Alaska Fisheries Data Series Number 2003-2

Estimation of sockeye and coho salmon escapement in Mortensens Creek, Izembek National Wildlife Refuge, 2002

Kellie S. Whitton

U.S. Fish and Wildlife Service
King Salmon Fish and Wildlife Office
P.O. Box 277
King Salmon, AK 99613
(907)246-3442

TABLE OF CONTENTS

LIST OF FIGURES

Figure

LIST OF TABLES

Table

LIST OF APPENDICES

Appendix

Alaska Fisheries Data Series Number 2003-2

Estimation of sockeye and coho salmon escapement in Mortensens Creek, Izembek National Wildlife Refuge, 2002

Kellie S. Whitton

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

Abstract.& A fixed picket weir was operated on Mortensens Creek from 25 June to 22 October 2002. Coho salmon *Onchorynchus kisutch* was the most abundant species counted through the weir (N=6,406) followed by sockeye *O. nerka* (N=5,205), chum *O. keta* (N=55), and pink salmon *O. gorbushca* (N=16). Dolly Varden char *Savelinus malma* were also observed at the weir. Sockeye salmon sampled at the weir were 47% female (SE=1.7%), and represented seven age groups. Age 1.3 was estimated to be 73% (SE=1.4%) of the escapement followed by age 1.2 (17%; SE=1.6%). The mid-eye-to-fork length for male sockeye salmon ranged from 451 to 657 mm and from 465 to 640 mm for females. Coho salmon sampled at the weir were 45% female (SE=2.5%) and represented four age groups. Age 2.1 was estimated to account for 83% (SE=2.0%) of the escapement followed by age 1.1 (11%; SE=1.7%) and 3.1(6%; SE=1.3%). The mid-eye-to-fork length for male coho salmon ranged from 479 to 741 mm and from 486 to 711 mm for females.

INTRODUCTION

The Alaska Department of Fish and Game (ADFG) 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, ADFG, 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 (Shaul and Dinnocenzo 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 subsistence harvest of sockeye salmon 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 (Shaul and Dinnocenzo 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).

An escapement goal of 3,200 to 6,400 (Nelson and Lloyd 2001) has been established for sockeye salmon, but currently there is no goal for coho salmon. 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. Specific objectives were:

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 toward 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*).

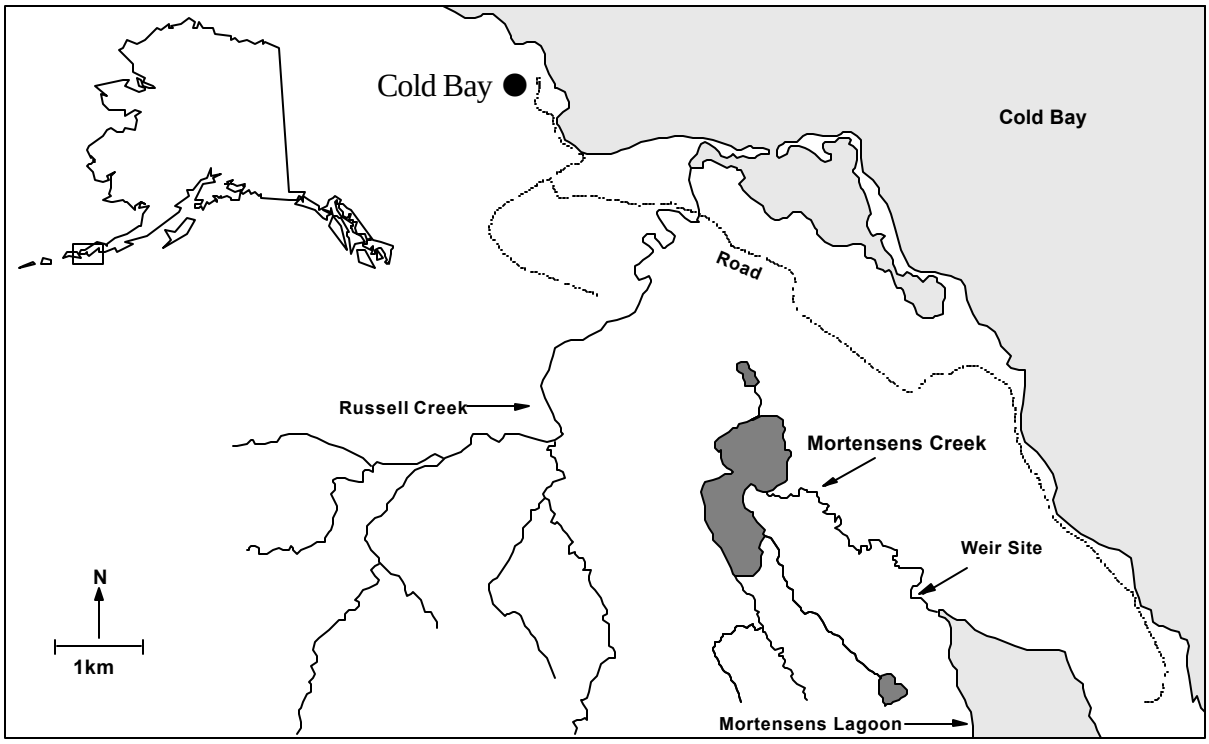


Figure 1. Map of Mortensens Creek and the weir site.

Weir Operation

The King Salmon Fishery Resources Office installed a fixed picket weir in 2001, the first year of a three-year escapement study. In 2002, the weir was moved slightly upstream and, operated 25 June to 22 October 2002. 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. In 2002, a 1.2-m wide section of plastic mesh was added to the top of the weir and trap box to reduce the chance that fish could escape upstream without being counted.

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. In 2002, a passing gate was installed in the weir to improve our ability to count fish in turbid water. The gate was a hinged panel that when lowered, would direct salmon upwards in the water column, reducing the likelihood of undercounting. Two additional weir panels were anchored on the sides of the counting panel to prevent fish from escaping over the sides.

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 trap box. 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 2 h and summarized as daily maximum, minimum, and mean (Appendix 1).

Escapement, Age, Sex, and Length

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).

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

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 < 10,000 for sockeye salmon and <5,000 for coho salmon during most years. The weekly sample size goal was expected to be a substantial fraction of the passage in some weeks; therefore, a target of about 20% of the weekly escapement was sampled during weeks of low passage when the maximum sample size goal could not be practically obtained. This was sufficient to describe the age composition and reduced the number of fish handled at the weir. For sample size determination, age categories were defined as the total age (fresh water and ocean age combined) for both sockeye (ages 3, 4, 5, and 6) and coho salmon (ages 3, 4, and 5)(Table 1).

Characteristics of fish passing through the weir were estimated using standard stratified random sampling estimators (Cochran 1977). Within a given stratum m, the proportion of species *i* passing the weir that were of sex *j* and age *k* (p_{ijkm}) was estimated as

$$\hat{p}_{ijkm} = \frac{n_{ijkm}}{n_{i++m}}, \tag{1.1}$$

where n_{ijkm} denotes the number of fish of species i, sex j, and age k sampled during stratum m and a subscript of "+" represents summation over all possible values of the corresponding variable, e.g., n_{i++m} denotes the total number of fish of species i sampled in stratum m. The variance of $\hat{p}_{ijkm}$ was estimated as

$$\hat{v}\left(\hat{p}_{ijkm}\right) = \left(1 - \frac{n_{i++m}}{N_{i++m}}\right)\frac{\hat{p}_{ijkm}\left(1 - \hat{p}_{ijkm}\right)}{n_{i++m} - 1} \tag{1.2}$$

where N_{i++m} denotes the total number of species i fish passing the weir in stratum m. The estimated number of fish of species i, sex j, and age k passing the weir in stratum m (N_{ijkm}) was

$$\hat{N}_{ijkm} = N_{i+m}\hat{P}_{ijkm} \tag{2.1}$$

with estimated variance

$$\hat{v}(\hat{N}_{ijkm}) = N^2_{i++m}\hat{v}(\hat{p}_{ijkm}) \tag{2.2}$$

Estimates of proportions for the entire period of weir operation were computed as weighted sums of the stratum estimates, i.e.,

$$\hat{p}_{ijk} = \sum_m \left\{ \frac{N_{i++m}}{N_{i+++}} \right\} \hat{p}_{ijkm} \tag{3.1}$$

and

$$\hat{v}\left(\hat{p}_{ijk}\right) = \sum_m \left(\frac{N_{i++m}}{N_{i+++}} \right)^2 \hat{v}\left(\hat{p}_{ijkm}\right) \tag{3.2}$$

The total number of fish in a species and age category passing the weir during the entire period of operation was estimated as

$$\hat{N}_{ik} = \sum_m \hat{N}_{ikm} \tag{4.1}$$

with estimated variance

$$\hat{v}\left(\hat{N}_{ik}\right) = \sum_m \hat{v}\left(\hat{N}_{ikm}\right). \tag{4.2}$$

If the length of fish of species i, sex j, and age k sampled in stratum m is denoted x_{ijkm}, the sample mean length of fish of species i, sex j, and age k within stratum m was computed as,

$$\bar{x}_{ijkm} = \frac{\sum x_{ijkm}}{n_{ijkm}} \tag{5.1}$$

With corresponding sample variance s^2_{ijkm}

$$s^2_{ijkm} = \left(1 - \frac{n_{ijkm}}{\hat{N}_{ijkm}}\right) \frac{\sum \left(x_{ijkm} - \bar{x}_{ijkm}\right)^2}{n_{ijkm} - 1}. \quad (5.2)$$

The mean length of all fish of species i, sex j, and age k $\left(\hat{\bar{x}}_{ijk}\right)$ was estimated as a weighted sum of the stratum means, i.e.,

$$\hat{\bar{x}}_{ijk} = \sum_m \left(\frac{\hat{N}_{ijkm}}{\hat{N}_{ijk}}\right) \bar{x}_{ijkm}. \quad (6.1)$$

An approximate estimator of the variance of $\hat{\bar{x}}_{ijk}$ was obtained using the delta method (Seber 1982),

$$\hat{v}\left(\hat{\bar{x}}_{ijk}\right) = \sum_m \left\{ \hat{v}\left(\hat{N}_{ijkm}\right) \left[\frac{\bar{x}_{ijkm}}{\sum_x \hat{N}_{ijkx}} - \sum_y \frac{\hat{N}_{ijky}}{\left(\sum_x \hat{N}_{ijkx}\right)^2} \bar{x}_{ijky} \right]^2 + \left(\frac{\hat{N}_{ijkm}}{\sum_x \hat{N}_{ijkx}} \right)^2 s^2_{ijkm} \right\} \quad (6.2)$$

During sampling, biological data were collected on a weekly basis. However, for the purposes of data analysis, strata were redefined to account for escapement during weeks when no fish were sampled. Sockeye salmon escapement was divided into six strata, and coho salmon escapement into five (Table 2).

Sport Fishing and Subsistence Harvest

To estimate the minimum sport fish and subsistence harvest of sockeye and coho salmon in Mortensens Creek Lagoon, a harvest survey was conducted opportunistically from 3 July to 10 September. The fishery has a single access point allowing fishermen to be easily monitored. The weir crew attempted to interview all fishing parties when feasible. However, surveys were not conducted if the weir crew was in town and occasionally fishing parties would be inaccessible until after dark. In addition, if fishing parties arrived and departed while the crew was at the weir, they were likely not interviewed. Weir crews would observe (binoculars) fishing parties from the camp or while returning from the weir. When fishing parties were preparing to leave, one or two technicians would intercept the group and collect the following information: time of interview, party size (number of people fishing), hours fished, gear (hook and line or gillnet), residence (e.g., Cold

Table 2. Strata (time periods) used for analysis of Mortensens Creek coho and sockeye salmon biological data in 2002.

Strata	Coho Salmon	Sockeye Salmon
1	21 August - 7 September	25 June - 20 July
2	8 September - 14 September	21 July - 27 July
3	15 September - 26 September	28 July - 3 August
4	27 September - 8 October	4 August - 10 August
5	9 October - 22 October	11 August - 24 August
6	-------	25 August - 22 October

Bay, King Cove, Alaska, and lower 48 states), reason (sport or subsistence), and the numbers caught and kept of each Pacific salmon species.

RESULTS

Weir Operation

Operation of the weir began 25 June and continued through 22 October 2002. Early in the season high tides associated with strong southeast winds may have allowed fish to pass upstream without being counted (9 to 11 and 23 July). Water marks on the weir during the high tides on 9 to11 July, indicate that the water did not exceed the height of the weir, but a few fish were seen upstream of the weir. Therefore, it is likely these fish jumped over the weir or out of the trap box. On 23 July, the water did appear to have exceeded the height of the weir and additional fish may have passed upstream of the weir without being counted. To prevent further problems with high water, additional plastic mesh was added to the weir and trap box on 7 August. On 11 September a high tide and strong winds pushed the weir over and an unknown number of coho salmon were observed passing the weir. On 9 October, water exceeded the height of the weir in a 3-ft section, but no coho salmon were observed going upstream. Modifications to the weir in 2002, improved our ability to count salmon in turbid conditions without undercounting.

Escapement, Sex, Length, and Age

Coho salmon was the most abundant species counted through the weir (N=6,406) followed by sockeye (N=5,205), chum (N=55), and pink salmon (N=16) (Appendix 2). Picket spacing (38 mm) allowed small pink salmon to pass through the weir without being counted and therefore, the number passed at the weir likely underestimates the actual escapement. The picket spacing allowed all Dolly Varden char to pass through the weir without being counted.

Sockeye Salmon

The cumulative escapement of sockeye salmon in Mortensens Creek in 2002 was estimated to be 5,205. Sockeye salmon were first captured at the weir on 25 June 2002, and the peak escapement occurred on 21 July (1,373 fish or 26% of the total run) (Figure 2; Appendix 2). Seventy percent of the escapement estimate occurred on four days (3,663 fish). Only three sockeye salmon were captured at the weir after 7 September. The estimated sex composition for the run varied from 29% (SE=8.4%) female at the end of the run to 59% (SE=4.3%) in late July (Table 3). The sex composition averaged for the entire season was 47% female (SE=1.7%). Sockeye salmon that were not identified as male or female were not included in the analysis of sex composition (N=4). Sockeye salmon sampled in Mortensens Creek were categorized into seven age groups, but two age classes (0.4 and 1.4) were <1% of the fish sampled (N=3; Table 4). Age 1.3 was estimated to be 73% (SE=1.4%) of the escapement followed by age 1.2 (17%; SE=1.6%). Sockeye salmon scales that could not be aged (reabsorption, missing, or low quality), were not included in the analysis for age composition (N=96). The mid-eye-to-fork length (MEF) for male sockeye salmon ranged from 451 to 657 and from 465 to 640 mm for females (Figure 3 and Table 5). The average MEF for male sockeye salmon was larger than females for all age classes identified in sampled fish.

Coho Salmon

An estimated 6,406 coho salmon passed the weir on Mortensens Creek in 2002. Coho salmon were first captured at the weir on 21 August (N=1), and the peak daily escapement occurred on 21 September (2,286 fish) (Figure 4; Appendix 2). Coho salmon were not observed at the weir after 19 October 2002. The sex composition of the run varied from 28% (SE=4.5%) female during the first stratum (21 August - 7 September) to 51% (SE=4.5%) during stratum two (8 - 14 September; Table 6). The sex composition for the entire season averaged 45% female (SE=2.5%). Coho salmon that were not identified as male or female were not included in the analysis of sex composition (N=1). Four age classes were identified from 433 of the 485 coho salmon sampled at the weir (Table 7). Age 2.1 was estimated to account for 83% (SE=2.0%) of the sample followed by age 1.1 (11%; SE=1.7%) and 3.1(6%; SE=1.3%). Only one coho salmon sampled was age 4.1. Coho that could not be aged, were not included in the analysis of age composition (N=51). The MEF for male coho salmon ranged from479 to 741 mm and from 486 to 711 mm for females (Figure 5 and Table 8). The average length of male coho salmon was larger than for females for all age classes, and average length increased with age for both males and females.

Sport Fishing and Subsistence Harvest

In 2002, 14 subsistence and 27 sport fishing groups were interviewed at Mortensens Lagoon (Table 9; Appendix 3 and 4). An additional nine surveys were incomplete (5 sport and 4 subsistence). All 14 subsistence groups were residents of Cold Bay, while the 27 sport fishing groups consisted of 82% Cold Bay residents, 14% nonresidents (contiguous 48 states), 3% King

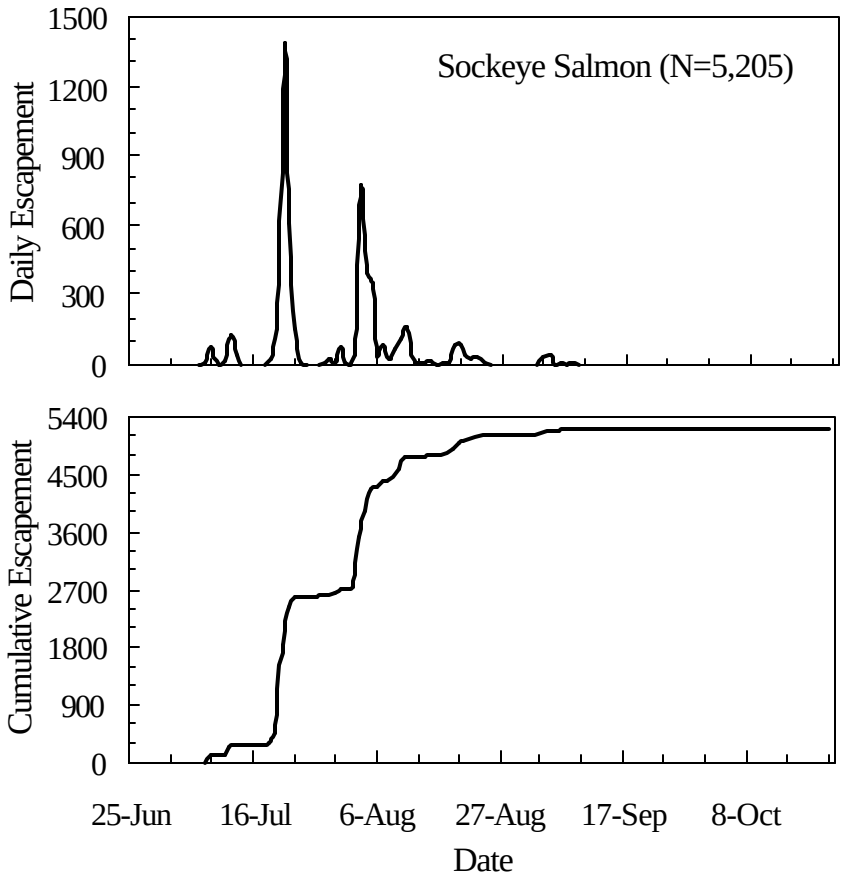


Figure 2. Daily (upper) and cumulative escapement (lower) of sockeye salmon in Mortensens Creek, 2002.

Table 3. Estimated sex composition and standard errors (SE) of sockeye salmon sampled by stratum in Mortensens Creek, 2002.

				Escapement						
	Sample			Percent			Number			
Strata	N	Male	Female	Male	Female	SE	Male	Female	SE	Total
Jun 25 - Jul 20	134	60	74	45	55	3.6	203	251	16.4	454
Jul 21 - Jul 27	267	109	158	41	59	0.2	875	1,269	60.5	2,144
Jul 28 - Aug 3	131	86	45	66	34	3.9	605	316	35.5	921
Aug 4 - Aug 10	135	81	54	60	40	4.0	638	425	42.0	1,063
Aug 11 - Aug 24	108	74	34	69	31	4.0	351	161	20.4	512
Aug 25 -Oct 22	24	17	7	71	29	8.4	79	32	9.2	111
Season Total	799	427	372	53	47	1.7	2,750	2,455	86.3	5,205

Table 4. Estimated age composition (%), sample sizes (N), and standard errors (SE) of sockeye salmon by stratum in Mortensens Creek, 2002.

							Escapement									
	Sample						0.3		1.2		1.3		2.2		2.3	
Strata	N	0.3	1.2	1.3	2.2	2.3	%	SE	%	SE	%	SE	%	SE	%	SE
1	118	1	12	85	5	15	1	0.7	10	2.4	72	3.4	4	1.6	13	2.6
2	240	5	31	181	8	14	2	0.9	13	2.0	75	2.6	3	1.1	6	1.4
3	117	0	18	87	4	7	0	0.0	15	3.1	74	3.8	3	1.6	6	2.1
4	117	1	28	83	1	4	1	0.8	24	3.7	71	4.0	1	0.8	3	1.6
5	92	0	25	61	1	4	0	0.0	27	4.2	66	4.5	1	1.0	4	1.9
6	21	1	9	10	0	1	5	4.3	43	10.0	48	10.1	0	0.0	5	4.3
Total	705[a]	8	123	507	19	45	1	0.4	17	1.4	73	1.6	3	0.6	6	0.8

[a] Sample sizes for listed age classes do not equal the total sample size because ages 0.4 and 1.4 (N=3) were not included as they were <1% of the total sample.

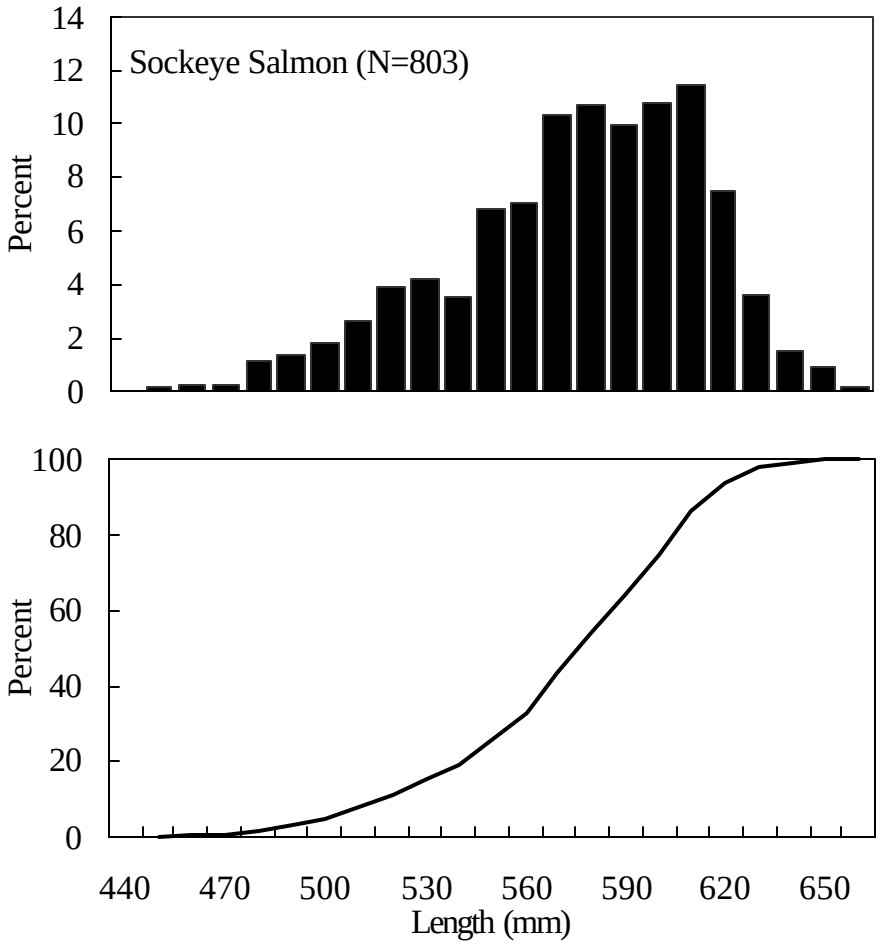


Figure 3. Length frequency (upper) and cumulative length frequency (lower) for sockeye salmon sampled at the Mortensens Creek weir, 2002.

Cove residents, and 1% other Alaska residents. The average group size for subsistence fishermen was 3 (SE=1.7) with a range of 1 to 7. The average size for sport fishing groups was also 3 fishermen (SE=1.9) with a range of 1 to 8. Subsistence groups spent an average of 3.1 h fishing (SE=1.0; range: 0.5-5.5 h) while the average for sport fishing groups was 2.0 h (SE=1.4; range 1-7 h). Hook and line fishing gear was used by all sport fishing groups (N=27) and 50% of the subsistence groups (N=7).

Coho and sockeye salmon were the primary species of Pacific salmon harvested by sport and subsistence fishermen (Table 10). Three hundred and sixteen sockeye salmon were harvested by subsistence fishermen, while 108 were harvested by sport fishermen (i.e., complete and incomplete surveys; Appendix 3 and 4). Sport fishermen also harvested 199 coho salmon (i.e., complete and

Table 5. Estimated length composition (mean, SE, range, and sample size) of Mortensens Creek sockeye salmon escapement by age and sex, 2002.

	Ages						
	0.3	1.2	0.4	1.3	2.2	1.4	2.3
Females							
Mean Length	572	509	563	571	520	566	573
SE	6.7	2.5	---	2.7	7.0	---	3.1
Range	566-576	465-590	---	489-640	487-556	---	539-624
Sample Size	5	55	1	236	7	1	24
Males							
Mean Length	584	526	---	597	521	609	583
SE	16.0	2.4	---	2.2	4.2	---	3.4
Range	572-604	451-599	---	498-657	466-560	---	509-616
Sample Size	3	68	0	269	12	1	19
All Fish							
Mean Length	575	519	563	585	521	588	577
SE	2.0	2.3	---	2.5	3.6	30.4	2.7
Range	566-604	451-599	---	489-657	466-560	566-609	509-624
Sample Size	8	123	1	505	19	2	43

incomplete surveys; Appendix 3 and 4). The mean number of sockeye salmon harvested by subsistence fishermen (21 fish; SE=22.5) was higher than for sport fishermen (4 fish; SE=5.2; Table 10).

DISCUSSION

Sockeye salmon were captured at the weir the day after it was installed (25 June; N=2), indicating that we may have missed fish early in the run. However, no additional sockeye salmon were passed until 8 July. Therefore, we assumed that few sockeye salmon passed upstream prior to weir installation. Occasionally high tides associated with strong southeast winds may have allowed fish to pass upstream without being counted. However, water marks on the weir indicated that the water only exceeded the weir on 23 July. The fish noticed upstream of the weir likely jumped over the weir or out of the trap box. In mid-September, we observed 10 coho salmon jumping out of the trap box in a 2-h period during a high tide wind event. Therefore, the chance that a large number of fish escaped upstream during other high tide events is unlikely. A high tide wind event on 11 September pushed the weir over during the incoming tide. A large number of coho were seen downstream of the weir prior to the breech; therefore, the estimated coho salmon escapement likely underestimates the actual escapement. On 9 October, high winds and a high tide resulted in

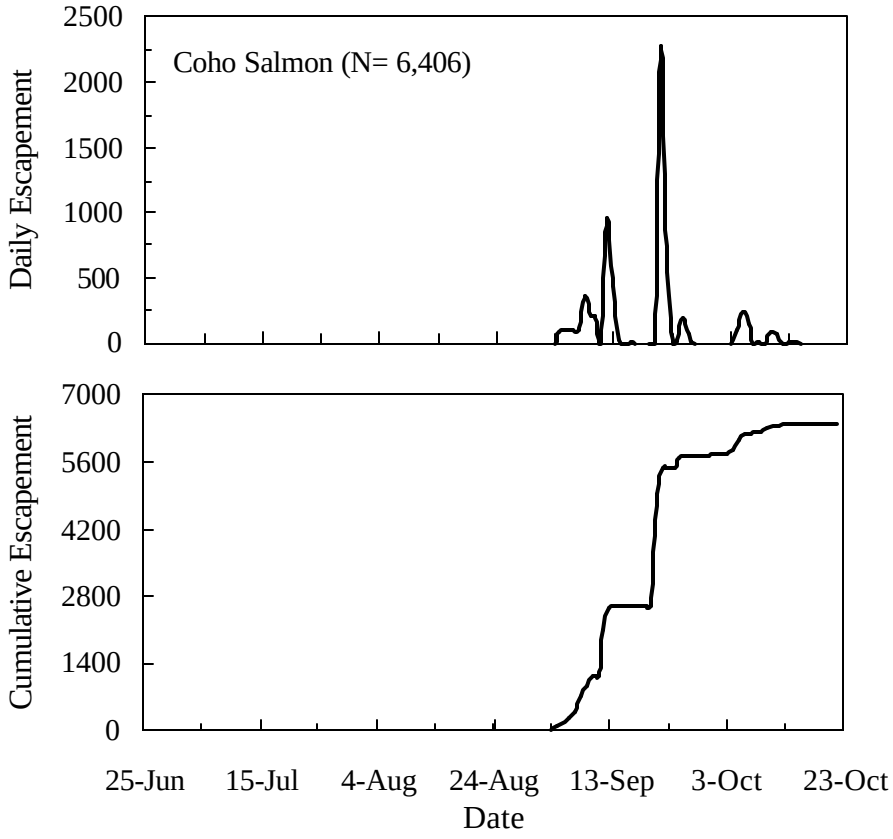


Figure 4. Daily (upper) and cumulative escapement (lower) of coho salmon in Mortensens Creek, 2002.

Table 6. Estimated sex composition and standard errors (SE) of coho salmon by stratum in Mortensens Creek, 2002.

				Escapement						
	Sample			Percent			Number			
Strata	N	Male	Female	Male	Female	SE	Male	Female	SE	Total
Aug 21 - Sep 7	78	56	22	72	28	4.6	264	104	16.8	368
Sep 8 - Sep 14	121	59	62	49	51	4.4	1,080	1,134	98.3	2,215
Sep 15 - Sep 26	148	84	64	57	43	4.0	1,786	1,361	125.6	3,148
Sep 27 - Oct 8	108	61	47	56	44	4.2	280	215	21.0	495
Oct 8 - Oct 22	28	15	13	54	46	8.8	96	84	15.9	180
Season Total	483	275	208	55	45	2.5	3,647	2,759	139.0	6,406

Table 7. Estimated age composition (percent and number) and standard errors (SE) of coho salmon by stratum in Mortensens Creek, 2002.

					Escapement											
	Sample				1.1				2.1				3.1			
Strata	N	1.1	2.1	3.1	%	SE	No.	SE	%	SE	No.	SE	%	SE	No.	SE
1	68	10	53	5	15	3.9	54	14.4	78	4.6	287	16.8	7	2.9	27	10.6
2	110	15	87	8	14	3.2	302	71.0	79	3.8	1,752	84.1	7	2.4	161	53.7
3	129	11	112	6	8	2.4	269	76.1	87	2.9	2,733	92.1	5	1.8	146	57.4
4	99	13	80	5	13	3.1	65	15.1	81	3.6	400	17.6	5	2.0	25	9.8
5	27	2	23	2	7	4.7	13	8.5	85	6.4	153	11.6	7	4.7	13	8.5
Total	433[a]	51	355	26	11	1.7	703	106.5	83	2.0	5,325	127.7	6	1.3	373	80.4

[a] Sample sizes for listed age classes do not equal the total sample size because 4.1 (N=1) was not included as it was <1% of the total sample.

water going over a 0.6-m section of the weir. No fish were seen bypassing the weir in 3 h; however, it is possible that a few went upstream unobserved.

In 2002, the Alaska Department of Fish and Game (ADFG) used weir counts to report the annual escapement of sockeye salmon in Mortensens Creek (Joe Dinnocenzo, ADFG, personal communication). In previous years, escapement was determined from aerial surveys using a 2-week stream life to estimate escapement. The discrepancy between weir and aerial estimates in 2001 suggested that either a large number of sockeye salmon passed upstream of the weir without being counted, or aerial counts overestimated the actual escapement. Even with the number of fish passing the weir uncounted, we feel the weir counts appear to be more accurate. In 2002 ADFG also used weir counts for in-season management of the commercial fishery (Joe Dinnocenzo, ADFG, personal communication).

Picket spacing on the weir allowed small pink salmon to pass upstream without being counted, but since few were observed at the weir, it is unlikely that large numbers passed uncounted. It is possible that Mortensens Creek supports small populations of pink and chum salmon, or the fish observed at the weir were straying from nearby streams (e.g., Old Mans Lagoon and Russell Creek). A few Dolly Varden char were observed at the weir, but only presence was recorded.

Age 1.3 and 1.2 sockeye salmon were the most abundant in the 2001 and 2002 Mortensens Creek escapement, similar to what was found in Thin Point Cove and Orzinski River escapements during most years (Bouwens et al. 2001; Nelson et al. 2000; Nelson et al. 1999; Wadle et al. 1999; Nelson et al. 1997; Nelson and Murphy 1996; Nelson and Murphy 1995a; Murphy 1994).

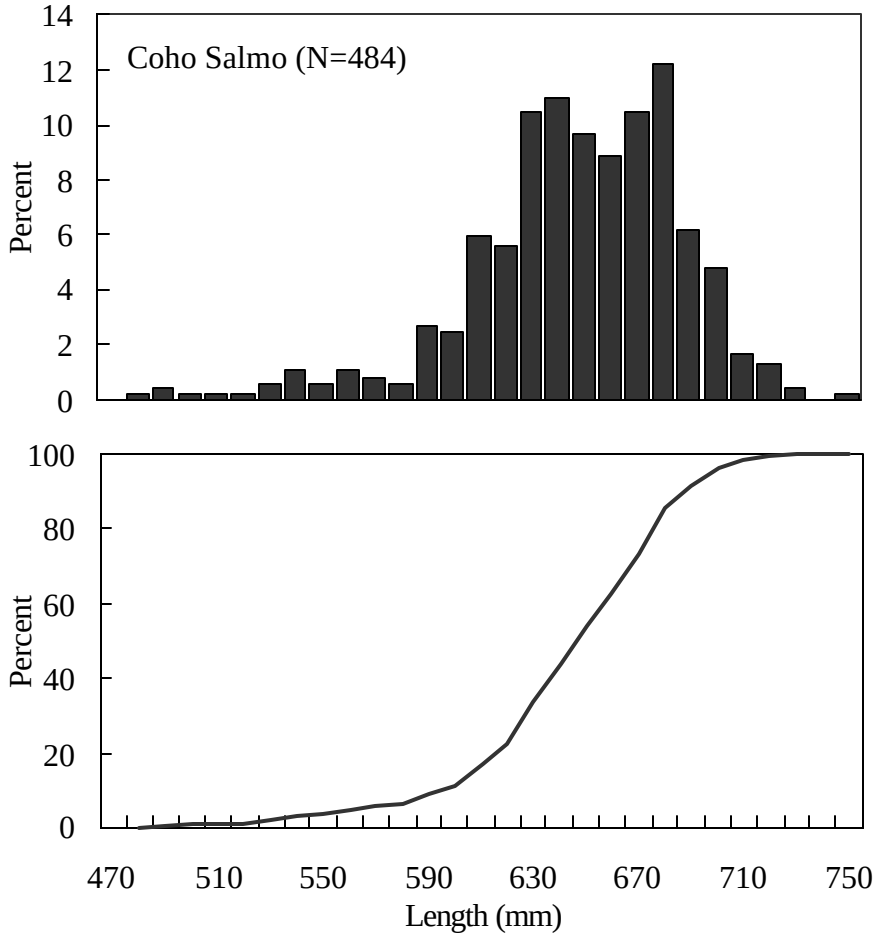


Figure 5. Length frequency(upper) and cumulative length frequency (lower) for coho salmon sampled at the Mortensens Creek weir, 2002.

However, age composition in those streams was variable from year to year, and at times age classes other than 1.3 and 1.2 were more abundant (2.3, 2.2, and 2.1)(Nelson and Murphy 1995b; Murphy 1992). Thin Point Cove is located about 8 miles southwest of Mortensens Creek while Orzinski River is located further up the Alaska Peninsula near Sand Point.

In Mortensens Creek age 2.1 coho salmon were 83% (SE=2.0%) of the escapement and age 1.1 coho salmon were 11%. The only coho salmon age data available for the Cold Bay area was from the Joshua Green River, located on the west side of the Alaska Peninsula. The predominant age class varied between locations, years, and sexes (Whitton and Eaton, 2001). In 1994, males were predominately age 1.1 and females 2.1. However, in 1996, age 2.1 males and females were more abundant. Other studies done on the Alaska Peninsula and in western Alaska found that age 2.1 coho salmon were predominant (Price and Larson 1999; West and Gray 2001).

Table 8. Estimated length composition (mean, SE, range, and sample size) of Mortensens Creek coho salmon escapement by age and sex, 2002

	Ages			
	1.1	2.1	3.1	4.1
Females				
Mean Length	632	636	649	682
SE	6.0	3.1	3.9	---
Range	488-672	486-711	604-694	---
Sample Size	18	152	13	1
Males				
Mean Length	641	652	675	---
SE	4.5	3.5	6.1	---
Range	497-704	479-741	615-724	---
Sample Size	33	202	13	0
All Fish				
Mean Length	638	645	661	682
SE	4.0	3.4	3.6	---
Range	488-704	486-741	604-724	---
Sample Size	51	354	26	1

Subsistence and sport fish harvest surveys only estimate the minimum harvest in Mortensens Lagoon because not all subsistence and sport fish groups were surveyed. Estimates of sockeye salmon harvest are likely more accurate because a three person crew allowed us to interview fishermen while also sampling fish at the weir. During the coho salmon escapement, the weir crew was reduced to two, and because fishing at the lagoon often coincided with sampling at the weir, weir crews often were not able to conduct surveys. Estimates of coho salmon harvest likely underestimate the actual harvest. Harvest surveys have provided important information about the residence and purpose of fishing groups. Cold Bay residents represented the greatest portion of both groups (subsistence: 100%; sport: 82%). Concerns of excessive nonresident effort and harvest were not supported by the harvest survey in 2002.

CONCLUSIONS

With only two seasons of escapement data and limited information on the subsistence and 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. Sockeye salmon escapement in 2002 was within the established sustainable escapement goal (SEG) of 3,200 to 6,400 (Nelson and Lloyd 2001) and coho salmon escapement was slightly higher than 2001. However, additional monitoring may be required to determine whether these escapement levels are sustainable at current commercial, sport, and subsistence harvest levels.

Table 9. Comparison of residence, group size (mean, SE, and range), time spent fishing (mean, SE and range), and gear type between sport and subsistence fishermen interviewed at Mortensens Lagoon, 2002.

	Subsistence[a]	Sport Fishing[a]
Groups (N)	14	27
Residence of Group		
Cold Bay	14	21
King Cove	0	2
Alaska (other)	0	1
Lower 48 states	---	6
Group Size (#)		
Mean	3.3	3
SE	1.7	1.9
Range	1-7	1-8
Effort (h)		
Mean	3.1	2.0
SE	1.6	1.4
Range	0.5-5.5	1-7
Total	38[b]	63
Gear Type		
Gillnet	7	---
Hook and Line	7	27

[a] Summary statistics were calculated from complete surveys.

[b] Total effort includes effort recorded for both complete and incomplete surveys.

Table 10. Estimated minimum sport fish and subsistence catch and harvest (mean, SE, range, and total harvest) of Pacific salmon from Mortensens Lagoon, 2002.

	Sockeye		Coho		Chum		Pink	
	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept
Subsistence								
Mean	21	21	---	---	2	1	<1	---
SE	22.4	22.4	---	---	2.8	2.5	0.5	---
Range	0-69	0-69	---	---	0-8	0-8	0-2	---
Total	298	298	0	0	33	19	2	0
Sport Fishery								
Mean	4	4	3	3	<1	<1	<1	---
SE	5.0	5.2	6.1	6.2	1.17	0.2	0.2	---
Range	0-18	0-18	0-22	0-22	0-6	0-1	0-1	---
Total	115	104	141	139	8	1	1	0
Total[a]	413	402	141	139	41	20	3	0

[a] Totals do not include information from incomplete surveys.

RECOMMENDATIONS

1. Based on the results of the 2001 and 2002 weir operations, we recommend that the weir height be increased to prevent high tides from exceeding the height of the weir during strong wind events. In addition, design modifications should reduce the likelihood of the weir going down during a high tide-wind event.

2. Information on the coho salmon harvest in Mortensens Lagoon is limited therefore, we recommend that the creel survey be continued in 2003 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 FIS 01-206. I wish to thank the many people who helped with field work and data entry: Sara Gilk, Emily Loose, John and Dorothea Bernsten, Starr Nicely, Mark Nelson, David Leer, Frank Preston, Jason Stolarski, and Kara Cornum. I also thank the staff at the Izembek National Wildlife Refuge for logistical support.

LITERATURE CITED

Bouwens, K. A., M. B. Foster, and R. L. Murphy. 2001. Alaska peninsula management area salmon escapement and catch sampling results, 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K01-8.

Bromaghin, J. F. 1993. Sample size determination for interval estimation of multinomial probabilities. The American Statistician 47: 203-206.

Cochran, W. G. 1977. Sampling Techniques, 3rd edition. John Wiley & Sons, New York.

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 1997. Harvest, catch, and participation in Alaska sport fisheries during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-29 revised.

Howe, A. L., R. J. Walker, C. Olnes, K. Sundet, and A. E. Bingham. 1998. Harvest, catch, and participation in Alaska sport fisheries during 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-25 revised.

Howe, A. L., R. J. Walker, C. Olnes, G. Heineman, and A. E. Bingham. 1999. Harvest, catch, and participation in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41.

Jearld, A. 1983. Age determination. Pages 301-324 *in* L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, MD.

Koo, T. S. Y. 1962. Age determination in salmon. Pages 301-324 *in* T. S. Y. Koo, editor. Studies of Alaska red salmon. University of Washington Press, Seattle, Washington.

Murphy, R. L. 1992. Alaska Peninsula and Aleutian Islands management areas commercial salmon catch and escapement statistics, 1990. Alaska Department of Fish and Game, Division of Commercial Fisheries. Technical Fishery Report No. 92-08.

Murphy, R. L. 1994. Alaska Peninsula and Aleutian Islands management areas commercial salmon catch and escapement statistics, 1991. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Technical Fishery Report No. 94-01.

Nelson, P. A. and D. S. Lloyd. 2001. Escapement goals for Pacific salmon in the Kodiak, Chignik, and Alaska Peninsula/Aleutian Islands areas of Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report No. 4K01-66.

Nelson, P. A. and R. L. Murphy. 1995a. Alaska Peninsula management area salmon escapement and catch sampling results, 1993. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 4K95-10.

Nelson, P. A. and R. L. Murphy. 1995b. Alaska Peninsula management area salmon escapement and catch sampling results, 1994. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 4K95-34.

Nelson, P. A. and R. L. Murphy. 1996. Alaska Peninsula management area salmon escapement and catch sampling results, 1995. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 4K96-36.

Nelson, P. A., R. L. Murphy and C. J. Hicks. 1997. Alaska Peninsula management area salmon escapement and catch sampling results, 1996. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division. Regional Information Report No. 4K97-48.

Nelson, P. A., R. L. Murphy, and J. A. Wadle. 1999. Alaska Peninsula management area salmon escapement and catch sampling results, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K99-42.

Nelson, P. A., M. B. Foster, K. A. Bouwens, and R. L. Murphy. 2000. Alaska Peninsula management area salmon escapement and catch sampling results, 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K00-62.

Price, M.A. and J. Larson. 1999. Abundance and run timing of chinook, chum, coho, pink, and sockeye salmon in the Kulukak River, Togiak National Wildlife Refuge, Alaska, 1994-96. U.S. Fish and Wildlife Service, King Salmon, Alaska. Alaska Fisheries Technical Report 52.

Schaul, A. and J. Dinnocenzo. 2000. Alaska Peninsula and Aleutian Islands management areas annual salmon management report, 1999. Division of Commercial Fisheries, Regional Information Report No.4K00-17.

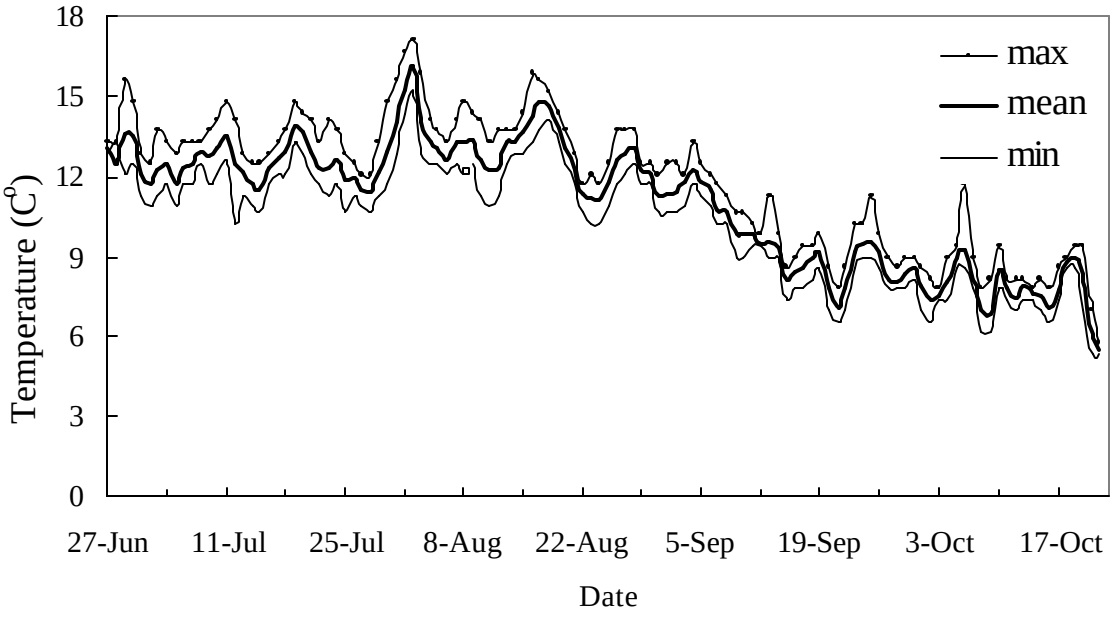
Seber, G. A. F. 1982. The estimation of animal abundance and related parameters, 2nd edition. Maxmillan, New York.

Wadle, J. A, P. A, Nelson, and R. L. Murphy. 1999. Alaska Peninsula management area salmon escapement and catch sampling results, 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 4K99-41.

West, F. W. and D. C. Gray. 2001. Abundance, age, sex and size statistics for Pacific salmon in Bristol Bay, 1999-2000. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report No. 2A01-29.

Whitton, K. S. and D. M. Eaton. 2001. Joshua Green River Pacific salmon stock assessment and resident fish species survey, Izembek National Wildlife Refuge, Alaska 1994-1996. U.S. Fish and Wildlife Service, King Salmon Fishery Resource Office, King Salmon, Alaska. Alaska Fisheries Data Series Number 2001-3.

Whitton, K. S. 2002. Estimation of sockeye and coho salmon escapement in Mortensens Creek, Izembek National Wildlife Refuge, 2001. U.S. Fish and Wildlife Service, King Salmon Fishery Resources Office, King Salmon, AK. Alaska Fisheries Data Series Number 2002-3.



Appendix 1. Mean, maximum, and minimum water temperatures at the Mortensens Creek weir, 2002.

Appendix 2. Counts (daily and cumulative) and cumulative percent (Cum. %) of sockeye, coho, pink, and chum salmon escapement through the Mortensens Creek weir, 2002.

	Sockeye Salmon			Coho Salmon			Pink Salmon	Chum Salmon
Date	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
Jun25	2	2	0.04	0	0	0.00	0	0
Jun 26	0	2	0.04	0	0	0.00	0	0
Jun 27	0	2	0.04	0	0	0.00	0	0
Jun 28	0	2	0.04	0	0	0.00	0	0
Jun 29	0	2	0.04	0	0	0.00	0	0
Jun 30	0	2	0.04	0	0	0.00	0	0
Jul 1	0	2	0.04	0	0	0.00	0	0
Jul 2[a]	0	2	0.04	0	0	0.00	0	0
Jul 3	0	2	0.04	0	0	0.00	0	0
Jul 4	0	2	0.04	0	0	0.00	0	0
Jul 5	0	2	0.04	0	0	0.00	0	0
Jul 6	0	2	0.04	0	0	0.00	0	0
Jul 7	0	2	0.04	0	0	0.00	0	0
Jul 8	8	10	0.19	0	0	0.00	0	0
Jul 9[a]	73	83	1.59	0	0	0.00	0	2
Jul 10[a]	0	83	1.59	0	0	0.00	0	0
Jul 11[a]	18	101	1.94	0	0	0.00	0	0
Jul 12	125	226	4.34	0	0	0.00	0	0
Jul 13	45	271	5.21	0	0	0.00	0	0
Jul 14	0	271	5.21	0	0	0.00	0	0
Jul 15	0	271	5.21	0	0	0.00	0	0
Jul 16	0	271	5.21	0	0	0.00	0	0
Jul 17	0	271	5.21	0	0	0.00	0	0
Jul 18	0	271	5.21	0	0	0.00	0	0
Jul 19	30	301	5.78	0	0	0.00	0	0
Jul 20	153	454	8.72	0	0	0.00	0	0
Jul 21	1,373	1,827	35.10	0	0	0.00	0	6
Jul 22	603	2,430	46.69	0	0	0.00	2	3
Jul 23[a]	154	2,584	49.64	0	0	0.00	0	0
Jul 24	11	2,595	49.86	0	0	0.00	0	0
Jul 25	2	2,597	49.89	0	0	0.00	0	0
Jul 26	0	2,597	49.89	0	0	0.00	0	0
Jul 27	1	2,598	49.91	0	0	0.00	0	0
Jul 28	8	2,606	50.07	0	0	0.00	0	0

Appendix 2.-Continued

	Sockeye Salmon			Coho Salmon			Pink Salmon	Chum Salmon
Date	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
3Jul 29	25	2,631	50.55	0	0	0.00	0	0
Jul 30	9	2,640	50.72	0	0	0.00	0	0
Jul 31	68	2,708	52.03	0	0	0.00	0	0
Aug 1	4	2,712	52.10	0	0	0.00	0	0
Aug 2	41	2,753	52.89	0	0	0.00	0	0
Aug 3	766	3,519	67.61	0	0	0.00	0	1
Aug 4	389	3,908	75.08	0	0	0.00	0	1
Aug 5	345	4,253	81.71	0	0	0.00	0	1
Aug 6	49	4,302	82.65	0	0	0.00	0	0
Aug 7	83	4,385	84.25	0	0	0.00	0	0
Aug 8	28	4,413	84.78	0	0	0.00	0	0
Aug 9	62	4,475	85.98	0	0	0.00	0	0
Aug 10	107	4,582	88.03	0	0	0.00	0	1
Aug 11	158	4,740	91.07	0	0	0.00	0	2
Aug 12	11	4,757	91.28	0	0	0.00	0	0
Aug 13	6	4,757	91.39	0	0	0.00	0	0
Aug 14	12	4,769	91.62	0	0	0.00	0	0
Aug 15	15	4,784	91.91	0	0	0.00	0	1
Aug 16	4	4,788	91.99	0	0	0.00	0	0
Aug 17	10	4,798	92.18	0	0	0.00	0	0
Aug 18	12	4,810	92.41	0	0	0.00	0	1
Aug 19	84	4,894	94.02	0	0	0.00	1	5
Aug 20	79	4,973	95.54	0	0	0.00	3	7
Aug 21	48	5,021	96.46	1	1	0.02	1	4
Aug 22	31	5,052	97.06	0	1	0.02	0	3
Aug 23	32	5,084	97.68	0	1	0.02	0	2
Aug 24	10	5,094	97.88	2	3	0.05	0	0
Aug 25	4	5,098	97.94	0	3	0.05	0	0
Aug 26	0	5,098	97.94	0	3	0.05	0	0
Aug 27	1	5,099	97.96	0	3	0.05	0	1
Aug 28	2	5,101	98.00	0	3	0.05	0	0
Aug 29	2	5,103	98.04	1	4	0.06	1	1
Aug 30	3	5,106	98.10	0	4	0.06	0	1
Aug 31	0	5,106	98.10	0	4	0.06	0	0

Appendix 2.-Continued

	Sockeye Salmon			Coho Salmon			Pink Salmon	Chum Salmon
Date	Daily	Cum.	Cum %	Daily	Cum.	Cum. %	Daily	Daily
Sep 1	0	5,106	98.10	0	4	0.06	1	0
Sep 2	0	5,106	98.10	0	4	0.06	0	0
Sep 3	34	5,140	98.75	1	5	0.08	0	7
Sep 4	41	5,181	99.54	71	76	1.19	0	2
Sep 5	2	5,183	99.58	96	172	2.68	0	0
Sep 6	5	5,188	99.67	96	268	4.18	0	0
Sep 7	4	5,192	99.75	100	368	5.74	2	0
Sep 8	5	5,197	99.85	354	722	11.27	0	0
Sep 9	3	5,200	99.90	202	924	14.42	0	2
Sep 10	0	5,200	99.90	208	1,132	17.67	2	1
Sep 11	0[b]	5,200	99.90	8	1,140	17.80	1	0
Sep 12	1	5,201	99.92	962	2,102	32.81	1	0
Sep 13	0	5,201	99.92	446	2,548	39.78	0	0
Sep 14	0	5,201	99.92	35	2,583	40.32	0	0
Sep 15	0	5,201	99.92	0	2,583	40.32	0	0
Sep 16	0	5,201	99.92	8	2,591	40.45	0	0
Sep 17	0	5,201	99.92	2	2,593	40.48	0	0
Sep 18	0	5,201	99.92	0	2,593	40.48	0	0
Sep 19	0	5,201	99.92	3	2,596	40.52	0	0
Sep 20	0	5,201	99.92	14	2,610	40.74	0	0
Sep 21	1	5,202	99.94	2,286	4,896	76.43	0	0
Sep 22	0	5,202	99.94	548	5,444	84.98	1	0
Sep 23	0	5,202	99.94	3	5,447	85.03	0	0
Sep 24	0	5,202	99.94	29	5,476	85.48	0	0
Sep 25	0	5,202	99.94	194	5,670	88.51	0	0
Sep 26	0	5,202	99.94	61	5,731	89.46	0	0
Sep 27	0	5,202	99.94	5	5,736	89.54	0	0
Sep 28	0	5,202	99.94	2	5,738	89.57	0	0
Sep 29	0	5,202	99.94	1	5,739	89.59	0	0
Sep 30	0	5,202	99.94	0	5,739	89.59	0	0
Oct 1	1	5,203	99.96	2	5,741	89.62	0	0
Oct 2	0	5,203	99.96	0	5,741	89.62	0	0
Oct 3	0	5,203	99.96	0	5,741	89.62	0	0
Oct 4	0	5,203	99.96	93	5,834	91.07	0	0

Appendix 2.-Continued

	Sockeye Salmon			Coho Salmon			Pink Salmon	Chum Salmon
Date	Daily	Cum.	Cum. %	Daily	Cum.	Cum. %	Daily	Daily
Oct 5	0	5,203	99.96	230	6,064	94.66	0	0
Oct 6	0	5,203	99.96	138	6,202	96.82	0	0
Oct 7	1	5,204	99.98	7	6,209	96.92	0	0
Oct 8	0	5,204	99.98	17	6,226	97.19	0	0
Oct 9[c]	0	5,204	99.98	1	6,227	97.21	0	0
Oct 10	0	5,204	99.98	78	6,305	98.42	0	0
Oct 11	0	5,204	99.98	63	6,368	99.41	0	0
Oct 12	0	5,204	99.98	2	6,370	99.44	0	0
Oct 13	0	5,204	99.98	18	6,388	99.72	0	0
Oct 14	0	5,204	99.98	16	6,404	99.97	0	0
Oct 15	0	5,204	99.98	1	6,405	99.98	0	0
Oct 16	0	5,204	99.98	0	6,405	99.98	0	0
Oct 17	1	5,205	100.00	0	6,405	99.98	0	0
Oct 18	0	5,205	100.00	0	6,405	99.98	0	0
Oct 19	0	5,205	100.00	1	6,406	100.00	0	0
Oct 20	0	5,205	100.00	0	6,406	100.00	0	0
Oct 21	0	5,205	100.00	0	6,406	100.00	0	0
Oct 22	0	5,205	100.00	0	6,406	100.00	0	0
Total	5,205	5,205	100.00	6,406	6,406	100.00	16	55

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

[b] Partial count because the weir went down during the high tide.

[c] Water went over a small part of the weir, but no fish were observed going over the weir.

Appendix 3. Summary of subsistence harvest surveys conducted at Mortensens Lagoon, 2002. Gear types include hook and line (HL) and gillnet (GN). Residence includes Cold Bay (CB).

				Sockeye		Coho		Chum		Pink			
Date	Time	Party #	Hour	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept	Gear	Residence
Complete Surveys													
3 Jul	21:30	5	3	4	4	0	0	0	0	0	0	HL	CB
4 Jul	16:30	3	0.5	16	16	0	0	8	8	0	0	HL	CB
6 Jul	20:15	6	5	12	12	0	0	1	1	0	0	HL	CB
7 Jul	18:30	2	2	14	14	0	0	1	1	0	0	HL	CB
8 Jul	10:30	3	2	66	66	0	0	1	0	0	0	HL	CB
11 Jul	14:30	3	5.5	69	69	0	0	6	6	0	0	HL	CB
19 Jul	16:55	4	1	15	15	0	0	6	0	0	0	GN	CB
19 Jul	17:00	3	1	15	15	0	0	2	0	2	0	GN	CB
20 Jul	19:00	2	4	10	10	0	0	0	0	0	0	GN	CB
20 Jul	19:00	1	3	5	5	0	0	0	0	0	0	GN	CB
20 Jul	18:00	3	1	15	15	0	0	0	0	0	0	GN	CB
23 Jul	11:00	2	1	0	0	0	0	0	0	0	0	GN	CB
24 Jul	14:00	2	3	9	9	0	0	6	1	0	0	GN	CB
27 Jul	15:00	7	4	48	48	0	0	2	2	0	0	HL	CB
Partial Surveys													
12 Jul[a]	N/A	5										GN	
15 Jul[a]	14:00	1	2										
22 Jul[b]	N/A	3		15	15	0	0	0	0	0	0	HL	CB
23 Jul[a]	23:00	6?										GN	

[a] Could not interview.

[b] Did not interview at time of fishing.

Appendix 4. Summary of sport fishing harvest surveys conducted at Mortensens Lagoon, 2002.

				Sockeye		Coho		Chum		Pink			
Date	Time	Party #	Hours	Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept	Gear	Residence
						Complete Surveys							
5 Jul	12:50	1	2	1	1	0	0	0	0	0	0	HL	CB
6 Jul	20:07	8	1	2	2	0	0	0	0	0	0	HL	CB
7 Jul	18:30	7	7	5	5	0	0	0	0	0	0	HL	CB
13 Jul	13:00	1	3	5	5	0	0	0	0	0	0	HL	CB
27 Jul	15:00	5	2	6	6	0	0	1	1	0	0	HL	CB
28 Jul	11:30	1	1	6	0	0	0	0	0	0	0	HL	L48
29 Jul	11:30	1	1	3	1	0	0	0	0	0	0	HL	L48
29 Jul	14:00	1	1	5	5	0	0	0	0	0	0	HL	CB
29 Jul	14:00	1	1	5	5	0	0	0	0	0	0	HL	ANC
28 Jul	N/A	5	2	18	18	0	0	1	0	0	0	HL	CB
29 Jul	N/A	3	2	15	15	0	0	0	0	0	0	HL	CB
11 Aug	15:30	3	2	0	0	0	0	0	0	0	0	HL	1CB/2L48
15 Aug	20:00	2	3	3	3	3	3	0	0	0	0	HL	CB
16 Aug	18:00	2	4	1	0	3	1	0	0	0	0	HL	KC/L48
17 Aug	14:30	1	1	5	5	0	0	0	0	0	0	HL	CB
17 Aug	17:30	3	4	8	8	0	0	6	6	0	0	HL	1L48/2CB
17 Aug	17:30	1	1	2	0	0	0	0	0	1	0	HL	KC
20 Aug	10:30	3	2	12	12	3	3	0	0	0	0	HL	CB
21 Aug	11:15	3	3	13	13	2	2	0	0	0	0	HL	CB

Appendix 4.-Continued.

Date	Time	Party #	Hour	Sockeye		Coho		Chum		Pink		Gear	Residence
				Caught	Kept	Caught	Kept	Caught	Kept	Caught	Kept		
Complete Surveys (cont.)													
24 Aug	13:35	2	2	0	0	1	1	0	0	0	0	HL	CB
26 Aug	N/A	3	2	0	0	3	3	0	0	0	0	HL	CB
30 Aug	15:00	2	1	0	0	0	0	0	0	0	0	HL	CB
30 Aug	14:00	4	3	0	0	20	20	0	0	0	0	HL	CB
5 Sep	16:00	2	1	0	0	2	2	0	0	0	0	HL	CB
7 Sep	12:43	3	3	0	0	15	15	0	0	0	0	HL	CB
18 Sep	1:40	5	4	0	0	22	22	0	0	0	0	HL	L48
18 Sep	1:40	3	4	0	0	9	9	0	0	0	0	HL	CB
Incomplete Surveys													
13 Aug	N/A	?	?	4	4	2	2	0	0	0	0	HL	CB
7 Sep	N/A	4	?	0	0	20	20	0	0	0	0	HL	CB
7 Sep	N/A	3	?	0	0	13	13	0	0	0	0	HL	CB
7 Sep	N/A	1	?	0	0	5	5	0	0	0	0	HL	CB
10 Sep	N/A	4	?	0	0	20	20	0	0	0	0	HL	CB