Alaska Fisheries Data Series Number 2003-4

Estimation of the Sockeye Salmon Escapement into McLees Lake, Unalaska Island, Alaska, 2002

Douglas E. Palmer

March 2003

United States Department of the Interior
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Abstract.—From June 1 to July 29, 2002, a flexible picket weir was used to collect abundance, run timing, and biological data from sockeye salmon returning to McLees Lake on Unalaska Island. A total of 97,780 sockeye *Oncorhynchus nerka*, and one chinook *O. tshawytscha* salmon were counted through the weir. Peak passage occurred from June 18 through July 9 when 60,203 (62%) sockeye salmon entered McLees Lake. The sockeye salmon return to McLees Lake during 2002 was about twice that observed during 2001 when 45,866 sockeye were counted through the weir.

Six age groups were identified from 751 sockeye salmon sampled from the weir escapement between June 4 and July 24. This escapement was composed primarily of age 1.2 (60.1%) and 1.3 (31.7%) fish. Females composed an estimated 43.2% of the sampled sockeye salmon escapement. Age composition did not differ between sexes.

Introduction

McLees Lake empties into Reese Bay on the north side of Unalaska Island approximately 12 miles NW of the city of Unalaska (Figure 1). This watershed provides important spawning and rearing habitat for sockeye salmon. Adult sockeye salmon returning to McLees Lake are harvested in Reese Bay by subsistence users from Unalaska. The Reese Bay subsistence fishery currently provides 85-95 % of the annual sockeye harvest for this community (Shaul and Dinnocenzo 2002a) and the number of households participating in this fishery has increased in recent years (Appendix 1). Current management of the fishery is limited to using aerial surveys and harvest information to assess escapement.

The escapement of sockeye salmon to McLees Lake has been monitored using aerial survey counts since 1974 (Arnie Shaul, Alaska Department of Fish and Game, personal communication). Aerial surveys have generally been limited to one survey each year and have ranged from 300 - 34,000 fish (Appendix 2). Aerial counts serve as an index to abundance but can be influenced by several factors including time of survey, poor weather, lack of availability of suitable aircraft and variation among observers. No aerial surveys were conducted during some years because of one or more of these factors.

Subsistence harvests of sockeye salmon returning to McLees Lake have been monitored since 1985 (Shaul and Dinnocenzo 2002b). The estimated annual harvest in the Reese Bay subsistence fishery has ranged from 436 to 3,985 sockeye salmon (Appendix 1). During this time period the number of permits issued for this fishery has ranged from

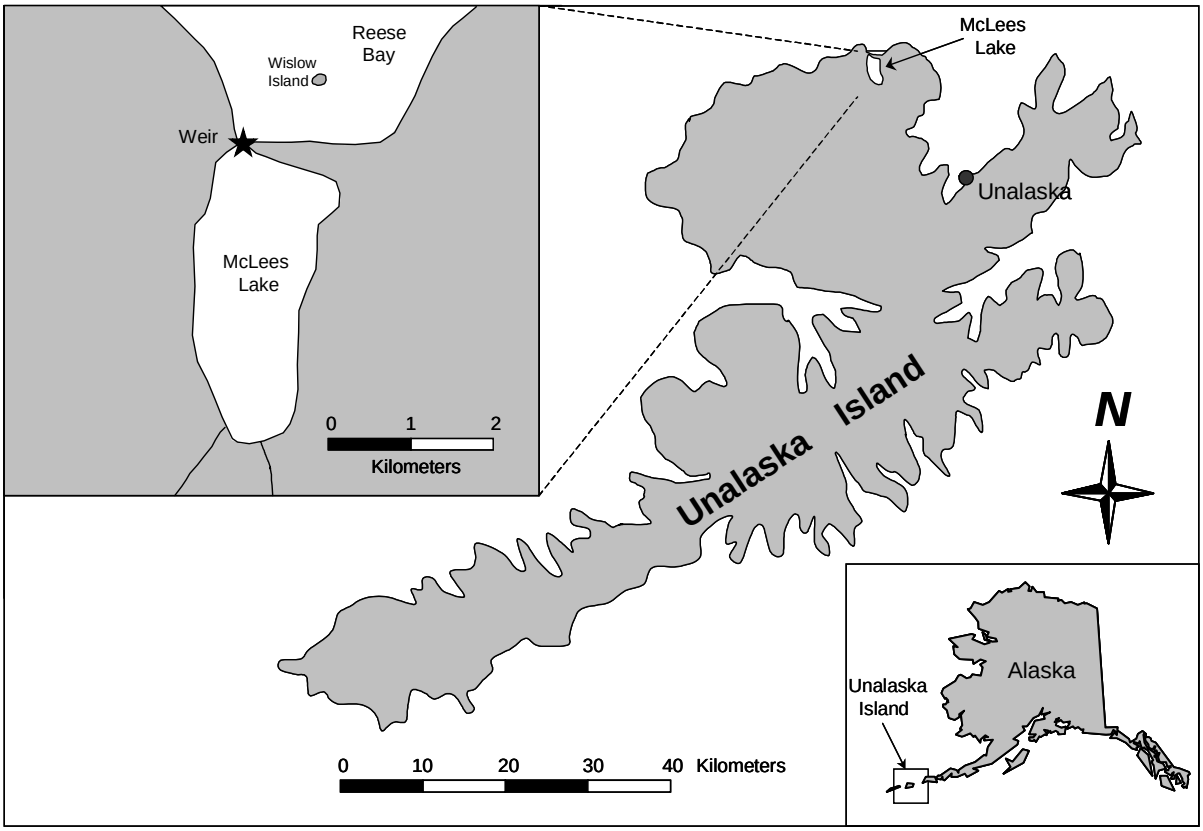

FIGURE 1.—Map of Unalaska Island showing the location of McLees Lake and the weir site.

12 to 121. Annual fluctuations in harvest have generally corresponded to the number of permits issued for the fishery. Since 1995, the average annual harvest has nearly doubled and the number of permits issued has nearly tripled from that observed from 1985-1994. These numbers suggest that sockeye salmon returning to McLees Lake have become increasingly important to the local subsistence fishery.

Local residents and the Alaska Department of Fish and Game (Department) have expressed concerns that the lack of an escapement estimate for sockeye salmon into McLees Lake may jeopardize the health of the run, as well as future opportunities for subsistence fishing. These concerns prompted the Kodiak/Aleutian Federal Regional Subsistence Advisory Council to identify an escapement monitoring project on McLees Lake as a high priority. To address these concerns, the Kenai Fish and Wildlife Field Office (Kenai FWFO) and the Qawalangin Tribe of Unalaska entered into a partnership agreement to monitor the sockeye salmon return to McLees Lake over a 3-year period. Specific objectives of the project were to: (1) enumerate the daily passage of sockeye salmon through a flexible picket weir; (2) describe the run-timing of sockeye salmon through the weir; (3) estimate the weekly sex and age composition of the sockeye salmon return; and, (4) estimate the mean length of sockeye salmon by sex and age. This report summarizes findings during 2002, the second year of the project.

Methods

Weir Design and Operation

A flexible picket weir spanning 21 m was installed at the outlet of McLees Lake and operated from June 1 to July 29, 2002. The weir was patterned after a design used on the Alaska Peninsula (Nick Hetrick, U.S. Fish and Wildlife Service, personal communication). Weir pickets are electrical metal conduit with a 1.3 cm inside diameter. Picket spacing ranged from 3.5 cm for panels in shallow water near each stream bank to 2.2 cm on panels near the middle of the McLees Lake outlet channel. All pickets are 1.5 m long and strung together with 3-mm aircraft cable to make panels 3 m long (Appendix 3). A spanning cable (6-mm aircraft) was strung bank to bank and pulled tight about 0.3 m above the surface of the water. The weir panels were leaned against the cable which was supported with a single tripod in mid-channel and fenceposts approximately every 3 meters (Appendix 4). A trap and holding area was constructed into the upstream side of the weir to facilitate sampling fish and passing adult salmon through the weir. The weir and sampling trap were inspected daily and maintained as needed to ensure integrity.

A staff gauge was installed 4 m downstream of the weir to measure daily water levels. Water temperatures were monitored in the outlet channel with a StowAway® TidbiT® temperature logger.

Escapement Counts

Fish were passed and counted intermittently between 0700 and 2400 hours each day. The duration of each counting session varied depending on the intensity of fish passage through the weir. Daily escapement counts were relayed to Kenai FWFO via satellite phone. Kenai FWFO provided daily escapement information (E-mail) to the Department in Cold Bay, allowing for possible in-season management decisions regarding the Reese Bay subsistence fishery.

Biological Sampling

Data on fish age, sex, and length (ASL) were collected using a temporally stratified sampling design (Cochran 1977), with statistical weeks defining strata. A sample of fish was collected weekly for ASL information. Sampling typically occurred during two or three days during each statistical week in an effort to obtain a weekly sub-sample of 100 sockeye salmon.

Fish sampling consisted of measuring length, determining sex, collecting scales, and then releasing the fish upstream of the weir. Length was measured from mid-eye to fork-of-caudal-fin to the nearest 5 mm. Sex was determined by observing external characteristics. Scales were removed from the preferred area for age determination (Koo 1962; Mosher 1968). One scale was collected from each sockeye salmon.

Sample data for salmon were recorded on all-weather age, sex, length (ASL) field forms and transferred to ASL mark-sense forms provided by the Department. Salmon scales were cleaned and properly affixed to gummed scale cards. Mark-sense forms and scale cards were completed according to Department procedures for the Alaska Peninsula/Aleutian Islands Area (Murphy 2000). At the end of the season, mark-sense forms and scale cards were forwarded to the Department in Kodiak to determine age from the scales and enter age data onto the ASL forms. The Department scanned the completed forms and provided a synopsis of the ASL data to Kenai FWFO.

Data Analysis

Mean lengths of males and females by age were compared using a two-tailed *t* test at $\alpha = 0.05$ (Zar 1984). Age and sex composition were estimated using a stratified sampling design (Cochran 1977). Chi-square contingency table analysis was used to test for differences in age composition between the sexes. Because the standard test only applies to data collected under simple random sampling, adjustments were made to the test statistic, following Rao and Thomas (1989), to account for the impact of our stratified sampling design on the results. The χ^2 statistic, hereafter referred to as $\chi^2(\delta.)$, was divided by the mean generalized design effect, $\delta.$, as a first-order correction to the standard test (Rao and Thomas 1989). Estimated design effects for the cells are presented in Appendix 7. Age and sex specific escapements in a stratum, $\hat{A}_{hij}$, and their variances, $V[\hat{A}_{hij}]$, were estimated as:

$$\hat{A}_{hij} = N_h \hat{p}_{hij}\,; \qquad (1)$$

and

$$\hat{V}\left[\hat{A}_{hij}\right] = N_h^2\left(1-\frac{n_h}{N_h}\right)\left(\frac{\hat{p}_{hij}\left(1-\hat{p}_{hij}\right)}{n_h-1}\right) \qquad (2)$$

where

N_h = total escapement of a given species during stratum *h*;

$\hat{p}_{hij}$ = estimated proportion of age *i* and sex *j* fish, of a given species, in the sample in stratum *h*; and

n_h = total number of fish, of a given species, in the sample for stratum *h*.

Abundance estimates and their variances for each stratum were summed to obtain age- and sex- specific escapements for the season as follows:

$$\hat{A}_{ij} = \sum \hat{A}_{hij}\,; \qquad (3)$$

and

$$\hat{V}\left[\hat{A}_{ij}\right] = \sum \hat{V}\left(\hat{A}_{hij}\right). \qquad (4)$$

Results

Weir Operation

The weir was functional throughout the operational period. No holes were reported, water levels did not exceed the height of the weir, and no salmon were observed escaping through the pickets. The sampling trap was installed mid-channel and worked well throughout the sampling period and at all stage heights (Appendix 5). Water temperatures during weir operations ranged from 11.0 to 13.6 °C and averaged 12.5 °C (Appendix 5).

Biological Data

Two species of Pacific salmon, including 97,780 sockeye and one chinook salmon, were counted upstream through the weir (Appendix 6). Sockeye salmon passed through the weir from June 3 to July 29. Peak passage occurred from June 18 to July 9 when 60,203 (62%) sockeye salmon entered McLees Lake (Figure 2; Appendix 6). During this period, counts of sockeye salmon exceeded 3,000 fish/day on eight days. The largest daily count was 4,093 fish on June 26. One chinook salmon was observed passing the weir on July 8.

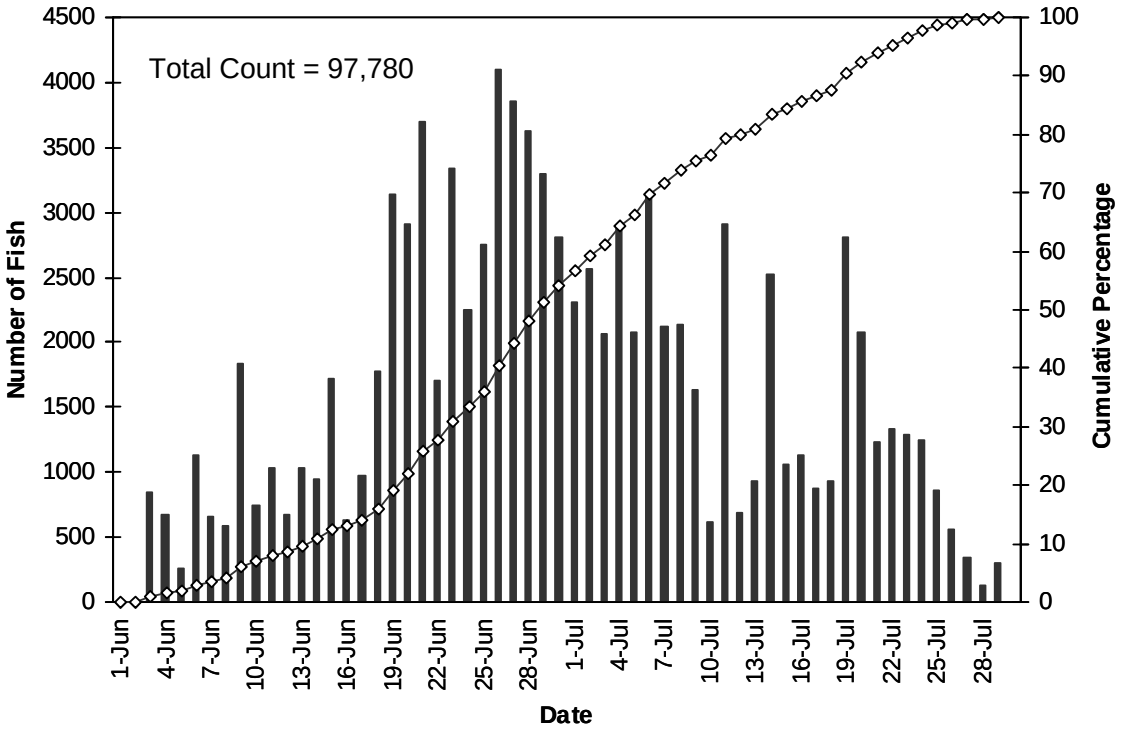

FIGURE 2.—Adult sockeye salmon counts through the McLees Lake weir, Unalaska Island, Alaska, 2002.

Six age groups were identified from 654 out of 751 sockeye salmon sampled from the weir escapement between June 4 and July 24 (Appendix 7). During this period, 96,447 sockeye salmon were counted through the weir. Age 1.2 and 1.3 sockeye salmon were most abundant, accounting for 60.1 % and 31.7 % of the sampled fish, respectively. Females made up an estimated 43.2 % of the sockeye escapement. Age composition did not differ between sexes (O^2(¢.)=7.018, df=3, P>0.05; age groups 1.4, 2.3 and 3.2 were combined for this analysis because of small sample sizes). In sampled fish, the mean lengths of age 1.2, 1.3, and 2.2 males were greater than those of same-aged females (two-tailed t test: age 1.2, t=10.972, df= 357, P<0.001; age 1.3, t=8.276, df=198, P<0.001; age 2.2, t=4.533, df=38, P<0.001; insufficient data for other age groups)(Appendix 8).

Discussion

Weir Operation

The weir was operated from June 1 through July 29 during 2002. No sockeye salmon were counted through the weir during the first two days of operation followed by escapements of several hundred fish on subsequent days (Figure 2). This dramatic increase in fish passage from zero to several hundred fish suggests that few fish had entered McLees Lake prior to weir installation.

The weir was operated throughout the season without interruption. The trap was installed in the deepest part of the channel which allowed us to sample fish through July 24. Fish passage began to steadily decline after July 24 and the weir was removed on July 29.

Biological Data

The sockeye salmon return to McLees Lake during 2002 (*N*=97,780) was more than twice that observed during 2001 (*N*=45,866; Palmer 2002). The number of sockeye salmon counted during 2002 included fish entering McLees Lake prior to June 15 (*N*=10,414). This segment of the run was missed during 2001, however, it accounted for only 10.7 % of the run during 2002.

Sockeye salmon escapements to McLees Lake for the last two years have been much stronger than expected based on previous aerial survey counts. Aerial surveys conducted on the McLees Lake watershed from 1974 through 2000 ranged from 300 - 11,000 fish (Appendix 2). Aerial surveys conducted by the Department during mid-August in 2001 and 2002 resulted in counts of 34,000 and 33,000 sockeye salmon, respectively (Arnie Shaul, Alaska Department of Fish and Game, personal communication). These aerial counts are considered low because substantial numbers of salmon were probably upstream of where it was possible to fly. Nonetheless, the aerial index counts for 2001 and 2002 were several times larger than any aerial count prior to 2001 suggesting that escapements into McLees Lake over the last two years were much larger than any return since 1974.

The age composition of sockeye salmon sampled at the weir during 2002 was different from that observed during 2001 (Palmer 2002). Age 1.2 and 1.3 sockeye salmon were the dominant age groups during both years, however, age 1.3 were dominant (94.5 %) in 2001 and age 1.2 fish were dominant (60.1%) in 2002. The proportion of females in the 2002 weir escapement (43.2%) was similar to that observed during 2001(41.9 %).

Acknowledgments

Special appreciation is extended to the field crew: Shane Keep and Kenny McGlashan. A special thanks is extended to Charlie Weeks, who assisted with logistics and pre-season support of the project. George Pletnikoff, environmental coordinator for the Qawalangin Tribe, was instrumental in fulfilling tribal responsibilities for the project.

We also appreciate the assistance of the Alaska Department of Fish and Game (Department). Forrest Bowers, local area management biologist with the Department, provided a skiff and personnel to transport groceries and supplies from Dutch Harbor to the weir site during June and July. The Department also provided bunkhouse space for the crew in Dutch Harbor at the beginning and end of field operations. Thanks are also extended to Matt Foster and Patti Nelson with the Department in Kodiak for scale sample analysis.

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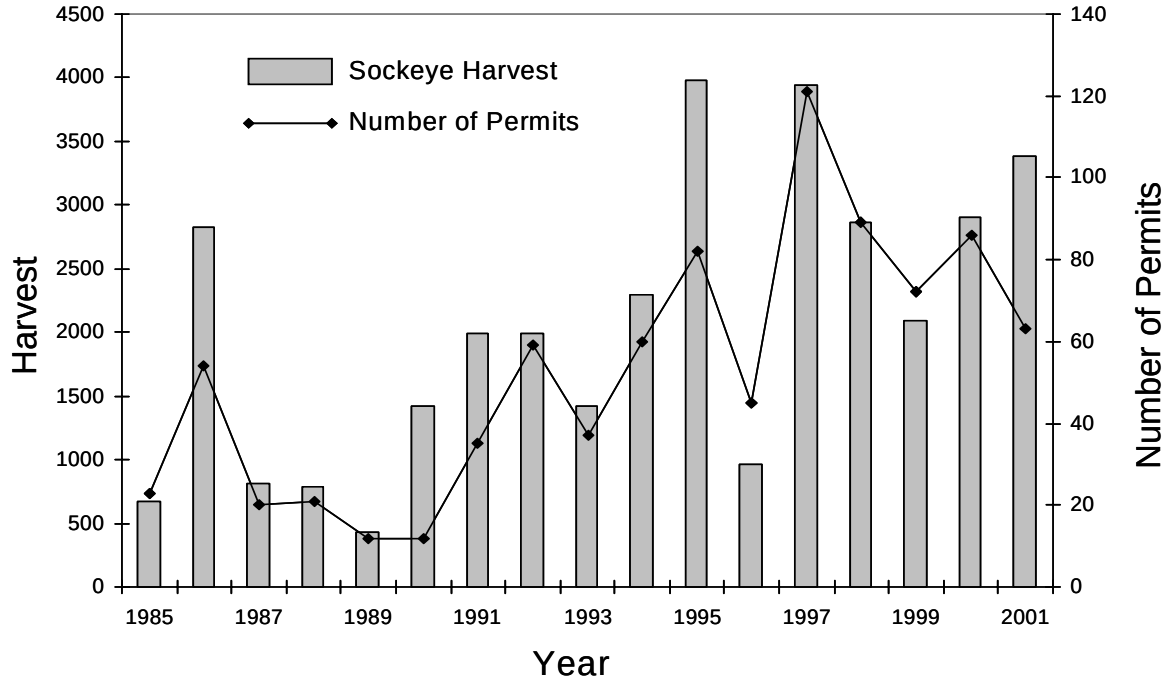
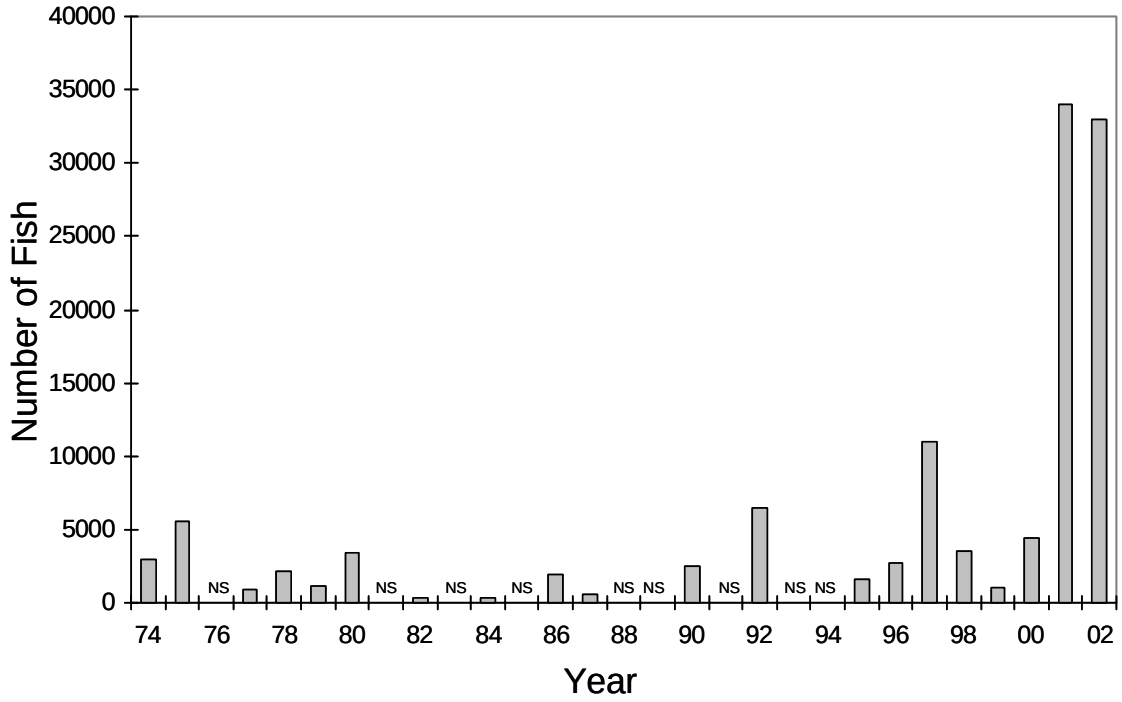
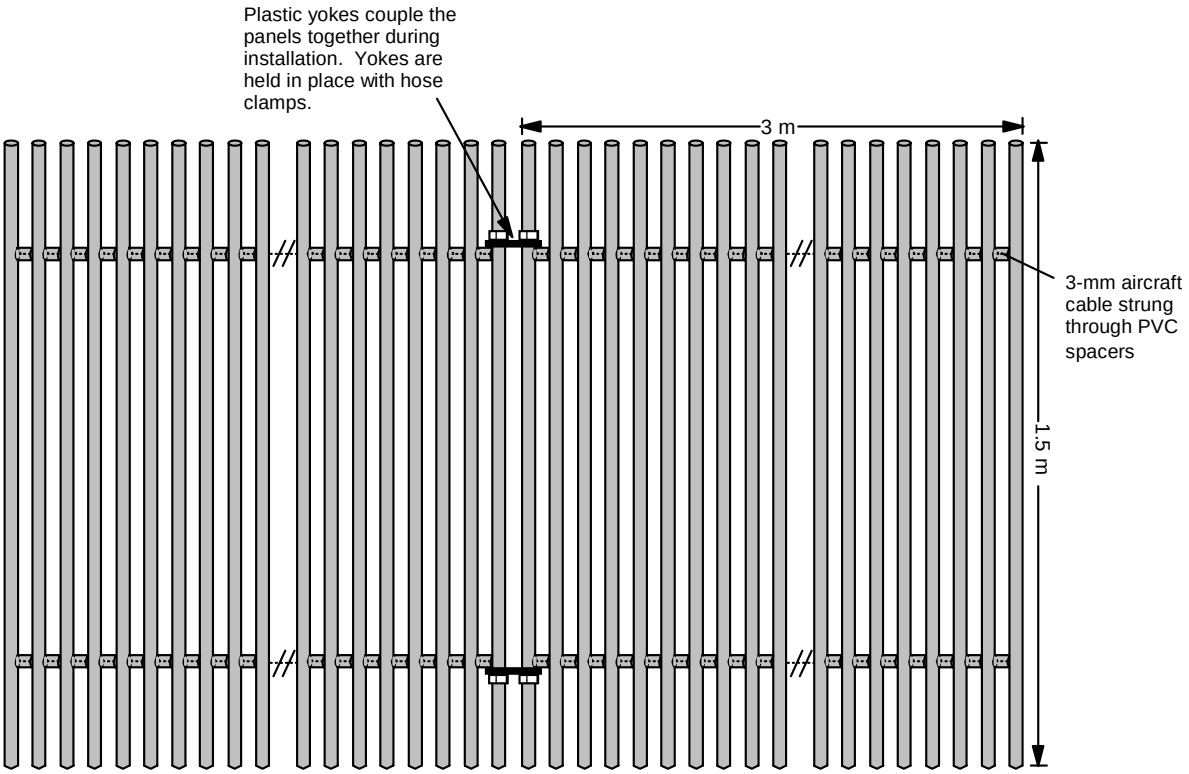


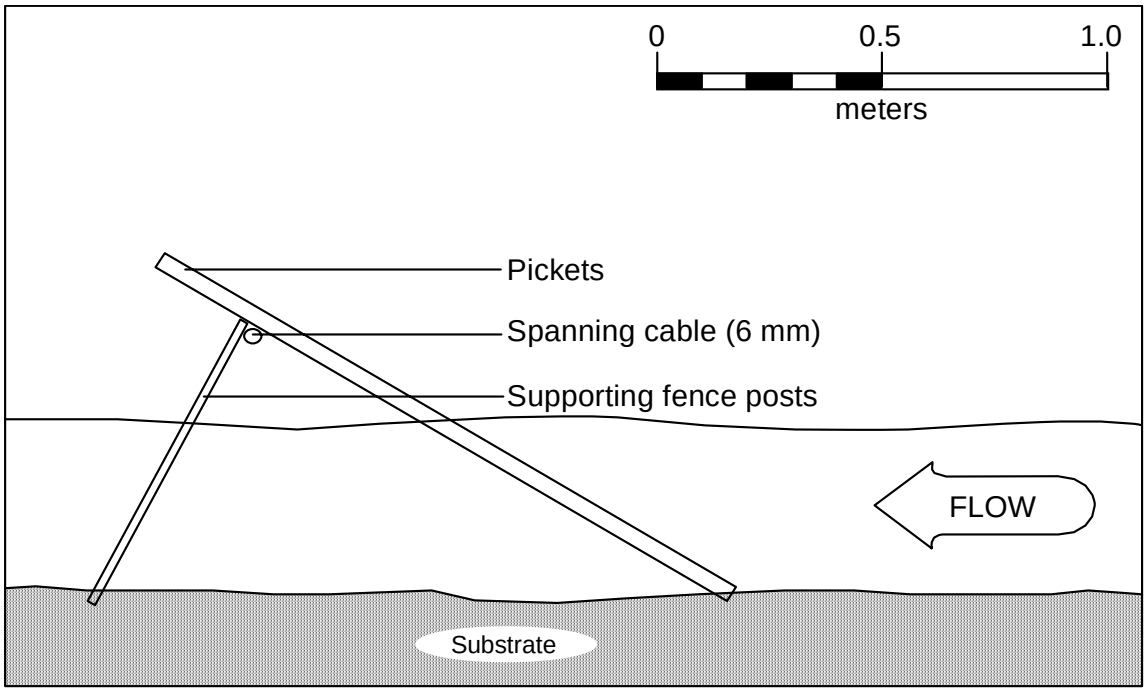
APPENDIX 1.—Estimated harvest of sockeye salmon and number of permits issued for the Reese Bay subsistence fishery 1985-2001 (Shaul and Dinnocenzo 2002a).



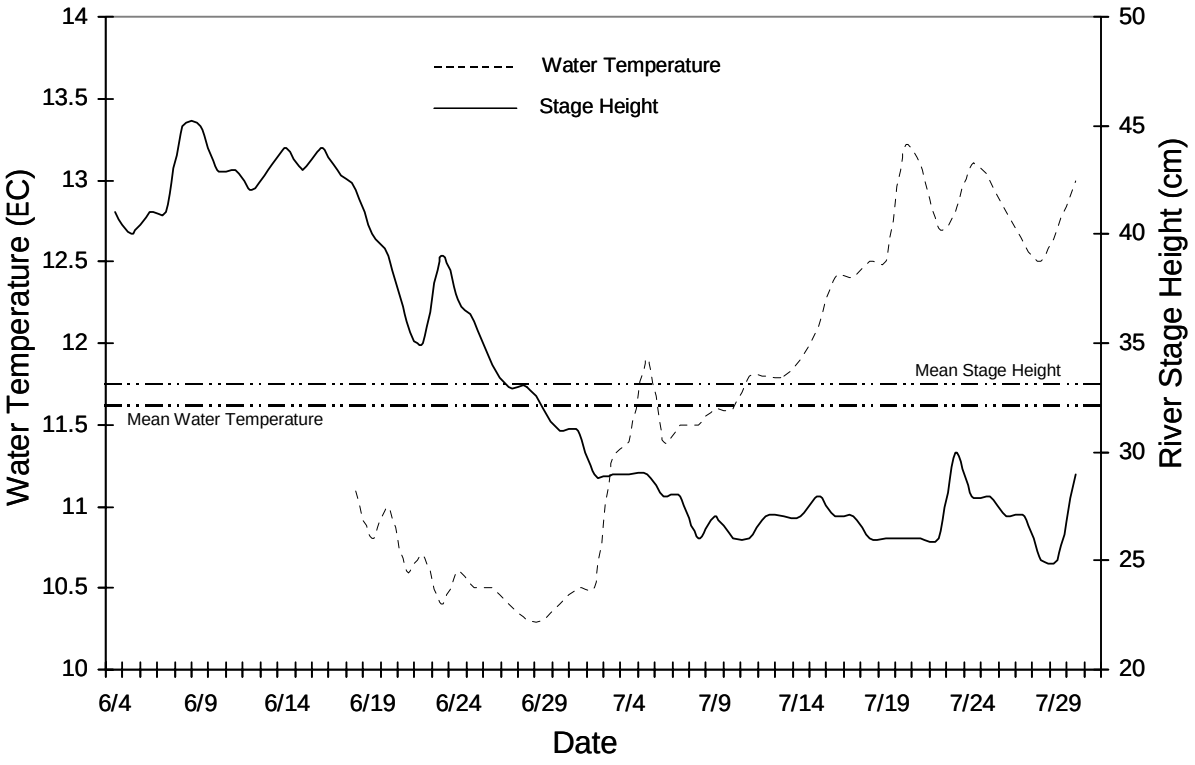
APPENDIX 2.—Aerial index escapement counts of sockeye salmon for the McLees Lake watershed, Unalaska Island, Alaska 1974-2002. NS denotes years when no survey was conducted.



APPENDIX 3.—Weir panels with pickets constructed from electrical metal conduit with a 1.3 cm inside diameter and strung together with 3-mm aircraft cable.



APPENDIX 4.—Lateral view of an installed weir panel. Spanning cable is anchored to both banks and pulled tight so it does not sag into the water. Fence posts and one tripod support the cable so the weight of the weir does not cause the panels to submerge.



APPENDIX 5.—Water temperature and river stage height at the McLees Lake weir, Unalaska Island, 2002.

APPENDIX 6.—Daily counts, cumulative counts, and cumulative proportion of sockeye and chinook salmon escapements through McLees Lake weir, 2002. Boxed areas encompass the second quartile, median, and third quartile of the sockeye salmon escapement.

	Sockeye Salmon			Chinook Salmon		
	Daily	Cumulative		Daily	Cumulative	
Date	Count	Count	Proportion	Count	Count	Proportion
6/1	0	0	0.000	0	0	0.000
6/2	0	0	0.000	0	0	0.000
6/3	840	840	0.009	0	0	0.000
6/4	678	1,518	0.016	0	0	0.000
6/5	257	1,775	0.018	0	0	0.000
6/6	1,130	2,905	0.030	0	0	0.000
6/7	662	3,567	0.036	0	0	0.000
6/8	582	4,149	0.042	0	0	0.000
6/9	1,835	5,984	0.061	0	0	0.000
6/10	747	6,731	0.069	0	0	0.000
6/11	1,037	7,768	0.079	0	0	0.000
6/12	670	8,438	0.086	0	0	0.000
6/13	1,037	9,475	0.097	0	0	0.000
6/14	939	10,414	0.107	0	0	0.000
6/15	1,713	12,127	0.124	0	0	0.000
6/16	635	12,762	0.131	0	0	0.000
6/17	976	13,738	0.140	0	0	0.000
6/18	1,776	15,514	0.159	0	0	0.000
6/19	3,143	18,657	0.191	0	0	0.000
6/20	2,907	21,564	0.221	0	0	0.000
6/21	3,701	25,265	0.258	0	0	0.000
6/22	1,712	26,977	0.276	0	0	0.000
6/23	3,346	30,323	0.310	0	0	0.000
6/24	2,254	32,577	0.333	0	0	0.000
6/25	2,748	35,325	0.361	0	0	0.000
6/26	4,093	39,418	0.403	0	0	0.000
6/27	3,852	43,270	0.443	0	0	0.000
6/28	3,620	46,890	0.480	0	0	0.000
6/29	3,298	50,188	0.513	0	0	0.000
6/30	2,802	52,990	0.542	0	0	0.000
7/1	2,308	55,298	0.566	0	0	0.000
7/2	2,565	57,863	0.592	0	0	0.000
7/3	2,058	59,921	0.613	0	0	0.000
7/4	2,882	62,803	0.642	0	0	0.000
7/5	2,080	64,883	0.664	0	0	0.000
7/6	3,158	68,041	0.696	0	0	0.000
7/7	2,126	70,167	0.718	0	0	0.000
7/8	2,141	72,308	0.739	1	1	1.000
7/9	1,633	73,941	0.756	0	1	1.000
7/10	620	74,561	0.763	0	1	1.000
7/11	2,906	77,467	0.792	0	1	1.000
7/12	693	78,160	0.799	0	1	1.000
7/13	927	79,087	0.809	0	1	1.000
7/14	2,520	81,607	0.835	0	1	1.000
7/15	1,060	82,667	0.845	0	1	1.000
7/16	1,133	83,800	0.857	0	1	1.000
7/17	872	84,672	0.866	0	1	1.000
7/18	936	85,608	0.876	0	1	1.000
7/19	2,810	88,418	0.904	0	1	1.000
7/20	2,074	90,492	0.925	0	1	1.000
7/21	1,226	91,718	0.938	0	1	1.000
7/22	1,328	93,046	0.952	0	1	1.000
7/23	1,295	94,341	0.965	0	1	1.000
7/24	1,246	95,587	0.978	0	1	1.000
7/25	860	96,447	0.986	0	1	1.000
7/26	556	97,003	0.992	0	1	1.000
7/27	346	97,349	0.996	0	1	1.000
7/28	126	97,475	0.997	0	1	1.000
7/29	305	97,780	1.000	0	1	1.000

APPENDIX 7.—Estimated age and sex composition of weekly sockeye salmon escapements through the McLees Lake weir, 2002; and estimated design effects of the stratified sampling design.

		Brood Year and Age Class						
		1998	1997		1996			
		1.2	1.3	2.2	1.4	2.3	3.2	Total
Stratum 1: 05/31 - 06/06								
Sampling Dates: 06/04 & 06/06								
Female:	Number in Sample:	11	13	1	0	2	0	27
	Estimated % of Escapement	13.8	16.3	1.3	0.0	2.5	0.0	33.8
	Estimated Escapement:	399	472	36	0	73	0	980
	Standard Error:	111.0	118.9	35.8	0.0	50.3	0.0	
Male:	Number in Sample:	9	38	2	2	1	1	53
	Estimated % of Escapement	11.3	47.5	2.5	2.5	1.3	1.3	66.3
	Estimated Escapement:	327	1,380	73	73	36	36	1,925
	Standard Error:	101.8	161.0	50.3	50.3	35.8	35.8	
Total:	Number in Sample:	20	51	3	2	3	1	80
	Estimated % of Escapement	25.0	63.8	3.8	2.5	3.8	1.3	100.0
	Estimated Escapement:	726	1,852	109	73	109	36	2,905
	Standard Error:	139.6	154.9	61.2	50.3	61.2	35.8	
Stratum 2: 06/07 - 06/13								
Sampling Dates: 06/10 & 06/12								
Female:	Number in Sample:	7	11	1	0	0	0	19
	Estimated % of Escapement	12.3	19.3	1.8	0.0	0.0	0.0	33.3
	Estimated Escapement:	807	1,268	115	0	0	0	2,190
	Standard Error:	286.9	345.0	114.8	0.0	0.0	0.0	
Male:	Number in Sample:	10	21	3	2	0	2	38
	Estimated % of Escapement	17.5	36.8	5.3	3.5	0.0	3.5	66.7
	Estimated Escapement:	1,153	2,421	346	231	0	231	4,380
	Standard Error:	332.5	421.7	195.2	160.8	0.0	160.8	
Total:	Number in Sample:	17	32	4	2	0	2	57
	Estimated % of Escapement	29.8	56.1	7.0	3.5	0.0	3.5	100.0
	Estimated Escapement:	1,959	3,688	461	231	0	231	6,570
	Standard Error:	399.9	433.8	223.3	160.8	0.0	160.8	
Stratum 3: 06/14 - 06/20								
Sampling Dates: 06/15, 06/18 & 06/20								
Female:	Number in Sample:	11	17	2	0	1	0	31
	Estimated % of Escapement	13.1	20.2	2.4	0.0	1.2	0.0	36.9
	Estimated Escapement:	1,583	2,447	288	0	144	0	4,461
	Standard Error:	446.1	531.3	201.6	0.0	143.4	0.0	
Male:	Number in Sample:	28	19	4	1	0	1	53
	Estimated % of Escapement	33.3	22.6	4.8	1.2	0.0	1.2	63.1
	Estimated Escapement:	4,030	2,734	576	144	0	144	7,628
	Standard Error:	623.3	553.2	281.6	143.4	0.0	143.4	
Total:	Number in Sample:	39	36	6	1	1	1	84
	Estimated % of Escapement	46.4	42.9	7.1	1.2	1.2	1.2	100.0
	Estimated Escapement:	5,613	5,181	864	144	144	144	12,089
	Standard Error:	659.5	654.4	340.5	143.4	143.4	143.4	

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APPENDIX 7.—(Page 2 of 3)

		Brood Year and Age Class						
		1998	1997		1996			
		1.2	1.3	2.2	1.4	2.3	3.2	Total
Stratum 4: 06/21 - 06/27								
Sampling Dates: 06/24, 06/25 & 06/27								
Female:	Number in Sample:	23	20	2	0	0	0	45
	Estimated % of Escapement	25.6	22.2	2.2	0.0	0.0	0.0	50.0
	Estimated Escapement:	5,547	4,824	482	0	0	0	10,853
	Standard Error:	1,001.5	954.6	338.5	0.0	0.0	0.0	
Male:	Number in Sample:	30	11	3	1	0	0	45
	Estimated % of Escapement	33.3	12.2	3.3	1.1	0.0	0.0	50.0
	Estimated Escapement:	7,235	2,653	724	241	0	0	10,853
	Standard Error:	1,082.4	752.1	412.2	240.7	0.0	0.0	
Total:	Number in Sample:	53	31	5	1	0	0	90
	Estimated % of Escapement	58.9	34.4	5.6	1.1	0.0	0.0	100.0
	Estimated Escapement:	12,782	7,477	1,206	241	0	0	21,706
	Standard Error:	1,129.7	1,091.1	525.9	240.7	0.0	0.0	
Stratum 5: 06/28 - 07/04								
Sampling Dates: 07/01, 07/02 & 07/04								
Female:	Number in Sample:	25	13	2	0	0	0	40
	Estimated % of Escapement	29.4	15.3	2.4	0.0	0.0	0.0	47.1
	Estimated Escapement:	5,745	2,987	460	0	0	0	9,192
	Standard Error:	969.0	765.4	322.3	0.0	0.0	0.0	
Male:	Number in Sample:	31	11	2	1	0	0	45
	Estimated % of Escapement	36.5	12.9	2.4	1.2	0.0	0.0	52.9
	Estimated Escapement:	7,124	2,528	460	230	0	0	10,341
	Standard Error:	1,023.6	713.8	322.3	229.3	0.0	0.0	
Total:	Number in Sample:	56	24	4	1	0	0	85
	Estimated % of Escapement	65.9	28.2	4.7	1.2	0.0	0.0	100.0
	Estimated Escapement:	12,869	5,515	919	230	0	0	19,533
	Standard Error:	1,008.2	957.3	450.3	229.3	0.0	0.0	
Stratum 6: 07/05 - 07/11								
Sampling Dates: 07/08, 07/09 & 07/11								
Female:	Number in Sample:	31	6	3	0	0	0	40
	Estimated % of Escapement	34.8	6.7	3.4	0.0	0.0	0.0	44.9
	Estimated Escapement:	5,108	989	494	0	0	0	6,591
	Standard Error:	742.5	390.8	281.3	0.0	0.0	0.0	
Male:	Number in Sample:	34	10	5	0	0	0	49
	Estimated % of Escapement	38.2	11.2	5.6	0.0	0.0	0.0	55.1
	Estimated Escapement:	5,602	1,648	824	0	0	0	8,073
	Standard Error:	757.2	492.2	358.9	0.0	0.0	0.0	
Total:	Number in Sample:	65	16	8	0	0	0	89
	Estimated % of Escapement	73.0	18.0	9.0	0.0	0.0	0.0	100.0
	Estimated Escapement:	10,710	2,636	1,318	0	0	0	14,664
	Standard Error:	691.6	598.4	445.7	0.0	0.0	0.0	

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APPENDIX 7.—(Page 3 of 3)

		Brood Year and Age Class						
		1998	1997		1996			
		1.2	1.3	2.2	1.4	2.3	3.2	Total
Stratum 7: 07/12 - 07/18								
Sampling Dates: 07/15, 07/16 & 07/17								
Female:	Number in Sample:	30	7	3	0	0	0	40
	Estimated % of Escapement	31.6	7.4	3.2	0.0	0.0	0.0	42.1
	Estimated Escapement:	2,571	600	257	0	0	0	3,428
	Standard Error:	388.0	218.1	146.0	0.0	0.0	0.0	
Male:	Number in Sample:	38	12	3	2	0	0	55
	Estimated % of Escapement	40.0	12.6	3.2	2.1	0.0	0.0	57.9
	Estimated Escapement:	3,256	1,028	257	171	0	0	4,713
	Standard Error:	409.0	277.3	146.0	119.8	0.0	0.0	
Total:	Number in Sample:	68	19	6	2	0	0	95
	Estimated % of Escapement	71.6	20.0	6.3	2.1	0.0	0.0	100.0
	Estimated Escapement:	5,827	1,628	514	171	0	0	8,141
	Standard Error:	376.5	333.9	203.1	119.8	0.0	0.0	
Stratum 8: 07/19 - 07/25								
Sampling Dates: 07/23 & 07/24								
Female:	Number in Sample:	22	5	0	0	0	0	27
	Estimated % of Escapement	29.7	6.8	0.0	0.0	0.0	0.0	36.5
	Estimated Escapement:	3,222	732	0	0	0	0	3,955
	Standard Error:	577.9	317.3	0.0	0.0	0.0	0.0	
Male:	Number in Sample:	29	13	4	0	1	0	47
	Estimated % of Escapement	39.2	17.6	5.4	0.0	1.4	0.0	63.5
	Estimated Escapement:	4,248	1,904	586	0	146	0	6,884
	Standard Error:	617.2	481.1	285.9	0.0	146.0	0.0	
Total:	Number in Sample:	51	18	4	0	1	0	74
	Estimated % of Escapement	68.9	24.3	5.4	0.0	1.4	0.0	100.0
	Estimated Escapement:	7,470	2,637	586	0	146	0	10,839
	Standard Error:	585.1	542.4	285.9	0.0	146.0	0.0	
Stratum 9: 07/26 - 08/01								
No Samples Collected								
Strata 1 - 9: 05/31 - 08/01								
Sampling Dates: 06/04 - 07/24								
Female:	Number in Sample:	160	92	14	0	3	0	269
	% Females in Age Group:	60.0	34.4	5.1	0.0	0.5	0.0	100.0
	Estimated % of Escapement	25.9	14.8	2.2	0.0	0.2	0.0	43.2
	Estimated Escapement:	24,982	14,318	2,133	0	217	0	41,650
	Standard Error:	1,808.7	1,487.8	611.5	0.0	152.0	0.0	
	Estimated Design Effects:	1.203	1.236	1.221	0.000	0.731	0.000	1.204
Male:	Number in Sample:	209	135	26	9	2	4	385
	% Males in Age Group:	60.2	29.7	7.0	2.0	0.3	0.7	100.0
	Estimated % of Escapement	34.2	16.9	4.0	1.1	0.2	0.4	56.8
	Estimated Escapement:	32,974	16,296	3,844	1,089	183	411	54,797
	Standard Error:	1,962.2	1,461.3	790.9	416.9	150.3	218.5	
	Estimated Design Effects:	1.208	1.074	1.154	1.099	0.845	0.797	1.204
Total:	Number in Sample:	369	227	40	9	5	4	654
	Estimated % of Escapement	60.1	31.7	6.2	1.1	0.4	0.4	100.0
	Estimated Escapement:	57,957	30,614	5,977	1,089	399	411	96,447 [a]
	Standard Error:	1,967.1	1,873.8	985.2	416.9	213.6	218.5	
	Estimated Design Effects:	1.139	1.144	1.179	1.099	0.784	0.797	

[a] 1,333 fish that were counted through the weir during stratum 9 are not included in this total.

APPENDIX 8.—Length (mm) at age for sockeye salmon at McLees Lake weir, 2002.

		Brood Year and Age Class					
		1998	1997		1996		
		1.2	1.3	2.2	1.4	2.3	3.2
Stratum 1: 05/31-06/06							
Sampling Dates: 06/04 & 06/06							
Female:	Mean Length	515	553	515		568	
	Std. Error	3.0	5.6	---		17.5	
	Range	500-525	515-600	---		550-585	
	Sample Size	11	13	1	0	2	0
Male:	Mean Length	531	581	568	608	545	520
	Std. Error	8.7	3.9	7.5	2.5	---	---
	Range	495-590	520-620	560-575	605-610	---	---
	Sample Size	9	38	2	2	1	1
Stratum 2: 06/07-06/13							
Sampling Dates: 06/10 & 06/12							
Female:	Mean Length	496	556	515			
	Std. Error	11.0	5.4	---			
	Range	475-555	520-580	---			
	Sample Size	7	11	1	0	0	0
Male:	Mean Length	522	585	512	608		520
	Std. Error	6.3	3.4	13.0	7.5		20.0
	Range	500-560	555-615	490-535	600-615		500-540
	Sample Size	10	21	3	2	0	2
Stratum 3: 06/14-06/20							
Sampling Dates: 06/15, 06/18 & 06/20							
Female:	Mean Length	485	552	510		510	
	Std. Error	5.8	5.9	5.0		---	
	Range	430-500	490-590	505-515		---	
	Sample Size	11	17	2	0	1	0
Male:	Mean Length	518	572	523	610		495
	Std. Error	3.2	7.4	6.0	---		---
	Range	475-550	460-610	510-535	---		---
	Sample Size	28	19	4	1	0	1

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APPENDIX 8.—(Page 2 of 3)

		Brood Year and Age Class					
		1998	1997		1996		
		1.2	1.3	2.2	1.4	2.3	3.2
Stratum 4: 06/21-06/27 Sampling Dates: 06/24, 06/25 & 06/27							
Female:	Mean Length	498	549	485			
	Std. Error	4.8	4.9	5.0			
	Range	465-550	490-595	480-490			
	Sample Size	23	20	2	0	0	0
Male:	Mean Length	518	580	520	635		
	Std. Error	4.6	7.9	17.6	---		
	Range	475-560	520-615	500-555	---		
	Sample Size	30	11	3	1	0	0
Stratum 5: 06/28-07/04 Sampling Dates: 07/01, 07/02 & 07/04							
Female:	Mean Length	498	550	505			
	Std. Error	4.9	6.7	10.0			
	Range	450-550	490-575	495-515			
	Sample Size	25	13	2	0	0	0
Male:	Mean Length	520	585	523	605		
	Std. Error	2.8	5.6	17.5	---		
	Range	490-550	545-610	505-540	---		
	Sample Size	31	11	2	1	0	0
Stratum 6: 07/05-07/11 Sampling Dates: 07/08, 07/09 & 07/11							
Female:	Mean Length	500	538	492			
	Std. Error	2.4	22.2	6.0			
	Range	475-525	435-585	480-500			
	Sample Size	31	6	3	0	0	0
Male:	Mean Length	523	579	526			
	Std. Error	2.9	5.5	7.3			
	Range	480-550	550-600	505-550			
	Sample Size	34	10	5	0	0	0

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APPENDIX 8.—(Page 3 of 3)

		Brood Year and Age Class					
		1998	1997		1996		
		1.2	1.3	2.2	1.4	2.3	3.2
Stratum 7: 07/12-07/18 Sampling Dates: 07/15, 07/16 & 07/17							
Female:	Mean Length	501	552	498			
	Std. Error	2.4	6.8	6.0			
	Range	475-525	530-585	490-510			
	Sample Size	30	7	3	0	0	0
Male:	Mean Length	522	590	517	600		
	Std. Error	2.9	5.5	21.9	20.0		
	Range	490-560	555-610	490-560	580-620	0	0
	Sample Size	38	12	3	2		
Stratum 8: 07/19-07/25 Sampling Dates: 07/23 & 07/24							
Female:	Mean Length	501	545				
	Std. Error	5.2	12.0				
	Range	430-535	500-570				
	Sample Size	22	5	0	0	0	0
Male:	Mean Length	540	552	528		590	
	Std. Error	5.8	7.9	3.2		---	
	Range	500-615	520-610	520-535		---	
	Sample Size	29	13	4	0	1	0
Stratum 9: 07/26-08/01 No Samples Collected							
All Strata							
Female:	Mean Length	499	551	500		548	
	Std. Error	1.6	2.6	3.4		21.7	
	Range	430-555	435-600	480-515		510-585	
	Sample Size	160	92	14	0	3	0
Male:	Mean Length	524	578	525	609	568	514
	Std. Error	1.5	2.2	4.4	5.0	22.5	10.3
	Range	475-615	460-620	490-575	580-635	545-590	495-540
	Sample Size	209	135	26	9	2	4
All Fish:	Mean Length	513	567	516	609	556	514
	Std. Error	1.3	1.9	3.6	5.0	14.6	10.3
	Range	430-615	435-620	480-575	580-635	510-590	495-540
	Sample Size	369	227	40	9	5	4