

Fishery Data Series No. 06-25

**Estimates of Commercial and Sport Harvest and
Escapement in 1999-2001 of Coho Salmon Stocked
into Northern Cook Inlet Streams in 1998-2000**

by

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June 2006

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative Code	AAC	fork length	FL
deciliter	dL			mid-eye-to-fork	MEF
gram	g	all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.	mid-eye-to-tail-fork	METF
hectare	ha			standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.		
meter	m			Mathematics, statistics	
milliliter	mL	at	@	<i>all standard mathematical signs, symbols and abbreviations</i>	
millimeter	mm	compass directions:		alternate hypothesis	H _A
		east	E	base of natural logarithm	<i>e</i>
		north	N	catch per unit effort	CPUE
		south	S	coefficient of variation	CV
		west	W	common test statistics	(F, t, χ^2 , etc.)
Weights and measures (English)		copyright	©	confidence interval	CI
cubic feet per second	ft ³ /s	corporate suffixes:		correlation coefficient (multiple)	R
foot	ft	Company	Co.	correlation coefficient (simple)	r
gallon	gal	Corporation	Corp.	covariance	cov
inch	in	Incorporated	Inc.	degree (angular)	°
mile	mi	Limited	Ltd.	degrees of freedom	df
nautical mile	nmi	District of Columbia	D.C.	expected value	<i>E</i>
ounce	oz	et alii (and others)	et al.	greater than	>
pound	lb	et cetera (and so forth)	etc.	greater than or equal to	≥
quart	qt	exempli gratia		harvest per unit effort	HPUE
yard	yd	(for example)	e.g.	less than	<
		Federal Information Code	FIC	less than or equal to	≤
Time and temperature		id est (that is)	i.e.	logarithm (natural)	ln
day	d	latitude or longitude	lat. or long.	logarithm (base 10)	log
degrees Celsius	°C	monetary symbols		logarithm (specify base)	log ₂ , etc.
degrees Fahrenheit	°F	(U.S.)	\$, ¢	minute (angular)	'
degrees kelvin	K	months (tables and figures): first three letters	Jan, ..., Dec	not significant	NS
hour	h	registered trademark	®	null hypothesis	H ₀
minute	min	trademark	™	percent	%
second	s	United States (adjective)	U.S.	probability	P
		United States of America (noun)	USA	probability of a type I error (rejection of the null hypothesis when true)	α
Physics and chemistry		U.S.C.	United States Code	probability of a type II error (acceptance of the null hypothesis when false)	β
all atomic symbols		U.S. state	use two-letter abbreviations (e.g., AK, WA)	second (angular)	"
alternating current	AC			standard deviation	SD
ampere	A			standard error	SE
calorie	cal			variance	
direct current	DC			population	Var
hertz	Hz			sample	var
horsepower	hp				
hydrogen ion activity (negative log of)	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA SERIES NO. 06-25

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by

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ABSTRACT

An ongoing evaluation of a coho salmon *Oncorhynchus kisutch* stocking program in urban areas of Southcentral Alaska was conducted in 1999, 2000, and 2001. Juvenile coho salmon reared in hatcheries and released into several Northern Cook Inlet (NCI) freshwater systems in 1998, 1999, and 2000 returned to Upper Cook Inlet (UCI) during 1999, 2000, and 2001. Some fish in each release group were marked with an adipose finclip and a coded wire tag (CWT). Marked coho salmon were recovered in 1999, 2000, and 2001 from selected UCI commercial fisheries, sport fisheries, and escapements to estimate contribution of stocked coho salmon to each, and to estimate total return of stocked coho to those systems.

In 1999, 2000, and 2001 the UCI mixed-stock commercial fisheries harvested 125,343, 236,128, and 113,311 coho salmon, respectively. During all 3 years, a majority (80%-90%) of coho salmon were harvested in the Central District drift gillnet, the Northern District set gillnet, and the Central District (eastside) Upper Subdistrict set gillnet fisheries. Sampling effort focused on coho salmon harvested in these three fisheries. UCI commercial fisheries harvested 4,715 stocked coho salmon in 1999; 9,534 in 2000; and 6,229 in 2001.

Sport fisheries harvested 11,622 stocked coho salmon in 1999; 25,421 fish in 2000; and 38,940 in 2001. From 1999-2001, the estimated escapement of coho salmon into Ship and Campbell creeks exceeded the annual biological escapement goal of 200 coho for each creek. In Ship Creek, escapement was an estimated 474 (1999), 815 (2000), and 1,393 (2001) coho salmon based on weir counts. In Campbell Creek, indexes of escapement from foot surveys were 537 coho salmon in 1999; 3,196 in 2000; and 2,377 in 2001. Effort, harvest, and catch estimated from the Statewide Harvest Survey increased in each year relative to the 1988-1992 (prestocking) averages at Ship, Campbell, and Bird creeks, most likely due to the return of stocked coho salmon.

Key words: coho salmon, *Oncorhynchus kisutch*, commercial harvest, sport harvest, escapement, coded wire tag, Northern Cook Inlet, stocking, straying.

INTRODUCTION

Upper Cook Inlet (UCI) includes all waters of Cook Inlet north of a line at the latitude of Anchor Point light (Figure 1). Coho salmon *Oncorhynchus kisutch* stocks are distributed throughout UCI and support large commercial and sport harvests. During 1999, 2000, and 2001 approximately 32%, 22%, and 18% of the total Central District commercial harvest (Fox and Shields 2000; 2001a; 2001b) were taken from UCI waters. The primary UCI coho salmon commercial fisheries are: (1) Central District drift gillnet (CDD), (2) Central District Upper Subdistrict (eastside) set gillnet (CDES), and (3) Northern District set gillnet (NDS) fisheries (Figure 1). UCI sport anglers harvested 21%, 33%, and 25% of the total statewide coho salmon in 1999, 2000, and 2001, respectively (Howe et al. 2001d; Jennings et al. 2004; Walker et al. 2003). The most popular directed sport fisheries in UCI occur on the Kenai River on the Kenai Peninsula, the Susitna River drainage and Little Susitna River in Northern Cook Inlet (NCI), and Ship Creek in the Anchorage area.

The Northern Cook Inlet (NCI) urban area extends from Ingram Creek in Turnagain Arm north to the Little Susitna River drainage (Figure 2). Annual recreational fishing effort in this area increased from an average of about 214,000 angler-days from 1979-1988 to about 259,000 angler-days from 1989-2001 (Howe et al. 1995, 1996, 2001 a-d; Jennings et al. 2004; Mills 1981a-b, 1982-1994; Walker et al. 2003). Anglers fishing in NCI target the five species of Pacific salmon *Oncorhynchus*, rainbow trout *O. mykiss*, Dolly Varden *Salvelinus malma*, Arctic char *S. alpinus*, Arctic grayling *Thymallus arcticus*, and the illegally introduced northern pike *Esox lucius*. Sport fisheries for these species are supported by a combination of wild and hatchery-produced stocks.

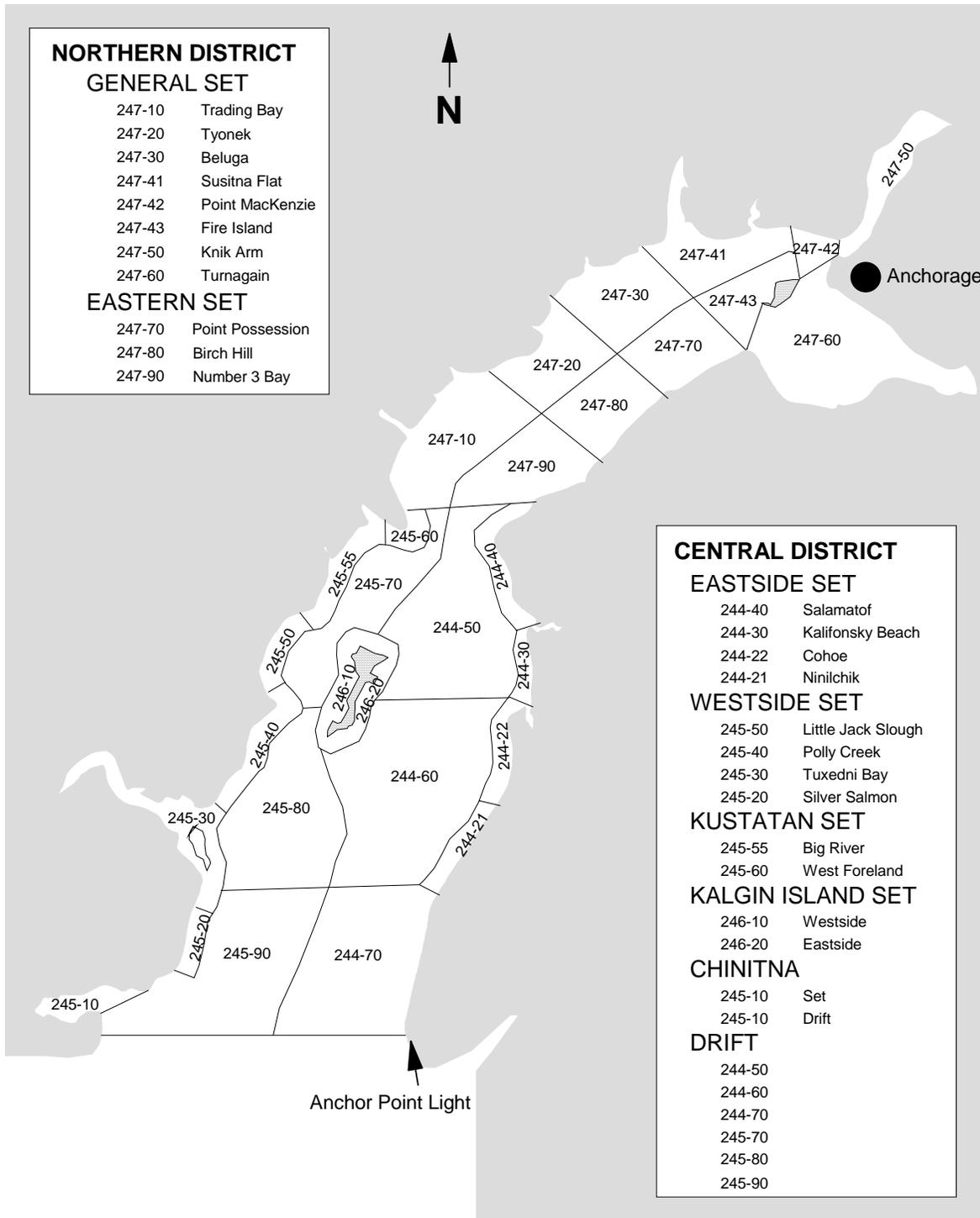


Figure 1.-Upper Cook Inlet commercial salmon fishing districts and statistical areas.

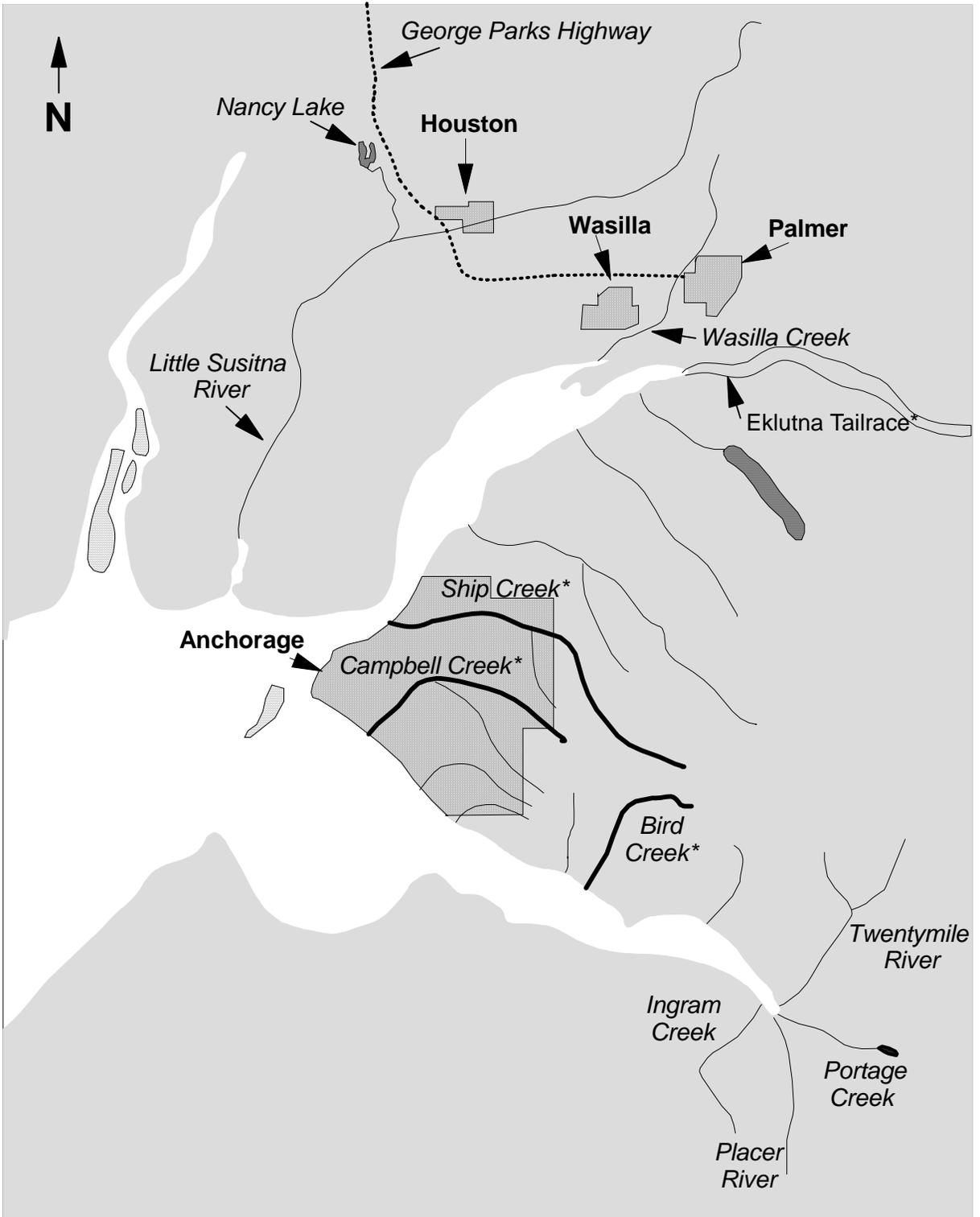


Figure 2.-Northern Cook Inlet urban area. Streams stocked with coho salmon in 1999, 2000 and 2001 are starred (*).

As the NCI human population has grown, the demand for sport fishing opportunities has increased. Hatchery-produced stocks play an important role in supporting these growing sport fisheries, and help deflect effort from less abundant wild stocks. A coho salmon smolt stocking program was initiated in 1992 to increase recreational sport fishing opportunities in the NCI urban area, specifically in Bird, Campbell, and Ship creeks. In 1998 the Eklutna Tailrace was added as an urban coho stocking site. To succeed, the stocking program must be cost-effective, have minimal impact on wild stocks and other fisheries, and maintain historic levels of spawning escapements in stocked streams.

The goal of the stocking program is to create or enhance terminal sport fisheries in selected NCI urban area streams and attract additional recreational fishing participation. The target of the program is to increase recreational angler effort by 25,000 angler-days and harvest by 10,000 coho salmon relative to the 5-year prestocking mean levels among all stocked streams. The Statewide Harvest Survey (SWHS) is used to evaluate increases in angler effort (for all species combined) and coho salmon harvest.

Prior to the start of this program in 1992, there was no quantitative information on stock composition from the mixed-stock commercial harvests, and virtually no information on the magnitude of inriver runs or spawning escapements. To provide information needed to manage these fisheries, an assessment program was initiated in 1991 to evaluate coho salmon stocks in UCI (Meyer et al. *Unpublished*). The program was designed to estimate harvest of selected wild and hatchery-reared coho salmon stocks in major UCI commercial fisheries and to evaluate the success of the coho salmon hatchery stocking programs in NCI. The overall program consists of three distinct but interrelated components: (1) estimation of commercial and inriver sport harvests, and escapement of coho salmon stocked in NCI streams; (2) marking of wild stock juvenile coho salmon from the Kenai River (and later Cottonwood Creek in NCI), inriver recovery of marked adults, and estimation of UCI commercial harvests of coho salmon from the Kenai River (and later from Cottonwood Creek); more recently an adult mark-recapture study has been conducted to estimate escapement to the Kenai River; and (3) production, marking, and release of coho salmon smolt by the hatcheries.

This report focuses on the first component above and primarily on results of marked coho salmon stocked in 1998, 1999, and 2000 (Table 1) that returned to UCI in 1999, 2000, and 2001. The remaining two program components are reported elsewhere (Carlson 2000; Carlson and Hasbrouck 1993, 1994, 1996-1998; Peltz and Hansen 1994; Peltz and Starkey 1993; Starkey et al. 1995-1997, 1999). In 2000 the NCI coho salmon hatchery-stocking assessment program was in its eighth year. Results from previous years can be found in Cyr et al. (1997-1999, 2001), Hoffmann and Hasbrouck (1994), and Stratton et al. (1996).

Table 1.-Summary of coded wire tagging data by release site for coho salmon smolt reared at Fort Richardson Hatchery and stocked in Northern Cook Inlet streams, 1998, 1999, and 2000.

Parameter	Release Site				Total
	Bird Creek	Ship Creek	Campbell Creek	Eklutna Tailrace	
1998 Releases					
Tagged fish released	46,094	66,997	22,296	111,882	247,269
Total fish released ^a	164,211	232,765	83,317	112,219	592,512
Theta ^b	0.2807	0.2878	0.2676	0.9970	0.4173
Tagging dates	10/30/97 to 11/6/97	10/15/97 to 11/6/97	10/23/97 to 10/27/97	11/6/97 to 11/24/97	
Tag retention Check	5/15/1998	5/14/98 & 5/18/98	5/14/1998	5/15/1998	
Days elapsed	190	197 & 193	199	172	
Release Dates	5/18/98 & 6/2/98	5/19/98 & 6/2 - 6/3/98	5/18 & 5/29/98 & 6/2/98	5/19 & 5/26 & 5/28/98	
1999 Releases					
Tagged fish released	36,746	45,380	20,378	42,663	145,167
Total fish released ^a	111,430	165,388	42,046	126,602	445,466
Theta ^b	0.3298	0.2744	0.4847	0.3370	0.3259
Tagging dates	11/10/98 to 11/16/98	10/27/98 to 11/2/98	11/6/98 to 11/10/98	10/20/98 to 10/27/98	
Tag retention Check	5/20/1999	5/11/1999	5/26/1999	5/19/1999	
Days elapsed	185	194	197	204	
Release Dates	5/25/99 & 5/27/99	2/21/99 - 5/24/99	5/28/99 - 5/29/99	5/24/99 & 5/27/99	
2000 Releases					
Tagged fish released	39,392	58,989	19,549	40,149	158,079
Total fish released ^a	97,407	260,070	63,730	76,851	498,058
Theta ^b	0.4044	0.2268	0.3067	0.5224	0.3174
Tagging dates	10/26/99 to 11/1/99	10/19/99 to 10/25/99	11/2/99 to 11/4/99	11/4/99 to 11/10/99	
Tag retention Check	5/18/2000	5/1/2000	5/23/2000	6/1/2000	
Days elapsed	199	210	201	204	
Release Dates	5/23/2000	5/24/2000	5/26/2000	6/2/2000	

Sources: Loopstra 2000a, 2000b, 2002

^a Hatchery inventory estimate.

^b Calculated from total fish released into each stream.

OBJECTIVES

Objectives for the 1999, 2000, and 2001 NCI adult coho salmon assessments fall into three categories: commercial harvest, sport harvest and escapement.

Commercial harvest objectives were to:

1. Estimate the harvest of hatchery-produced coho salmon stocked into Bird, Campbell, and Ship creeks, and the Eklutna Tailrace, in the CDD, CDES and NDS.
2. Estimate the total harvest of hatchery-produced coho salmon in the three commercial fisheries listed in objective 1 by system of origin.

Sport harvest and escapement objectives were to:

1. Estimate the hatchery contribution to the inriver returns at Campbell and Ship creeks for both the sport harvest and spawning escapement.
2. Enumerate coho salmon spawning escapement through a weir at Ship Creek; and estimate the coho salmon spawning escapements in Bird and Campbell creeks, Twentymile and Placer river drainages, and selected Portage Creek tributaries through the use of foot and/or aerial surveys.

METHODS

STUDY DESIGN

This project was designed to estimate the harvest of hatchery-produced coho salmon stocked into NCI streams in the UCI mixed-stock commercial fishery, and to estimate the contributions of stocked coho salmon to sport harvests and escapements for Campbell and Ship creeks. Index values for escapements for Bird Creek and Twentymile and Placer rivers were also obtained.

Coho salmon smolt were marked at the hatchery where they were reared by inserting a coded wire tag (CWT) into their snouts and by removing their adipose fins. Marked smolt were mixed and released with unmarked smolt into each stream. An adult catch sampling program was conducted during 1999, 2000, and 2001 to recover marked fish from the commercial harvest. Heads were collected from coho salmon missing the adipose fin and sent to the Alaska Department of Fish and Game (ADF&G) Coded Wire Tag and Otolith Laboratory (Tag Lab) in Juneau. The Tag Lab determined if a tag was present and decoded recovered tags to determine year and stream of release. Catch sampling data were used to estimate harvest of marked cohorts and to calculate final estimates of harvest and their variances.

To estimate sport harvest and escapement of stocked fish, the escapements at Campbell, Ship, and Bird creeks were also sampled to recover marked coho salmon. The proportion of stocked fish in the sport harvest was assumed to be the same as the proportion in the escapements. Total return and survival of stocked fish could then be estimated.

DATA COLLECTION

Stocking and Marking

Coho salmon from the Ship Creek (ancestral Little Susitna River stock) broodstock were used for 1998, 1999, and 2000 hatchery releases into Bird, Campbell, and Ship creeks. Broodstock for Eklutna Tailrace (ancestral Jim Creek stock) were collected at Eklutna tailrace and then transported to Elmendorf Hatchery for subsequent egg takes. Eggs collected in 1996, 1997 and

1998 from coho salmon at the Elmendorf Hatchery were fertilized and incubated, and the resultant fry reared at ADF&G's Fort Richardson Hatchery. The smolt were stocked in 1998, 1999, and 2000 (Loopstra 2000 a-b, 2002) and returned as adults in 1999, 2000, and 2001.

A portion of smolt from release cohorts was marked with an adipose finclip and a uniquely numbered CWT inserted in the snout (Table 1). In 1998, releases of smolt ranged from about 83,300 coho salmon into Campbell Creek to about 232,700 released into Ship Creek (Table 1). In 1999, releases ranged from approximately 42,000 smolt into Campbell Creek to approximately 165,400 released into Ship Creek (Table 1). In 2000, releases ranged from approximately 63,700 smolt into Campbell Creek to approximately 260,000 released into Ship Creek (Table 1). Details of the rearing, marking, and release of hatchery-stocked coho salmon are documented by Loopstra et al. (2000a, b, 2002).

Commercial Harvest Sampling

Sampling of the UCI commercial coho salmon harvest was conducted each year from late June or early July through early September, with the majority of sampling occurring mid-July through late August. Coho salmon were sampled on fishing boats at the Port of Anchorage, on sorting lines at processors, at buying stations, or onboard tenders. All regular commercial fishing periods (7:00 a.m. to 7:00 p.m., Mondays and Thursdays) that occurred in the three fisheries of interest were sampled. Additional Central District fishing periods (as allowed through emergency order) were sampled as time and budget allowed.

Coho salmon delivered to processors, buying stations, or tenders were examined for the absence of the adipose fin. As many fish as possible were examined from deliveries during the sampling shift. All coho salmon observed with a missing adipose fin were retrieved, the head removed, and a uniquely numbered cinch strap affixed to the head. Each head was placed in an individual clear plastic bag with the cinch strap number visible. Collected data included: date of harvest, date of sampling, processor, delivery location, name of tender or buying station, statistical area, number of coho salmon examined, number of coho salmon missing the adipose fin, number of heads collected from coho salmon missing the adipose fin, and the cinch strap number of each head collected. All coho salmon heads with cinch straps were returned to ADF&G offices in Soldotna or Anchorage. The heads were frozen and shipped weekly to the Tag Lab for tag removal and decoding. After each commercial fishing period, the preliminary commercial harvest of coho salmon in UCI by statistical area was obtained from Commercial Fisheries Division (CFD) staff in Soldotna.

In general, totes sampled from setnet harvests contained coho salmon harvested in a single statistical area. Thus, the total harvest and catch sample data could be summarized by statistical area. Totes of coho salmon sampled from the Central District driftnet fishery were a mixture of fish harvested in different statistical areas. Thus, harvest and catch sample data from the Central District driftnet fishery were combined for statistical areas 244-50, 244-60, 244-70, 245-70, 245-80, and 245-90 (Figure 1).

Northern District

The Northern District is divided into 11 statistical areas (Figure 1). By regulation, commercial fishing periods occur between 7:00 a.m. and 7:00 p.m. on Mondays and Thursdays from 25 June (except when 25 June falls within a closed weekly period, then the season will open the next weekly period) until closed by emergency order (5 AAC 21.320 *Weekly Fishing Periods*).

Additional fishing periods are allowed and/or regularly scheduled periods may be closed by emergency order; however, no additional fishing periods may be allowed after 15 August (5 AAC 21.363 *Upper Cook Inlet Salmon Management Plan*). Only set gillnet gear is allowed in Northern District waters (5 AAC 21.330 *Gear*). Statistical area 247-50 is only opened through emergency order (5 AAC 21.364 *Fish Creek Sockeye Salmon Management Plan*) and statistical area 247-60 is closed to commercial fishing (5 AAC 21.350 *Closed Waters*).

Harvest from the Northern District was sampled in Anchorage, Seward, and Nikiski from the second Monday in July through the end of the first week in September each year. Coho salmon processed in the Anchorage area were composed entirely of fish harvested in Northern District statistical areas. Typically three technicians and one college intern in Anchorage sampled commercial harvests primarily on fishing boats at the small boat harbor as fishermen returned from fishing. Shorebased processors also bought fish, and technicians also sampled at Great Pacific, 10th and M Seafoods, FAVCO, and Alaska Smoked Salmon International.

Setnet harvests from statistical areas 247-70, 247-80, and 247-90, purchased by Cook Inlet Processors in Nikiski, were sampled regularly by personnel from Soldotna. Most coho salmon harvested from statistical areas 247-10, 247-20, and 247-30 were sampled at Icicle Seafoods in Seward by Anchorage-based technicians and at Deep Creek Custom Packing Inc. in Ninilchik by Soldotna-based technicians. We anticipated needing to examine about 60% of the harvest of each Northern District statistical area to achieve the desired accuracy and precision of the estimated harvest of hatchery-reared coho salmon. The project biologist and/or technicians contacted processors throughout the season to coordinate sampling logistics and to ensure that all fish possible were examined.

Central District

The Central District driftnet fleet operates in seven statistical areas and the setnet fishery occurs in 13 statistical areas (Figure 1). Coho salmon harvested by the CDD fishery were sampled from six statistical areas (244-50, 244-60, 244-70, 245-70, 245-80, and 245-90) and those harvested by the CDES fishery were sampled from four statistical areas (244-21, 244-22, 244-30, and 244-40). We anticipated needing to examine about 40% of the CDD harvest and 30% of the coho salmon harvested from each CDES statistical area to achieve the desired accuracy and precision of our estimates of commercial harvest.

Commercial fishing periods for both the driftnet and eastside setnet fisheries occur between 7:00 a.m. and 7:00 p.m. on Mondays and Thursdays (5 AAC 21.320 *Weekly Fishing Periods*). Dates of the driftnet fishery are restricted to 25 June (except when 25 June falls within a closed weekly period, then the season will open the next weekly period) through 9 August (5 AAC 21.310). The *Upper Cook Inlet Salmon Management Plan* (5 AAC 21.363) restricts the dates of the setnet fishery from 1 July through 15 August. Additional fishing periods are allowed by emergency order as are restrictions to regularly scheduled periods. Several management plans affect time and area openings and closures of both fisheries (5 AAC 21.358 *Northern District Coho Salmon Management Plan*; 5 AAC 21.359 *Kenai River Late Run Chinook Salmon Management Plan*; 5 AAC 21.360 *Kenai River Late Run Sockeye Salmon Management Plan*; 5 AAC 21.361 *Russian River Sockeye Salmon Management Plan*; 5 AAC 21.363 *Upper Cook Inlet Salmon Management Plan*; and 5 AAC 21.365 *Kasilof River Sockeye Salmon Special Harvest Area Management Plan*).

Six technicians sampled the CDD harvest from late June through the first week of August each year. The harvest in the CDES fishery was examined by four technicians, sampling from the second Monday in July through the first week in August. Most coho salmon harvested from these fisheries as well as some coho salmon harvested by NDS fisheries were processed at facilities on the Kenai Peninsula. Commercial catch sampling of these coho salmon harvests was conducted under the supervision of CFD biologists in Soldotna. Sampling of the CDD harvest occurred at Carlson Seafoods, Cook Inlet Processing, Dragnet Fisheries Co. Inc., Icicle Seafoods Inc., Inlet Salmon, Pacific Star Seafoods Inc., R & J Seafoods, Royal Pacific Fisheries Inc., Salamatof Seafoods Inc., Seasonal Seafoods, Snug Harbor Seafoods Inc., Trans-Aqua International Inc., and Wards Cove Packing Co. The CDES harvest was sampled at buying stations of major fish processors. These processors included: Alaska Salmon Purchasers, Cook Inlet Processing, Deep Creek Custom Packing Inc., Dragnet Fisheries Co. Inc., Fishhawk Fisheries of Alaska Inc., Icicle Seafoods Inc., Inlet Salmon, Pacific Star Seafoods Inc., R & J Seafoods, Royal Pacific Fisheries Inc., Salamatof Seafoods Inc., Snug Harbor Seafoods Inc., Trans-Aqua International Inc., and Wards Cove Packing Co.

Escapement

A steep pass that allowed fish to swim into holding tanks in Elmendorf Hatchery, and a fish trap located on the Chugach Power Plant Dam were used to enumerate the coho salmon escapement into Ship Creek. The total coho salmon count, less fish collected for broodstock requirements (taken either at the fish ladder or from the creek upstream of the fish trap), was used as the final escapement. Returning adult coho salmon passing through the fish trap and those taken for broodstock were examined for the absence of an adipose fin. The total number of coho salmon examined and the number of fish missing the adipose fin were recorded.

A single foot survey conducted during peak spawning was used to index coho salmon escapements in both Bird and Campbell creeks. In Campbell Creek upstream of Lake Otis Parkway, coho salmon were also captured using a beach seine and long-handled dip nets 1 day each week during September. Each captured fish was examined for the absence of an adipose fin. Captured fish were marked with a caudal hole punch to prevent double sampling.

Multiple foot surveys by U.S. Forest Service (USFS) personnel and aerial surveys by ADF&G were conducted to index wild-stock coho salmon escapements in selected Twentymile and Placer river drainages and selected Portage Creek tributaries. Peak coho salmon counts were used as the final tally for each stream. Turnagain Arm escapement surveys were conducted later in the season because peak spawning of these native coho stocks is generally 3-6 weeks later than streams stocked with Little Susitna broodstock. Results from these Turnagain Arm aerial and foot surveys were reported in Miller and Bosch 2004.

DATA ANALYSIS

Estimating Commercial Harvest of Stocked Coho Salmon

Estimating the commercial harvest of a hatchery cohort required that the proportion of the cohort bearing a CWT upon capture be known. Based on inriver CWT recoveries from adult coho salmon in previous years (Cyr et al. 1997-1999, 2001; Hoffmann and Hasbrouck 1994; Stratton et al. 1996) we assumed tag loss after release was insignificant for adults returning in 1999, 2000, and 2001. The proportion of each adult hatchery cohort bearing a tag was therefore assumed to be that upon release (Starkey et al. 1999).

Harvest sampling did not occur over the entire fishing season; however, less than 1% (1999), 8% (2000) and 1% (2001) of the overall UCI coho salmon harvest in the selected fisheries occurred on days not sampled. Harvest on days not sampled was combined with the nearest day the harvest was sampled to estimate harvest of marked cohorts for the entire season.

Harvest of a single marked cohort j (release group) in stratum i was estimated by (Bernard and Clark 1996):

$$\hat{r}_{ij} = N_i \theta_j^{-1} \left(\frac{m_{ij}}{\lambda_i n_i} \right), \quad (1)$$

where:

- N_i = total number of fish harvested in stratum i ,
- θ_j = proportion of cohort j marked and released with a CWT,
- m_{ij} = number of decoded CWTs from cohort j in stratum i ,
- n_i = number of fish in stratum i sampled for a missing adipose fin,
- λ_i = $\frac{t_i' a_i'}{t_i a_i}$, which is the decoding rate of CWTs from marked fish sampled in stratum i ,
- a_i = number of fish sampled in stratum i missing their adipose fin,
- a_i' = number of heads from a_i that arrived at the Tag Lab,
- t_i = number of heads from a_i' with CWTs detected, and
- t_i' = number of tags from t_i that were decoded.

This estimator is statistically unbiased when sampling is from a simple random or pseudo-random process (Bernard and Clark 1996).

When the harvest (N_i) and the proportion marked (θ_j) are known without error, the large-sample approximation of an unbiased estimate of the variance of \hat{r}_{ij} is:

$$\hat{V}ar(\hat{r}_{ij}) = \frac{\hat{r}_{ij}}{\lambda_i \phi_i \theta_j} (1 - \lambda_i \phi_i \theta_j), \quad (2)$$

where:

$$\phi_i = \frac{n_i}{N_i}.$$

Total harvest from the fish ticket database is assumed known and measured without error. The values of θ_j at the time of release (Loopstra 2000 a-b, 2002) were used and treated as known values measured without error for all 1998, 1999, and 2000 releases.

Harvest of each cohort was stratified by date and statistical area for each sampled fishery. Statistical area was unknown when catch sampling the CDD fishery so harvest of this fishery was stratified only by date. The total harvest of a cohort in a fishery was estimated by summing the estimates among the strata. Variance of the total estimate was also calculated by summing the variances of the strata estimates since sampling among strata was assumed independent.

In 1999, 2000, and 2001 much of the sampled catch from Northern District statistical areas 247-10, 247-20, and 247-30, and an unknown proportion of the sampled catch from Northern District statistical areas 247-70, 247-80, and 247-90, contained a mixture of coho salmon harvested from more than one statistical area. Nearly all coho salmon harvested from statistical areas 247-41, 247-42, and 247-43 were sampled throughout the season and were identifiable with respect to statistical area of origin. Sample data and harvest from all Northern District statistical areas except 247-43 were combined into three larger geographic areas: westside (247-10, 247-20, and 247-30); eastside (247-70, 247-80, and 247-90); and Susitna Flat/Point MacKenzie (247-41 and 247-42). Analyses of data collected in previous years indicated that combining catch sample and harvest data into these larger areas did not bias estimates of harvest of hatchery-reared coho salmon (Cyr et al. 1997-1999, 2001; Hoffmann and Hasbrouck 1994; Stratton et al. 1996).

Estimating Sport Harvest and Escapement of Stocked Coho Salmon

The harvest of hatchery-produced coho salmon by the sport fisheries in Campbell and Ship creeks was estimated using SWHS estimates of total sport harvest, the proportion of fish marked with an adipose finclip at time of release, and recovery data collected from returning adults during beach seining (Campbell Creek) and broodstock collection (Ship Creek). No heads were collected from coho salmon missing the adipose fin in Campbell Creek because all finclipped fish observed were assumed to be from hatchery stockings into Campbell Creek. Heads collected from coho salmon missing the adipose fin during Ship Creek egg takes were sent to the Tag Lab in Juneau for decoding. Based on recovery data in previous years (Cyr et al. 1997-1999, 2001; Hoffmann and Hasbrouck 1994; Stratton et al. 1996) the straying rate from the stream of origin was assumed insignificant. It was assumed that sport anglers were not selective in harvesting coho salmon in these streams with respect to finclip status, so it was assumed that the marked proportion of fish observed in the escapement was the same as that in the respective sport harvest for all recovery years. Contribution of hatchery-produced coho salmon cohort j to the sport harvest of creek k was estimated by:

$$\hat{r}_{kj} = \hat{N}_k \Psi_j^{-1} \left(\frac{m_{kj}}{n_k} \right), \quad (3)$$

$$\hat{V}ar(\hat{r}_{kj}) = \hat{r}_{kj}^2 \left[\left(\frac{1 - \hat{\phi}_k \Psi_j}{m_{kj}} \right) + G(\hat{N}_k) - \left(\frac{1 - \hat{\phi}_k \Psi_j}{m_{kj}} \right) G(\hat{N}_k) \right], \quad (4)$$

where:

- \hat{N}_k = SWHS estimates of coho salmon sport harvest for stream k ,
- m_{kj} = number of fish missing the adipose fin observed from cohort j in stream k ,
- n_k = total number of coho salmon sampled in stream k ,
- ψ_j^{-1} = proportion of cohort j marked with an adipose finclip at time of release,
- $G(\hat{N}_k)$ = coefficient of variation squared of total sport harvest in stream k from SWHS,
- $\hat{\phi}_k = \frac{n_k}{\hat{N}_k + E_k}$, and
- E_k = escapement estimate.

The contribution of hatchery-produced coho salmon to the spawning escapements in Campbell and Ship creeks was estimated using equation (3), where $\hat{N}_k = \text{estimated spawning escapement}$. The escapement estimate from the foot survey at Campbell Creek, a small clear stream, is an index and represents a minimum escapement. No variance was calculated for the Campbell Creek contribution estimate. The escapement to Ship Creek was a weir count and was measured without error; the variance of the contribution to Ship Creek escapement was estimated as in equation 4 with $\hat{\phi}_k=1$ and $G(\hat{N}_k)=0$.

At Bird Creek, all coho salmon in both the sport harvest and indexed escapement were assumed to be from hatchery releases because no significant numbers of coho salmon were observed in Bird Creek prior to the initial stocking in 1992. At the Eklutna Tailrace, returning fish not harvested were not enumerated, so estimates of total run, and thus marine survival, are minimums.

For Campbell and Bird creeks, escapements were indexed and estimates of total return in these cases, and thus survival, of stocked coho salmon are biased low. Estimates of total run, and thus marine survival, cannot be determined for Eklutna Tailrace coho salmon stocking because escapement is unknown.

RESULTS

1999 RESULTS

Commercial Harvest of Stocked Coho Salmon

A total of 125,343 coho salmon were harvested in the UCI mixed-stock fishery during 1999 (Table 2). A combined total of 107,644 coho salmon were harvested in sampled fisheries (Table 3). Technicians examined more than 55% of the total harvest (Table 3) associated with the sampled UCI fisheries and heads were collected from 3% of the fish examined (Table 4). In the NDS, 73% of the coho salmon harvested were examined for a missing adipose fin. In the CDD and CDES fisheries, 51% and 36% of the coho salmon harvested in each respective fishery were examined (Table 3).

The majority of the UCI coho salmon harvest in the sampled fisheries occurred in the CDD fishery (59.9%), followed by the NDS fishery and the CDES fishery (Table 5). Most of the CWTs recovered, and most of the harvest of hatchery-produced coho salmon occurred in the CDD and the NDS fisheries (Tables 4 and 5). A total of 4,715 (SE = 154) stocked coho salmon were harvested in UCI commercial fisheries in 1999, or 4.4% (SE = 0.1%) of the total commercial harvest (Table 5). Contributions to the 1999 sampled fisheries from 1997 coho smolt releases can be found in Appendix B4.

Table 2.-Commercial salmon harvest in Upper Cook Inlet, 1999, 2000, and 2001.

	Statistical Area	1999	2000	2001
Central District Drift (CDD)				
General (East/West Sides)	245-70,80,90; 244-50, 51, 60, 61, 70	64,529	131,200	39,418
Westside Setnet				
Western, Kustatan	245-20,30,40,50,55,60	6,812	11,680	10,514
Kalgin Island	246-10,20	10,842	11,160	13,205
Chinitna Bay	245-10	45	0	0
Total		17,699	22,840	23,719
Eastside (CDES)				
Ninilchik	244-21	2,149	2,211	781
Cohoe	244-22	2,942	3,313	973
Kalifonsky	244-30	2,358	2,928	577
Salamatof	244-40	4,230	2,388	1,915
Total		11,679	10,840	4,246
Central District Total		93,907	164,880	67,383
Northern District Set (NDS)				
Susitna Flat	247-41	1,185	4,738	5,628
Pt. MacKenzie	247-42	1,074	7,211	8,754
Fire Island	247-43	2,603	7,238	5,311
Knik Arm	247-50		0	0
Total		4,862	19,187	19,693
Westside				
Trading Bay	247-10	1,156	4,761	5,972
Tyonek	247-20	9,073	11,741	3,187
Beluga	247-30	8,609	17,150	5,604
Total		18,838	33,652	14,763
Eastside				
Pt. Possession	247-70	3,047	6,299	4,160
Birch Hill	247-80	2,380	2,208	3,094
Number 3 Bay	247-90	2,309	9,902	4,218
Total		7,736	18,409	11,472
Northern District setnet total		31,436	71,248	45,928
Upper Cook Inlet total		125,343	236,128	113,311

Table 3.-Commercial coho salmon harvest, harvest dates, and sampling dates for Upper Cook Inlet fisheries sampled in 1999, 2000, and 2001.

UCI Fishery	Statistical Area	Harvest dates	Total Coho Harvest	Sampling dates	Harvest During Sampling	Potential Sampled ^a	Actual Coho Sampled	% Coho Sampled
1999								
Central District Drift (CDD)	244, 245	6/28-8/09	64,529	7/01-8/09	64,505	100.0%	33,153	51%
Central District Set (CDES)								
Ninilchik	244-21	7/01-8/12	2,149	7/01-8/12	2,149	100.0%	937	44%
Cohoe	244-22	7/01-8/12	2,942	7/12-8/12	2,927	99.5%	716	24%
Kalifonsky ^b	244-30	7/08-8/12	2,358	7/08-8/12	2,358	100.0%	584	25%
Salamatof ^c	244-40	7/08-8/12	<u>4,230</u>	7/08-8/12	<u>4,230</u>	<u>100.0%</u>	<u>1,912</u>	<u>45%</u>
CDES Total			11,679		11,664	99.9%	4,149	36%
Northern District Set (NDS)								
Westside	247-10,20,30	7/01-8/30	18,838	7/12-8/16	18,732	99.4%	13,361	71%
Susitna Flats/Pt. MacKenzie	247-41,42	7/12-8/12	2,259	7/15-8/12	2,194	97.1%	2,529	112%
Fire Island	247-43	7/12-8/12	2,603	7/12-8/12	2,603	100.0%	2,084	80%
Eastside	247-70/80/90	7/08-9/16	<u>7,736</u>	7/12-9/16	<u>7,231</u>	<u>93.5%</u>	<u>4,629</u>	<u>60%</u>
NDS Total			31,436		30,760	97.8%	22,603	72%
Upper Cook Inlet total			107,644		106,929	99.3%	59,905	56%
2000								
Central District Drift (CDD)	244, 245	6/26-8/7	131,200	6/29-8/07	120,892	92.1%	32,459	25%
Central District Set (CDES)								
Ninilchik	244-21	7/03-8/07	2,211	7/10-8/07	1,949	88.2%	488	22%
Cohoe	244-22	7/03-8/07	3,313	7/10-8/07	2,584	78.0%	1,284	39%
Kalifonsky ^b	244-30	7/03-8/07	2,928	7/10-8/07	2,698	92.1%	801	27%
Salamatof ^c	244-40	7/10-7/20	<u>2,388</u>	7/10-7/20	<u>2,388</u>	<u>100.0%</u>	<u>1,001</u>	<u>42%</u>
CDES Total			10,840		9,619	88.7%	3,574	33%

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Table 3.-Page 2 of 2.

UCI Fishery	Statistical Area	Harvest dates	Total Coho Harvest	Sampling dates	Harvest During Sampling	Potential Sampled ^a	Actual Coho Sampled	% Coho Sampled
Northern District Set (NDS)								
Westside	247-10, 20, 30	6/26-9/11	33,652	7/10-8/24	33,275	98.9%	25,484	76%
Sustina Flats/Pt. MacKenzie	247-41, 42	6/26-9/11	11,949	7/10-9/04	11,796	98.7%	10,094	84%
Fire Island	247-43	6/26-9/11	7,238	7/10-9/04	7,244	100.1%	8,076	112%
Eastside	247-70, 80, 90	6/26-9/11	<u>18,409</u>	7/10-9/04	<u>13,463</u>	<u>73.1%</u>	<u>7,698</u>	<u>42%</u>
NDS Total			71,248		65,778	92.3%	51,352	72%
Upper Cook Inlet Total			213,288		196,289	92.0%	87,385	41%
2001								
Central District Drift (CDD)	244, 245	6/25-8/09	39,418	6/25-8/09	39,369	99.9%	16,808	43%
Central District Set (CDES)								
Ninilchik	244-21	7/02-7/28	781	7/02-7/28	721	92.3%	215	28%
Cohoe	244-22	7/02-7/28	973	7/02-7/28	745	76.6%	281	29%
Kalifonsky ^b	244-30	7/02-7/28	577	7/02-7/28	409	70.9%	141	24%
Salamatof ^c	244-40	7/19-7/60	<u>1,915</u>	7/10-7/20	<u>1,915</u>	<u>100.0%</u>	<u>611</u>	<u>32%</u>
CDES Total			4,246		3,790	89.3%	1,248	29%
Northern District Set (NDS)								
Westside	247-10, 20, 30	6/18-8/16	14,763	7/09-8/23	14,364	97.3%	8,687	59%
Sustina Flats/Pt. MacKenzie	247-41, 42	7/09-9/24	14,382	7/09-9/3	14,356	99.8%	12,453	87%
Fire Island	247-43	7/02-8/27	5,311	7/09-8/27	5,308	99.9%	4,894	92%
Eastside	247-70, 80, 90	7/02-9/27	<u>11,472</u>	7/09-9/06	<u>11,219</u>	<u>97.8%</u>	<u>6,420</u>	<u>56%</u>
NDS Total			45,928		45,247	98.5%	32,454	71%
Upper Cook Inlet Total			89,592		88,406	98.7%	50,510	56%

^a Percentage of total coho harvest represented by sampling.

^b Combination of statistical areas 244-31 and 244-32.

^c Combination of statistical areas 244-41, and 244-42.

Table 4.-Harvest, sampling data, and coded wire tag recoveries for selected Upper Cook Inlet commercial coho salmon fisheries for 1999, 2000, and 2001.

Recovery Site	Statistical Area	Catch During Sampling	Number Coho Examined	Number of Heads Collected	Number of CWTs Recovered by Release Site					Tag Not Detected	Tag/Head Lost
					Bird Creek	Campbell Creek	Ship Creek	Eklutna Tailrace			
1998 Releases/1999 Recoveries											
Central District Drift (CDD)	244, 245	64,505	33,158	737	78	47	177	306	60	24	
Central District Eastside Set (CDES)											
Ninilchik	244-21	2,149	937	45	0	0	0	1	5	1	
Cohoe	244-22	2,927	716	38	2	1	4	1	0	0	
Kalifonsky Beach	244-30	2,358	584	36	1	0	1	0	2	0	
Salamatof	244-40	<u>4,230</u>	<u>1,912</u>	<u>53</u>	<u>4</u>	<u>1</u>	<u>7</u>	<u>10</u>	<u>2</u>	<u>0</u>	
CDES Total		11,664	4,149	172	7	2	12	12	9	1	
Northern District (NDS)											
Westside	247-10,20,30	18,732	13,361	106	10	5	12	57	18	2	
Susitna Flat/Pt. MacKenzie	247-41,42	2,194	2,529	265	16	30	69	140	9	1	
Fire Island	247-43	2,603	2,086	220	31	32	74	76	7	0	
Eastside	247-70/80/90	<u>7,231</u>	<u>4,629</u>	<u>67</u>	<u>11</u>	<u>7</u>	<u>15</u>	<u>19</u>	<u>3</u>	<u>0</u>	
NDS Total		30,760	22,605	658	68	74	170	292	37	3	
Upper Cook Inlet Total		106,929	59,912	1,567	153	123	359	610	106	28	
1999 Releases/2000 Recoveries											
Central District Drift (CDD)	244, 245	120,892	32,459	667	125	78	151	135	64	2	
Central District Eastside Set (CDES)											
Ninilchik	244-21	1,949	488	22	0	0	0	0	0	0	
Cohoe	244-22	2,584	1,284	82	0	2	2	0	3	0	
Kalifonsky Beach	244-30	2,698	801	54	0	1	0	0	11	1,305	
Salamatof	244-40	<u>2,388</u>	<u>1,001</u>	<u>18</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>3</u>	<u>0</u>	
CDES Total		9,619	3,574	176	0	4	2	1	17	1,305	
Northern District (NDS)											
Westside	247-10,20,30	33,275	25,484	155	0	1	3	2	4	0	
Susitna Flat/Pt. MacKenzie	247-41,42	11,796	10,094	853	59	92	183	178	74	2	
Fire Island	247-43	7,244	8,076	793	134	96	204	131	67	0	
Eastside	247-70/80/90	<u>13,463</u>	<u>7,698</u>	<u>81</u>	<u>25</u>	<u>11</u>	<u>12</u>	<u>8</u>	<u>8</u>	<u>1</u>	
NDS Total		65,778	51,352	1,882	218	200	402	319	153	3	
Upper Cook Inlet Total		196,289	87,385	2,725	343	282	555	455	234	1,310	

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Table 4.-Page 2 of 2.

Recovery Site	Statistical Area	Catch During Sampling	Number Coho Examined	Number of Heads Collected	Number of CWTs Recovered by Release Site					
					Bird Creek	Campbell Creek	Ship Creek	Eklutna Tailrace	Tag Not Detected	Tag/Head Lost
2000 Releases/2001 Recoveries										
Central District Drift (CDD)	244, 245	39,369	16,808	319	47	30	70	66	32	2
Central District Eastside Set (CDES)										
Ninilchik	244-21	721	215	7	0	0	0	0	0	0
Cohoe	244-22	745	281	9	0	1	0	1	1	0
Kalifonsky Beach	244-30	409	141	3	0	0	0	1	0	0
Salamatof	244-40	<u>1,915</u>	<u>611</u>	<u>10</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>3</u>	<u>0</u>	<u>0</u>
CDES Total		3,790	1,248	29	2	3	1	5	1	0
Northern District (NDS)										
Westside	247-10,20,30	14,364	8,687	126	17	8	26	21	18	0
Susitna Flat/Pt. MacKenzie	247-41,42	14,356	12,453	1045	71	91	356	134	93	2
Fire Island	247-43	5,308	4,894	507	121	61	150	28	38	0
Eastside	247-70/80/90	<u>11,219</u>	<u>6,420</u>	<u>168</u>	<u>23</u>	<u>3</u>	<u>6</u>	<u>8</u>	<u>4</u>	<u>0</u>
NDS Total		45,247	32,454	1,846	232	163	538	191	153	2
Upper Cook Inlet Total		88,406	50,510	2,194	281	196	609	262	186	4

Note: Several heads are also collected each year from coho salmon released 2 years prior. These are reported in Appendix B.

Table 5.-Estimated harvest (r_{ij}) and standard error (SE) of coho salmon stocked in Northern Cook Inlet streams in 1998, 1999, and 2000 by sampled Upper Cook Inlet commercial fisheries during 1999, 2000, and 2001.

Recovery Site	Statistical Area	Total Harvest	Stocking Location										% of Total Harvest			
			Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		Total		CV (r_{ij})	Est.	SE	
			r_{ij}	SE (r_{ij})	r_{ij}	SE (r_{ij})	r_{ij}	SE (r_{ij})	r_{ij}	SE (r_{ij})	r_{ij}	SE (r_{ij})				
1998 Releases/1999 Recoveries																
Central District Drift (CDD)	244, 245	64,529	564	60	347	48	1,239	87	610	25	2,761	119	4.3%	4.3%	0.2%	
Central District Eastside Set (CDES)																
Ninilchik	244-21	2,149	0	0	0	0	0	0	3	2	3	2	81.6%	0.1%		
Cohoe	244-22	2,942	28	19	13	13	42	20	6	5	89	31	34.9%	3.0%		
Kalifonsky	244-30	2,358	16	15	0	0	10	10	0	0	26	18	69.5%	1.1%		
Salamatof	244-40	<u>4,230</u>	<u>22</u>	<u>10</u>	<u>6</u>	<u>5</u>	<u>57</u>	<u>24</u>	<u>26</u>	<u>8</u>	<u>110</u>	<u>27</u>	<u>24.8%</u>	<u>2.6%</u>		
CDES Total		11,679	65	26	19	14	109	32	35	10	228	45	19.8%	2.0%	0.4%	
Northern District (NDS)																
Westside	247-10,20,30	18,838	57	18	27	11	52	13	85	8	221	27	12.0%	1.2%		
Su Flat/ Pt. MacKenzie	247-41,42	2,259	51	12	105	17	219	27	147	4	522	35	6.6%	23.1%		
Fire Island	247-43	2,603	116	21	123	22	323	35	99	6	661	47	7.1%	25.4%		
Eastside	247-70/80/90	<u>7,736</u>	<u>62</u>	<u>22</u>	<u>66</u>	<u>29</u>	<u>147</u>	<u>44</u>	<u>47</u>	<u>11</u>	<u>321</u>	<u>58</u>	<u>18.1%</u>	<u>4.2%</u>		
NDS Total		31,436	286	37	321	42	742	64	377	16	1,726	87	5.0%	5.5%	0.3%	
Upper Cook Inlet Total		107,644	916	75	687	65	2,090	113	1,022	31	4,715	154	3.3%	4.4%	0.1%	
1999 Releases/2000 Recoveries																
Central District Drift (CDD)	244, 245	131,200	1,438	128	626	70	2,133	175	1,484	129	5,682	262	4.6%	4.3%	0.2%	
Central District Eastside Set (CDES)																
Ninilchik	244-21	2,211	0	0	0	0	0	0	0	0	0	0	NA	0.0%		
Cohoe	244-22	3,313	0	0	8	7	20	14	0	0	27	16	59.3%	0.8%		
Kalifonsky	244-30	2,928	0	0	4	7	0	0	0	0	4	7	175.0%	0.1%		
Salamatof	244-40	<u>2,388</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>4</u>	<u>0</u>	<u>0</u>	<u>6</u>	<u>5</u>	<u>10</u>	<u>6</u>	<u>60.0%</u>	<u>0.4%</u>		
CDES total		10,840	0	0	16	11	20	14	6	5	41	19	46.3%	0.4%	0.0%	

-continued-

Table 5.-Page 2 of 2.

Recovery Site	Statistical Area	Total Harvest	Stocking Location										% of Total Harvest		
			Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		Total	CV (r _{ij})	Est.	SE	
			r _{ij}	SE (r _{ij})	r _{ij}	SE (r _{ij})	r _{ij}	SE (r _{ij})	r _{ij}	SE (r _{ij})					
1999 Releases/2000 Recoveries (continued)															
Northern District (NDS)															
Westside	247-10,20,30	33,652	50	12	26	7	94	20	121	20	293	32	10.9%	0.9%	
Su Flat/ Pt. MacKenzie	247-41,42	11,949	199	23	210	18	721	49	579	38	1,709	69	4.0%	14.3%	
Fire Island	247-43	7,244	313	26	178	14	664	45	338	26	1,566	62	4.0%	21.6%	
Eastside	247-70/80/90	<u>18,409</u>	<u>119</u>	<u>25</u>	<u>38</u>	<u>10</u>	<u>56</u>	<u>17</u>	<u>30</u>	<u>12</u>	<u>243</u>	<u>34</u>	<u>14.0%</u>	<u>1.3%</u>	
NDS Total		71,254	681	45	452	26	1,535	71	1,068	52	3,811	103	2.7%	5.3%	0.1%
Upper Cook Inlet Total		213,294	2,119	136	1,094	75	3,688	189	2,558	139	9,534	268	2.8%	4.5%	0.1%
2000 Releases/2001 Recoveries															
Central District Drift (CDD)															
	244, 245	39,418	263	35	220	38	746	102	312	34	1,541	119	7.7%	3.9%	0.2%
Central District Eastside Set (CDES)															
Ninilchik	244-21	781	0	0	0	0	0	0	0	0	0	0	NA	0.0%	
Cohoe	244-22	973	0	0	8	7	0	0	11	11	19	18	94.7%	2.0%	
Kalifonsky	244-30	577	0	0	0	0	0	0	8	7	8	7	87.5%	1.4%	
Salamatof	244-40	<u>1,915</u>	<u>14</u>	<u>10</u>	<u>26</u>	<u>17</u>	<u>8</u>	<u>8</u>	<u>16</u>	<u>9</u>	<u>65</u>	<u>23</u>	<u>35.4%</u>	<u>3.4%</u>	
CDES total		4,246	14	10	34	19	8	8	35	16	92	28	30.4%	2.2%	0.5%
Northern District (NDS)															
Westside	247-10,20,30	14,763	58	13	38	13	233	49	84	18	413	55	13.3%	2.8%	
Su Flat/ Pt. MacKenzie	247-41,42	14,382	206	20	349	32	1,803	86	309	20	2,667	96	3.6%	18.5%	
Fire Island	247-43	5,311	326	24	219	24	711	52	60	8	1,316	63	4.8%	24.8%	
Eastside	247-70/80/90	<u>11,472</u>	<u>96</u>	<u>23</u>	<u>25</u>	<u>16</u>	<u>31</u>	<u>12</u>	<u>49</u>	<u>21</u>	<u>200</u>	<u>37</u>	<u>18.5%</u>	<u>1.7%</u>	
NDS Total		45,928	686	41	631	45	2,778	112	502	36	4,596	133	2.9%	10.0%	0.2%
Upper Cook Inlet Total		89,592	963	55	885	61	3,532	152	849	52	6,229	180	2.9%	7.0%	0.1%

Sport Harvest and Escapement

In 1999, an estimated 4,649 (SE = 629) coho salmon were harvested in the Ship Creek sport fishery (Howe et al. 2001d). A total of 196 coho salmon were missing adipose fins from 710 fish examined during broodstock collection at Ship Creek. Of these 196 fish with missing adipose fins, 90 heads were collected and sent to the tag lab for decoding; 10 did not contain a tag, and 1 tag was lost. Of the 79 coho salmon heads with readable tags 1 was from Eklutna Tailrace (1998 releases) and 1 was from Bird Creek (1998 releases). An estimated 4,459 (SE = 678) or 96% of the Ship Creek sport harvest was from hatchery releases. A total of 710 coho salmon were counted through the weir, 323 coho salmon were collected for broodstock, resulting in an escapement of 384 coho salmon into Ship Creek (Appendix A1). An estimated 368 (SE = 22) or 96% of the fish were from hatchery releases; the remaining coho salmon were assumed to be from natural production.

In Campbell Creek, an estimated 1,341 (SE = 504) coho salmon were harvested by anglers in 1999 (Howe et al. 2001d). A total of 187 coho salmon were examined during beach seining of returning adults during September 1999, of which 41 were missing the adipose fin. An estimated 1,099 (SE = 442), or 81%, of the coho sport harvest were from hatchery origins. The coho salmon index into Campbell Creek on 29 September was 537 fish (Appendix A2). An estimated 440 or 81% of this indexed escapement were from hatchery releases. The remaining coho salmon were assumed to be from natural production.

At Bird Creek anglers harvested an estimated 4,611 (SE = 786) coho salmon in 1999 (Howe et al. 2001d), all of which are assumed to be stocked fish. A coho salmon escapement count conducted during September 1999 in Bird Creek and Penguin Creek (a tributary of Bird Creek) resulted in 279 coho salmon (Appendix A2).

At Eklutna Tailrace anglers harvested an estimated 1,453 (SE = 382) coho salmon. This run is considered 100% hatchery return, as the stocking location never had a native run of coho. During the 1999 Eklutna Tailrace egg take 118 heads were sent to the CWT lab. Six of these heads had no tag, and 1 tag was lost. All 111 readable tags collected were originally released at Eklutna Tailrace in 1998.

Results of aerial and foot surveys of Turnagain Arm drainages were reported in Miller and Bosch 2004.

Total Returns, Marine Survival and Exploitation Rates

Total returns of coho salmon to urban area streams are made up of three measurable components: commercial harvest, inriver sport harvest, and spawning escapement (Table 6). In 1999 at the four stocking locations, 52% to 79% of the returns were harvested in the sport fishery (Figure 3).

Overall marine survival of the four major coho salmon cohorts released in 1998 and returning in 1999 was 3.2% (SE = 0.2%), the lowest estimate recorded in the urban coho salmon project. Survival was 3.1% (SE = 0.3%) for Ship Creek; minimum survival estimates were 2.7% for Campbell Creek, 3.5% for Bird Creek, and 2.2% for Eklutna Tailrace releases (Table 6).

Commercial exploitation rates were 0.309 for Campbell Creek, 0.158 for Bird Creek, 0.289 for Ship Creek and 0.413 for Eklutna Tailrace (Table 6). Exploitation rates for the sport fishery were 0.494 for Campbell Creek, 0.794 for Bird Creek, 0.617 for Ship Creek and 0.587 for Eklutna Tailrace (Table 6).

Table 6.-Harvest, survival, and exploitation rates of stocked coho salmon released in Campbell, Bird and Ship creeks, 1992-2001.

Release Year	Return Year	Smolt Released	Harvest			Esc. and Brood	Total Run ^a	% Survival	Exploitation			
			Comm	Sport	Total				Comm	Sport	Total	% Esc
Campbell Creek												
1992	1993	97,076	3,396		3,396	1,658	5,054	5.2%	0.672	0.000	0.672	32.8%
1993	1994	140,797	8,461		8,461	2,227	10,688	7.6%	0.792	0.000	0.792	20.8%
1994	1995	87,686	4,320	1,348	5,668	985	6,653	7.6%	0.649	0.203	0.852	14.8%
1995	1996	157,241	6,458	1,045	7,503	1,116	8,619	5.5%	0.749	0.121	0.871	12.9%
1996	1997	74,943	2,153			1,007						
1997	1998	71,519	954	1,014	1,968	2,968	4,936	6.9%	0.193	0.205	0.399	60.1%
1998	1999	83,317	687	1,099	1,786	440	2,226	2.7%	0.309	0.494	0.802	19.8%
1999	2000	41,926	1,094	486	1,580	2,797	4,376	10.4%	0.250	0.111	0.361	63.9%
2000	2001	63,730	885	673	1,558	1,969	3,527	5.5%	0.251	0.191	0.442	55.8%
2001	2002	69,836										
Average		88,807	3,156	944	3,990	1,685	5,760	6.4%	0.483	0.166	0.649	35.1%
Bird Creek												
1992	1993	95,377	2,977	6,195	9,172	593	9,765	10.2%	0.305	0.634	0.939	6.1%
1993	1994	140,382	8,020	5,425	13,445	277	13,722	9.8%	0.584	0.395	0.980	2.0%
1994	1995	84,643	4,367	4,121	8,488	169	8,657	10.2%	0.504	0.476	0.980	2.0%
1995	1996	154,753	5,774	6,934	12,708	169	12,877	8.3%	0.448	0.538	0.987	1.3%
1996	1997	147,618	3,818	6,771	10,589	603	11,192	7.6%	0.341	0.605	0.946	5.4%
1997	1998	294,565	4,305	22,406	26,711	1,446	28,157	9.6%	0.153	0.796	0.949	5.1%
1998	1999	164,211	916	4,611	5,527	279	5,806	3.5%	0.158	0.794	0.952	4.8%
1999	2000	111,105	2,118	10,741	12,859	703	13,562	12.2%	0.156	0.792	0.948	5.2%
2000	2001	97,409	963	8,449	9,412	1,554	10,966	11.3%	0.088	0.770	0.858	14.2%
2001	2002	0										
Average		129,006	3,695	8,406	12,101	644	12,745	9.2%	0.304	0.645	0.949	5.1%
Ship Creek												
1992	1993	67,178	198		198	202	400	0.6%	0.495		0.495	50.5%
1993	1994	54,764	3,108		3,108	741	3,849	7.0%	0.807		0.807	19.3%
1994	1995	75,779	2,634	2,717	5,351	826	6,177	8.2%	0.426	0.440	0.866	13.4%
1995	1996	158,981	6,769	4,944	11,713	997	12,710	8.0%	0.533	0.389	0.922	7.8%
1996	1997	227,914	6,550			1,205						
1997	1998	232,066	3,469	11,917	15,386	1,375	16,761	7.2%	0.207	0.711	0.918	8.2%
1998	1999	232,765	2,090	4,459	6,549	678	7,227	3.1%	0.289	0.617	0.906	9.4%
1999	2000	165,388	3,688	9,141	12,829	628	13,457	8.1%	0.274	0.679	0.953	4.7%
2000	2001	260,070	3,532	26,419	29,951	1,610	31,561	12.1%	0.112	0.837	0.949	5.1%
2001	2002	233,563										
Average		170,847	3,560	9,933	10,636	918	11,518	6.8%	0.393	0.612	0.852	14.8%
Eklutna Tailrace												
1998	1999	112,219	1,022	1,453	2,475		2,475	2.2%	0.413	0.587	1.000	0.0%
1999	2000	126,602	2,558	5,053	7,611		7,611	6.0%	0.336	0.664	1.000	0.0%
2000	2001	76,851	849	3,399	4,248		4,248	5.5%	0.200	0.800	1.000	0.0%
2001	2002	124,838										
Average		110,128	1,476	3,302	4,778		4,778	4.6%	0.316	0.684	1.000	0.0%

^a Total run is equivalent to total return because an insignificant percentage of the hatchery released coho return at age 4.

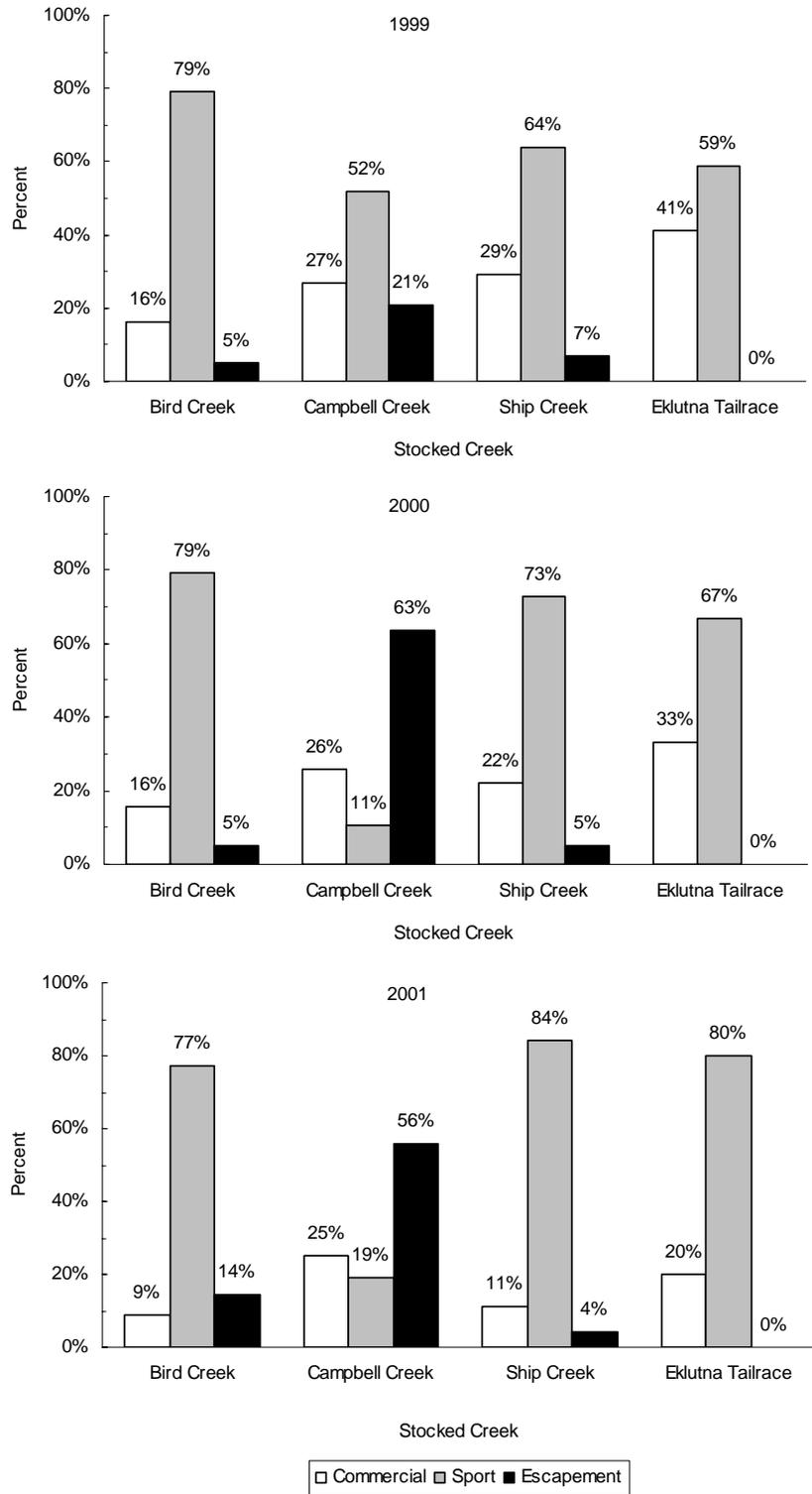


Figure 3.-Distribution of coho salmon total returns among commercial and sport fisheries and the escapement at four stocked sites, 1999-2001.

2000 RESULTS

Commercial Harvest of Stocked Coho Salmon

A total of 236,128 coho salmon were harvested in UCI mixed-stock fisheries in 2000 (Table 2). A combined total of 213,288 coho salmon were harvested in the sampled fisheries (Table 3). Technicians examined 41% of the total harvest for sampled UCI fisheries (Table 3) and 3% of the fish examined had a missing adipose fin (Table 4). In the NDS, 72% of the coho salmon harvested were examined for a missing adipose fin; 25% in the CDD and 33% in the CDES fisheries (Table 3).

The majority of the UCI coho salmon harvest in the sampled fisheries occurred in the CDD fishery (62%), followed by the NDS fishery and the CDES fishery (Table 5). Most of the CWTs recovered and most of the harvest of stocked coho salmon occurred in the CDD and NDS fisheries (Tables 4 and 5). A total of 9,534 (SE = 268) stocked coho salmon were harvested in UCI commercial fisheries in 2000, or 4.5% (SE = 0.1%) of the total commercial harvest (Table 5). Contributions to the 2000 sampled fisheries from 1998 coho smolt releases can be found in Appendix B4.

Sport Harvest and Escapement

An estimated 11,858 (SE = 1,346) coho salmon were harvested in the Ship Creek sport fishery (Walker et al. 2003). A total of 169 coho salmon were missing the adipose fin from 799 coho salmon examined at the Ship Creek fish trap. No broodstock was collected from the trap during 2000. A total of 494 coho were collected for broodstock from the fish ladder at Elmendorf Hatchery and from the creek between the dam and Reeve Blvd. The heads of 71 of these fish that were missing the adipose fin were sent to the Tag Lab for decoding. Eight did not contain a tag, 1 contained a tag from 1999 Cottonwood Creek, and 1 contained a tag from Bird Creek releases. An estimated 9,141 (SE = 1,247) coho salmon, or 77%, of the Ship Creek sport harvest was from hatchery releases (Table 6). A total of 814 coho salmon were counted through the Ship Creek fish trap (Appendix A1), 494 were collected for broodstock resulting in an escapement of 321 coho salmon into Ship Creek. An estimated 247 (SE = 16), or 76%, of these fish were from hatchery releases; the remaining coho salmon were assumed to be from natural production (Table 6).

An estimated 555 (SE = 230) coho salmon were harvested by anglers from Campbell Creek in 2000 (Walker et al. 2003). A total of 415 coho salmon were examined during beach seining of returning adults from 8 September-29 September 2000, of which 176 fish were missing the adipose fin. An estimated 486 (SE = 204), or 88%, of coho salmon in the Campbell Creek sport harvest were from hatchery releases (Table 6). The coho salmon escapement index into Campbell Creek on 14 September was 3,196 fish (Appendix A2). An estimated 2,797, or 88% of the indexed escapement, were from hatchery releases; the remaining coho salmon were assumed to be from natural production (Table 6).

At Bird Creek, anglers harvested an estimated 10,741 (SE = 1,164) coho salmon in 2000 (Walker et al. 2003). A coho salmon escapement index survey conducted on 9 September 2000 in Bird Creek and Penguin Creek (a tributary of Bird Creek) counted 703 coho salmon (Appendix A2).

Anglers harvested an estimated 5,053 (SE = 1,339) coho salmon at Eklutna Tailrace (Walker et al. 2003). All coho returning to the Tailrace are considered to be from hatchery returns. During the 2000 egg take, the heads of 29 coho salmon missing adipose fins were sent to the CWT lab.

Of the heads, 3 did not contain a tag. One of the tagged fish was a stray from Cottonwood Creek (1999) and 25 were from the 1999 Eklutna Tailrace releases.

Results of aerial and foot surveys of Turnagain Arm drainages were reported in Miller and Bosch (2004).

Total Returns, Marine Survival and Exploitation Rates

Returns to the four stocking locations were composed primarily of sport harvest, except the Campbell Creek return which was composed of 63% escapement (Table 6, Figure 3).

Overall marine survival of the four major coho salmon cohorts released in 1999 and recovered in 2000 was 9.8% (SE = 0.5%). Survival estimates were 10.4% for smolt released into Campbell Creek, 12.2% for Bird Creek, 8.1% for Ship Creek, and 6.0% for Eklutna Tailrace (Table 6).

Commercial exploitation rates were 0.250 for Campbell Creek, 0.156 for Bird Creek, 0.274 for Ship Creek, and 0.336 for Eklutna Tailrace (Table 6). Exploitation rates for the sport fishery were 0.111 for Campbell Creek, 0.792 for Bird Creek, 0.679 for Ship Creek and 0.664 for Eklutna Tailrace (Table 6).

2001 RESULTS

Commercial Harvest of Stocked Coho Salmon

A total of 113,311 coho salmon were harvested in the UCI mixed-stock fishing during 2001 (Table 2). A total of 89,592 coho salmon were harvested in sampled fisheries (Table 3). Technicians examined 56% of the total harvest for sampled UCI fisheries (Table 3) and heads were collected from 4.3% of the fish examined (Table 4). In the NDS, 72% of the coho salmon harvested were examined for a missing adipose fin. In the CDD and CDES fisheries, 43% and 33% of the coho salmon harvested in each respective fishery were examined.

The majority of the UCI coho salmon harvest in the sampled fisheries occurred in the NDS fishery (51%) followed by the CDD fishery (44%), and the CDES set net fishery (5%) (Table 3). Most of the CWTs recovered and most of the harvest of hatchery-produced coho salmon occurred in the NDS and the CDD fisheries (Tables 4 and 5). A total of 6,229 (SE = 180) stocked coho salmon were harvested in UCI commercial fisheries in 2001, or 7.0% (SE = 0.1%) of the total commercial harvest (Table 5). Contributions to the 2001 sampled fisheries from 1999 coho smolt releases can be found in Appendix B4.

Sport Harvest and Escapement

An estimated 26,419 (SE = 2,206) coho salmon were harvested in the Ship Creek sport fishery (Jennings et al. 2004). A total of 318 coho salmon were missing adipose fins from 1,393 fish examined as they passed through the fish trap on the lowest dam on Ship Creek. Broodstock was collected at two locations at Ship Creek in 2001; 208 were collected from the fish trap and another 425 were collected at the hatchery fish pass, or from the creek adjacent to the hatchery. Of the 127 heads collected from fish missing adipose fins that were sent to the tag lab for decoding, 11 did not contain a tag. Of the 116 coho salmon heads that contained a tag, 6 were from Eklutna Tailrace, 1 from Campbell Creek, and 1 was from Moose River. An estimated 26,419 (SE = 2,650) or 100% of the Ship Creek sport harvest were from hatchery releases (Table 6). The escapement into Ship Creek was 977 coho. All were estimated to be from hatchery releases.

In Campbell Creek, an estimated 813 (SE = 318) coho salmon were harvested by anglers in 2001 (Jennings et al. 2004). A total of 244 coho salmon were examined during beach seining of returning adults during September 2001, of which 62 were missing the adipose fin. An estimated 198 or 83% of the coho were of hatchery origin. The coho salmon index into Campbell Creek on 12 October was 2,377 fish (Appendix A2). An estimated 1,969 of this indexed escapement were from hatchery releases. The remaining coho salmon were assumed to be from natural production.

At Bird Creek anglers harvested an estimated 8,449 (SE = 980) coho salmon in 2001 (Jennings et al. 2004). A coho salmon escapement survey conducted on 26 September 2001 in Bird Creek and Penguin Creek counted 1,554 live coho salmon (Appendix A2). All are considered returns from hatchery releases.

At Eklutna Tailrace anglers harvested an estimated 3,399 (SE = 474) coho salmon. All coho returning to this fishery are considered to be of hatchery origin. During the 2001 Eklutna coho egg take, the heads of 17 coho salmon missing adipose fins were sent to the CWT lab. Two of these heads did not contain a tag, and all of the remaining 15 had been stocked into Eklutna Tailrace in 2000.

Results of aerial and foot surveys of Turnagain Arm drainages were reported in Miller and Bosch (2004).

Total Returns, Marine Survival and Exploitation Rates

In 2001, the commercial fishery harvested approximately 8.8% of Bird Creek hatchery returns, 25.1% for Campbell Creek, 11.2% for Ship Creek, and 20.0% for Eklutna Tailrace (Table 6, Figure 3). The sport fishery harvested 77.0% of Bird Creek hatchery returns, 19.1% for Campbell Creek, 83.7% for Ship Creek, and 80.0% for Eklutna Tailrace (Table 6, Figure 3).

Overall marine survival of the four major coho salmon cohorts released in 2000 and recovered in 2001 was 10.9 (SE = 0.7%). Survival estimates were 5.5% for smolt released into Campbell Creek, 11.3% for Bird Creek, 12.1% for Ship Creek, and 5.5% for Eklutna Tailrace (Table 6).

DISCUSSION

COMMERCIAL CATCH ASSESSMENT

During these 3 years of the study, overall sampling goals were generally met for all areas (Table 3). It was possible to sample a greater proportion of the Northern District harvest than the Central District harvest because fewer processors purchased fish, there were fewer fishing periods, and all fishing periods were scheduled openings rather than a combination of scheduled and emergency order openings. The sampling effort of the commercial harvest provided relatively precise estimates. For these 3 years, relative precision (95%) of the total harvest of hatchery-produced fish by the UCI commercial fisheries was 6.5%, 5.5%, and 4% for 1999, 2000, and 2001, respectively. These estimates of harvest were precise because of high rates of tagging in each release group, and a large sample from the commercial harvest was obtained.

The pattern of commercial coho salmon harvest between 1999 and 2001 was atypical of previous years. Between 1993 and 1998 the CDD fishery typically harvested 45% or more of the total coho salmon harvested in the sampled UCI fisheries, the CDES fishery at least 12%, and the NDS fishery at least 24%. During 1999 and 2000 this pattern was maintained for the CDD, but in 2001 only 35% of the coho harvested in UCI were from this fishery. The proportion of coho

salmon taken in the CDES fishery declined to lows of 9%, 5%, and 4% for the years 1999, 2000, and 2001, respectively, while the proportion of UCI coho harvested from the NDS increased from 25% to 41% during these 3 years.

Coho salmon harvests in the CDD fishery fell well below the 1993-1998 average of 165,606 coho salmon harvest from the CDD fishery (Table 5), and the 1999 and 2001 harvests are the two lowest since the urban coho project started. The low harvest in 1999 is a result of poor marine survival, which will be discussed later in this section, while the record low harvest during 2001 is a result of closures due to poor returns of sockeye salmon to the Kenai River and Susitna River drainages in the NDS. Also, BOF action in 1996 reduced fishing time of the CDD fleet directed at surplus sockeye and coho salmon in NDS and other areas, which has resulted in a lower exploitation rate by the commercial fleet (Fox and Shields 2000).

The harvest of coho salmon from the CDES fishery dropped dramatically from the 1993 to 1998 average of 39,331 to 4,246 in 2001. During 1999, the CDES fishery was closed many times due to below average, or late, runs of sockeye and Chinook salmon into the Kenai River.

NDS harvest declined from the 1993-1998 average of 81,575 to 31,436 coho salmon in 1999, the lowest on record. The decrease is the result of an areawide decline in coho abundance caused by very low marine survival rates for both wild (Jay Carlon, ADF&G, Sport Fish Division, Soldotna, personal communication) and stocked coho smolt. Harvest of coho salmon from the NDS subareas (statistical areas 247-10, 247-20, and 247-30) averaged about 60% (ranging from 75% to 38%) of the 1993-1998 NDS total harvest. The NDS westside harvest contributed a declining 60%, 47% and 32% of the total NDS harvest in 1999, 2000, and 2001, respectively. Since 1994 there has been a steady decrease in the coho salmon harvest in the NDS westside setnet fishery, from a high of 94,401 fish in 1994 to a low of 12,974 fish in 1998. The cause of this decline, at least in part, appears to be related to a decrease in the number of commercial fishermen working permits in this area, perhaps because of fewer fishing periods, restrictions on existing fishing periods, remote location of permit sites, and fewer fishing tenders and local sites for fishermen to sell fish.

Coho salmon harvest in the NDS eastside area (statistical areas 247-70, 247-80, and 247-90) averaged about 19% of the Northern District harvest from 1993-1998. From 1999 to 2001 the NDS eastside harvest contributed a very steady 25% to 26% of the total NDS harvest. The majority of coho salmon harvest in the NDS eastside occurred from late July through late August and targeted coho from Turnagain Arm streams that have a later run timing. Emergency order closures of fishing periods in the Northern District in July typically do not affect the NDS eastside harvest as much as other NDS subdistricts, because the eastside targets later run coho headed for the end of Turnagain Arm. Additionally, fishing period closures and restrictions placed on the CDD and CDES fisheries in late July and August may allow a greater number of coho salmon to reach NDS eastside statistical areas.

The overall proportion of hatchery-stocked coho salmon in the UCI sampled fisheries decreased from an average of 8% for 1993-1998 to an average of 5% for 1999-2001. In the NDS fishery, the average relative contributions of hatchery stocks decreased from 1993-1998 to 1999-2001: from 3% to 2% for westside (247-10, 247-20, 247-30), 8% to 2% for the eastside (247-70, 247-80, 247-90), 25% to 19% for Su Flats/Pt. MacKenzie (247-41, 247-42), and 34% to 24% for Fire Island (247-43) statistical areas. Slight differences in the proportion of hatchery-stocked coho

salmon in the sampled fisheries were most likely caused by the location and timing of restrictions placed on these fisheries and smaller than average coho salmon harvests.

SPORT FISHERY

Results of this project, along with field observations of the sport fisheries, indicate that the urban coho salmon stocking program was successful for 1999 through 2001. This program is considered successful if recreational angler effort is at least 25,000 angler-days, and sport harvest is at least 10,000 coho salmon, greater than the 1988-1992 pre-stocking mean among all stocked urban streams. Although effort, harvest and catch varied from year to year for individual streams (Figure 4), targeted increases for urban stocked streams combined were met in 1999-2001, except for harvest in 1999 (Figure 5).

In 2001, a record 39,080 coho salmon were harvested from urban stocked streams with 26,419 harvested from Ship Creek alone, almost double the next highest Ship Creek harvest of 14,049 coho salmon in 1998. A substantial increase in the catch of coho salmon has occurred in Ship, Campbell, and Bird creeks since the start of the stocking program (Mills 1991, 1992, 1993; Table 7).

A more important measure of success of the stocking program was the extent to which angler effort increased. The Statewide Harvest Survey estimated angling effort for all species combined. Increased angler effort for a specific species was therefore not easily quantified and may have been confounded by fluctuations in effort in other fisheries. The targeted increase in angler effort of 25,000 angler-days over the prestocking mean of 34,699 for Bird, Campbell and Ship creeks was exceeded each year (Table 7).

The coho salmon fishery at Ship Creek became increasingly popular with anglers while angler effort at Campbell Creek declined overall. Since 1996, in order to reduce run size in Campbell Creek and increase angler opportunity in Ship Creek, coho salmon smolt stocking in Campbell Creek has been reduced by about half with the difference being stocked into Ship Creek.

The true increase in overall angler effort for coho salmon may be masked by the increasing popularity of the Chinook salmon fishery in Ship Creek. This fishery has grown dramatically in recent years and the effort associated with it is included in the estimate of angler effort. In addition, a weakness of using the SWHS is that the survey targets households with a licensed angler. Field observations indicate that urban streams, especially Campbell Creek, are fished primarily by young anglers who are not required to purchase a license. Households in which youths fish but adults do not purchase a fishing license are not sampled by the SWHS. Thus, estimates of harvest and effort in Campbell Creek are considered minimum estimates.

The Eklutna tailrace coho salmon fishery started with the first return in 1999. Effort has increased from 6,150 angler-days in 1999 to 10,166 angler-days in 2001. The highest catch (6,812) and harvest (5,053) occurred in 2000, corresponding to returns from its highest releases over the course of this study.

Anglers fishing Ship Creek typically released about 33% of the coho they caught. However, in 2000, they released 43% of the coho catch. Bird Creek anglers released 27% to 32% of the coho while anglers fishing the Eklutna tailrace only released 22% to 26% of the coho salmon they caught.

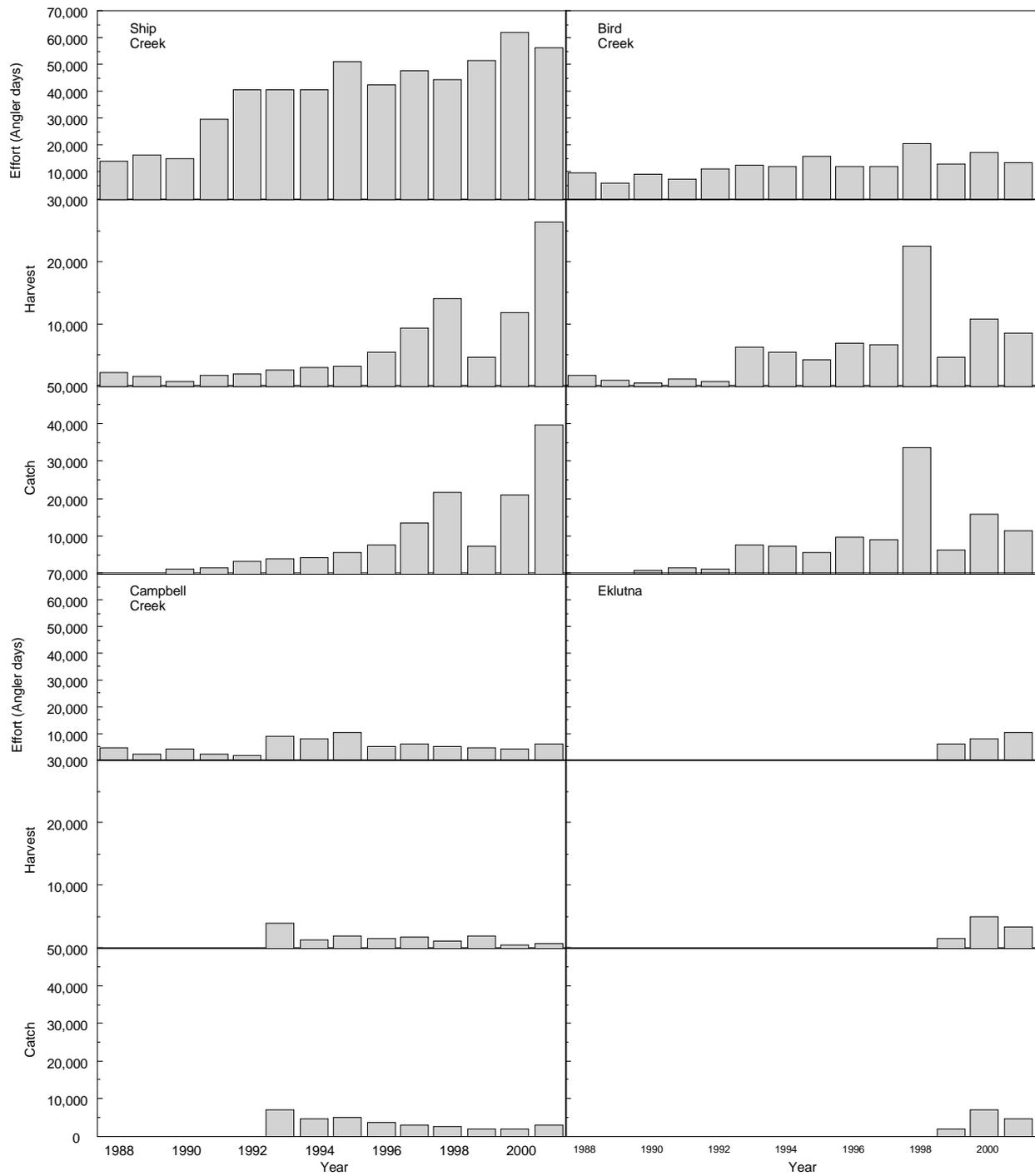
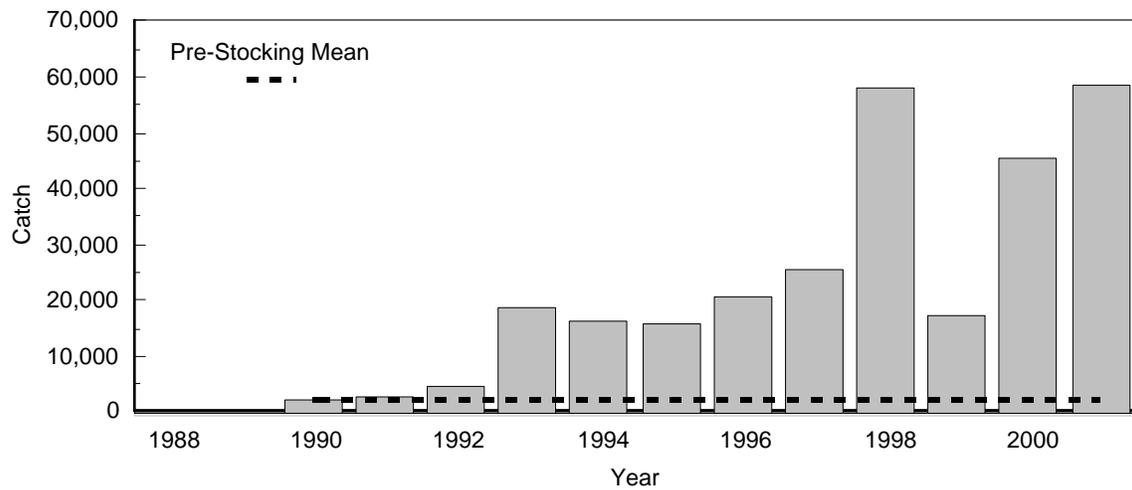
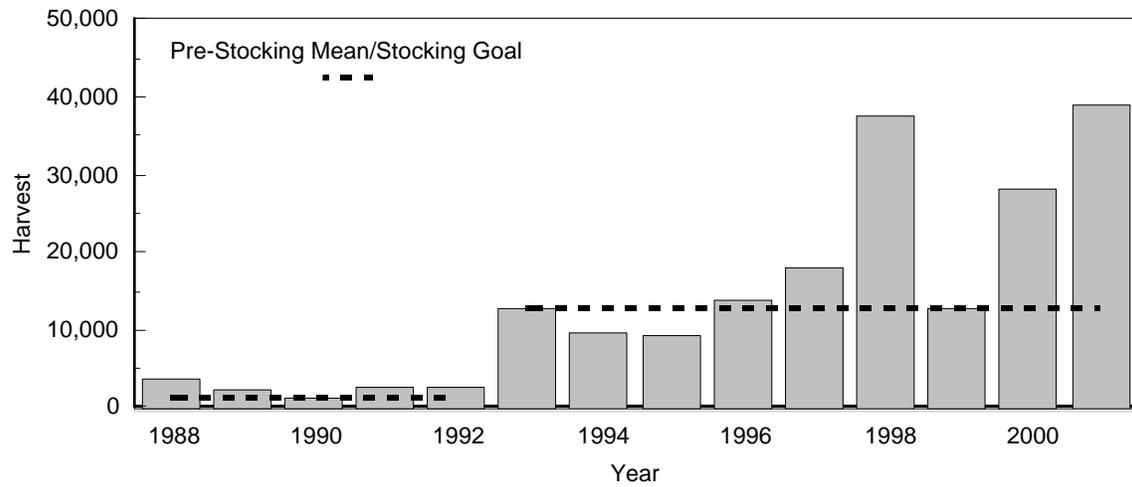
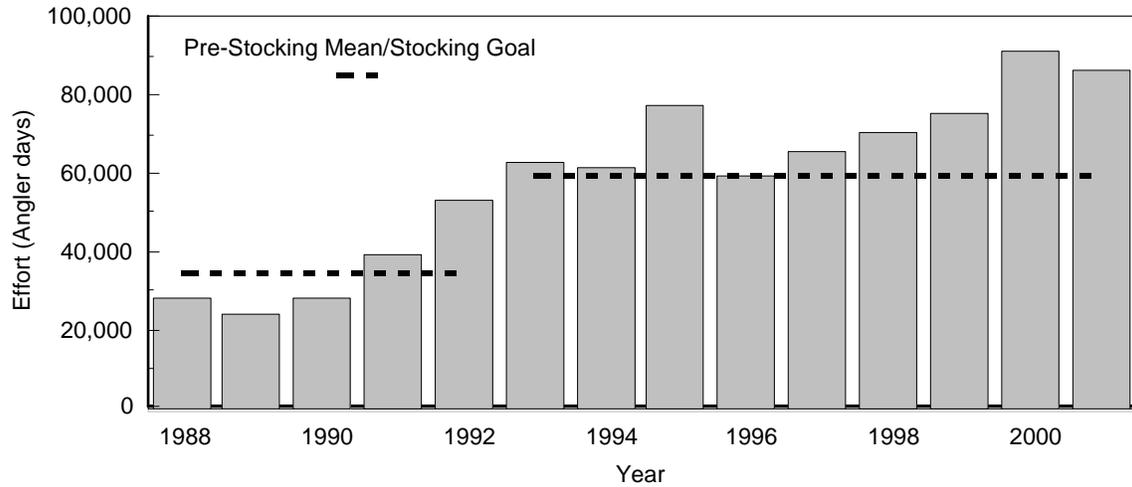


Figure 4.-Sport effort, and harvest and catch of coho salmon in four Anchorage urban area stocked streams, 1988-2001.



Source: Statewide Harvest Survey (Howe et al. 1995, 1996, 2001 a-d; Jennings et al. 2004; Mills 1989 -1994; Walker et al. 2003).

Figure 5.-Sport effort, harvest, and catch in urban Anchorage streams stocked with coho salmon, 1988-2001.

Table 7.-Sport effort, catch, and harvest of coho salmon, in Anchorage urban streams stocked with coho salmon, 1988-2001.

Year	Effort (angler-days)					Catch ^a					Harvest				
	Ship	Bird	Campbell	Eklutna ^b	Total	Ship	Bird	Campbell	Eklutna ^b	Total	Ship	Bird	Campbell	Eklutna ^b	Total
Prestocking															
1988	14,115	9,532	4,729		28,376						2,128	1,710	0		3,838
1989	16,424	5,844	1,942		24,210						1,467	899	28		2,394
1990	15,112	9,138	3,983		28,233	1,220	811	0		2,031	818	535	0		1,353
1991	29,768	7,551	1,977		39,296	1,384	1,372	89		2,845	1,668	1,099	25		2,792
1992	40,513	11,352	1,515		53,380	3,142	1,279	24		4,445	1,911	785	8		2,704
Prestocking Avg ^c															
	23,186	8,683	2,829		34,699	1,915	1,154	38		3,107	1,598	1,006	12		2,616
Stocking Program															
1993	40,815	12,852	9,073		62,740	3,876	7,799	6,894		18,569	2,579	6,195	3,942		12,716
1994	40,727	12,357	8,036		61,120	4,239	7,169	4,725		16,133	3,011	5,425	1,256		9,692
1995	51,087	15,947	10,457		77,491	5,482	5,639	4,910		16,031	3,222	4,121	1,947		9,290
1996	42,454	12,003	5,225		59,682	7,710	9,675	3,474		20,859	5,369	6,934	1,458		13,761
1997	47,826	12,136	5,897		65,859	13,448	9,097	3,006		25,551	9,434	6,771	1,651		17,856
1998	44,670	20,797	4,834		70,301	21,733	33,546	2,624		57,903	14,049	22,406	1,167		37,622
1999	51,873	13,056	4,441	6,150	75,520	7,196	6,427	1,927	1,857	17,407	4,724	4,710	1,927	1,453	12,814
2000	62,101	17,550	3,918	7,938	91,507	20,890	15,799	1,873	6,812	45,374	11,858	10,741	555	5,053	28,207
2001	56,402	13,662	6,222	10,166	86,452	39,615	11,563	2,748	4,497	58,423	26,419	8,449	813	3,399	39,080
Stocking Program Avg															
	48,662	14,484	6,456	8,085	72,297	13,799	11,857	3,576	4,389	30,694	8,963	8,417	1,635	3,302	20,115

^a Estimates of catch not available prior to 1990.

^b Eklutna Tailrace was first stocked with coho salmon in 1998, making 1999 the first return.

^c 1988-1992 for effort and harvest; 1990-1992 for catch.

ESCAPEMENT

All three stocked urban creeks (Ship, Bird, and Campbell) experienced their highest escapements during the 2000 season. The individual biological escapement goals (BEGs) of 200 coho salmon into Ship and Campbell creeks were met each year from 1999 through 2001. Bird Creek does not have a BEG because prior to coho salmon stocking it had no significant natural spawning population of coho salmon. Starting in 2002, both Campbell and Ship creeks will no longer have coho salmon BEGs due to the influence of stocked fish and non-existent or very small natural runs (Bue and Hasbrouck 2001).

The straying of hatchery-reared coho salmon from stream of release was not tested during this study, as no significant straying has been detected in the past.

Sufficient coho salmon spawning escapement data have not been collected yet to set BEGs for wild coho salmon escapements in Twentymile and Placer river drainages and Portage Creek drainage. Surveying these streams has not always taken place due to unfavorable flying or water conditions.

MARINE SURVIVAL

Marine survival estimates for Bird and Campbell creeks are biased low because the only escapement measure for these creeks were survey indexes, and additionally for Campbell Creek in 2001 because stream surveys were incomplete that year. No estimates were available for the Eklutna Tailrace because we had no measure of escapement in that system.

The 1999 overall marine survival estimate of 3.2% is the lowest on record, and the lowest recorded marine survival for Kenai River coho also occurred then (Jay Carlon, Alaska Department of Fish and Game, Soldotna, personal communication). Also notable and important in regard to the reduced abundance for coho salmon returning in 1999 is the September 1995 flood experienced in the Kenai River drainage and parts of the Susitna River drainage. Approximately 70% of the coho salmon returning each year to UCI are 4 years old (Fox and Shields 2000). This 147-year flood (in the Kenai River drainage), which occurred after most adults had returned to natal streams, increased the mortality of both spawning adults and of eggs already deposited in the gravel.

Marine survival estimates for coho salmon returning in 2000 and 2001 were similar to historical estimates for stocked urban streams (Cyr et al. 1997-1999, 2001), and survival estimates for individual streams did not vary much. Of note, in 2000 there were more coho salmon returning 2 years after stocking (in 1998) than has been observed for other stocking years (Appendices B1–B4). Because they were not aged, we cannot determine if these fish spent an extra year in fresh water, or in the marine environment.

The catch in UCI commercial coho salmon fisheries is typically reflected by marine survival: a higher survival usually translates into a higher catch. However, the coho salmon commercial catch during 2001 was atypical, with a low coho salmon catch associated with a high survival rate, because of commercial fishing closures implemented to preserve low salmon runs in other UCI streams, most notably the Kenai River sockeye and Chinook salmon runs.

RECOMMENDATIONS

Our results justify continuation of the stocking program. Additional streams flowing into Knik and Turnagain arms should be stocked depending on availability of broodstock. Stocking urban

streams has several benefits: (1) it provides opportunity in Anchorage, especially for anglers unable to drive far from town; (2) it relieves fishing effort on wild stocks; (3) it provides commercial fishermen some fish with little apparent effect to sport anglers; and (4) the stocked coho salmon have similar run timing to wild stocks in the area and the sampling regimen described in this report can be used to sample returning wild tagged fish.

This project was conducted annually from 1993-2001, and has provided a wealth of knowledge about coho salmon. Tagging every released group is no longer necessary, and the focus of sampling should subsequently turn towards wild coho salmon. The terminal and commercial sampling programs should continue to assess coded wire tagged wild stocks from Cottonwood Creek and the Kenai River. Only coho salmon released into Ship Creek will be coded wire tagged. All stocked coho salmon should continue to be thermally marked during the hatching stage.

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**APPENDIX A. COHO SALMON ESCAPEMENT COUNTS AT
BIRD, CAMPBELL, AND SHIP CREEKS AND SELECTED
TURNAGAIN ARM STREAMS**

Appendix A1.-Coho salmon weir counts in Ship Creek, 1999, 2000 and 2001.

Date	1999			2000 ^a			2001		
	Unclipped	Clipped	Total	Unclipped	Clipped	Total	Unclipped	Clipped	Total
7/05	1		1						
7/06									
7/07									
7/08									
7/09									
7/10									
7/11							1		1
7/12							1		1
7/13				1		1	1		1
7/14	1	1	2						
7/15				1		1	1		1
7/16				4		4			
7/17				21	9	30			
7/18				35	9	44	2		2
7/19				58	13	71	1		1
7/20	2		2	15	3	18	7	2	9
7/21				13	5	18	3		3
7/22				18	4	22			
7/23				3	1	4	1	2	3
7/24				2	3	5	3	1	4
7/25							6	1	7
7/26	3	2	5	43	19	62	2		2
7/27	12	5	17	29	11	40	14	7	21
7/28	1	2	3	49	14	63	23	12	35
7/29	6	0	6	42	7	49			
7/30	5	3	8	19	1	20	106	15	121
7/31	6	5	11	20	8	28	98	20	118
8/01			0	12	5	17	82	22	104
8/02	8	4	12	12	5	17	36	8	44
8/03	13	4	17	8		8	34	17	51
8/04	16	12	28	11	3	14	23	12	35
8/05	64	18	82	8	8	16	38	11	49
8/06	31	6	37	8	1	9	51	25	76
8/07	51	24	75	13	4	17	54	12	66
8/08	39	14	53	4	2	6	49	14	63
8/09	32	13	45	5	3	8	25	9	34
8/10	14	11	25	14	3	17	14	3	17
8/11	11	7	18	5	2	7	22	2	24
8/12	20	17	37	8	2	10	15	3	18
8/13	61	16	77	7	3	10	5	1	6
8/14	14	3	17	75	12	87	55	14	69
8/15	14	3	17	13	1	14	33	9	42
8/16	11	3	14	3		3	31	17	48
8/17	6		6	3		3	64	23	87
8/18	9	1	10	3	1	4	30	10	40
8/19	11	5	16	0			12	8	20

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Date	1999			2000 ^a			2001		
	Unclipped	Clipped	Total	Unclipped	Clipped	Total	Unclipped	Clipped	Total
8/20	10	2	12	5	1	6	8	3	11
8/21	4	2	6	9	3	12	4	6	10
8/22	2	1	3	11		11	40	15	55
8/23	2	3	5				15	5	20
8/24			0	2	1	3			
8/25	5	4	9						
8/26	7	2	9				17	3	20
8/27									
8/28									
8/29									
8/30									
8/31									
9/01							15	1	16
9/02							4	1	5
9/03	6		6						
9/04	12		12	7	1	8			
9/05				15	1	16			
9/06				2		2			
9/07				5		5			
9/08									
9/09									
9/10							11	1	12
9/11							3		3
9/12							3	2	5
9/13				4		4	6		6
9/14									
9/15	2	1	3						
9/16	2	2	4						
9/17									
9/18							4	1	5
9/19									
9/20							2		2
9/21									
9/22									
9/23									
9/24									
9/25									
9/26									
9/27									
9/28									
9/29									
9/30									
Totals	514	196	710	645	169	814	1,075	318	1,393

^a In 2000 a coho passed the weir on June 27.

Appendix A2.-Coho salmon escapement index counts from foot surveys in Bird and Campbell creeks, 1999, 2000 and 2001.

Stream	Date	Live	Dead	Total
<u>1999^a</u>				
<i>Bird Creek Drainage</i>				
Total				279
<i>Campbell Creek Drainage</i>				
Total				537
<u>2000</u>				
<i>Bird Creek Drainage</i>				
Bird Ck. Falls downstream to Penguin Ck.	9/09	318	0	318
Penguin Ck.	9/09	29	9	38
Bird Ck. From Penguin Ck. To Seward Hwy.	9/09	<u>347</u>	<u>0</u>	<u>347</u>
Total		694	9	703
<i>Campbell Creek Drainage</i>				
Upper South Fork	9/13	44	0	44
Lower South Fork	9/13	420	0	420
Upper North Fork	9/12	55	2	57
Lower North Fork	9/12	88	0	88
Piper St. to Folker St.	9/14	383	12	395
Folker St. to C St.	9/14	<u>2,192</u>	<u>0</u>	<u>2,192</u>
Total		3,182	14	3,196
<u>2001</u>				
<i>Bird Creek Drainage</i>				
Bird Ck. Falls downstream to Penguin Ck.	9/26	529	0	529
Penguin Ck.	9/26	611	2	613
Bird Ck. From Penguin Ck. To Seward Hwy.	9/26	<u>414</u>	<u>0</u>	<u>414</u>
Total		1,554	2	1,556
<i>Campbell Creek Drainage</i>				
Upper South Fork	10/12	30	0	30
Lower South Fork	10/12	970	92	1,062
Upper North Fork		NA	NA	0
Lower North Fork		NA	NA	0
Piper St. to Folker St.	10/12	1,285	0	1,285
Folker St. to C St.		<u>NA</u>	<u>NA</u>	<u>0</u>
Total		2,285	92	2,377

^a Counts by reach not available for 1999.

NA = No estimates conducted in these stream reaches this year.

**APPENDIX B. ESTIMATES BY RELEASE SITE OF COHO
SALMON THAT WERE HARVESTED IN SAMPLED UPPER
COOK INLET COMMERCIAL FISHERIES IN 1999, 2000 AND
2001.**

Appendix B1.-Estimates of harvest contribution (r_{ij}) and standard error (SE) of coho salmon, stocked in 1998, by release site in Upper Cook Inlet, 1999.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution						
		r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	V(r_{ij})	SE	%	V(%)	SE(%)	
Upper Cook Inlet Central District Cohoe Beach (244-22) setnet commercial harvest, 1999.																
7/1-7/12	17	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/14	7	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/15	12	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/17-7/19	167	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/22	26	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/24-7/25	218	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/27	91	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/28	16	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/29	32	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/30	101	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/31	28	17	16	0	0	0	0	0	0	1	17	16	4%	2.1	1.46	
8/1-8/2	122	0	0	0	0	20	14	0	0	2	20	14	2%	0.1	0.37	
8/03	239	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
8/04	308	0	0	13	13	0	0	0	0	1	13	13	0%	0.0	0.12	
8/05	735	11	11	0	0	22	15	0	0	3	33	18	0%	0.0	0.08	
8/09	499	0	0	0	0	0	0	6	5	1	6	5	0%	0.0	0.05	
8/12	324	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
Total ^a	2,942	28	19	13	13	42	20	6	5	8	89	31	0%	0.0	0.03	

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Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
District Kalifornsky Beach (244-30) setnet commercial harvest, 1999.															
7/8-7/12	26	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/14	2	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/15	5	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/17-7/19	152	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/22	14	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/24-7/25	43	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/27	70	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/28	5	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/29	27	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/30	44	16	15	0	0	0	0	0	0	16	230	15	36%	11.9	3.45
7/31	246	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/1-8/2	273	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/03	104	0	0	0	0	10	10	0	0	10	96	10	10%	0.9	0.94
8/04	433	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/05	271	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/09	337	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/12	306	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total ^a	2,358	16	15	0	0	10	10	0	0	26	326	18	1%	0.0	0.08
District Salamatof Beach (244-40) setnet commercial harvest, 1999.															
7/8-7/12	32	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/15	18	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/19	208	6	6	0	0	0	0	0	0	6	33	6	3%	0.1	0.27
7/22	57	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/27	326	0	0	0	0	0	0	6	5	6	28	5	2%	0.0	0.16
7/29	176	0	0	0	0	16	16	0	0	16	243	16	9%	0.8	0.89
7/30	162	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/1-8/2	695	0	0	0	0	15	14	9	5	24	236	15	3%	0.0	0.22
8/03	246	0	0	0	0	0	0	3	2	3	6	2	1%	0.0	0.10
8/04	378	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/05	1,058	16	8	6	5	26	10	3	1	50	201	14	5%	0.0	0.13
8/09	578	0	0	0	0	0	0	2	1	2	1	1	0%	0.0	0.02
8/12	296	0	0	0	0	0	0	4	1	4	1	1	1%	0.0	0.04
Total ^a	4,230	22	10	6	5	57	24	26	8	110	748	27	3%	0.0	0.06

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Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
Northern District westside (247-10, 20, 30) setnet commercial harvest, 1999.															
7/1-7/12	461	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/15	352	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/19	2,592	0	0	3	3	0	0	7	0	10	10	3	0%	0.0	0.01
7/26	4,751	12	7	6	6	11	7	13	3	42	146	12	1%	0.0	0.03
8/02	4,872	5	5	17	9	0	0	20	3	43	118	11	1%	0.0	0.02
8/05	2,947	27	10	0	0	30	10	15	2	72	197	14	2%	0.0	0.05
8/09	928	0	0	0	0	11	5	12	1	23	27	5	2%	0.0	0.06
8/12	315	0	0	0	0	0	0	7	4	7	17	4	2%	0.0	0.13
8/16-8/30	1,620	13	13	0	0	0	0	11	6	24	194	14	2%	0.0	0.09
Total ^a	18,838	57	18	27	11	52	13	85	8	221	707	27	1%	0.0	0.01

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Northern District Susitna Flats/Point Mackenzie (247-41, 247-42) setnet commercial harvest, 1999.															
7/12-7/15	83	0	0	0	0	15	15	4	4	20	230	15	24%	3.3	1.83
7/19	160	0	0	3	3	3	3	8	0	14	15	4	8%	0.1	0.24
7/26	251	5	4	5	4	19	7	40	0	69	73	9	27%	0.1	0.34
8/02	244	7	4	5	4	34	9	19	0	64	118	11	26%	0.2	0.44
8/05	635	24	8	54	12	57	12	25	0	161	352	19	25%	0.1	0.30
8/09	610	15	7	28	9	57	13	41	2	142	292	17	23%	0.1	0.28
8/12	276	0	0	10	5	35	9	9	0	54	114	11	20%	0.1	0.39
Total ^a	2,259	51	12	105	17	219	27	147	4	522	1193	35	23%	0.0	0.15

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Appendix B1.-Page 4 of 4.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution						
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)	
Northern District Fire Island (247-43) setnet commercial harvest, 1999.																
7/12	13	0	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/15	36	0	0	0	0	4	4	2	1	7	14	4	18%	1.1	1.03	
7/19	199	4	3	4	3	21	7	16	0	44	72	8	22%	0.2	0.43	
7/26	131	16	6	16	7	9	5	9	0	50	107	10	38%	0.6	0.79	
8/02	630	13	7	14	7	87	17	23	2	138	399	20	22%	0.1	0.32	
8/05	769	65	15	73	17	91	18	20	2	249	849	29	32%	0.1	0.38	
8/09	691	15	10	8	7	72	21	25	5	119	614	25	17%	0.1	0.36	
8/12	134	4	3	8	5	39	10	4	0	55	134	12	41%	0.7	0.86	
Total ^a	2603	116	21	123	22	323	35	99	6	661	2187	47	25%	0.0	0.18	
Northern District Eastside setnet (247-70, 80, & 90) setnet commercial harvest, 1999.																
7/8-7/12	30	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
7/15	72	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
7/19	382	0	0	0	0	0	0	5	5	5	21	5	1%	0.0	0.12	
7/26	499	5	4	9	6	18	8	4	1	35	111	11	7%	0.0	0.21	
8/02	660	18	18	39	27	107	43	26	10	190	2,949	54	29%	0.7	0.82	
8/05	179	8	5	0	0	4	3	5	1	17	37	6	9%	0.1	0.34	
8/09	595	26	9	9	6	12	6	7	1	54	156	12	9%	0.0	0.21	
8/12	526	0	0	10	9	0	0	0	0	10	82	9	2%	0.0	0.17	
8/16	406	5	5	0	0	5	5	0	0	10	42	6	3%	0.0	0.16	
8/19	1,085	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
8/23	1,385	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
8/26	685	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
8/30	519	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
9/2-9/16	713	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00	
Total ^a	7,736	62	22	66	29	147	44	47	11	321	3,398	58	4%	0.0	0.08	

^a Totals may not equal sum of individual estimates due to rounding.

Appendix B2.-Estimates of harvest contribution (r_{ij}) and standard error (SE) of coho salmon, stocked in 1999, by release site in Upper Cook Inlet, 2000.

Upper Cook Inlet Central District (244-00, 245-00) driftnet commercial harvest, 2000.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
		r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	V(r_{ij})	SE			
6/26, 29	864	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.0
7/03	874	0	0	0	0	0	0	9	9	9	74	9	1%	0.0	0.1
7/06	2,087	42	17	17	9	30	16	41	17	130	949	31	6%	0.0	0.1
7/10	98	7	6	0	0	0	0	13	9	20	113	11	20%	1.2	1.1
7/12	17	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.0
7/13, 15, 16	39,380	389	74	224	45	540	96	381	72	1,533	21,850	148	4%	0.0	0.0
7/17, 18	42,292	547	69	202	33	715	87	526	66	1,990	17,758	133	5%	0.0	0.0
7/20	32,353	439	76	183	40	800	113	485	79	1,907	26,406	162	6%	0.0	0.1
7/31	7,706	15	15	0	0	36	25	29	20	81	1,235	35	1%	0.0	0.0
8/03	3,877	0	0	0	0	12	12	0	0	12	138	12	0%	0.0	0.0
8/07	1,652	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.0
Total^a	131,200	1,438	128	626	70	2,133	175	1,484	129	5,682	68,522	262	4%	0.0	0.0

Upper Cook Inlet Central District Ninilchik (244-21) setnet commercial harvest, 2000.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
		r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	V(r_{ij})	SE			
7/3, 6, 10	60														
7/12	10	No hatchery fish recovered in this district													
7/13, 15	272														
7/16, 17	171														
7/18	36														
7/20	166														
7/24	182														
7/31	475														
8/07	839														
Total^a	2,211														

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Upper Cook Inlet Central District Coho Beach (244-22) setnet commercial harvest, 2000.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE			
7/3, 6, 10	14	0	0	0	0	6	0	0	0	6	0	0	40%	0.0	0.00
7/12	6	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/13, 15	327	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16, 17	454	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/18	175	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/20	258	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/24	249	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/31	630	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/07	1,200	0	0	8	0	14	0	0	0	22	0	0	2%	0.0	0.00
Total^a	3,313	0	0	8	0	20	0	0	0	27	0	0	1%	0.0	0.00

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Upper Cook Inlet Central District Kalifornsky Beach (244-30) setnet commercial harvest, 2000.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE			
7/3, 10	62	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/12	26	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/13, 15	498	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16, 17	632	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/18	363	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/20	388	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/24	105	0	0	4	0	0	0	0	0	4	0	0	3%	0.0	0.00
7/31	209	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/07	645	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total^a	2,928	0	0	4	0	0	0	0	0	4	0	0	0%	0.0	0.00

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Upper Cook Inlet Central District Salmatof Beach (244-40) setnet commercial harvest, 2000.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/10	61	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/13	576	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/17	688	0	0	4	0	0	0	6	0	10	0	0	1%	0.0	0.00
7/18	399	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/20	664	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total^a	2,388	0	0	4	0	0	0	6	0	10	0	0	0%	0.0	0.00

Upper Cook Inlet Northern District westside (247-10, 20, 30) setnet commercial harvest, 2000.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
6/26, 6/29, 7/3, 7/6, 7/10	1,889	0	0	0	0	0	0	9	0	9	0	0	0%	0.0	0.00
7/13	4,093	0	0	0	0	0	0	3	0	3	0	0	0%	0.0	0.00
7/17	1,521	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/20	9,860	12	6	3	5	15	7	44	6	73	141	12	1%	0.0	0.01
7/24	7,175	5	4	3	3	6	5	23	4	36	63	8	0%	0.0	0.01
7/27	4,599	13	7	6	5	26	7	25	6	70	162	13	2%	0.0	0.03
7/311	1,496	13	5	7	4	19	6	8	5	48	103	10	3%	0.0	0.07
8/03	455	3	2	2	2	3	3	3	2	10	21	5	2%	0.0	0.10
8/07	1,418	4	4	0	3	16	4	4	4	25	59	8	2%	0.0	0.05
8/10	494	2	2	0	2	0	2	2	2	5	18	4	1%	0.0	0.09
8/14, 24	652	0	0	5	0	9	0	0	0	14	0	0	2%	0.0	0.00
Total^a	33,652	50	12	26	9	94	14	121	12	293	568	24	1%	0.0	0.01

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Upper Cook Inlet Northern District Susitna Flats/Point Mackenzie (247-41, 247-42) setnet commercial harvest, 2000.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE			
6/29, 7/3, 7/6, 7/10	95	0	0	7	0	12	0	10	0	29	0	0	31%	0.0	0.00
7/13	50	2	2	0	1	0	2	4	2	6	16	4	12%	0.6	0.81
7/17	215	2	2	2	1	8	2	11	2	23	13	4	11%	0.0	0.17
7/20	1,740	24	8	12	6	136	9	90	7	261	220	15	15%	0.0	0.09
7/24	3,783	63	12	61	9	154	14	255	12	532	546	23	14%	0.0	0.06
7/27	2,312	47	10	61	8	160	12	105	10	373	415	20	16%	0.0	0.09
7/31	893	23	10	19	8	89	12	56	10	187	409	20	21%	0.1	0.23
8/03	235	3	2	4	2	27	3	11	2	44	22	5	19%	0.0	0.20
8/07	888	12	5	17	4	86	6	19	5	135	95	10	15%	0.0	0.11
8/10	847	21	7	17	5	25	8	14	7	77	201	14	9%	0.0	0.17
8/14	414	0	0	6	0	21	0	4	0	31	0	0	7%	0.0	0.00
8/17	123	0	0	0	0	2	0	0	0	2	0	0	1%	0.0	0.00
8/21	165	3	3	5	2	0	3	0	3	8	31	6	5%	0.1	0.34
8/24, 8/28, 8/31, 9/4, 9/7, 9/11	189	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total^a	11,949	199	23	210	17	721	26	579	22	1,709	1,968	44	14%	0.0	0.04

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Upper Cook Inlet Northern District Fire Island (247-43) setnet commercial harvest, 2000.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/10	83	3	2	0	2	9	3	2	2	14	19	4	17%	0.3	0.53
7/13	103	7	6	0	5	16	7	0	6	23	144	12	22%	1.4	1.16
7/17	860	35	9	37	6	66	10	72	9	210	296	17	24%	0.0	0.20
7/20	1,789	69	12	39	9	165	13	95	12	367	528	23	21%	0.0	0.13
7/24-	2,129	92	14	42	10	201	16	129	13	463	707	27	22%	0.0	0.12
7/27	1,014	108	16	38	12	91	18	38	15	275	936	31	27%	0.1	0.30
7/31	39	1	1	2	1	6	1	1	1	10	5	2	24%	0.3	0.57
8/07	429	31	9	12	6	50	10	0	9	92	288	17	22%	0.2	0.40
8/10	531	36	11	6	9	54	12	0	11	95	472	22	18%	0.2	0.41
8/14	172	5	3	2	2	6	4	0	3	12	38	6	7%	0.1	0.36
8/17,21,24,28, & 9/4,7,11	95	1	2	0	1	3	2	0	2	5	11	3	5%	0.1	0.35
Total^a	7,244	313	26	178	22	664	34	338	30	1,566	3,443	59	22%	0.0	0.08

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Upper Cook Inlet Northern District Eastside setnet (247-70, 80, & 90) setnet commercial harvest, 2000.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution			%	V(%)	SE(%)
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE			
6/29, 7/3, 7/6, 7/10	44	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/13, 15	267	14	4	0	11	0	15	0	13	14	672	26	5%	0.9	0.97
7/17	468	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/20	510	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/24	2,472	82	9	28	16	28	22	29	20	166	1,518	39	7%	0.0	0.16
7/27	149	2	1	0	2	2	2	1	2	6	17	4	4%	0.1	0.28
7/31	846	22	5	6	6	26	10	0	8	54	276	17	6%	0.0	0.20
8/03	833	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/07	1,305	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/10	3,137	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/14	2,554	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/17	2,116	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/21	1,636	0	0	4	0	0	0	0	0	4	0	0	0%	0.0	0.00
8/24	972	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/28	460	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/31	272	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
9/4, 7, 11	368	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total ^a	18,409	119	11	38	20	56	28	30	25	243	2,483	50	1%	0.0	0.03

^a Totals may not equal sum of individual estimates due to rounding.

Appendix B3.-Estimates of harvest contribution (r_{ij}) and standard error (SE) of coho salmon, stocked in 2000, by release site in Upper Cook Inlet Central District, 2001.

Upper Cook Inlet Central District (244 & 245) driftnet commercial harvest, 2001.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	V(r_{ij})	SE	%	V(%)	SE(%)
6/25	8	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
6/28	41	0	0	0	0	0	0	6	0	6	0	0	14%	0.0	0.00
7/02	202	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/04, 7/05	600	0	0	0	0	0	0	17	0	17	0	0	3%	0.0	0.00
7/08, 7/09	42	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/12	4,158	17	9	15	11	61	12	22	8	115	405	20	3%	0.0	0.05
7/16, 7/17	7,497	24	11	32	13	53	15	70	9	179	604	25	2%	0.0	0.03
7/19	12,881	114	25	67	29	260	34	172	21	612	3,071	55	5%	0.0	0.04
7/26	562	0	0	8	0	11	0	14	0	34	0	0	6%	0.0	0.00
7/30	1,893	0	0	0	0	66	0	0	0	66	0	0	3%	0.0	0.00
8/02	4,180	26	10	47	12	82	14	8	9	164	542	23	4%	0.0	0.06
8/06	5,238	82	18	51	21	206	25	4	15	343	1,604	40	7%	0.0	0.08
8/09	2,116	0	0	0	0	7	0	0	0	7	0	0	0%	0.0	0.00
Total^a	39,418	263	35	220	41	746	49	312	30	1,541	6,227	79	4%	0.0	0.02

Upper Cook Inlet Central District Coho Beach (244-22) setnet commercial harvest, 2001.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	V(r_{ij})	SE	%	V(%)	SE(%)
7/2, 4, 5, 8, 9, 10	16	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/11	1	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/12, 14/	10	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16	68	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/17	14	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/18	45	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/19	79	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/21, 23	268	0	0	8	0	0	0	0	0	8	0	0	3%	0.0	0.00
7/25	108	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/26	148	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/27, 28	216	0	0	0	0	0	0	11	0	11	0	0	5%	0.0	0.00
Total^a	973	0	0	8	0	0	0	11	0	19	0	0	2%	0.0	0.00

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Upper Cook Inlet Central District Kalifornsky Beach (244-30) setnet commercial harvest, 2001.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/2, 4, 5, 8, 9, 10, 11, 12, 14, 16, 17	140	0	0	0	0	0	0	8	0	8	0	0	6%	0.0	0.00
7/18, 19	75	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/21, 23	146	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/25	43	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/26	67	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/27, 28	106	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total^a	577	0	0	0	0	0	0	8	0	8	0	0	1%	0.0	0.00

Upper Cook Inlet Central District Salamatof Beach (244-40) setnet commercial harvest, 2000.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/09	15	0	0	0	0	0	0	3	0	3	0	0	17%	0.0	0.00
7/12	21	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16	765	0	0	0	0	0	0	6	0	6	0	0	1%	0.0	0.00
7/19	915	10	9	26	11	0	13	8	8	43	425	21	5%	0.1	0.23
7/26	199	5	4	0	5	8	6	0	4	13	90	10	7%	0.2	0.48
Total^a	1,915	14	10	26	12	8	14	16	9	65	515	23	3%	0.0	0.12

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Upper Cook Inlet Northern District westside (247-10, 20, 30) setnet commercial harvest, 2001.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
6/18, 7/2, 5, 9	643	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/12	471	0	0	0	0	0	0	1	0	1	0	0	0%	0.0	0.00
7/16, 19	5,172	14	10	10	11	64	13	50	8	139	453	21	3%	0.0	0.04
7/30	2,106	25	7	18	8	15	10	2	5	61	244	16	3%	0.0	0.07
8/02/	2,321	14	5	0	6	30	7	11	4	54	131	11	2%	0.0	0.05
8/06	1,341	0	0	0	0	68	0	7	0	76	0	0	6%	0.0	0.00
8/09	1,257	4	3	5	4	28	5	3	3	41	61	8	3%	0.0	0.06
8/13, 16	1,452	0	0	5	0	27	0	9	0	41	0	0	3%	0.0	0.00
8/23	0	0	0	0	0	0	0	0	0	0	0	0			
Total^a	14,763	58	13	38	16	233	19	84	11	413	889	30	3%	0.0	0.02

Upper Cook Inlet Northern District Susitna Flats/Point Mackenzie (247-41, 247-42) setnet commercial harvest, 2001.

Date	Coho	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
	Harvest	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/09	4	0	0	0	0	0	0	1	0	1	0	0	19%	0.0	0.00
7/12	17	0	0	0	0	4	0	0	0	4	0	0	22%	0.0	0.00
7/16	230	0	0	0	0	0	0	29	0	29	0	0	13%	0.0	0.00
7/19	416	0	0	0	0	11	0	26	0	37	0	0	9%	0.0	0.00
7/30	2,958	35	9	76	11	309	13	95	7	515	412	20	17%	0.0	0.07
8/02	3,038	46	10	100	12	357	14	45	8	548	493	22	18%	0.0	0.07
8/06	2,883	30	7	46	8	417	10	44	5	537	243	16	19%	0.0	0.05
8/09	2,172	57	11	71	13	357	16	37	9	521	600	24	24%	0.0	0.11
8/13	975	6	3	19	4	170	5	22	3	217	58	8	22%	0.0	0.08
8/16	1,081	20	5	33	7	146	8	6	4	205	162	13	19%	0.0	0.12
8/20	218	9	4	0	5	10	6	0	3	19	88	9	9%	0.2	0.43
8/23	150	0	0	0	0	9	0	2	0	11	0	0	8%	0.0	0.00
8/27	132	4	3	5	4	6	4	3	2	17	47	7	13%	0.3	0.52
8/30	36	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
9/3, 13, 20, 24	72	0	0	0	0	7	0	0	0	7	0	0	10%	0.0	0.00
Total^a	14,382	206	20	349	24	1,803	29	309	16	2,667	2,104	46	19%	0.0	0.03

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Upper Cook Inlet Northern District Fire Island (247-43) setnet commercial harvest, 2001.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/2, 5, 9	21	0	0	0	0	0	0	3	0	3	0	0	12%	0.0	0.00
7/12	10	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16	150	0	0	0	0	13	0	4	0	17	0	0	12%	0.0	0.00
7/19	38	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/30	1,296	92	13	66	16	148	20	25	11	332	964	31	26%	0.1	0.24
8/02	1,173	69	12	47	14	159	17	9	9	284	723	27	24%	0.1	0.23
8/06	896	52	9	20	11	141	13	10	7	222	420	20	25%	0.1	0.23
8/09	899	62	10	62	12	160	15	10	8	294	508	23	33%	0.1	0.25
8/13	402	22	6	0	7	43	9	0	4	65	178	13	16%	0.1	0.33
8/16	371	28	7	24	8	41	10	0	5	94	245	16	25%	0.2	0.42
8/27	55	0	0	0	0	4	0	0	0	4	0	0	8%	0.0	0.00
Total^a	5,311	326	24	219	29	711	35	60	19	1,316	3,037	55	25%	0.0	0.10

Upper Cook Inlet Northern District Eastside setnet (247-70, 80, & 90) setnet commercial harvest, 2001.

Date	Coho Harvest	Bird Creek		Campbell Creek		Ship Creek		Eklutna Tailrace		NCI Hatchery Contribution					
		r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	SE	r _{ij}	V(r _{ij})	SE	%	V(%)	SE(%)
7/2, 5, 9	31	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/12	170	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
7/16	1,018	0	0	0	0	0	0	18	0	18	0	0	2%	0.0	0.00
7/19	1,404	0	0	7	0	9	0	4	0	20	0	0	1%	0.0	0.00
7/30	914	22	15	15	18	0	21	9	13	46	1,132	34	5%	0.1	0.37
8/02	347	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/06	424	20	6	3	7	14	8	0	4	37	170	13	9%	0.1	0.31
8/09	1,070	10	9	0	11	0	13	8	8	18	446	21	2%	0.0	0.20
8/13	992	17	5	0	6	9	8	2	4	27	136	12	3%	0.0	0.12
8/16	2,635	24	13	0	15	0	18	6	11	30	818	29	1%	0.0	0.11
8/20	74	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
8/23	700	3	2	0	2	0	3	1	2	4	21	5	1%	0.0	0.07
8/27	439	0	0	0	0	0	0	2	0	2	0	0	0%	0.0	0.00
8/30	192	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
9/03	593	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
9/6, 10, 13, 27	469	0	0	0	0	0	0	0	0	0	0	0	0%	0.0	0.00
Total^a	11,472	96	23	25	27	31	32	49	20	200	2,724	52	2%	0.0	0.05

^a Totals may not equal sum of individual estimates due to rounding.

Appendix B4.-Estimates of harvest contribution (r_{ij}) and standard error (SE) of coho salmon, stocked 2 years prior to harvest, by release site in Upper Cook Inlet.

Estimates (r_{ij}) and standard errors (SE) of coho salmon stocked in 1997 by release site in Upper Cook Inlet Central District (244-00, 245-00) driftnet commercial harvest, 1999.

Date	Coho Harvest	Bird Creek		Campbell Creek	
		r_{ij}	SE	r_{ij}	SE
6/28-7/1	49	0	0	0	0
7/05	316	0	0	0	0
7/08-7/09	355	0	0	0	0
7/11-7/12	112	0	0	0	0
7/15	4,944	7	6	0	0
7/19	9,772	0	0	0	0
7/22	1,457	0	0	0	0
7/27-7/28	855	0	0	0	0
7/29	19,738	0	0	0	0
7/30-8/1	1,722	0	0	0	0
8/02	13,427	0	0	0	0
8/03	299	0	0	0	0
8/04	1,085	0	0	0	0
8/05	7,527	0	0	4	3
8/09	2,871	0	0	0	0
Total ^a	64,529	7	6	4	3

Estimates (r_{ij}) and standard errors (SE) of coho salmon stocked in 1997 by release site in Upper Cook Inlet Central District (244-00, 245-00) driftnet commercial harvest, 2000.

Date	Coho Harvest	Campbell Creek		Bird Creek		Ship Creek		Eklutna Tailrace	
		r_{ij}	SE	r_{ij}	SE	r_{ij}	SE	r_{ij}	SE
6/26, 29	864	0	0	0	0	0	0	0	0
7/03	874	0	0	0	0	0	0	0	0
7/06	2,087	0	20	0	19	10	19	0	9
7/10	98	0	7	0	7	0	7	0	3
7/12	17	0	0	0	0	0	0	0	0
7/13, 15, 16	39,380	0	82	0	80	0	79	10	39
7/17, 18	42,292	24	77	34	75	22	74	3	34
7/20	32,353	0	85	17	83	16	82	0	40
7/31	7,706	0	16	0	16	0	16	0	8
8/03	3,877	0	0	0	0	0	0	0	0
8/07	1,652	0	0	0	0	0	0	0	0
Total ^a	131,200	24	144	50	140	48	138	13	67

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Estimates (r_{ij}) and standard errors (SE) of coho salmon stocked in 1999 by release site in Upper Cook Inlet Northern District (247-41, 247-42) setnet commercial harvest, 2001.

Date	Coho	Ship Creek	
	Harvest	r_{ij}	SE
7/09	4	0	0
7/12	17	0	0
7/16	230	5	0
7/19	416	0	0
7/30	2,958	0	11
8/02	3,038	0	13
8/06	2,883	0	9
8/09	2,172	0	14
8/13	975	0	4
8/16	1,081	0	7
8/20	218	0	5
8/23	150	0	0
8/27	132	0	4
8/30	36	0	0
9/3, 13, 20, 24	72	0	0
Total^a	14,382	5	26

Estimates (r_{ij}) and standard errors (SE) of coho salmon stocked in 1999 by release site in Upper Cook Inlet Northern District, Fire Island (247-43) driftnet commercial harvest, 2001.

Date	Coho	Bird Creek	
	Harvest	r_{ij}	SE
7/2, 5, 9	21	0	0
7/12	10	0	0
7/16	150	0	0
7/19	38	0	0
7/30	1,296	0	16
8/02	1,173	0	13
8/06	896	3	10
8/09	899	0	11
8/13	402	0	7
8/16	371	0	8
8/27	55	0	0
Total^a	5,311	3	28

^a Totals may not equal sum of individual estimates due to rounding.