INFORMATIONAL LEAFLET NO. 176

COHO SALMON (Oncorhynchus kisutch) FLUORESCENT PIGMENT MARK-RECOVERY PROGRAM FOR THE TAKU, BERNERS, AND CHILKAT RIVERS IN SOUTHEASTERN ALASKA (1972-1974)

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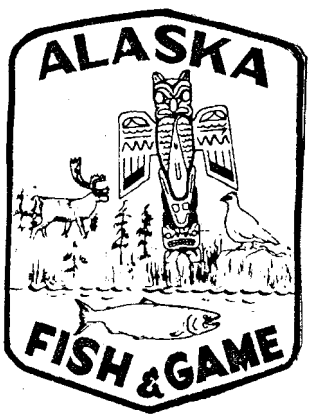

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ABSTRACT

Wild coho salmon juveniles were captured by minnow traps, adipose fin-clipped, fluorescent pigment marked, and released in rearing areas of the Taku, Berners, and Chilkat Rivers during the summer of 1972. Returning adults were sampled for marks at canneries and cold storage plants throughout Southeastern Alaska during the summer and fall of 1974. Fall spawning ground counts and mark sampling indicated commercial fishery harvest rates of 77 to 95%. Nearly 60% of tagged cohos were harvested by troll gear, nearly 40% by gillnet, and less than 2% by seine gear. Cohos from tagged portions of the Taku, Berners, and Chilkat Rivers contributed an estimated 11% (47,700 fish) to the northern Southeast Alaska commercial coho catch. Fingerling survival, migration timing, size, and age of tagged adults were determined. Minnow trapping and tagging of wild juvenile coho salmon appears to be an excellent method for obtaining data on migrations, timing, and gear type harvest rates needed for effective fishery management.

INTRODUCTION

The amount and efficiency of gear used for fishing coho salmon (Oncorhynchus kisutch) has greatly increased in Southeastern Alaska in recent years. From 1910 to 1927 the coho catch in Southeastern Alaska generally increased as the fishery developed. From 1928 to 1955 the catch was maintained at a fairly high level (average 1.8 million fish), and between 1956 and 1977 the catch declined (average 1.0 million fish) with a low of 427,357 fish in 1975. Expanding fishing pressure, in conjunction with a slowly decreasing average catch since the mid-1950's, has necessitated research to aid in management of the apparently dwindling stocks.

The technique of marking fish by forcing fluorescent pigment into the dermal tissue with compressed air from a small sandblast gun was introduced by Jackson (1959). The technique was refined, adapted for use with juvenile salmonids, and further described by Phinney (1966), Jaenicke (1967), Phinney et al. (1967), and Phinney and Matthews (1969).

During the summer of 1972 Alaska Department of Fish and Game (ADF&G) Coho Research personnel minnow trapped, pigment marked, and released over 21,000 wild coho juveniles from portions of the Taku, Berners, and Chilkat Rivers. The objectives of the project were to obtain information on migrations, timing, fishery harvest by gear type, and harvest rates of important wild coho stocks in northern Southeastern Alaska that could be used in management of the fishery. Coho juveniles from each river were adipose fin clipped and marked with a different color of fluorescent pigment, visible only under black light, to identify the river of origin. Only fish large enough to leave as smolts during the spring of 1973 were marked. About 75% of Southeastern Alaska cohos smoltify at age II+ or older after reaching a threshold size of about 90 mm, spend two summers in saltwater, and return as adults in their fourth year.

A marked fish recovery team was organized to recover returning adults during the summer of 1974. Commercial fishery landings were sampled at strategically located canneries and cold storage plants. There was also a limited effort to monitor the sport fishery by creel census in the Juneau and Haines areas. Spawning ground surveys were conducted for total escapement counts, and sampling with seines was conducted for a marked:unmarked ratio of returning adults during the fall of 1974.

MARKING PHASE

Methods and Materials

During the summer of 1972 juvenile cohos were captured with baited minnow traps in rearing areas of the Taku, Berners, and Chilkat Rivers. Nearly all of the rearing areas were remote and transportation in and out was accomplished by fixed wing aircraft, helicopter, or boat. In nearly all cases, it was necessary to fly personnel, camping equipment, food, boats, outboard motors and marking equipment both in and out of the study areas. Tent camps were set up in each area for 4 to 9 day periods. Inflatable boats were used to reach most rearing areas, and juvenile cohos were captured with "Gee" [1/] minnow traps baited with strawberry-sized portions of boraxed salmon eggs set in weedy areas of lakes, ponds, beaver ponds, sloughs, and slow, weedy sections of rivers. The traps were usually soaked for 1 to 3 hours before pulling, but sometimes overnight soaks were employed.

Scale samples and lengths were taken in each marking area to determine the maximum size of age 0+ fish. Previous sampling of the commercial fishery had demonstrated that nearly 75% of the cohos in Southeastern Alaska migrate to sea at age II+ or older. For this reason only fish large enough to be age I+ or older were marked to assure that the majority would migrate to sea as age II+ or older smolts during the spring of 1973, spend two summers feeding in the sea, and return as adults in the fall of 1974.

Cohos usually smoltify at 85 to 90 mm, though there are variations from area to area. The minimum size of juveniles marked was 65 mm in the Taku River and Berners River, 78 mm in Mosquito Lake (Chilkat River system) and 85 mm in Chilkat Lake. Fish below these sizes were determined to be age 0+. The range in sizes of juveniles marked was 65 to 90 mm in the Taku River and Berners River, about 78 to 120 mm in Mosquito Lake, and 85 to 140 mm in Chilkat Lake.

The rearing fish were usually captured by a two-man crew, transported to a marking area consisting of a screened-in tent (for protection from biting insects and rain), a table, dishpans, aerators, and the spraying equipment. The spray marking equipment (Figure 1, Appendix Table 1), consisted of a SCUBA tank containing compressed air, a pressure regulator,

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1/ Use of trade names is not intended to connote endorsement by the Alaska Department of Fish and Game.

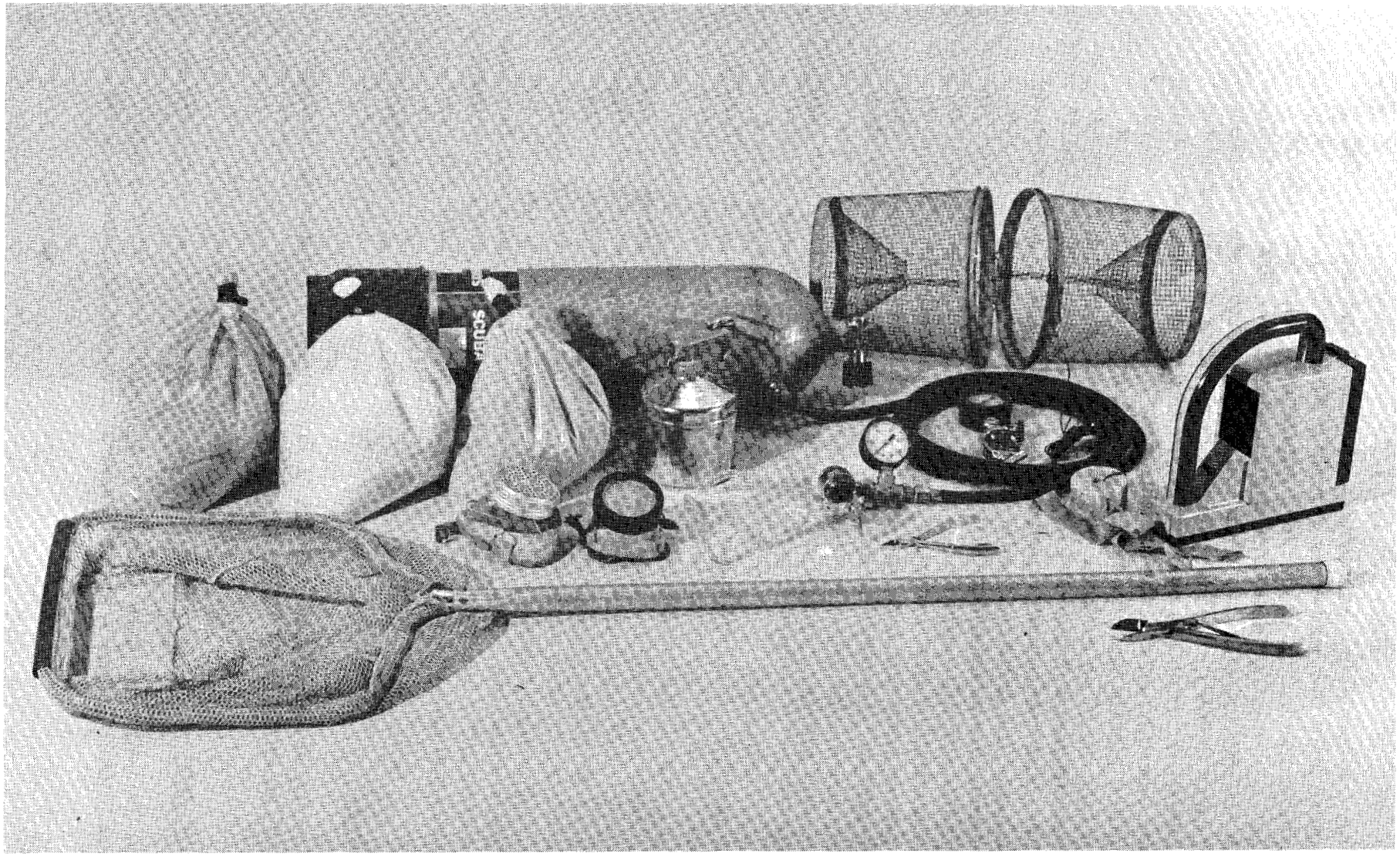

Figure 1. Minnow trap and spraying equipment used to capture and pigment mark juvenile coho salmon.

a 10 foot hose, a spray gun, cannister for pigment, and nozzle. The pigment used to mark fish was a dry grannular fluorescent powder that fluoresced under black light (3400-3800 angstroms), was non-soluble in water, was biologically inert, and contained at least 70% of particles between 50-350 microns in size. Four full SCUBA tanks were sufficient for marking up to 8,000 fish. Fish were marked either in a screened-in tent in bad weather, or on the banks of a stream, pond, lake, or in a boat when insects were absent and the weather good. The fish were held in several 5 gallon plastic buckets with lids and battery powered aerator pumps until they could be marked. They were then adipose fin clipped with surgical clippers and placed in a 12" x 18" dip net, about 12 to 15 fish at a time, and sprayed with pigment from a distance of approximately 10 to 12 inches. The pressure reading on the gauge was set at 105 lbs. It was not necessary to anesthetize fish to fin clip or spray them and, in fact the thrashing in the net probably ensured that all fish were hit with pigment. Immediately after spraying the fish were placed in a bucket of water and poured back and forth into another bucket several times. This washed off most excess visible pigment that had not penetrated the skin and probably helped somewhat to prevent predation after release. The larger individual pigment grannules embedded in the skin of the fish could only be seen under black light. Marked fish were held in aerated pails until taken by foot or boat back to their capture area for release 1 to 2 hours after marking. The limiting factor in the operation was the difficulty, or slowness, of capturing large numbers of age I+ or older cohos. There seemed to be fair to good numbers of rearing cohos in many scattered places but there were seldom large numbers of fish in any one area. Distances between concentrations of fish and between rivers made marking large numbers of rearing cohos difficult. An average of 473 fish per day were captured and marked over the season. Approximately two-thirds of the rearing cohos were captured and marked by a four-man crew, with two trapping and two marking. The rest of the work was conducted with two-man crews, both capturing and then marking the fish. Up to 1,000 coho juveniles were captured and marked per day in the best areas with a four-man crew.

Marking Areas

Marking locations and numbers of juvenile coho salmon marked in 1972 are shown in Appendix Table 2.

Taku River

The Taku River (Figure 2) is a large, glacial river flowing into Alaska from British Columbia about 33 miles northeast of Juneau. It has

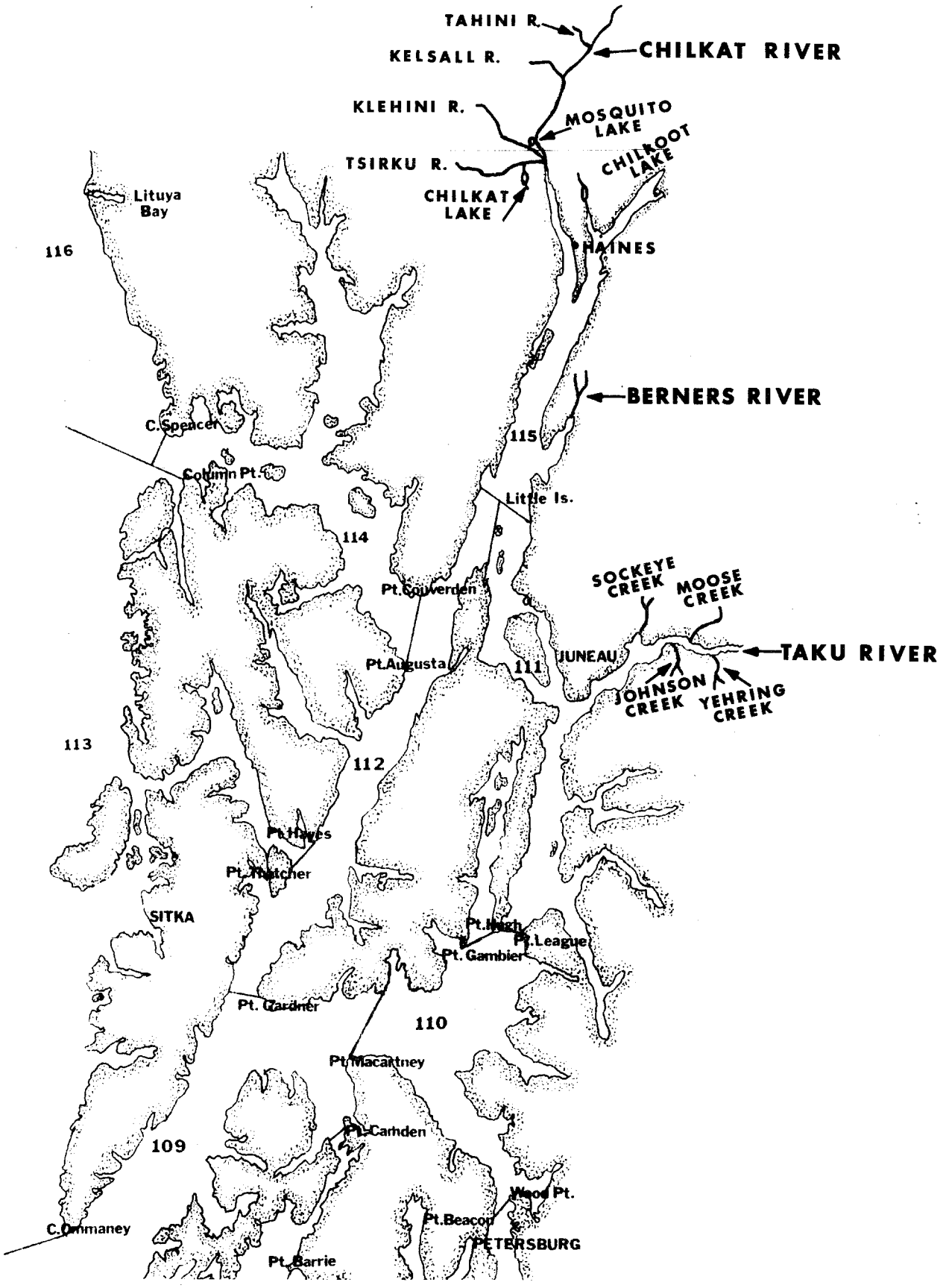

Figure 2. Pigment marking locations, 1972.

several tributary streams in Alaska which support coho salmon runs. These include Fish Creek, Moose Creek, Sockeye Creek, Yehring Creek, and Johnson Creek. Previous surveys had located concentrations of rearing cohos in Yehring and Johnson Creeks and these areas were selected for tagging.

Yehring Creek

Yehring Creek is a small brown colored tributary to the Taku River located about 27 miles northeast of Juneau. It has a coho salmon escapement of between 1,000 to 2,500 fish annually. The main stream has good spawning in the upper area but poor rearing in the main stream. The great majority of cohos rearing in this system utilized beaver ponds that averaged about 18.3°C during July while the main stream averaged 8.9°C to 10.0° C (6-28 to 7-6-72). Access to several beaver pond rearing areas by coho juveniles was probably only during high water levels in the spring or fall.

All cohos marked in Yehring Creek came from three separate groups of beaver ponds.

Johnson Creek

Johnson Creek is a small, clear tributary to the Taku River located about 24 miles northeast of Juneau (Figure 2). It has a coho escapement of 150 to 230 fish annually. The main stream has good spawning in the upper area but nearly all the coho rearing area is in the warmer, brown colored slough downstream from beaver ponds in the left fork. The main stream was 11.7° C while the left fork had a temperature of 15.6° C to 16.7°C on 8-5-71. Access to the left fork by juvenile coho salmon was at all water levels but at least one side pond required high water levels for access. All of the cohos that were marked in Johnson Creek came from the slow moving slough (left fork) below the beaver ponds, the small pond connected to the slough by a high water channel, and in some of the beaver ponds themselves. The beaver ponds on Johnson Creek were clearer, colder, deeper, and, in general, poorer coho habitat than those on Yehring Creek.

Berners River

The Berners River is a medium sized river about 45 miles north-northwest of Juneau. The main (west) fork is glacial, but clears after freeze-up in the fall, and has good spawning in the headwaters. Very little spawning appeared to take place in the east fork which was mostly

slow, weedy, and brown colored. Most of the coho rearing appeared to take place in the east fork which was 13.9° C on 7-13-72 while the west fork was much colder, only 5.0°C. The best catches were around weeds and logs. Some of the best catches came from a large, shallow, weedy, warm, (16.7°C) brown colored beaver pond halfway up, and connected to, the east fork by a narrow channel. In all of these ponds fish were large, fat, and in excellent condition. Spawning escapements for this river have ranged from 4,200 to 6,000 cohos during recent years. Coho fry resulting from spawning in the east fork appear to drift downstream in the cold glacial water and then ascend the warmer, brown colored waters of the east fork for rearing.

All cohos marked in the Berners River came from the slow and weedy east fork, weed filled side sloughs and ponds, and one large weed-filled beaver pond (1.215 ± Ha.), all connected to the east fork. No trapping was conducted in the glacial west fork as few rearing cohos were found there.

Chilkat River

The Chilkat River is a large, glacial river system about 85 miles northwest of Juneau (Figure 2). It has numerous, large, tributary rivers, small tributaries, and mainstream spawning areas. Known spawning areas include inlet streams in Chilkat Lake, Takhin River, Little Salmon River, Mosquito Lake inlet stream, Bear Lake inlet stream, 3/4 miles of the main Chilkat River just south of the Kelsall River, the Kelsall River, Nataga Creek, 3 total miles of main Chilkat River above and below Turtle Rock, Tahini River, and a small side tributary starting in Section 36 of T26S, R55E (Skagway C-3, topographic map 1:63,360). This river system is so large and complex that a total count of adult coho spawners would be nearly impossible to obtain. Known, important, coho rearing areas in the Chilkat River system include Mosquito Lake and many side sloughs and ponds along the main river. Chilkat Lake has a spawning escapement of approximately 1,000 coho adults but contains only scattered rearing populations throughout the lake. Most coho fry probably drift downstream from their respective spawning areas and rear in warmer side sloughs and ponds that connect with, or flow into, the main Chilkat River. Chilkat Lake has several spawning tributaries, the most important located at the south end of the lake. Mosquito Lake has a small spawning stream at the south end but it appears that many of the cohos rearing there enter when the Chilkat River floods and back flows into Mosquito Lake.

Most cohos that were marked in the Chilkat River system came from Mosquito Lake (121.5 ± Ha.), a medium sized, weedy lake connected by a

1/3+ mile long channel to the river, about 26 miles upstream from Haines. Chilkat Lake was the next best trapping area, although it had a relatively small amount of shallow, weedy areas for rearing. Important coho rearing areas in Chilkat Lake were weed beds at the south end near the inlet, the narrows, and the north end near the outlet. Trapping was also conducted in several ponds in the upper Chilkat River, off the mouth of the Tahini River and further downstream, but catches were poor and no concentrations of rearing cohos were found.

RECOVERY PHASE

Commercial Catch Sampling

Commercial fishery landings were sampled at cold storage plants and canneries at Pelican, Hoonah, Excursion Inlet, Juneau, and Petersburg (Figure 3) between June 15 and October 11, 1974. As coho stocks from the Taku, Berners, and Chilkat Rivers were believed to return through Cross Sound and Icy Strait, the majority of sampling effort was concentrated in these areas. Less effort was made in Chatham Strait and the southern areas. Sampling was conducted by six ADF&G biologists and technicians, who watched for adipose fin clipped cohos during the off-loading and sorting of fish at canneries and cold storage plants. Cohos were most easily examined for adipose fin clips as they moved down conveyor belts or during the sorting or dressing operations. Hand tally counters were used to record the number of fish examined for marks. Fish with missing adipose fins were examined with a portable black light in a dark location. Snout-fork and mideye-fork lengths were measured to the nearest 1/8 inch with a Stanley measuring tape, weighed to the nearest ounce on a hand scale (Chatillon Model IN-30), and recorded as either round or dressed weight. A smear of scales (15 to 20) was collected from each adipose fin clipped fish from the preferred area. Sex was determined on all round fish by making a short incision anterior to the vent and examining the gonads. The results of the biological sampling are given as a separate section appended to this report (Appendix A). General comments as to the quality of the adipose clip, location, color, and quantity of pigment (if any), general brightness, kype development, and presence and location of fluorescent fungus was also recorded. An orange, fluorescent fungus was confused with pigment early in the recovery program before any marked fish were found. Once the pigment on marked fish was recognized it was not confused with the fungus. The heads of fish lacking visible pigment were saved for later examination for coded wire tags. The few coded wire tagged cohos (7) and multiple fin clipped cohos (3) obtained were from fish originating to the south of Alaska (Oregon Department of Fish and Wildlife 1974 Wire Tag Recovery Report).

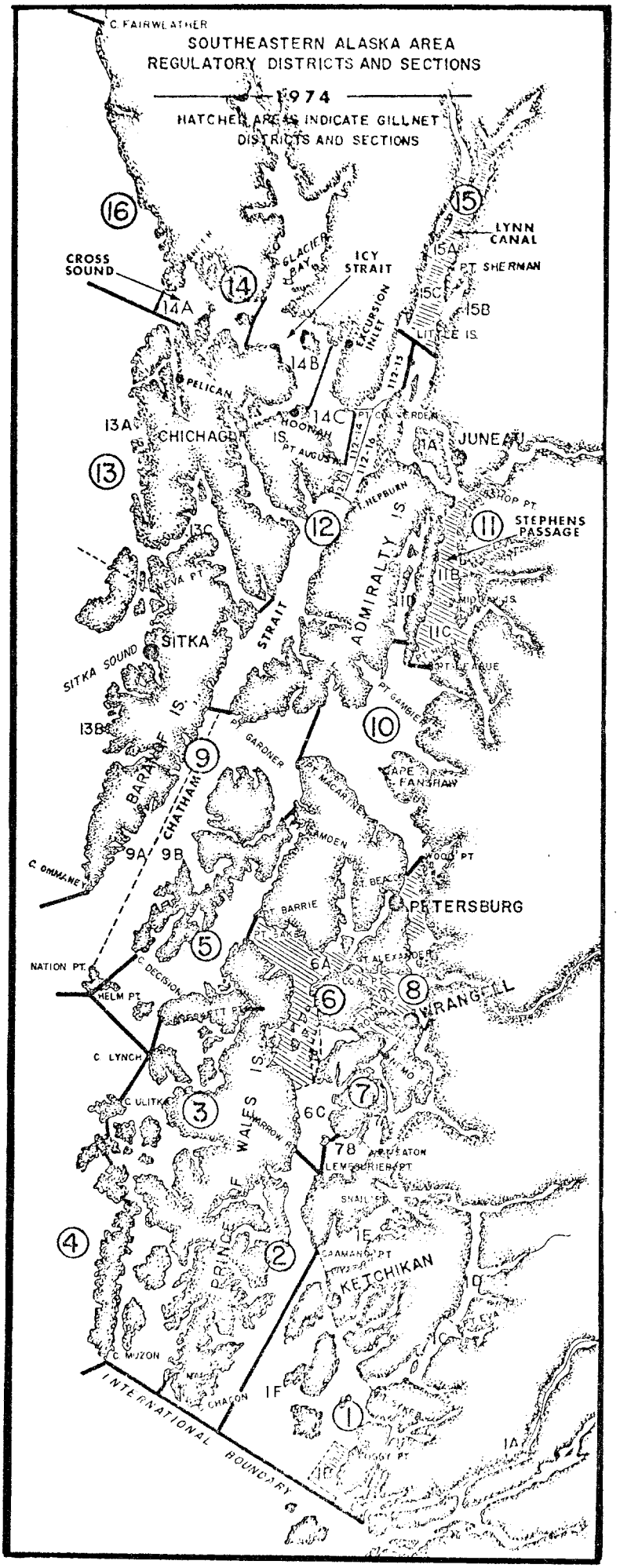

Figure 3. Commercial fishery regulatory districts in Southeastern Alaska where marked coho salmon were recovered.

Fluorescent pigment colors used were red for Taku River, green for Berners River, and orange for Chilkat River fish. Under examination with black light the pigment glowed as tiny pin points of fluorescent color of varying densities, depending on how much pigment was embedded in the skin of the flesh. Common locations for pigment on the marked fish were in the eyes, eye sockets, operculum, sides, bases of pectoral, ventral, and anal fins, and in the adipose scar area. About halfway through the recovery program we learned that by slicing skin off the scar from the adipose fin clip with a scalpel and checking the white meat for pigment with a black light we could nearly always find pigment, even in fish that otherwise displayed none.

During commercial landings of cohos the skippers of fishing vessels and tenders were interviewed to determine their fishing areas and dates of catch. All data computation was delineated by the statistical week (Appendix Table 3) in which the landing date of a catch occurred. Marked fish were recovered in many statistical catch areas. In order to simplify analysis of the data and make it more meaningful, catches from adjacent statistical fishing areas were grouped into eleven larger composite areas (Table 1 and Figure 3) so that migration routes and timing could be more easily followed. The groupings consisted of fishing districts (circled numbers on Figure 3), sections of districts (i.e., 14A, 14B, 14C), and a few individual statistical areas (i.e., 112-13, 112-14, 112-15, and 112-16) which were the smallest parts of districts.

The Sport Fish Division estimated that Juneau area sports fishermen took 5,622 cohos in 1974. Four pigment marked cohos were recovered from the sports fishery but the majority of the marks came from the commercial fishery.

Sampling Schedule

Sampling of the commercial fishery was conducted at the following locations and times:

Pelican: June 15 to September 19, 1974 (statistical weeks 24-38).

Hoonah: July 15 to 19; July 29 to August 23, 1974 (statistical weeks 29, 31 to 34).

Excursion Inlet: July 8 to 22; August 28 to September 26, 1974 (statistical weeks 28 to 30, 35 to 39).

Juneau: June 26 to October 11, 1974 (statistical weeks 26 to 41).

Table 1. 1974 Southeastern Alaska commercial coho catch by area, sample percentage, and number of marked cohos recovered.

Fishing areas	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total Expanded
[d] 13A, 14A & 16	238,959	189,941	79.49	107[e]	158	204	83	137	148	79	84	95	265	155	205	9	10	543	662
[d] 14B & C, 112-13, 112-14 & 112-16	47,391	13,417	28.31	11	14	67	9	11	68	7	7	23	14	9	48	---	---	41	206
[d] 11A & 112-15	34,134	21,116	61.86	21	36	53	10	15	24	5	5	9	20	---	---	---	---	56	86
[d] 15A & C	65,672	41,320	62.92	5	7	10	54	79	120	141	155	253	41	---	---	---	---	241	383
[d] 11B	42,661	25,489	59.75	49	72	114	---	---	---	---	---	---	23	---	---	---	---	72	114
10, 11C & D	24,720	3,112	12.59	---	---	---	---	---	---	---	---	---	5	(5)	29	---	---	5	29
12 so. of Pt. Hepburn	5,737	2,458	42.84	1	1	2	---	---	---	---	---	---	1	(1)	1	---	---	2	3
5, 9 & 13B	114,956	19,803	17.23	---	---	---	1	2	7	1	1	5	36	35	159	1	3	39	174
[f] 3 & 4	352,264	10,783	3.06	---	---	---	---	---	---	---	---	---	12	12	12	1	1	13	13
[f] 6, 7 & 8	95,146	4,156	4.37	---	---	---	---	---	---	---	---	---	6	6	6	---	---	6	6
[f] 1 & 2	177,885	305	0.17	---	---	---	---	---	---	---	---	---	1	1	1	---	---	1	1
TOTALS	1,199,525	331,900	27.66	194	288	450	157	244	367	233	252	385	424	224	461	11	14	1,019	1,677
Subtotal for major recovery areas	428,817	291,283	67.93																

(continued)

Table 1. 1974 Southeastern Alaska commercial coho catch by area, sample percentage, and number of marked cohos recovered (continued).

Total expanded estimate of adipose clipped cohos in the commercial catch.

TAKU	-	450	-	26.8%
BERNERS	-	367	-	21.9%
CHILKAT	-	385	-	23.0%
AD ONLY	-	461 f/	-	27.5%
OTHER (CWT & fin marks)	-	14 f/	-	.8%
Total Tags		1,677		100.0%

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.
d/ Major recovery areas.
e/ Includes adjustment for missed pigment marked fish at Pelican.
f/ No correction over observed numbers in areas 1,2,3,4,6,7, & 8 due to small sample sizes.

Petersburg: July 2 to October 3, 1974 (statistical weeks 27 to 40).

The coho fishery in Southeastern Alaska legally opens on June 15 with trollers along the outside coast taking the first fish. Later, cohos begin migrating through Icy Strait and upper Chatham Strait where they are available to both troll and purse seine gear, and, after moving up into Lynn Canal and off the Taku River, they are taken by drift gillnet and troll gear. The troll fishery for cohos closes on September 20 and the gillnet fishery for cohos usually closes during the first or second week in October.

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Spawning Ground Escapement Counts and Marked:Unmarked Sampling 1974

The objectives of the spawning ground surveys were to obtain total escapement counts of adult coho salmon for each study stream and to net, or otherwise capture, a sample of the escapement for a marked:unmarked ratio. From this information we were able to calculate the total number of marked fish escaping to spawn. By knowing the total number of marked cohos from a given river system that were taken by the commercial fishery and the total escapement we were able to calculate the harvest rate for that stock of fish.

Taku River

Yehring Creek

The Yehring Creek spawning ground surveys (Appendix Table 4) took place from 10-21 to 11-3-74. The creek was reached by fixed wing aircraft and then ascended with an inflatable Avon boat with an outboard motor. Fish in the lower reaches of the stream were counted from the boat while running slowly upstream and fish in the upper reaches of the stream were counted while walking streambanks. At the time of the spawning ground surveys record rainfall and flood conditions lowered stream visibility and made seining in the main stream nearly impossible. A total escapement count of 746 fish was obtained, though a determination of the marked: unmarked ratio was not possible. A second trip was made to Yehring Creek at a later date; 128 fish were captured, of which three (2.34%) had adipose clips.

Johnson Creek

The Johnson Creek survey was a continuation of the first Yehring Creek trip. A foot count showed a total escapement of 217 cohos. Seining

was impossible in Johnson Creek due to flood conditions but a careful visual examination of 36 cohos in a side channel showed one (2.78%) to be adipose fin clipped.

Fish examined for marks from Yehring and Johnson Creeks were combined for an overall marked:unmarked ratio of 4:160 (2.44%). Fish from these two streams were not separable in the commercial fishery as they were marked with the same pigment color.

Berners River

Berners River was reached by helicopter drop off in the headwaters of the west fork. Tent camps were made as we proceeded downstream by inflatable boat and pickup by helicopter was made at the river mouth when the survey was completed. The upper stream areas were reached by foot and a 50 foot seine was used to capture fish for examination in the upper areas in small, brushy, confined places. After the headwaters areas were foot surveyed, and samples of cohos examined for marks, the survey was continued by drifting downstream. A total escapement of 4,124 cohos was obtained for the Berners River. Of the 733 cohos examined, 19 (2.59%) were adipose fin clipped. Captured fish were given a partial dorsal fin-clip prior to release. This prevented counting a previously examined fish twice in the marked:unmarked ratio determination.

Chilkat River

No extensive escapement survey was conducted on the Chilkat River due to a lack of visibility in the glacial water, the impossibility of obtaining an escapement count, and flood conditions during the fall of 1974. A Sport Fish Division creel census on the Chilkat River near Haines estimated that sport fishermen caught 138 cohos. Twenty-three cohos were examined for marks but none were found. Sport fishing success was much below that observed in the previous 2 years and coho escapement to the Chilkat River was believed to be very poor.

It is quite interesting that the percentage of marked cohos in the escapement was similar (2.34% Yehring Creek, 2.78% Johnson Creek and 2.59% Berners River) for the three different streams. This was a much lower percentage than had been expected.

DATA ANALYSIS AND RESULTS

Method of Data Analysis

To determine a harvest rate for each study river it was first necessary to know the total commercial catch of coho salmon by statistical week by area. This was obtained from fish tickets filled out by fish buyers when the catches were landed. This data is summarized annually by the ADF&G Statistics Section. The number of marked fish found by area and statistical week and the percent of the catch that was sampled was then determined. The number of marked fish found in a sample was then expanded to an estimate of the number of marked fish in the total catch. The same method was employed for the spawning ground surveys. A total escapement count was made for each river, a sample of the escapement examined for marks, and the number of marks found in the sample expanded to the estimated number of marks in the total escapement. The ratio of marked cohos in the commercial catch to marked cohos in the escapement gave the harvest rate for each river.

Sampling Percentage

Of the 428,817 coho salmon caught in major recovery areas (fishing areas 11A and B, 12 (north of Pt. Hepburn), 13A, 14, 15A and C, and 16) 291,283 or 67.9% were sampled by recovery personnel (Table 1 and Figure 3). Approximately 28% of all the cohos commercially caught in Southeastern Alaska were sampled for fluorescent pigment marks. Table 1 shows the commercial catch of cohos, the sample size, the sampling percentage by area, and the number and catch location of marked fish. Commercial landings of cohos as reported on fish tickets for several statistical weeks were less than the number of fish examined for marks. This was probably due in a few cases to catches on the fish tickets being reported from erroneous catch areas. Because a few sample sizes were as high as 125% of reported landings the catch and sampling data were all grouped into two-week periods before expanding them. This tended to average out minor errors in the fish ticket catch reporting (Appendix Tables 5A-K).

Fluorescent Pigment Loss

Due to a wide variation in the amount of pigment found on returning adults, a correction factor was necessary for pigment loss. Pigment loss percentages were calculated for each river by examining adipose fin clipped cohos taken by the commercial fishery in near river-of-origin recovery

areas (fishing areas 11B, 15A and 15C). There were no other tagging projects anywhere near fishing areas 11B (Taku River mouth) or 15A and C (Lynn Canal) and no coded wire tagged or multiple fin clipped cohos found in these areas. Thus all adipose fin clipped cohos recovered in these areas were considered to be pigment marked fish. Pigment loss percentages were calculated by dividing the number of non-pigment marked adipose fin clipped fish by the total number of adipose fin clipped cohos (marked plus unmarked) found in the area.

Taku River (area 11B)

The Taku River pigment loss percentage was calculated using area 11B data where Berners and Chilkat River fish were not present. The total number of adipose fin clipped cohos caught in this area was 72 of which 49 had red (Taku River) pigment and 23 had no pigment.

$\frac{23}{72}$ = 31.94% Pigment loss estimate for Taku River fish

Chilkat River (area 15A)

The Chilkat River pigment loss calculation was more difficult as some Berners River cohos were mixed with Chilkat River cohos in area 15A. The ratio of Chilkat River cohos to Berners River cohos in the catch times the number of non-pigmented adipose fin clips gave the percentage pigment loss for the Chilkat River fish. The total number of adipose fin clipped cohos caught in this area was 126 of which 108 had orange (Chilkat River) pigment (85.71%), 9 had green (Berners River) pigment (7.14%), and 9 had no pigment (7.14%).

Ratio of orange to green clips = 108:9

9/117 = 7.69% of clips = green X 9 unknowns = 0.69 fish

108/117 = 92.31% of clips = orange X 9 unknowns = 8.31 fish

$\frac{8.31}{116.31}$ = 7.19% pigment loss estimate for Chilkat River fish

Berners River (area 15C)

The Berners River pigment loss calculation was difficult as both Chilkat River and Taku River cohos mixed with the Berners River cohos in

area 15C. The numbers of possible pigment marked Chilkat and Taku cohos were corrected by multiplying their percentage contribution to the catch in area 15C times the number of non-pigmented adipose fin clips in this area times their pigment loss estimate. The total number of adipose fin clipped cohos caught in this area was 78 of which 38 (48.72%) were green (Berners River), 10 (12.82%) were orange (Chilkat River), 4 (5.13%) were red (Taku River), and 26 (33.33%) had no pigment.

Ratio of marks in the catch in area 15C = 38 = 73.08% green (Berners River)

10 = 19.23% orange (Chilkat River)

4/52 = 7.69% red (Taku River)

	ratio in catch		unknowns in this area		pigment loss percentage		
orange = 10 fish	19.23%	X	26	X	7.14%	=	.36 fish
red = 4 fish	7.69%	X	26	X	31.94%	=	.64 fish
							1.00

26 unknown
-1 orange and red due to pigment loss
25 unknowns = green

25 green without pigment
+38 green with pigment
63

25/63 = 39.68% pigment loss for Berners River cohos

The pigment loss percentages for each river were used to correct (add to) the numbers of pigment marked cohos found in other areas. For areas 11A and 112-15, 15A and C, and 11B, all the "adipose only" fin marks were assumed to be pigment marks and were corrected on the basis of the ratio of marked fish from each river in the catch in that area and the pigment loss percentage. Pigment loss corrections for all other areas were made on the basis of pigment marked fish recovered in that area and time period, up to the number of "adipose only" clips found.

Correction to Pelican Data

In addition to the standard pigment loss corrections mentioned above, a correction was made for missed pigment on adipose fin clipped cohos sampled at Pelican during statistical weeks 26 to 29. During weeks 27 to 29 the sampler at Pelican Cold Storage looked at 33,204 cohos from fishing areas 13A, 14A, and 16 and found 78 adiposed clipped cohos of which 8 (10%) had fluorescent pigment. During weeks 27 to 29

samplers at the Juneau Cold Storage examined 18,876 cohos from fishing areas 13A, 14A, and 16 and found 42 adipose clipped cohos of which 18 (43%) had fluorescent pigment. The Pelican sampler was working in a -40°F freezer and was not examining fish as closely for pigment as the Juneau samplers. The ratio of adipose fin clipped to unclipped cohos found in the catch for areas 13A, 14A, and 16 by the Pelican sampler was 1:426 and 1:449 by the Juneau sampler. Because of the low percentage of pigment marked fish found by the Pelican sampler it was decided to use the Juneau sampler's pigment recovery percentage for each week and apply them to the adipose clipped cohos found by the Pelican sampler. This added 26 Taku River (red) tags, 1 Berners River (green) tag, and 2 Chilkat River (orange) tags and reduced the "adipose only" recoveries at Pelican by 29 for this time period.

Unaccountable Adipose Fin Clipped Cohos

Table 1 shows that 27.5% (461 fish) of the total expanded commercial catch of adipose fin clipped cohos could not be accounted for after correcting for pigment loss. This excluded those taken in areas 11A and 112-15, 11B, and 15A and C which were all assumed to be pigmented fish because they were relatively near the spawning streams. Some of the "adipose only" marked cohos were found in every area but the majority came from area 13A, 14A, and 16 (205 fish, or 31% of the adipose fin clipped cohos caught in that area), area 5, 9, and 13B, (159 fish or 91% of the adipose fin clipped cohos caught in that area), and area 14B and C, 112-13, 112-14, and 112-16 (48 fish or 23% of the adipose fin clipped cohos found in that area). Other areas having a few "adipose only" marked cohos were areas 10, 11C and D (29 fish); areas 6, 7, and 8 (6 fish); and areas 3 and 4 (12 fish). The number of marked fish in areas 1, 2, 3, 4, 6, 7, and 8 was not expanded because of the small sample size, so more marks were probably present than are shown. The adipose only clips in areas 6, 7, 8, and 10 were probably unauthorized marks released from the Crystal Lake Hatchery in Petersburg. The large number of "adipose only" marked cohos (376 fish) found off the outer coast of Southeast Alaska from Cape Fairweather to Cape Muzon (areas 16, 14A, 13, 9, 5, 4, and 3) cannot be explained.

Miscellaneous Tag Recoveries

There were 11 tagged cohos recovered whose river of origin and release date could be determined by either the presence of a multiple fin clip or a coded wire tag (3 multiple fin clips and 8 coded wire tags). These fish from areas south of Alaska were reported with recoveries from other parts of S.E. Alaska (Oregon Department of Fish and Wildlife 1976).

Escapement of Marked Cohos

The total escapement of marked cohos was expanded from marked: unmarked sampling and escapement counts for each river (Appendix Table 4) as follows:

Taku River:
(Johnson and Yehring Creeks)

$\frac{4 \text{ adipose clips}}{164 \text{ examined}}$ = 2.44% X 963 escapement = 23 total estimated marks in escapement

Berners River:

$\frac{19 \text{ adipose clips}}{733 \text{ examined}}$ = 2.59% X 4,124 = 107 total estimated marks in escapement

Chilkat River: no escapement count or marked:unmarked sample possible.

Total Return of Marked Cohos

The total return (catch plus escapement) of marked fish to each of the three river systems was as follows:

Taku (Yehring & Johnson Creeks): 450 commercial catch estimate (Table 1)
+23 escapement estimate
473 total return of marked cohos

Berners River: = 367 commercial catch estimate
+107 escapement estimate
474 total return of marked cohos

Chilkat River: = 385 commercial catch estimate
+ ? no escapement estimate
385 + partial return of marked cohos

Harvest Rates by Stock

Harvest rates (H) were calculated by dividing the estimated number of marked fish taken in the fishery (F) by the sum of (F) plus the estimated

number of marked fish in the escapement (E):

$$\text{Harvest Rate (H)} = \frac{F}{F + E}$$

For Yehring and Johnson Creeks of the Taku River system:

Escapement = Yehring Creek (746) and Johnson Creek (217) = 963

963 X marks in escapement ratio (4/164 = 2.44%) = 23 estimated marks in escapement

$F = 450$, $E = 23$ $\quad H = \frac{450}{450 + 23} = \underline{95.14\%}$

For Berners River:

Escapement = 4,124

4,124 X marks in escapement ratio (19/733 = 2.59%) = 107 estimated marks in escapement

$F = 367$, $E = 107$ $\quad H = \frac{367}{367 + 107} = \underline{77.43\%}$

No harvest rate could be calculated for the Chilkat River due to the difficulty in obtaining an escapement count. Observations made in the Chilkat sport fishery and the late spawning ground survey of the Mosquito Lake inlet indicated an extremely weak coho escapement and a high harvest rate.

Fingerling to Adult Survival

The juvenile cohos that were marked were mostly age I+ and migrated to sea at age II+. Some of the fish were also age II+ migrating to sea at age III+. The size at time of marking ranged from 65 to 90 mm for Taku and Berners River; 78 to 120 mm for Mosquito Lake and 85 to 140 mm for Chilkat Lake in the Chilkat River system.

Fingerling to adult survival was determined by the equation:

$$\text{Survival Rate (S)} = \frac{F + E}{T}$$

Where F = estimated number of marked fish taken by the commercial fishery.

E = estimated number of marked fish in the escapement

T = number of fingerlings marked.

For the Taku River (Yehring and Johnson Creeks):

$$F = 450 \quad E = 23 \quad T = 8,883 \qquad S = \frac{450 + 23}{8,883} = \underline{5.32\%}$$

For the Berners River:

$$F = 367 \quad E = 107 \quad T = 8,066 \qquad S = \frac{367 + 107}{8,066} = \underline{5.88\%}$$

For the Chilkat River:

$$F = 385 \quad E = ? \quad T = 4,320 \qquad S = \frac{385 + ?}{4,320} = \underline{8.91+\%}$$

Part of the difference in survival rates between the three rivers was probably due to the time of marking (Appendix Table 2). The Taku River fish were marked earlier in the season, the Berners River fish next, and the Chilkat River fish last. Late in the season fish were larger and had a greater chance for survival. The extra large size of lake fish (Chilkat and Mosquito Lakes), probably as a result of better feeding conditions, allowed them to reach a larger size at age I+ (or II+) and resulted in higher survival. The survival rate for the three rivers was fairly high compared with those reported in the literature. There are no known references on survival rates from wild coho fingerlings to adults. Most studies report survival rates for potential egg deposition to adult, or smolt to adult. Shapovalov and Taft (1954) reported 4.95% average survival (range 0.98% to 7.72%) for wild coho (smolts to adult) for 4 return years to Wadell Creek, California. Salo and Bayliff (1958) reported 4.18% average survival (range 0.91% to 7.15%) for wild coho (smolts to adult) for 10 return years to Minter Creek, Washington. To compare the survival rates found in this study (5.32%, 5.88% and 8.91+%) with smolt to adult survival rates from other studies we would have to subtract the unknown mortality from the time of tagging to the time of smoltification. For this reason the smolt to adult survival rates for the three rivers studied would be considerably higher than we found for fingerling to adult.

Survival rates for these wild stocks are considerably higher than attained by most hatchery stocks. High survival of tagged cohos also indicates our tagging methods were easy on the fish. Not anesthetizing fish before marking and immediate release of marked fish in the areas of capture favored survival.

Estimate of Total Adult Return

An estimate of total adult return to each of the rivers is important in determining their contribution to the commercial fishery. To calculate total adult return a ratio of escapement percentage to escapement count was used.

$$\text{Total adult return (A)} = \frac{E'}{1.0 - H}$$

Where E' = Escapement count (marked + unmarked)

1.0 - H = Escapement percentage where H = harvest percentage

Taku River (Yehring and Johnson Creeks):

$$\frac{E'}{1.0 - H} = \frac{963}{1.0 - 0.9514} = A = \frac{963}{.0486} = \underline{19,815}$$

Berners River:

$$\frac{E'}{1.0 - H} = \frac{4,124}{1.0 - 0.7743} = A = \frac{4,124}{.2257} = \underline{18,272}$$

No estimate of adult return for the Chilkat River could be made by this method.

Percent of Available Fingerlings That Were Marked

Knowledge of the percentage of coho fingerlings marked is important in evaluating the relative productivity of rearing areas. It also helps in evaluating the effectiveness of minnow trapping as a method of obtaining fish for tagging and stream inventory studies. The percent of fingerlings that were minnow trapped can be calculated by two methods.

1) Estimate of total adult return/percentage fingerling survival = estimated total number of fingerlings.

2) Marked:unmarked ratio of adult escapement.

Both methods give similar values for the Taku and Berners Rivers stocks.

Taku River (Johnson and Yehring Creeks):

1) 19,815/0.0532 = 372,462 = estimate of total coho fingerlings

Yehring Creek = 6,711
Johnson Creek = 2,172
8,883 = total fingerlings marked

8,883/372,462 = 2.38%

2) 4/164 = 2.44%

Berners River:

1) 18,272/0.0588 = 310,748 = estimate of total coho fingerlings

8,066/310,748 = 2.60%

2) 19/733 = 2.59%

Chilkat River:

As no escapement count was possible in the Chilkat River, and no mark:unmark ratio obtained, no fingerling to adult survival, harvest rate, or total adult return calculation could be made. The fingerling to adult survival for the Chilkat River, excluding the unknown contribution from the escapement, was 8.91%.

The small percentage of fingerlings marked (2.4% to 2.6% of the estimated rearing cohos available) indicates that our minnow trapping, although intensive, was not effective in capturing a high percentage of the rearing fish. It is possible that other undiscovered rearing areas were

more heavily utilized. It is interesting that the percentage of rearing coho fingerlings that were marked in Johnson and Yehring Creeks of the Taku River (2.4%) was almost exactly the same as for Berners River (2.6%). This may indicate that only a low percentage of rearing cohos are available to minnow trapping. Despite the low percentage of available rearing cohos that were captured, the numbers obtained were adequate.

Migration Timing

Figures 4A-E and Appendix Tables 5A-K show the migration timing and estimated numbers of marked cohos caught in the major recovery areas. Figure 4A shows that in areas 13A, 14A, and 16, Taku River cohos enter the fishery in largest numbers earlier (weeks 28-35, July 7 to August 31) while the Berners and Chilkat River cohos do not appear in large numbers until several weeks later (weeks 32-37, August 4 to September 14). Taku River cohos began to drop off as the Berners and Chilkat cohos became most abundant.

In areas 14B and C, 112-13, 112-14, and 112-16 (Figure 4B) there was little difference in timing. Taku River and Berners River cohos both appeared in weeks 28-29 (July 7 to July 20). Taku River cohos were most abundant (weeks 34-35, August 18-31) about 2 weeks earlier than the Berners and Chilkat River cohos (weeks 36-37, September 1-14).

In areas 11A and 112-15 (Figure 4C) Taku River cohos appeared in greatest numbers several weeks earlier than those of the Berners and Chilkat Rivers. The Taku cohos were most abundant from weeks 30-37, (July 21 to September 14), Berners cohos from weeks 34-39, (August 18 to September 28), and Chilkat cohos from weeks 34-37, (August 18 to September 14).

The overall trend in areas 16, 14, 13A, 112-13, 112-14, 112-15, 112-16, and 11A where Taku, Berners, and Chilkat River cohos were found together was for the Taku River cohos to appear in largest numbers 2 to 4 weeks before the Berners and Chilkat River cohos. There was considerable overlap in occurrence of cohos from the three rivers in each of these areas, and nearly always a few fish from each river were present at the same time. The Berners and Chilkat cohos were found in largest numbers at about the same time.

In areas 15A and C (Figure 4D), where Berners and Chilkat River cohos were found in greatest numbers, they both peaked at about the same time (between weeks 32 and 41, August 4 to October 12). There would be no way to separate these two stocks in the commercial fishery, particularly

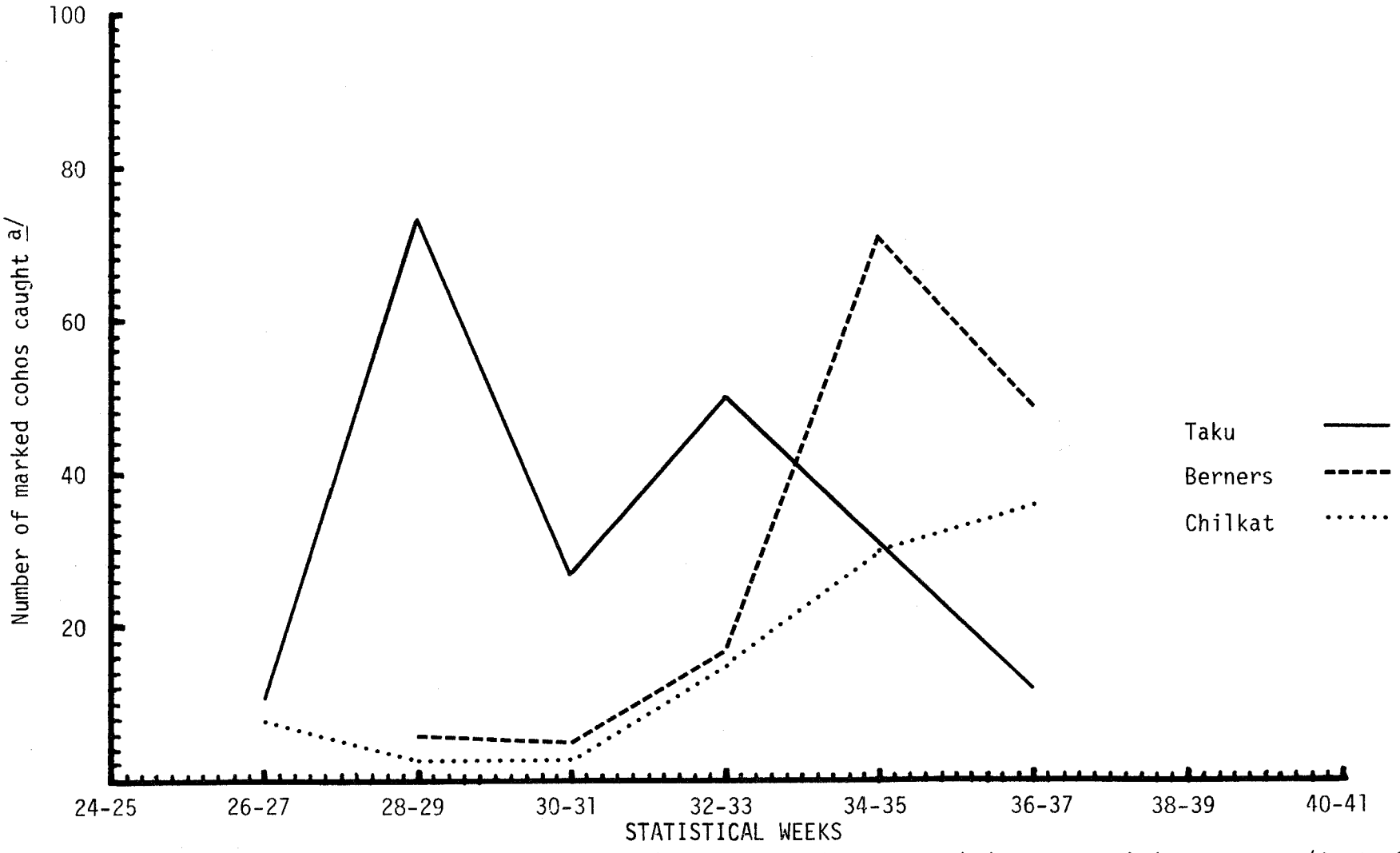

Figure 4A. Number of pigment marked coho salmon caught by statistical weeks in fishing areas 13A, 14A, and 16.

a/ Expanded to 100% sample size.

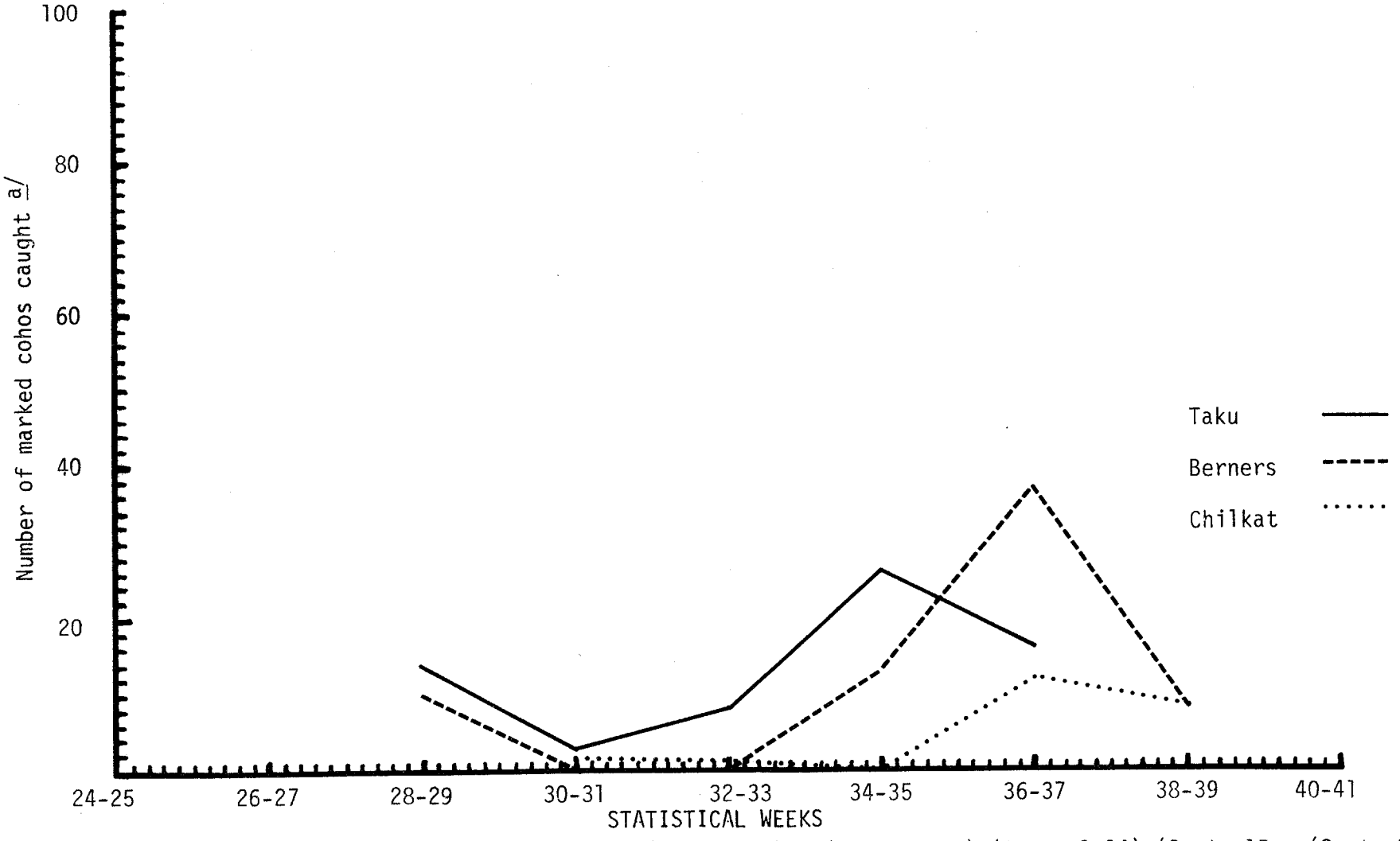

Figure 4B. Number of pigment marked coho salmon caught by statistical weeks in fishing areas 14B and C, 112-13, 112-14, and 112-16.

a/ Expanded to 100% sample size.

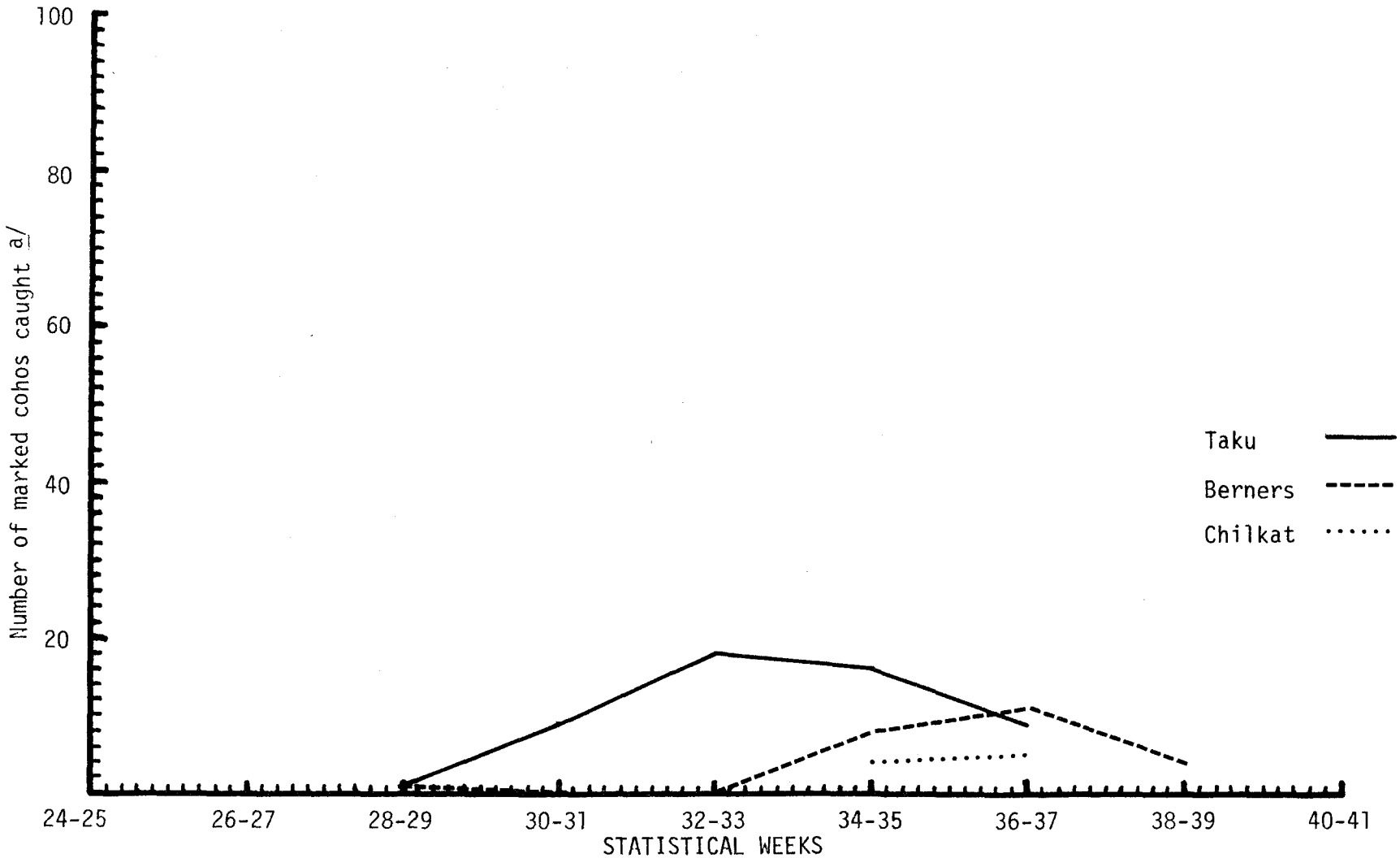

Figure 4C. Number of pigment marked coho salmon caught by statistical weeks in fishing areas 11A and 112-15.

a/ Expanded to 100% sample size.

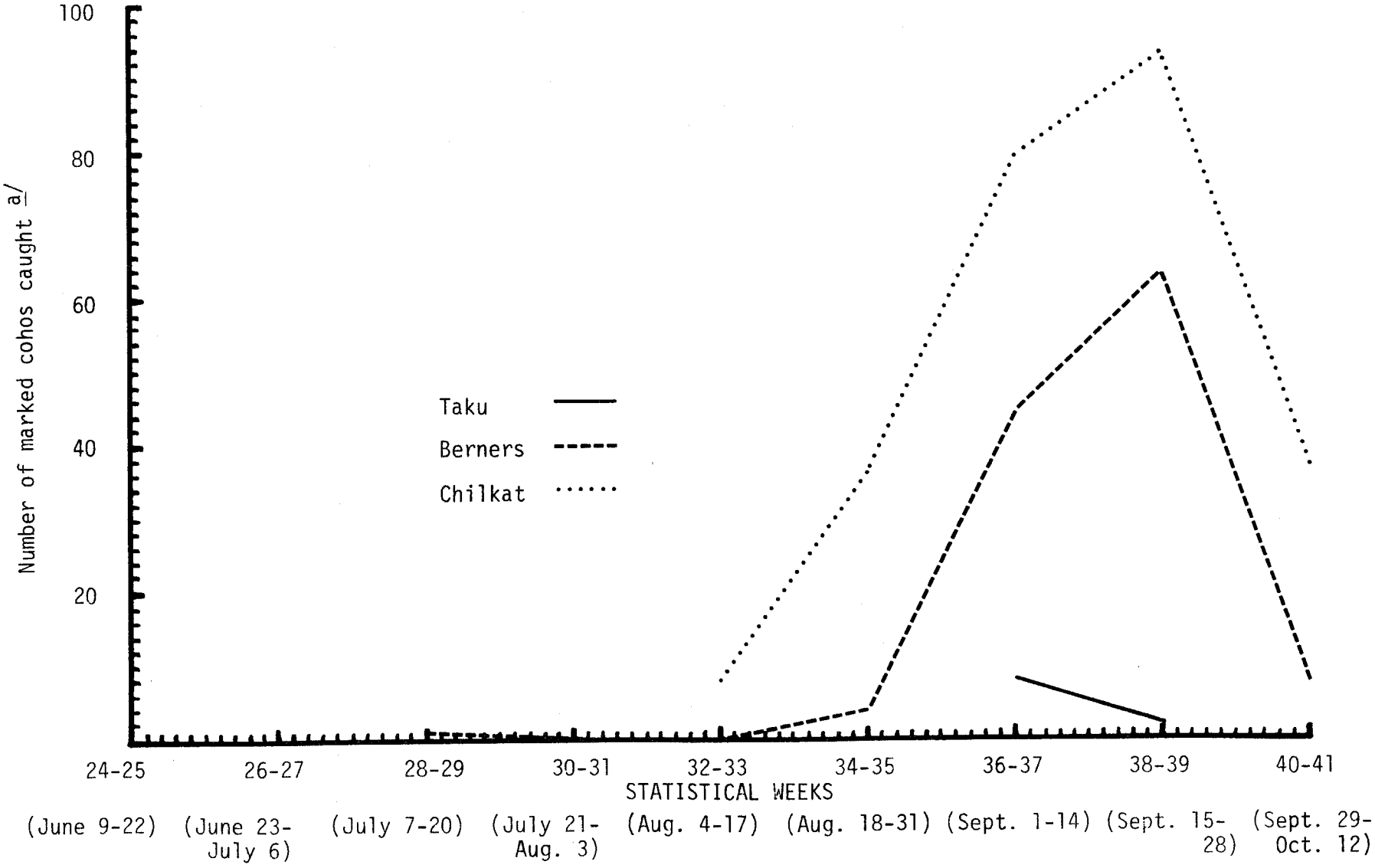

Figure 4D. Number of pigment marked coho salmon caught by statistical weeks in fishing areas 15A and C.

a/ Expanded to 100% sample size.

in area 15C. A few Taku River cohos were taken in area 15C, probably near the northern boundary of area 11A.

Taku River cohos first appeared in area 11B (Figure 4E) during weeks 26-27 (June 23 to July 6) and were present in largest numbers from weeks 32-39 (August 4 to September 28).

Gear Type Harvest Rates

Marked coho salmon from the Taku, Berners, and Chilkat Rivers were harvested by the commercial fishery from June 15, when the troll fishery opened, until the gillnet fishery closed October 11. The troll fishery harvested marked cohos along the outside coast of Southeastern Alaska beginning June 15 when the season opened and followed them in through Icy Strait, upper Chatham Strait, Lynn Canal, Stephens Passage, and up to the river mouths when the season closed on September 20. Drift gillnet gear harvested marked cohos in Lynn Canal and Stephens Passage during open fishing periods between June 16 and October 11 when the gillnet season closed. Purse seine gear harvested marked cohos in Icy Strait and upper Chatham Strait during open fishing periods between July 7 and September 26. The harvest rates by different gear types are related to length of season, areas open to each type of gear, and effectiveness of each gear type.

Nearly three quarters (72%) of the marked Taku River cohos were taken by troll gear (Table 2). Over one quarter were taken by drift gillnets, and less than 1% by purse seine gear. Almost two-thirds of the Berners River cohos were taken by troll gear, one-third by drift gillnet and less than 3% by seine gear. By contrast, nearly two-thirds of Chilkat River cohos were taken by gillnet, over one-third by troll, and less than 2% by seine gear. It appeared that the Taku River cohos had either a shorter period of milling off the river mouth or there was a smaller area available to gillnet gear than off the Berners or Chilkat Rivers. While some 27% of Taku River cohos were taken by gillnet, gillnet gear harvested 32% of Berners River cohos, and nearly 62% of Chilkat River cohos. This reflects the size of the area and the amount of time each of these stocks is available to gillnet gear. Chilkat River cohos are available to gillnet gear nearly the full length of Lynn Canal (area 15A and C).

The overall gear type harvest rate for cohos from all three rivers was nearly 60% by troll gear, nearly 40% by drift gillnet and less than 2% by purse seine. The high overall troll harvest of cohos reflects the large area (from open ocean to river mouths) open to troll, the long season, and the effectiveness of the gear on this species.

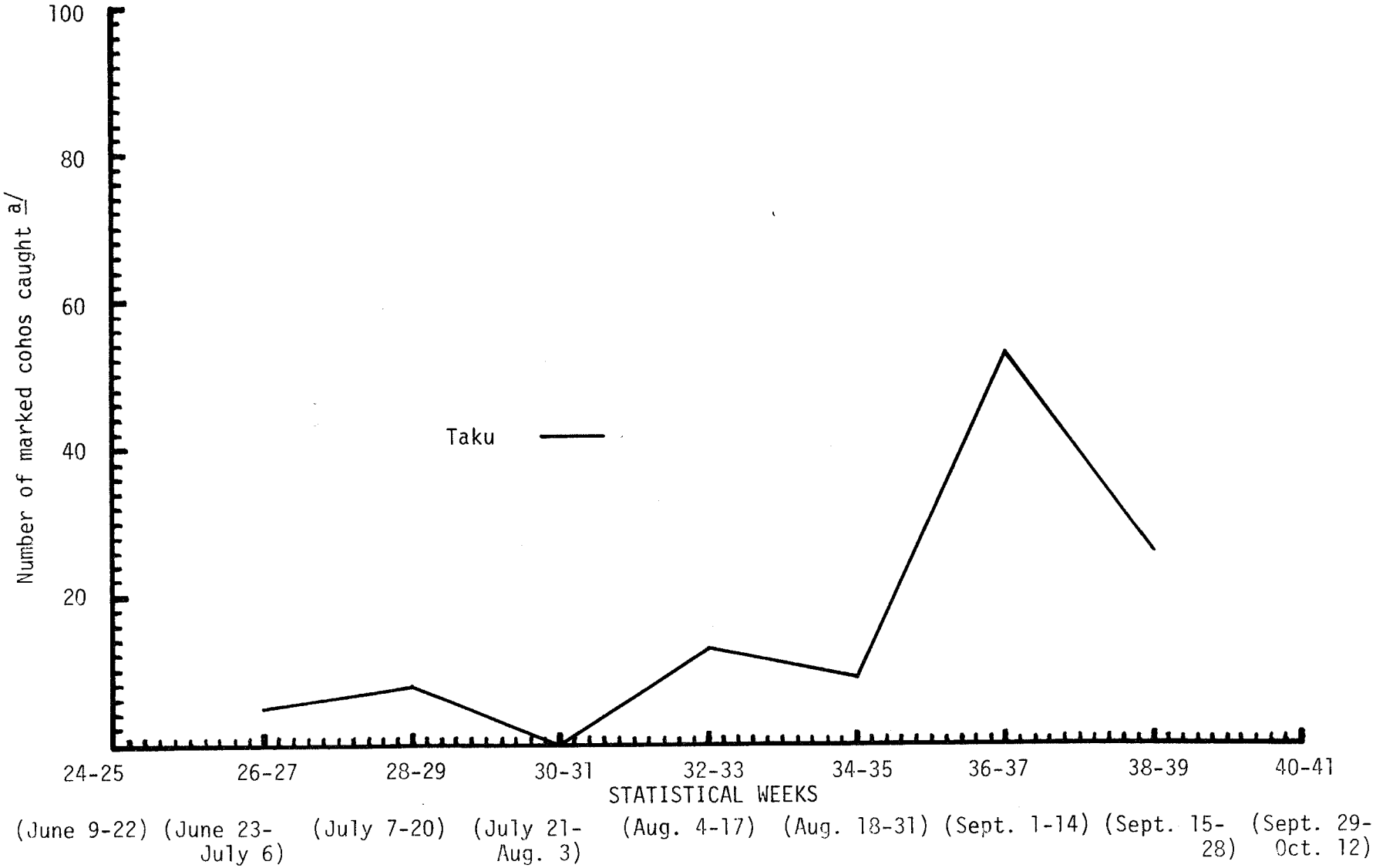

Figure 4E. Number of pigment marked coho salmon caught by statistical weeks in fishing area 11B.

a/ Expanded to 100% sample size.

Table 2. 1974 total harvest of marked coho salmon by gear type and river of origin [a/].

	TAKU RIVER (Yehring & Johnson Creeks)		BERNERS RIVER		CHILKAT RIVER		TOTALS	
	Number of Fish	Percent	Number of Fish	Percent	Number of Fish	Percent	Number of Fish	Percent
Troll	208	(72.2%)	158	(64.8%)	93	(36.9%)	459	(58.5%)
Drift Gillnet	79	(27.4%)	79	(32.4%)	155	(61.5%)	313	(39.9%)
Purse Seine	1	(0.3%)	7	(2.9%)	4	(1.6%)	12	(1.5%)
Totals	288		244		252		784	

a/ Corrected for pigment loss.

The gear type harvest by fishing area (Table 3) shows that the major harvest area for Taku River cohos was outside waters north and south of and including Cross Sound (areas 13A, 14A, and 16) where 55% of the catch was taken by troll gear. The second most important catch area for Taku River cohos was the Taku River mouth and upper Stephens Passage (area 11B) where drift gillnet gear took 25% of the catch. Most of the rest of the Taku River cohos (17%) were taken by troll gear, 4.5% in Icy Strait and upper Chatham Strait (areas 14B and C, 112-13, 112-14, and 112-16) and 12.5% in lower Lynn Canal and upper Stephens Passage (areas 11A and 112-15).

The major harvest area for Berners River cohos was also outside waters (areas 13A, 14A, and 16) where 56% of the catch was taken by troll gear. The second most important catch area for Berners River cohos was Lynn Canal (area 15A and C) where drift gillnet took 32% of the catch. Most of the rest of Berners River cohos (nearly 8%) were taken by troll gear, 1.6% in areas 14B and C, 112-13, 112-14, and 112-16, and 6.1% in 11A and 112-15).

By contrast, the major harvest area for Chilkat River cohos was Lynn Canal (area 15A and C), where nearly 62% of the catch was taken by drift gillnet gear. The second most important catch area for Chilkat River cohos was outside waters (areas 13A, 14A, and 16) where 33% of the catch was taken by troll gear.

The major recovery area for marked cohos from the three rivers combined was outside waters (13A, 14A, and 16) where 48% of the total catch was taken, all by troll gear. The second most important recovery area for marked cohos was Lynn Canal (area 15A and C) where nearly 31% of the catch was taken, all by drift gillnet (nearly all Chilkat and Berners River cohos). The third most important catch area for marked cohos was the Taku River mouth (area 11B) where 9% of the catch was taken, all by drift gillnet (all Taku River cohos).

Taku, Berners, and Chilkat Rivers Contribution to Northern Southeastern Alaska Coho Production

The percentage contribution of Taku River (Yehring and Johnson Creeks), Berners River, and Chilkat Rivers (all mainland systems) to total coho production in northern Southeast Alaska is important when assigning priorities for future coho management. No absolute numbers can be assigned for the contribution from these rivers, although several calculations can be made to show their relative importance.

Table 3. 1974 harvest of marked coho salmon by fishing area, river of origin and gear type [a/].

FISHING AREAS	TAKU		BERNERS		CHILKAT		TOTAL MARKS	
	No. of Fish	Percent	No. of Fish	Percent	No. of Fish	Percent	No. of Fish	Percent
13A, 14A and 16	158	(54.9% troll)	137	(56.1% troll)	84	(33.3% troll)	379	(48.3%)
14B and C, 112-13,	13	(4.5% troll)	4	(1.6% troll)	3	(1.2% troll)	20	(2.6% troll)
112-14, and 112-16	1	(0.3% seine)	7	(2.9% seine)	4	(1.6% seine)	12	(1.5% seine)
		(4.9% total)		(4.5% total)		(2.8% total)		(4.1% total)
11A and 112-15	36	(12.5% troll)	15	(6.1% troll)	5	(2.0% troll)	56	(7.1% troll)
15A and C	7	(2.4% gillnet)	79	(32.4% gillnet)	155	(61.5% gillnet)	241	(30.7% gillnet)
11B	72	(25.0% gillnet)		-------		-------	72	(9.2% gillnet)
12 (S. of Pt. Hepburn)	1	(0.3% troll)		-------		-------	1	(0.1% troll)
5, 9, and 13B	___	-------	2	(0.8% troll)	1	(0.4% troll)	3	(0.4% troll)
TOTALS	288		244		252		784	

a/ Corrected for pigment loss.

Ratio of Pigment Marked Cohos in the Commercial Catch

The proportion of pigment marked:unmarked coho salmon in the commercial catch increased as the fish moved closer to their stream of origin (Table 4). From 1:535 for areas 13A, 14A, and 16 to 1:300 for areas 14B and C, 112-13, 112-14, and 112-16 it increased to 1:244 for areas 11A and 112-15, 15A and C, and 11B combined. The overall ratio of pigment marked to unmarked cohos in the commercial catch in major recovery areas was 1:361. These figures include only marked fish, about 2.52% of cohos produced from trapping areas of the Taku, Berners, and Chilkat Rivers.

Percent Contribution of Marked Populations to the Commercial Catch by Area

Table 5 shows the percentage of total contribution (marked plus unmarked cohos) from the three river systems to the northern Southeast Alaska commercial coho catch by area. The estimated commercial coho catch produced from fingerling trapped portions of the Taku, Berners, and Chilkat Rivers was estimated by dividing the total number of marked cohos taken by the fishery by the average percent of fingerlings marked. The average percentage of coho marked, determined from a marked:unmarked ratio of spawners, was 2.52% (2.44% from the Taku River, Yehring, and Johnson Creeks and 2.59% from Berners River).

An overall estimate of 11% of the commercial coho catch from major recovery areas (13A,14, 16, 112-13, 112-14, 112-15, and 112-16, 11A and B, and 15A and C) in northern Southeastern Alaska came from fingerling trapped portions of the Taku, Berners, and Chilkat Rivers. Over 7% of outside and Cross Sound coho catches (areas 13A, 14A, and 16), over 13% of the coho catch from Icy Strait and upper Chatham Strait (areas 14B and C, 112-13, 112-14, and 112-16), and 10% of the coho catch from lower Lynn Canal and upper Stephens Passage (areas 11A and 112-15) came from fingerling trapped portions of the Taku, Berners, and Chilkat Rivers. Nearly one-quarter (23%) of the coho catch in Lynn Canal (area 15A and C) came from fingerling trapped portions of the Chilkat and Berners Rivers (minus a few Taku River cohos). Although Yehring and Johnson Creeks are fairly small tributaries of the Taku River, they contributed an estimated 10.6% of the coho catch in area 11B. These high percentages indicate that the Taku, Berners, and Chilkat Rivers are very important contributors of coho salmon to the northern Southeast Alaska commercial fishery.

Table 4. Ratios of pigment marked cohos in the commercial catch.

Fishing areas	Estimate of marks in catch a/					
	Taku	Berners	Chilkat	Total estimated marks in catch	Commercial catch	Ratio of marked:unmarked cohos in commercial catch
13A, 14A and 16	204	148	95	447	238,959	1:535
14B and C, 112-13, 112-14 and 112-16	67	68	23	158	47,391	1:300
11A and 112-15	53	24	9	86	34,134	1:397
15A and C	10	120	253	383	65,672	1:171
11B	114	---	---	114	42,661	1:374
Totals for major recovery areas	448	360	380	1,188	428,817	1:361 (0.278%)

a/ Corrected and expanded to 100% sample.

Table 5. Contribution of fingerling trapped portions of Taku, Berners, and Chilkat Rivers to northern Southeastern Alaska commercial coho catch.

Fishing Areas	Total estimated marks in catch / Mark % found on spawning grounds [a/]		Estimated total catch from marked populations	Commercial catch	Percent contribution of marked populations to catch [b/]
13A, 14A and 16	447 / 2.52	=	17,738	238,959	7.4%
14B and C, 112-13, 112-14, and 112-16	158 / 2.52	=	6,270	47,391	13.2%
11A and 112-15	86 / 2.52	=	3,413	34,134	10.0%
15A and C	383 / 2.52	=	15,198	65,672	23.1%
11B	114 / 2.52	=	4,524	42,661	10.6%
Totals for major recovery areas	1,188 / 2.52		47,143	428,817	11.0%

a/ Average of Taku 2.44% and Berners 2.59% = 2.52%.

b/ Marked plus unmarked cohos from all three rivers combined.

Total Contribution Estimate for the Marked Populations (Catch Plus Escapement)

An estimated 52,817 total adult cohos were produced from fingerling trapped portions of the three rivers. To calculate this estimate, a weighted average survival rate from fingerling to adult for the three rivers was first obtained (Table 6).

Table 6. Weighted average survival from fingerling to adult for Taku, Berners, and Chilkat Rivers.

	Fingerlings Marked	Percent of Total Marked		Percent Survival to Adults		
Taku (Yehring & Johnson Creeks)	8,883	41.77%	X	5.32%	=	2.22%
Berners	8,066	37.92%	X	5.88%	=	2.23%
Chilkat	4,320	20.31%	X	8.91%	=	1.81%
TOTAL	21,269	100.00%				6.26%

The weighted average fingerling to adult survival rate (6.26%) times the total number of fingerlings marked (21,269) gave an estimated total return of marked coho adults from fingerling trapped portions of the Taku, Berners, and Chilkat Rivers of 1,331 fish. With an average marked:unmarked ratio of 2.52% on Taku and Berners River spawning grounds being equal to 1,331 marked cohos, then the total return from 100% (marked plus unmarked) of coho salmon from fingerling trapped portions of the Taku, Berners, and Chilkat Rivers was equal to 52,817 fish.

$$1{,}331:2.52\% = X:100\%$$
$$2.52X = 133{,}100$$
$$X = 52{,}817$$

Combined Harvest Rate Estimate for Taku, Berners, and Chilkat Rivers

Using the estimated total of these stocks commercially landed only from areas 13A, 14, 16, 112-13, 112-14, 112-15, 112-16, 11A and B, 15A

and C of 47,143 cohos (Table 5), an overall estimate of the harvest rate percentage can be obtained.

$$\frac{47,143}{52,817} = \underline{89.3\%}$$ combined harvest rate for Taku, Berners, and Chilkat Rivers for major recovery areas.

If the estimated 555 marked fish (Table 7) from the two minor recovery areas (area 12 south of Pt. Hepburn and 5, 9, and 13B) are added to the total 47,698 cohos were taken.

$$\frac{47,698}{52,817} = \underline{90.3\%}$$ combined harvest rate for Taku, Berners, and Chilkat Rivers for all recovery areas.

The harvest rates of 77% for Berners River, 95% for Taku River (Yehring and Johnson Creeks), and an overall estimated combined harvest rate of 90% for all three rivers is very high, leaving only 5 to 13% (combined average of 10%) of the fish to spawn.

Estimate of Adult Return to the Chilkat River

An estimate of the adult coho return to the Chilkat River can also be made from the total return estimate of 52,817 by subtracting the estimated adult returns to the Taku (Yehring and Johnson Creeks) and Berners Rivers.

Estimated total adult return	=	52,817
Estimated adult return from Taku River (Yehring and Johnson Creeks)		-19,815
Estimated adult return from Berners River		-18,272
Estimated adult return from Chilkat River	=	14,730

Area Harvest Rate Estimates for Taku, Berners, and Chilkat Rivers Combined

Area harvest rates of returning marked cohos can also be estimated from the total return estimate (Table 7). A majority (33.6%) of cohos from the Taku, Berners, and Chilkat Rivers were taken in outside waters including Cross Sound (areas 13A, 14A, and 16). The second highest catch area was in Lynn Canal (areas 15A and C) where 28.8% were taken. This area

Table 7. Combined harvest rates for Taku, Berners and Chilkat cohos by fishing area.

Fishing Areas	Estimated total catch from marked populations		Estimated total return from marked populations	Percent of return taken
13A, 14A and 16	17,738	÷	52,817	33.6%
14B and C, 112-13, 112-14, and 112-16	6,270	÷	52,817	11.9%
11A and 112-15	3,413	÷	52,817	6.5%
15A and C	15,198	÷	52,817	28.8%
11B	4,524	÷	52,817	8.6%
12 (south of Pt. Hepburn)	79	÷	52,817	0.2%
5, 9 and 13B	476	÷	52,817	0.9%
TOTALS	47,698		52,817	90.3%

included almost entirely Chilkat and Berners River cohos. Icy Strait and upper Chatham Strait (areas 14B and C, 112-13, 112-14, and 112-16) were the third most important catch areas where 11.9% of the marked populations of cohos were harvested. The Taku River mouth (area 11B) was the fourth most important harvest area where 8.6% of the catch was taken. This included only Taku River cohos. Lower Lynn Canal and upper Stephens Passage (areas 11A and 112-15) were the fifth most important harvest areas where 6.5% of the cohos were taken. Small numbers of cohos (0.2%) from the marked populations were taken in Chatham Strait (area 12 South of Pt. Hepburn) and outside waters near Sitka (areas 5, 9, and 13B) had 0.9%.

DISCUSSION AND SUMMARY

This study was the first attempt in Alaska to obtain harvest rates by gear type, migration, and timing data by trapping and tagging wild coho salmon juveniles. The minnow trapping technique proved adequate for capturing sufficient numbers of age I+ and older coho juveniles over a wide range of habitat types.

It was possible to sample a high percentage of commercially landed coho salmon for marks in northern Southeastern Alaska with relatively few personnel.

The pigment spray-marking technique proved adequate in this study but had some drawbacks; the most serious being a high pigment loss rate (7% to 40% of the fingerlings marked). Other drawbacks were having to examine each fish in a darkened area and the possibility of an inexperienced observer missing pigment or confusing fluorescent fungus for pigment. Since this mark study was conducted in 1972, coded wire tagging of juvenile salmonids has developed as a more reliable method. In 1976 and 1977 the Alaska Department of Fish and Game repeated this study with coded wire tags. Better tag retention will result and better separation of coho stocks within each river system will be possible when tagged cohos begin returning in 1978 and 1979. The recent studies using coded wire tags will also provide two additional years of harvest data on the Taku, Berners, and Chilkat Rivers to compare with the 1974 study.

Taku River cohos appear to enter the fishery several weeks before the Chilkat and Berners River cohos.

Nearly 60% of the tagged cohos were harvested by troll gear, nearly 40% by gillnet, and less than 2% by seine gear.

The major recovery area for marked cohos from the three rivers combined was outside waters (13A, 14A, and 16) where 48% of the total catch was taken, all by troll gear. The second most important recovery area for marked cohos was Lynn Canal (area 15A and C) where nearly 31%of the catch was taken, all by drift gillnets (nearly all Chilkat and Berners River cohos). The third most important catch area for marked cohos was the Taku River mouth (area 11B) where 9% of the catch was taken, all by drift gillnet (all Taku River cohos).

Cohos from tagged portions of the Taku, Berners, and Chilkat Rivers contributed an estimated 11% (47,700 fish) to the northern Southeast Alaska commercial coho catch.

Harvest rates of wild marked coho stocks in this study were found to range from 77 to 95% with an overall average of 90%. It is doubtful that wild stock coho salmon can maintain themselves at harvest levels this high. The Washington State Department of Fisheries is presently using a catch:escapement ratio of 3:1 (75% harvest, 25% escapement) for Puget Sound wild stock coho salmon where no hatchery fish occur (personal communication, Gordon Zillges, Wash. Dept. of Fisheries). In Puget Sound, where both wild stock and hatchery cohos are mixed in the catch, the Washington State Dept. of Fisheries uses a catch:escapement ratio of 4:1 (80% harvest and 20% escapement). It is felt that a harvest rate of this magnitude is probably too high for the wild stocks to maintain themselves. In areas where only hatchery cohos are present, however, a catch to escapement ratio of up to 9:1 has been allowed.

It is difficult to determine a safe harvest:escapement ratio for wild stock coho salmon. Southeastern Alaska cohos spend an average of two years in freshwater before reaching smolt size compared to only one year in Washington State, hence higher escapement levels may be necessary here as a greater number of spawners might be necessary to offset the higher mortality during the additional year of freshwater rearing.

A conservative estimate of a safe catch:escapement ratio required to maintain wild stock coho salmon runs in Southeastern Alaska may even be in the range of 1:1 (50% catch and 50% escapement). A catch:escapement ratio greater than 3:2 (60% catch and 40% escapement) may prove detrimental to our wild coho stocks. If this is true, then these stocks based on the current study, at least the Taku, Berners, and Chilkat River cohos, are being over-harvested. Tagging projects now in progress will provide more detailed information on harvest levels on these northern Southeastern river systems. Expansion of the tagging program to stream systems in southern Southeastern Alaska was also initiated in 1978.

Minnow trapping and tagging of wild juvenile coho salmon appears to be an excellent method for obtaining data on migrations, timing, and gear type harvest rates needed for effective fishery management.

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APPENDIX

Appendix Table 1. List of equipment used in fluorescent pigment marking (1972).

QUANTITY	MARKING EQUIPMENT	USE	SOURCE	COST (1972)
(6)	Fin Clipping Scissors (Lawton #19L305 5-1/2" Straight Edge Nail Nippers)	Clipping adipose fins	Biddle & Crowther Co. 910 North 137th 365-9900 Seattle, WA 98133	$8.00 each
	Grannular Fluorescent Pigment - fluoresces under black light (3400-3800 angstroms) non-soluble in water, biologically inert, at least 70% between 50-350 microns size. Red, green, orange, 12 lbs. each color.	Marking fish with spray gun	Scientific Marking Materials P.O. Box 24122 Seattle, WA 98124	$6.00/lb. red $6.50/lb. green $7.00/lb. orange
(2)	#SG100 Spray Guns (with nozzles)	Marking fish	Scientific Marking Materials P.O. Box 24122 Seattle, WA 98124	$32.50 each
(2)	#SG100A Canisters	Attach to spray gun and hold granular pigment	Scientific Marking Materials P.O. Box 24122 Seattle, WA 98124	$ 4.98 each
(2)	#SH 101 - 10 ft. Hoses	Connect spray gun to pressure regulator on tank	Scientific Marking Materials P.O. Box 24122 Seattle, WA 98124	$ 9.45 each
(2)	#R-101 2-Stage SCUBA Regulator (0-200 psi)	Regulates pressure from tank to spray gun 0-200 psi adjustable with hex wrench	Scientific Marking Materials P.O. Box 24122 Seattle, WA 98124	$66.50 each
(4)	71.2 cu. ft. SCUBA Tank with K Valve (no reserve). Complete with neoprene rubber tank boot. U.S. Divers #651	Hold compressed air for spray marking	Jafco 520 Westlake No. Seattle, WA 98134	$90.00 each tank
(2)	#700345D Pressure Gauges	To check amount of air in SCUBA tank	Jafco 520 Westlake No. Seattle, WA 98134	$11.47 each

(Continued)

Appendix Table 1. List of equipment use in fluorescent pigment marking (1972) - continued.

QUANTITY	MARKING EQUIPMENT	USE	SOURCE	COST (1972)
(3)	#UVC303 Safety Goggles	To protect eyes from pigment while spraying	Ultra Violet Products, Inc. 5114 Walnut Grove Ave. San Gabriel, CA 91778	$ 5.00 pair
(8)	#ML-49 BLAK RAY Lamp (operates on two six-volt lantern batteries)	Portable UV lamp for detecting pigment mark on juveniles and returning adults	Ultra Violet Products, Inc. 5114 Walnut Grove Ave. San Gabriel, CA 91778	$39.75
(2)	Painter's Face Masks	To protect lungs from pigment when spray marking fish	Local hardware store	$ 4.00 each
(2)	#BN-36-8 Nylon Bait Net (15" x 14" x 8" - 3/16 nylon mesh)	Holding fish for spraying	Nylon Net Company 7 Vance Ave., P.O. Box 592 Memphis, TN 38101	$ 5.00 each
(1)	#81-1512K Screened Marking Tent	For protection from biting insects and rain while marking fish	Gander Mountain, Inc. P.O. Box 248 Wilmot, WI 53192	$74.95
(1)	Collapsible Table (8' x 4' x 5/8" plywood w/screw on pipe legs)	Hold pans of fish for clipping	Home-made	$20.00
(20)	Gee Minnow Traps	Trapping juvenile cohos for marking	Nylon Net Company 7 Vance Ave., Box 592 Memphis, TN 38101	$ 3.00 each
(6)	Lew's Live Bait Bucket with Aerator Pump (operates on flashlight batteries)	To keep juvenile cohos alive while transporting to and from marking site and while marking	Gander Mountain, Inc. P.O. Box 248 Wilmot, WI 53192	$12.00 each
(6)	Rubbermaid Dishpans (dark green, 14-1/2" x 12" x 5-1/4")	Sorting fish	Local hardware store	$ 2.00 each
	BOATS			
(1)	Avon #S550 14'6" - Mercury 20 hp outboard	Transportation of gear and personnel to marking sites		

(continued)

Appendix Table 1. List of equipment use in fluorescent pigment marking (1972) - continued.

QUANTITY	MARKING EQUIPMENT	USE	SOURCE	COST (1972)
(1)	Avon #Redshank 12' - Evinrude 5-1/2 hp outboard	Capture fish in main river and lakes		
(2)	Avon #Redcrest 9' oars or Johnson 1.5 hp outboard	Capture fish in beaver ponds and sloughs		

Appendix Table 2. Marking locations and numbers of juvenile cohos pigment marked in 1972.

Pigment color used	Location	Date	Size of fish marked	Persons marking fish	Number of fish marked		No. of days trapped	Average number of fish trapped and marked per day
Red	TAKU RIVER Yehring Creek	6/28-7/6/72	> 65mm	Marriott, Gray Bland, Sanders	5,103		9.0	567
	Yehring Creek	8/8-8/13/72	> 65mm	Marriott, Bland	1,608		5.5	292
					6,711	Total Yehring Creek	14.5	463
	Johnson Creek	8/13-8/16/72	> 65 mm	Marriott, Bland	2,172	Total Johnson Creek	3.5	621
					8,883	Total Taku River	18.0	494
Green	BERNERS RIVER (East Fork)	7/11-7/19/72	> 65mm	Marriott, Bland Gray, Sanders	8,066	Total Berners River	8.0	1,008
Orange	CHILKAT RIVER-Chilkat Lake	7/25-7/30/72	> 85mm	Marriott, Bland Gray, Sanders	902	Total Chilkat Lake	6.0	150
	Mosquito Lake	9/5/72	> 78mm	Gray, Dye	118		1.0	118
	Mosquito Lake	9/8-9/13/72	> 78mm	Gray, Dye	1,266		6.0	211
	Mosquito Lake	9/17-9/20/72	> 78mm	Marriott, Bland	1,838		4.0	460
					3,222	Total Mosquito Lake	11.0	293
	Lower Tahini River	9/6/72	> 78mm	Gray, Dye	115	Total Lower Tahini R.	1.0	115
	Main Chilkat River	9/7/72	> 78mm	Gray, Dye	81	Total Main Chilkat R.	1.0	81
					4,320	Total Chilkat River System	19.0	227
					21,269	Total Cohos Marked	45.0	473

Appendix Table 3. 1974 statistical weeks.

The numbered calendar weeks to be used for the 1974 catch statistics are as follows:

WEEK	FROM	THRU	WEEK	FROM	THRU
1	Jan 1	Jan 5	28	Jul 7	Jul 13
2	Jan 6	Jan 12	29	Jul 14	Jul 20
3	Jan 13	Jan 19	30	Jul 21	Jul 27
4	Jan 20	Jan 26	31	Jul 28	Aug 3
5	Jan 27	Feb 2	32	Aug 4	Aug 10
6	Feb 3	Feb 9	33	Aug 11	Aug 17
7	Feb 10	Feb 16	34	Aug 18	Aug 24
8	Feb 17	Feb 23	35	Aug 25	Aug 31
9	Feb 24	Mar 2	36	Sept 1	Sept 7
10	Mar 3	Mar 9	37	Sept 8	Sept 14
11	Mar 10	Mar 16	38	Sept 15	Sept 21
12	Mar 17	Mar 23	39	Sept 22	Sept 28
13	Mar 24	Mar 30	40	Sept 29	Oct 5
14	Mar 31	Apr 6	41	Oct 6	Oct 12
15	Apr 7	Apr 13	42	Oct 13	Oct 19
16	Apr 14	Apr 20	43	Oct 20	Oct 26
17	Apr 21	Apr 27	44	Oct 27	Nov 2
18	Apr 28	May 4	45	Nov 3	Nov 9
19	May 5	May 11	46	Nov 10	Nov 16
20	May 12	May 18	47	Nov 17	Nov 23
21	May 19	May 25	48	Nov 24	Nov 30
22	May 26	Jun 1	49	Dec 1	Dec 7
23	Jun 2	Jun 8	50	Dec 8	Dec 14
24	Jun 9	Jun 15	51	Dec 15	Dec 21
25	Jun 16	Jun 22	52	Dec 22	Dec 28
26	Jun 23	Jun 29	53	Dec 29	Dec 31
27	Jun 30	Jul 6			

Appendix Table 4. Spawning ground counts and marked:unmarked ratios of cohos (1974).

	Dates & persons making counts	Total escapement count (live plus carcasses)		Marked:unmarked ratio
Taku River				
Yehring Creek	10-21 to 10-24 (Gray, Florey, Laner)	558	(10-21) mainstream	Stream flooding. Unable to seine or sample for marks.
		69	(10-22) mainstream	
		119	(10-23) west fork above dams	
		746	TOTAL	
Yehring Creek	11-1 to 11-3 (Marriott, Staska)	---		Seine / Dip Net and Carcasses
				----- / 0:65 (11-1) Most dip netted in side channels. One-third of fish dead.
				0:57 (11-2) / Most seined off spawning riffles in upper areas.
				2:0 (11-2)
				1:3 (11-3)
				0:57 / 3:68
				TOTAL = 3:125 = 3/128 = 2.34% adipose fin marks in escapement.
Johnson Creek	10-25 to 10-27 (Gray, Florey, Laner)	37	meadow	Visual Count
		125	mainstream	1:35 = 1/36 = 2.78% adipose fin marks in escapement.
		45	lower fork	
		10	side channels	
		217	TOTAL	
				3/128 (Yehring) + 1/36 (Johnson) = 4/164 = 2.44% average % of adipose fin marks in escapement for Taku River (Yehring and Johnson Creeks combined).

(continued)

Appendix Table 4. Spawning ground counts and marked:unmarked ratios of cohos (1974) - continued.

	Dates & persons making counts	Total escapement count (Live plus carcasses)	Marked:unmarked ratio		
Berners River	11-1 to 11-7 (Gray, Laner, Saviko, Staska)	1,761 (11-1) 333 (11-2) 607 (11-5) 1,078 (11-6) 343 (11-7) 4,124 TOTAL	Seine 5:96 (11-2) 4:145 (11-4) 6:134 (11-5) 0:53 (11-6) 15:428	Carcasses 0:27 (11-1) 0:15 (11-2) 0:2 (11-4) 1:28 (11-5) 0:50 (11-6) 0:14 (11-7) 1:136	Visual Counts 1:84 (11-2) headwaters. 2:66 (11-6) side pool shallows. 3:150
			TOTAL = 19:714 = 19/733 = 2.59% adipose fin marks in escapement.		
Chilkat River					
Lower Main River	9-28 to 11-2 (Burleson)	No escapement count possible	Examination of Sport Catch 0:23		
Mosquito Lake	11-9 (Marriott)		One adipose fin clipped carcass found. No other cohos seen and run looked over. Signs of recent heavy flooding.		

Appendix Table 5A. 1974 Southeastern Alaska commercial coho catch in fishing areas 13A, 14A, and 16 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	1,946	914	46.97	---	---	---	---	---	---	---	---	---	1	1	2	---	---	1	2
26-27 (June 23-July 6)	15,646	10,125	64.71	5	7	11	---	---	---	5	5	8	15	13	20	---	---	25	39
28-29 (July 7-20)	54,252	43,926	80.97	40	59	73	3	5	6	2	2	3	58	37	46	1	1	104	129
30-31 (July 21-August 3)	28,368	9,363	33.01	6	9	27	1	2	5	1	1	3	16	12	36	---	---	24	71
32-33 (Aug. 4-17)	47,658	37,499	78.68	27	40	50	8	13	17	11	12	15	51	32	41	3	4	100	127
34-35 (Aug. 18-31)	63,516	63,823	100.48	21	31	31	43	71	71	28	30	30	95	55	55	3	3	190	190
36-37 (Sept. 1-14)	25,092	23,998	95.64	8	12	12	28	46	49	32	34	36	29	5	5	2	2	99	104
38-39 (Sept. 15-28)	2,481	293	11.81	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	238,959	189,941	79.49	107	158	204	83	137	148	79	84	95	265	155	205	9	10	543	662

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5B. 1974 Southeastern Alaska commercial coho catch in fishing areas 14B & C, 112-13, 112-14, and 112-16 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. Catch	Number Sampled	Percent Sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	433	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	3,116	10	0.32	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	12,060	3,813	31.62	3	4	14	2	3	10	---	---	---	5	3	9	---	---	10	33
30-31 (July 21-August 3)	3,090	1,354	43.82	1	1	3	---	---	---	1	1	2	2	2	5	---	---	4	10
32-33 (Aug. 4-17)	7,238	5,431	75.03	4	6	8	---	---	---	1	1	1	3	1	1	---	---	8	10
34-35 (Aug. 18-31)	11,195	863	7.71	2	2	26	1	1	13	---	---	---	---	---	---	---	---	3	39
36-37 (Sept. 1-14)	7,773	697	8.97	1	1	16	2	3	37	1	1	12	4	3	33	---	---	8	98
38-39 (Sept. 15-28)	2,486	1,249	50.24	---	---	---	4	4	8	4	4	8	---	---	---	---	---	8	16
TOTAL	47,391	13,417	28.31	11	14	67	9	11	68	7	7	23	14	9	48	---	---	41	206

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5C. 1974 Southeastern Alaska commercial coho catch in fishing areas 11A & 112-15 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	128	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	1,674	206	12.31	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	3,681	1,795	48.76	---	---	1	---	---	1	---	---	---	1	---	---	---	---	1	2
30-31 (July 21-August 3)	5,429	2,868	52.83	3	5	9	---	---	---	---	---	---	2	---	---	---	---	5	9
32-33 (Aug. 4-17)	8,234	6,875	83.50	5	15	18	---	---	---	---	---	---	10	---	---	---	---	15	18
34-35 (Aug. 18-31)	8,122	6,018	74.10	9	12	16	4	6	8	3	3	4	5	---	---	---	---	21	28
36-37 (Sept. 1-14)	5,593	2,808	50.21	4	4	9	5	6	11	2	2	5	1	---	---	---	---	12	25
38-39 (Sept. 15-28)	1,273	546	42.89	---	---	---	1	2	4	---	---	---	1	---	---	---	---	2	4
TOTAL	34,134	21,116	61.86	21	36	53	10	14	24	5	5	9	20	---	---	---	---	56	86

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5D. 1974 Southeastern Alaska commercial coho catch in fishing areas 15A and C by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
23 (June 2-8)	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
24-25 (June 9-22)	171	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	678	11	1.62	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	352	320	90.91	---	---	---	1	1	1	---	---	---	---	---	---	---	---	1	1
30-31 (July 21-August 3)	449	144	32.07	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-17)	733	94	12.82	---	---	---	---	---	---	1	1	8	---	---	---	---	---	1	8
34-35 (Aug. 18-31)	7,056	4,015	56.90	---	---	---	1	3	4	16	20	36	6	---	---	---	---	23	40
36-37 (Sept. 1-14)	23,821	17,283	72.55	4	6	8	21	32	44	52	57	79	18	---	---	---	---	95	131
38-39 (Sept. 15-28)	25,716	15,986	62.16	1	1	2	28	39	63	54	58	93	15	---	---	---	---	98	158
40-41 (Sept. 29-Oct. 12)	6,691	3,467	51.82	---	---	---	3	4	8	18	19	37	2	---	---	---	---	23	45
TOTAL	65,672	41,320	62.92	5	7	10	54	79	120	141	155	253	41	---	---	---	---	241	383

(continued)

Appendix Table 5D. 1974 Southeastern Alaska commercial coho catch in fishing areas 15A and C by statistical weeks, sample percentage, and number of marked cohos recovered (continued).

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5E. 1974 Southeastern Alaska commercial coho catch in fishing area 11B by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	249	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	2,026	855	42.20	1	2	5	---	---	---	---	---	---	1	---	---	---	---	2	5
28-29 (July 7-20)	3,326	1,287	38.70	1	3	8	---	---	---	---	---	---	2	---	---	---	---	3	8
30-31 (July 21-August 3)	613	47	7.67	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-17)	3,942	2,092	53.07	5	7	13	---	---	---	---	---	---	2	---	---	---	---	7	13
34-35 (Aug. 18-31)	5,389	3,017	55.98	5	5	9	---	---	---	---	---	---	---	---	---	---	---	5	9
36-37 (Sept. 1-14)	16,586	12,185	73.47	24	39	53	---	---	---	---	---	---	15	---	---	---	---	39	53
38-39 (Sept. 15-28)	9,929	5,998	60.41	13	16	26	---	---	---	---	---	---	3	---	---	---	---	16	26
40-41 (Sept. 29-Oct. 12)	601	8	1.33	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	42,661	25,489	59.75	49	72	114	---	---	---	---	---	---	23	---	---	---	---	72	114

(continued)

Appendix Table 5E. 1974 Southeastern Alaska commercial coho catch in fishing area 11B by statistical weeks, sample percentage, and number of marked cohos recovered (continued).

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5F. 1974 Southeastern Alaska commercial coho catch in fishing areas 10, 11C and D by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	35	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	583	30	5.15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	2,151	300	13.95	---	---	---	---	---	---	---	---	---	1	1	7	---	---	1	7
30-31 (July 21-August 3)	3,982	117	4.45	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-17)	3,842	1,606	41.80	---	---	---	---	---	---	---	---	---	2	2	5	---	---	2	5
34-35 (Aug. 18-31)	7,375	847	11.48	---	---	---	---	---	---	---	---	---	2	2	17	---	---	2	17
36-37 (Sept. 1-14)	5,125	152	2.97	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
38-39 (Sept. 15-28)	1,627	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	24,720	3,112	12.59	---	---	---	---	---	---	---	---	---	5	5	29	---	---	5	29

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berner R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5G. 1974 Southeastern Alaska commercial coho catch in fishing area 12 (south of Pt. Hepburn) by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	55	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	982	750	76.37	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-31 (July 21-August 3)	1,658	1,127	67.97	1	1	2	---	---	---	---	---	---	1	1	1	---	---	2	3
32-33 (Aug. 4-17)	2,260	420	18.58	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
34-35 (Aug. 18-31)	216	123	56.94	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
36-37 (Sept. 1-14)	259	38	14.67	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
38-39 (Sept. 15-28)	291	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	5,737	2,458	42.84	1	1	2	---	---	---	---	---	---	1	1	1	---	---	2	3

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5H. 1974 Southeastern Alaska commercial coho catch in fishing areas 5, 9 and 13B by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	794	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	4,361	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	19,045	766	4.02	---	---	---	---	---	---	---	---	---	1	1	25	---	---	1	25
30-31 (July 21-August 3)	31,863	7,392	23.20	---	---	---	1	2	7	1	1	5	13	12	52	---	---	15	64
32-33 (Aug. 4-17)	23,938	7,226	30.19	---	---	---	---	---	---	---	---	---	11	11	36	1	3	12	39
34-35 (Aug. 18-31)	17,048	4,057	23.80	---	---	---	---	---	---	---	---	---	11	11	46	---	---	11	46
36-37 (Sept. 1-14)	11,860	362	3.05	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
38-39 (Sept. 15-28)	6,047	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	114,956	19,803	17.23	---	---	---	1	2	7	1	1	5	36	35	159	1	3	39	174

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.

Appendix Table 5I. 1974 Southeastern Alaska commercial coho catch in fishing areas 3 and 4 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	7,716	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	11,735	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	35,217	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-31 (July 21-August 3)	85,693	1,009	1.18	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-17)	98,990	4,836	4.89	---	---	---	---	---	---	---	---	---	5	5	5[d]	1	1	6	6[d]
34-35 (Aug. 18-31)	100,693	4,919	4.89	---	---	---	---	---	---	---	---	---	7	7	7[d]	---	---	7	7[d]
36-37 (Sept. 1-14)	12,068	19	0.16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
38-39 (Sept. 15-28)	152	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	352,264	10,783	3.06	---	---	---	---	---	---	---	---	---	12	12	12[d]	1	1	13	13[d]

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.
d/ No correction over observed numbers due to small sample sizes.

Appendix Table 5J. 1974 Southeastern Alaska commercial coho catch in fishing areas 6, 7 and 8 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
23 (June 2-8)	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
24-25 (June 9-22)	787	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	4,337	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	3,825	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-31 (July 21-August 3)	8,389	13	0.15	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-17)	16,658	945	5.67	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
34-35 (Aug. 18-31)	28,520	1,585	5.56	---	---	---	---	---	---	---	---	---	2	2	2[d]	---	---	2	2[d]
36-37 (Sept. 1-14)	27,769	1,613	5.81	---	---	---	---	---	---	---	---	---	4	4	4[d]	---	---	4	4[d]
38-39 (Sept. 15-28)	4,840	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
40-41 (Sept. 29-Oct. 12)	20	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(continued)

Appendix Table 5J. 1974 Southeastern Alaska commercial coho catch in fishing areas 6, 7 and 8 by statistical weeks, sample percentage, and number of marked cohos recovered (continued).

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
TOTAL	95,146	4,156	4.37	---	---	---	---	---	---	---	---	---	6	6	6[d]	---	---	6	6[d]

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.
d/ No correction over observed numbers due to small sample sizes.

Appendix Table 5K. 1974 Southeastern Alaska commercial coho catch in fishing areas 1 and 2 by statistical weeks, sample percentage, and number of marked cohos recovered.

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
24-25 (June 9-22)	1,429	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
26-27 (June 23-July 6)	11,692	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
28-29 (July 7-20)	22,512	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
30-31 (July 21-August 3)	22,631	76	0.34	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
32-33 (Aug. 4-7)	37,439	229	0.61	---	---	---	---	---	---	---	---	---	1	1	1[d]	---	---	1	1[d]
34-35 (Aug. 18-31)	49,189	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
36-37 (Sept. 1-14)	21,625	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
38-39 (Sept. 15-28)	11,227	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
40-41 (Sept. 29-Oct. 12)	135	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
42-43 (Oct. 13-26)	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(continued)

Appendix Table 5K. 1974 Southeastern Alaska commercial coho catch in fishing areas 1 and 2 by statistical weeks, sample percentage, and number of marked cohos recovered (continued).

Statistical weeks	Comm. catch	Number sampled	Percent sampled	TAKU (red)			BERNERS (green)			CHILKAT (orange)			AD only			OTHER MARKS (cwt or fin clips)		TOTAL MARKS (all types)	
				Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[a]	Expanded[b]	Marks found	Corrected[c]	Expanded[b]	Marks found	Expanded[b]	Total found	Total expanded
44 (Oct. 27-Nov. 2)	3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	177,885	305	0.17	---	---	---	---	---	---	---	---	---	1	1	1[d]	---	---	1	1[d]

a/ Corrected for pigment loss (31.94% for Taku R., 39.68% for Berners R., 7.14% for Chilkat R.).
b/ Expanded to 100% sample size.
c/ Corrected for less adipose only marks due to pigment loss correction.
d/ No correction over observed numbers due to small sample sizes.

APPENDIX A. BIOLOGICAL SAMPLING OF PIGMENT MARKED COHO SALMON

Length and Weight of Pigment Marked Coho Salmon

Appendix Tables A1-A4 show the number, mean, and range of sizes of coho salmon recovered by statistical week. The tables also show the results of linear regression analysis of fish size by statistical week.

Snout-fork lengths of 551 pigment marked coho salmon ranged from 50.8 to 83.8 cm (20.0 to 33.0 in.) and round weights (228 fish) from 2.39 to 8.18 kg (4 lbs. 14 oz. to 18 lbs.). Taku River cohos had a wide range in fish size for each statistical week. Fish of double the weight were common in the same week. Berners River cohos also had a wide range in sizes and fish up to double the weight were fairly common in the same week. Chilkat River cohos had less range in size and fish up to double the weight in the same week were not common.

Reasons for the wide range in fish size for the same week might be the two different streams on the Taku River (Yehring and Johnson Creek) or time of migration of smolts from each stream. The time of smolt migration may also vary considerably within the same stream. Time of smolt migration could determine both length of time and area of feeding in saltwater. Some cohos migrate out Icy Strait for open ocean feeding while others may remain in inside waters and thus attain a smaller size at maturity.

Large differences in size of cohos at maturity have been found in Washington State where some fish remain inside Puget Sound while others migrate into open ocean areas to feed. Cohos that migrated to outside waters attained a considerably larger size than those remaining inside Puget Sound.

Linear regressions of fish length and weight on statistical week were calculated to show the increase in fish size as the season progressed. These regressions did not yield good correlations, probably because of the wide range in sizes for any given week. The increase in snout-fork length per week was 0.9 cm (0.36 in.) for Taku cohos, 1.0 cm (0.40 in.) for Berners cohos, and 0.8 cm (0.31 in.) for Chilkat cohos. Round weight increases were 0.23 kg (0.50 lb.) per week for Taku River cohos, 0.17 kg (0.36 lb.) for Berners cohos, and 0.17 kg (0.36 lb.) for Chilkat cohos.

Appendix Table A1. Snout-fork lengths of pigment marked coho salmon by statistical week.

Statistical Week	TAKU			BERNERS			CHILKAT		
	Number of Fish	Range in Lengths (cm)	Mean	Number of Fish	Range in Lengths (cm)	Mean	Number of Fish	Range in Lengths (cm)	Mean
27 (6/30-7/6)	2	(62.2-66.4)	64.3	---	---	---	1	(64.8)	64.8
28 (7/7-7/13)	14	(58.4-68.6)	64.1	3	(58.4-66.7)	62.4	1	(55.2)	55.2
29 (7/14-7/20)	9	(61.6-74.9)	68.2	2	(64.8-69.9)	67.3	3	(65.4-69.9)	67.9
30 (7/21-7/27)	3	(50.8-73.0)	63.4	2	(55.2-66.0)	60.6	3	(64.1-67.9)	66.0
31 (7/28-8/3)	8	(58.7-72.4)	67.1	---	---	---	---	---	---
32 (8/4-8/10)	24	(52.1-76.2)	67.4	4	(65.1-73.3)	68.8	7	(63.5-73.7)	68.0
33 (8/11-8/17)	17	(54.0-74.9)	69.4	4	(65.4-72.4)	69.2	6	(63.5-70.2)	68.3
34 (8/18-8/24)	20	(55.2-81.3	69.4	21	(57.8-75.6)	70.0	15	(55.2-75.2)	69.6
35 (8/25-8/31)	16	(67.0-83.2)	73.0	28	(54.6-77.2)	70.6	32	(64.1-78.4)	71.9
36 (9/1-9/7)	21	(55.9-83.8)	71.2	37	(62.2-79.4)	72.7	36	(64.5-80.0)	71.8
37 (9/8-9/14)	19	(65.7-78.7)	73.0	18	(67.9-78.7)	73.7	49	(60.0-78.7)	72.0
38 (9/15-9/21)	13	(70.2-83.8)	73.8	23	(67.6-81.3)	73.7	33	(66.0-78.1)	73.3
39 (9/22-9/28)	1	(75.6)	75.6	10	(69.9-83.8)	75.0	25	(66.7-81.3)	74.2
40 (9/29-10/5)	---	---	---	3	(63.5-76.2)	71.5	16	(66.0-79.1)	73.3
41 (10/6-10/12)	---	---	---	---	---	---	2	(76.2-80.0)	78.1
	167			155			229		

Linear Regression Analysis - Snout-Fork Length on Statistical Week

TAKU	BERNERS	CHILKAT
a_o 38.7445 a_1 0.9219 r^2 0.2197 $\hat{y}$ 38.7445 + 0.9219X	a_o 35.5677 a_1 1.0119 r^2 0.2330 $\hat{y}$ 35.5677 + 1.0119x	a_o 43.1207 a_1 0.7901 r^2 0.2165 $\hat{y}$ 43.1207 + 0.7901x

Appendix Table A2. Mideye-fork lengths of pigment marked coho salmon by statistical week.

Statistical Week	TAKU Number of Fish	TAKU Range in Lengths (cm)	TAKU Mean	BERNERS Number of Fish	BERNERS Range in Lengths (cm)	BERNERS Mean	CHILKAT Number of Fish	CHILKAT Range in Lengths (cm)	CHILKAT Mean
27 (6/30-7/6)	2	(57.8-62.2)	60.0	---	---	---	1	(59.7)	59.7
28 (7/7-7/13)	14	(54.0-63.5)	59.4	3	(53.3-62.2)	58.0	1	(50.8)	50.8
29 (7/14-7/20)	9	(57.2-68.6)	62.4	2	(59.7-63.5)	61.6	3	(60.3-64.5)	62.8
30 (7/21-7/27)	3	(46.4-66.0)	58.0	2	(50.2-61.0)	55.6	3	(59.7-64.1)	61.8
31 (7/28-8/3)	8	(55.9-65.4)	61.8	---	---	---	---	---	---
32 (8/4-8/10)	24	(47.6-68.9)	61.9	4	(60.3-66.7)	63.2	7	(59.1-67.3)	62.8
33 (8/11-8/17)	17	(49.5-69.2)	64.0	4	(59.7-66.0)	64.0	6	(59.1-65.1)	63.5
34 (8/18-8/24)	19	(51.8-72.4)	64.2	21	(52.7-68.9)	64.2	15	(50.8-67.9)	64.1
35 (8/25-8/31)	16	(61.9-73.7)	66.8	28	(49.5-69.9)	64.7	32	(57.8-71.8)	65.8
36 (9/1-9/7)	21	(49.8-73.7)	64.6	37	(57.5-71.1)	66.3	36	(58.7-71.4)	65.5
37 (9/8-9/14)	19	(59.7-70.5)	66.2	18	(60.3-69.9)	66.7	49	(55.6-70.5)	65.5
38 (9/15-9/21)	3	(63.5-73.3)	66.8	23	(62.2-73.7)	66.7	33	(60.3-72.1)	67.3
39 (9/22-9/28)	1	(67.9)	67.9	10	(61.0-73.0)	66.6	25	(61.6-73.0)	67.2
40 (9/29-10/5)	---	---	---	3	(56.2-69.9)	65.0	16	(59.7-71.1)	66.4
41 (10/6-10/12)	---	---	---	---	---	---	2	(69.9-72.1)	71.0
	166			155			229		

Linear Regression Analysis - Mideye-Fork Length on Statistical Week

TAKU	BERNERS	CHILKAT
a_o 40.1324 a_1 0.7058 r^2 0.1854 $\hat{y}$ 40.1324 + 0.7058x	a_o 39.7604 a_1 0.7157 r^2 0.1603 $\hat{y}$ 39.7604 + 0.7157x	a_o 44.3995 a_1 0.5837 r^2 0.1567 $\hat{y}$ 44.3995 + 0.5837x

Appendix Table A3. Round weights of pigment marked coho salmon by statistical week.

Statistical Week	TAKU Number of Fish	TAKU Range in Weight (kg)	TAKU Mean	BERNERS Number of Fish	BERNERS Range in Weight (kg)	BERNERS Mean	CHILKAT Number of Fish	CHILKAT Range in Weight (kg)	CHILKAT Mean
27 (6/30-7/6)	---	---	---	---	---	---	---	---	---
28 (7/7-7/13)	1	(2.73)	2.73	---	---	---	---	---	---
29 (7/14-7/20)	---	---	---	2	(2.73-3.64)	3.18	---	---	---
30 (7/21-7/27)	---	---	---	---	---	---	---	---	---
31 (7/28-8/3)	---	---	---	---	---	---	---	---	---
32 (8/4-8/10)	1	(3.75)	3.75	---	---	---	---	---	---
33 (8/11-8/17)	---	---	---	---	---	---	---	---	---
34 (8/18-8/24)	2	(2.39-7.73)	5.06	---	---	---	1	(2.22)	2.22
35 (8/25-8/31)	2	(4.09-4.55)	4.32	---	---	---	15	(3.64-5.68)	4.73
36 (9/1-9/7)	11	(3.30-7.05)	5.23	6	(3.07-5.91)	4.47	13	(3.98-5.57)	4.75
37 (9/8-9/14)	11	(3.86-6.82)	5.47	9	(3.75-6.14)	4.90	36	(3.41-6.14)	4.85
38 (9/15-9/21)	13	(4.55-8.18)	5.40	19	(3.75-6.59)	5.23	31	(3.69-6.39)	5.31
39 (9/22-9/28)	1	(4.43)	4.43	9	(3.41-6.36)	4.85	24	(3.64-6.93)	4.99
40 (9/29-10/5)	---	---	---	3	(2.73-6.14)	4.66	16	(3.41-6.70)	5.17
41 (10/6-10/12)	---	---	---	---	---	---	2	(5.00-5.91)	5.46
	42			48			138		

Linear Regression Analysis - Round Weight on Statistical Week

TAKU	BERNERS	CHILKAT
a_o -3.1269 a_1 0.2274 r^2 0.1238 $\hat{y}$ -3.1269 + 0.2274x	a_o -1.3152 a_1 0.1652 r^2 0.1223 $\hat{y}$ -1.3152 + 0.1652 x	a_o 0.1296 a_1 0.1289 r^2 0.0610 $\hat{y}$ 0.1296 + 0.1289 x

Appendix Table A4. Dressed weights of pigment marked coho salmon by statistical week.

Statistical Week	TAKU Number of Fish	TAKU Range in Weight (kg)	TAKU Mean	BERNERS Number of Fish	BERNERS Range in Weight (kg.)	BERNERS Mean	CHILKAT Number of Fish	CHILKAT Range in Weight (kg)	CHILKAT Mean
27 (6/30-7/6)	2	(2.53-3.18)	2.86	---	---	---	1	(2.53)	2.53
28 (7/7-7/13)	13	(1.82-3.41)	2.67	3	(1.70-2.50)	2.16	1	(1.59)	1.59
29 (7/14-7/20)	9	(2.27-4.89)	3.42	---	---	---	3	(2.84-3.41)	3.18
30 (7/21-7/27)	3	(1.11-3.78)	2.56	2	(1.70-2.87)	2.29	3	(2.39-3.18)	2.80
31 (7/28-8/3)	8	(2.13- 4.55)	3.31	---	---	---	---	---	---
32 (8/4-8/10)	23	(1.48-5.11)	3.44	4	(2.87-4.46)	3.64	7	(2.39-4.43)	3.32
33 (8/11-8/17)	17	(1.62-4.43)	3.59	4	(3.18-4.09)	3.72	6	(3.10-3.72)	3.37
34 (8/18-8/24)	19	(1.99-5.45)	3.76	20	(2.16-4.91)	3.96	13	(2.98-5.00)	3.96
35 (8/25-8/31)	14	(3.69-6.36)	4.68	28	(2.27-5.48)	3.98	17	(3.32-5.51)	4.30
36 (9/1-9/7)	10	(3.64-5.11)	4.29	31	(2.36-6.36)	4.43	23	(3.10-5.00)	4.18
37 (9/8-9/14)	8	(3.07-5.34)	4.24	9	(3.24-6.02)	4.45	15	(2.27-5.23)	3.97
38 (9/15-9/21)	---	---	---	4	(3.21-5.23)	3.96	2	(3.38-3.66)	3.53
39 (9/22-9/28)	---	---	---	1	(3.52)	3.52	1	(4.66)	4.66
40 (9/29-10/5)	---	---	---	---	---	---	---	---	---
41 (10/6-10/12)	---	---	---	---	---	---	---	---	---
	126			106			92		

Linear Regression Analysis - Dressed Weight on Statistical Week

TAKU	BERNERS	CHILKAT
a_o -2.5693	a_o -3.3918	a_o -1.8604
a_1 0.1907	a_1 0.2125	a_1 0.1657
r^2 0.2633	r^2 0.1965	r^2 0.2643
$\hat{y}$ -2.5693 + 0.1907x	$\hat{y}$ -3.3918 + 0.2125x	$\hat{y}$ -1.8604 + 0.1657x

Age Analysis of Pigment Marked Coho Salmon

Total age of marked cohos

The age composition of pigment marked coho salmon recovered in the commercial fishery consisted of four different age classes and are compared in Appendix Table A5 1/. The 2.1 age class was predominant in all three river systems followed by the 3.1 age class. The 1.1 age class was represented in only 1.8% of the total scale samples. This is due to the fact that during the pigment marking operations an effort was made to mark only age I+ or older juveniles which migrated to sea as age II+ smolts. The 4.1 age class was present in only the Chilkat and Taku Rivers and consisted of 5.0% and 0.7% respectively of the total scale samples from those systems.

Scales from Berners River cohos were easiest to read followed by Taku River cohos which were more difficult and by Chilkat River cohos which were considerably more difficult. This is reflected in the percentage of cohos going to sea in their third year of life (2.1) which was highest in Berners River cohos (89.1%), second in Taku River cohos (78.9%), and lowest in Chilkat River cohos (60%). The highest percentage of older aged cohos (3.1 and 4.1) was found in Chilkat River cohos followed by Taku River cohos and Berners River cohos. The longer a coho spends in freshwater the more difficult the scales become to read.

Mean freshwater circuli counts

The mean circuli counts of each year of freshwater life by age class is shown in Appendix Table A6. Marked coho that went to sea in their second year of life (1.1) exhibited the highest mean circuli count for the first year of freshwater growth ranging from 14.5 in the Chilkat River sample to 14.0 in the Taku River sample. Coho that went to sea as smolts in their third year of life (age 2.1) exhibited the most growth in their second year of freshwater residency. As the freshwater age increased the mean circuli counts for each year of freshwater growth decreased, averaging only 4 to 6 circuli per year in age 4.1 coho.

1/ European age designation (the numbers before and after the decimal point refer to the number of winters a fish spent in fresh and saltwater respectively. A 1.1 age coho spent one winter in freshwater, one winter in saltwater and returned to spawn in its third year of life.)

Appendix Table A5. Comparison of the age structure of pigment marked coho salmon 1/.

River System	Age 1.1 N	Age 1.1 %	Age 2.1 N	Age 2.1 %	Age 3.1 N	Age 3.1 %	Age 4.1 N	Age 4.1 %	Total
Taku River	1	0.7	120	78.9	30	19.7	1	0.7	152
Berners River	3	2.2	123	89.1	12	8.7	0	0.0	138
Chilkat River	4	2.5	96	60.0	52	32.5	8	5.0	160
Total	8	1.8	339	75.3	94	20.9	9	2.0	450

1/ European age designation (the numbers before and after the decimal point refer to the number of winters a fish spent in fresh and saltwater respectively. A 1.1 age coho spent one winter in freshwater, one winter in saltwater and returned to spawn in its third year of life.

Appendix Table A6. Mean circuli counts of each year of freshwater growth by age class for pigment marked coho salmon.

River System	Age 1.1 1st	Age 2.1 1st	Age 2.1 2nd	Age 3.1 1st	Age 3.1 2nd	Age 3.1 3rd	Age 4.1 1st	Age 4.1 2nd	Age 4.1 3rd	Age 4.1 4th
Taku River	14.0	6.9	7.7	6.1	6.4	6.7	5.0	8.0	6.0	5.0
Berners River	14.3	8.1	8.2	6.0	7.3	6.5	-	-	-	-
Chilkat River	14.5	9.1	10.3	7.6	7.9	7.6	5.3	4.6	4.8	4.5
Average	14.2	8.2	8.9	6.8	7.4	7.0	5.3	5.5	4.9	4.6

The Chilkat River sample showed the highest mean circuli count for each year of freshwater residency followed by the Berners River sample. The Taku River cohos showed the lowest mean circuli counts averaging 6.9 and 7.7 for the first and second years of growth in age 2.1 coho as compared with 9.1 and 10.3 for the Chilkat River sample and 8.1 and 8.2 for the Berners River sample.

It appears that the fastest growing cohos (as evidenced by higher mean circuli counts) go to sea at an earlier age because they reach smolt size sooner. The difference in mean circuli counts between the three river systems is probably due to the quality of the rearing environment. The Chilkat River cohos from Mosquito and Chilkat Lakes were probably in the richest environment followed by the Berners River's warm, weedy east fork and small lake, and the smaller beaver ponds and sloughs of Yehring and Johnson Creek (Taku River) in last place.

Mean saltwater circuli counts

The mean circuli counts of the first year of saltwater residency by age class is shown in Appendix Table A7. The mean saltwater counts did not vary significantly by age class in any of the samples. The Berners River sample exhibited the highest mean saltwater circuli count when all age classes were combined. The mean counts ranged from 37.1 in the Berners River sample to 36.6 and 36.0 for the Taku and Chilkat samples.

Appendix Table A7. Mean circuli counts for the first year of saltwater residency by age class for pigment marked coho salmon.

River system	Age 1.1	Age 2.1	Age 3.1	Age 4.1	All ages combined
Taku River	38.0	36.6	36.7	38.0	36.6
Berners River	35.6	37.2	36.8	--	37.1
Chilkat River	36.3	35.7	36.7	36.3	36.0