150	32	211	28	431
19	18	105	31	129	21	257	15	172
20	24	179	25	133	29	515	25	397
21	27	128	28	147	33	234	--	---
22	24	112	30	246	--	---	22	220
23	27	170	--	---	22	220	26	304
24	32	327	27	534	28	152	29	271
25	--	---	33	468	28	139	28	296
26	19	244	31	300	29	432	28	278
27	33	191	31	316	19	234	29	586
28	31	150	38	246	32	320	--	---
29	25	130	32	308	--	---	26	521
30	22	94	--	---	27	180	21	267
31	4	20	11	59	30	472	26	162

Gillnet Catch of Chinook Salmon in Taku Inlet (cont'd)

-May-
1951-1954

Day	1951 Boats	1951 Chinook	1952 Boats	1952 Chinook	1953 Boats	1953 Chinook	1954 Boats	1954 Chinook
01			3	18				
02			16	47				
03			9	22			16	84
04					11	83	26	247
05			1	6	30	236	36	370
06			20	189	25	202	35	307
07	22	183	18	103	22	160	27	282
08	32	346	30	285	26	136		
09	33	180	35	517				
10	39	270	38	524			49	813
11	39	345			20	163	46	685
12	35	244	14	111	49	333	46	468
13			36	434	49	399	50	521
14	12	37	48	686	45	611	32	187
15	35	161	55	660	43	315		
16	31	188	59	830				
17	35	163	57	786			49	511
18	22	90			15	193	61	687
19	31	288	32	272	15	235	51	219
20			53	536	46	235	44	321
21	26	512	59	403	52	840	35	339
22	40	1031	47	174	45	840		
23	41	580						
24	43	906					61	901
25	42	940			32	503	67	1718
26	43	1016	56	1337	63	1219	67	1349
27			69	1095	51	744		
28	33	264	59	603	50	696		
29	40	377	52	481	33	296		
30	38	441						
31	39	497						

Gillnet Catch of Chinook Salmon in Taku Inlet (cont'd)

-May-
1955-1958

Day	1955 Boats	1955 Chinook	1956 Boats	1956 Chinook	1957 Boats	1957 Chinook	1958 Boats	1958 Chinook
01			7	33	1	18		
02			27	283	17	153		
03	3	35	33	332				
04	29	388						
05	35	406					2	10
06					26	315	35	515
07			12	87	12	130	41	620
08			61	819	3	33	43	644
09	13	135	55	473	20	199		
10	51	824	54	867				
11	46	595	3	62				
12	41	530					13	196
13					20	76	45	1098
14			10	113	23	160	59	772
15			55	987	37	200	54	470
16	8	61	57	546	30	401		
17	74	1033	55	508				
18	59	569						
19	62	453					3	14
20							72	1356
21			3	11	41	175	64	716
22			65	652	36	219	50	353
23	17	191	63	498	27	133		
24	73	1065	56	357				
25	47	391	3	44				
26	60	345						
27							69	1247
28			6	34	46	1462	68	905
29			64	825	53	1255	65	880
30	10	45	54	432	41	970		
31	69	585	59	773				

Gillnet Catch of Chinook Salmon in Taku Inlet

-June-
1932-1954

				1953		1954	
Day	1932	1933	1935	Boats	Chinook	Boats	Chinook
01	220	47	479	40	827		
02	220	94	---	56	1466	52	484
03	220	29	375	56	1293	63	915
04		--	833	60	1229	65	776
05		84	383	29	430		
06		175	305				
07		54	277			47	275
08		193	384	26	188	56	588
09		194	---	48	584	60	621
10		79	78	43	487		
11		--	321	31	249		
12		--	335	4	15		
13		--	152				
14		45	263			39	236
15		--	352			35	558
16		--	---			61	795
17		--	152				
18		--	296				
19		54	415				
20		4	243				
21		7	732			61	126
22		--	415			80	306
23		--	---			81	424
24		--	104				
25		--	219				
26		23	79				
27		--	163				
28			96			56	131
29			136			63	85
30			---			63	78

Gillnet Catch of Chinook Salmon in Taku Inlet (cont'd)

-June-
1955-1958

	1955		1956		1957		1958	
y	Boats	Chinook	Boats	Chinook	Boats	Chinook	Boats	Chinook
01	53	336						
02	44	235						
03							70	808
04			7	55	43	496	60	580
05			58	569	39	275	51	506
06	7	31	58	444	32	250		
07	73	769	40	159				
08	50	356						
09	50	375						
10							63	681
11			1	4	40	193	47	209
12			53	392	36	284	28	267
13	19	98	39	218	27	240		
14	64	504	33	361				
15	56	279						
16	31	138					4	15
17							51	360
18			1	5	44	200	54	203
19			50	235	44	139	41	356
20	33	88	38	181	41	129		
21	33	104	41	247				
22	57	97						
23	40	52					2	6
24					16	40	49	148
25			1	1	31	95	47	123
26			54	175	46	126	48	167
27	27	34	49	72	37	70	1	7
28	60	96	49	116				
29	55	69						
30	38	48					1	2

Gillnet Catch of Chinook Salmon in Taku Inlet
1959-1961

1959			1960			1961		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
				-May-				
04-07	51.6	1,388	02-05	78.0	1,214	01-04	65	999
11-14	59.7	2,450	09-12	89.0	1,270	08-11	69	993
18-21	64.7	2,148	16-19	90.0	1,542	15-18	72	1,699
25-28	63.7	3,415	23-25	88.0	1,194	22-25	67	1,249
				-June-				
01-04	55.7	3,882						
08-11	59.7	2,029	06-08	84.0	1,103	05-07	68	872
15-18	44.3	1,307				12-14	44	672
22-25	59.3	1,006	20-23	42.0	383	19-22	36	410
			27-30	53.0	247	26-29	41	205

Gillnet Catch of Chinook Salmon in Taku Inlet
1962-1964

1962			1963			1964		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
			-May-					
01	14	248	01	23	104	01	6	48
07-08	27	259	06-07	34	234	04-05	14	145
14-15	29	596	13-14	40	231	11-12	24	350
21-22	36	582	20-21	44	227	18-19	24	178
28-29	33	592	27-28	Closed		25-26	17	68
			-June-					
04-05	33	777	03-04	Closed		01-02	17	116
11-12	40	434	10-11	Closed		08-09	21	312
18-21	38	1,156	17-20	39	710	15-18	36	534
25-28	43	565	24-27	40	511	22-25	36	253

Gillnet Catch of Chinook Salmon in Taku Inlet
1965-1967

1965			1966			1967		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
				-May-				
01	2	18	01	1	7	01	7	100
02-03	3	84	01-02	10	24			
09-11	32	354	08-09	19	270	07-08	27	772
16-17	21	315	15-16	19	278	14-15	29	586
23-24	24	563	22-23	17	228	21-22	33	565
30-31	23	477	29-30	21	275	28-29	27	464
				-June-				
06-07	23	567	05-06	18	312	04-05	27	457
13-16	25	466	12-15	24	1,146	11-12	24	527
20-23	22	454	19-22	36	1,111	18-21	29	1,222
27-30	22	347	26-29	32	254	25-28	31	291

Gillnet Catch of Chinook Salmon in Taku Inlet
1968-1970

1968			1969			1970		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
			-May-					
01	17	159	01	25	166	01	18	126
05-06	33	374	04-05	28	280	03-04	28	196
12-13	37	618	11-12	27	260	10-11	28	154
19-20	34	376	18	24	157	17-18	Closed	
26-27	40	634	Closed			24-25	Closed	
			-June-					
02-03	35	497	01-02	25	1,135	01	36	328
09-10	36	584	08-09	31	365	07-08	Closed	
16-19	41	609	15-18	33	1,599	14-17	36	1,024
23-26	40	374	22-25	35	680	21-24	43	384
			29-30	45	444	28-30	43	347

Gillnet Catch of Chinook Salmon in Taku Inlet
1971-1973

1971			1972			1973		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
				-May-				
02-03	21	359	01	20	160	01	23	220
09-10	32	702	07-08	28	210	06-07	34	401
16-17	33	476	14-15	32	384	13-14	28	209
23-24	31	291	21-22	34	420	20-21	39	926
30-31	30	307	28-29	30	317	27-28	43	601
				-June-				
06-07	30	193	04-05	31	706	03-04	36	560
13-16	37	1,236	11-12	33	303	10-11	32	156
20-23	51	718	18-21	44	864	17-20	65	1,471
27-30	54	647	25-28	45	1,180	24-27	74	1,817

Gillnet Catch of Chinook Salmon in Taku Inlet 1974-1975

1974			1975		
Days	Boats Avg.	Chinook	Days	Boats Avg.	Chinook
		-May-			
01	29	145	01	23	127
05-06	32	198	04-05	18	182
12-13	Closed		11-12	21	114
19-20	Closed			Closed	
26-27	Closed			Closed	
		-June-			
02-03	Closed			Closed	
09-10	Closed			Closed	
16-19	65	1,103	15-18	56	652
23-26	80	288	22-25	83	472
30	116	256	29-30	98	211