

SPORT EFFORT, HARVEST, AND ESCAPEMENT OF
COHO SALMON (*Oncorhynchus kisutch*) IN THE
BUSKIN RIVER, KODIAK, ALASKA 1986¹

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ABSTRACT

A creel survey conducted on Buskin River 12 August through 2 October 1986 estimated sport anglers fished 20,098 angler-hours and harvested 3,872 adult coho salmon (*Oncorhynchus kisutch* Walbaum). Summaries of the creel survey statistics and biological data for coho salmon sampled from angler creels are presented.

Buskin River fish escapement counts, as determined by foot surveys and a weir operated from 19 April through 2 October 1986, totaled 71 outmigrant steelhead (*Salmo gairdneri* Richardson); 83 inmigrant steelhead; 8,878 sockeye salmon (*Oncorhynchus nerka* Walbaum); 9,492 coho salmon; 52 chum salmon, (*Oncorhynchus keta* Walbaum); and 110,958 pink salmon (*Oncorhynchus gorbuscha* Walbaum). Summaries of weir counts and biological data for fish sampled are presented.

KEY WORDS: coho salmon, *Oncorhynchus kisutch*, escapement, harvest, size and age, Buskin River, Kodiak, Alaska.

INTRODUCTION

Buskin River (Figure 1) is centrally located in the urban area of Kodiak Island and receives more effort by anglers than any other water on Kodiak Island. The river contains steelhead/rainbow trout (*Salmo gairdneri* Richardson); Dolly Varden (*Salvelinus malma* Walbaum); and all species of Pacific salmon (*Oncorhynchus* sp. Walbaum) except chinook salmon (*Oncorhynchus tshawytscha* Walbaum). It supports approximately 63% (32,485 angler-days) of the sport effort and 48% of the sport harvest (all species) for all Kodiak lakes and streams (Mills, 1986). Buskin River salmon also support the largest personal use/subsistence fishery on Kodiak Island and a commercial fishery that targets primarily on pink salmon (*Oncorhynchus gorbuscha* Walbaum) and coho salmon (*Oncorhynchus kisutch* Walbaum) (Manthey et al. 1984).

The sport fishery is directed at anadromous Dolly Varden during April and May, sockeye salmon (*Oncorhynchus nerka* Walbaum) and pink salmon from June through mid-August, and coho salmon from mid-August through mid-October. In 1983, approximately 18.5%, 59.7% and 21.8% of the sport effort (20,136 angler trips) occurred during these time periods, respectively (Murray 1984). Inmigrant Dolly Varden are also caught from mid-summer through fall. The primary management concerns are for Dolly Varden, sockeye salmon, and coho salmon because the harvest of these fish by all user groups is thought to be high in relation to the population size.

In 1985, the Alaska Department of Fish and Game began a project to estimate the magnitude and composition of salmon, Dolly Varden, and steelhead returns to Buskin River (Murray 1986). The project consists of: (1) counting fish escapements through a weir; (2) estimating sport fish effort and harvest for the spring Dolly Varden and fall coho salmon fisheries; and (3) estimating the age-sex-size composition of Dolly Varden and coho salmon in both the sport harvest and the escapement.

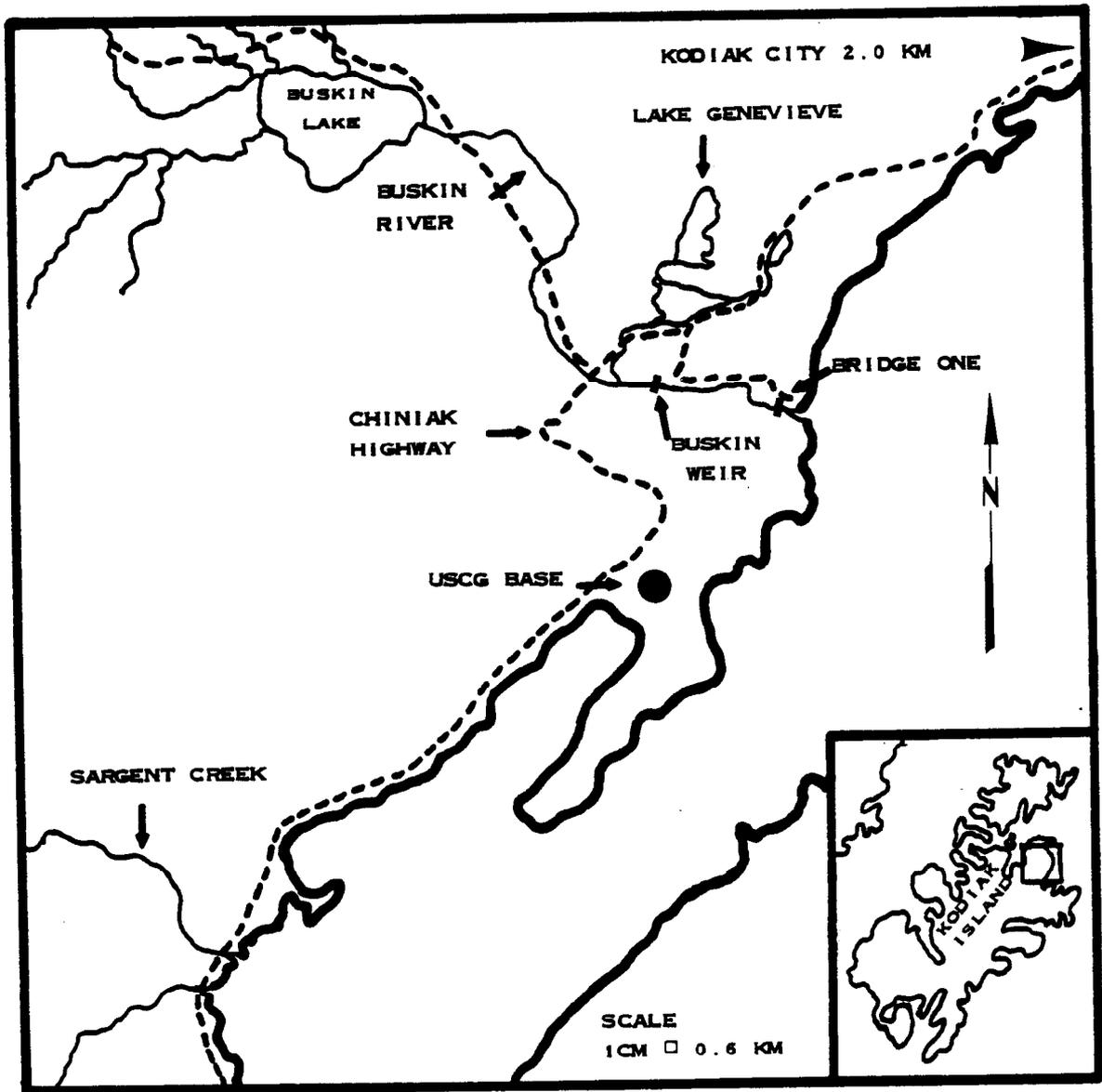


Figure 1. Location of Buskin River, Kodiak Island, Alaska.

The objective of this report is to present data for Buskin River salmon and steelhead escapements and the sport harvest of coho salmon. Information pertaining to the personal use/subsistence and commercial fisheries are reported by Manthey et al. (1984). Results of that portion of the project pertaining to Dolly Varden are reported by Murray (in prep.).

METHODS

Sport Fishery

Study Area:

The Buskin River sport fishery for coho salmon occurs in two distinct locations and time frames. Prior to 11 September, the fishery is restricted by regulation to that portion of the river below Bridge One (Figure 1). This is referred to as the early fishery. Most effort in this fishery occurs at the tidal lagoon at the river mouth. After 10 September (referred to as the late fishery), the area restriction is lifted and the fishery occurs throughout the river. This late fishery occurs both above and below the weir (Figure 1), and fishery statistics are compiled separately for these locations.

Coho salmon first enter the river in late July and continue through late October (Murray 1986). Low stream flow conditions may hold the fish in the lagoon and delay the migration several weeks.

Study Design:

A creel survey was conducted on Buskin River from 12 August through 2 October. Effort in angler-hours and coho salmon harvest were estimated for two time frames and three areas. The time frames were 12 August through 10 September and 11 September through 2 October. The fishing areas were: (1) the Bridge One fishery which occurred 12 August through 10 September; (2) below weir fishery (11 September through 2 October; and (3) above weir fishery (11 September through 2 October).

Angler counts were conducted following a stratified random sampling design. The fishing day was 16 hours long (0600-2200 hours) through 10 September and 14 hours long (0700-2100 hours) from 11 September through 2 October. Each fishing day was stratified into four time periods: period A, 0600-0759 hours; period B, 0800-1159 hours; period C, 1200-1659 hours; and period D, 1700-2200 hours. After 10 September, periods A and D were reduced by one hour because of the shorter daylight hours. Sampling effort was allocated approximately proportional to the number of hours in each period during each fishery.

Angler counts were made by a roving creel survey clerk and took approximately 20 minutes to complete. Those counts were considered instantaneous counts (Neuhold and Lu 1957). Angler interviews were completed trip interviews collected by monitoring the major access points and interviewing anglers as they departed.

The major assumptions necessary for the creel survey are:

1. Angler counts made during the same day and on consecutive days are independent.
2. No significant fishing effort occurs during the hours 2200-0600 prior to 11 September and during the hours 2100-0700 after 10 September.
3. Interviewed anglers are representative of the total angler population.
4. The number of anglers interviewed during a day is proportional to the effort on that day.
5. Fishing effort does not influence catch per unit effort.
6. Angler efforts and catches are normally distributed random variables.

Data Collection:

During a selected sample period, a random starting time was selected to count the number of anglers and the remaining time was spent conducting angler interviews. Effort counts were conducted by walking and/or driving the length of the fishing area as quickly as possible and counting the number of people actively engaged in fishing. Only anglers who had completed fishing were interviewed. The following information was recorded during each interview: number of fish released by species, number of fish retained by species, and total hours fished (to the nearest one-quarter hour).

Data Analysis:

Angler effort was calculated using a stratified random sample design (Schaeffer et al., 1979). Effort was estimated for each location and time frame as:

$$\hat{E} = \sum_{j=1}^4 H_j Y_j$$

with variance

$$V(\hat{E}) = \sum_{j=1}^4 H_j^2 (s_j^2/n_j)$$

where Y_j = the mean number of anglers per count in stratum j ,

H_j = total number of hours of fishing possible in stratum j ,

s_j^2 = the sample variance for angler counts in stratum j , and

n_j = the number of angler counts conducted in stratum j .

The mean effort and mean catch per angler was calculated for each location and time frame using a two-stage random sample design with days as the

primary sample units and anglers as the secondary sample units (Von Geldern and Tomlinson 1973). Catch refers to fish kept only. Arithmetic means were calculated from all completed trip anglers interviewed at a location and time frame.

The variance of mean effort was estimated as (Sukhatme et al., 1984):

$$V(\bar{f}) = [1-(d/D)]s_B^2/d + [\sum_{i=1}^d (s_{wi}^2/m_i)]/dD$$

where

$$s_{wi}^2 = \left[\sum_{k=1}^{m_i} (f_{ik} - \bar{f}_i)^2 \right] / (m_i - 1),$$

$$s_B^2 = \left[\sum_{i=1}^d (\bar{f}_i - \bar{F})^2 \right] / (d-1),$$

d = number of days on which sampling was conducted,

D = number of possible days at a location in a time frame,

f_{ik} = effort by angler k interviewed on day i ,

m_i = number of anglers interviewed on day i , and

\bar{F} = mean effort per angler at a location during a time frame.

The variance of mean catch per angler was estimated by substituting individual catches for efforts in the above formulae.

Catch per effort, \bar{c}/\bar{f} , was computed for each location and time frame. The variance of catch per effort is approximated by the variance for a quotient of two random variables (Jessen 1978),

$$\hat{V}(\bar{c}/\bar{f}) = (\bar{c}/\bar{f})^2 \left[(s_c^2/\bar{c}^2) + (s_f^2/\bar{f}^2) - (2rs_c s_f / \bar{c}\bar{f}) \right]$$

where,

\bar{c} = mean number of coho salmon caught per angler,

\bar{f} = as defined previously,

s_c^2 = two-stage variance of \bar{c} ,

s_f^2 = two-stage variance of \bar{f} , and

r = Pearson's correlation coefficient for the c_{ik} and f_{ik} .

Total harvest (T) for each location-time frame was computed as

$\hat{T} = \hat{E}(\bar{c}/\bar{f})$; and variance, (Goodman, 1960):

$$V(\hat{T}) = [\hat{E}^2 \hat{V}(\bar{c}/\bar{f})] + [(\bar{c}/\bar{f})^2 V(\hat{E})] - [V(\hat{E}) \hat{V}(\bar{c}/\bar{f})].$$

Escapement

The Buskin River weir is located 2.0 km upstream of the river mouth at an area approximately 40 m wide. Both river banks at the weir site are steep and the river bottom is predominantly small rock substrate suitable for holding a weir. The weir is constructed of 21 mm diameter aluminum pipe spaced 21 mm apart.

Adult fish counted through the weir gates were identified by species, and the daily totals recorded. Spawning pink salmon were counted below the weir. When the coho salmon immigration was nearly completed, the weir was dismantled and a foot survey was conducted to count fish holding below the weir. These estimates were added to the weir count to estimate total escapement.

Biological Data

Coho salmon from the sport harvest and escapement and sockeye salmon from the escapement were sampled for age, sex, and size data. Sport-caught fish were sampled when encountered during angler interviews. Salmon in the escapement were originally sampled at the weir, however, initial efforts indicated that sampled fish suffered a high mortality. Thereafter, the salmon escapement was sampled by beach seining spawning fish. Fish were sampled for scales, sex, and length data. Scales were collected from the preferred area¹ and mounted on a gum card. Permanent scale impressions were made on plastic acetate cards which were read on a microfiche projector.

The percent contribution of each age group to the samples were calculated and a variance estimated using the binomial approximation of the normal (Cochran 1977). Mean lengths and variances were calculated for each age group by sex.

RESULTS AND DISCUSSION

Sport Fishery

Mean angler counts (Table 1 and Figure 2) progressively increased from the early morning stratum (period A) to the late evening stratum (period D). Approximately one-half of the angler-effort (10,484 hours) occurred during the early fishery from 12 August through 10 September. During the late fishery, most of the effort (7,634 angler-hours or 79%) occurred below the weir. Angler counts by date, location, and daily time period are presented in Appendix Tables A1 and A2.

Harvest rates for all fisheries were similar (Table 2 and Figure 3). Daily summaries of angler interviews are presented in Appendix Tables A3 and A4.

¹ The preferred area is on the left side of the fish, approximately two rows above the lateral line (Koo 1962).

Table 1. Estimated effort in angler-hours during the Buskin River sport fishery for coho salmon, 1986.

Early fishery: 8/12 - 9/10						
Location	Period	Counts			Effort (hours)	
		Mean	SE ¹	SS ²	Total	SE ¹
Below bridge	A	10.3	5.2	8	615.0	311.3
	B	20.5	5.4	8	2,460.0	648.2
	C	21.1	3.3	7	3,171.4	491.5
	D	28.3	6.7	8	4,237.5	1,006.1
	Total				10,483.9	1,330.8
Late fishery: 9/11 - 10/2						
Below weir	A	5.0	3.2	3	110.0	70.7
	B	22.0	6.6	4	1,936.0	582.6
	C	28.0	3.6	3	3,080.0	396.6
	D	28.5	6.6	8	2,508.0	579.0
	Total				7,634.0	914.9
Above weir	A	1.3	1.3	3	29.3	29.3
	B	3.5	2.4	4	308.0	207.9
	C	8.3	3.3	3	916.7	366.7
	D	8.3	2.5	8	726.0	221.7
	Total				1,980.0	447.2
Total late fishery					9,614.0	1,018.3

¹ Standard error.

² Sample size.

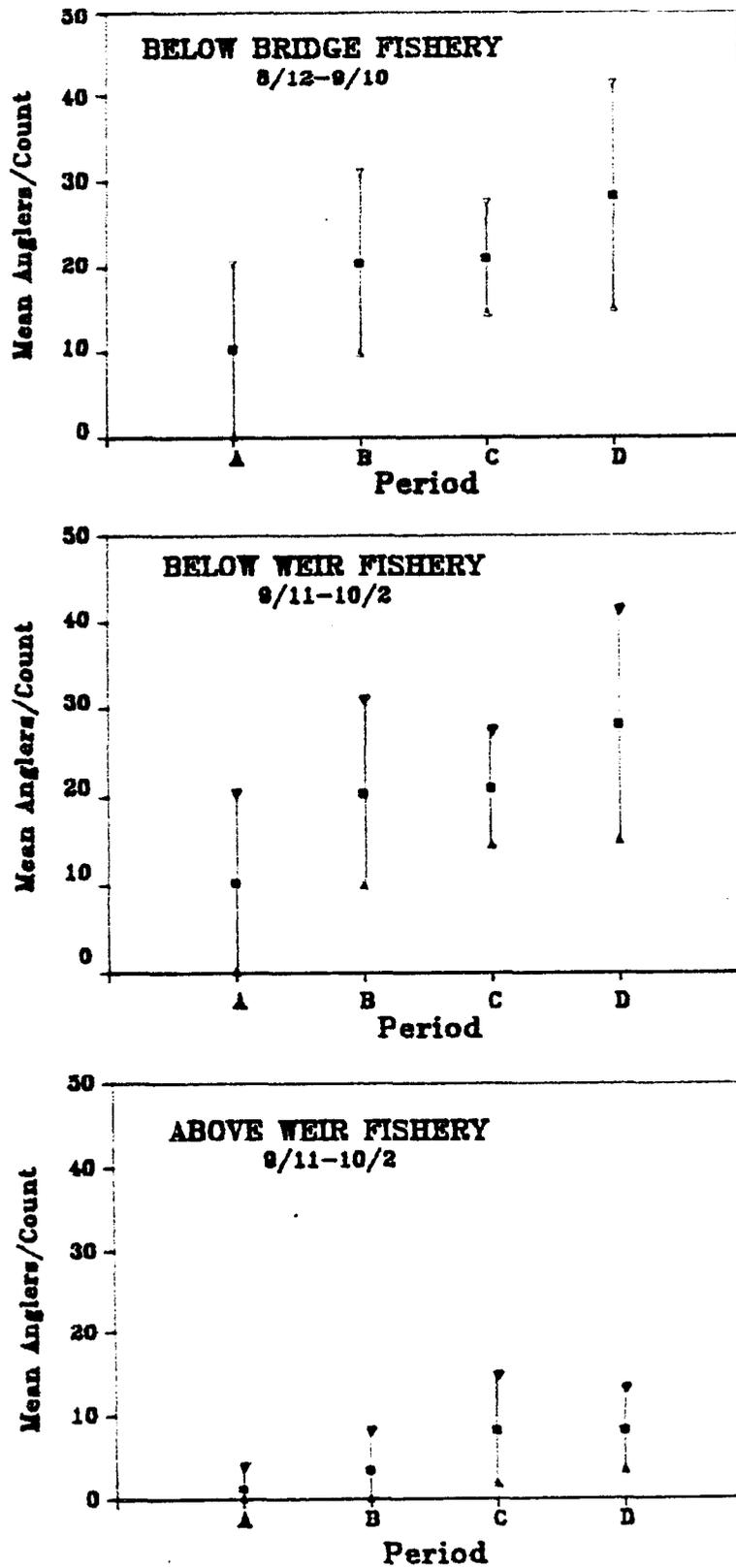


Figure 2. Mean number of anglers per count by fishery and daily period, 1986.

Table 2. Effort and catch summary statistics for anglers interviewed during the Buskin River sport fishery for coho salmon, 1986

Time	Location	No. Int. ¹	D ²	d ³	Effort (hours)		Harvest				
					Mean	SE ⁴	Mean	SE	r ⁵	CPUE ⁶	SE
8/12 - 9/10	Below bridge	899	30	16	1.92	0.083	0.317	0.065	0.134	0.165	0.001
9/11 - 10/2	Below weir	461	22	14	2.36	0.237	0.523	0.063	0.188	0.222	0.001
9/11 - 10/2	Above weir	112	22	11	2.10	0.225	0.473	0.081	0.508	0.226	0.001

¹ Number of anglers interviewed.

² Number of days possible for sampling.

³ Number of days sampled.

⁴ Standard error.

⁵ Correlation coefficient between angler effort and harvest.

⁶ Number of fish retained per hour fished.

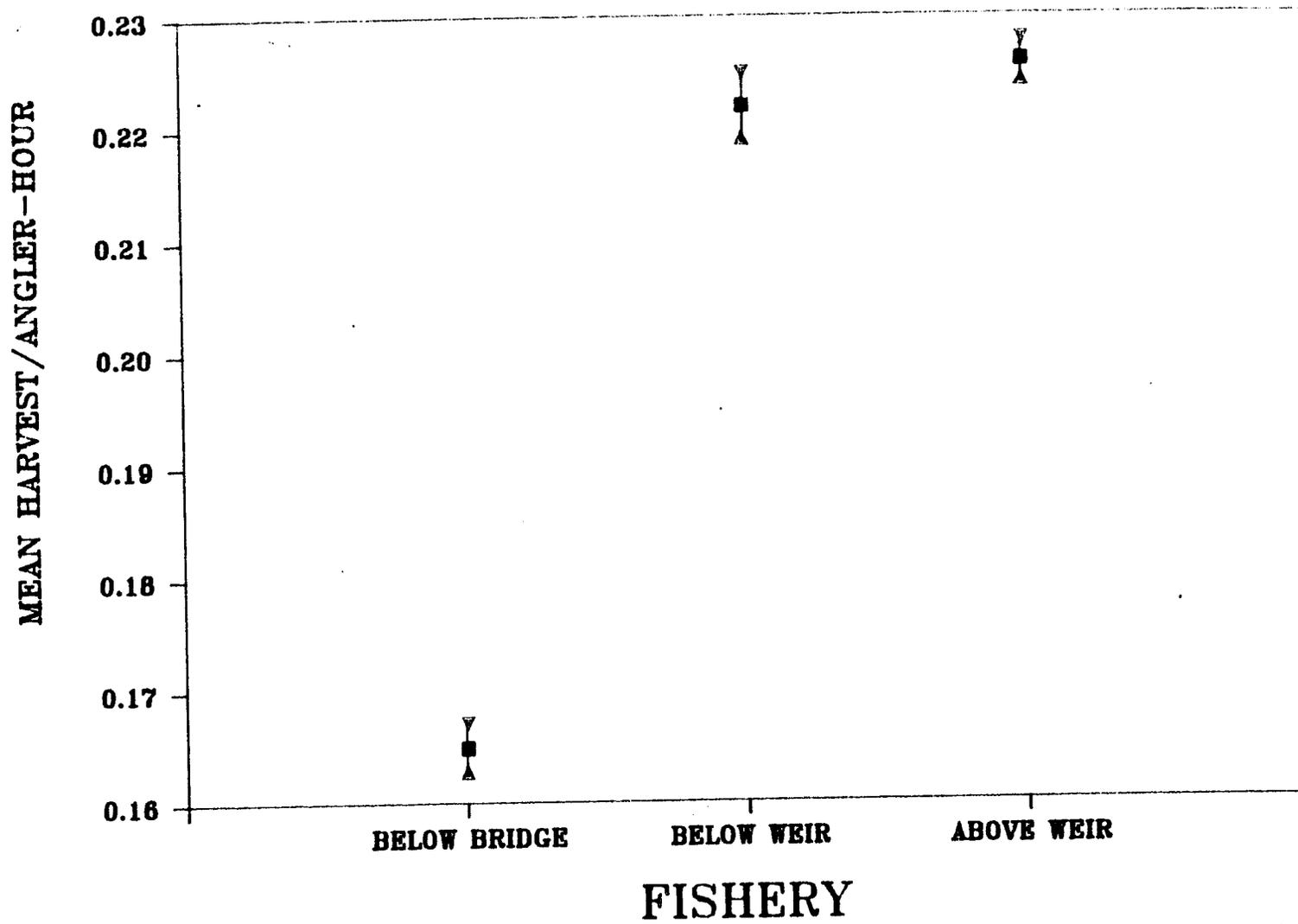


Figure 3. Buskin River coho salmon harvest per angler-hour by fishery, 1986.

An estimated 3,872 coho salmon were harvested during 20,098 angler-hours of effort (Table 3). Harvests were similar during the early and late fisheries. During the late fishery, most of the harvest occurred below the weir (1,695 fish or 79%).

A comparison of relative precision for the estimates of harvest and effort (Table 3) shows that most of the imprecision occurred in the estimate of effort for the above weir fishery. The high degree of variability is attributed to the sporadic nature of this fishery; no consistent pattern was obvious for fishing effort. A visual inspection of the mean count data in Table 1 indicates that most of the fishing effort consistently occurred during strata B, C, and D for all fishing locations.

Escapement

Buskin River weir escapement counts from 19 May through 2 October 1986 (Appendix Table A5) totaled 8,878 sockeye salmon; 98,958 pink salmon; 52 chum salmon; and 9,589 coho salmon. A total of 71 outmigrant and 83 immigrant steelhead were also counted through the weir, but these counts are incomplete as the weir was removed before the fall steelhead immigration was completed.

Biological Data

Ages 2.1² and 1.1 coho salmon comprised 49.1% and 49.4% of the sport fishery sample, respectively (Appendix Table B1). Males and females were nearly equally abundant (48.5% females, 51.5% males). Ages 2.1 and 1.1 coho salmon also composed most of the escapement (48.2% and 48.2%, respectively) (Appendix Table B2). The sexes were nearly equally abundant in the escapement, also (45.2% females and 54.8% males). Mean lengths by sex and age group are presented in Appendix Tables B3 and B4.

Ages 2.3, 2.2, 1.3, and 1.2 sockeye salmon comprised 55.4%, 8.0%, 27.2% and 9.1% of the escapement, respectively (Appendix Table C1). Mean lengths by sex and age are presented in Appendix Table C2.

ACKNOWLEDGEMENTS

The assistance of the Kodiak Commercial Fish Division and Mr. Michael Mortensen in operating the weir and collecting field data is gratefully acknowledged.

² European formula: the first numeral refers to the number of years of freshwater residence. The second numeral refers to the number of years of marine residence. Total age is the sum of both numbers plus one.

Table 3. Estimated effort and harvest during the Buskin River sport fishery for coho salmon, 1986.

Time	Location	Effort Total	Rel. Pre. ¹	CPUE ²	Rel. Pre.	Harvest Total	SE ³	Rel. Pre.
8/12-9/10	Below bridge	10,484	24.9%	0.165	1.3%	1,730	220.3	25.0%
9/11-10/2	Below weir	7,634	23.5%	0.222	1.3%	1,695	203.4	23.5%
9/11-10/2	Above weir	1,980	47.2%	0.226	0.8%	447	107.8	47.3%
	Subtotal	9,614	21.0%			2,142	230.2	21.1%
	Total	20,098	16.4%			3,872	318.6	16.1%

¹ Relative precision for 95% confidence interval.

² Catch per angler-hour.

³ Standard error.

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APPENDICES

APPENDIX A

Sport harvest and escapement data

Appendix Table A1. Angler counts in the Buskin River coho salmon sport fishery, 12 August through 10 September 1986.

Date	Weekend/ Holiday (+)	Counts by Period ¹			
		A	B	C	D
8/12		0			
8/13				12	
8/14					
8/15					
8/16	+				
8/17	+	0	12		44
8/18			3		
8/19		3			
8/20					55
8/21					
8/22					
8/23	+				
8/24	+		10		
8/25				11	
8/26		1	5		10
8/27			22	31	34
8/28			43		
8/29			36		9
8/30	+				
8/31	+				
9/01	+	43	33	30	46
9/02				29	
9/03		8			
9/04					
9/05		8		17	21
9/06	+	19			7
9/07	+			18	
9/08					
9/09					
9/10					

¹ Period A: 0600 - 0759, period B: 0800 - 1159, period C: 1200 - 1659, period D: 1700 - 2200.

Appendix Table A2. Angler counts in the Buskin River coho salmon sport fishery, 11 September through 2 October 1986.

Date	Weekend/ Holiday (+)	Counts by Period ¹				Counts by Period ¹			
		<u>Below weir fishery</u>				<u>Above weir fishery</u>			
		A	B	C	D	A	B	C	D
9/11					53				18
9/12					32				17
9/13	+	11	30		54	4	10		14
9/14	+								
9/15									
9/16									
9/17					30				8
9/18									
9/19									
9/20	+		32	35			0	5	
9/21	+			26	10			5	0
9/22									
9/23									
9/24					31				3
9/25									
9/26									
9/27	+	4	23	23		0	4	15	
9/28	+	0			14	0			3
9/29									
9/30									
10/01			3				0		
10/02					4				3

¹ Period A: 0700 - 0759, period B: 0800 - 1159, period C: 1200 - 1659, period D: 1700 - 2100.

Appendix Table A3. Angler effort and harvest data for the Buskin River coho salmon sport fishery, 12 August through 10 September 1986.

Date	Wd/ We	No. Int. ¹	Hours		Coho Harvest			Pink Harvest		
			Mean	SE ²	Mean	SE	CPUE	Mean	SE	CPUE
13-Aug	Wd	28	1.821	0.209	0.071	0.050	0.039	0.571	0.181	0.314
17-Aug	We	48	2.055	0.139	0.000	0.000	0.000	0.854	0.191	0.416
18-Aug	Wd	3	0.917	0.363	0.333	0.333	0.364	0.333	0.333	0.364
20-Aug	Wd	47	2.154	0.164	0.085	0.051	0.040	0.362	0.107	0.168
24-Aug	We	10	1.700	0.305	1.000	0.298	0.588	0.000	0.000	0.000
25-Aug	Wd	26	1.606	0.201	0.423	0.138	0.263	0.115	0.115	0.072
26-Aug	Wd	109	1.541	0.114	0.193	0.050	0.125	0.046	0.020	0.030
27-Aug	Wd	139	1.866	0.104	0.338	0.053	0.181	0.036	0.019	0.019
28-Aug	Wd	18	1.370	0.254	1.167	0.218	0.852	0.000	0.000	0.000
29-Aug	Wd	57	1.592	0.161	0.509	0.107	0.320	0.000	0.000	0.000
01-Sept	We	159	1.800	0.107	0.415	0.054	0.231	0.044	0.022	0.024
02-Sept	Wd	55	2.589	0.240	0.164	0.057	0.063	0.000	0.000	0.000
04-Sept	Wd	9	1.333	0.118	1.111	0.200	0.833	0.000	0.000	0.000
05-Sept	Wd	80	2.681	0.211	0.325	0.066	0.121	0.000	0.000	0.000
06-Sept	We	65	2.185	0.175	0.185	0.062	0.085	0.000	0.000	0.000
07-Sept	We	46	1.565	0.165	0.348	0.084	0.222	0.000	0.000	0.000

¹ Number of anglers interviewed.

² Standard error.

Appendix Table A4. Angler effort and harvest data for the Buskin River coho salmon sport fishery,
11 September through 2 October 1986.

Date	Wd/ We	No. Int. ¹	Hours		Coho Harvest			Pink Harvest		
			Mean	SE ²	Mean	SE	CPUE	Mean	SE	CPUE
Location: Below Weir										
11-Sept	Wd	29	2.546	0.31344	1.00000	0.17894	0.39279	0.00000	0.00000	0.0000
12-Sept	Wd	57	2.039	0.20406	0.59649	0.11432	0.29247	0.03509	0.03509	0.0172
13-Sept	We	63	1.922	0.17653	0.52381	0.09291	0.27255	0.00000	0.00000	0.0000
17-Sept	Wd	50	1.740	0.14060	0.30000	0.09147	0.17243	0.00000	0.00000	0.0000
18-Sept	Wd	18	1.574	0.24790	0.94444	0.22099	0.60007	0.00000	0.00000	0.0000
20-Sept	We	87	2.109	0.11971	0.58621	0.08264	0.27793	0.00000	0.00000	0.0000
21-Sept	We	50	1.947	0.19616	0.16000	0.07205	0.08219	0.00000	0.00000	0.0000
22-Sept	Wd	12	4.833	0.98873	0.58333	0.22891	0.12069	0.00000	0.00000	0.0000
24-Sept	Wd	29	5.224	0.56386	0.41379	0.11657	0.07921	0.00000	0.00000	0.0000
25-Sept	Wd	7	1.714	0.34256	0.71429	0.35952	0.41667	0.00000	0.00000	0.0000
27-Sept	We	37	2.072	0.14951	0.37838	0.11198	0.18260	0.00000	0.00000	0.0000
28-Sept	We	15	4.700	0.72670	1.00000	0.21822	0.21277	0.00000	0.00000	0.0000
01-Oct	Wd	4	1.625	0.21651	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000
02-Oct	Wd	3	1.083	0.46398	0.33333	0.33333	0.30769	0.00000	0.00000	0.0000
Location: Above Weir										
11-Sept	Wd	13	2.160	0.32457	0.61539	0.18040	0.28490	0.00000	0.00000	0.00000
12-Sept	Wd	22	1.288	0.21299	0.27273	0.11735	0.21179	0.13636	0.13636	0.10589
13-Sept	We	19	1.285	0.20213	0.42105	0.15887	0.32760	0.00000	0.00000	0.00000
17-Sept	Wd	17	4.353	1.05175	1.00000	0.22687	0.22973	0.00000	0.00000	0.00000
18-Sept	Wd	2	1.125	0.62500	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
20-Sept	We	7	2.107	0.59171	0.14286	0.14286	0.14286	0.06780	0.00000	0.00000
21-Sept	We	12	1.896	0.41794	0.16667	0.11237	0.08791	0.00000	0.00000	0.00000
24-Sept	Wd	3	1.667	0.33333	0.66667	0.33333	0.40000	0.00000	0.00000	0.00000
27-Sept	We	6	2.613	0.46363	0.83333	0.30732	0.31888	0.00000	0.00000	0.00000
28-Sept	We	6	1.250	0.11180	0.16667	0.16667	0.13333	0.00000	0.00000	0.00000
02-Oct	Wd	5	2.400	0.40000	0.60000	0.24495	0.25000	0.00000	0.00000	0.00000

¹ Number of anglers interviewed.

² Standard error.

Appendix Table A5. Buskin River salmon escapement by day and species, 1986.

Date	Sockeye	Pink	Coho	Date	Sockeye	Pink	Coho	Date	Sockeye	Pink	Coho	Date	Sockeye	Pink	Coho	Date	Sockeye	Pink	Coho
5/19	4			6/20	117			7/22	84	228		8/23	7	1,065	78	9/24	0	2	147
5/20	0			6/21	117			7/23	102	331		8/24	6	565	44	9/25	0	2	40
5/21	0			6/22	117			7/24	21	107	1	8/25	0	2,073	24	9/26	5	34	363
5/22	0			6/23	2			7/25	64	359	0	8/26	0	6,104	198	9/27	0	14	750
5/23	0			6/24	2			7/26	94	331	0	8/27	0	4,191	254	9/28	0	2	55
5/24	0			6/25	102			7/27	71	286	0	8/28	0	1,058	213	9/29	1	2	63
5/25	0			6/26	102			7/28	253	942	2	8/29	0	530	112	9/30	0	0	24
5/26	33			6/27	82			7/29	104	629	0	8/30	0	1,357	1,733	10/1	2	9	1,847
5/27	3			6/28	82			7/30	71	1,063	0	8/31	0	1,565	309	10/2	0	0	254
5/28	0			6/29	155			7/31	137	1,457	0	9/01	0	874	119				
5/29	0			6/30	155			8/01	321	897	3	9/02	0	968	163				
5/30	25			7/01	0			8/02	177	1,676	2	9/03	0	770	180	Total ¹	8,878 ²	98,958 ³	9,589 ⁴
5/31	0			7/02	0			8/03	652	5,406	13	9/04	1	427	91				
6/01	0			7/03	143			8/04	158	3,312	2	9/05	7	1,298	117				
6/02	1			7/04	19			8/05	86	4,266	6	9/06	1	1,860	65				
6/03	585			7/05	412			8/06	113	3,576	2	9/07	0	3,463	444				
6/04	323			7/06	459			8/07	220	3,745	2	9/08	0	221	81				
6/05	0			7/07	155			8/08	135	3,946	20	9/09	0	150	65				
6/06	0			7/08	6			8/09	50	4,148	38	9/10	0	209	48				
6/07	183			7/09	14	1		8/10	25	2,833	128	9/11	0	585	22				
6/08	93			7/10	21	5		8/11	59	8,024	20	9/12	0	680	39				
6/09	93			7/11	21	17		8/12	1	5,063	49	9/13	2	716	26				
6/10	20			7/12	13	12		8/13	15	2,743	25	9/14	1	456	56				
6/11	18			7/13	30	11		8/14	3	1,575	20	9/15	0	345	87				
6/12	117			7/14	99	70		8/15	0	3,008	59	9/16	0	209	58				
6/13	117			7/15	140	11		8/16	0	1,027	57	9/17	1	132	71				
6/14	117			7/16	8	13		8/17	0	781	58	9/18	0	94	76				
6/15	117			7/17	193	60		8/18	15	2,488	64	9/19	0	75	98				
6/16	117			7/18	89	74		8/19	1	537	42	9/20	0	87	83				
6/17	117			7/19	162	154		8/20	0	180	37	9/21	1	29	153				
6/18	117			7/20	342	314		8/21	1	225	101	9/22	0	21	27				
6/19	117			7/21	132	204		8/22	2	577	89	9/23	0	4	72				

- 1 A total of 52 chum salmon, 71 kelt steelhead and 83 inmigrant steelhead moved through the weir during August-September, May-August and September, respectively.
- 2 Sockeye salmon escapements were estimated when the weir was inoperable during June by averaging 5-day pre and post counts x days missed.
- 3 Approximately 12,000 pink salmon spawned below the weir, therefore, the actual escapement was 110,958 fish.
- 4 Approximately 350 coho salmon were below the weir when it was removed, the sport harvest above the weir was 447 fish; therefore, total coho salmon escapement was 9,492 fish.

APPENDIX B

Coho salmon age, sex, and size data

Appendix Table B1. Age composition of coho salmon in the
Buskin River sport harvest, 1986.

Sex	Age Group				Total ¹
	3.1	2.1	2.0	1.1	
Female					
Sample Size	1	75	0	87	163
Percent	0.3	22.3	0.0	25.9	48.5
Male					
Sample Size	3	90	1	79	173
Percent	0.9	26.8	0.3	23.5	51.5
Sexes Combined					
Sample Size	4	165	1	166	336
Percent	1.2	49.1	0.3	49.4	100.0
Standard Error	0.59	2.73	0.3	2.73	

¹ Of the 464 fish sampled, 128 (27.6%) had unreadable scales.

Appendix Table B2. Age composition of coho salmon in the Buskin River escapement, 1986.

Sex	Age Group					Total ¹
	3.1	3.0	2.1	2.0	1.1	
Female						
Sample Size	1	0	76	0	72	149
Percent	0.3	0.0	23.0	0.0	21.8	45.2
Male						
Sample Size	0	5	83	6	87	181
Percent	0.0	1.5	25.1	1.8	26.4	54.8
Sexes Combined						
Sample Size	1	5	159	6	159	330
Percent	0.30	1.5	48.2	1.8	48.2	100.0
Standard Error	0.3	0.67	2.75	0.73	2.75	

¹ Of the 413 fish sampled, 83 (20.1%) had unreadable scales.

Appendix Table B3. Mean length (mm) of coho salmon in the Buskin River sport harvest, 1986.¹

Sex	Age Group			
	3.1	2.1	2.0	1.1
Female				
Mean Length	---	672	---	646
Standard Error	---	6	---	9
Sample Size	0	75	0	87
Male				
Mean Length	731	692	320	669
Standard Error	4	9	0	10
Sample Size	3	90	1	79

¹ Mid-eye to fork-of-tail length.

Appendix Table B4. Mean length (mm) of coho salmon in the Buskin River escapement, 1986.¹

Sex	Age Group					
	3.2	3.1	3.0	2.1	2.0	1.1
Female						
Mean Length	---	692	---	668	---	654
Standard Error	---	0	---	7	---	10
Sample Size	0	1	0	76	0	72
Male						
Mean Length	320	---	330	686	328	654
Standard Error	15	---	0	8	0	9
Sample Size	4	0	1	83	6	87

¹ Mid-eye to fork-of-tail length.

APPENDIX C

Sockeye salmon age, sex, and size data

Appendix Table C1. Age composition of sockeye salmon sampled from the Buskin Lake escapement, 1986.

Sex	Age Group						Total ¹
	3.3	3.2	2.3	2.2	1.3	1.2	
Female							
Sample Size	0	1	125	26	58	16	226
Percent	0.0	0.2	29.2	6.1	13.6	3.7	52.8
Male							
Sample Size	1	0	112	8	58	23	202
Percent	0.2	0.0	26.2	1.9	13.6	5.4	47.3
Sexes Combined							
Sample Size	1	1	237	34	116	39	428
Percent	0.2	0.2	55.4	8.0	27.2	9.1	100.1
Standard Error	0.2	0.2	2.4	3.1	2.2	1.4	

¹ Of the 597 fish sampled, 169 (28.3%) had unreadable scales.

Appendix Table C2. Mean length (mm) of sockeye salmon in the Buskin Lake escapement, 1986.¹

Sex	Age Group					
	3.3	3.2	2.3	2.2	1.3	1.2
Female						
Mean Length	---	485	529	478	531	477
Standard Error	---	0.0	1.2	4.1	2.1	5.6
Sample Size	0	1	125	26	58	16
Male						
Mean Length	561	---	549	449	548	427
Standard Error	0.0	---	2.3	8.9	3.8	4.9
Sample Size	1	0	112	8	58	23

¹ Mid-eye to fork-of-tail length.