

**Fishery Data Series No. 03-25**

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**Smolt Production, Adult Harvest, and Spawning  
Escapement of Coho Salmon from the Nakwasina  
River in Southeast Alaska, 1999–2000**

by

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and

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December 2003

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Alaska Department of Fish and Game

Division of Sport Fish



## Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used in Division of Sport Fish Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications without definition.

<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics, fisheries</b>	
centimeter	cm	all commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	$H_A$
deciliter	dL			base of natural logarithm	e
gram	g	all commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
hectare	ha	and	&	coefficient of variation	CV
kilogram	kg	at	@	common test statistics	F, t, $\chi^2$ , etc.
kilometer	km	compass directions:		confidence interval	C.I.
Liter	L			correlation coefficient	R (multiple)
meter	m	east	E	correlation coefficient	r (simple)
metric ton	mt	north	N	covariance	cov
milliliter	ml	south	S	degree (angular or temperature)	°
millimeter	mm	west	W	degrees of freedom	df
		copyright	©	divided by	÷ or / (in equations)
		corporate suffixes:		equals	=
		Company	Co.	expected value	E
		Corporation	Corp.	fork length	FL
		Incorporated	Inc.	greater than	>
		Limited	Ltd.	greater than or equal to	≥
		et alii (and other people)	et al.	harvest per unit effort	HPUE
		et cetera (and so forth)	Etc.	less than	<
		exempli gratia (for example)	e.g.,	less than or equal to	≤
		id est (that is)	i.e.,	logarithm (natural)	ln
		latitude or longitude	lat. or long.	logarithm (base 10)	log
		monetary symbols (U.S.)	\$, ¢	logarithm (specify base)	log <sub>2</sub> etc.
		months (tables and figures): first three letters	Jan,...,Dec	mid-eye-to-fork	MEF
		number (before a number)	# (e.g., #10)	minute (angular)	'
		pounds (after a number)	# (e.g., 10#)	multiplied by	x
		registered trademark	®	not significant	NS
		trademark	™	null hypothesis	$H_0$
		United States (adjective)	U.S.	percent	%
		United States of America (noun)	USA	probability	P
		U.S. state and District of Columbia abbreviations	Use two-letter abbreviations (e.g., AK, DC)	probability of a type I error (rejection of the null hypothesis when true)	$\alpha$
				probability of a type II error (acceptance of the null hypothesis when false)	$\beta$
				second (angular)	"
				standard deviation	SD
				standard error	SE
				standard length	SL
				total length	TL
				variance	var

<b>Weights and measures (English)</b>					
cubic feet per second	ft <sup>3</sup> /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				

<b>Time and temperature</b>					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
hour	h				
minute	min				
second	s				

<b>Physics and chemistry</b>					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	v				
watts	w				

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SOUTHEAST ALASKA, 1999–2000**

by

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## ABSTRACT

In 1998, a coded-wire tag (CWT) project was conducted for coho salmon in the Nakwasina River near Sitka, Alaska, to supplement a continuing regionwide effort to assess the status of key coho salmon *Oncorhynchus kisutch* stocks in Southeast Alaska. We conducted a study for the second season to estimate abundance of coho salmon smolt in 1999 and harvest of returning adults in 2000, using Chapman's modification of a two-event Peterson closed population estimator. During spring 1999, 3,971 coho salmon smolt  $\geq 70$  mm fork length (FL) were captured in minnow traps, marked with an adipose finclip, given a coded-wire tag and released. During fall 2000, 34 adult coho salmon bearing coded-wire tags with a Nakwasina River code were recovered in random sampling of marine fisheries, and 8.2% of 586 adults examined inriver carried CWTs, as evidenced by adipose finclips. An estimated 1,219 (SE = 231) coho salmon of Nakwasina River origin were harvested in Southeast Alaska marine fisheries in 2000. The sport fishery harvested an estimated 61 fish, or 5.0% of the total harvest of Nakwasina River coho salmon, while the commercial troll and net fisheries contributed the remaining 89.2% and 5.7%. Smolt abundance in 1999 was an estimated 47,571 (SE = 6,402).

We also conducted an open-population mark-recapture experiment to estimate the abundance of coho salmon in the Nakwasina River during fall 2000. An estimated 2,000 (SE = 261) adults escaped into the Nakwasina River. This represents a factor of 4.8 times greater than the peak visual count of 419 adult coho salmon observed during foot surveys of the main river in 2000. The total run (i.e., escapement plus harvest) for all coho salmon bound for the Nakwasina River was 3,219, the marine survival rate was 6.8%, and the marine fishery exploitation was 37%.

Key words: coho salmon, *Oncorhynchus kisutch*, Nakwasina River, harvest, troll fishery, sport fishery, migratory timing, return, exploitation rate, marine survival, coded-wire tag, mark-recapture experiment, spawning escapement

## INTRODUCTION

Collectively, coho salmon produced by the Nakwasina River and thousands of other coastal river systems in Southeast Alaska support the regions mixed stock commercial troll and net fisheries and freshwater and marine sport fisheries. Fishing pressure on coho salmon in Southeast Alaska, particularly along the outer coast of Baranof Island near Sitka, has increased as a direct result of growth in the region's sport fisheries and as an indirect result of increased hatchery production and reductions in the commercial troll fishery for chinook salmon (*Oncorhynchus tshawytscha*). The Alaska Department of Fish and Game (ADF&G) has conducted comprehensive CWT assessment projects on a long-term basis to evaluate the effects of Southeast Alaska fisheries on specific coho stocks native to streams in northern and inside areas of Southeast Alaska (Yanusz et al. 1999) but stock-specific information is more limited in outside, central, and southern areas. To bridge geographic areas, projects have been implemented more recently for specific stocks,

including the Unuk River in the southern Southeast (Jones et al. 1999) and Slippery Creek in central Southeast (Beers 1999). Along the outer coast, the first comprehensive CWT program began at Ford Arm in 1982 and continued through 2000 (Shaul 1998; Leon Shaul, Alaska Department of Fish and Game, Commercial Fisheries Division, Douglas, personal communication). The Division of Sport Fish also conducted a CWT project to assess fishery impacts to Salmon Lake coho salmon from 1983 to 1990 and again in 1994–1995 (Schmidt 1996).

In 1998, Sport Fish Division initiated a CWT project for coho salmon in the Nakwasina River to supplement the regionwide effort to assess the status of key coho salmon stocks in Southeast Alaska (Brookover et al. 2001). Estimated smolt abundance in 1998 from the Nakwasina River was 102,794 (SE = 15,255) and estimated harvest of returning adults in 1999 was 1,983 (SE = 605). The objectives of our study were to: (1) estimate the number of coho salmon smolt leaving the Nakwasina River in 1999 and (2) estimate the marine harvest of coho salmon from Nakwasina

River in 2000 via recovery of coded-wire tags (CWTs) applied in 1999. Our study also incorporated an additional objective to (3) estimate spawning escapement in 2000. Sampling and tagging of smolts in 1999 and recapture of fish in the commercial and sport fisheries in 2000 allowed us to estimate smolt abundance in 1999 and harvest in 2000, and sampling and tagging in the Nakwasina River during 2000 allowed us to estimate spawning abundance that year.

## STUDY AREA

The Nakwasina River drainage is located on the outer coast of Baranof Island in Southeast Alaska (Figure 1). The Nakwasina River (ADF&G Anadromous Stream Catalog No. 113-43-01) is about 13 km long, 6 to 30 m wide, and up to 3 m deep; it empties into Nakwasina Sound (57° 15' 16.8"W, 135° 20' 41.5"N) about 15 miles north of Sitka. The Nakwasina River drains nearly 8,600 square hectares and is one of the larger riverine systems on Baranof Island.

The Nakwasina River is known locally for its freshwater fisheries for Dolly Varden and coho salmon. Easy access by boat and one of the largest populations of coho salmon produced in Sitka Sound make it one of the few rivers near Sitka that attracts freshwater sport fishing effort for coho salmon. From 1984 to 1999, annual harvests of coho salmon in Nakwasina Sound, including the Nakwasina River, ranged from 0 to 182 fish (Statewide harvest survey estimates database at <http://intra.sf.adfg.state.ak.us/> described in Mills 1985–1994, Howe et al. 1995–96, 2001a, b, c, d and Walker et al. 2003). Estimated angler effort expended in Nakwasina Sound and River (for all fish species) ranged from 31 to 891 angler-days.

In the 1960s, the majority of riparian area in the anadromous portion of the Nakwasina River valley was clearcut to the stream bank (Greg Killinger, personal communication, Sitka Ranger District, U.S. Forest Service, Sitka). Nakwasina River coho salmon are of special concern because of the potential risk of excessive exploitation in combination with the potential negative impacts to the stock from habitat damage due to logging. Since 1988, visual surveys have been conducted by foot on the Nakwasina River to provide an indication of trends in the annual abundance of coho

escapement. Surveys conducted from 1988 to 2000 have documented 104 (1988) to 654 (1993) adult coho salmon spawners in the Nakwasina River (Table 1). Annual peak counts in the Nakwasina River represent the largest counts of the five systems surveyed annually in the Sitka area.

## METHODS

There were three major components of this study. A 2-event Petersen mark-recapture experiment for a closed population was used to estimate the abundance of coho salmon smolt  $\geq 70$  mm FL in the Nakwasina River during spring 1999. For this component, coho salmon smolt were sampled and tagged with coded-wire tags during spring 1999 (event 1) and recaptured as returning adults in the Nakwasina River during fall 2000 to estimate the fraction carrying CWTs (event 2). The second component was sampling the marine harvest. Marine harvests were sampled during the summer and fall of 2000 to estimate the tagged fraction and origin of coho captured through commercial fisheries port sampling and recreational fisheries creel survey programs.

The final component of this study was an open-population mark-recapture experiment conducted fall of 2000 in the Nakwasina River to estimate the spawning escapement of adult coho. Instream mark and recapture events were integrated with coded-wire tag recovery efforts.

## SMOLT TAGGING AND SAMPLING

From April 22 to June 2, 1999, between 50 and 100 G-40 minnow traps were baited with salmon roe and fished daily in the Nakwasina River. Traps were fished for 24 hours per day approximately 6 days per week and checked at least once each day. Traps were set along mainstem banks and in backwater areas of the lower river between the estuary and approximately 6 km upstream. Traps were distributed and redistributed opportunistically to maximize catch by targeting areas of likely rearing habitat, unfished areas, and areas known to produce relatively high catch rates. Coho salmon smolt and fry were removed from minnow traps and transported to holding pens at the camp-site each day. Other species (primarily Dolly Varden *Salvelinus malma*) were counted and released on site.

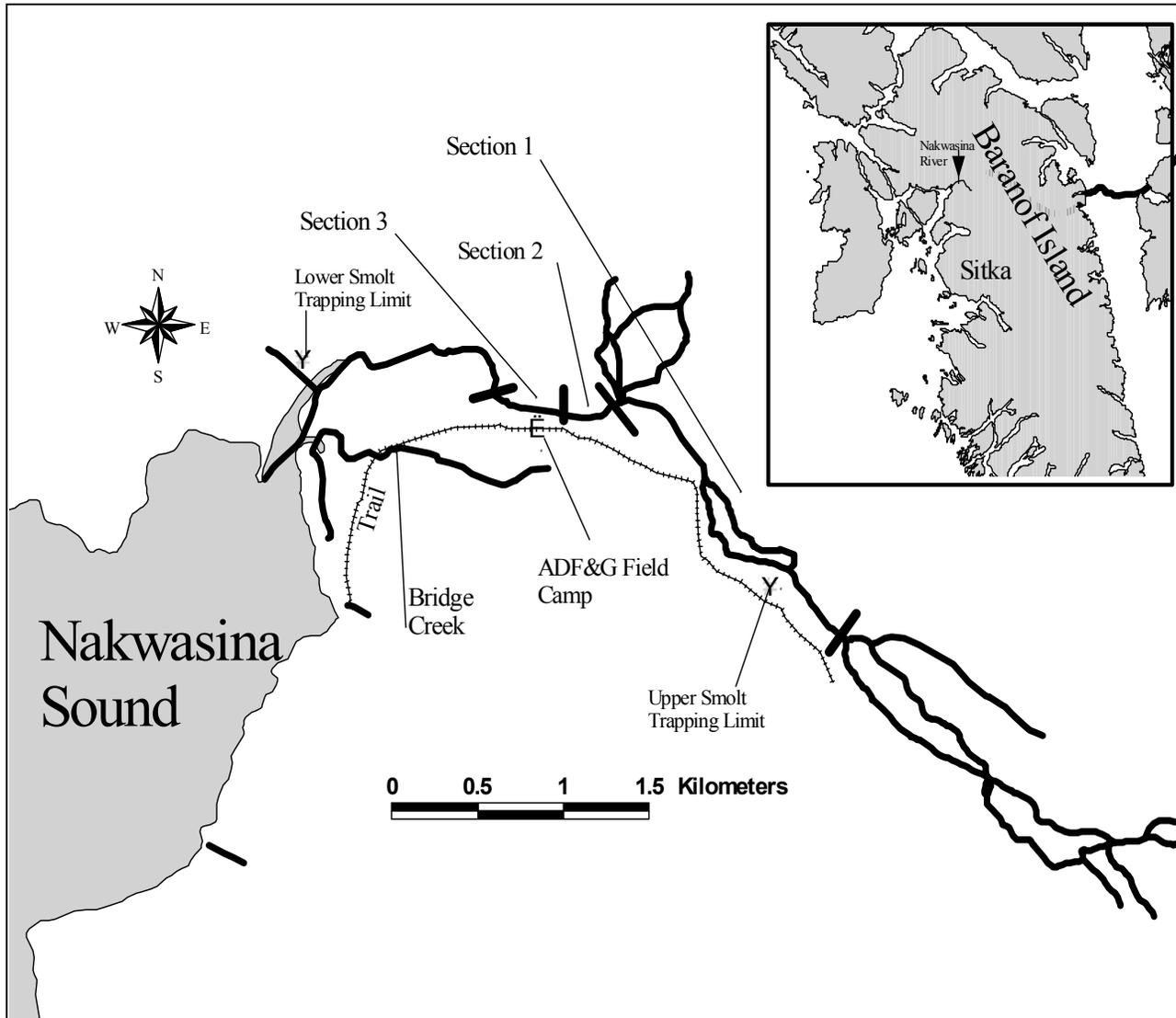


Figure 1.—Nakwasina River area, major tributaries, and location of ADF&G research sites and stream sections.

**Table 1.—Peak visual counts of coho salmon in the Sitka area, 1980–2000.**

Year	Sinitsin Creek			St. John Baptist Bay Creek			Starrigavan River			Eagle River			Nakwasina River			Black River			
	Survey type	Peak survey date	Number of coho	Survey type	Peak survey date	Number of coho	Survey type	Peak survey date	Number of coho	Survey type	Peak survey date	Number of coho	Survey type	Peak survey date	Number of coho	Survey type	Peak survey date	Number of coho	
1980	foot	30 Sep	39	foot	9-Oct	26	foot						foot	29-Oct	70	foot	26-Oct	328	
1981	foot	6 Oct	85	foot	14-Oct	51	foot	20-Oct	170	foot	22-Sep	27	foot	7-Oct	780				
1982	foot	20 Oct	46	foot			foot	21-Oct	317										
1983	foot	27 Sep	31	foot	13-Oct	12	foot	6-Oct	45				foot	14-Oct	217				
1984	foot	10 Oct	160	foot	10-Oct	154	foot	10-Oct	385				foot	17-Oct	715	helo	3-Oct	425	
1985	foot	15 Oct	144	foot	8-Oct	109	foot	11-Oct	193				foot	7-Oct	408	helo	7-Oct	1,628	
1986	foot	30 Sep	4	foot	10-Oct	9	foot	10-Oct	57	foot	26-Sep	245	foot	28-Oct	275	helo	10-Oct	312	
1987	foot	23 Sep	32	foot	23-Sep	9	foot	9-Oct	36	foot	24-Sep	167	foot	30-Oct	47	helo	9-Oct	262	
1988	foot	3 Oct	56	foot	3-Oct	71	foot	12-Oct	45	foot	2-Sep	10	foot	27-Oct	104	helo	10-Oct	280	
1989	foot	5 Oct	76	foot	5-Oct	89	foot	13-Oct	101	foot	2-Oct	130	foot	19-Oct	129	helo	13-Oct	181	
1990	foot	1 Oct	80	foot	1-Oct	35	foot	17-Oct	39	snorkel	2-Oct	214	foot	31-Oct	195	helo	4-Oct	842	
1991	foot	1 Oct	186	foot	10-Oct	107	foot	2-Oct	142	snorkel	17-Oct	454	foot	25-Oct	621	helo	17-Oct	690	
1992	foot	23 Sep	265	foot	14-Oct	110	foot	12-Oct	241	snorkel	6-Oct	629	foot	30-Oct	654	helo	6-Oct	866	
1993	foot	7 Oct	213	foot	6-Oct	90	foot	13-Oct	256	snorkel	13-Oct	513				helo	7-Oct	764	
1994	foot	30 Sep	313	foot	30-Sep	227	foot	11-Oct	304	snorkel	1-Oct	717	foot	14-Oct	404	helo	14-Oct	758	
1995	foot	26 Sep	152	foot	5-Oct	99	foot	6-Oct	272	snorkel	5-Oct	336	foot	29-Sep	626	helo	27-Sep	1,265	
1996	foot	2 Oct	150	snorkel	2-Oct	201	foot	17-Oct	59	snorkel	30-Sep	488	foot	30-Oct	553	helo	30-Sep	385	
1997	foot	29 Sep	90	snorkel	30-Sep	68	foot	27-Oct	55	snorkel	30-Sep	296	foot	14-Nov	239	helo	30-Sep	686	
1998	foot	1 Oct	109	snorkel	9-Oct	57	foot	8-Oct	123	snorkel	9-Oct	300	foot	2-Nov	653	helo	8-Oct	1,520	
1999	snorkel	11 Oct	48	snorkel	29-Oct	25	snorkel	8-Oct	166				snorkel	12-Nov	291	helo	4-Oct	1,590	
2000	foot	26 Sep	62	snorkel	26-Sep	32	snorkel	8-Oct	144	snorkel	29-Sep	108	foot	8-Nov	419	helo	2-Oct	880	
Mean (1980–1999)			111				79	158			299			389			759		
5-yr mean (1995–1999)			110				90	135			355			472			1,089		

Every 2 to 3 days, all live coho salmon smolt  $\geq 70$  mm FL were tranquilized with a solution of tricaine methane-sulfonate (MS222), injected with a coded-wire tag (CWT) with code 04-47-30 or 04-47-31, and marked externally by excising the adipose fin following methods in Koerner (1977). All tagged fish were held overnight in a net pen to test for mortality and tag retention and released. To test for tag retention, 100 fish were selected randomly and passed through a Northwest Marine Portable Sampling Detector™. If tag retention was 98/100 or greater, all fish were counted, mortalities recorded, and released. If tag retention was 97/100 or less, all fish were retagged. The number of fish tagged, number of tagging-related mortalities, and number of fish that had shed their tags were recorded on *ADF&G Tagging Summary and Release Information Forms* which were then submitted to ADF&G Commercial Fisheries Division (CFD) Tag Lab in Juneau when field work ended.

One in every 15 tagged smolt was measured to the nearest 1 mm FL, weighed to the nearest 0.1 g, and sampled for scales. Twelve to 15 scales were removed from the preferred area (Scarnecchia 1979) on the left side of the coho salmon smolt. Scales were sandwiched between two 1 × 3-in microscope slides and numbered consecutively for each fish. Slides were taped together and the number of each fish was written on the frosted portion of the bottom slide according to scale position on the slide.

#### **INSTREAM MARK-RECAPTURE SAMPLING, AND CODED-WIRE TAG RECOVERY, AND MARINE HARVEST SAMPLING**

Instream sampling was designed to conduct tagging, recovery, and sampling efforts required for the open-population mark-recapture estimate of adults instream in conjunction with CWT recovery efforts necessary for the closed population estimate of smolt in 1999. Requirements of the open-population experiment demanded the most intensive sampling efforts; sampling methods were designed for the open population experiment and sampling for CWT recovery became incidental.

From September 22 through December 12, 2000, sampling occurred for 2- or 3-day periods once

each week, except during the week of October 9 when high, turbid, water conditions prevented capture. Adult coho salmon were captured in a 3.6 × 22.5-m, 3.75-cm mesh beach seine and a 3.0 × 35-m, 7.5-cm mesh gillnet. Hook and line gear was used to supplement beach seine captures.

We divided the stream into three sections (Figure 1) to facilitate sampling efforts and to evaluate experimental assumptions. Section 1 extended from river kilometer (rkm) 7.75 downstream to rkm 4.1. The portion of the river upstream of rkm 7.75 was not included, because few fish have been observed in this area and the presence of excessive amounts of woody debris and undercut banks were not conducive to capturing fish. Section 2 extended from rkm 4.1 to rkm 3.7, and section 3 extended from rkm 3.4 to rkm 3.7. Sampling was concentrated in section 2 because its large pool contained the majority of fish visible in the river at any one time and enabled use of the more effective beach seine. The river below rkm 3.4 was not sampled, because we wished to avoid potential mortality associated with capturing coho salmon that had recently entered fresh water (Vincent-Lang et al. 1993).

All captured coho salmon were examined for presence or absence of their adipose fin. For all fish missing adipose fins, CWT presence was verified with a portable tag detector. Any fish missing an adipose fin with a negative detection signal was sacrificed and the head was sent to the CFD Tag Lab for verification of CWT absence or decoding if present. For all fish with a CWT detected, tag location was assumed to be the Nakwasina River.

All captured coho salmon were examined for an anchor tag and opercle punch combination. All coho salmon absent this combination were measured to the nearest millimeter mid-eye to fork length, tagged with uniquely numbered Floy™ T-Bar anchor tag, given a secondary mark to permit estimation of tag loss, sampled to determine sex and condition, and sampled to collect scales for aging. Tags were inserted just posterior of and 1 cm below the dorsal fin on the left side of the fish. Secondary marks included various combinations of opercle punches that consisted of 0.6-cm diameter holes (Table 2, Appendix A1). The condition of each fish was

**Table 2.—Week, week group, dates, and operculum punches given to coho sampled in the Nakwasina River in 2000.**

Week	Week group	Dates	Operculum punches
1	1	9/17-9/23	LU
2	1	9/24-9/30	LL
3	2	10/1-10/7	RU
5	3	10/15-10/21	RL
6	3	10/22-10/28	LUU
7	4	10/29-11/4	LLL
8	4	11/5-11/11	RUU
9	5	11/12-11/18	RLL
10	5	11/19-11/25	LUL
11	6	11/26-12/2	RUL
12	6	12/4-12/9	LU
13	7	12/10-12/16	RMM

determined from external characteristics using the following convention:

- 1) **Bright:** Ocean bright or nearly ocean bright
- 2) **Blush:** Some color (primarily blush red)
- 3) **Dark:** Dark color (primarily red)
- 4) **LPS (live post-spawner):** Spawned out but not yet dead
- 5) **Carcass:** Dead spawned fish
- 6) **Mortality:** Dead unspawned fish

For fish captured with an anchor tag, the tag number and condition of the fish was recorded (Appendix A1) and the fish was released. If an opercle punch but no anchor tag was present, the fish was recorded as a valid tag recovery (indicating the tag was shed), retagged and examined for condition. All carcasses that could be retrieved were also inspected for marks, recorded, and removed from the population by slashing the left side of the fish. These fish were not counted in subsequent observations.

Sex was determined from external characteristics. Scale samples, consisting of 4 scales from the preferred area near the lateral line on an imaginary line from the insertion of the posterior dorsal fin to the anterior origin of the anal fin (Scarnecchia

1979), were collected and affixed to a gum card in the field. Post-season, scale images were impressed on acetate and ages were determined by examining the impressions under a microscope. Criteria used to assign ages were similar to those of Moser (1968).

Harvest in 2000 of coho salmon originating from the Nakwasina River was estimated from fish sampled in commercial and recreational fisheries. Fisheries personnel with the CFD port-sampling program examined commercially caught fish at processing locations and recovered coho with missing adipose fins. Similarly, the Division of Sport Fish employed a creel survey program to examine fish caught in the sport fishery. When possible, heads of fish without an adipose were removed and sent to the ADF&G Coded Wire Tag and Otolith Processing Laboratory for tag detection and decoding. Because several fisheries exploited coho salmon over several months in 2000, harvest was estimated over several strata, each a combination of time, area, and type of fishery. Statistics from the commercial troll fishery were stratified by fishing period and by fishing quadrant. Statistics from the recreational fishery were stratified by fortnight.

### FOOT SURVEY COUNTS

Adult coho salmon in the Nakwasina River were counted visually every two weeks from October 4 to December 5, 2000. Visual counts were conducted by two or three experienced observers during or one day after instream sampling efforts. Only fish positively identified as coho salmon were counted. All observers wore polarized lenses. In braided areas, one observer would walk one braid and the other observer the adjacent braid. Counts were conducted between the uppermost portion of the survey area (rkm 7.75) and a pool near the high tide mark at rkm 0.25. This survey area included the portion of river below the lower most point of the mark-recapture study area (rkm 3.4) to provide consistency with past counts. The major uncontrolled variables were observer abilities, weather conditions, water clarity, and stream life of salmon.

### ESTIMATE OF SMOLT ABUNDANCE AND SIZE

The mark-recapture experiment used to estimate smolt abundance was Chapman's modification of

the Petersen method (Seber 1982). To estimate abundance of smolts and its variance we used:

$$\hat{N}_s = \frac{(M+1)(C+1)}{(R+1)} - 1 \quad (1)$$

$$V[\hat{N}_s] = \frac{\hat{N}_s(M-R)(C-R)}{(R+1)(R+2)} \quad (2)$$

where

$\hat{N}_s$  = estimated abundance of smolts in 1999,

$M$  = number of marked smolts released  
live into the population in 1999,

$C$  = number of adults inspected for marks  
in 2000, and

$R$  = number of adults with missing  
dipose fins in samples taken in 2000.

Estimates of mean length and weight-at-age and their variances were calculated with standard procedures assuming lengths and weights were normally distributed.

### ESTIMATE OF HARVEST

The contribution ( $r_{ij}$ ) of release group  $j$  to a fishery stratum  $i$  is estimated as:

$$\hat{r}_{ij} = N_i \left[ \frac{m_{ij}}{\lambda_i n_i} \right] \theta_j^{-1}; \quad \lambda_i = \frac{a_i' t_i}{a_i t_i} \quad (3)$$

where

$N_i$  = total harvest in fishery stratum  $i$ ,

$n_i$  = number of fish inspected in fishery  
stratum  $i$  (the sample),

$a_i$  = number of fish which are missing an  
adipose fin,

$a_i'$  = number of heads that arrive at the lab,

$t_i$  = number of heads with CWTs detected,

$t_i'$  = number of CWTs that are dissected  
from heads and decoded,

$m_i$  = number of CWTs with code(s) of  
interest, and

$\theta_j$  = fraction of the cohort tagged with  
code(s) of interest.

When  $N_i$  and  $\theta_j$  are known without error, an unbiased estimate of the variance of (1) can be calculated as shown by Clark and Bernard (1987). However,  $N_i$  is estimated with error in our sport fisheries, and  $\theta_j$  is estimated with error on the Nakwasina River since wild stocks are tagged. Because of these circumstances, unbiased estimates of the variance of  $\hat{r}_{ij}$  will be obtained using the appropriate equations in Table 2 of Bernard and Clark (1996), which show the formulations for large samples.

The total harvest for a cohort was calculated as the sum of strata estimates:

$$\hat{H} = \sum_i \sum_j \hat{r}_{ij} \quad (4)$$

$$v[\hat{H}] = \sum_i \sum_j v[\hat{r}_{ij}] \quad (5)$$

Several assumptions were required for estimating smolt abundance and adult harvest:

1. all smolts had an equal probability of being marked in 1999; or all adults had an equal probability of being inspected for CWT marks in 2000; or marked fish mixed completely with unmarked fish in the population between years; and
2. marked fish at the Nakwasina River were smolts;
3. survival and catchability were the same for marked and unmarked individuals;
4. marking did not affect catchability of the fish;
5. fish did not lose their marks in the time between the two events; and
6. tag code and release locations were correctly determined for all fish observed with a missing adipose fin.

### SPAWNING ESCAPEMENT

A modified Jolly-Seber model (Seber 1982, Sykes and Botsford 1986, Pollock et al. 1985) for open populations was used for coho salmon as an estimate of escapement (Schwartz et al. 1993) in the Nakwasina River. The computer program RECAP (Buckland 1980) was used to estimate parameters  $\{N_b, p_b, \phi_i, B_i\}$  needed to estimate escapement of coho salmon in the Nakwasina

River. Escapement ( $E$ ) was considered the total number of fish immigrating ( $B$ ) between the first and last sampling occasion including those fish that enter the system and die between any two sampling occasions and the number of fish that entered before the first sampling occasion ( $B_0$ ) and after the last sampling occasion ( $B_s$ ):  $\hat{E} = \hat{B}_0 + \dots + \hat{B}_{s-2} + \hat{B}_{s-1} + B_s$ . The modified Jolly-Seber estimator ignored recaptures of carcasses ‘captured’ in a decayed condition. It calculated escapement as the number present at the first sample occasion, plus the number of individuals immigrating prior to each subsequent occasion  $I = 2, \dots, s$ :

$$\hat{E} = n_1 + (\hat{N}_2 - R_1 * \hat{\phi}_1) \left( \frac{1}{\sqrt{\hat{\phi}_1}} \right) + \sum_{i=2}^{s-2} \hat{D}_i + \hat{D}_{s-1} \quad (6)$$

where

$n_1$  = the number sampled at the first sample time,

$R_1$  = the number tagged and released at the first sample time,

$\hat{N}_2$  = the estimated population size at sample time two,

$\hat{D}_i = \frac{\hat{B}_i}{\sqrt{\hat{\phi}_i}}, 2 \leq i \leq s-2$

$\hat{\phi}_i$  = the survival rate from  $i$  to  $i+1$ ,

$\hat{B}_i$  = the estimated number of fish still present at the sample time  $i+1$  which immigrated between  $i$  and  $i+1$ , and

$\hat{D}_{s-1}$  = an estimate of immigration during the last sample period ( $s-1$  to  $s$ ) made as for  $D_i$ , but where  $B_i$  and  $\phi_i$  are obtained with survival and capture probabilities estimated using assumptions not provided in the standard Jolly-Seber analysis.

Whereas immigration prior to  $i = 1$  in Sykes and Botsford’s estimator was assumed to be the sample size at  $i = 1$ , this could be estimated as  $\frac{n_i}{\hat{p}_i}$ , where  $p_i$  is an estimated probability of capture

at  $i = 1$ , if  $\hat{p}_i$  from the Jolly-Seber model are constant over time. Assumptions of the Jolly-Seber methodology include mixing of marked and unmarked fish and no size-selective sampling.

The possibility of size- and sex-selective sampling was investigated. The hypothesis that fish of different lengths were captured with equal probabilities was tested by using Kolmogorov-Smirnov (K-S) 2-sample tests (Appendix A3) and 3-sample Anderson-Darling tests (Stephens 1974). Sex-selective sampling was investigated with a  $\chi^2$  test comparing the number of males and females marked with those recaptured. If a significant difference in sex composition was observed, the abundance estimate could be further stratified by sex to reduce bias. If sex compositions differed significantly, either marking or recapture samples alone could be used to estimate sex composition, although sex determination is known to be more difficult early in the season while marking fish (Ericksen 1999).

The assumptions required in the instream mark-recapture phase of this project were:

1. All coho salmon in the population at time  $i$  had an equal probability of being caught in the  $i^{th}$  sample;
2. survival and catchability were the same for marked and unmarked individuals; and,
3. fish did not lose their marks and all the marks were recognizable.

## AGE AND SEX COMPOSITION

The proportion of the spawning population composed of a given age or sex was estimated as:

$$\hat{p}_j = \frac{n_j}{n} \quad (7)$$

$$Var(\hat{p}_j) = \frac{\hat{p}_j(1 - \hat{p}_j)}{n - 1} \quad (8)$$

where

$p_j$  = the proportion in the population in group  $j$ ,

$n_j$  = the number in the sample of group  $j$ , and

$n$  = sample size.

To reduced bias caused by inseason changes in age composition, samples were systematically obtained.

### ESTIMATES OF TOTAL RUN, EXPLOITATION, AND MARINE SURVIVAL

Estimates of total run (i.e., harvest and escapement) for coho salmon returning to the Nakwasina River in 2000 and the associated exploitation rate in commercial and sport fisheries are based on the sum of the estimated harvest and escapement:

$$\hat{N}_R = \hat{H} + \hat{E} \quad (8)$$

The variance of the estimated run was calculated as the sum of the variances for estimated escapement and harvest:

$$\text{var}[\hat{N}_R] = \text{var}[\hat{H}] + \text{var}[\hat{E}] \quad (9)$$

The estimate of exploitation rate was calculated as:

$$\hat{U} = \frac{\hat{H}}{\hat{N}_R} \quad (10)$$

$$\text{var}[\hat{U}] \approx \frac{\text{var}[\hat{H}] \hat{E}^2}{\hat{N}_R^4} + \frac{\text{var}[\hat{E}] \hat{H}^2}{\hat{N}_R^4} \quad (11)$$

The estimated survival rate of smolt to adults was calculated as:

$$\hat{S} = \frac{\hat{N}_R}{\hat{N}_s} \quad (12)$$

$$\text{var}[\hat{S}] \approx \hat{S}^2 \left[ \frac{\text{var}[\hat{N}_R]}{\hat{N}_R^2} + \frac{\text{var}[\hat{N}_s]}{\hat{N}_s^2} \right] \quad (13)$$

## RESULTS

### SMOLT ABUNDANCE, SIZE AND AGE IN 1999

The estimate of smolt abundance in the Nakwasina River in 1999 was 47,571 (SE = 6,402). From April 22 through June 2, 1999, 3,985 coho salmon

smolt  $\geq 70$  mm FL were captured and given a coded-wire tag. Six died within 24 h of tagging, and tag retention was 99.8%, leaving a total release of 3,971 smolts with a valid tag.

Age-1 fish, those rearing for one year in fresh water, composed 95% of sampled smolt and averaged 79.3 mm in FL (SE = 0.6) and 4.7 g (SE = 0.1) in weight (Table 3). Age-2 coho smolt averaged 96.4 mm in FL (SE = 2.7) and 7.9 g (SE = 0.4) in weight. The combined catch averaged 80.1 mm in FL (SE = 0.6) and 4.9 g (SE = 0.1) in weight. Average lengths and weights of captured coho remained about the same throughout the tagging effort.

The tagged fraction of adult coho salmon sampled in the Nakwasina River during 2000 was 0.082. Of the 586 coho salmon examined, 48 had an adipose finclip and a coded-wire tag. No tag was detected in the field for 2 of the 48 adult fin-clipped fish. Both were sent to the tag lab and determined to contain tags implanted at the Nakwasina River in 1999.

The proportion of freshwater age-1 fish was not significantly different ( $\chi^2 = 0.0003$ ,  $P = 0.987$ ) between smolt sampled in 1999 and adults sampled in-river during 2000 (Table 4). Both groups were predominantly (>95%) freshwater age-1 fish.

Length distributions of adult coho salmon captured in 2000 in the Nakwasina River were not different between areas of capture, between marked and recaptured fish, or gear types (all P-values  $\geq 0.23$ ; Figure 2). No difference in sex composition was detected between gear types, locations or the probability of recapture (all P-values  $\geq 0.11$ , Table 5).

Most (459) adult coho captured in the Nakwasina River in 2000 were captured with the beach seine; 69 were captured in a gillnet, and 56 with hook and line. Two carcasses were found. Hook and line gear was the primary means of catching fish in section 1. Hook and line gear was moderately effective at capturing fish, but only when water conditions allowed for sighting fish. A beach seine seemed to be the most effective means of capture in the lower holes of sections 2 and 3.

**Table 3.—Estimated length (mm) and weight (g) by age of coho salmon smolt in the Nakwasina River in 1999.**

	Age 1		Age 2		Combined	
	Length	Wt.	Length	Wt.	Length	Wt.
Mean	79.3	4.7	96.4	7.9	80.1	4.9
Sample variance	72.5	2.25	84.9	2.1	85.6	2.7
Standard error	0.56	0.1	2.7	0.43	0.59	0.1
Count	229	228	11	11	240	239
Minimum	65	2.2	80	4.9	65	2.4
Maximum	117	12.5	115	9.7	117	12.5

**Table 4.—Number of freshwater age-1 versus freshwater age-2 coho salmon for smolt in 1999 versus 2000 adult samples.**

	Age		Proportion age-2	$\chi^2$ value	P-value
	1.1	2.1			
Adult 2000	477	23	0.0460	0.0003	0.9871
Smolt 1999	230	11	0.0456		

**Table 5.—Comparison of captured male and female coho salmon ratio by sampling event, gear type, and location.**

Capture	M	F	% male	$\chi^2$	P-value
Marked	372	208	64	0.46	0.498
Recaptured	100	49	67		
<b>Gear</b>					
Gillnet	46	32	59	1.42	0.491
Hook and line	44	25	64		
Seine	382	199	66		
<b>Location</b>					
Section 1	41	17	71	4.37	0.113
Section 2	387	204	65		
Section 3	44	36	55		

## CONTRIBUTION OF SMOLT TAGGED IN 1999 TO HARVEST IN 2000

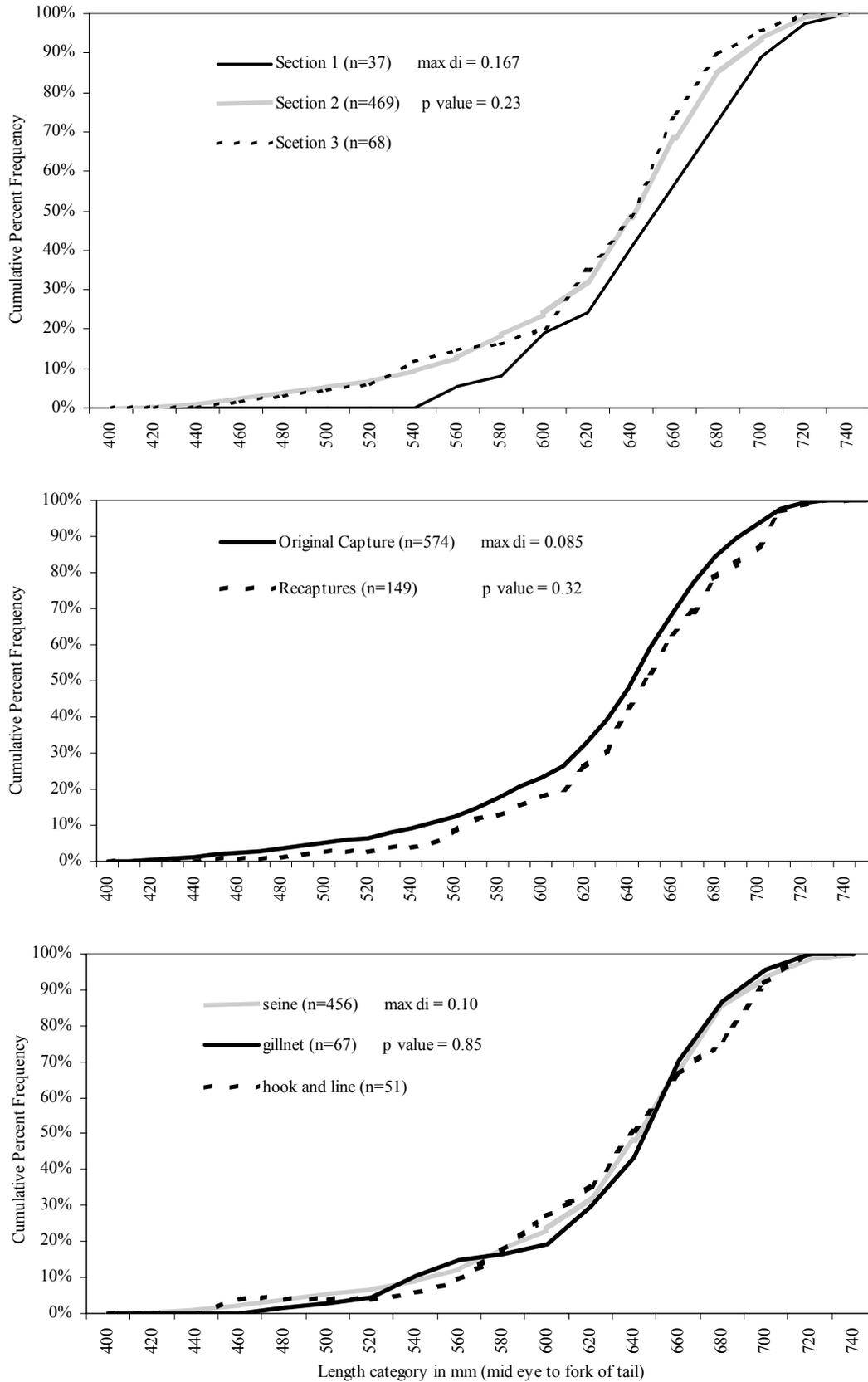
In 2000, 46 CWTs from the Nakwasina River were recovered from coho salmon in the sampled fisheries. Of these, 34 were random recoveries (Table 6). Thirty (30) coho salmon bearing CWTs with a Nakwasina River code were recovered randomly from Southeast Alaska's commercial troll fisheries; all but 2 of these were caught in the Northwest Quadrant (Figure 3) of Southeast Alaska between July 8 and September 20, 1999. Two coho salmon bearing CWTs with a Nakwasina River code were recovered in the sport fishery; both near Sitka between August 21 and August 25. Two fish were recovered in the commercial seine fishery, but none were recovered in the commercial gillnet fisheries. Detailed information is provided for each recovered tag in Appendix A1.

The estimated harvest of Nakwasina River coho salmon in sampled marine fisheries in 2000 was 1,219 (SE = 213; Table 6). Nakwasina coho salmon contributed less than 1% of the combined sport and commercial troll harvest (970,673) for the areas in which Nakwasina River fish were recovered. The total contribution to the sport fishery by Nakwasina coho was estimated at 61 fish. Sport-caught Nakwasina coho salmon composed 5.0% of the harvest of that stock in the sampled marine fisheries, but relative contributions were higher for the sport harvest (0.8%) than the troll harvest (0.1%).

Coho salmon bearing CWTs with a Nakwasina River code recovered in the commercial and sport fisheries averaged 626 mm FL (SE = 9.8).

## ESTIMATED SPAWNING ESCAPEMENT, TOTAL RUN, AND MARINE SURVIVAL

The estimated spawning escapement of coho salmon in the Nakwasina River was 2,000 fish (SE = 261; Table 7). Estimates of abundance, growth, survival, and standard errors were obtained from the program RECAP (Buckland 1980).



**Figure 2.**—Cumulative length frequencies to test for differences in length. (Maximum differences between captures were compared with Kolmogorov-Smirnov test; gear type and location were compared with Anderson-Darling tests).

**Table 6.—Estimated harvest of adult Nakwasina River coho salmon (tag codes 04-47-30 and 04-47-31) sampled in sport and commercial fisheries in 2000.**

<b>TROLL FISHERY</b>											
Stat. week	Date (period)	Quad-rant	H	n	<i>a</i>	<i>a'</i>	<i>t</i>	<i>t'</i>	m	$\hat{r}$	SE( $\hat{r}$ )
29-32	7/9–8/5 (3)	NW	516,263	146,026	3,164	3,127	2,576	2,573	13	586	176
33	8/6–19 (4)	NW	128,318	45,686	1,147	1,138	945	944	3	104	60
35-36	8/20–26 (5)	NW	135,705	52,283	1,735	1,720	1,501	1,497	8	256	96
38-39	9/10–23 (6)	NW	33,409	13,063	504	499	442	441	4	126	64
30	7/16–22 (3)	SE	44,522	32,100	558	548	437	437	1	17	16
32	7/30-8/5 (3)	SW	105,248	77,427	1,401	1,389	1,116	1,115	1	17	16
Subtotal troll fishery			963,465	366,585	8,509	8,421	7,017	7,007	30	1,089	
<b>SEINE FISHERY</b>											
35	8/20–26	113	309	68	2	2	2	2	1	55	55
37	9/3–9	113	162	140	3	3	2	2	1	14	14
Subtotal seine fishery			471	208	5	5	4	4	2	70	
<b>SPORT FISHERY</b>											
Biweek	Date	Area	H	n	<i>a</i>	<i>a'</i>	<i>t</i>	<i>t'</i>	m	$\hat{r}$	SE( $\hat{r}$ )
17	8/12–25	Sitka	7,208	2,907	85	85	76	76	2	60	43
Subtotal sport fishery			7,208	2,907	85	85	76	76	2	60	43
TOTAL ALL FISHERIES			971,144	369,700	8,599	8,511	7,079	7,078	34	1,219	213

We captured and examined 586 individual adult coho salmon, 579 of which were marked and released alive; 1 fish died upon capture and 4 others were intentionally sacrificed. In subsequent weeks over the course of the study, 122 tagged fish were recaptured at least once; no recaptured fish were killed. Again, no differences were detected in length or sex between locations, gear types, or marked or recaptured (Figure 2, Table 5). Details of the marking and recovery by location are shown in Table 8.

Twelve sampling events occurred (Table 9) during the 13-week duration of this study (water conditions prevented sampling during week 4). Weekly sampling periods were combined to facilitate data analysis and obtain adequate sample sizes. Weeks one and two were grouped into week group one, weeks three and four into week group two and so on (Table 2).

Eight percent (8%) of the sample was captured or recovered in section 1, 80% at location 2, and 11% at location 3. In total, 18.9 % of the fish

inspected for tags during week groups 2-7 had at least a secondary mark present. The probability of capturing a tagged fish was higher at location 1 than at 2 or 3 (Table 10), perhaps because the fish tended to mill downstream in pools for prolonged periods of time before actually moving upstream to spawn. Thus, a fish would have a greater chance of actually being marked in location 1 before it moved to upstream spawning areas (Table 10).

Based on an escapement estimate of 2,000 coho salmon, a marine harvest of 1,219 fish, and smolt abundance of 47,571 we estimated the total run to be 3,211 (SE = 474) and ocean survival to be 6.8% (SE = 0.7%). Total exploitation was estimated to be 37.9% (SE = 5.2%).

#### **VISUAL COUNTS**

Visual counts were conducted on the Nakwasina River on 6 occasions in 2000. Visual counts were performed between the river mouth and the top of the mark-recapture survey area. Visual counts

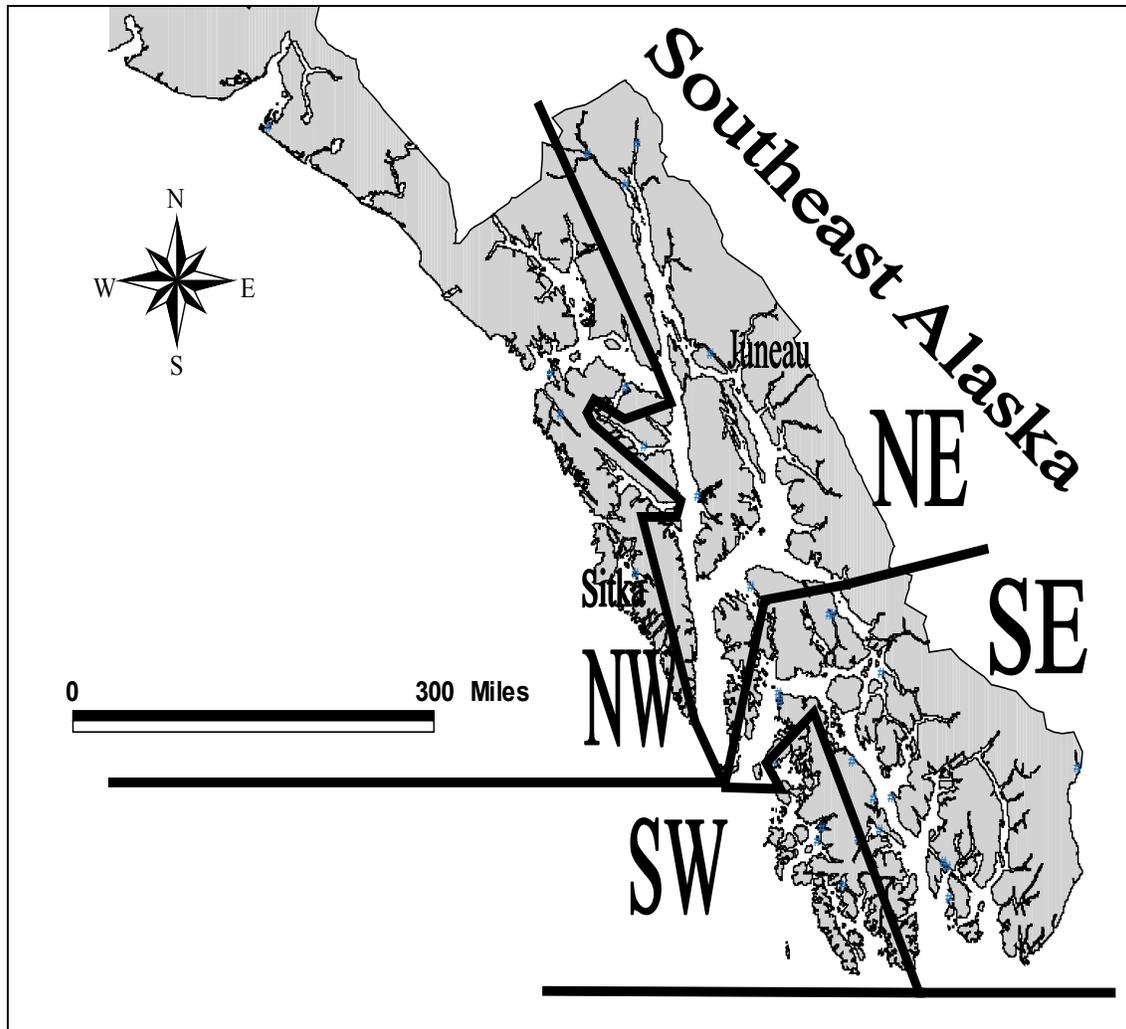


Figure 3.—Boundaries of CWT quadrants in Southeast Alaska.

Table 7.—Total escapement estimate for the Nakwasina coho salmon Jolly-Seber mark-recapture study, 2000 (using parameters from RECAP and 7 strata).

Strata	Abundance		Growth		Survival		Adjustment ( $\log\phi_i/(\phi_i-1)$ )	Escapement <i>E</i>
	N	SE	<i>B</i>	SE	$\phi_i$	SE		
1	0	—	—	—	1.000	0.210	1.000	339
2	339	157	782	297	0.414	0.119	1.505	1177
3	922	310	302	244	0.787	0.160	1.125	340
4	1,027	234	106	111	0.521	0.158	1.361	144
5	641	148	0	18	0.458	0.303	1.441	0
6	293	214	—	—	—	—	—	—
7	0	—	—	—	—	—	—	—
Total	3,222		1,190		3			2,000 SE = 261

**Table 8.—Marking and recovery data from the Nakwasina River coho salmon mark-recapture study in 2000, by area and period.**

Date	Week group	Location	Captured without tag	Captured with tag	Total captured	Proportion tagged
Sept. 17–30	1	1	2		2	0
		2	17		17	0
Subtotal			19		19	
Oct. 1–14	2	1	1		1	0
		2	113	7	120	0.06
		3	3	1	4	0.25
Subtotal			117	8	125	0.06
Oct. 15–28	3	1	9	0	9	0.00
		2	86	8	94	0.09
		3	31	1	32	0.03
Subtotal			126	9	135	0.07
Oct. 28–Nov. 11	4	1	4	2	6	0.33
		2	124	25	149	0.17
		3	18	2	20	0.10
Subtotal			146	29	175	0.17
Nov. 12–25	5	1	13	7	20	0.35
		2	115	43	158	0.27
		3	19	7	26	0.27
Subtotal			147	57	204	0.28
Nov. 26–Dec. 9	6	1	9	10	19	0.53
		2	16	18	34	0.53
Subtotal			25	28	53	0.53
Dec. 10–23	7	1	3	1	4	0.25
		2	2	5	7	0.71
		3	1	0	1	0.00
Subtotal			6	6	12	0.50
Total by location		1	41	20	61	0.33
		2	473	106	579	0.18
		3	72	11	83	0.13
Total			586	137	723	0.19

were performed in the area below the mark-recapture area (salt water and rkm 3.4) because counts have traditionally been done here. On one occasion, high turbid water conditions prevented observations of coho salmon (Table 11). For the other occasions, observations ranged from 77 to 419 fish and represented 8.4% to 40.8% of the estimated abundance in the river at the time of the survey. The peak count (419) occurred November 8 (Table 11) and represented 20.9% of the estimated total escapement. A separate survey conducted on October 25 by floating the stream with a snorkel, mask, and dry suit yielded a count of 459 fish.

The area between rkm 7.75 (upper end of sampling area) and rkm 13.0 was inspected in November to investigate the presence and absence of fish above the sampling area; few coho (<10) were observed in this area.

## DISCUSSION

### SMOLT ABUNDANCE AND ADULT HARVEST

To estimate smolt abundance and adult harvest we assumed that:

1. all smolts had an equal probability of being marked in 1999, or all adults had an equal probability of being inspected for CWT marks in 2000, or marked fish mixed completely with unmarked fish in the population between years;
2. there was no recruitment, immigration or emigration to the population between years;
3. there was no tagging induced behavior or mortality; and
4. fish did not lose their marks and all marks were recognizable.

We believe that most of these assumptions were satisfied. The assumption required that either all smolt had the same probability of capture regardless of time of smolting, location in the river, or size or marked fish mixed completely with unmarked fish in the population between years. Smolt capture and tagging occurred throughout the emigration, within most of the available smolt habitat, and was also accomplished with minnow traps that would capture a wide range of smolt sizes encompassing the entire geographic range of smolt observed in the river. Because nearly equal effort occurred throughout the emigration, later-running smolt may have had a higher probability of capture. Similarly, recovery effort was expended through-out most of the run of returning adults, but not in exact proportion to fish abundance, and a small number of fish probably returned earlier or later than the tag recovery sampling.

Although the assumption about mixing cannot be tested, coho salmon most likely mixed within

**Table 9.—Summarized mark-recapture data for Nakwasina River coho salmon, 2000.** Notation follows that in Seber (1982).

Week	Number captured $n_i$	Number marked caught in $m_i$	Losses on capture	Released after marking $R_i$	Subsequently recaptured $r_i$
1	9	0	0	9	3
2	10	0	0	10	8
3	117	8	0	117	21
5	36	5	0	36	13
6	90	5	4	86	30
7	102	19	0	102	26
8	44	13	0	44	15
9	116	29	1	115	29
10	31	35	1	30	3
11	22	24	0	22	—
12	3	5	0	3	1
13	6	6	1	5	—
Total	586	149	7	579	149

**Table 10.—Results of  $\chi^2$  tests for differences in tagged rate between locations.**

Location	Number tagged	Number untagged	Total	Capture probability
1	20	41	61	0.49
2	106	473	579	0.22
3	11	72	83	0.15
Total	137	586	723	

$\chi^2 = 9.51$        $P < 0.01$

**Table 11.—Stream counts including number of coho counted, date survey conditions, and percentage of total escapement estimate represented by daily count.**

Week	Date	Count	Conditions	Percent of total escapement abundance
3	4-Oct	182	Ideal-low, clear water	9.1
5	17-Oct	77	Medium water, clear day	3.9
6	25-Oct (walking count)	339 <sup>a</sup>	Low water, good visibility	17.0
6	25-Oct (float count)	459 <sup>a</sup>	Low water, good visibility	23.0
8	8-Nov	419	Low water, good visibility	21.0
10	21-Nov	113	Poor, high water, low clarity	5.7
12	5-Dec	-	High, turbid water	—

<sup>a</sup> Two separate surveys were done on 25 Oct (one as a traditional foot count and one floating the stream in a dry suit).

or across stocks during their extended time (14 months) at sea. This should provide adequate mixing of the population. In catches in the Nakwasina River, the fraction of adult coho salmon with marks (missing an adipose fin) did not vary significantly over time (Table 12). This indicates that at least one of the conditions in assumption 1 was satisfied.

Assumption 2 required that there was no recruitment to the population between years. Because almost all salmon return to their natal streams and sampling only occurred in the river, there was probably no appreciable recruitment to the stock between marking and recovery. We believe the presence of stray coho salmon reared at Medvejie hatchery is possible but unlikely given the geographical distance between the two sites.

Although we have no direct evidence, it is possible that the capture and tagging procedures caused fish to emigrate the system prematurely. This premature emigration would likely increase the mortality rate of tagged fish and subsequently bias the estimate of abundance high and the estimate of marine survival low. Based on the age composition observed for 1999 smolt, it is also possible that some fish tagged in 1999 remained in fresh water an additional year to smolt and emigrate in 2000, this would also bias the abundance estimate high and the survival estimate low.

**Table 12.—Proportion of recovered Nakwasina River adult coho salmon observed with and without adipose finclips.** An adipose finclipped fish was assumed to have a tag originating from the Nakwasina River.

Date	No clip	Clip observed	Tagged proportion
09/22/00	8	1	0.11
09/25/00	7		0.00
09/26/00	3		0.00
10/02/00	47	2	0.04
10/03/00	59	9	0.13
10/16/00	33	3	0.08
10/23/00	4		0.00
10/24/00	52	6	0.10
10/25/00	24	2	0.08
10/28/00	2		0.00
10/30/00	37	6	0.14
10/31/00	53	2	0.04
11/01/00	3	1	0.25
11/09/00	42	2	0.05
11/14/00	6	1	0.14
11/15/00	6		0.00
11/16/00	56	5	0.08
11/17/00	37	5	0.12
11/20/00	22	3	0.12
11/21/00	6		0.00
11/28/00	22		0.00
12/04/00	3		0.00
12/12/00	6		0.00
Total	538	48	0.082

The smolt-to-adult survival rate of 6.8% is low but within the same range as other systems in the region. Average smolt-to-adult survival rates in other parts of the region range from 13.4% in Hugh Smith Lake (Shaul and Crabtree 1998) and 14% above Canyon Island in the Taku River to as high as 23% in Auke Lake (Yanusz et al. 1999). In 1997 coho survival was 6.7% (SE = 1.5%) above Canyon Island in the Taku River (McPherson et al. 1998). Because of the low survival rate in the Nakwasina River, the tagging operation was moved in the spring of 2000 to an area adjacent a large slough with dense cover to

insure smolt were given an adequate opportunity to recover and smolt naturally. If survival rates in future years are found to be higher, it may indicate that the fish tagged in 1999 had a low survival rate and our estimate of abundance was biased high.

It is unlikely that smolt regenerated the clipped adipose fin that identified the fish as containing a tag. In conjunction with tag retention and overnight mortality tests, we examined adipose finclips on smolt. All smolt examined appeared to have good finclips. Also, all adult coho examined had well defined or a complete absence of an adipose fin.

### ADULT ESCAPEMENT IN 2000

Assumptions we made in the estimation of adult escapement in 2000 were:

1. all coho salmon in the population at time  $i$  had an equal probability of being caught in the  $i^{th}$  sample,
2. survival and catchability were the same for marked and unmarked individuals, and
3. fish did not lose their marks and all the marks were recognizable.

Tagged adults were identified with two marks: one individually numbered Floy™ tag and a weekly operculum punch. Only 2 fish were recovered that had lost the external tag, as evidenced by the operculum punches. These measures should have prevented any duplicate samplings. Adipose finclips have a rare occurrence of regeneration. Additionally, marking did not appear to affect the behavior or movement of fish, as marked fish were observed spawning with or near unmarked fish throughout the study.

Some of the adult coho may not have had the same probability of capture as others, because only river kilometers 3.4 to 7.75 were sampled. The estuary to rkm 3.4 was excluded to reduce mortality and/or stress associated with handling of fish acclimatizing to fresh water. The river above rkm 7.75 was excluded because relatively few have been observed in this area and because of time constraints. The ratio of tagged to untagged fish in the upper stretch of the river (location 1) was higher than the two lower locations. This may be an indication that some fish bound for upper portions of the stream were captured in one of the

two holes in the lower part of the river before they moved upstream. All sampled areas were sampled as thoroughly as possible and with approximately equal effort.

Although it is possible that coho died as a result of the capture and tagging process, no coho were observed floating downstream of the tagging and capture locations. Tagged coho may have moved back downstream to recover. This “sulking” behavior may have removed some fish from the sampling area for a time before they moved back into the holding and spawning areas. No dead coho were recovered that had been recently tagged (i.e., died from tagging-related injuries or stress). If there were an undetected mortality associated with coho capture and tagging, the escapement estimate would be biased high.

### VISUAL COUNTS

The Nakwasina River is similar to other clearwater streams in the area and the relationship between the peak observer count and the total escapement are typical for similar streams in Southeast Alaska (McPherson et al. 1996; Jones and McPherson 1997). The visibility of spawning salmon depends on many factors such as weather, water clarity, canopy cover, pool-to-riffle ratio, the density of fish, the amount of undercut banks, and the ecology, behavior, size, and color of salmon (Jones 1995).

### HARVEST SAMPLING

To assess the adequacy of sampling rates in the purse seine and gillnet fisheries, we examined purse seine and gillnet harvests that occurred within the Southeast Alaska where Nakwasina River coho salmon recovery occurred (Table 13). The sampling rate in the troll fishery in the Southwest Quadrant was 75%. The sampling rate in the purse seine fishery in district 113 was 44%. The troll fisheries in the Northwest Quadrant ranged from 24% (Districts 113) to 50% (District 154). Because not all fisheries were sampled, and not all fish in a sampled fishery were examined, it is likely that Nakwasina River coho salmon carrying a CWT were missed and harvest was underestimated in some fisheries.

The coho salmon harvest in the District 113 drift gillnet fishery was under-reported and sampled at

**Table 13.—Numbers of fish harvested and sampled for CWT recovery for districts in which Nakwasina River coho were recovered.**

District	Gear	Fish harvested	Fish sampled	Proportion sampled
104	Troll	12,639	9472	0.75
113	Purse	471	208	0.44
	Troll	442,017	107,087	0.24
116	Troll	14,059	6,162	0.44
154	Troll	14,502	7,248	0.50
Total		483,688	130,177	0.27

a very low rate. The only gillnet fishery within District 113 targets hatchery produced chum salmon in the Deep Inlet Terminal Harvest Area. This fishery was sampled for coho salmon CWT recovery September 21 of 1999 when thirteen coho salmon were examined from only four vessels observed fishing. Fishers interviewed on each vessel reported similar or greater catches per boat-day during previous openings when fishing effort was higher. Fishers also reported that most coho were kept for home use and not recorded on fish tickets. For these reasons, the reported harvest of 30 coho salmon in 2000 probably represents only a fraction of the actual harvest, and the harvest of Nakwasina River coho salmon in this fishery was likely underestimated. In a similar study, Schmidt (1996) estimated that the Deep Inlet gillnet fishery harvested 7% of the total harvest of another Sitka Sound coho salmon stock, but considered that estimate biased low, from underreporting and sampling problems similar to those experienced during 1999 and 2000.

The smolt abundance estimate in 1999 of 47,571 is less than half of the 1998 estimated abundance. This may be due to lower freshwater survival or fewer adult returns to the stream in 1997 (Table 1).

In future tagging events, extra care should be taken to ensure that effects of tagging are minimized. Recommendations for future tagging include: 1) releasing smolt in side tributaries with extensive available rearing habitat as opposed to mainstem areas with higher velocities; 2) minimizing transport distances by centralizing the tagging and holding site; 3) returning tagged smolt to locations near their capture site; and, 4)

tagging and sampling all fish within 48 hours of capture to ensure fish are not held for periods greater than 72 hours, including overnight mortality testing. Future study designs should also address the problems encountered in sampling the 1999 and 2000 commercial purse seine and gillnet fisheries to ensure accurate harvest estimates and adequate CWT sampling rates, particularly for fisheries in District 113.

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## **APPENDIX A**



**Appendix A1.–Recoveries of coded-wire tags originating from Nakwasina River coho salmon during 2000.**

Head number	Tag code	Gear	Recovery date	Stat. week	Quad	Dist.	Subdist.	Length	Port survey site	Sample number
<b>RANDOM RECOVERIES</b>										
501666	44730	PURSE	22-Aug-00	35	NW	113	38	634	EXCURSION INLET	100120
156658	44730	PURSE	3-Sep-00	37	NW	113		473	SITKA	31054
149613	44730	SPORT	21-Aug-00	35	NW	113	45	660	SITKA	35499
149639	44730	SPORT	25-Aug-00	35	NW	113	41	660	SITKA	35519
157512	44730	TROLL	11-Jul-00	29	NW	113	41	671	SITKA	30572
157763	44730	TROLL	12-Jul-00	29	NW	113	31	605	SITKA	30585
164316	44730	TROLL	18-Jul-00	30	NW	113	91	598	PELICAN	10060
135057	44730	TROLL	21-Jul-00	30	NW	154		645	SITKA	30687
67919	44730	TROLL	22-Jul-00	30	SE			594	KETCHIKAN	60283
500706	44730	TROLL	26-Jul-00	31	NW			609	EXCURSION INLET	100063
135992	44730	TROLL	27-Jul-00	31	NW	154		620	SITKA	30741
158705	44730	TROLL	29-Jul-00	31	NW	113		525	HOONAH	110186
158685	44730	TROLL	29-Jul-00	31	NW	116	11	625	HOONAH	110185
55593	44730	TROLL	2-Aug-00	32	NW	113	91	635	JUNEAU	40079
158771	44730	TROLL	2-Aug-00	32	NW	113	95	630	HOONAH	110193
158809	44730	TROLL	2-Aug-00	32	NW	113	95	670	HOONAH	110194
159992	44730	TROLL	3-Aug-00	32	SW	104	40	625	CRAIG	70357
501111	44730	TROLL	4-Aug-00	32	NW			654	EXCURSION INLET	100071
163569	44731	TROLL	4-Aug-00	32	NW	116	11	640	ELFIN COVE	20110
154478	44731	TROLL	8-Aug-00	33	NW	113	61	631	SITKA	30860
155281	44730	TROLL	12-Aug-00	33	NW			673	SITKA	30946
500948	44730	TROLL	14-Aug-00	34	NW			610	EXCURSION INLET	100104
178104	44730	TROLL	24-Aug-00	35	NW	113	95	445	HOONAH	110233
178106	44730	TROLL	24-Aug-00	35	NW	113	95	675	HOONAH	110233
165069	44730	TROLL	26-Aug-00	35	NW	113	91	650	PELICAN	10151
503112	44730	TROLL	27-Aug-00	36	NW	113	61	712	PETERSBURG	50932
156084	44731	TROLL	27-Aug-00	36	NW	113	45	590	SITKA	31000
165143	44730	TROLL	28-Aug-00	36	NW	113	91	636	PELICAN	10158
178180	44730	TROLL	28-Aug-00	36	NW	113	91	650	HOONAH	110247
165418	44730	TROLL	31-Aug-00	36	NW	113	91	593	PELICAN	10177
165566	44730	TROLL	11-Sep-00	38	NW	113	91	747	PELICAN	10207
151930	44730	TROLL	13-Sep-00	38	NW	113	41	646	SITKA	31083
165620	44730	TROLL	13-Sep-00	38	NW	113	91	610	PELICAN	10219
165676	44730	TROLL	18-Sep-00	39	NW			670	PELICAN	10230
<b>SELECT RECOVERIES</b>										
142547	44730	TROLL	21-Jul-00	30	NW				YAKUTAT	140019
164935	44730	TROLL	13-Aug-00	34	NW				PELICAN	10138
144073	44730	SPORT	4-Oct-00	41	NW	113	43		NAKWASINA R.	00EG5001
144074	44730	SPORT	18-Oct-00	43	NW	113	43	720	NAKWASINA R.	00EG5002
98105	44730	ESCAPE	25-Oct-00	44	NW	113	43	690	NAKWASINA R.	00EG0003
98112	44730	ESCAPE	14-Nov-00	47	NW	113	43	570	NAKWASINA R.	00EG0016

**Appendix A2.—Tagging and recovery data for individual coho salmon at the Nakwasina River, 2000.**

Week	Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
1	9/22	1	1	HL	2	no	n/a	-	none	LU	1	695	2	bright	no	n/a	n/a
1	9/22	2	1	HL	2	no	n/a	-	none	LU	2	570	1	blush	no	n/a	n/a
1	9/22	3	1	HL	2	no	n/a	-	none	LU	3	645	2	bright	yes	yes	n/a
1	9/22	4	1	HL	2	no	n/a	-	none	LU	4	620	1	bright	no	n/a	n/a
1	9/22	5	1	HL	2	no	n/a	-	none	LU	5	640	1	bright	no	n/a	n/a
1	9/22	6	1	HL	2	no	n/a	-	none	LU	6	700	1	blush	no	n/a	n/a
1	9/22	7	1	HL	2	no	n/a	-	none	LU	7	530	1	blush	no	n/a	n/a
1	9/22	8	1	HL	2	no	n/a	-	none	LU	9	580	2	bright	no	n/a	n/a
1	9/22	9	1	HL	2	no	n/a	-	none	LU	10	460	1	bright	no	n/a	n/a
2	9/25	1	2	HL	2	no	n/a	-	none	LL	11	660	2	blush	no	n/a	n/a
2	9/26	1	3	HL	2	no	n/a	-	none	LL	18	685	2	bright	no	n/a	n/a
2	9/25	2	2	HL	2	no	n/a	-	none	LL	12	570	2	bright	no	n/a	n/a
2	9/26	2	3	HL	2	no	n/a	-	none	LL	19	660	2	bright	no	n/a	n/a
2	9/25	3	2	HL	2	no	n/a	-	none	LL	13	650	2	bright	no	n/a	n/a
2	9/26	3	3	HL	2	no	n/a	-	none	LL	20	620	2	blush	no	n/a	n/a
2	9/25	4	2	HL	2	no	n/a	-	none	LL	14	635	1	bright	no	n/a	n/a
2	9/25	5	2	HL	2	no	n/a	-	none	LL	15	585	1	blush	no	n/a	n/a
2	9/25	6	2	HL	1	no	n/a	-	none	LL	17	700	2	bright	no	n/a	n/a
2	9/25	7	2	HL	1	no	n/a	-	none	LL	**	615	1	blush	no	n/a	n/a
3	10/2	1	4	HL	3	no	n/a	-	none	RU	21	450	1	blush	no	n/a	n/a
3	10/2	1	5	seine	2	no	n/a	-	none	RU	31	645	1	bright	no	n/a	n/a
3	10/2	1	6	seine	2	no	n/a	-	none	RU	41	565	1	bright	yes	yes	n/a
3	10/2	1	7	seine	2	no	n/a	-	none	RU	71	455	1	blush	no	n/a	n/a
3	10/2	1	8	seine	2	no	n/a	-	none	RU	60	475	1	-	no	n/a	n/a
3	10/2	1	9	seine	2	no	n/a	-	none	RU	70	535	2	bright	no	n/a	n/a
3	10/3	1	10	seine	2	no	n/a	-	none	RU	81	650	1	bright	no	n/a	n/a
3	10/3	1	11	seine	2	no	n/a	-	none	RU	90	420	1	bright	no	n/a	n/a
3	10/3	1	12	seine	2	no	n/a	-	none	RU	101	615	1	blush +	no	n/a	n/a
3	10/3	1	14	seine	2	no	n/a	-	none	RU	120	635	2	bright	no	n/a	n/a
3	10/3	1	15	seine	2	no	n/a	-	none	RU	130	615	1	blush	no	n/a	n/a
3	10/2	2	4	HL	3	no	n/a	-	none	RU	22	625	1	blush	no	n/a	n/a
3	10/2	2	5	seine	2	no	n/a	-	none	RU	32	580	1	blush	no	n/a	n/a
3	10/2	2	6	seine	2	no	n/a	-	none	RU	42	650	2	bright	no	n/a	n/a
3	10/2	2	7	seine	2	no	n/a	-	none	RU	51	650	1	blush	no	n/a	n/a
3	10/2	2	8	seine	2	no	n/a	-	none	RU	61	655	1	-	no	n/a	n/a
3	10/2	2	9	seine	2	no	n/a	-	none	RU	72	570	1	dark	no	n/a	n/a
3	10/3	2	10	seine	2	no	n/a	-	none	RU	82	635	2	bright	no	n/a	n/a
3	10/3	2	11	seine	2	no	n/a	-	none	RU	91	525	2	bright	no	n/a	n/a
3	10/3	2	12	seine	2	no	n/a	-	none	RU	103	680	2	bright	no	n/a	n/a
3	10/3	2	13	seine	2	no	n/a	-	none	RU	112	510	1	blush	no	n/a	n/a
3	10/3	2	14	seine	2	no	n/a	-	none	RU	121	660	1	dark	no	n/a	n/a
3	10/3	2	15	seine	2	no	n/a	-	none	RU	131	480	1	blush	no	n/a	n/a
3	10/2	3	4	HL	3	no	n/a	-	none	RU	23	665	2	bright	no	n/a	n/a
3	10/2	3	5	seine	2	no	n/a	-	none	RU	33	700	1	blush	no	n/a	n/a
3	10/2	3	7	seine	2	no	n/a	-	none	RU	52	615	2	bright	no	n/a	n/a
3	10/2	3	8	seine	2	no	n/a	-	none	RU	62	640	1	-	no	n/a	n/a
3	10/3	3	9	seine	2	no	n/a	-	none	RU	73	465	1	blush	no	n/a	n/a
3	10/3	3	10	seine	2	no	n/a	-	none	RU	83	655	2	bright	no	n/a	n/a
3	10/3	3	11	seine	2	no	n/a	-	none	RU	92	575	2	bright	no	n/a	n/a
3	10/3	3	12	seine	2	no	n/a	-	none	RU	102	585	1	bright	no	n/a	n/a
3	10/3	3	13	seine	2	no	n/a	-	none	RU	113	445	1	blush	no	n/a	n/a
3	10/3	3	14	seine	2	no	n/a	-	none	RU	122	695	1	blush	no	n/a	n/a

-continued-

Appendix A2.—continued (Page 2 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/3	3	15	seine	2	no	n/a	-	none	RU	132	650	2	bright	no	n/a	n/a
10/3	3	16	seine	2	no	n/a	-	none	RU	139	610	2	blush	no	n/a	n/a
10/2	4	4	seine	2	no	n/a	-	none	RU	24	710	1	blush	no	n/a	n/a
10/2	4	5	seine	2	no	n/a	-	none	RU	34	645	2	bright	no	n/a	n/a
10/2	4	6	seine	2	no	n/a	-	none	RU	44	535	1	bright	no	n/a	n/a
10/2	4	7	seine	2	no	n/a	-	none	RU	53	545	1	blush	no	n/a	n/a
10/2	4	8	seine	2	no	n/a	-	none	RU	63	590	1	bright	no	n/a	n/a
10/3	4	9	seine	2	no	n/a	-	none	RU	74	650	2	bright -	no	n/a	n/a
10/3	4	10	seine	2	no	n/a	-	none	RU	84	650	1	bright -	no	n/a	n/a
10/3	4	12	seine	2	no	n/a	-	none	RU	104	475	1	bright	no	n/a	n/a
10/3	4	13	seine	2	no	n/a	-	none	RU	114	585	1	bright	no	n/a	n/a
10/3	4	14	seine	2	no	n/a	-	none	RU	123	625	2	bright	yes	yes	n/a
10/3	4	15	seine	2	no	n/a	-	none	RU	133	520	2	bright	no	n/a	n/a
10/2	5	4	seine	2	no	n/a	-	none	RU	25	675	2	bright	no	n/a	n/a
10/2	5	5	seine	2	no	n/a	-	none	RU	35	670	2	bright	no	n/a	n/a
10/2	5	6	seine	2	no	n/a	-	none	RU	46	550	1	bright	no	n/a	n/a
10/2	5	7	seine	2	no	n/a	-	none	RU	54	490	1	blush	no	n/a	n/a
10/2	5	8	seine	2	no	n/a	-	none	RU	64	710	1	bright	no	n/a	n/a
10/3	5	9	seine	2	no	n/a	-	none	RU	75	620	1	bright -	no	n/a	n/a
10/3	5	10	seine	2	no	n/a	-	none	RU	85	580	2	blush	no	n/a	n/a
10/3	5	11	seine	2	no	n/a	-	none	RU	95	445	1	blush	yes	yes	n/a
10/3	5	12	seine	2	no	n/a	-	none	RU	105	655	1	bright	no	n/a	n/a
10/3	5	13	seine	2	no	n/a	-	none	RU	115	645	1	bright	no	n/a	n/a
10/3	5	14	seine	2	no	n/a	-	none	RU	124	665	2	bright	no	n/a	n/a
10/3	5	15	seine	2	no	n/a	-	none	RU	134	655	1	blush	no	n/a	n/a
10/3	5	16	seine	2	no	n/a	-	none	RU	141	640	1	dark	no	n/a	n/a
10/2	6	4	seine	2	no	n/a	-	none	RU	26	645	1	bright	no	n/a	n/a
10/2	6	5	seine	2	no	n/a	-	none	RU	36	580	1	blush	no	n/a	n/a
10/2	6	6	seine	2	no	n/a	-	none	RU	45	670	2	bright	no	n/a	n/a
10/2	6	8	seine	2	no	n/a	-	none	RU	65	635	1	bright	no	n/a	n/a
10/3	6	9	seine	2	no	n/a	-	none	RU	76	610	1	bright -	no	n/a	n/a
10/3	6	11	seine	2	no	n/a	-	none	RU	96	690	1	blush	yes	yes	n/a
10/3	6	12	seine	2	no	n/a	-	none	RU	106	665	2	blush	no	n/a	n/a
10/3	6	13	seine	2	no	n/a	-	none	RU	116	660	1	bright	no	n/a	n/a
10/3	6	14	seine	2	no	n/a	-	none	RU	125	580	1	dark	no	n/a	n/a
10/3	6	15	seine	2	no	n/a	-	none	RU	135	615	2	bright	no	n/a	n/a
10/3	6	16	seine	2	no	n/a	-	none	RU	142	645	1	bright	no	n/a	n/a
10/2	7	4	seine	2	no	n/a	-	none	RU	27	670	1	bright	no	n/a	n/a
10/2	7	5	seine	2	no	n/a	-	none	RU	37	650	2	bright	no	n/a	n/a
10/2	7	6	seine	2	no	n/a	-	none	RU	47	685	1	blush	no	n/a	n/a
10/2	7	7	seine	2	no	n/a	-	none	RU	56	555	1	-	no	n/a	n/a
10/2	7	8	seine	2	no	n/a	-	none	RU	66	565	2	bright	no	n/a	n/a
10/3	7	9	seine	2	no	n/a	-	none	RU	77	595	1	blush +	yes	yes	n/a
10/3	7	10	seine	2	no	n/a	-	none	RU	86	630	1	bright	no	n/a	n/a
10/3	7	11	seine	2	no	n/a	-	none	RU	97	635	1	bright	no	n/a	n/a
10/3	7	12	seine	2	no	n/a	-	none	RU	107	630	1	bright	yes	yes	n/a
10/3	7	14	seine	2	no	n/a	-	none	RU	126	625	1	bright	no	n/a	n/a
10/3	7	15	seine	2	no	n/a	-	none	RU	*	600	2	bright	yes	yes	n/a
10/3	7	16	HL	1	no	n/a	-	none	RU	143	640	2	bright	no	n/a	n/a
10/2	8	4	seine	2	no	n/a	-	none	RU	28	685	2	bright	no	n/a	n/a
10/2	8	5	seine	2	no	n/a	-	none	RU	38	625	1	bright	no	n/a	n/a
10/2	8	6	seine	2	no	n/a	-	none	RU	48	645	1	bright	no	n/a	n/a

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Appendix A2.-continued (Page 3 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/2	8	7	seine	2	no	n/a	-	none	RU	57	610	2	-	no	n/a	n/a
10/2	8	8	seine	2	no	n/a	-	none	RU	67	625	2	bright	no	n/a	n/a
10/3	8	9	seine	2	no	n/a	-	none	RU	78	650	2	blush +	no	n/a	n/a
10/3	8	10	seine	2	no	n/a	-	none	RU	87	675	2	bright +	no	n/a	n/a
10/3	8	11	seine	2	no	n/a	-	none	RU	98	625	1	bright	no	n/a	n/a
10/3	8	12	seine	2	no	n/a	-	none	RU	108	595	-	bright	yes	yes	n/a
10/3	8	13	seine	2	no	n/a	-	none	RU	117	565	1	blush	no	n/a	n/a
10/3	8	14	seine	2	no	n/a	-	none	RU	127	595	1	bright	no	n/a	n/a
10/3	8	15	seine	2	no	n/a	-	none	RU	136	575	1	bright	no	n/a	n/a
10/2	9	4	seine	2	no	n/a	-	none	RU	29	630	1	bright	no	n/a	n/a
10/2	9	5	seine	2	no	n/a	-	none	RU	39	645	1	bright	no	n/a	n/a
10/2	9	6	seine	2	no	n/a	-	none	RU	49	680	1	bright	no	n/a	n/a
10/2	9	7	seine	2	no	n/a	-	none	RU	58	580	1	bright	yes	yes	n/a
10/3	9	9	seine	2	no	n/a	-	none	RU	79	580	1	bright -	no	n/a	n/a
10/3	9	10	seine	2	no	n/a	-	none	RU	88	610	1	bright -	no	n/a	n/a
10/3	9	11	seine	2	no	n/a	-	none	RU	99	680	2	bright	no	n/a	n/a
10/3	9	12	seine	2	no	n/a	-	none	RU	109	435	1	blush	no	n/a	n/a
10/3	9	13	seine	2	no	n/a	-	none	RU	118	485	1	bright	no	n/a	n/a
10/3	9	14	seine	2	no	n/a	-	none	RU	128	585	1	blush	no	n/a	n/a
10/3	9	15	seine	2	no	n/a	-	none	RU	137	630	2	blush -	no	n/a	n/a
10/2	10	4	seine	2	no	n/a	-	none	RU	30	645	1	blush	no	n/a	n/a
10/2	10	5	seine	2	no	n/a	-	none	RU	40	480	1	bright	no	n/a	n/a
10/2	10	6	seine	2	no	n/a	-	none	RU	50	615	1	dark	no	n/a	n/a
10/2	10	7	seine	2	no	n/a	-	none	RU	59	550	1	-	no	n/a	n/a
10/2	10	8	seine	2	no	n/a	-	none	RU	69	500	1	dark	no	n/a	n/a
10/3	10	9	seine	2	no	n/a	-	none	RU	80	645	2	bright -	no	n/a	n/a
10/3	10	10	seine	2	no	n/a	-	none	RU	89	580	1	bright	yes	yes	n/a
10/3	10	11	seine	2	no	n/a	-	none	RU	100	600	1	blush ++	no	n/a	n/a
10/3	10	12	seine	2	no	n/a	-	none	RU	110	600	1	bright	yes	yes	n/a
10/3	10	13	seine	2	no	n/a	-	none	RU	119	505	1	blush -	no	n/a	n/a
10/3	10	14	seine	2	no	n/a	-	none	RU	129	495	2	bright	no	n/a	n/a
10/3	10	15	seine	2	no	n/a	-	none	RU	138	600	1	dark	no	n/a	n/a
10/2	-	-	seine	2	yes	15	2	LL	-	-	-	-	-	-	-	-
10/2	-	-	seine	2	yes	19	2	LL	-	-	-	-	-	-	-	-
10/3	-	-	seine	2	yes	18	2	LL	-	-	-	-	-	-	-	-
10/3	-	-	seine	2	yes	9	1	LU	-	-	-	-	-	-	-	-
10/3	-	-	seine	2	yes	16	2	LL	-	-	-	-	-	-	-	-
10/3	-	-	seine	2	yes	11	2	-	-	-	-	-	-	-	-	-
10/3	-	-	seine	3	yes	12	2	LL	-	-	-	-	-	-	-	-
10/3	-	-	seine	2	yes	6	1	RU	-	-	-	-	-	-	-	-
10/16	1	17	seine	2	no	n/a	-	none	RL	147	685	1	blush	no	n/a	n/a
10/16	1	18	seine	2	no	n/a	-	none	RL	157	680	1	blush	no	n/a	n/a
10/16	1	19	seine	2	no	n/a	-	none	RL	168	615	1	bright	no	n/a	n/a
10/16	1	20	seine	2	no	n/a	-	none	RL	178	700	2	bright	yes	yes	n/a
10/16	2	17	seine	2	no	n/a	-	none	RL	148	650	2	bright	no	n/a	n/a
10/16	2	18	seine	2	no	n/a	-	none	RL	158	705	2	blush	no	n/a	n/a
10/16	2	19	seine	2	no	n/a	-	none	RL	169	625	2	bright	yes	yes	n/a
10/16	2	20	seine	2	no	n/a	-	none	RL	179	585	2	blush	no	n/a	n/a
10/16	3	17	seine	2	no	n/a	-	none	RL	149	525	1	blush	no	n/a	n/a
10/16	3	18	seine	2	no	n/a	-	none	RL	159	660	1	bright	no	n/a	n/a
10/16	3	19	seine	2	no	n/a	-	none	RL	170	660	1	bright	no	n/a	n/a
10/16	3	20	seine	2	no	n/a	-	none	RL	180	555	1	blush	no	n/a	n/a

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Appendix A2.—continued (Page 4 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/16	4	17	seine	2	no	n/a	-	none	RL	150	615	1	bright	no	n/a	n/a
10/16	4	18	seine	2	no	n/a	-	none	RL	160	645	1	blush	no	n/a	n/a
10/16	4	19	seine	2	no	n/a	-	none	RL	171	435	1	blush	no	n/a	n/a
10/16	5	17	seine	2	no	n/a	-	none	RL	151	650	1	bright	no	n/a	n/a
10/16	5	18	seine	2	no	n/a	-	none	RL	161	620	1	blush	no	n/a	n/a
10/16	5	19	seine	2	no	n/a	-	none	RL	172	585	1	bright	no	n/a	n/a
10/16	6	17	seine	2	no	n/a	-	none	RL	152	685	2	bright	no	n/a	n/a
10/16	6	18	seine	2	no	n/a	-	none	RL	163	640	2	blush	no	n/a	n/a
10/16	6	19	seine	2	no	n/a	-	none	RL	173	570	1	dark	no	n/a	n/a
10/16	7	17	seine	2	no	n/a	-	none	RL	153	640	1	bright	yes	yes	n/a
10/16	7	18	seine	2	no	n/a	-	none	RL	164	675	2	bright	no	n/a	n/a
10/16	7	19	seine	2	no	n/a	-	none	RL	174	640	1	dark	no	n/a	n/a
10/16	8	16	seine	2	no	n/a	-	none	RL	144	650	1	bright	no	n/a	n/a
10/16	8	17	seine	2	no	n/a	-	none	RL	154	630	2	bright	no	n/a	n/a
10/16	8	18	seine	2	no	n/a	-	none	RL	165	465	1	blush	no	n/a	n/a
10/16	8	19	seine	2	no	n/a	-	none	RL	175	645	1	blush	no	n/a	n/a
10/16	9	16	seine	2	no	n/a	-	none	RL	145	635	1	blush	no	n/a	n/a
10/16	9	17	seine	2	no	n/a	-	none	RL	155	675	1	bright	no	n/a	n/a
10/16	9	18	seine	2	no	n/a	-	none	RL	166	620	1	bright	no	n/a	n/a
10/16	9	19	seine	2	no	n/a	-	none	RL	176	575	1	blush	no	n/a	n/a
10/16	10	16	seine	2	no	n/a	-	none	RL	146	705	2	bright	no	n/a	n/a
10/16	10	17	seine	2	no	n/a	-	none	RL	156	675	2	bright	no	n/a	n/a
10/16	10	18	seine	2	no	n/a	-	none	RL	167	425	1	bright	no	n/a	n/a
10/16	10	19	seine	2	no	n/a	-	none	RL	177	620	1	blush	no	n/a	n/a
10/17	-	-	HL	3	yes	138	3	RU	-	-	-	-	-	-	-	-
10/16	-	-	seine	2	yes	142	3	RU	-	-	-	-	-	-	-	-
10/16	-	-	seine	2	yes	48	3	-	-	-	-	-	-	-	-	-
10/16	-	-	seine	2	yes	48	3	RU	-	-	-	-	-	-	-	-
10/16	-	-	seine	2	yes	63	3	RU	-	-	-	-	-	-	-	-
10/24	1	21	seine	2	no	n/a	-	none	LUU	188	660	1	blush	no	n/a	n/a
10/24	1	22	seine	2	no	n/a	-	none	LUU	199	680	1	bright	no	n/a	n/a
10/24	1	23	gillnet	3	no	n/a	-	none	LUU	210	710	2	bright	yes	yes	n/a
10/24	1	24	gillnet	3	no	n/a	-	none	LUU	222	695	1	blush	no	n/a	n/a
10/24	1	25	gillnet	3	no	n/a	-	none	LUU	227	660	1	blush	no	n/a	n/a
10/24	1	26	gillnet	1	no	n/a	-	none	LUU	236	670	1	blush	no	n/a	n/a
10/25	1	27	seine	2	no	n/a	-	none	LUU	246	660	2	blush	no	n/a	n/a
10/25	1	28	seine	2	no	n/a	-	none	LUU	255	655	1	blush	no	n/a	n/a
10/25	1	29	seine	2	no	n/a	-	none	LUU	265	665	2	bright	no	n/a	n/a
10/24	2	21	seine	2	no	n/a	-	none	LUU	189	650	1	blush	no	n/a	n/a
10/24	2	22	seine	2	no	n/a	-	none	LUU	200	695	1	bright	no	n/a	n/a
10/24	2	23	gillnet	3	no	n/a	-	none	LUU	211	690	2	bright	no	n/a	n/a
10/24	2	24	gillnet	3	no	n/a	-	none	LUU	223	635	1	blush	no	n/a	n/a
10/24	2	25	gillnet	3	no	n/a	-	none	LUU	228	620	2	blush	no	n/a	n/a
10/24	2	26	gillnet	1	no	n/a	-	none	LUU	237	665	2	bright	no	n/a	n/a
10/25	2	27	seine	2	no	n/a	-	none	LUU	247	635	1	bright	no	n/a	n/a
10/25	2	28	seine	2	no	n/a	-	none	LUU	256	680	2	bright	no	n/a	n/a
10/28	2	29	HL	2	no	n/a	-	none	killed	killed	560	2	bright	no	n/a	no
10/24	3	21	seine	2	no	n/a	-	none	LUU	191	635	1	blush	no	n/a	n/a
10/24	3	22	seine	2	no	n/a	-	none	LUU	201	690	1	bright	no	n/a	n/a
10/24	3	23	gillnet	3	no	n/a	-	none	LUU	214	630	1	blush	no	n/a	n/a
10/24	3	24	gillnet	3	no	n/a	-	none	LUU	224	630	2	bright	no	n/a	n/a
10/24	3	25	gillnet	3	no	n/a	-	none	LUU	229	465	1	blush	no	n/a	n/a

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Appendix A2.—continued (Page 5 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/24	3	26	gillnet	1	no	n/a	-	none	LUU	238	645	2	bright	no	n/a	n/a
10/25	3	27	seine	2	no	n/a	-	none	killed	killed	690	1	bright	yes	no	98,105
10/25	3	28	seine	2	no	n/a	-	none	LUU	257	695	1	dark	no	n/a	n/a
10/24	4	21	seine	2	no	n/a	-	none	LUU	192	665	1	blush	no	n/a	n/a
10/24	4	22	seine	2	no	n/a	-	none	LUU	202	595	2	bright	no	n/a	n/a
10/24	4	23	gillnet	3	no	n/a	-	none	LUU	215	680	2	bright	no	n/a	n/a
10/24	4	24	gillnet	3	no	n/a	-	none	LUU	225	645	1	blush	yes	yes	n/a
10/24	4	25	gillnet	3	no	n/a	-	none	LUU	230	510	1	blush	no	n/a	n/a
10/24	4	26	gillnet	1	no	n/a	-	none	LUU	239	720	1	bright	no	n/a	n/a
10/25	4	27	seine	2	no	n/a	-	none	LUU	248	645	2	bright	no	n/a	n/a
10/25	4	28	seine	2	no	n/a	-	none	LUU	258	705	2	bright	no	n/a	n/a
10/28	4	29	HL	2	no	n/a	-	none	killed	killed	505	1	blush	no	n/a	no
10/23	5	20	HL	1	no	n/a	-	none	LUU	181	690	2	dark	no	n/a	n/a
10/24	5	21	seine	2	no	n/a	-	none	LUU	193	695	1	blush	no	n/a	n/a
10/24	5	22	seine	2	no	n/a	-	none	LUU	203	685	2	bright++	no	n/a	n/a
10/24	5	23	gillnet	3	no	n/a	-	none	LUU	216	685	1	bright	no	n/a	n/a
10/24	5	24	gillnet	3	no	n/a	-	none	LUU	213	615	1	blush	no	n/a	n/a
10/24	5	25	gillnet	3	no	n/a	-	none	killed	killed	670	2	blush	no	n/a	n/a
10/24	5	26	gillnet	1	no	n/a	-	none	LUU	240	670	2	bright	no	n/a	n/a
10/25	5	27	seine	2	no	n/a	-	none	LUU	249	605	1	blush +	no	n/a	n/a
10/25	5	28	seine	2	no	n/a	-	none	LUU	261	655	1	bright	no	n/a	n/a
10/23	6	20	HL	1	no	n/a	-	none	LUU	182	660	1	dark	no	n/a	n/a
10/24	6	21	seine	2	no	n/a	-	none	LUU	194	615	1	blush	no	n/a	n/a
10/24	6	22	seine	2	no	n/a	-	none	LUU	204	635	1	bright	no	n/a	n/a
10/24	6	23	gillnet	3	no	n/a	-	none	LUU	217	580	1	blush	no	n/a	n/a
10/24	6	24	gillnet	3	no	n/a	-	none	LUU	190	605	1	blush	no	n/a	n/a
10/24	6	25	gillnet	3	no	n/a	-	none	LUU	231	625	2	bright	yes	yes	n/a
10/25	6	26	seine	2	no	n/a	-	none	LUU	241	670	1	bright	no	n/a	n/a
10/25	6	27	seine	2	no	n/a	-	none	LUU	250	655	2	bright	no	n/a	n/a
10/25	6	28	seine	2	no	n/a	-	none	LUU	262	600	2	bright	yes	yes	n/a
10/23	7	20	HL	1	no	n/a	-	none	LUU	183	670	1	dark	no	n/a	n/a
10/24	7	21	seine	2	no	n/a	-	none	LUU	195	625	2	blush	no	n/a	n/a
10/24	7	22	seine	2	no	n/a	-	none	LUU	205	690	1	bright	no	n/a	n/a
10/24	7	23	gillnet	3	no	n/a	-	none	LUU	218	620	1	blush	no	n/a	n/a
10/24	7	24	gillnet	3	no	n/a	-	none	LUU	208	670	2	bright	no	n/a	n/a
10/24	7	25	gillnet	3	no	n/a	-	none	LUU	232	705	1	bright	no	n/a	n/a
10/25	7	26	seine	2	no	n/a	-	none	LUU	242	670	2	bright +	no	n/a	n/a
10/25	7	27	seine	2	no	n/a	-	none	LUU	251	650	1	dark	no	n/a	n/a
10/25	7	28	seine	2	no	n/a	-	none	LUU	263	690	2	bright	no	n/a	n/a
10/23	8	20	HL	1	no	n/a	-	none	LUU	184	585	1	dark	no	n/a	n/a
10/24	8	21	seine	2	no	n/a	-	none	LUU	196	545	1	blush	no	n/a	n/a
10/24	8	22	seine	2	no	n/a	-	none	LUU	206	590	1	blush	no	n/a	n/a
10/24	8	23	gillnet	3	no	n/a	-	none	LUU	219	655	1	blush	no	n/a	n/a
10/24	8	24	gillnet	3	no	n/a	-	none	LUU	212	655	2	bright	no	n/a	n/a
10/24	8	25	gillnet	3	no	n/a	-	none	LUU	233	665	2	bright	no	n/a	n/a
10/25	8	26	seine	2	no	n/a	-	none	LUU	243	655	1	dark	no	n/a	n/a
10/25	8	27	seine	2	no	n/a	-	none	LUU	252	535	1	bright	no	n/a	n/a
10/25	8	28	seine	2	no	n/a	-	none	LUU	259	660	2	bright -	no	n/a	n/a
10/24	9	20	seine	2	no	n/a	-	none	LUU	185	685	1	bright	no	n/a	n/a
10/24	9	21	seine	2	no	n/a	-	none	LUU	197	680	1	dark	no	n/a	n/a
10/24	9	22	seine	2	no	n/a	-	none	LUU	207	685	1	blush	no	n/a	n/a
10/24	9	23	gillnet	3	no	n/a	-	none	LUU	220	660	1	bright	no	n/a	n/a

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Appendix A2.—continued (Page 6 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/24	9	24	gillnet	3	no	n/a	-	none	LUU	186	665	2	bright	no	n/a	n/a
10/24	9	25	gillnet	3	no	n/a	-	none	LUU	234	655	1	bright -	no	n/a	n/a
10/25	9	26	seine	2	no	n/a	-	none	LUU	244	690	1	dark +	no	n/a	n/a
10/25	9	27	seine	2	no	n/a	-	none	LUU	253	670	1	blush	no	n/a	n/a
10/25	9	28	seine	2	no	n/a	-	none	LUU	260	695	1	dark	no	n/a	n/a
10/24	10	20	seine	2	no	n/a	-	none	LUU	187	630	1	blush	no	n/a	n/a
10/24	10	21	seine	2	no	n/a	-	none	LUU	198	615	1	blush -	no	n/a	n/a
10/24	10	22	gillnet	2	no	n/a	-	none	LUU	209	635	1	bright	yes	yes	n/a
10/24	10	23	gillnet	3	no	n/a	-	none	LUU	221	530	1	blush	yes	yes	n/a
10/24	10	24	gillnet	3	no	n/a	-	none	LUU	226	645	2	blush	yes	yes	n/a
10/24	10	25	gillnet	3	no	n/a	-	none	LUU	235	650	1	dark	no	n/a	n/a
10/25	10	26	seine	2	no	n/a	-	none	LUU	245	680	1	dark	no	n/a	n/a
10/25	10	27	seine	2	no	n/a	-	none	LUU	254	680	2	blush +	no	n/a	n/a
10/25	10	28	seine	2	no	n/a	-	none	LUU	264	670	2	blush	no	n/a	n/a
10/25	-	-	seine	2	yes	26	3	RU	-	-	-	-	blush	-	-	-
10/24	-	-	gillnet	3	no	n/a	-	none	-	***	595	1	blush	no	n/a	n/a
10/24	-	-	seine	2	yes	132	3	RU	-	-	-	-	-	-	-	-
10/24	-	-	seine	2	yes	75	3	-	-	-	-	-	-	-	-	-
10/25	-	-	seine	2	yes	2	1	LU	-	-	-	-	blush	-	-	-
10/24	-	-	seine	2	yes	178	5	RL	-	-	-	-	bright	-	-	-
10/30	1	30	seine	2	no	n/a	-	none	LLL	267	655	2	dark	no	n/a	n/a
10/30	1	31	seine	2	no	n/a	-	none	LLL	282	535	1	dark	no	n/a	n/a
10/30	1	32	seine	2	no	n/a	-	none	LLL	294	650	1	dark -	no	n/a	n/a
10/30	1	33	seine	2	no	n/a	-	none	LLL	303	665	2	blush	no	n/a	n/a
10/31	1	34	seine	2	no	n/a	-	none	LLL	313	705	1	bright	no	n/a	n/a
10/31	1	35	seine	2	no	n/a	-	none	LLL	322	640	1	dark	no	n/a	n/a
10/31	1	36	seine	2	no	n/a	-	none	LLL	332	640	1	dark	no	n/a	n/a
10/31	1	37	seine	2	no	n/a	-	none	LLL	342	420	1	bright	no	n/a	n/a
10/31	1	38	gillnet	3	no	n/a	-	none	LLL	352	530	1	blush	no	n/a	n/a
10/31	1	39	gillnet	3	no	n/a	-	none	LLL	355	625	1	dark	no	n/a	n/a
10/30	2	30	seine	2	no	n/a	-	none	LLL	268	725	2	bright	no	n/a	n/a
10/30	2	31	seine	2	no	n/a	-	none	LLL	281	645	1	dark	no	n/a	n/a
10/30	2	32	seine	2	no	n/a	-	none	LLL	295	570	1	dark	no	n/a	n/a
10/30	2	33	seine	2	no	n/a	-	none	LLL	304	450	1	dark	no	n/a	n/a
10/31	2	34	seine	2	no	n/a	-	none	LLL	269	625	1	blush	no	n/a	n/a
10/31	2	35	seine	2	no	n/a	-	none	LLL	323	635	1	dark	no	n/a	n/a
10/31	2	36	seine	2	no	n/a	-	none	LLL	333	655	2	blush	no	n/a	n/a
10/31	2	37	seine	2	no	n/a	-	none	LLL	334	590	1	blush	no	n/a	n/a
10/31	2	38	gillnet	3	no	n/a	-	none	LLL	353	525	1	blush	no	n/a	n/a
10/31	2	39	gillnet	3	no	n/a	-	none	LLL	363	695	1	dark	no	n/a	n/a
10/30	3	30	seine	2	no	n/a	-	none	LLL	266	660	2	blush	no	n/a	n/a
10/30	3	31	seine	2	no	n/a	-	none	LLL	285	620	1	dark	no	n/a	n/a
10/30	3	32	seine	2	no	n/a	-	none	LLL	288	625	1	blush	no	n/a	n/a
10/30	3	33	seine	2	no	n/a	-	none	LLL	305	635	2	dark	no	n/a	n/a
10/31	3	34	seine	2	no	n/a	-	none	LLL	314	545	1	blush	no	n/a	n/a
10/31	3	35	seine	2	no	n/a	-	none	LLL	324	680	2	bright	no	n/a	n/a
10/31	3	36	seine	2	no	n/a	-	none	LLL	335	615	1	dark	no	n/a	n/a
10/31	3	37	seine	2	no	n/a	-	none	LLL	334	655	2	blush	no	n/a	n/a
10/31	3	38	gillnet	3	no	n/a	-	none	LLL	354	585	1	blush	no	n/a	n/a
10/31	3	39	gillnet	3	no	n/a	-	none	LLL	364	610	2	bright	no	n/a	n/a
10/30	4	30	seine	2	no	n/a	-	none	LLL	278	505	1	blush -	no	n/a	n/a
10/30	4	31	seine	2	no	n/a	-	none	LLL	286	535	1	dark	yes	yes	n/a

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Appendix A2.—continued (Page 7 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/30	4	32	seine	2	no	n/a	-	none	LLL	296	630	1	dark	no	n/a	n/a
10/30	4	33	seine	2	no	n/a	-	none	LLL	306	620	2	bright	no	n/a	n/a
10/31	4	34	seine	2	no	n/a	-	none	LLL	315	585	1	dark	yes	yes	n/a
10/31	4	35	seine	2	no	n/a	-	none	LLL	325	665	1	dark	no	n/a	n/a
10/31	4	36	seine	2	no	n/a	-	none	LLL	336	680	2	blush	no	n/a	n/a
10/31	4	37	seine	2	no	n/a	-	none	LLL	345	555	1	bright -	no	n/a	n/a
10/31	4	38	gillnet	3	no	n/a	-	none	LLL	356	635	2	blush	no	n/a	n/a
10/31	4	39	gillnet	3	no	n/a	-	none	LLL	365	600	1	dark	no	n/a	n/a
10/30	5	29	seine	2	no	n/a	-	none	LLL	271	690	1	blush	no	n/a	n/a
10/30	5	30	seine	2	no	n/a	-	none	LLL	277	675	1	blush	yes	yes	n/a
10/30	5	31	seine	2	no	n/a	-	none	LLL	287	700	1	blush -	no	n/a	n/a
10/30	5	32	seine	2	no	n/a	-	none	LLL	297	645	2	blush	no	n/a	n/a
10/30	5	33	seine	2	no	n/a	-	none	LLL	308	500	1	bright	yes	yes	n/a
10/31	5	34	seine	2	no	n/a	-	none	LLL	316	640	2	bright	no	n/a	n/a
10/31	5	35	seine	2	no	n/a	-	none	LLL	326	635	2	blush	no	n/a	n/a
10/31	5	36	seine	2	no	n/a	-	none	LLL	337	655	1	dark	no	n/a	n/a
10/31	5	37	seine	2	no	n/a	-	none	LLL	346	565	2	blush	no	n/a	n/a
10/31	5	38	gillnet	3	no	n/a	-	none	LLL	357	660	1	dark	no	n/a	n/a
11/1	5	39	gillnet	1	no	n/a	-	none	LLL	366	650	1	blush	no	n/a	n/a
10/30	6	29	seine	2	no	n/a	-	none	LLL	272	680	1	dark	no	n/a	n/a
10/30	6	30	seine	2	no	n/a	-	none	LLL	276	625	2	blush	no	n/a	n/a
10/30	6	31	seine	2	no	n/a	-	none	LLL	289	560	1	dark	yes	yes	n/a
10/30	6	32	seine	2	no	n/a	-	none	LLL	298	590	1	dark	no	n/a	n/a
10/31	6	34	seine	2	no	n/a	-	none	LLL	317	660	1	dark	no	n/a	n/a
10/31	6	35	seine	2	no	n/a	-	none	LLL	327	650	1	dark	no	n/a	n/a
10/31	6	36	seine	2	no	n/a	-	none	LLL	338	670	2	blush	no	n/a	n/a
10/31	6	37	seine	2	no	n/a	-	none	LLL	347	520	1	dark	no	n/a	n/a
10/31	6	38	gillnet	3	no	n/a	-	none	LLL	358	625	1	dark	no	n/a	n/a
11/1	6	39	gillnet	1	no	n/a	-	none	LLL	367	700	1	blush -	no	n/a	n/a
10/30	7	29	seine	2	no	n/a	-	none	LLL	273	525	1	dark	yes	yes	n/a
10/30	7	30	seine	2	no	n/a	-	none	LLL	279	620	1	dark	no	n/a	n/a
10/30	7	31	seine	2	no	n/a	-	none	LLL	290	730	1	blush	no	n/a	n/a
10/30	7	32	seine	2	no	n/a	-	none	LLL	299	640	2	blush	no	n/a	n/a
10/30	7	33	seine	2	no	n/a	-	none	LLL	310	595	2	bright	no	n/a	n/a
10/31	7	34	seine	2	no	n/a	-	none	LLL	318	705	1	dark	no	n/a	n/a
10/31	7	35	seine	2	no	n/a	-	none	LLL	328	575	1	dark	no	n/a	n/a
10/31	7	36	seine	2	no	n/a	-	none	LLL	339	660	2	blush	no	n/a	n/a
10/31	7	37	gillnet	3	no	n/a	-	none	LLL	349	625	2	bright -	no	n/a	n/a
10/31	7	38	gillnet	3	no	n/a	-	none	LLL	359	670	2	dark	no	n/a	n/a
11/1	7	39	gillnet	1	no	n/a	-	none	LLL	368	690	1	blush -	no	n/a	n/a
10/30	8	29	seine	2	no	n/a	-	none	LLL	274	630	1	blush	no	n/a	n/a
10/30	8	30	seine	2	no	n/a	-	none	LLL	280	615	1	bright	no	n/a	n/a
10/30	8	31	seine	2	no	n/a	-	none	LLL	291	695	2	blush	no	n/a	n/a
10/30	8	32	seine	2	no	n/a	-	none	LLL	300	615	1	blush	no	n/a	n/a
10/30	8	33	seine	2	no	n/a	-	none	LLL	311	665	2	bright	no	n/a	n/a
10/31	8	34	seine	2	no	n/a	-	none	LLL	319	715	1	dark	no	n/a	n/a
10/31	8	35	seine	2	no	n/a	-	none	LLL	329	645	1	blush -	no	n/a	n/a
10/31	8	36	seine	2	no	n/a	-	none	LLL	340	565	1	dark	no	n/a	n/a
10/31	8	37	gillnet	3	no	n/a	-	none	LLL	350	650	1	blush	no	n/a	n/a
10/31	8	38	gillnet	3	no	n/a	-	none	LLL	360	535	1	dark	no	n/a	n/a
11/1	8	39	gillnet	1	no	n/a	-	none	LLL	369	545	1	blush	yes	yes	n/a
10/30	9	29	seine	2	no	n/a	-	none	LLL	275	655	1	dark	no	n/a	n/a

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Appendix A2.—continued (Page 8 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
10/30	9	30	seine	2	no	n/a	-	none	LLL	283	605	1	dark	no	n/a	n/a
10/30	9	31	seine	2	no	n/a	-	none	LLL	292	590	1	dark	yes	yes	n/a
10/30	9	32	seine	2	no	n/a	-	none	LLL	302	575	2	blush	no	n/a	n/a
10/31	9	33	HL	2	no	n/a	-	none	LLL	312	675	1	bright	no	n/a	n/a
10/31	9	34	seine	2	no	n/a	-	none	LLL	320	705	2	bright	no	n/a	n/a
10/31	9	35	seine	2	no	n/a	-	none	LLL	330	665	2	bright -	no	n/a	n/a
10/31	9	36	seine	2	no	n/a	-	none	LLL	341	625	1	dark	no	n/a	n/a
10/31	9	37	gillnet	3	no	n/a	-	none	LLL	307	665	2	blush	no	n/a	n/a
10/31	9	38	gillnet	3	no	n/a	-	none	LLL	361	605	1	dark spent	no	n/a	n/a
10/30	10	29	seine	2	no	n/a	-	none	LLL	270	635	2	blush -	no	n/a	n/a
10/30	10	30	seine	2	no	n/a	-	none	LLL	284	665	1	dark	no	n/a	n/a
10/30	10	31	seine	2	no	n/a	-	none	LLL	293	640	1	dark	no	n/a	n/a
10/30	10	32	seine	2	no	n/a	-	none	LLL	301	680	2	blush	no	n/a	n/a
10/31	10	34	seine	2	no	n/a	-	none	LLL	321	630	2	bright	yes	yes	n/a
10/31	10	35	seine	2	no	n/a	-	none	LLL	331	665	1	blush	no	n/a	n/a
10/31	10	36	seine	2	no	n/a	-	none	LLL	343	555	1	dark	no	n/a	n/a
10/31	10	37	gillnet	3	no	n/a	-	none	LLL	351	645	2	bright	no	n/a	n/a
10/31	10	38	gillnet	3	no	n/a	-	none	LLL	362	620	1	blush	no	n/a	n/a
10/31	-	-	gillnet	3	yes	258	6	RUU	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	195	6	-	-	-	-	-	blush	-	-	-
10/30	-	-	seine	2	yes	102	3	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	180	5	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	30	3	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	255	6	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	197	6	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	134	3	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	243	6	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	173	5	-	-	-	-	-	-	-	-	-
10/31	-	-	seine	2	yes	240	6	-	-	-	-	-	-	-	-	-
10/30	-	-	seine	2	yes	129	3	-	-	-	-	-	-	-	-	-
10/31	-	-	seine	2	yes	154	5	RL	-	-	-	-	-	-	-	-
10/30	-	-	HL	3	yes	237	6	-	-	-	-	-	bright	-	-	-
10/31	-	-	seine	2	yes	174	5	RL	-	-	-	-	dark	-	-	-
10/30	-	-	seine	2	yes	243	6	-	-	-	-	-	dark	-	-	-
11/1	-	-	gillnet	1	yes	62	3	UR	-	-	-	-	blush	-	-	-
11/1	-	-	gillnet	1	yes	14	2	LL	-	-	-	-	blush -	-	-	-
10/31	-	-	seine	2	yes	181	6	LUU	-	-	-	-	-	-	-	-
11/9	1	40	seine	2	no	n/a	-	none	RUU	373	650	1	dark	no	n/a	n/a
11/9	1	41	seine	2	no	n/a	-	none	RUU	382	645	1	dark	no	n/a	n/a
11/9	1	42	seine	2	no	n/a	-	none	RUU	393	695	1	blush	no	n/a	n/a
11/9	1	43	seine	2	no	n/a	-	none	RUU	403	645	2	dark	no	n/a	n/a
11/9	1	44	seine	2	no	n/a	-	none	RUU	413	715	2	blush	no	n/a	n/a
11/9	2	40	seine	2	no	n/a	-	none	RUU	374	655	1	dark	no	n/a	n/a
11/9	2	41	seine	2	no	n/a	-	none	RUU	383	680	2	blush	no	n/a	n/a
11/9	2	42	seine	2	no	n/a	-	none	RUU	394	620	1	dark	no	n/a	n/a
11/9	2	43	seine	2	no	n/a	-	none	RUU	404	475	1	dark	no	n/a	n/a
11/9	2	44	seine	2	no	n/a	-	none	RUU	414	690	1	blush	no	n/a	n/a
11/9	3	40	seine	2	no	n/a	-	none	RUU	375	685	2	blush	no	n/a	n/a
11/9	3	41	seine	2	no	n/a	-	none	RUU	384	570	1	dark	no	n/a	n/a
11/9	3	42	seine	2	no	n/a	-	none	RUU	395	640	1	dark	no	n/a	n/a
11/9	3	43	seine	2	no	n/a	-	none	RUU	405	635	2	dark	no	n/a	n/a
11/9	4	40	seine	2	no	n/a	-	none	RUU	371	625	1	dark	no	n/a	n/a

-continued-

Appendix A2.—continued (Page 9 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/9	4	41	seine	2	no	n/a	-	none	RUU	385	640	2	bright	no	n/a	n/a
11/9	4	42	seine	2	no	n/a	-	none	RUU	396	625	1	blush	no	n/a	n/a
11/9	4	43	seine	2	no	n/a	-	none	RUU	406	680	2	blush	no	n/a	n/a
11/9	5	40	seine	2	no	n/a	-	none	RUU	376	690	1	dark	yes	yes	n/a
11/9	5	41	seine	2	no	n/a	-	none	RUU	386	610	1	blush	no	n/a	n/a
11/9	5	42	seine	2	no	n/a	-	none	RUU	397	645	2	blush	no	n/a	n/a
11/9	5	43	seine	2	no	n/a	-	none	RUU	407	425	1	blush	no	n/a	n/a
11/9	6	40	seine	2	no	n/a	-	none	RUU	377	670	2	gray	no	n/a	n/a
11/9	6	41	seine	2	no	n/a	-	none	RUU	387	630	1	dark	no	n/a	n/a
11/9	6	42	seine	2	no	n/a	-	none	RUU	398	650	1	blush	no	n/a	n/a
11/9	6	43	seine	2	no	n/a	-	none	RUU	408	490	1	dark	no	n/a	n/a
11/9	7	40	seine	2	no	n/a	-	none	RUU	378	680	1	dark	no	n/a	n/a
11/9	7	41	seine	2	no	n/a	-	none	RUU	388	705	1	bright	no	n/a	n/a
11/9	7	42	seine	2	no	n/a	-	none	RUU	399	705	2	dark	yes	yes	n/a
11/9	7	43	seine	2	no	n/a	-	none	RUU	409	730	2	bright	no	n/a	n/a
11/9	8	40	seine	2	no	n/a	-	none	RUU	379	685	1	blush	no	n/a	n/a
11/9	8	41	seine	2	no	n/a	-	none	RUU	390	680	1	blush	no	n/a	n/a
11/9	8	42	seine	2	no	n/a	-	none	RUU	400	665	2	spawnout	no	n/a	n/a
11/9	8	43	seine	2	no	n/a	-	none	RUU	410	650	2	blush	no	n/a	n/a
11/9	9	39	seine	2	no	n/a	-	none	RUU	370	505	2	dark	no	n/a	n/a
11/9	9	40	seine	2	no	n/a	-	none	RUU	380	560	1	blush	no	n/a	n/a
11/9	9	41	seine	2	no	n/a	-	none	RUU	391	695	1	dark	no	n/a	n/a
11/9	9	42	seine	2	no	n/a	-	none	RUU	401	675	1	dark	no	n/a	n/a
11/9	9	43	seine	2	no	n/a	-	none	RUU	411	640	2	bright	no	n/a	n/a
11/9	10	39	seine	2	no	n/a	-	none	RUU	372	705	1	blush	no	n/a	n/a
11/9	10	40	seine	2	no	n/a	-	none	RUU	381	640	2	blush	no	n/a	n/a
11/9	10	41	seine	2	no	n/a	-	none	RUU	392	645	1	dark	no	n/a	n/a
11/9	10	42	seine	2	no	n/a	-	none	RUU	402	675	2	dark	no	n/a	n/a
11/9	10	43	seine	2	no	n/a	-	none	RUU	412	680	2	bright	no	n/a	n/a
11/9	-	-	seine	2	yes	325	7	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	296	7	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	174	5	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	343	7	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	193	6	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	175	5	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	14	2	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	353	7	none	-	-	-	-	LPS	-	-	-
11/9	-	-	seine	2	yes	145	5	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	272	7	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	40	3	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	319	7	none	-	-	-	-	-	-	-	-
11/9	-	-	seine	2	yes	250	6	none	-	-	-	-	-	-	-	-
11/15	1	45	HL	1	no	n/a	-	none	RLL	422	595	1	dark	no	n/a	n/a
11/16	1	46	seine	2	no	n/a	-	none	RLL	432	690	1	dark	no	n/a	n/a
11/16	1	47	seine	2	no	n/a	-	none	RLL	443	640	1	blush	no	n/a	n/a
11/16	1	48	seine	2	no	n/a	-	none	RLL	453	555	1	dark	no	n/a	n/a
11/16	1	49	seine	2	no	n/a	-	none	RLL	464	450	1	dark	no	n/a	n/a
11/16	1	50	seine	2	no	n/a	-	none	RLL	474	645	1	dark +	yes	yes	n/a
11/16	1	51	seine	2	no	n/a	-	none	RLL	486	655	1	blush	no	n/a	n/a
11/17	1	52	HL	2	no	n/a	-	none	RLL	497	695	1	dark	no	n/a	n/a
11/17	1	53	seine	2	no	n/a	-	none	RLL	505	535	1	dark	yes	yes	n/a
11/17	1	54	seine	2	no	n/a	-	none	RLL	515	615	2	LPS	no	n/a	n/a

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Appendix A2.—continued (Page 10 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/17	1	55	seine	2	no	n/a	-	none	RLL	525	645	2	blush	yes	yes	n/a
11/15	2	45	HL	1	no	n/a	-	none	RLL	423	645	1	blush	no	n/a	n/a
11/16	2	46	seine	2	no	n/a	-	none	RLL	434	705	1	dark	no	n/a	n/a
11/16	2	47	seine	2	no	n/a	-	none	RLL	444	665	1	blush	no	n/a	n/a
11/16	2	48	seine	2	no	n/a	-	none	RLL	454	725	1	blush	no	n/a	n/a
11/16	2	49	seine	2	no	n/a	-	none	RLL	465	565	1	blush	no	n/a	n/a
11/16	2	50	seine	2	no	n/a	-	none	RLL	475	650	1	dark	no	n/a	n/a
11/16	2	51	seine	2	no	n/a	-	none	RLL	487	665	2	dark	no	n/a	n/a
11/17	2	52	seine	2	no	n/a	-	none	RLL	500	645	1	blush	no	n/a	n/a
11/17	2	53	seine	2	no	n/a	-	none	RLL	506	605	2	blush	no	n/a	n/a
11/17	2	54	seine	2	no	n/a	-	none	RLL	516	685	2	blush	no	n/a	n/a
11/17	2	55	seine	2	no	n/a	-	none	RLL	526	675	1	blush	no	n/a	n/a
11/14	3	44	seine	3	no	n/a	-	none	RLL	415	710	2	dark	no	n/a	n/a
11/15	3	45	HL	1	no	n/a	-	none	RLL	424	665	1	blush	no	n/a	n/a
11/16	3	46	seine	2	no	n/a	-	none	RLL	435	645	2	dark	no	n/a	n/a
11/16	3	47	seine	2	no	n/a	-	none	RLL	445	660	2	blush	no	n/a	n/a
11/16	3	48	seine	2	no	n/a	-	none	RLL	455	655	1	dark	no	n/a	n/a
11/16	3	49	seine	2	no	n/a	-	none	RLL	466	670	1	blush	no	n/a	n/a
11/16	3	50	seine	2	no	n/a	-	none	RLL	463	715	1	dark+	no	n/a	n/a
11/16	3	51	gillnet	3	no	n/a	-	none	RLL	488	645	2	blush	no	n/a	n/a
11/17	3	52	seine	2	no	n/a	-	none	RLL	499	680	2	blush	no	n/a	n/a
11/17	3	53	seine	2	no	n/a	-	none	RLL	507	665	1	blush	no	n/a	n/a
11/17	3	54	seine	2	no	n/a	-	none	RLL	517	635	2	blush	no	n/a	n/a
11/17	3	55	seine	2	no	n/a	-	none	RLL	527	635	2	blush	no	n/a	n/a
11/14	4	44	seine	3	no	n/a	-	none	RLL	416	660	2	dark	no	n/a	n/a
11/15	4	45	HL	1	no	n/a	-	none	RLL	425	550	1	blush	no	n/a	n/a
11/16	4	46	seine	2	no	n/a	-	none	RLL	436	645	2	blush	no	n/a	n/a
11/16	4	47	seine	2	no	n/a	-	none	RLL	446	570	1	dark	no	n/a	n/a
11/16	4	48	seine	2	no	n/a	-	none	RLL	456	570	1	dark	no	n/a	n/a
11/16	4	49	seine	2	no	n/a	-	none	RLL	467	705	1	blush	no	n/a	n/a
11/16	4	50	seine	2	no	n/a	-	none	RLL	476	640	1	dark	no	n/a	n/a
11/16	4	51	gillnet	3	no	n/a	-	none	RLL	489	655	2	blush	no	n/a	n/a
11/17	4	52	seine	2	no	n/a	-	none	RLL	483	625	1	blush	no	n/a	n/a
11/17	4	53	seine	2	no	n/a	-	none	RLL	508	590	1	blush	no	n/a	n/a
11/17	4	54	seine	2	no	n/a	-	none	RLL	518	655	1	blush	no	n/a	n/a
11/17	4	55	gillnet	3	no	n/a	-	none	RLL	528	665	2	blush	no	n/a	n/a
11/14	5	44	seine	3	no	n/a	-	none	RLL	417	615	1	dark	no	n/a	n/a
11/15	5	45	HL	1	no	n/a	-	none	RLL	426	580	2	blush	no	n/a	n/a
11/16	5	46	seine	2	no	n/a	-	none	RLL	437	520	1	spawnout	no	n/a	n/a
11/16	5	47	seine	2	no	n/a	-	none	RLL	447	575	1	dark	no	n/a	n/a
11/16	5	48	seine	2	no	n/a	-	none	RLL	457	700	1	dark ripe	no	n/a	n/a
11/16	5	49	seine	2	no	n/a	-	none	RLL	468	670	1	blush	no	n/a	n/a
11/16	5	50	seine	2	no	n/a	-	none	RLL	477	660	1	blush	no	n/a	n/a
11/16	5	51	gillnet	3	no	n/a	-	none	RLL	490	655	1	blush	yes	yes	n/a
11/17	5	52	seine	2	no	n/a	-	none	RLL	482	670	1	dark	no	n/a	n/a
11/17	5	53	seine	2	no	n/a	-	none	RLL	509	685	2	bright-	no	n/a	n/a
11/17	5	54	seine	2	no	n/a	-	none	RLL	519	660	2	bright	no	n/a	n/a
11/17	5	55	gillnet	3	no	n/a	-	none	RLL	529	490	1	dark	no	n/a	n/a
11/14	6	44	seine	3	no	n/a	-	none	RLL	418	605	1	dark	no	n/a	n/a
11/16	6	45	seine	2	no	n/a	-	none	RLL	427	660	2	bright	no	n/a	n/a
11/16	6	46	seine	2	no	n/a	-	none	RLL	438	685	2	blush	no	n/a	n/a
11/16	6	47	seine	2	no	n/a	-	none	RLL	448	530	1	dark	no	n/a	n/a

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Appendix A2.—continued (Page 11 of 15).

Date	Fish #	Card #	Gear	Loca- tion	Recap- ture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/16	6	48	seine	2	no	n/a	-	none	RLL	458	715	1	blush	no	n/a	n/a
11/16	6	49	seine	2	no	n/a	-	none	RLL	469	680	1	blush	no	n/a	n/a
11/16	6	50	seine	2	no	n/a	-	none	RLL	478	665	2	blush	no	n/a	n/a
11/16	6	51	seine	1	no	n/a	-	none	RLL	491	635	1	dark	no	n/a	n/a
11/17	6	52	seine	2	no	n/a	-	none	RLL	484	625	1	dark	no	n/a	n/a
11/17	6	53	seine	2	no	n/a	-	none	RLL	510	670	2	blush	no	n/a	n/a
11/17	6	54	seine	2	no	n/a	-	none	RLL	520	705	2	blush	yes	yes	n/a
11/17	6	55	gillnet	3	no	n/a	-	none	RLL	530	660	2	dark	no	n/a	n/a
11/14	7	44	seine	3	no	n/a	-	none	RLL	419	665	2	dark	no	n/a	n/a
11/16	7	45	seine	2	no	n/a	-	none	RLL	428	605	1	dark	no	n/a	n/a
11/16	7	46	seine	2	no	n/a	-	none	RLL	439	645	1	dark	no	n/a	n/a
11/16	7	47	seine	2	no	n/a	-	none	RLL	449	660	2	bright	no	n/a	n/a
11/16	7	48	seine	2	no	n/a	-	none	RLL	459	625	1	dark	no	n/a	n/a
11/16	7	49	seine	2	no	n/a	-	none	RLL	470	660	2	blush	no	n/a	n/a
11/16	7	50	seine	2	no	n/a	-	none	RLL	479	675	2	blush	no	n/a	n/a
11/17	7	51	seine	2	no	n/a	-	none	RLL	492	665	1	dark	no	n/a	n/a
11/17	7	52	seine	2	no	n/a	-	none	RLL	501	655	1	dark	no	n/a	n/a
11/17	7	53	seine	2	no	n/a	-	none	RLL	511	635	1	bright	no	n/a	n/a
11/17	7	54	seine	2	no	n/a	-	none	RLL	521	675	1	blush	no	n/a	n/a
11/17	7	55	gillnet	3	no	n/a	-	none	RLL	531	675	2	dark	no	n/a	n/a
11/14	8	44	seine	3	no	n/a	-	none	RLL	420	660	1	dark	no	n/a	n/a
11/16	8	45	seine	2	no	n/a	-	none	RLL	429	605	2	bright	yes	yes	n/a
11/16	8	46	seine	2	no	n/a	-	none	RLL	440	645	1	blush	no	n/a	n/a
11/16	8	47	seine	2	no	n/a	-	none	RLL	450	635	2	bright	no	n/a	n/a
11/16	8	48	seine	2	no	n/a	-	none	RLL	460	695	2	blush	no	n/a	n/a
11/16	8	49	seine	2	no	n/a	-	none	RLL	471	640	2	bright	no	n/a	n/a
11/16	8	50	seine	2	no	n/a	-	none	RLL	480	625	1	dark	no	n/a	n/a
11/17	8	51	HL	2	no	n/a	-	none	RLL	493	705	1	blush	no	n/a	n/a
11/17	8	52	seine	2	no	n/a	-	none	RLL	502	630	1	blush	no	n/a	n/a
11/17	8	53	seine	2	no	n/a	-	none	RLL	512	650	1	blush	yes	yes	n/a
11/17	8	54	seine	2	no	n/a	-	none	RLL	522	680	2	bright	yes	yes	n/a
11/17	8	55	gillnet	3	no	n/a	-	none	RLL	532	550	1	dark	no	n/a	n/a
11/14	9	44	seine	3	no	n/a	-	none	killed	killed	570	1	dark	yes	no	98112
11/16	9	45	seine	2	no	n/a	-	none	RLL	430	635	1	dark	yes	yes	n/a
11/16	9	46	seine	2	no	n/a	-	none	RLL	441	710	1	blush	no	n/a	n/a
11/16	9	47	seine	2	no	n/a	-	none	RLL	451	625	2	blush	no	n/a	n/a
11/16	9	48	seine	2	no	n/a	-	none	RLL	461	630	1	dark	no	n/a	n/a
11/16	9	49	seine	2	no	n/a	-	none	RLL	472	675	1	dark	no	n/a	n/a
11/16	9	50	seine	2	no	n/a	-	none	RLL	481	660	1	blush	no	n/a	n/a
11/17	9	51	HL	2	no	n/a	-	none	RLL	494	705	1	dark	no	n/a	n/a
11/17	9	52	seine	2	no	n/a	-	none	RLL	503	665	2	dark	no	n/a	n/a
11/17	9	53	seine	2	no	n/a	-	none	RLL	513	715	2	-	no	n/a	n/a
11/17	9	54	seine	2	no	n/a	-	none	RLL	523	670	2	bright	no	n/a	n/a
11/15	10	44	HL	1	no	n/a	-	none	RLL	421	625	1	dark	no	n/a	n/a
11/16	10	45	seine	2	no	n/a	-	none	RLL	431	670	2	blush	no	n/a	n/a
11/16	10	46	seine	2	no	n/a	-	none	RLL	442	605	1	blush	no	n/a	n/a
11/16	10	47	seine	2	no	n/a	-	none	RLL	452	650	2	blush	no	n/a	n/a
11/16	10	48	seine	2	no	n/a	-	none	RLL	462	590	1	dark	no	n/a	n/a
11/16	10	49	seine	2	no	n/a	-	none	RLL	473	690	1	bright	yes	yes	n/a
11/16	10	50	seine	2	no	n/a	-	none	RLL	485	650	1	blush	no	n/a	n/a
11/17	10	51	HL	2	no	n/a	-	none	RLL	495	555	2	blush	no	n/a	n/a
11/17	10	52	seine	2	no	n/a	-	none	RLL	504	635	2	dark	no	n/a	n/a

-continued-

Appendix A2.—continued (Page 12 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/17	10	53	seine	2	no	n/a	-	none	RLL	514	675	2	bright-	no	n/a	n/a
11/17	10	54	seine	2	no	n/a	-	none	RLL	524	640	2	bright	no	n/a	n/a
11/16	-	-	seine	2	yes	145	5	RLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	1	yes	110	3	RU	-	-	-	-	-	-	-	-
11/15	-	-	HL	1	yes	143	3	RU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	401	8	RUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	296	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	388	8	RUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	198	6	LUU	-	-	-	-	-	-	-	-
11/17	-	-	seine	2	yes	398	8	RUU	-	-	-	-	-	-	-	-
11/17	-	-	seine	2	yes	330	7	LLL	-	-	-	-	-	-	-	-
11/17	-	-	carc	1	yes	336	7	LLL	-	carcass	-	-	-	-	-	-
11/15	-	-	HL	1	yes	362	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	346	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	316	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	215	6	LUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	372	8	RUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	319	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	272	7	LLL	-	-	-	-	-	-	-	-
11/17	-	-	gillnet	3	yes	135	3	RU	-	-	-	-	-	-	-	-
11/17	-	-	gillnet	3	yes	409	8	RUU	-	-	-	-	-	-	-	-
11/17	-	-	gillnet	3	yes	219	6	LUU	-	-	-	-	dark	-	-	-
11/17	-	-	seine	2	yes	234	6	LUU	-	-	-	-	-	-	-	-
11/17	-	-	seine	2	yes	253	6	LUU	-	-	-	-	-	-	-	-
11/17	-	-	seine	2	yes	372	8	RUU	-	-	-	-	-	-	-	-
11/16	-	-	gillnet	3	yes	231	6	LUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	128	3	RU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	244	6	LUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	285	7	LLL	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	247	6	LUU	-	-	-	-	-	-	-	-
11/16	-	-	seine	2	yes	279	7	LLL	-	-	-	-	-	-	-	-
11/20	1	56	seine	2	no	n/a	-	none	LUL	535	715	1	dark	no	n/a	n/a
11/20	1	57	seine	2	no	n/a	-	none	LUL	545	665	2	dark	no	n/a	n/a
11/20	1	58	seine	3	no	n/a	-	none	LUL	547	595	1	dark	no	n/a	n/a
11/20	2	56	seine	2	no	n/a	-	none	LUL	536	710	1	dark	no	n/a	n/a
11/20	2	57	seine	2	no	n/a	-	none	LUL	546	635	2	blush-	no	n/a	n/a
11/20	2	58	gillnet	3	no	n/a	-	none	LUL	556	560	1	LPS	no	n/a	n/a
11/20	3	56	seine	2	no	n/a	-	none	LUL	537	675	2	blush	no	n/a	n/a
11/20	3	57	seine	2	no	n/a	-	none	LUL	547	660	2	blush-	no	n/a	n/a
11/20	3	58	gillnet	3	no	n/a	-	none	LUL	557	655	2	dark	no	n/a	n/a
11/20	4	56	seine	2	no	n/a	-	none	LUL	538	670	2	blush	no	n/a	n/a
11/20	4	57	seine	2	no	n/a	-	none	LUL	548	660	2	dark	no	n/a	n/a
11/21	4	58	carc	1	no	n/a	-	none	LUL	carcass	-	2	carcass	no	n/a	n/a
11/20	5	56	seine	2	no	n/a	-	none	LUL	539	605	2	bright	no	n/a	n/a
11/20	5	57	seine	2	no	n/a	-	none	LUL	549	715	1	dark	no	n/a	n/a
11/21	5	58	HL	1	no	n/a	-	none	LUL	558	625	1	dark	no	n/a	n/a
11/20	6	56	seine	2	no	n/a	-	none	LUL	540	680	2	dark	no	n/a	n/a
11/20	6	57	seine	2	no	n/a	-	none	LUL	550	645	2	blush-	no	n/a	n/a
11/21	6	58	HL	1	no	n/a	-	none	LUL	559	610	1	dark	no	n/a	n/a
11/20	7	56	seine	2	no	n/a	-	none	LUL	541	545	1	dark	no	n/a	n/a
11/20	7	57	seine	2	no	n/a	-	none	LUL	551	645	2	blush-	no	n/a	n/a
11/21	7	58	HL	1	no	n/a	-	none	LUL	560	705	1	dark	no	n/a	n/a

-continued-

Appendix A2.—continued (Page 13 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/20	8	56	seine	2	no	n/a	-	none	LUL	542	645	2	dark	yes	yes	n/a
11/20	8	57	seine	2	no	n/a	-	none	LUL	552	620	2	bright	no	n/a	n/a
11/21	8	58	HL	1	no	n/a	-	none	LUL	561	680	2	dark	no	n/a	n/a
11/20	9	55	seine	2	no	n/a	-	none	LUL	533	640	1	dark	yes	yes	n/a
11/20	9	56	seine	2	no	n/a	-	none	LUL	543	685	1	dark	no	n/a	n/a
11/20	9	57	seine	2	no	n/a	-	none	LUL	553	695	1	blush	no	n/a	n/a
11/21	9	58	HL	1	no	n/a	-	none	LUL	562	695	1	dark	no	n/a	n/a
11/20	10	55	seine	2	no	n/a	-	none	LUL	534	590	1	dark	yes	yes	n/a
11/20	10	56	seine	2	no	n/a	-	none	LUL	544	675	1	dark	no	n/a	n/a
11/20	10	57	seine	3	no	n/a	-	none	LUL	555	620	2	bright	no	n/a	n/a
11/20	-	-	gillnet	3	yes	509	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	272	7	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	415	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	257	6	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	209	6	LUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	460	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	464	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	419	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	525	9	-	-	-	-	-	-	-	-	-
11/20	-	-	gillnet	3	yes	145	5	-	-	-	-	-	LPS	-	-	-
11/20	-	-	seine	2	yes	369	7	LLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	156	5	RL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	444	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	519	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	244	6	LUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	219	6	LUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	386	8	RUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	475	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	520	9	RLL	-	-	-	-	-	-	-	-
11/21	-	-	HL	1	yes	214	6	LUU	-	-	-	-	dark	-	-	-
11/21	-	-	HL	1	yes	88	3	RU	-	-	-	-	dark	-	-	-
11/21	-	-	HL	1	yes	314	7	LLL	-	-	-	-	dark	-	-	-
11/20	-	-	gillnet	3	yes	523	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	gillnet	3	yes	485	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	232	6	LUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	250	6	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	110	3	RU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	247	6	ULL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	495	9	RUU	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	159	5	RL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	417	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	459	9	RLL	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	401	8	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	493	9	-	-	-	-	-	-	-	-	-
11/20	-	-	seine	2	yes	491	9	RLL	-	-	-	-	-	-	-	-
11/28	1	59	seine	2	no	n/a	-	none	RUL	564	615	1	LPS	no	n/a	n/a
11/28	1	60	seine	2	no	n/a	-	none	RUL	574	625	1	LPS	no	n/a	n/a
11/28	1	61	seine	2	no	n/a	-	none	RUL	584	670	2	blush	no	n/a	n/a
11/28	2	59	seine	2	no	n/a	-	none	RUL	565	555	1	LPS	no	n/a	n/a
11/28	2	60	seine	2	no	n/a	-	none	RUL	575	530	1	blush	no	n/a	n/a
11/28	2	61	seine	2	no	n/a	-	none	RUL	585	690	1	dark	no	n/a	n/a
11/28	3	59	seine	2	no	n/a	-	none	RUL	566	605	1	LPS	no	n/a	n/a

-continued-

Appendix A2.-continued (Page 14 of 15).

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
11/28	3	60	seine	2	no	n/a	-	none	RUL	576	645	2	dark	no	n/a	n/a
11/28	4	59	seine	2	no	n/a	-	none	RUL	567	640	2	bright	no	n/a	n/a
11/28	5	59	seine	2	no	n/a	-	none	RUL	568	640	2	blush	no	n/a	n/a
11/28	5	60	HL	1	no	n/a	-	none	RUL	578	710	1	dark	no	n/a	n/a
11/28	6	59	seine	2	no	n/a	-	none	LUL	569	490	2	blush	no	n/a	n/a
11/28	6	60	HL	1	no	n/a	-	none	RUL	579	595	1	dark	no	n/a	n/a
11/28	7	59	seine	2	no	n/a	-	none	RUL	570	660	2	blush	no	n/a	n/a
11/28	7	60	HL	1	no	n/a	-	none	RUL	580	625	1	dark	no	n/a	n/a
11/28	8	59	seine	2	no	n/a	-	none	RUL	571	665	1	dark	no	n/a	n/a
11/28	8	60	HL	1	no	n/a	-	none	RUL	581	620	2	LPS(blush)	no	n/a	n/a
11/28	9	59	seine	2	no	n/a	-	none	RUL	572	605	2	bright-	no	n/a	n/a
11/28	9	60	HL	1	no	n/a	-	none	RUL	582	685	1	dark	no	n/a	n/a
11/28	10	58	seine	2	no	n/a	-	none	RUL	563	705	2	LPS	no	n/a	n/a
11/28	10	59	seine	2	no	n/a	-	none	RUL	573	665	1	blush-	no	n/a	n/a
11/28	10	60	HL	1	no	n/a	-	none	RUL	583	645	1	dark	no	n/a	n/a
11/28	-	-	seine	2	yes	409	8	RUU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	403	8	RUU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	432	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	466	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	453	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	455	9	RRL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	159	5	-	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	247	6	LUU	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	388	8	RUU	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	524	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	493	9	-	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	270	7	LLL	-	-	-	-	-	-	-	-
11/28	-	-	HL	1	yes	384	8	RUU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	443	9	-	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	110	3	RU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	390	8	RUU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	497	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	415	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	529	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	452	9	RLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	540	10	LUL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	353	7	LLL	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	212	6	RUU	-	-	-	-	-	-	-	-
11/28	-	-	seine	2	yes	428	9	RLL	-	-	-	-	LPS	-	-	-
12/4	3	61	HL	1	no	n/a	-	none	LU	586	650	2	dark	no	n/a	n/a
12/4	4	61	HL	1	no	n/a	-	none	LU	587	635	2	LPS(blush)	no	n/a	n/a
12/4	5	61	HL	1	no	n/a	-	none	LU	588	585	1	dark	no	n/a	n/a
12/4	-	-	HL	1	yes	313	7	LLL	-	-	-	-	-	-	-	-
12/4	-	-	HL	1	yes	256	6	LUU	-	-	-	-	-	-	-	-
12/4	-	-	HL	1	yes	312	7	LLL	-	-	-	-	dark	-	-	-
12/4	-	-	HL	1	yes	384	8	-	-	-	-	-	dark	-	-	-
12/4	-	-	HL	1	yes	399	8	RUU	-	-	-	-	LPS	-	-	-
12/12	1	62	carc	3	no	n/a	-	none	RMM carcass	570		1	carcass	no	n/a	n/a
12/12	6	61	HL	1	no	n/a	-	none	RMM killed	630		2	LPS	no	n/a	n/a
12/12	7	61	HL	1	no	n/a	-	none	RMM killed	665		1	LPS	no	n/a	n/a
12/12	8	61	seine	2	no	n/a	-	none	RMM	589	615	1	LPS	no	n/a	n/a
12/12	9	61	seine	2	no	n/a	-	none	RMM	590	680	-	-	no	n/a	n/a

-continued-

**Appendix A2.—continued (Page 15 of 15).**

Date	Fish #	Card #	Gear	Location	Recapture (y or n)	Recap tag #	Week recap was tagged	Marks observed	Marks given	Tag #	Length	Sex	Condition	CWT AD clip	Internal tag detected	Cinch tag #
12/12	10	61	seine	1	no	n/a	-	none	RMM	591	735	1	dark	no	n/a	-
12/12	-	-	seine	2	yes	555	10	-	-	-	-	-	-	-	-	-
12/12	-	-	seine	2	yes	586	12	-	-	-	-	-	-	-	-	-
12/12	-	-	seine	1	yes	313	7	LLL	-	-	-	-	LPS	-	-	-
12/12	-	-	seine	2	yes	280	7	LLL	-	-	-	-	LPS	-	-	-
12/12	-	-	seine	2	yes	544	10	-	-	-	-	-	LPS	-	-	-
12/12	-	-	seine	2	yes	320	7	LLL	-	-	-	-	LPS	-	-	-

**Appendix A3.—Detection of size-selectivity in sampling and its effects on estimation of abundance and age and size composition.**

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**RESULTS OF HYPOTHESIS TESTS, K-S on lengths of fish marked during the First Event and Recaptured during the Second Event:**

**RESULTS OF HYPOTHESIS TESTS, K-S on lengths of fish Captured during the First Event and Captured during the Second Event:**

*Case I:*

Accept  $H_0$

Accept  $H_0$

There is no size-selectivity during marking or recapture, gear types, or locations.

*Case II:*

Accept  $H_0$

Reject  $H_0$

There is no size-selectivity during recapture but there is during marking.

*Case III:*

Reject  $H_0$

Accept  $H_0$

There is size-selectivity during both marking and recapture, between all gear types, or all locations.

*Case IV:*

Reject  $H_0$

Reject  $H_0$

There is size-selectivity during recapture; the status of size-selectivity during marking is unknown.

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Case I: Calculate one unstratified abundance estimate, and pool lengths, sexes, and ages from both marking and recapture events to improve precision of proportions in estimates of composition.

Case II: Calculate one unstratified abundance estimate, and only use lengths, sexes, and ages from recapture to estimate proportions in compositions.

Case III: Completely stratify both sampling events, and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Pool lengths, ages, and sexes from both sampling events to improve precision of proportions in estimates of composition, and apply formulae to correct for size bias to the pooled data (p. 17).

Case IV: Completely stratify both sampling events and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Use lengths, ages, and sexes from only recapture to estimate proportions in compositions, and apply formulae to correct for size bias to the data from recapture.

Whenever the results of the hypothesis tests indicate that there has been size-selective sampling (Case III or IV), there is still a chance that the bias in estimates of abundance from this phenomenon is negligible. Produce a second estimate of abundance by not stratifying the data as recommended above. If the two estimates (stratified and unbiased vs. biased and unstratified) are dissimilar, the bias is meaningful, the stratified estimate should be used, and data on compositions should be analyzed as described above for Cases III or IV. However, if the two estimates of abundance are similar, the bias is negligible in the UNSTRATIFIED estimate, and analysis can proceed as if there were no size-selective sampling during Event 2 (Cases I or II).

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**Appendix A4.–Computer data files on 1999 Nakwasina River coho salmon smolt and subsequent estimates of 2000 Nakwasina River adult coho salmon run parameters.**

<b>File name</b>	<b>Description</b>
00Nak.xls	Spreadsheet containing all coho fishery recovery data, fishery data, smolt and adult AWL data, and calculations to estimate smolt abundance, theta, and other coho run parameters.
00EscapEst.xls	Spreadsheet containing the Jolly-Seber mark recapture estimate of escapement.
00NakKS	Spreadsheet containing the Kolmogorov-Smirnov (K-S) 2-sample test results with figures and tables.
00NakEscRaw.xls	Spreadsheet containing raw escapement data in the Nakwasina River in 2000.
00NakApp.xls	Spreadsheet containing summarized appendix tables
00NakGPX.	Spreadsheet containing figures, tables, and analysis
RECAP.exe	Analysis program used to estimate escapement of coho salmon in 2000