Fishery Data Series No. 17-10

Deshka River Chinook and Coho Salmon Escapement Studies, 2005–2014

by

Daryl Lescanec

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 17-10

DESHKA RIVER CHINOOK AND COHO SALMON ESCAPEMENT STUDIES, 2005–2014

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) annual escapements to the Deshka River were assessed from 2005 to 2014 to provide escapement counts and stock-specific biological information. Both Chinook and coho salmon were counted at a weir operated from approximately late May through mid-September each year, except for 2006 when coho salmon were counted through 16 August. The mean annual Chinook salmon weir count was 19,366 fish. Age composition for Chinook salmon averaged 30.8% age-1.2 fish, 50.4 % age-1.3 fish, and 16.7% age-1.4 fish. On average, females composed 48.3% of the runs. Chinook salmon run timing was consistent until 2013 and then quite variable in the last 2 years. On average, 50% (SE 8.1%) of the fish passed upstream of the weir by 20 June. Chinook salmon escapement goals were met for the years 2005–2007 and 2010–2014. The 2005–2014 mean annual coho salmon weir count was 18,684 fish. Above average coho salmon runs were observed in 2005 and 2006, whereas 2012 was the lowest count recorded since the weir was first operated in 1995. High water and a flood precluded complete coho salmon weir counts 2 of the 10 years. Coho salmon run timing was inconsistent (SD = 8 days at mean 50th percentile).

Key words: Deshka River, Chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, resistance board weir, weir count, escapement, age composition, mean length-at-age

INTRODUCTION

The Deshka River is one of the Northern Cook Inlet Management Area's (NCIMA) most popular fishing locations. The 1977–2004 average number of angler-days spent fishing the Deshka River for all species combined was 21,933 angler-days. Only during the years 1995–1997, when the majority of the Chinook salmon fishery was closed, has sport fishing effort for the Deshka River been below 10,000 angler days since 1979 (Table 1). Anglers fish the Deshka River primarily for Chinook salmon (*Oncorhynchus tshawytscha*) but also for coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), rainbow trout (*O. mykiss*), Arctic grayling (*Thymallus arcticus*), and northern pike (*Esox lucius*).

CHINOOK SALMON

The Deshka River (Figure 1), a tributary of the Susitna River, supports the largest Chinook salmon run in the NCIMA (Ivey et al. 2007), the average escapement past the weir from 1995 to 2004 was 31,257 fish (Ivey 2014). Prior to 1995, the Deshka River Chinook salmon fishery was managed with a single aerial survey conducted yearly after the sport fishery had taken place. Due to the popularity of the fishery and declining escapement indices, a weir was installed in 1995 to give the Alaska Department of Fish and Game (ADF&G) managers precise inseason information about run size and biological composition of the escapement. Information gathered from the operation of this weir, in conjunction with historical escapement indices and sport harvest data, were used to construct spawner–recruit models for the Deshka River Chinook salmon stock. Based on these models, ADF&G developed a biological escapement goal range (BEG) of 13,000–28,000 Chinook salmon counted at the weir (Bue and Hasbrouck *Unpublished*) that went into effect in 2002 and has been reviewed every 3 years prior to the Upper Cook Inlet Board of Fish (BOF) meetings. In 2011, the BEG was changed to a sustainable escapement goal (SEG) due to uncertainty in the estimated harvest of Deshka River stock occurring in the commercial fisheries (Fair et al. 2010); the SEG was also designated as 13,000–28,000 Chinook salmon. The Deshka River weir allows ADF&G to manage the Deshka River Chinook salmon fishery commensurate with the size of the run by providing a preseason run outlook, inseason run strength information, and refinement of the spawner–recruit relationship for this stock.

Table 1.–Deshka River angler-days and sport harvests.

Year	Angler-days	Chinook salmon	Coho salmon	Pink salmon	Rainbow trout	Arctic grayling	Northern pike
1977	3,852	1,017	559	391	1,556	631	0
1978	9,111	850	1,789	697	3,634	579	0
1979	13,236	2,811	973	109	3,182	1,463	0
1980	19,364	3,685	2,290	689	4,305	1,817	0
1981	13,248	2,769	632	19	3,631	1,255	0
1982	18,391	4,307	2,463	377	3,804	1,457	0
1983	23,174	4,889	1,036	21	2,434	1,280	0
1984	20,561	5,699	1,646	748	2,120	1,110	0
1985	29,322	6,407	2,637	87	3,104	1,335	0
1986	29,739	6,490	4,256	882	3,038	938	0
1987	30,008	5,632	2,789	652	3,006	942	0
1988	32,160	5,474	7,458	800	4,075	1,164	0
1989	39,432	8,062	8,947	152	1,676	457	0
1990	32,082	6,161	4,959	297	707	152	0
1991	38,011	9,306	8,111	98	1,275	333	0
1992	37,056	7,256	7,110	513	459	105	0
1993	30,643	5,682	6,530	84	452	89	0
1994	19,267	624	5,511	564	415	61	78
1995	4,808	0	2,275	77	183	0	0
1996	5,246	11	4,615	236	321	97	161
1997	5,110	42	1,169	11	264	68	137
1998	11,574	3,384	3,630	702	218	8	18
1999	20,088	3,496	4,034	67	561	11	283
2000	30,997	7,076	8,687	799	205	122	462
2001	23,734	5,007	6,556	291	270	139	400
2002	20,362	4,508	3,616	185	417	60	226
2003	24,904	6,605	4,946	24	368	35	143
2004	28,653	9,050	4,440	249	938	79	336
2005	26,638	7,332	3,616	77	60	0	240
2006	30,958	7,753	6,042	76	523	0	505
2007	34,726	5,696	2,550	70	185	172	277
2008	15,514	2,036	3,426	78	419	268	168
2009	10,532	723	4,060	23	562	35	455
2010	17,867	3,381	5,690	77	122	67	1,120
2011	13,206	3,139	2,282	56	0	0	258
2012	11,050	1,650	1,358	100	61	0	64
2013	10,315	1,087	2,658	15	103	0	998
2014	10,947	1,329	2,598	128	29	0	164
Average							
1977–2004	21,933	4,511	4,059	351	1,665	564	80
2005–2014	16,336	3,413	3,428	70	209	54	425

Source: Alaska Sport Fishing Survey database [Internet]. 1996– . Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited February 2016). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/.

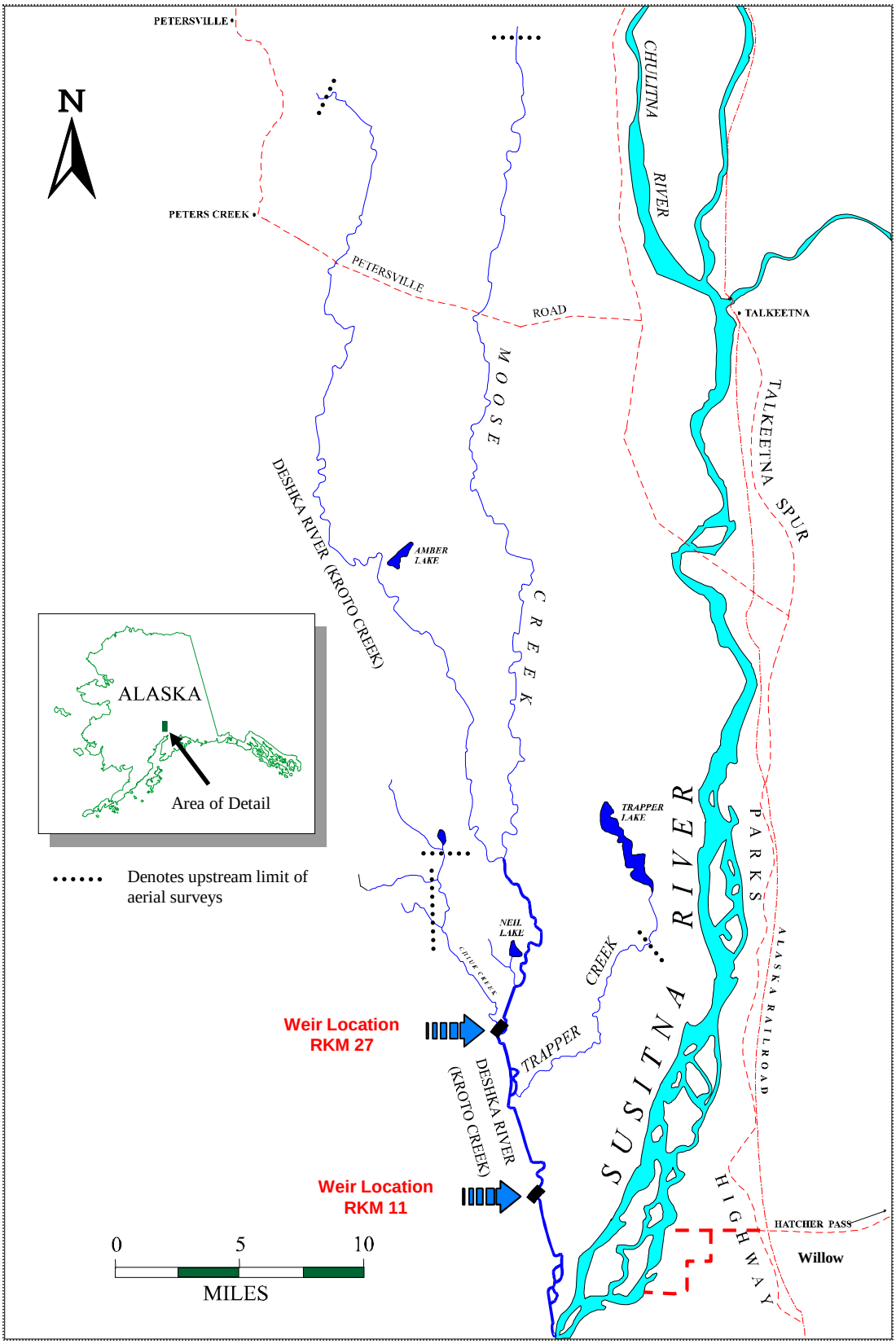

Figure 1.–The Deshka River drainage, weir locations, and aerial survey reaches.

COHO SALMON

The Deshka River is a major producer of coho salmon in the Susitna River drainage and is among the largest sport fisheries for early-run coho salmon in the NCIMA. Abundance and spawning distribution studies conducted by ADF&G in 2011 on the Susitna River drainage indicated that 23% of radiotagged coho salmon spawned in the Kahiltna, Tokositna, and Deshka rivers (Cleary et al. 2016). Of the coho salmon tagged in the lower Susitna River in 2013, 96% migrated to 4 major tributaries, which included the Deshka, along with the Yentna, Talkeetna, and Chulitna rivers (Alaska Energy Authority 2014).

Coho salmon harvests and escapements from the Deshka River have been variable. The lowest estimated sport fish harvest of coho salmon was 559 in 1977 and the highest was 8,947 in 1989; mean harvest from 1977 to 2004 was 4,059 fish (Mills 1979-1980, 1981a-b, 1982-1994; Howe et al. 1995, 1996, 2001 a-d; Walker et al. 2003; Jennings et al. 2004, 2006 a-b, 2007) (Table 1). The Deshka River coho salmon escapement reported previously (Ivey 2014) has varied dramatically from year to year, from a low of 8,063 in 1997 to a high of approximately 63,000 in 2004. The 1995–2004 average coho salmon count through the weir during complete years (n = 6) was 26,241 (Ivey 2014). Deshka River coho salmon are also harvested in Cook Inlet commercial fisheries in both the Central District drift fishery and the Northern District set gillnet fishery to an unknown degree. The weir program continues to be a good means of monitoring salmon stocks inseason and provides long-term escapement information to use in future management.

STUDY AREA

The Deshka River headwaters, referred to as Kroto and Moose Creeks on U.S. Geological Survey (USGS) topographical maps, drain lowlands west of the mainstem of the Susitna River and discharge into the west side of the Susitna River west of the town of Willow (Figure 1). The lower 48 river kilometers (RKM) are generally referred to as the Deshka River. Chijuk Creek at RKM 28 and Trapper Creek at RKM 23 are 2 minor Deshka River tributaries. The river flows about 141 RKM and drains about 153,100 ha of lowland taiga dominated by black spruce muskegs (Meyer et al. 2001) that give the river a tannin-stained appearance. The Deshka River drainage has no glacial input (Glass 1999). In mid-May, spring runoff normally begins at about 4,500 ft^3/s and decreases to approximately 1,500 ft^3/s by late May (Scott Lindsey, Alaska-Pacific River Forecast Center, Anchorage, personal communication; Figure 2). Low water levels normally occur from mid to late summer (July–early August), and fall (August–September) precipitation typically causes a number of high-water events.

The Deshka River supports 5 species of Pacific salmon and 2 other anadromous species: humpback whitefish (*Coregonus pidschian*) and Arctic lamprey (*Lampetra camtschatica*) (Johnson and Coleman 2014). Rainbow trout (*O. mykiss*), Arctic grayling (*Thymallus arcticus*), Dolly Varden (*Salvelinus malma*), and Burbot (*Lota lota*) were documented by Delaney et al. (1981).

Nonsport fish species documented in the mainstem Deshka River include round whitefish (*Prosopium cylindraceum*), longnose sucker (*Catostomus catostomus*), threespine stickleback (*Gasterosteus aculeatus*), slimy sculpin (*Cottus cognatus*), and Pacific lamprey (*Lampetra tridentate*) (Kirsch et al. 2014).

This report focuses on Chinook and coho salmon weir operations, weir counts, and biological data obtained across a 10-year period: 2005–2014. Results can be compared to Ivey (2014), in which the first 10 years (1995–2004) of weir operations are reported.

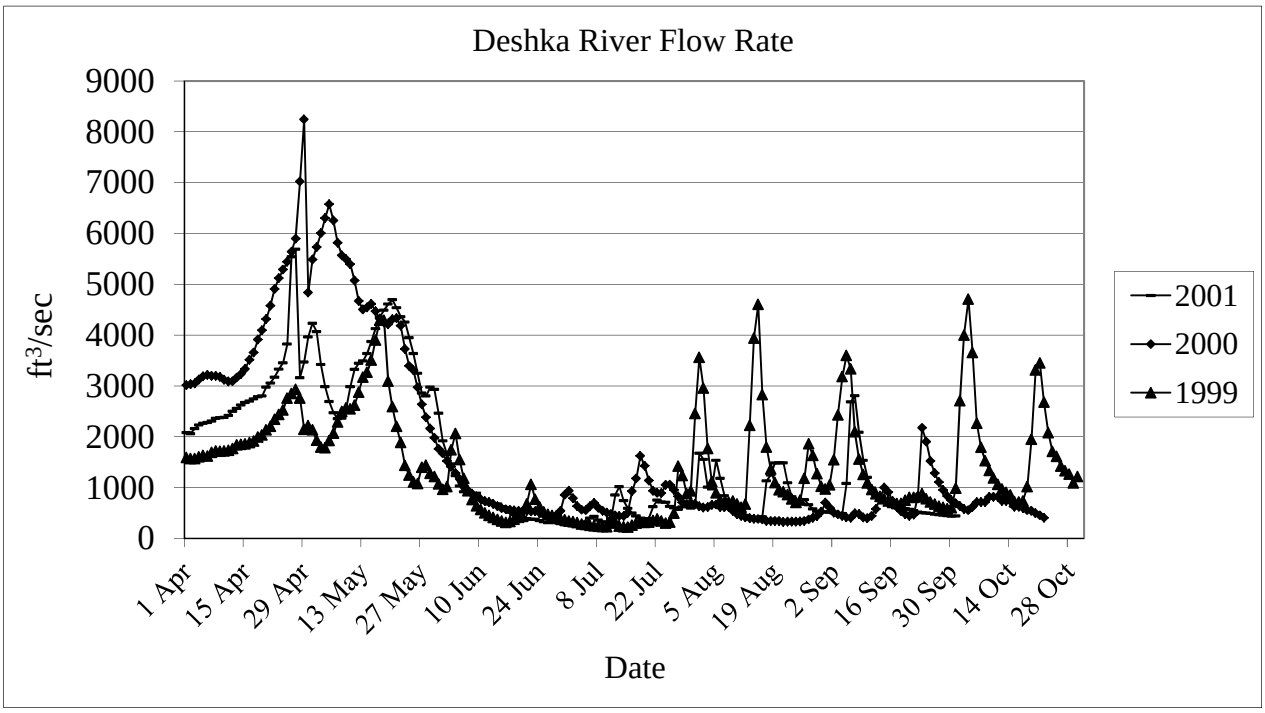

Figure 2.–Average daily flow rate from 1 April to 31 October for the years 1999–2001 as measured at a USGS hydrological station located at RKM 9.5 of the Deshka River.

Source: Bertrand et al. 2000; Meyer et al. 2001-2002.
Note: the USGS gauging station was not operational after 2001.

METHODS

WEIR SITE

A weir was first installed on the Deshka River at RKM 27 in 1995 (Figure 1). The river width at the RKM 27 weir site was approximately 31 m. It was difficult to maintain the weir at this site because the weir was prone to flooding due to a narrow channel and relatively unstable substrate. In 1997, the weir was moved downstream to RKM 11 where the Deshka River is 53 m wide and the substrate is predominately cobble with some gravel and sand.

WEIR DESIGN AND OPERATION

A resistance board weir as described in Ivey (2014) was used to census upstream passage of Chinook and coho salmon from late May through mid-September. Details of weir design, modifications, and installation technique can be found in Ivey (2014).

The weir consisted of 57 panels, each 94 cm (39.5 in) wide by 6 m (20 ft) long, constructed of 2.5 cm (1 in) diameter schedule 40 polyvinyl chloride (PVC) pickets. Pickets were spaced such that the gaps were at most 3.8 cm (1.5 in) to allow census of all salmon except ocean-age-1 Chinook salmon, ocean-age-0 coho salmon, and some pink salmon.

A live trap (2.4 m × 1.2 m × 1.2 m) was positioned on the upstream side of the rail that was used to anchor the weir. The trap had 2.5 cm (1 in) diameter aluminum tubing spaced such that the gaps were at most 3.8 cm (1.5 in). Two V-shaped wings on the downstream side of the trap could be opened internally to allow fish to pass or be configured to trap fish. Additionally, the trap had 2 vertically sliding doors to allow entrance into and out of the trap. A narrow channel on the upstream end of the trap allowed for the installation of riser boards when water clarity was low and river stage high. Fish swimming over the riser board and adjustable flash panel could be identified while exiting the trap. Because the water depth at the live trap during high water events nearly exceeded the trap height, a 0.6 m (2 ft) trap extension was added, increasing the trap height to 1.8 m (6 ft). A plywood platform (8 ft × 12 ft) was located adjacent to the top of the live trap so that technicians could sample the fish from the trap or view the fish exiting.

SALMON COUNTS

Counts of all salmon passing the weir were made daily from the first day that weir construction was complete until the weir was removed or until high water made operating the weir impossible. When daylight was sufficient to identify fish species, the on-duty technician would open the doors to the trap and count salmon exiting the trap upstream. Multiple unit tally counters were used to tally each species. When river height increased, riser boards and the adjustable flash panel were added to the upstream exit to raise fish to a level adequate for identification and counting. The trap doors were closed when no fish were present downstream from the weir, for breaks, for cleaning and maintaining the weir, and at the end of daylight hours. Two technicians worked each day during the entire field season. During most of the Chinook salmon season, the amount of daylight allowed fish to be counted from 4:00 AM until the following 1:00 AM. In August and September, salmon were typically counted during daylight hours from 6:00 AM to 11:00 PM.

AGE, SEX, AND LENGTH

A preseason goal of age, sex, and length (ASL) samples was established for both species. Sampling for Chinook salmon in proportion to the run was the goal for every year. Proportional sampling was attempted for coho salmon until 2009, when the strategy was changed to sampling fixed numbers in 6 temporal strata to improve goal attainment.

Fish for ASL sampling were obtained when the appropriate number of fish had entered the trap on their own through the downstream door. The downstream door was then closed and all fish were sampled to prevent any selectivity due to human or fish behavior. The fish were netted out of the trap and placed on the platform in the dip net. The technicians worked quickly to minimize the time it took to measure and sex the fish, and to obtain scales for age determination.

External morphological features (kype development or a protruding ovipositor) were used to identify sex. Lengths from mid eye to tail fork (METF) were measured to the nearest 5 mm. Chinook and coho salmon scales from each fish were taken 2 rows above the lateral line from a preferred area midway on a diagonal line between the posterior insertion of the dorsal fin and the anterior insertion of the anal fin (Scarnecchia 1979). Scales were mounted directly on gum cards in the field and then thermo-hydraulically pressed into cellulose acetate to make impressions as described by Clutter and Whitesel (1956). Scale impressions were magnified by a microfiche reader and ages determined by identifying annuli. Age, sex, and length were recorded on standardized age, weight, and length (AWL) version 1.1 mark-sense forms as outlined in

Heineman (1991) and archived at either the ADF&G Division of Sport Fish (SF) Research and Technical Services (RTS) unit (333 Raspberry Rd, Anchorage, AK 99518) or at the ADF&G Division of Sport Fish (PO Box 110024, Douglas, AK 99811-0024).

Scales from coho salmon were taken and pressed but not aged from 2011 onwards due to findings that experienced age determination professionals can misinterpret the freshwater ages of coho salmon. These preliminary findings are described in the memo "A Summary of Coho Salmon Aging Problems and Aging Validation Studies in Southeast Alaska" (Leon Shaul, 2005, ADF&G Commercial Fisheries Division, Douglas). This memo documents that even experienced coho salmon scale readers in Southeast Alaska were producing erroneous results. Coho salmon age composition and mean length-at-age will not be presented in this report. Mean length by sex and sex composition are presented.

Sampling rates among quartiles of the run's cumulative empirical distribution were compared. Equal sampling rates among quartiles indicate that the run was sampled in proportion to the number of fish passing the weir. If the run was sampled in proportion to fish passage, then estimates and associated variances of the proportion by age and sex class *z* for the escapement ($\hat{p}_z$) and the number of fish by age and sex class ($\hat{N}_z$) were calculated per Equations 1–4 using grouped data (i.e., not stratified by time).

If sampling was not proportional to fish passage, then age and sex proportions were tested for independence of run time. If a chi-square test for independence was not rejected ($P \geq 0.05$), then age and sex proportions were considered similar over the run and the grouped data were used as described above. If the test was rejected ($P \leq 0.05$), then the proportion by age and sex of the Chinook salmon escapement was estimated as follows:

$$\hat{p}_{tz} = \frac{n_{tz}}{n_t} \tag{1}$$

where $\hat{p}_{tz}$ equals the estimated proportion of Chinook salmon passing the weir during sampling stratum *t* from age and sex category *z*, n_{tz} equals the number of fish sampled during sampling stratum *t* that were classified as age and sex category *z*, and n_t equals the number of Chinook salmon sampled for age and sex during sampling stratum *t*.

The variance of $\hat{p}_{tz}$ was calculated as follows:

$$\hat{V}\left[\hat{p}_{tz}\right] = \left(1 - \frac{n_t}{N_t}\right) \frac{\hat{p}_{tz}\left(1 - \hat{p}_{tz}\right)}{n_t - 1} \tag{2}$$

where N_t is the number of Chinook salmon passing the weir during sampling stratum *t*.

The total proportion of the escapement by age and sex and its variance were then estimated by the following summations:

$$\hat{p}_z = \sum_{t=1}^{L} \frac{N_t}{N} \hat{p}_{tz} \tag{3}$$

and

$$\hat{V}[\hat{p}_z] = \frac{1}{N^2}\sum_{t=1}^{L} N_t^2 \hat{V}[\hat{p}_{tz}] \tag{4}$$

where L equals the number of temporal strata and N_t/N are the stratum weights.

The total escapement (abundance) by age and sex category and its variance were then estimated as follows:

$$\hat{N}_z = N\hat{p}_z \tag{5}$$

and

$$\hat{V}[\hat{N}_z] = N^2 \hat{V}[\hat{p}_z]. \tag{6}$$

Estimates were also calculated for mean length-at-age of Chinook salmon sampled from the escapement. The procedures outlined by Sokal and Rohlf (1981: Boxes 4.2 and 7.1, pages 56 and 139) were used to obtain the estimates of each mean and its standard error.

RESULTS

WEIR OPERATION

During the years 2005–2014, the mean weir installation date was 24 May (Table 2). The earliest and latest weir installation dates respectively were 15 May in 2014 and 7 June in 2013, which was due to a late breakup (Table 2). The weir was fully functional for 9 years during the Chinook salmon run. However, in 2014 there were 2 days (28–29 June) that the weir was overtopped by high water (Table 3), but because it was late in the run (78–81% of the run complete; Table 2), no attempt was made to interpolate counts from previous years, and the count is considered complete.

The Deshka River weir was breached 2 out of 10 years during part of the coho salmon run (Table 3). Severe flooding from 16 to 20 August 2006 destroyed over half of the weir, and the field camp was flooded with 3 ft of water. The weir was not reinstalled in 2006 but was rebuilt during the winter and in place for the 2007 season. In 2011, high water submerged the counting cage and the counting platform was knocked downstream by a cottonwood tree on 9 August. The nearshore portions of the weir were intentionally breached to avoid further loss of weir parts and were put back in place on 14 August. The coho salmon counts for 2006 and 2011 are not considered complete (Appendix B1).

Table 2.–Chinook salmon weir counts, run timing, and dates of weir installation on the Deshka River, 2005–2014.

Year	Installation date	Weir counts	Quartile ending dates			
			25%	50%	75%	98%
2005	27 May	37,725	12 Jun	20 Jun	27 Jun	21 Jul
2006	26 May	31,150	15 Jun	20 Jun	29 Jun	17 Jul
2007	18 May	18,714	14 Jun	21 Jun	27 Jun	22 Jul
2008	28 May	7,533	17 Jun	26 Jun	3 Jul	24 Jul
2009	21 May	11,960	14 Jun	20 Jun	26 Jun	31 Jul
2010	20 May	18,594	13 Jun	17 Jun	19 Jun	15 Jul
2011	24 May	19,026	15 Jun	21 Jun	27 Jun	22 Jul
2012	24 May	14,096	14 Jun	21 Jun	29 Jun	21 Jul
2013	7 Jun	18,531	22 Jun	25 Jun	30 Jun	13 Jul
2014	15 May	16,335	9 Jun	12 Jun	16 Jun	3 Jul
Mean	24 May	19,366	15 Jun	20 Jun	26 Jun	20 Jul
SD	6 days		3 days	4 days	5 days	8 days

Table 3.–Deshka River weir operations, 2005–2014.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Date installed	27 May	26 May	18 May	28 May	21 May	20 May	24 May	24 May	7 Jun	15 May
Dates submerged [a]		16 Aug–7 Sep					9–14 Aug			28–30 Jun
Days submerged during Chinook run [b]	0	0	0	0	0	0	0	0	0	2
Days submerged during coho run [c]	0	10	0	0	0	0	5	0	0	0
Date pulled	16 Sep	7 Sep	6 Sep	10 Sep	8 Sep	7 Sep	6 Sep	13 Sep	16 Sep	3 Sep

[a] Dates weir was submerged after installation.

[b] Number of days submerged during the Chinook salmon run (4 June–11 July). Dates encompass 90% of the run based on 1997 and 1999–2004 average run timing.

[c] Number of days submerged during the coho salmon run (22 July–26 August). Dates encompass 90% of the run based on 1997 and 2000, 2001, and 2003 average run timing.

Chinook Salmon

Complete Chinook salmon weir counts were documented each year (Table 2, Appendix A1). The sustainable escapement goal range (13,000–28,000) was surpassed in 2005 with a count of 37,725 Chinook salmon, the highest weir count in the last 10 years. The 2006 count also surpassed the upper end of the goal range with a weir total of 31,150. Six years (2007 and 2010–2014) were within the SEG. Two years (2008 and 2009) were below the SEG goal range. The lowest weir count occurred in 2008 with a weir count of 7,533 (Figure 3, Table 2). The 10-year average was 19,366 Chinook salmon.

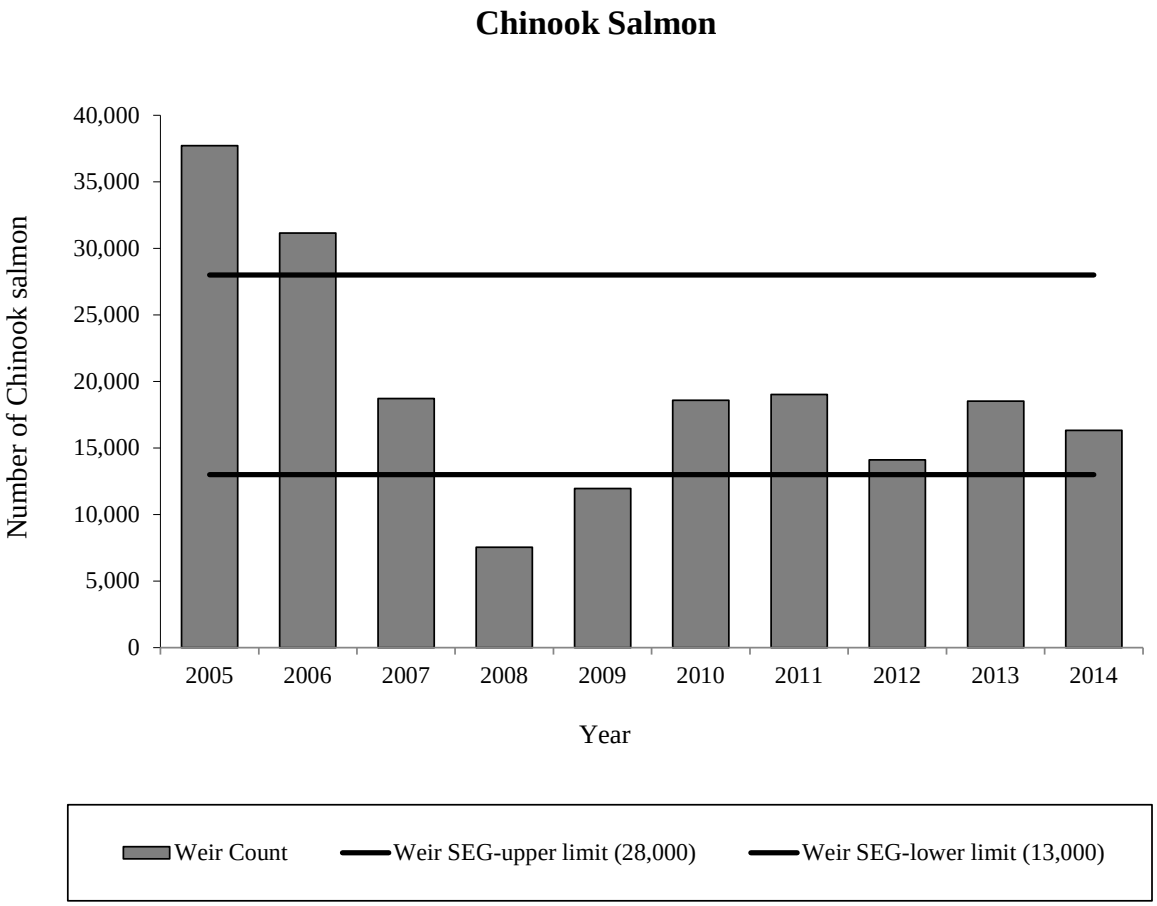

Figure 3.–Weir counts with associated escapement goal for Chinook salmon monitored on the Deshka River, 2005–2014.

Run Timing

Chinook salmon run timing was fairly consistent until 2013 and 2014. The mean first quartile from 2005 to 2014 (25%, SD 3 days) was 15 June and ranged from 9 June to 22 June (Table 2). The mean midpoint (50%, SD 4 days) was 20 June and ranged from 12 June to 26 June (Table 2). On average, 98% (SE 0.6%) of Chinook salmon passed the weir by 20 July (Table 2). The 2013 run was 6 days later than average based on the historical midpoint of the run; 25% of the run was counted by 22 June, 50% by 25 June, and 75% by 30 June (Figure 4, Table 2). The 2014 run was 8 days earlier than average based on the historical midpoint of the run; 25% of the run was counted by 9 June, 50% by 12 June, and 75% by 16 June (Figure 4, Table 2).

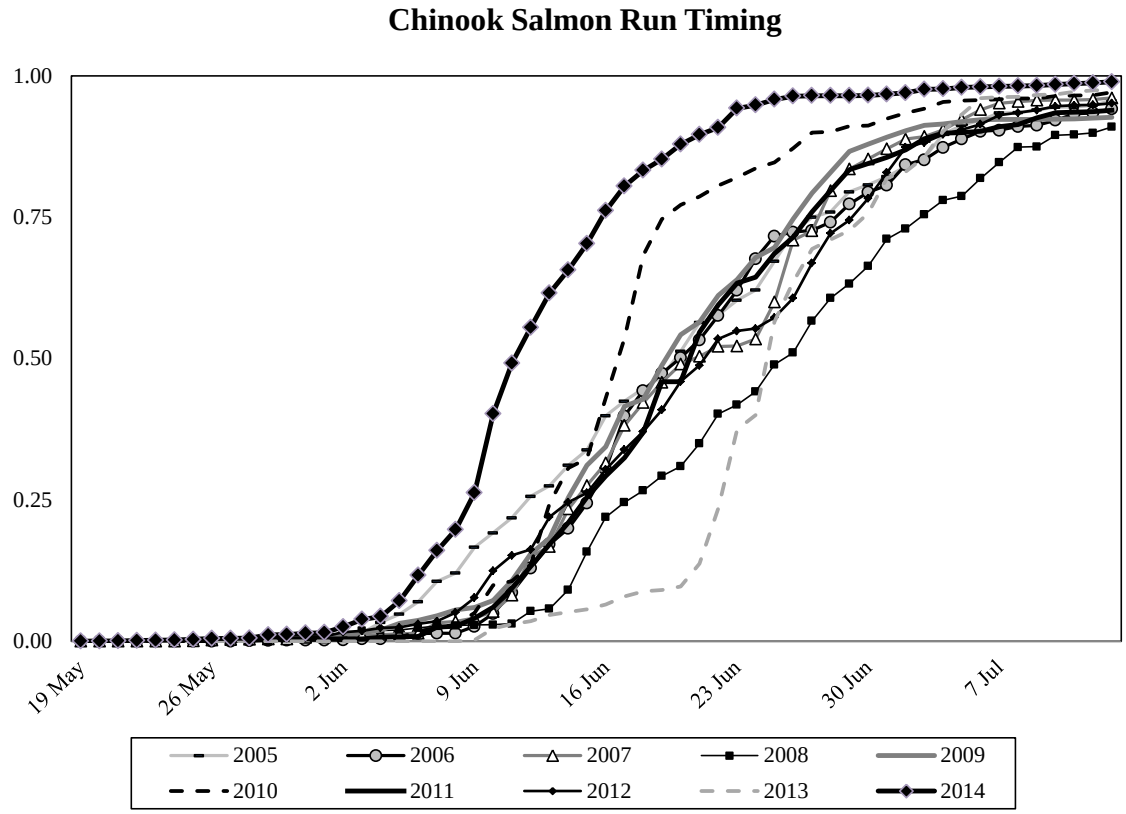

Figure 4.–Run timing for Chinook salmon passing the Deshka River weir at RKM 11, 2005–2014.

Coho Salmon

The mean coho salmon weir count from 2005 to 2014 was 18,684 fish (complete count years only). Complete counts ranged from 6,825 in 2012 to 47,887 in 2005 (Table 4) and were recorded in 8 of 10 years (Tables 3 and 4). Coho salmon counts in 2006 and 2011 were incomplete because of breaches in the weir during the dates when 90% of the counts historically occur. Despite being incomplete, the 2006 weir count of 59,419 coho salmon was highest of any coho salmon run from 2005 to 2014 (Figure 5).

Table 4.–Coho salmon weir counts and run timing on the Deshka River, 2005–2014.

		Quartile ending dates			
Year	Weir counts	25%	50%	75%	98%
2005	47,887	21 Aug	22 Aug	23 Aug	29 Aug
2006	59,419 [a]				
2007	10,575	5 Aug	6 Aug	16 Aug	2 Sep
2008	12,724	24 Jul	31 Jul	13 Aug	28 Aug
2009	27,348	14 Aug	14 Aug	15 Aug	27 Aug
2010	10,393	23 Jul	30 Jul	4 Aug	16 Aug
2011	7,326 [a]				
2012	6,825	1 Aug	4 Aug	9 Aug	28 Aug
2013	22,141	11 Aug	12 Aug	20 Aug	23 Aug
2014	11,578	5 Aug	15 Aug	17 Aug	29 Aug
Mean [b]	18,684	3 Aug	11 Aug	17 Aug	29 Aug
SD		10 days	8 days	6 days	5 days

[a] Incomplete count.

[b] Weir count mean excludes incomplete years; mean quartile dates exclude 2006 and 2011.

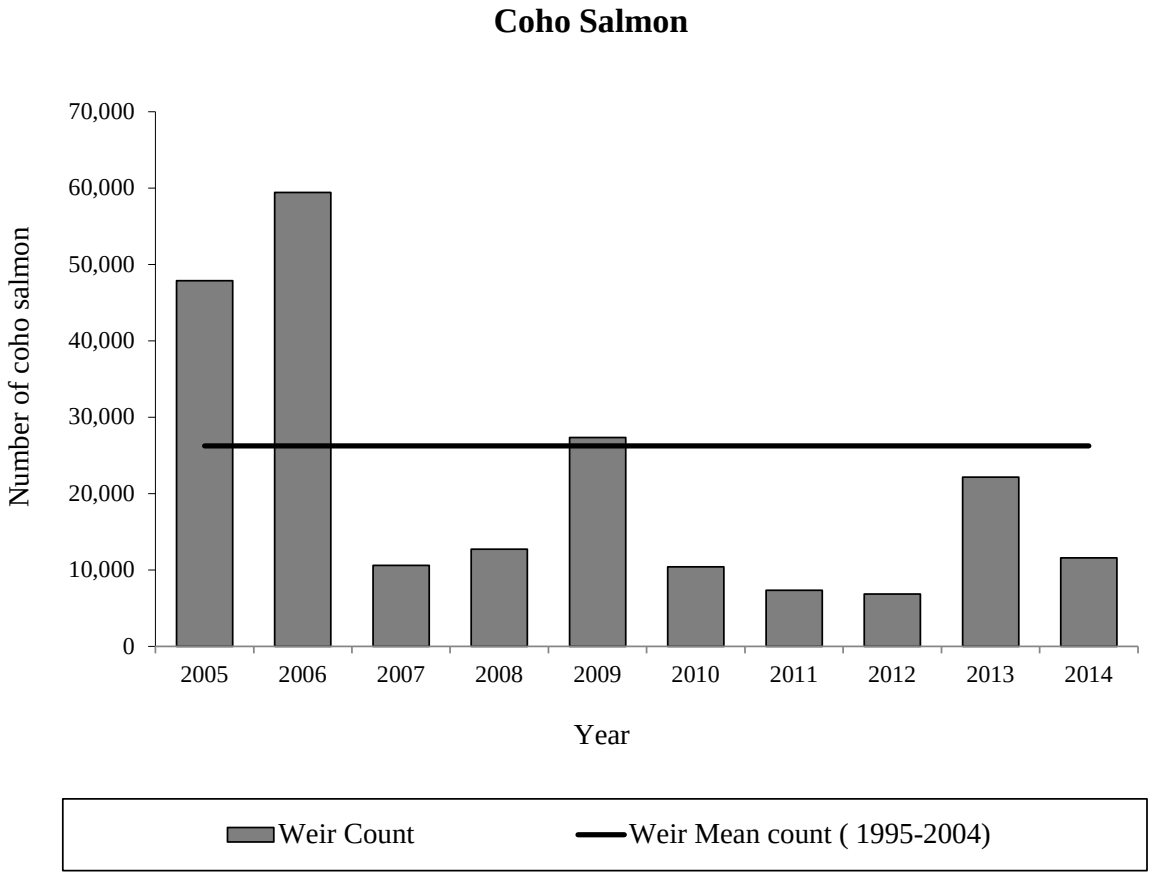

Figure 5.–Weir counts of coho salmon monitored on the Deshka River 2005–2014; 2006 and 2011 are incomplete counts.

Run Timing

Coho salmon run timing was inconsistent. The mean midpoint (50%, SD 8 days) for run timing was 11 August, but ranged from 30 July to 22 August. The earliest runs occurred in 2008 and 2010 with 50% of the run completed by 30 or 31 July, and the latest run occurred in 2005 with 50% of the run completed by 22 August (Figure 6). There were 2 patterns of run timing: one was highly compressed with the majority of the run occurring in 2 to 3 days (2005, 2009; Figure 6) and the other featured drawn out runs where the majority of the run came through over 12–20 days (2007, 2008, 2010, 2014) (Figure 6 and Appendix B1).

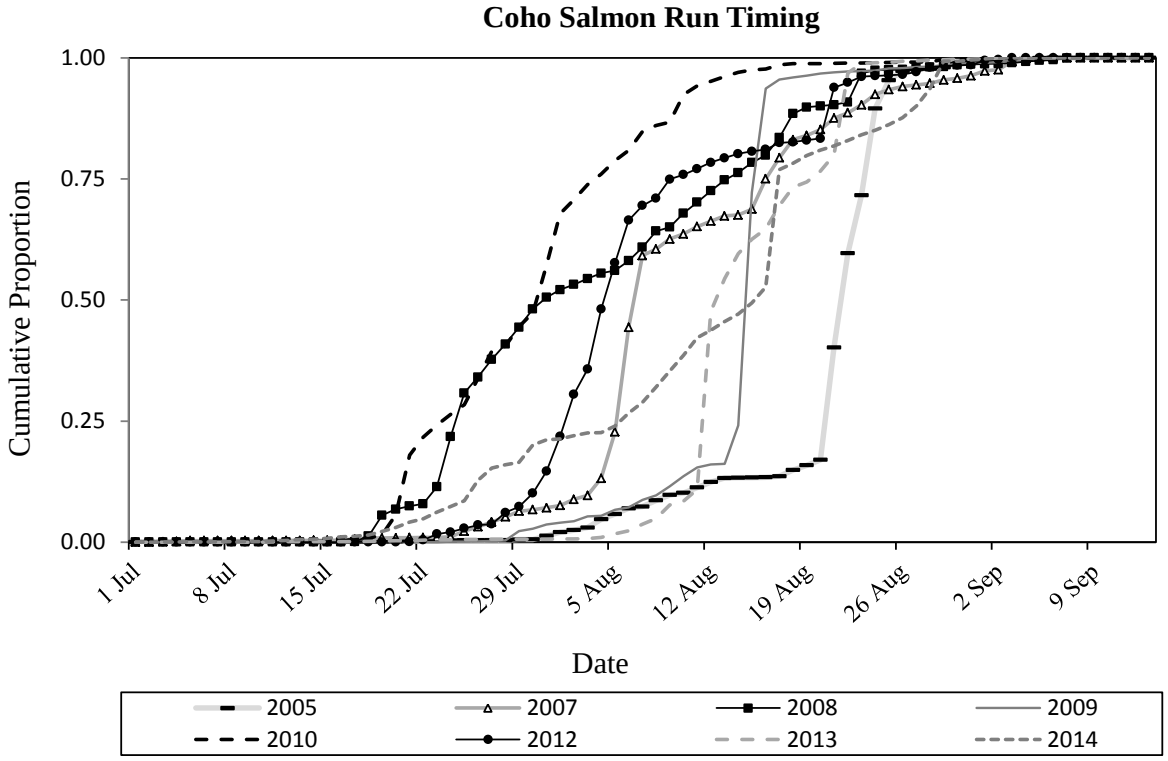

Figure 6.–Run timing for Coho salmon passing the Deshka River weir at RKM 11, 2005–2014.

AGE, SEX, AND LENGTH

Chinook salmon

Proportional sampling was achieved in 6 out of the 10 years (2005, 2009–2012, and 2014). Therefore, unstratified data were used to estimate age and sex proportions. Stratified estimates of age and sex proportions were necessary for 2006–2008 and in 2013 due to disproportional sampling and a dependence of age on run timing.

The average age composition from 2005 to 2014 was 3.5% age-1.1, 30.8% age-1.2, 50.4% age-1.3, and 16.7% age-1.4 Chinook salmon, for both sexes combined (Table 5). Age-1.3 fish dominated Deshka River Chinook salmon escapements in most years. However, age 1.2 was dominant in 2009 (66.8%, SE 2.4) and 2012 (54.7%, SE 2.9), and age 1.4 was dominant in 2008 (46.4%, SE 4.1). Female Chinook salmon composed 48.3% of the runs on average annually (Table 6).

For all age classes combined for the years 2005–2014, female Chinook salmon METF length ranged from 480 to 990 mm and male Chinook salmon METF length ranged from 320 to 1,090 mm. Mean length-at-age of males averaged 579 mm for age-1.2, 762 mm for age-1.3, and 878 mm for age-1.4 fish (Table 7). Mean length-at-age of females averaged 607 mm for age-1.2, 776 mm for age-1.3, and 847 mm for age-1.4 fish. The 2004–2005 brood years produced smaller than average age-1.2 fish in 2008–2009. Smaller than average age-1.3 and age-1.4 fish were also seen in 2009 (Table 7).

Coho Salmon

Female coho salmon composed 46% of all runs. Female coho salmon lengths ranged from 350 to 665 mm METF and male coho salmon from 385 to 695 mm METF (Table 8). From 2005 to 2014, mean length of females averaged 560 mm and males averaged 557 mm.

Coho salmon age composition and mean length-at-age are not presented due to possible misinterpretation of scale age.

Table 5.–Age composition of Chinook salmon sampled at the Deshka River weir by sex and age class, 2005–2014.

		Age 1.1		Age 1.2		Age 1.3		Age 1.4		Total			Total	No.
Sex	Year	%	SE	%	SE	%	SE	%	SE	%	SE	*n*	collected	rejected [a]
Male														
	2005	1.2	0.5	28.0	2.0	19.2	1.8	4.7	1.0	53.1	2.3	260		
	2006			19.4	0.9	19.5	0.9	6.1	0.5	44.7	2.3	218		
	2007			7.3	1.7	28.5	3.0	5.2	1.5	41.0	3.2	95		
	2008			15.0	2.2	20.7	2.5	12.8	2.1	48.5	3.1	129		
	2009			47.2	2.5	11.7	1.6	2.1	0.7	60.9	2.5	235		
	2010	0.6	0.4	17.3	2.1	26.8	2.4	2.4	0.8	47.0	2.7	158		
	2011	1.7	0.7	21.0	2.2	32.2	2.5	3.2	0.9	58.1	2.7	202		
	2012	3.5	1.1	38.4	2.9	8.3	1.6	5.5	1.4	55.7	2.9	161		
	2013	4.8	1.4	24.0	2.7	18.0	2.4	6.4	1.6	53.2	3.2	133		
	2014	8.3	1.8	28.1	2.9	12.8	2.2	2.9	1.1	52.1	3.2	126		
	Average	3.3	1.0	24.6	2.2	19.8	2.1	5.1	1.1	51.4	2.8	172		
Female														
	2005			1.2	0.5	38.6	2.2	7.1	1.2	46.9	2.3	230		
	2006			3.4	0.4	35.7	1.2	15.7	0.8	55.3	2.3	270		
	2007			1.7	0.9	42.7	3.3	14.7	2.3	59.1	3.2	137		
	2008			3.4	1.1	17.3	2.3	30.8	2.8	51.5	3.1	137		
	2009			19.7	2.0	12.4	1.7	7.0	1.3	39.1	2.5	151		
	2010	0.3	0.3	3.6	1.0	42.9	2.7	6.3	1.3	53.0	2.7	178		
	2011	0.6	0.4	5.8	1.3	31.9	2.5	3.7	1.0	42.0	2.7	146		
	2012	0.7	0.5	16.3	2.2	17.7	2.3	9.7	1.7	44.3	2.9	128		
	2013	0.4	0.4	1.6	0.8	37.2	3.1	7.6	1.7	46.8	3.2	117		
	2014	0.4	0.4	11.6	2.1	26.9	2.9	9.1	1.9	47.9	3.2	116		
	Average	0.5	0.4	6.8	1.2	30.3	2.4	11.2	1.6	48.6	2.8	161		

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Table 5.–Page 2 of 2.

Sex	Year	Age 1.1 %	Age 1.1 SE	Age 1.2 %	Age 1.2 SE	Age 1.3 %	Age 1.3 SE	Age 1.4 %	Age 1.4 SE	Total %	Total SE	Total *n*	Total collected	No. rejected [b]
Combined														
	2005	1.2	0.5	29.2	2.1	57.8	2.2	11.8	1.5	100.0		490	623	133
	2006			22.8	1.0	55.3	1.5	21.9	1.0	100.0		488	603	115
	2007			9.9	2.2	71.2	4.6	18.9	2.7	100.0		232	307	75
	2008			15.7	2.1	38.0	3.8	46.4	4.1	100.0		266	340	74
	2009			66.8	2.4	24.1	2.2	9.1	1.5	100.0		386	441	55
	2010	0.9	0.5	20.8	2.2	69.6	2.5	8.6	1.5	100.0		336	366	30
	2011	2.3	0.8	26.7	2.4	64.1	2.6	6.9	1.4	100.0		348	386	38
	2012	4.2	1.2	54.7	2.9	26.0	2.6	15.2	2.1	100.0		289	323	34
	2013	3.9	1.1	21.4	3.0	58.3	5.2	16.4	3.6	100.0		250	281	31
	2014	8.7	2.1	39.7	3.4	39.7	3.6	12.0	2.3	100.0		242	296	54
	Average	3.5	1.0	30.8	2.4	50.4	3.1	16.7	2.2	100.0		333	396	64

[a] Regenerated scales, inverted scales, and scales missing associated sex were excluded from the sample.

Table 6.–Sex composition by percent with standard errors (SE) and upper and lower confidence intervals (CI) of Chinook salmon at the Deshka River weir, 2005–2014.

Year	Sex	%	SE	Lower CI	Upper CI	Sample size	Stratified or unstratified by time
2005							Unstratified
	Female	43.8	2.3	39.4	48.2	273	
	Male	56.2	2.3	51.8	60.6	350	
2006							Stratified
	Female	55.0	2.3	49.8	58.6	327	
	Male	45.0	2.3	41.4	50.2	276	
2007							Stratified; add sex comp est. to passage proportion
	Female	59.2	2.9	53.5	64.9	180	
	Male	40.8	2.9	35.1	46.5	127	
2008							Stratified
	Female	48.0	3.0	42.1	53.8	171	
	Male	52.0	3.0	46.2	57.9	169	
2009							Unstratified
	Female	40.4	2.3	35.9	44.9	178	
	Male	59.6	2.3	55.1	64.1	263	
2010							Unstratified
	Female	52.7	2.6	47.6	57.8	193	
	Male	47.3	2.6	42.2	52.4	173	
2011							Unstratified
	Female	42.2	2.5	37.3	47.2	163	
	Male	57.8	2.5	52.8	62.7	223	
2012							Unstratified
	Female	44.0	2.8	38.5	49.4	142	
	Male	56.0	2.8	50.6	61.5	181	
2013							Stratified
	Female	52.0	3.9	44.3	59.7	128	
	Male	48.0	3.9	40.3	55.7	153	
2014							Unstratified
	Female	46.0	2.9	39.9	52.1	136	
	Male	54.1	2.9	48.0	60.2	160	
Average							
	Female	48.3					
	Male	51.7					

Table 7.–Mean length-at-age of Chinook salmon sampled at the Deshka River weir by sex and age class, 2005–2014.

			Year										
Sex	Age	Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Male [a]	Age 1.1												
		Mean length	419.2					542.5	506.7	481.0	511.7	468.8	488.3
		SE	22.2					10.6	21.1	14.7	9.5	10.6	14.8
		Min	320					535	450	420	450	345	420.0
		Max	470					550	590	570	555	585	553.3
		n	6					2	6	10	12	20	9.3
	Age 1.2												
		Mean length	574.9	583.3	596.8	558.5	561.3	597.3	580.3	575.9	595.3	561.6	578.5
		SE	4.8	6.1	21.1	7.0	3.7	9.0	8.2	4.5	5.8	7.8	7.8
		Min	430	450	480	480	430	450	405	450	480	455	451.0
		Max	750	820	750	660	750	805	745	675	710	790	745.5
		n	137	93	17	40	182	58	73	111	60	68	83.9
	Age 1.3												
		Mean length	784.5	760.0	785.9	770.9	672.7	778.6	789.8	738.6	792.2	750.3	762.4
		SE	6.6	10.2	9.1	18.9	13.3	6.9	5.9	21.7	7.5	11.0	11.1
		Min	650	510	580	510	495	555	570	510	700	590	567.0
		Max	970	930	925	1015	900	900	935	885	925	845	923.0
		n	94	95	66	55	45	90	112	24	45	31	65.7

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Table 7.–Page 2 of 4.

Sex	Age	Parameter	Year 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Male [a]	Age 1.4												
		Mean length	935.7	886.7	882.1	878.8	841.9	795.0	922.3	915.3	889.1	833.6	878.0
		SE	12.0	15.1	24.3	10.2	11.6	23.7	25.0	15.8	14.2	11.1	16.3
		Min	850	750	650	750	785	650	790	820	835	810	769.0
		Max	1,070	1,090	975	975	895	845	1,090	1,040	995	890	986.5
		n	23	30	12	34	8	8	11	16	16	7	16.5
	Total												
		Mean length	727.7	702.1	764.2	733.5	592.2	709.9	712.9	628.0	689.7	608.5	686.9
		SE	5.6	9.31	11.7	14.1	5.7	8.9	9.4	10.3	11.5	11.2	9.8
		n	260	218	95	129	235	158	202	161	133	126	171.7
Female [a]	Age 1.1												
		Mean length						485	552.5	515	510	510	514.5
		SE							10.6	49.5			30.1
		Min						485	545	480	510	510	506.0
		Max						485	560	550	510	510	523.0
		n						1	2	2	1	1	1.4
	Age 1.2												
		Mean length	675.0	669.9	601.3	566.7	574.9	605.8	610.0	592.3	593.8	580.0	607.0
		SE	16.7	24.2	21.2	26.4	4.8	25.2	18.4	7.8	25.3	8.2	17.819
		Min	640	530	565	480	475	465	470	500	530	500	515.5
		Max	750	900	640	740	665	740	775	850	630	680	737.0
		n	6	18	4	9	76	12	20	47	4	28	22.4

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Table 7.–Page 3 of 4.

Sex	Age	Parameter	Year 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Female [a]	Age 1.3	Mean length	770.7	767.8	789.9	822.8	746.9	777.1	781.9	775.2	772.4	755.9	776.0
		SE	3.3	4.3	5.6	9.1	10.0	4.2	6.6	6.9	4.1	8.1	6.233
		Min	620	570	590	570	595	570	530	610	690	580	592.5
		Max	880	950	915	915	845	945	990	885	895	890	911.0
		n	189	174	99	46	48	144	111	51	93	65	102.0
	Age 1.4	Mean length	866.4	842.3	845.3	863.0	842.0	792.4	837.7	875.9	842.4	858.4	846.6
		SE	8.1	7.9	12.5	5.9	8.7	13.0	16.0	9.4	8.9	10.3	10.1
		Min	720	600	650	750	775	670	730	770	780	770	721.5
		Max	965	990	960	990	970	880	925	975	930	935	952.0
		n	35	78	34	82	27	21	13	28	19	22	35.9
	Total	Mean length	782.8	782.8	798.1	733.5	677.4	765.7	760.1	726.0	775.4	730.7	753.3
		SE	4.0	4.8	6.2	14.1	9.8	5.5	7.8	11.1	5.8	10.5	7.9495
		n	230	270	137	137	151	178	146	128	117	116	161.0
Combined [a]	Age 1.1	Mean length	419.2					523.3	518.1	486.7	511.5	470.7	488.3
		SE	22.2					24.1	17.1	13.5	8.8	10.3	16.0
		Min	320					485	450	420	450	345	411.7
		Max	470					550	590	570	555	585	553.3
		n	6					3	8	12	13	21	10.5

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Table 7.–Page 4 of 4.

Sex	Age	Parameter	Year 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average
Combined [a]	Age 1.2												
		Mean length	579.1	597.4	597.6	560.0	565.3	598.8	586.7	580.8	595.2	567.0	582.8
		SE	5.0	7.0	17.2	7.2	3.0	8.5	7.5	3.9	5.6	6.0	7.1
		Min	430	450	480	480	430	450	405	450	480	455	451.0
		Max	750	900	750	740	750	805	775	850	710	790	782.0
		n	143	111	21	49	258	70	93	158	64	96	106.3
	Age 1.3												
		Mean length	775.3	765.1	788.3	794.6	711.0	777.7	785.9	763.5	778.8	754.1	769.4
		SE	3.2	4.6	4.9	11.3	9.1	3.7	4.2	8.5	3.7	6.5	6.0
		Min	620	510	580	510	495	555	530	510	690	580	558.0
		Max	970	950	925	1015	900	945	990	885	925	890	939.5
		n	283	269	165	101	842	29	223	75	138	96	222.1
	Age 1.4												
		Mean length	893.9	854.6	854.9	867.7	775.0	793.1	876.5	890.2	863.7	852.4	852.2
		SE	8.1	7.3	11.2	5.1	7.1	11.0	16.4	8.6	8.8	8.3	9.2
		Min	720	600	650	750	970	650	730	770	780	770	739.0
		Max	1070	1090	975	990	35	880	1090	1040	995	935	910.0
		n	58	108	46	116	35	29	24	44	35	29	52.4
	Total												
		Mean length	727.7	746.7	784.2	783.2	625.5	739.5	732.7	671.4	729.8	667.1	720.8
		SE	5.6	5.2	6.1	8.5	5.6	5.3	6.4	8.1	7.2	8.6	6.7
		n	490	488	232	266	386	336	348	289	250	242	332.7

Note: All fish measured in millimeters from mid eye to tail fork.

[a] Excludes age classes composing less than 1% of the sample.

Table 8.–Mean length of coho salmon sampled at the Deshka River weir, 2005–2014.

Sex	Year	Mean length	SE	Min	Max	*n*
Male						
	2005	556.7	2.9	385	661	284
	2006	549.8	3.1	430	670	197
	2007	555.2	4.4	460	665	139
	2008	576.4	3.6	486	670	127
	2009	549.7	3.9	410	645	170
	2010	578.4	6.9	410	695	173
	2011	544.0	4.1	435	640	116
	2012	547.1	4.0	430	635	126
	2013	548.2	3.9	450	635	138
	2014	559.9	3.3	440	645	165
	Average	556.5	4.0	433.6	656.1	163.5
Female						
	2005	570.2	2.1	470	660	290
	2006	549.0	2.3	470	660	149
	2007	548.9	4.7	440	615	82
	2008	572.1	4.7	475	645	76
	2009	549.6	3.8	350	620	148
	2010	582.0	5.9	490	665	108
	2011	545.4	3.2	460	625	130
	2012	554.9	3.5	445	665	124
	2013	559.5	3.2	420	650	129
	2014	563.9	2.5	480	615	139
	Average	559.6	3.6	450.0	642.0	137.5
Combined						
	2005	563.7	1.8	385	661	574
	2006	549.3	2.1	430	670	346
	2007	551.9	3.2	440	665	221
	2008	574.8	2.8	475	670	203
	2009	549.7	2.7	350	645	318
	2010	579.2	6.6	410	695	281
	2011	544.8	2.5	435	640	246
	2012	551.0	2.7	430	665	250
	2013	553.7	2.6	420	650	267
	2014	561.7	2.1	440	645	304
	Average	558.0	2.9	421.5	660.6	301.0

DISCUSSION

CHINOOK SALMON

Weir counts contributed to timely inseason management of the Deshka River sport fishery. Inseason projections were accurate during low runs and allowed managers to restrict the recreational fisheries in June. Weir counts were used to justify emergency orders to aid in the achievement of the escapement goal, which was met for the years 2005–2007 and 2010–2014, and not met only in 2008 and 2009. Trends in escapement observed on the Deshka River during these 10 years mirror trends observed throughout the state. The majority of statewide Chinook salmon goals were met or exceeded from 2005 to 2006, with a shift towards being below or meeting the goal range from 2007 to 2014 (Munro and Volk 2014).

Fairly consistent timing of the Deshka River Chinook salmon run between years was observed from 2005 to 2012. During this period, the mean run timing was 3 days later at the first quartile and 2 days later at the second quartile than the mean for 1995–2004 (Ivey 2014).

Inconsistent run timing of the Deshka River Chinook salmon run was observed in 2013 and 2014. In 2013, anglers and staff observed a general absence of Chinook salmon during late May and early June, suggesting that run entry to the Susitna River may have been delayed due to a late spring breakup. In addition to the late spring, it is speculated that much warmer water temperatures recorded during the third week in June resulted in the stalling of upstream fish migration, which contributed to late run timing (Figure 4). In 2014, run timing was 8 days earlier than average, and no conclusions can be made as to why such an early run was observed.

COHO SALMON

Few escapement goals exist in the NCIMA for coho salmon (Munro and Volk 2014; Fair et al. 2013). Escapement data is reviewed every 3 years prior to regular BOF meetings as data accumulates for this stock. However, no escapement goal exists for Deshka River coho salmon at this time. In recent years, there has been interest in using the Deshka River as a surrogate for run strength on the Susitna River. Coho salmon abundance has been estimated for the Susitna River drainage (Cleary et al. 2016a, 2016b) and can be paired with weir counts. More years of Susitna River estimates and weir counts are needed to determine Deshka River's utility in the future management of Susitna River coho salmon.

Inconsistent timing of the Deshka River coho salmon run was observed from 2005 to 2014. The mean dates of run timing match those that occurred during 1995–2004 (Ivey 2014), but the error in predicting the 25th, 50th, and 75th percentiles of the run increased. Inseason assessment of run size is difficult due to such variability in run timing. Low water stage and high water temperatures probably delay salmon migration and contribute to late run timing (Ivey 2014). In the future, river temperature should continue to be monitored twice daily and benchmarks should be established so that staff gauge readings can be comparable between years.

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APPENDIX A: DESHKA RIVER CHINOOK SALMON WEIR COUNTS 2005–2014

Appendix A1.–Deshka River Chinook salmon weir counts.

	Daily passage									
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
19 May			1							2
20 May			1							3
21 May			1		0	4				4
22 May			3		0	1				10
23 May			0		4	13	0			8
24 May			0		1	2	0			9
25 May			1		43	12	6	0		15
26 May		10	27		2	9	23	9		25
27 May	0	0	22		6	26	12	22		6
28 May	0	23	12	0	0	0	10	22		7
29 May	97	18	3	2	2	8	19	18		93
30 May	113	7	7	34	1	0	3	2		14
31 May	79	0	47	38	4	0	4	24		39
1 Jun	49	10	8	8	9	0	2	21		13
2 Jun	184	3	49	28	82	1	2	107		166
3 Jun	25	61	14	30	28	12	53	33		214
4 Jun	721	10	28	2	56	1	21	77		86
5 Jun	543	234	25	8	140	34	8	10		454
6 Jun	823	55	15	27	64	199	317	87		735
7 Jun	1,365	16	346	26	97	121	24	68		715
8 Jun	560	1	43	7	124	101	271	217		608
9 Jun	1,715	371	123	6	52	392	375	368	43	1,065
10 Jun	966	704	204	5	150	910	637	672	382	2,279
11 Jun	1,004	1,164	543	13	420	134	732	383	141	1,463
12 Jun	1,431	1,340	1,277	167	569	542	742	147	89	1,033
13 Jun	702	1,316	335	33	329	2,008	735	813	206	994
14 Jun	1,372	878	1,241	252	858	1,172	845	368	98	666
15 Jun	1,022	1,392	778	506	684	304	720	230	89	758
16 Jun	2,279	1,859	742	462	388	1,989	618	584	155	955
17 Jun	972	2,947	1,249	197	861	1,976	852	496	262	712
18 Jun	852	1,392	756	158	145	2,724	1,700	453	174	455
19 Jun	774	949	672	193	717	1,186	1,667	538	44	320
20 Jun	1,706	861	597	129	652	470	923	708	110	432
21 Jun	1,913	989	260	305	267	274	734	402	752	278
22 Jun	507	1,340	327	394	563	366	199	659	1,810	206
23 Jun	979	1,389	13	121	334	264	793	199	2,583	556
24 Jun	683	1,738	233	175	463	297	556	59	481	92
25 Jun	1,919	1,242	1,222	361	210	195	847	274	3,055	163
26 Jun	1,919	223	2,054	158	610	473	714	487	1,313	94

-continued-

Date	Daily passage									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
27 Jun	1,023	88	303	423	548	507	702	870	1,072	14
28 Jun	347	462	1,334	305	435	31	211	743	310	0
29 Jun	1,349	1,001	713	192	444	182	206	331	295	0
30 Jun	466	652	334	234	156	19	260	542	563	10
1 Jul	548	382	337	362	146	231	367	644	1,158	36
2 Jul	674	1,132	321	138	137	187	186	631	215	37
3 Jul	582	271	85	189	111	139	22	116	474	101
4 Jul	1,579	682	223	188	29	221	46	205	842	11
5 Jul	576	465	339	56	52	43	152	116	557	43
6 Jul	369	418	327	237	41	18	76	136	529	18
7 Jul	473	61	213	212	3	29	223	226	37	15
8 Jul	18	208	56	202	3	25	174	59	8	11
9 Jul	178	69	43	8	2	3	17	67	63	10
10 Jul	186	282	6	152	5	76	17	94	17	33
11 Jul	2	344	0	9	2	22	44	27	81	28
12 Jul	122	55	21	22	16	6	127	12	46	19
13 Jul	304	229	47	80	19	92	147	38	24	29
14 Jul	224	224	12	5	12	8	155	34	5	4
15 Jul	153	157	20	86	6	71	35	36	45	11
16 Jul	74	627	5	0	92	9	20	33	16	11
17 Jul	35	252	8	10	160	43	69	48	11	13
18 Jul	28	54	52	206	11	24	45	73	43	10
19 Jul	91	36	14	100	22	19	59	25	28	4
20 Jul	16	13	85	38	30	151	89	28	9	2
21 Jul	132	11	34	7	102	73	50	90	6	12
22 Jul	73	10	49	3	14	8	19	21	8	3
23 Jul	40	6	13	11	9	13	65	36	16	7
24 Jul	23	21	37	31	22	4	32	14	9	0
25 Jul	11	12	35	16	17	4	19	7	2	2
26 Jul	3	9	45	6	13	4	12	18	5	3
27 Jul	31	8	22	9	17	1	13	10	5	3
28 Jul	10	15	23	9	9	0	13	15	4	1
29 Jul	37	20	20	9	31	13	15	6	4	0
30 Jul	12	6	6	8	7	2	10	3	2	2
31 Jul	14	9	7	5	19	11	7	6	2	2
1 Aug	12	11	4	6	9	16	13	9	4	0
2 Aug	26	2	2	1	4	5	28	4	12	0
3 Aug	3	11	5	5	3	9	18	7	8	2
4 Aug	34	13	4	11	6	3	2	24	6	5
5 Aug	13	8	27	5	16	2	11	15	7	2

-continued-

Apppendix A1.–Page 3 of 3.

	Daily passage									
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
6 Aug	19	7	51	9	11	3	11	14	3	1
7 Aug	8	4	28	17	4	5	18	4	5	2
8 Aug	16	9	8	12	14	3	0	4	0	1
9 Aug	13	16	1	14	13	1		6	1	3
10 Aug	8	24	10	9	8	4		5	0	0
11 Aug	30	15	14	6	10	2		4	0	2
12 Aug	17	72	14	9	9	1		2	49	3
13 Aug	22	57	3	4	6	3	2	4	14	3
14 Aug	3	49	6	1	14	6	6	6	8	6
15 Aug	11	19	13	5	42	3	2	12	10	5
16 Aug	6	0	11	1	31	1	5	6	4	5
17 Aug	16	0	7	2	27	9	11	10	6	7
18 Aug	62		9	1	14	0	5	6	16	7
19 Aug	33		4	1	7	0	8	5	7	8
20 Aug	60		5	1	3	1	9	1	3	1
21 Aug	72		4	0	12	1	1	4	4	5
22 Aug	20		4	0	4	1	3	0	8	1
23 Aug	21		4	0	1	0	2	2	11	0
24 Aug	21		3	0	4	0	0	8	9	0
25 Aug	13		0	0	0	1	1	2	10	2
26 Aug	18		3	0	4	1	0	4	9	0
27 Aug	15		0	0	2	3	0	5	5	2
28 Aug	8		0	0	4	0	1	2	5	5
29 Aug	6		1	0	1	1	1	3	1	0
30 Aug	15		0	0	0	0	0	0	3	0
31 Aug	7		0	0	0	0	0	0	3	2
1 Sep	4		0	0	0	0	0	1	0	3
2 Sep	6		1	0	0	0	0	0	2	0
3 Sep	3		0	0	0	0	0	0	0	
4 Sep	4		0	0	0	0	0	0	0	
5 Sep	3		0	0	0	0		0	0	
6 Sep	0			0	0	0				
7 Sep				0	0					
8 Sep				0						
Total	37,725	31,150	18,714	7,533	11,960	18,594	19,026	14,096	18,531	16,335

APPENDIX B: DESHKA RIVER COHO SALMON WEIR COUNTS 2005–2014

Appendix B1.–Deshka River coho salmon weir counts.

	Daily passage									
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1 Jul	0	0	0	0	0	0	0	0	0	0
2 Jul	0	0	0	0	0	0	0	0	0	0
3 Jul	0	0	7	0	0	0	0	0	0	0
4 Jul	0	5	11	0	0	0	0	0	0	5
5 Jul	0	6	14	0	0	0	0	0	0	2
6 Jul	0	18	2	0	0	0	0	0	0	0
7 Jul	0	2	0	0	0	0	0	0	0	2
8 Jul	0	40	0	0	0	0	0	0	0	4
9 Jul	0	57	0	0	0	0	0	0	0	0
10 Jul	3	125	0	0	0	3	0	0	2	3
11 Jul	0	144	0	0	0	0	0	0	14	11
12 Jul	5	94	3	0	0	0	0	0	3	16
13 Jul	3	93	1	1	0	7	0	0	7	18
14 Jul	7	35	1	1	0	2	0	0	1	9
15 Jul	2	131	1	3	0	9	0	0	1	23
16 Jul	0	726	2	0	0	0	0	0	0	36
17 Jul	1	685	26	8	0	47	0	2	0	11
18 Jul	0	273	24	146	0	17	0	0	8	34
19 Jul	2	367	0	546	0	73	6	1	14	85
20 Jul	15	127	3	158	0	427	28	0	10	88
21 Jul	64	119	3	83	0	1,283	19	4	9	132
22 Jul	12	184	3	61	0	389	14	23	26	82
23 Jul	51	125	0	445	0	258	3	84	12	155
24 Jul	7	254	16	1,320	24	226	4	28	6	139
25 Jul	5	169	121	1,145	14	207	33	53	2	136
26 Jul	1	333	97	417	8	561	69	47	10	487
27 Jul	18	1,403	103	466	15	588	204	12	11	296
28 Jul	3	578	114	405	41	108	103	163	1	79
29 Jul	53	610	123	441	528	418	48	82	3	58
30 Jul	12	673	33	480	136	302	51	192	0	412
31 Jul	368	541	43	303	238	1,017	24	308	0	123
1 Aug	349	403	50	202	91	1,105	81	490	2	19
2 Aug	215	176	133	138	87	306	2,415	596	11	80
3 Aug	252	105	85	156	269	322	2,112	352	10	65
4 Aug	804	312	374	139	45	225	420	846	58	12
5 Aug	523	718	1,013	74	330	289	638	653	167	152
6 Aug	565	519	2,281	253	144	217	280	601	131	308
7 Aug	177	146	1,573	355	417	411	182	207	296	262
8 Aug	617	160	139	429	247	124	0	104	269	364

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Appendix B1.–Page 2 of 2.

	Daily passage									
Date	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
9 Aug	526	106	219	102	523	73		267	616	385
10 Aug	204	367	114	368	578	595		65	178	376
11 Aug	534	491	160	285	481	187		83	539	418
12 Aug	549	4,346	117	299	174	93		89	8,119	177
13 Aug	394	29,524	116	285	26	105		62	1,519	210
14 Aug	24	13,110	18	194	2,180	92	0	59	1,132	179
15 Aug	22	1,019	129	265	13,149	47	12	34	664	265
16 Aug	27	0	663	194	5,869	19	42	29	484	380
17 Aug	107	0	459	460	521	91	73	92	1,052	2,810
18 Aug	604		395	631	112	26	104	11	843	153
19 Aug	473		93	171	98	0	149	25	243	184
20 Aug	534		128	31	114	0	16	26	490	128
21 Aug	11,117		248	30	74	5	42	718	747	103
22 Aug	9,327		118	71	45	10	65	71	3,745	130
23 Aug	5,738		174	757	26	2	40	82	430	137
24 Aug	8,558		230	81	30	5	26	12	31	102
25 Aug	2,804		101	10	117	5	33	8	25	142
26 Aug	933		68	11	16	5	11	11	48	159
27 Aug	171		37	38	67	3	28	36	19	284
28 Aug	29		34	22	22	6	9	64	30	418
29 Aug	131		76	15	84	51	6	17	25	649
30 Aug	359		35	47	73	3	21	11	16	0
31 Aug	172		54	9	53	1	22	6	10	28
1 Sep	118		105	13	16	0	30	61	9	31
2 Sep	92		27	8	31	6	13	13	42	22
3 Sep	33		183	21	139	11	8	25	1	
4 Sep	58		58	34	70	8	16	0		
5 Sep	85		17	26	21	3	7	0		
6 Sep	30			17	2	0	1			
7 Sep				50	3					
8 Sep				4						
Total	47,887	59,419	10,575	12,724	27,348	10,393	7,508	6,825	22,141	11,578