

U.S. Fish and Wildlife Service
Office of Subsistence Management
Fisheries Resources Monitoring Program

Estimation of Sockeye and Coho Salmon Escapement in Mortensens Creek,
Izembek National Wildlife Refuge, 2001

Annual Report No. FIS01-206

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Kellie S. Whitton

U.S. Fish and Wildlife Service
King Salmon Fishery Resources Office
P.O. Box 277
King Salmon, AK 99613-0277

January 2001

ANNUAL REPORT SUMMARY PAGE

Title: Estimation of sockeye and coho salmon escapement in Mortensens Creek, Izembek National Wildlife Refuge

Study Number: FIS01-206

Investigator(s): Kellie Whitton, U.S. Fish and Wildlife Service, King Salmon Fishery Resource Office (KSFRO)

Geographic Area: Kodiak/Aleutian Islands

Information Type: Stock Status and Trends (SST)

Issue Addressed:

1. Lack of in-season information to ensure adequate escapement.
2. Lack of in-season information to ensure that subsistence needs are satisfied.
3. Conflict between subsistence users and the sport fishery.

Study Cost: \$96,313

Study Duration: June 2001-October 2003

Key Words: coho salmon, Cold Bay, Izembek National Wildlife Refuge, Mortensens Creek, *Onchorynchus nerka*, *Onchorynchus kisutch*, sockeye salmon, subsistence fishery

Citation: Whitton, K. 2000. Estimation of sockeye and coho salmon escapement in Mortensens Creek, Izembek National Wildlife Refuge. USFWS Office of Subsistence Management, Fisheries Resource Monitoring Program, Annual Report No. FIS01-206-1, Alaska.

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INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) expressed concern that the lack of an in-season estimate of sockeye *Oncorhynchus nerka* and coho *O. kisutch* salmon escapement into Mortensens Creek may jeopardize the health of the runs, as well as opportunities for subsistence and sport fishing (Arnold Shaul, ADF&G, personal communication). The outlet of Mortensens Creek is one of the few areas where sockeye salmon are available for harvest by subsistence users from King Cove and Cold Bay. In 1999, escapement of sockeye salmon in Mortensens Creek was estimated to be 3,600 fish with an additional 1,378 sockeye salmon harvested in the subsistence and commercial fisheries (ADFG 2000). It appeared that the subsistence and commercial harvest in 1999 may have been more than 25% of the entire run. In addition, about 30% of the total subsistence harvest of sockeye salmon by state and federally qualified users was taken by Alaska residents living outside of Cold Bay and King Cove. In 1999, 279 coho salmon were harvested in the commercial and subsistence fisheries (ADFG 2000).

King Cove residents were also concerned about sport fishing effects on coho salmon in Mortensens Creek. No creel survey or harvest information is available for Mortensens Creek. The State of Alaska annual mail out sportfish survey does not specifically estimate sport harvest for Mortensens Creek. However, the report does estimate sport harvest for the Cold Bay area which would primarily include Russell and Mortensens Creeks. The average sport harvest for this area from 1996 to 1998 was 671 coho salmon (Howe et al. 1997, Howe et. al. 1998, and Howe et al. 1999).

Current management of these species is based on aerial surveys that are used to assess escapement during and after the runs enter the stream. The accuracy of the aerial surveys is questionable due to dark stream bottoms, turbid water, and inclement weather. An accurate in-season estimate of escapement will help managers to ensure that a sufficient number of each species is available for subsistence harvest. Escapement estimates will also provide managers with the data needed to address concerns about overharvest and will be the first step in resolving the conflict between subsistence and sport users.

OBJECTIVES

1. Enumerate daily passage of sockeye and coho salmon through a weir on Mortensens Creek.
2. Describe the run-timing of sockeye and coho salmon through the weir.
3. Estimate the sex and age compositions of sockeye and coho salmon such that simultaneous 90% confidence intervals have a maximum width of 0.20.
4. Estimate the mean length of sockeye and coho salmon by sex and age.

5. From objective one, determine if the abundance of sockeye and coho salmon returns in Mortensens Creek are adequate to allow subsistence fishing
6. From objective one, determine if the abundance of sockeye and coho salmon returns in Mortensens Creek are adequate to allow sport fishing.

METHODS

Study Area

Mortensens Creek originates in the foothills of Frosty Peak and flows north towards the town of Cold Bay, Alaska before eventually turning south and emptying into Mortensens Lagoon (Figure 1). Little hydrological information is available, but the drainage consists of several small tributaries, ponds, and a lake. Mortensens Creek supports populations of sockeye, coho, chum (*O. keta*), and pink (*O. gorbuscha*) salmon and Dolly Varden char (*Salvelinus malma*).

Weir Operation

The King Salmon Fishery Resources Office installed and operated a weir on Mortensens Creek, 1 July to 26 October 2001. The weir was constructed of 12 mm diameter electrical metal tubing pickets separated by 38 mm lengths of polyvinyl chloride pipe. A 4 mm diameter hole was drilled about 30 cm from both ends of each picket. Four-mm diameter aircraft cable was used to string the pickets and spacers together, and clamps were attached to the ends of the cables to create 3-m long weir panels of varying heights to accommodate differences in channel depth.

Weir panels were supported by fence posts and an 8 mm diameter galvanized aircraft cable stretched across the stream. The supporting cable was anchored to the stream banks using “dead men” buried vertically at a depth that allowed the cable to be suspended just above the water surface. Each “dead man” was buried far enough from the stream channel to reduce the chance it would fail during high water. Weir panels were hooked together and placed across the channel at an angle to direct upstream migrant fish to the trap box. The continuous panel was tilted downstream in relation to the stream bed to shunt debris to the water surface, thereby maintaining free-flow of water through the pickets. A 4.6 m wide strip of Amoco® geotextile cloth was anchored beneath the weir to prevent substrate erosion beneath the panels. The tops of the panels were wired to the supporting cable. The stream banks at each end of the weir were armored with geotextile cloth to prevent erosion

A fyke was installed in the weir, leading to an upstream migrant holding pen. The fyke was located as close to the stream bank as adequate depth would allow. The depth in the holding pen was greater than 0.5 m to help minimize fish escaping from the pens. The entire weir was inspected, cleaned, and maintained daily to insure integrity.

A dip net was used to remove fish from the holding pen for biological sampling at least once a day or more often as the number moving through the weir increased. Weekly samples of sockeye and coho salmon were examined for gill net marks, measured, sexed, and scales were extracted for age analysis. Coho and sockeye salmon in excess of sampling needs were counted and identified as they were passed through an opening in the weir or trapbox. Fish were not allowed to hold downstream of the weir. If this occurred, the trap box was closed and the counting panel was opened to facilitate upstream passage. A Hobo® thermograph (model number H08-001-02) was installed at the weir to monitor water temperatures. Water temperature was recorded every two hours and summarized as daily maximum, minimum, and mean (Appendix 1).

Escapement, Age, Sex, and Length Data

Data on sockeye and coho salmon age, sex, and length (ASL) were collected using a temporally stratified sampling design (Cochran 1977), with statistical weeks defining strata. Sockeye and coho salmon were sampled most weeks for ASL information, and to the extent logistically feasible, the sample was collected uniformly throughout each week (Sunday through Saturday). Coho and sockeye salmon were sampled primarily during high tides. During other times of the day, water depth often prevented upstream migration. To avoid potential bias caused by the selection or capture of individual fish, all sockeye and coho salmon within the trap were included in the sample even if the target number of fish was exceeded.

During each week, a sample of sockeye and coho salmon was trapped, examined for gill net marks, length measured from mid-eye-to-fork of the tail (MEF), sex determined, and scales collected for aging. Mid-eye-to-fork lengths were measured to the nearest millimeter. One scale from sockeye salmon and three scales from coho salmon were removed from the preferred area on the left side of adult salmon (Jearld 1983). Scales samples were cleaned and mounted on gummed scale cards. The Alaska Department of Fish and Game-Kodiak pressed and aged the scales. Salmon ages are reported according to the European method (Koo 1962).

Maximum weekly sample size goals were established so that simultaneous 90% interval estimates of age composition for each week have maximum widths of 0.20 (Bromaghin 1993) (Table 1). Sample sizes obtained using these methods were increased to account for the expected number of unreadable scales. However, the derivation of maximum sample size goals was based on a multinomial sampling model (sampling with replacement or small samples relative to a large population). Seasonal escapement at Mortensens Creek was estimated to be < 5,000 for coho salmon and < 10,000 for sockeye salmon during most years. The weekly sample size goal

CONCLUSIONS

With only one season of escapement data and limited information on the sport fish harvest, it is not possible to determine whether sockeye and coho salmon populations in Mortensens Creek are sufficient to support, subsistence, commercial, and sport fisheries.

RECOMMENDATIONS

1. Based on the results of the 2001 weir operations, we recommend that the weir be moved slightly upstream of its present location to further reduce tidal influence in an effort to improve the accuracy of the escapement counts. Potential sites were identified prior to weir removal in October.
2. Information on the sport fish harvest is limited therefore, we recommend that a creel survey be conducted to determine effort and harvest levels in the sport and subsistence fisheries. The fishery has a single access point, which would allow the weir crew to interview most fishing parties.

ACKNOWLEDGMENTS

The U.S. Fish and Wildlife Service, Office of Subsistence Management, provided funding support for this project through the Fisheries Resource Monitoring Program, under agreement number FIS01-2006. I wish to thank the many people who helped with field work and data entry: Jeremiah Nelson, Alexander Potter, Benjamin Feldman, Robert Gerbi, Kristen Wolen, Jason Bradley, Peter Finch, Jeremy Carlson, Kevin Sims and Michael Harrington. I also thank the staff at the Izembek National Wildlife Refuge for logistical support.

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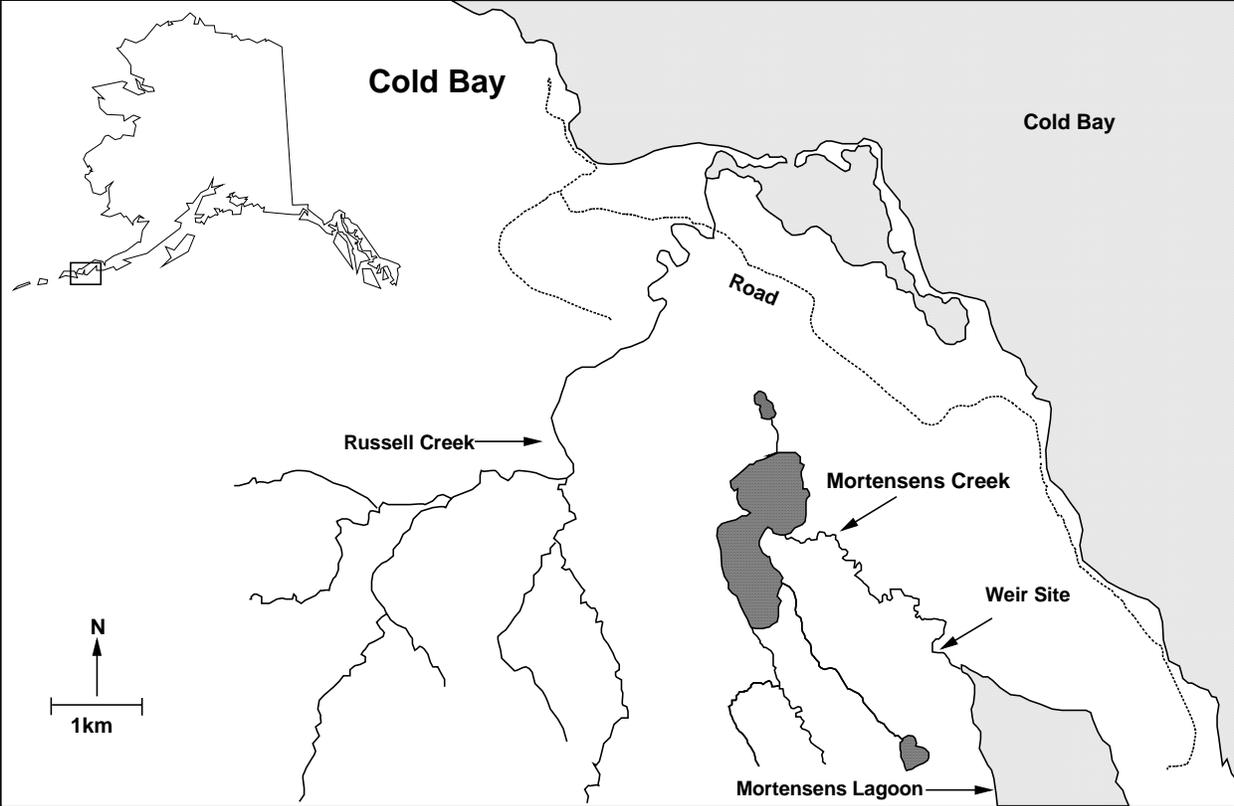


Figure 1. Map of Mortensens Creek and the weir site.

Table 1. Estimated maximum weekly sample size goals.

Species	Number of Age Categories	Sample Size	Estimate frequency of Unreadable Scales (%)	Adjusted Sample Size
Sockeye Salmon	4	121	10	135
Coho Salmon	3	109	10	122

Table 2. Strata (time periods) used for analysis of Mortensens Creek coho and sockeye salmon biological data.

Stratum	Coho Salmon	Sockeye Salmon
1	21 August - 7 September	1 July - 12 July
2	8 September - 17 September	13 July - 20 July
3	18 September - 29 September	21 July - 27 July
4	30 September - 13 October	28 July - 5 August
5	14 October - 26 October	6 August - 11 August
6	-----	12 August - 23 September

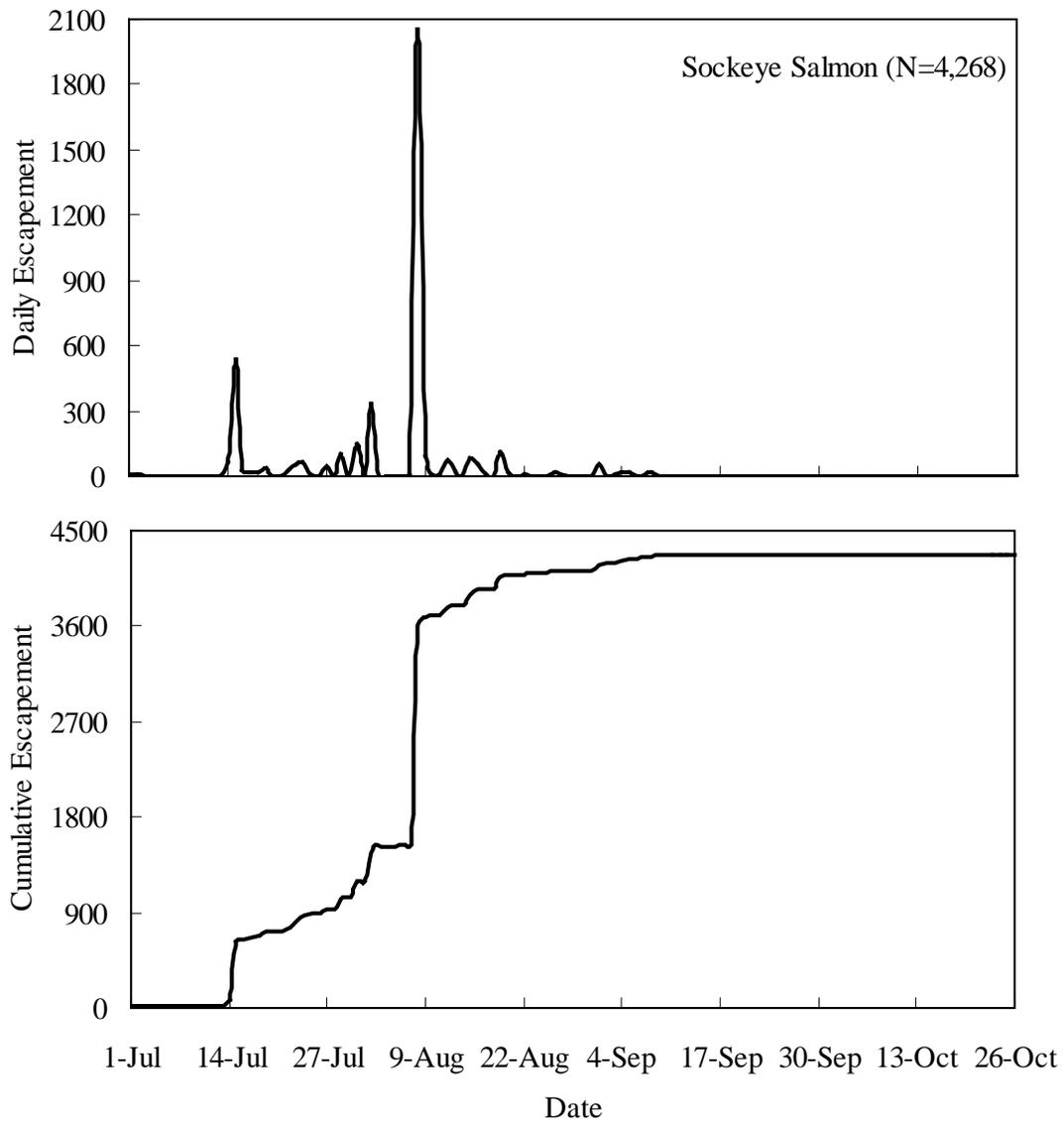


Figure 2. Daily (upper) and cumulative escapement (lower) of sockeye salmon in Mortensens Creek, 2001.

Table 3. Estimated sex composition and standard errors (SE) of sockeye salmon sampled by stratum in Mortensens Creek, 2001.

Stratum	Sample			Escapement						
	N	Male	Femal	Percent			Number			Total
				Male	Female	SE	Male	Female	SE	
Jul 1 - Jul 12	16	14	2	88	12	3.4	17	2	0.6	19
Jul 13 - Jul 20	115	78	37	68	32	0.2	227	478	28.2	705
Jul 21 - Jul 27	82	41	41	50	50	4.3	104	104	9.0	208
Jul 28 - Aug 5	45	28	17	62	38	7.0	370	225	41.8	595
Aug 6 - Aug	142	78	64	55	45	4.1	1,199	984	88.4	2,183
Aug 12 - Sep	111	61	50	55	45	4.2	307	251	23.7	558
Total	511	300	211	58	42	2.5	2,506	1,762	104.9	4,268

Table 4. Estimated age composition (%), sample sizes (N), and standard errors (SE) of sockeye salmon by stratum in Mortensens Creek, 2001.

Table 4. Estimated age composition (%), sample sizes (N), and standard errors (SE) of sockeye salmon by stratum in Mortensens Creek, 2001.

Stratum	Sample			Escapement			1.2			1.3			2.2			2.3		
	N	0.3	1.2	1.3	2.2	2.3	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
1	5	1	0	3	0	1	20	17.2	0	0	60	21.0	0	0	20	17.2		
2	92 ^a	6	8	71	0	6	7	2.4	9	2.8	77	4.1	0	0	7	2.4		
3	74	6	4	58	1	5	8	2.6	5	2.1	78	3.9	1	1.1	7	2.4		
4	35 ^a	1	5	20	5	3	3	2.8	14	6.0	57	8.2	14	5.8	9	4.7		
5	114 ^a	2	18	77	5	9	2	1.2	16	3.3	68	4.3	4	1.9	8	2.5		
6	85	1	29	51	2	2	1	1.1	34	4.8	60	4.9	2	1.5	2	1.5		
Total	405 ^a	17	64	280	13	26	3	0.9	16	2.0	67	2.7	4	1.3	7	1.5		

^a Sample sizes for listed age classes do not equal the total sample size because ages 1.4, 2.1, 2.4, and 3.3 (N=5) were not included as they were <2% of the total sample.
 Total sample size because ages 1.4, 2.1, 2.4, and 3.3 (N=5) were not included as they were <2% of the total sample.

Stratum	Sample			
	N	0.3	1.2	1.3
1	5	1	0	3
2	92 ^a	6	8	71
3	74	6	4	58
4	35 ^a	1	5	20
5	114 ^a	2	18	77
6	85	1	29	51
Total	405 ^a	17	64	280

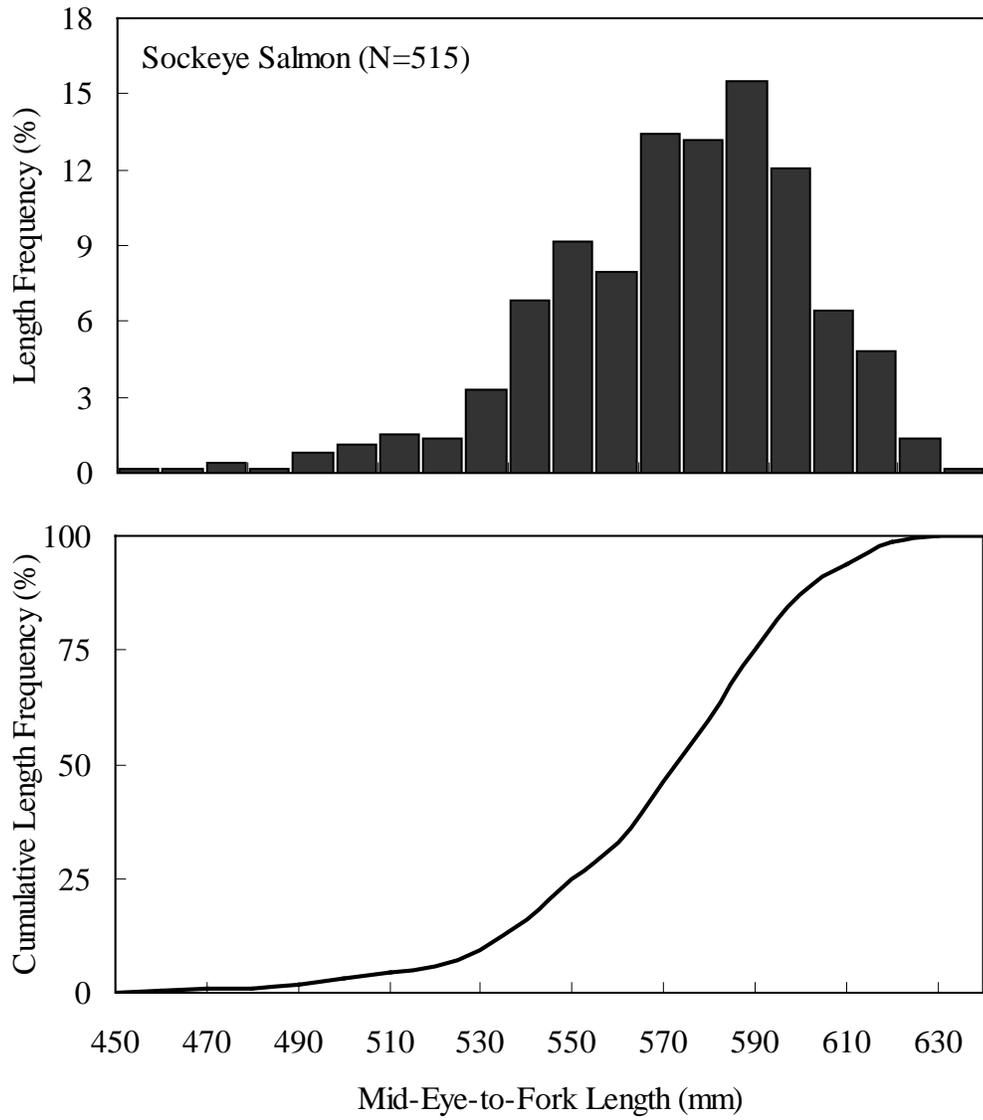


Figure 3. Length frequency (upper) and cumulative length frequency (lower) for sockeye salmon sampled at the Mortensens Creek weir, 2001.

Table 5. Average, standard error (SE), range, and sample size of lengths taken from sockeye salmon in Mortensens Creek, 2001.

	Ages ^a				
	0.3	1.2	1.3	2.2	2.3
<i>Females</i>					
Mean Length	562	524	560	503	566
SE	3.6	4.5	3.2	5.7	4.3
Range	478-534	460-572	501-612	467-533	521-594
<i>Males</i>					
Mean Length	589	549	590	539	589
SE	5.3	3.0	2.3	3.9	3.0
Range	556-621	489-616	516-632	479-595	539-606
<i>All Fish</i>					
Mean Length	580	536	577	529	578
SE	4.5	3.3	2.8	4.5	2.8
Range	534-621	460-616	501-632	467-595	521-606

^a Ages 1.4, 2.2, 2.4, and 3.3 (N=5) were not included as they were <2% of the total sample.

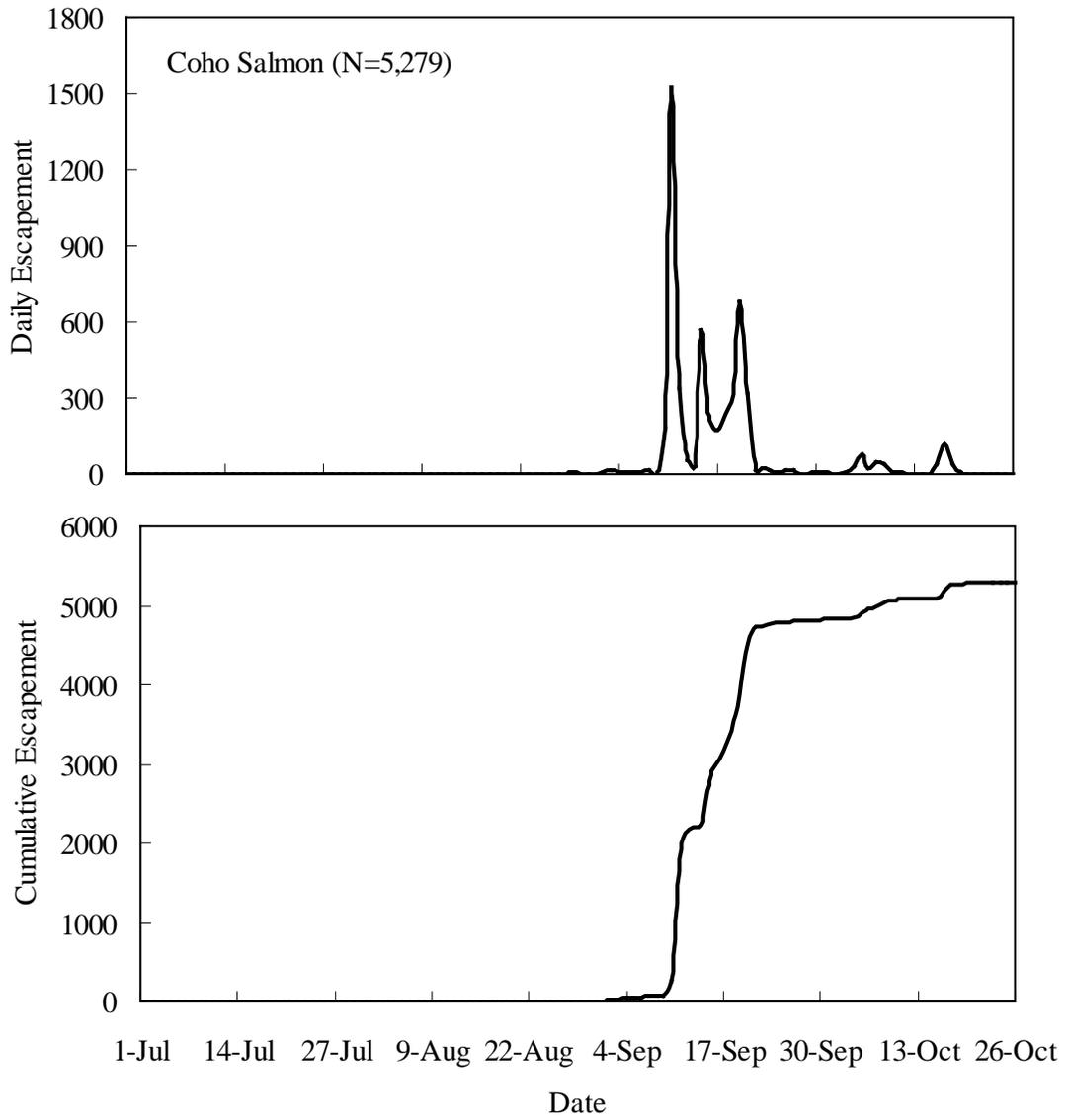


Figure 4. Daily (upper) and cumulative escapement (lower) of coho salmon in Mortensens Creek, 2001.

Table 6. Estimated sex composition and standard errors (SE) of coho salmon by stratum in Mortensens Creek, 2001.

Stratum	Escapement									
	Sample			Percent			Number			
	N	Male	Femal	Male	Female	SE	Male	Female	SE	Total
Aug 21 - Sep	11	8	3	73	27	12.8	47	18	8.3	65
Sep 8 - Sep	167	110	57	66	34	3.6	2,045	1,060	111.1	3,105
Sep 18 - Sep	98	47	51	48	52	4.9	789	856	80.9	1,645
Sep 30 - Oct	36	19	17	53	47	7.8	140	125	20.8	265
Oct 14 - Oct	19	13	6	68	32	10.4	136	63	20.7	199
Total	331	197	134	60	40	2.7	3,142	2,137	138.1	5,279

Table 7. Estimated age composition (percent and number) and standard errors (SE) of coho salmon by stratum in Mortensens Creek, 2001.

Stratu	Escanement															
	Sample				1.1				2.1				3.1			
	N	1.1	2.1	3.1	%	SE	No.	SE	%	SE	No.	SE	%	SE	No.	SE
1	19	3	15	1	16	7.2	10	4.7	79	8.1	51	5.3	5	4.4	3	2.9
2	145	14	123	8	10	2.4	300	74.6	85	2.9	2,634	90.6	6	1.9	171	57.7
3	93	18	73	2	19	4.0	318	65.8	78	4.2	1,291	68.4	2	1.5	35	24.2
4	41	5	36	0	12	4.8	32	12.6	88	4.8	233	12.6	0	0	0	0
5	18	5	13	0	28	10.4	55	20.6	72	10.4	144	20.6	0	0	0	0
Total	316	45	260	11	14	1.9	716	102.5	82	2.2	4,353	116.	4	1.2	210	62.6

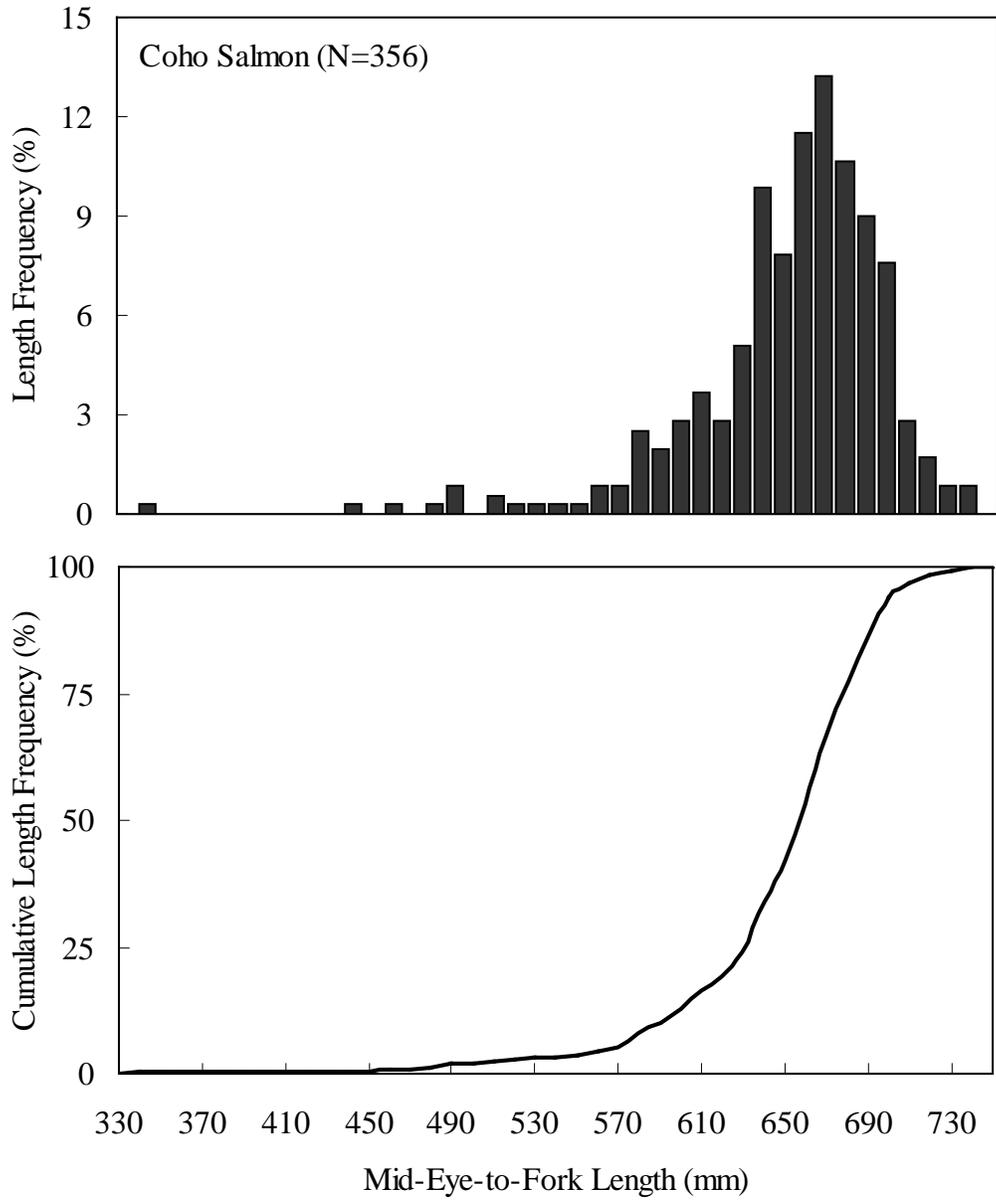
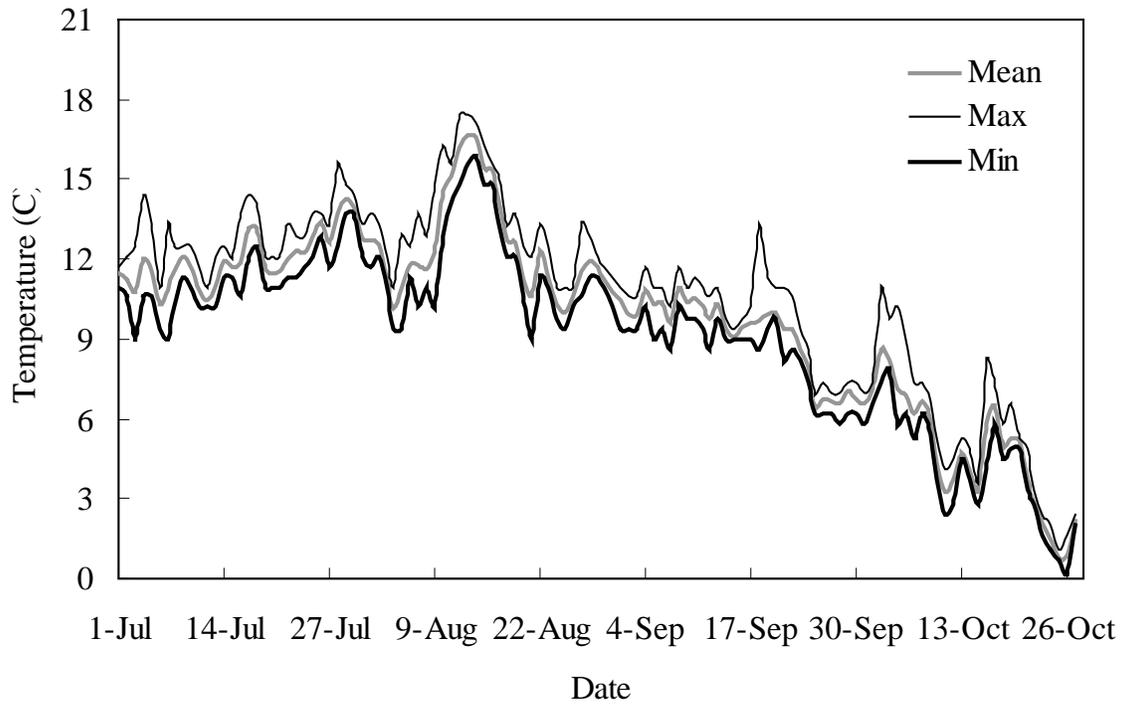


Figure 5. Length frequency (upper) and cumulative length frequency (lower) for coho salmon sampled at the Mortensens Creek weir, 2001.

Table 8. Average, standard error (SE), range, and sample size of lengths taken from coho salmon in Mortensens Creek, 2001.

	Ages		
	1.1	2.1	3.1
<i>Females</i>			
Mean Length	632	648	668
SE	5.8	3.5	3.8
Range	582-672	490-704	653-688
<i>Males</i>			
Mean Length	652	657	669
SE	5.3	5.0	5.8
Range	512-735	340-724	558-711
<i>All Fish^a</i>			
Mean Length	646	652	669
SE	4.5	4.3	3.8
Range	512-735	340-724	558-711

^a All fish includes fish which were not identified as male or female.



Appendix 1. Mean, maximum, and minimum water temperatures in Mortensens Creek, Alaska, 2001.

Appendix 2. Daily counts, cumulative counts (Cum.), and cumulative percent (Cum. %) of sockeye, coho, pink, and chum salmon escapement through the Mortensens Creek weir, 2001.

Date	Sockeye Salmon			Coho Salmon			Pink	Chum
	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
Jul 1	11	11	0.26	0	0	0.00	0	0
Jul 2 ^a	6	17	0.40	0	0	0.00	0	0
Jul 3	0	17	0.40	0	0	0.00	0	0
Jul 4	0	17	0.40	0	0	0.00	0	0
Jul 5	0	17	0.40	0	0	0.00	0	0
Jul 6	0	17	0.40	0	0	0.00	0	0
Jul 7	0	17	0.40	0	0	0.00	0	0
Jul 8	2	19	0.45	0	0	0.00	0	0
Jul 9	0	19	0.45	0	0	0.00	0	0
Jul 10	0	19	0.45	0	0	0.00	0	0
Jul 11	0	19	0.45	0	0	0.00	0	0
Jul 12	0	19	0.45	0	0	0.00	0	0
Jul 13	1	20	0.47	0	0	0.00	0	0
Jul 14 ^a	64	84	1.97	0	0	0.00	0	0
Jul 15	535	619	14.50	0	0	0.00	0	0
Jul 16	27	646	15.14	0	0	0.00	0	0
Jul 17	20	666	15.60	0	0	0.00	0	0
Jul 18	17	683	16.00	0	0	0.00	0	0
Jul 19	37	720	16.87	0	0	0.00	0	0
Jul 20	4	724	16.96	0	0	0.00	0	0
Jul 21	1	725	16.99	0	0	0.00	0	0
Jul 22	31	756	17.71	0	0	0.00	0	0
Jul 23	51	807	18.91	0	0	0.00	0	0
Jul 24	69	876	20.52	0	0	0.00	0	0
Jul 25	13	889	20.83	0	0	0.00	0	0
Jul 26	1	890	20.85	0	0	0.00	0	0
Jul 27	42	932	21.84	0	0	0.00	0	0
Jul 28	4	936	21.93	0	0	0.00	0	0
Jul 29	104	1,040	24.37	0	0	0.00	0	0
Jul 30	3	1,043	24.44	0	0	0.00	0	0
Jul 31	148	1,191	27.91	0	0	0.00	0	0
Aug 1	1	1,192	27.93	0	0	0.00	0	0
Aug 2	331	1,523	35.68	0	0	0.00	0	0

Appendix 2.&Continued

Date	Sockeye Salmon			Coho Salmon			Pink	Chum
	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
Aug 3	3	1,526	35.75	0	0	0.00	0	0
Aug 4	0	1,526	35.75	0	0	0.00	0	0
Aug 5	1	1,527	35.78	0	0	0.00	0	0
Aug 6	3	1,530	35.85	0	0	0.00	0	0
Aug 7	13	1,543	36.15	0	0	0.00	0	0
Aug 8	2,057	3,600	84.35	0	0	0.00	0	0
Aug 9	92	3,692	86.50	0	0	0.00	0	0
Aug 10	10	3,702	86.74	0	0	0.00	0	0
Aug 11	8	3,710	86.93	0	0	0.00	0	0
Aug 12	74	3,784	88.66	0	0	0.00	0	0
Aug 13	19	3,803	89.10	0	0	0.00	0	0
Aug 14	2	3,805	89.15	0	0	0.00	0	0
Aug 15	84	3,889	91.12	0	0	0.00	0	0
Aug 16	56	3,945	92.43	0	0	0.00	0	0
Aug 17	10	3,955	92.67	0	0	0.00	0	0
Aug 18	2	3,957	92.71	0	0	0.00	0	0
Aug 19	108	4,065	95.24	0	0	0.00	0	0
Aug 20	18	4,083	95.67	0	0	0.00	1	0
Aug 21	1	4,084	95.69	1	1	0.02	0	1
Aug 22	7	4,091	95.85	2	3	0.06	2	0
Aug 23	3	4,094	95.92	0	3	0.06	1	1
Aug 24	0	4,094	95.92	0	3	0.06	0	2
Aug 25	0	4,094	95.92	0	3	0.06	0	0
Aug 26	21	4,115	96.42	0	3	0.06	1	2
Aug 27	5	4,120	96.53	0	3	0.06	1	0
Aug 28	4	4,124	96.62	0	3	0.06	1	3
Aug 29	1	4,125	96.95	5	8	0.15	0	0
Aug 30	0	4,125	96.65	0	8	0.15	0	0
Aug 31	0	4,125	96.65	0	8	0.15	0	0
Sep 1	60	4,185	98.06	3	11	0.21	0	2
Sep 2	3	4,188	98.13	8	19	0.36	1	3
Sep 3	10	4,198	98.36	14	33	0.63	2	2
Sep 4	16	4,214	98.73	11	44	0.83	1	1

Appendix 2.&Continued

Date	Sockeye Salmon			Coho Salmon			Pink	Chum
	Daily	Cum.	Cum %	Daily	Cum.	Cum. %	Daily	Daily
Sep 5	22	4,236	99.25	6	50	0.95	2	0
Sep 6	4	4,240	99.34	7	57	1.08	1	1
Sep 7	8	4,248	99.53	8	65	1.23	0	0
Sep 8	14	4,262	99.86	14	79	1.50	0	0
Sep 9	2	4,264	99.91	0	79	1.50	0	2
Sep 10	4	4,268	100.00	180	259	4.91	1	0
Sep 11 ^a	0	4,268	100.00	1,535	1,794	33.98	0	1
Sep 12	0	4,268	100.00	343	2,137	40.48	0	0
Sep 13	0	4,268	100.00	55	2,192	41.52	0	0
Sep 14	0	4,268	100.00	29	2,221	42.07	0	0
Sep 15	0	4,268	100.00	565	2,786	52.78	0	0
Sep 16	0	4,268	100.00	211	2,997	56.77	0	0
Sep 17	0	4,268	100.00	173	3,170	60.05	0	0
Sep 18	0	4,268	100.00	236	3,406	64.52	0	0
Sep 19 ^b	0	4,268	100.00	317	3,723	70.52	0	0
Sep 20	0	4,268	100.00	685	4,408	83.50	0	0
Sep 21	0	4,268	100.00	313	4,721	89.43	0	0
Sep 22	0	4,268	100.00	17	4,738	89.75	0	0
Sep 23	0	4,268	100.00	24	4,762	90.21	0	0
Sep 24	0	4,268	100.00	13	4,775	90.45	0	0
Sep 25	0	4,268	100.00	4	4,779	90.53	0	0
Sep 26	0	4,268	100.00	18	4,797	90.87	0	0
Sep 27	0	4,268	100.00	16	4,813	91.17	0	0
Sep 28	0	4,268	100.00	2	4,815	91.21	0	0
Sep 29	0	4,268	100.00	0	4,815	91.21	0	0
Sep 30	0	4,268	100.00	5	4,820	91.31	0	0
Oct 1	0	4,268	100.00	4	4,824	91.38	0	0
Oct 2	0	4,268	100.00	0	4,824	91.38	0	0
Oct 3	0	4,268	100.00	0	4,824	91.38	0	0
Oct 4	0	4,268	100.00	5	4,829	91.48	0	0
Oct 5	0	4,268	100.00	35	4,864	92.14	0	0
Oct 6	0	4,268	100.00	80	4,944	93.65	0	0
Oct 7 ^a	0	4,268	100.00	26	4,970	94.15	0	0

Appendix 2.&Continued

Date	Sockeye Salmon			Coho Salmon			Pink	Chum
	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
Oct 8	0	4,268	100.00	50	5,020	95.09	0	0
Oct 9	0	4,268	100.00	36	5,056	95.78	0	0
Oct 10	0	4,268	100.00	11	5,067	95.98	0	0
Oct 11	0	4,268	100.00	11	5,078	96.19	0	0
Oct 12	0	4,268	100.00	2	5,080	96.23	0	0
Oct 13	0	4,268	100.00	0	5,080	96.23	0	0
Oct 14	0	4,268	100.00	3	5,083	96.28	0	0
Oct 15	0	4,268	100.00	1	5,084	96.31	0	0
Oct 16 ^a	0	4,268	100.00	37	5,121	97.01	0	0
Oct 17	0	4,268	100.00	115	5,236	99.19	0	0
Oct 18	0	4,268	100.00	36	5,272	99.87	0	0
Oct 19	0	4,268	100.00	5	5,277	99.96	0	0
Oct 20	0	4,268	100.00	2	5,279	100.00	0	0
Oct 21	0	4,268	100.00	0	5,279	100.00	0	0
Oct 22	0	4,268	100.00	0	5,279	100.00	0	0
Oct 23	0	4,268	100.00	0	5,279	100.00	0	0
Oct 24	0	4,268	100.00	0	5,279	100.00	0	0
Oct 25	0	4,268	100.00	0	5,279	100.00	0	0
Oct 26	0	4,268	100.00	0	5,279	100.00	0	0
Total	4,268	4,268	100.00	5,279	5,279	100.00	15	21

^a May be a partial count due to high tide-wind event.

^b Partial count because weir went down during the night.

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