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Abundance and Run Timing of Adult Salmon in Long Lake in the
Wrangell-St. Elias National Park and Preserve, 2012

2012 Annual Report 10-505

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ABSTRACT

The outlet creek of Long Lake flows into the Lakina River, a tributary of the Chitina River in the Copper River drainage. This system provides spawning habitat for sockeye salmon *Oncorhynchus nerka*, which contribute to down-river commercial, personal use, and subsistence fisheries. The monitoring and evaluation of this run is essential to ensure that Wrangell-St. Elias National Park and Preserve (WRST) maintains healthy populations of fish as required by the Alaska National Interest Lands Conservation Act (ANILCA). The Long Lake weir is one of two projects providing accurate assessment of sockeye salmon yearly run strength and migratory timing in tributaries to the Copper River. In 2012 the weir used an underwater camera, DVR recording system, and solar panel array to enumerate salmon at this weir. A total of 25,736 sockeye salmon migrated through the weir between August 2 and September 25 and represented approximately 2.0% of the total inriver run estimated by the Miles Lake sonar project. In 2012 age, sex and length samples were collected from 1% of the escapement. Otolith samples were collected from 323 carcasses: females comprised 66% of the sample, age-1.2 comprised 72% of the return, and age-1.3 comprised 25% of the return.

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INTRODUCTION

The upper Copper River drainage, where Long Lake is located, provides spawning habitat for sockeye *Oncorhynchus nerka*, coho *O. kisutch*, and Chinook *O. tshawytscha* salmon (Figure 1). Significant numbers of adult salmon are harvested in commercial drift gillnet operations near the mouth of the Copper River from mid-May to September. From 2000-2009 the average annual commercial harvest of Copper River sockeye salmon is 1,163,610; of Chinook salmon is 32,032; and of coho salmon is 9,356 (Sheridan et al. 2012). From 2000-2009 the upriver and delta sport fisheries have a combined average annual harvest of 12,175 sockeye and 4,230 Chinook. From 2000-2009 the annual average personal use fishery harvests 93,858 sockeye and 1,943 Chinook (Sheridan et al. 2012). Salmon escapement into the upper Copper River system provides for both federal and state subsistence fishing from May through September each year: the ten-year average subsistence harvest (combined state and federal, upriver and marine/delta) of sockeye is 69,475 and of Chinook is 4,042 (Sheridan et al. 2012). The monitoring and evaluation of these runs is essential to ensure that Wrangell - St. Elias National Park and Preserve (WRST) maintains healthy populations of fish as required by the Alaska National Interest Lands Conservation Act (ANILCA).

Accurate assessment of yearly run strength and migratory timing in tributaries to the Copper River is essential to the development of a management strategy that meets the mandates of ANILCA. The upper Copper River sockeye salmon populations are of particular importance to both federally qualified and state subsistence users (Sheridan et al. 2012). The primary assessment of inriver abundance for Copper River sockeye salmon occurs at the Miles Lake sonar site (Sheridan et al. 2012). However, migratory timing of sockeye salmon into the Copper River is prolonged (May-September) and subsequent assessment of escapement into some tributaries is needed to determine spawning distribution. The sonar equipment at the Miles Lake site is typically shut down around August 1st each year, after the majority of the sockeye salmon have migrated through. A portion of the Long Lake sockeye salmon run is believed to enter the Copper River after the sonar has been pulled from the Miles Lake site since sockeye typically take 2-3 weeks to swim to Chitina from Miles Lake, approximately 100 miles (Somerville 2013). The Long Lake weir is approximately 65 miles up the Chitina River from Chitina.

Thirty-nine years of weir data show annual variations in abundance of Long Lake runs ranging from 636 to 49,747 sockeye salmon (Table 1). This is the longest running data set of salmon weir counts in the Copper River drainage (Roberson 2002). The sockeye salmon stock that spawns within Long Lake is the largest known salmon stock within the Chitina River drainage (Taube 2003). The magnitude of escapement, and its contribution to the total inriver return of the Copper River, is widely variable (Table 1). The largest measured escapement of 50,000 sockeye salmon into Long Lake occurred in 2002, and comprised 6% of the estimated total inriver return. Since 1981, escapements into Long Lake have comprised no more than 6% of the total inriver return.

Background

The Long Lake population has the longest known annual spawning duration (August through April) of any sockeye salmon population in North America (Roberson 2002).

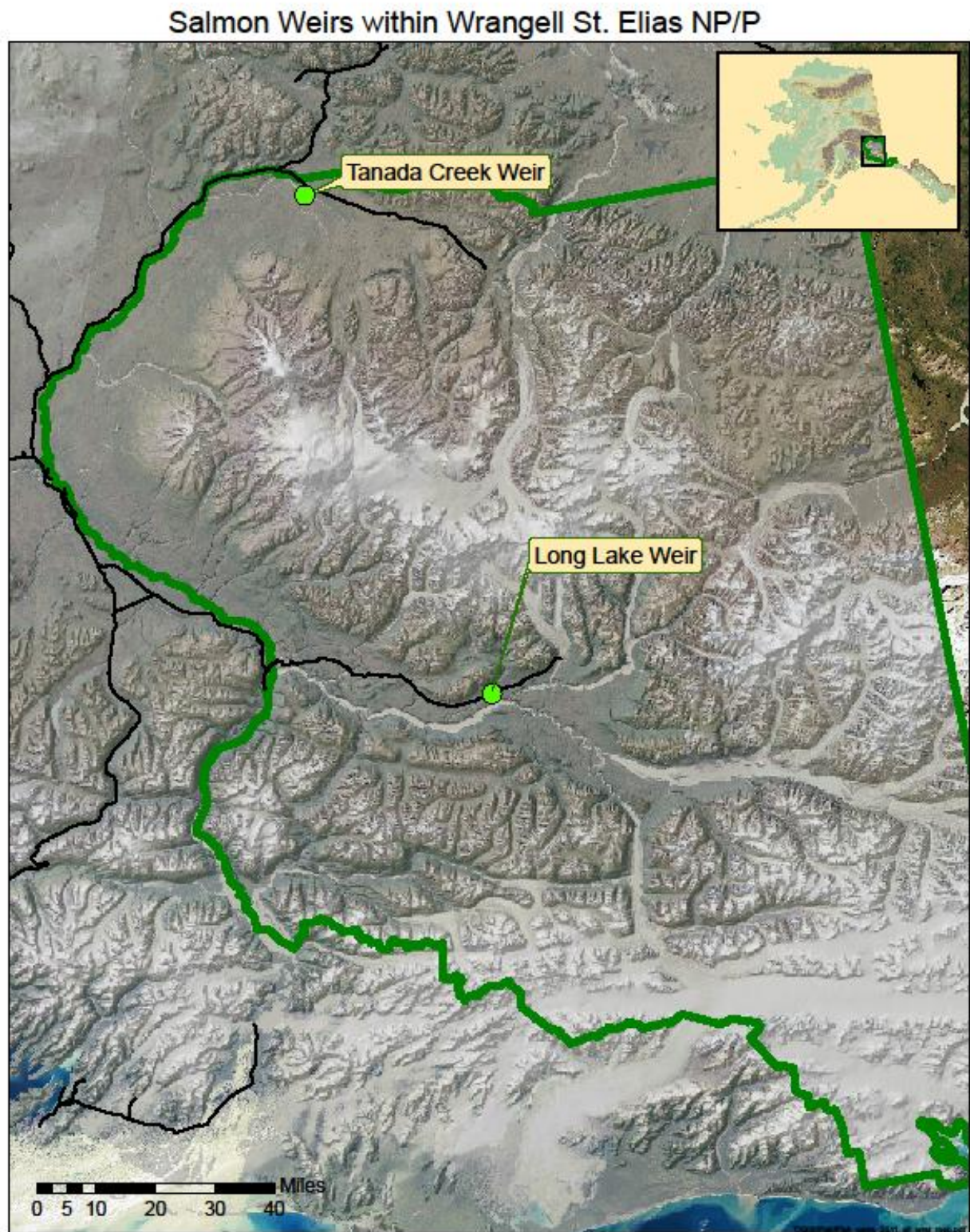


Figure 1. Escapement Projects in Wrangell-St. Elias National Park and Preserve.

The Alaska Department of Fish and Game (ADF&G) initially operated the Long Lake weir in 1974 and 1975. From 1976 through 2003 the weir was operated by a local private citizen who owned the land where the weir is located. In 2003 a cooperative agreement was formed between the Collins' Family Trust, Wrangell-St. Elias National Park/Preserve and the Copper River Watershed Project to keep the weir operating. Since 2010 the Long Lake weir has been operated by WRST with assistance from the Collins family. Funding for the weir operation and annual reporting has been provided by the U.S. Fish and Wildlife Service, Office of Subsistence Management through the Fisheries Resource Monitoring Program from 2004 to the present.

The physical structure of the weir has changed little since 1974. Starting in 2003 the weir operators began sampling sockeye salmon for age, sex, and length composition according to sampling protocols established by ADF&G (ADF&G Commercial Fisheries Division, Cordova, written communication). A small sampling box was constructed on the upstream side of the middle of the weir in 2003. In 2004 a larger sampling box was constructed against the west bank of the creek on the upstream side of the weir and has been used since. In 2010 an underwater camera and DVR recording system were installed at the weir and a video viewing and monitoring station was set up on the west bank. We continued to use this system in 2012.

OBJECTIVES

- 1) To enumerate adult sockeye salmon migrating past a weir from late July until mid-October by using video equipment to count all individuals entering Long Lake.
- 2) To estimate the age, sex, length composition of the sockeye salmon escapement from scale and otolith interpretation, such that the estimates are within 5% of the true proportion 90% of the time.

Table 1. Escapement of sockeye salmon at Long Lake weir and Miles Lake Sonar (Sheridan et al. 2013) from 1974-2012. The percent of Long Lake sockeye salmon (Sheridan et al. 2013).

Year	Miles Lake Sonar	Long Lake Weir	Long Lake Percentage of Miles Lake Sonar
1974		4,684	
1975		6,768	
1976		24,689	
1977		8,624	
1978		15,458	
1979	237,173	46,110	19.4%
1980	276,538	39,038	14.1%
1981	535,263	12,659	2.4%
1982	467,306	28,047	6.0%
1983	545,724	28,133	5.2%
1984	536,806	10,637	2.0%
1985	436,313	21,131	4.8%
1986	509,275	16,997	3.3%
1987	483,478	13,633	2.8%
1988	488,398	7,543	1.5%
1989	607,797	14,981	2.5%
1990	581,895	21,664	3.7%
1991	579,435	11,511	2.0%
1992	601,952	10,091	1.7%
1993	797,902	16,101	2.0%
1994	715,181	18,289	2.6%
1995	599,265	17,923	3.0%
1996	906,867	6,309	0.7%
1997	1,148,079	4,443	0.4%
1998	866,957	8,441	1.0%
1999	848,921	12,922	1.5%
2000	587,592	8,645	1.5%
2001	833,569	26,999	3.2%
2002	819,000	49,747	6.1%
2003	695,233	4,604	0.7%
2004	669,646	19,215	2.9%
2005	854,268	7,770	0.9%
2006	959,731	9,239	1.0%
2007	926,438	7,846	0.8%
2008	614,999	631	0.1%
2009	709,330	4,555	0.6%

Table 1. Continued

Year	Miles Lake Sonar	Long Lake Weir	Long Lake Percentage of Miles Lake Sonar
2010	924,010	10,876	1.2%
2011	914,285	12,885	1.4%
2012	1,271,354	25,736	2.0%
Average 1979- 1992	491,954	20,155	5.10%
Average 1993-2002	812,333	16,982	2.19%
Average 2003 - 2012	853,929	10,336	1.16%

METHODS

Site Description

Long Lake is located in the upper Copper River drainage adjacent to the McCarthy Road and is 0.5 km wide and 8.5 km long (Figure 1). It is 480 m above sea level, at latitude 61° 23' 1.68" N and longitude 143° 17' 15.89" W. The outlet stream runs 2.1 kilometers through nearly level terrain to the Lakina River, a tributary of the Chitina River that flows into the Copper River. Willows, alders, mosses, and sedges dominate the vegetation. Forested areas consist mainly of white spruce interspersed with stands of paper birch and quaking aspen. The soils are poorly drained. Average annual precipitation is 40.11 cm, and average annual temperature is 22° F (-5.6° C) with average highs and lows of 13.4° F (-10.4°C) and -27.06°F (-32.8°C) (USDA 1979).

Weir Operation

The project uses a rigid picket weir that is installed near the outlet of the lake, to enumerate salmon migrating into Long Lake. The site is extremely conducive to the operation of a rigid picket weir. Flows fluctuate only slightly, water velocity is always low, and the stream is shallow and easily waded. A walkway is placed across the stream immediately upstream of the weir providing access to the fish passage chute which is controlled by removing one or two pickets from the weir. Weir pickets are spaced 3.75 cm apart (Appendix A).

We incorporated a major change in the escapement estimation methodology in 2010 by installing an underwater video camera recording system (Appendices B and C). The system was designed from insight gained through the use of similar technology at the Tanada Creek weir (Sarafin 2010). The underwater camera was installed directly onto a fish passage chute which was connected to the upstream side of the weir (Appendix B). This allows fish to pass through the weir at all times except when the weir gate is closed, typically during the review of recorded video footage. When fish are passing through the weir, the fish chute forces them to swim within a few inches of the glass surface of the camera housing. Footage is then recorded on a digital video recorder (DVR). A 12 volt, underwater LED light was installed in the fish chute to illuminate the view area. A photocell switch automatically turns the light on and off in response

to changes in the level of ambient light. A 12 volt deep cycle battery bank (400 Amp-hours total capacity) provides power to the system. The charge is maintained in the battery bank from a photovoltaic solar panel array (360 Watts total rating) and a MPPT charge controller (Appendix C). Daily weir checks were performed throughout the season. All observed salmon passage was recorded in 1 hour increments on a daily data form.

Water level was monitored throughout the summer, from August 3 to September 25. A staff gauge, measuring in 10ths of feet and installed on the weir structure, was used to measure water level (by observation) each day (Appendix A). Water temperature was also monitored from August 3 through September 25.

Bears are frequently a problem at the weir and further downstream in the creek. An electric fence was installed around the weir, viewing station, and sampling box for the entire 2012 field season to prevent bears from damaging the weir and equipment (Appendix A).

Biological Data

Fish migrating through the weir were counted and identified to species. Both sockeye and coho salmon pass through this weir. From past observation, sockeye migrate earlier and coho migrate later throughout the season with overlapping migration in late September and early October.

From past work with this population, we anticipated the presence of 4 age classes (by total age). Sample size goals to meet the precision and accuracy stated in the objectives were derived from the multinomial sampling model of Bromaghin (1993).

To obtain age, sex, and length data, samples were collected from sockeye salmon carcasses throughout the fall and winter months from the main spawning grounds on the northern end of Long Lake which remains ice free throughout the year (Appendix E). Each sockeye salmon carcass that was sampled for otoliths was measured to the nearest millimeter from mid-eye to fork length (MEF) if enough of the carcass was available for measurement. The sex of each carcass was determined visually: sockeye salmon show a marked sexual dimorphism the nearer they get to spawning. Male sockeye bodies form a hump on their back and their snouts elongate and develop large, prominent teeth (Groot and Margolis, 1991). Two otoliths were collected from each carcass (Appendix D). Otoliths were later analyzed for freshwater and marine age by ADF&G Commercial Fisheries Division staff based in Cordova.



Figure 2. Weir damage from heavy leaf load, 2012.

RESULTS

Weir Operation

The weir was operational from August 2 through September 25. Strong winds in late September caused a heavy leaf load to damage the weir (Figure 2). In 2012 daily staff gauge readings between August 3 and September 25 varied between 1.66 feet and 1.90 feet, showing a maximum variation of 0.24 feet and appeared to be average (Figure 3). In 2012, between August 3 and September 25 daily water temperature data ranged from a high of 62° F to a low of 46° F (Figure 4).

Biological Data

In 2012, 25,736 sockeye salmon were counted through the Long Lake weir (Table 1, Figure 5, and Appendix F). The first sockeye salmon was recorded passing through the weir on August 2, the day that the video system was operational. The first day counts of August 2 likely consisted of fish that would have normally passed through on August 1, had they not been spooked downstream during the weir installation activity. Local residents reported seeing sockeye migrating into the lake about a week earlier. The median run day, when half of the sockeye had passed through the weir, occurred on August 17 with a cumulative count of 12,868 sockeye salmon (Table 3). Between August 14 and October 20, a total of 99 coho salmon were also enumerated (Appendix F).

A total of 323 sockeye salmon were sampled for sex, length, and age. This number was not sufficient to achieve the stated objective (within 5% of true proportion 90% of the time); however, our obtained sample size exceeds the number required for our estimate to be within 7.5% of the true proportion 90% of the time.

Sockeye returns to Long Lake during the 39 year period of weir operations have been highly variable, ranging from a high of 49,747 in 2002 to a low of 631 in 2008 (Table 1, Figure 6). The 39 year average migration through the weir is 15,784 sockeye salmon: in 2012 the escapement of sockeye into the Long Lake system was 163 percent of the average (Table 1). In 2012 the total inriver run estimated by the Miles Lake sonar was 1,271,354 sockeye salmon and the Long Lake sockeye count represented approximately 2.0% of it (Table 1). During 1978-2012 Long Lake escapement counts represented an average of 3.4% of the total inriver run, but ranged from 0.4% to 19.4% of the total inriver run (Table 1).

Long Lake escapements for sockeye salmon appear to have a decreasing trend in abundance for the 35 year time period 1978-2012 (Figure 6). Conversely, Miles Lake estimates showed an increasing abundance trend ($R^2=0.6317$).

In 2012 age-1.2 comprised 72% of the sockeye sampled and age-1.3 comprised 25%. Sixty-six percent were female and 34% were male (Table 2). In the past eleven years the majority of sampled sockeye were age-1.3. The exceptions were in 2010 and 2012 when the majority was age-1.2

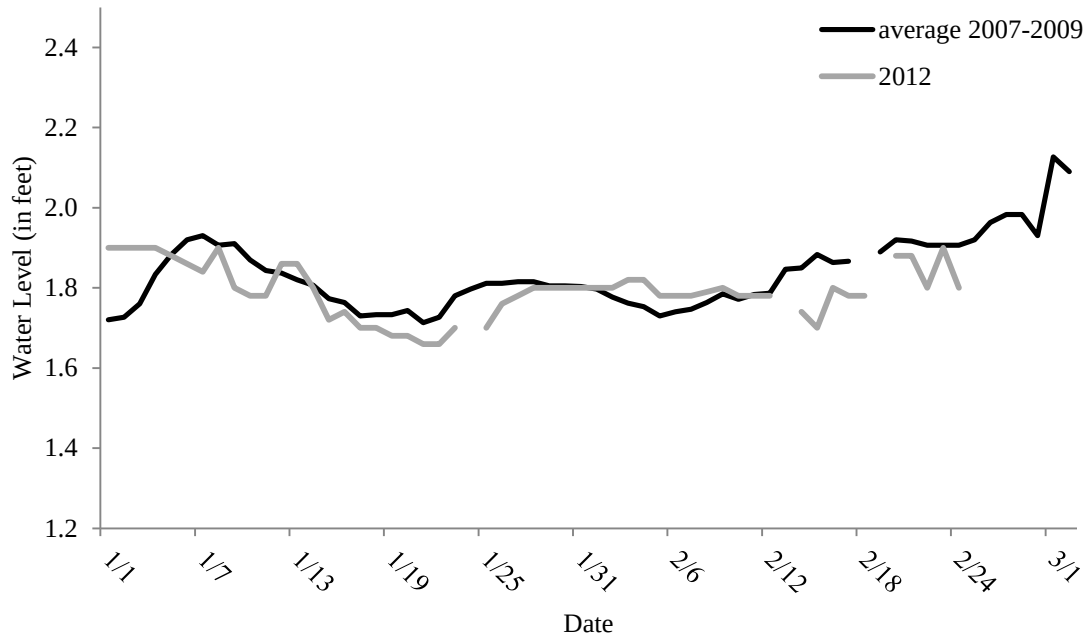


Figure 3. Water level at the Long Lake weir was monitored daily by a staff gauge that was installed on the weir. Daily readings were made by staff and recorded in 10ths of feet. The daily average water level from 2004 through 2011 (solid black line) and the daily water level from 2012 are shown.

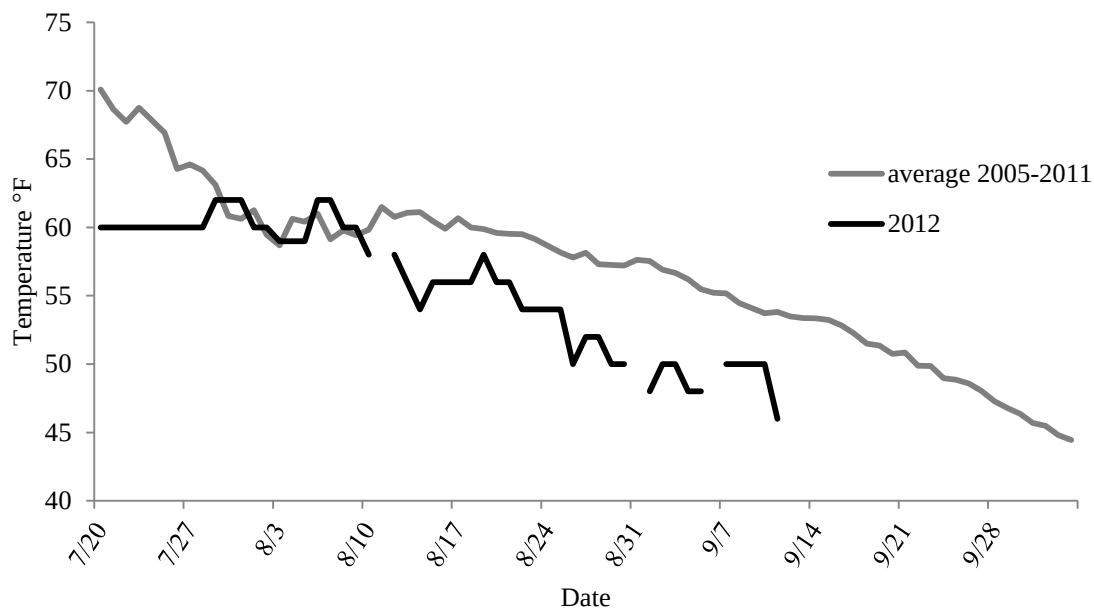


Figure 4. Daily water temperature at Long Lake weir was collected from July 28 to September 10 and recorded in degrees Fahrenheit. The average daily water temperature from 2005-2011 (solid grey line) and the daily water temperature for 2012 (solid black line) are shown.

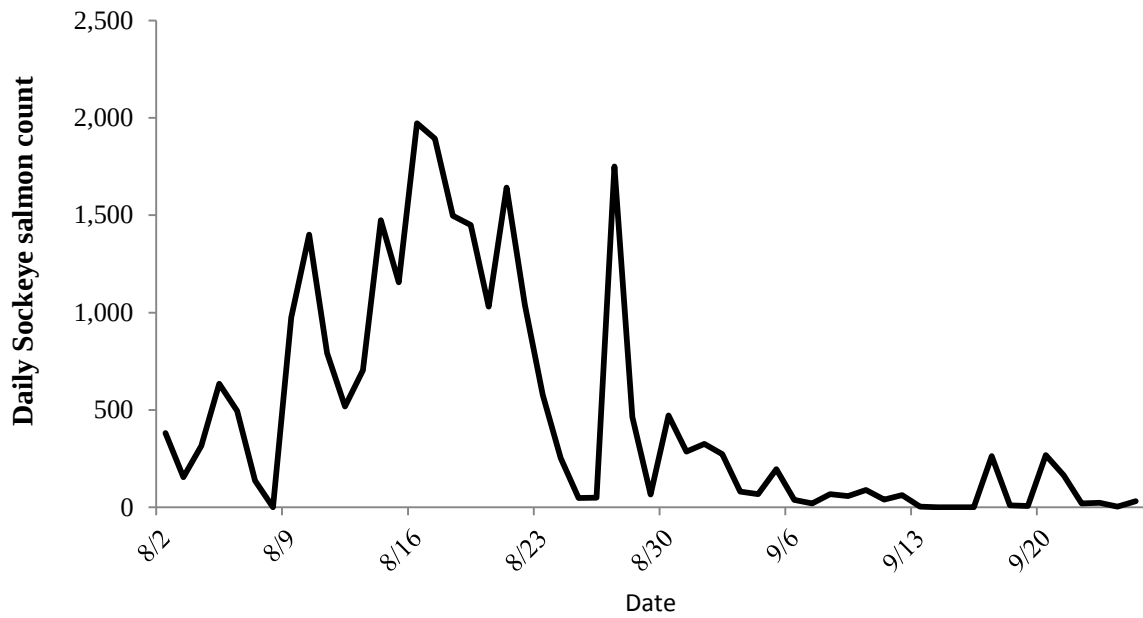


Figure 5. Daily sockeye salmon count, Long Lake weir, 2012.

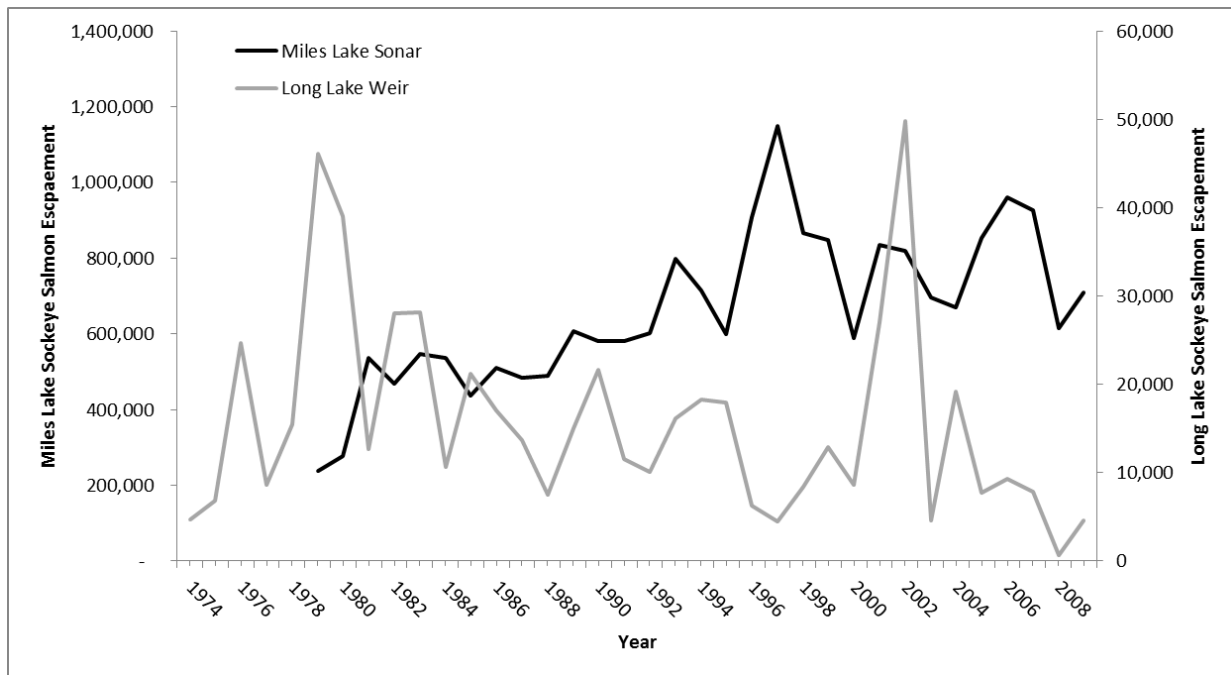


Figure 6. Miles Lake sockeye salmon escapement vs. Long Lake sockeye salmon escapement.

Table 2. The number of Long Lake sockeye salmon spawning by sex and age-class in 2012. A total of 323 sockeye salmon were sampled for sex and age in 2012. The percent of females and males by brood age-class, from the sample, were multiplied by the total fish counted to get an estimate of the total number of fish by brood year and sex.

	2009	2008	2007	2006		Total Fish Counted	Number of fish sampled
	1.1	1.2	1.3	2.2	1.4	2.3	
Females							
Percentage in Sample	0.30%	52.30%	12.10%	0.60%	0%	0.30%	
							16,883
Number in Population	77	13,460	3,114	154	0	77	212
Males							
Percentage in Sample	0%	19.80%	12.40%	0.60%	0.30%	1.20%	
							8,827
Percentage in Population	0	5,096	3,191	154	77	309	111
Total							
Percentage in Sample	0.30%	72.10%	24.50%	1.20%	0.30%	1.50%	
Percentage in Population	77	18,556	6,305	309	77	386	25,736
Standard Error	80	643	616	159	80	177	323

Run Timing

The first sockeye were observed downstream of the weir the day the weir structure was installed, August 1. The weir gate was closed on August 1 and remained closed until the video system was operational on August 2: salmon were first recorded passing through the weir on August 2 (Table 3). The median run date in 2012 was on August 17, which was the same day for the median run timing as 2011 (Table 3). The 2011 and 2012 median run date occurred earlier than the previous seven years (Table 3 and Figure 7). The last sockeye salmon was counted passing through the weir on September 25 (Table 3).

Table 3. Run timing information for the sockeye salmon migration through the Long lake weir, 2004-2012.

Year	Date of First Sockeye Salmon	Median Run Date	Cumulative Count on Median Run Date
2004	8-Aug	12-Sep	9,608
2005	11-Aug	12-Sep	3,885
2006	7-Aug	4-Sep	4,620
2007	15-Aug	8-Sep	4,868
2008	6-Aug	20-Aug	329
2009	23-Aug	31-Aug	2,352
2010	11-Aug	29-Aug	6,168
2011	9-Aug	17-Aug	6,514
2012	3-Aug	17-Aug	13,003

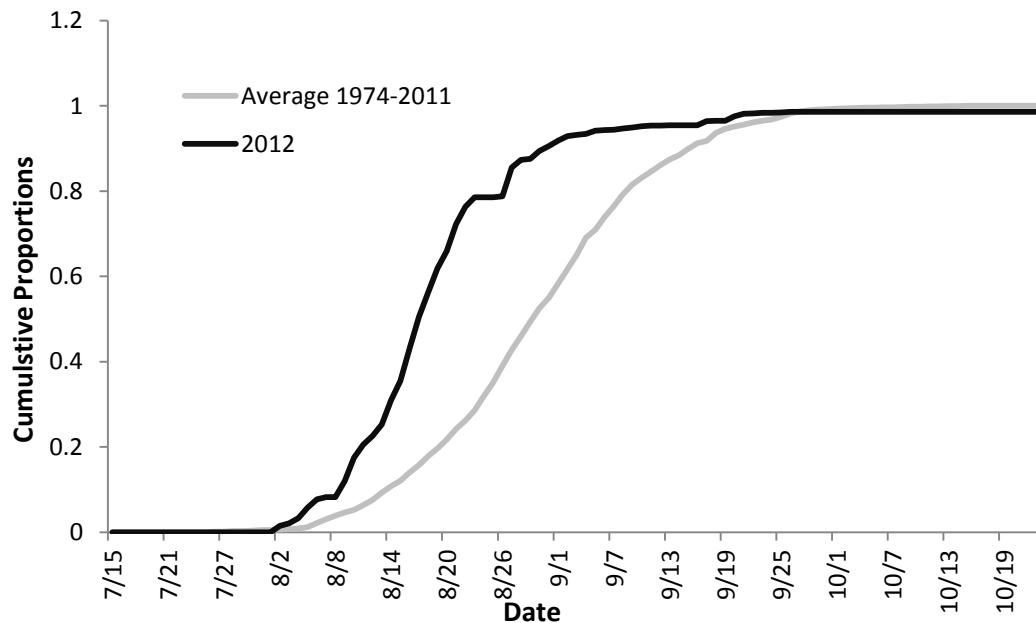


Figure 7. Average sockeye salmon migratory run timing from 1974-2011 (solid gray line) and the 2012 migratory run timing (solid black line) at Long Lake weir.

DISCUSSION

Weir Operation

Prior to 2010 Long Lake weir operations were based on direct visual observations at the weir made one or more times each day. The gate in the weir was only open to allow fish passage when counting was being done. Despite efforts to make counts and pass fish at various times of the day, salmon would not always pass through the weir while someone was on site and had

opened the gate. Inevitably salmon would be observed backed up below the weir and congregated in pools, delayed in their migration due to weir operations. This increases their vulnerability to predation, can cause self-inflicted injuries when salmon repeatedly attempt to pass the weir when the gate is closed, and may also deplete their energy stores. When salmon concentrate behind the weir, the likelihood of human-bear habituation is also increased, particularly as bears begin to associate the weir site with food availability.

In 2010 we installed an underwater video recording system and a fish passage chute that was built into the weir. Video technology provides a means of monitoring without having staff continually on site throughout the field season and allows fish to pass through the weir unhindered except when staff was downloading data, typically 1-3 hours per day. In 2012, because of a staffing issue, the weir was also closed for a four day period from September 13 through September 16.

The basic construction of the weir has changed very little since it was built in 1974 because the rigid picket design works well in this location. At the end of the season the pickets are removed from the weir and stored and then replaced each summer, while the weir's framework is left in place in the creek throughout the winter. The 2012 sampling crew consisted of one local Long Lake resident and 2 seasonal Long Lake residents. There was also help constructing the weir, taking the weir down, and for weir operations from WRST staff. Hiring sampling crew that live near the weir site has made it possible to operate this project efficiently and cost effectively.

Biological Data

Otolith collecting was started in 2007 to supplement the age data collected from scale samples. Scales taken from the sockeye salmon that return to Long Lake are usually difficult to accurately read due to scale reabsorption. Because of this, the ages in previous reports are based on length frequency data derived from mixed stock samples collected in the lower Copper River (ADF&G Commercial Fisheries Division, Cordova, written communication). Ages in this report are based on otolith samples. Since the edges of otoliths do not resorb like scales, otoliths provide a more accurate way to age these salmon (ADF&G Commercial Fisheries Division, Cordova, written communication). But it is more problematic to collect otoliths since they are collected from carcasses of spawned-out sockeye salmon sampled from spawning areas in the lake and upstream of the weir site. Such sampling depends upon the availability of carcasses to the sampling crew. Long Lake sockeye salmon run later in the season and spawning occurs over an extended time period: it has been documented as late as April in some areas of the lake (Ken Roberson, personal communication and personal observation). The primary spawning area in Long Lake does not freeze during the winter months which allows this extended spawning and makes access to the spawned out carcasses feasible (Appendix E).

In 2012 the weir crew collected otolith samples from spawned out sockeye salmon in September and October. Due to the long spawning season, a local Long Lake resident, collected otolith samples from sockeye salmon in Long Lake during the winter months. He obtained carcasses in the open water on the spawning grounds located on the northeast shore of the lake. A total of three 323 otoliths were collected from September 25th through May 1st.

Sockeye salmon returns to Long Lake have been highly variable, ranging from 631 in 2008 to 49,747 in 2002 (Table 1). While the total run of sockeye salmon to the Copper River, estimated at the Miles Lake sonar site, has shown an increasing trend in abundance since 1978, the escapement into Long Lake has generally shown a decreasing trend since 1974 (Figure 6). Long Lake sockeye salmon start coming into the Copper River in early to mid-July. The Miles Lake sonar estimate of salmon stops operations around the end of July and there are no other ways of estimating late-run stock. It is important to continue monitoring spawning components of the total run in addition to the total inriver return. To ensure genetic diversity and the continued health and sustainability of this important fishery resource, it is important to monitor and conserve all segments of the population.

CONCLUSIONS

Weir Operation

The underwater camera and video recording system functioned well and provided an excellent means of enumerating salmon passage through the weir. It also allowed us to reduce the number of crew members and work hours required to maintain the weir and collect information. Likewise, the photovoltaic system demonstrated its capability of providing necessary power for the electronics. There were no major changes at the weir in 2012. The weir structure sustained minor damage in September due to the heavy leaf load in the creek (Figure 2).

Biological Data

Sockeye salmon returns to Long Lake appear to be highly variable, from a high of 49,747 in 2002 to a low of 631 in 2008 (Table 1). The number of fish counted through the weir in 2012 is approximately 163 percent of the 39 year average of 15,784 sockeye. This is the largest number since 2002 and the 7th largest number in the 39 years of data. The majority of post-spawn fish collected as carcasses in Long Lake were predominantly age-1.2.

RECOMMENDATIONS

The final year of funding for the Long Lake weir from the Office of Subsistence Management is 2013. To continue this project we have submitted a proposal for the 2014 Fisheries Monitoring Program call for proposals. If approved for funding the operation of the weir will continue through 2017 and would allow us to:

1. Continue monitoring the sockeye salmon escapement into Long Lake so that an appropriate natural and healthy escapement range can be determined.
2. Continue collecting otoliths as a means to determine accurate age information for Long Lake sockeye salmon
3. Continue to operate the underwater video recording system to estimate escapement.

4. Add additional information on the Long Lake sockeye salmon population, to the 39 year data set. This will allow us to examine the population for trends in long-term migratory timing, population abundance, water temperature, and water depth.

ACKNOWLEDGMENTS

Stefanie Tschappat assumed the majority of the responsibility for operating the weir. She was assisted by Steve and Nancy Robinson. Adam Tschappat collected otoliths throughout the winter months. Steve Moffit and crew at the ADF&G, Commercial Fisheries Division in Cordova, Alaska proposed the sampling regime for the weir, read otolith samples, and provided age and sex summaries. The U.S. Fish and Wildlife Service, Office of Subsistence Management, provided \$10,504 in funding support for 2012 through the Fisheries Resource Monitoring Program, under contract number FIS07-505. Stephen Fried, Karen Hyer, and Kay Larson-Blair, US Fish & Wildlife Service, Office of Subsistence Management staff, provided statistical advice, statistical analysis, and support.

Photographed below is Cliff Collins with his Karelian bear dog. Cliff was the local private citizen who owned the land where the Long Lake weir is located and was very interested in the natural history of the area. In 1976 when ADF&G was no longer able to fund the operation of the weir, he voluntarily took over operation of the weir. He operated the weir continuously from 1976 through 2003. In 2003 when Mr. Collins, at age 93, was no longer able to operate the weir, a cooperative agreement was formed between the Collins' Family Trust, Wrangell-St. Elias National Park/Preserve and the Copper River Watershed Project to keep the weir operating. WRST continues to operate the Long Lake weir with assistance from the Collins family.



LITERATURE CITED

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APPENDICES



Appendix A. Staff gauge, electric bear fence, water surface thermometer at Long Lake weir.



Appendix B. Camera box and fish passage chute.



Appendix C. Work station and photovoltaic array.



Appendix D. Otolith sampling, 2011.



Appendix E. Salmon spawning in Long Lake, April 2004.

Appendix F. Daily and cumulative counts of sockeye and coho salmon, Long Lake weir, 2012

Date	Sockeye Salmon		Coho Salmon	
	Daily Count	Cumulative Count	Daily Count	Cumulative Count
8/2/2011	381	381	0	0
8/3/2011	154	535	0	0
8/4/2011	316	851	0	0
8/5/2011	634	1,485	0	0
8/6/2011	495	1,980	0	0
8/7/2011	137	2,117	0	0
8/8/2011	0	2,117	0	0
8/9/2011	975	3,092	0	0
8/10/2011	1401	4,493	0	0
8/11/2011	792	5,285	0	0
8/12/2011	518	5,803	0	0
8/13/2011	704	6,507	0	0
8/14/2011	1475	7,982	0	0
8/15/2011	1155	9,137	0	0
8/16/2011	1972	11,109	0	0
8/17/2011	1894	13,003	0	0
8/18/2011	1498	14,501	0	0
8/19/2011	1449	15,950	0	0
8/20/2011	1031	16,981	0	0
8/21/2011	1642	18,623	0	0
8/22/2011	1040	19,663	0	0
8/23/2011	577	20,240	0	0
8/24/2011	253	20,493	0	0
8/25/2011	48	20,541	0	0
8/26/2011	49	20,590	0	0
8/27/2011	1751	22,341	0	0
8/28/2011	463	22,804	0	0
8/29/2011	66	22,870	0	0
8/30/2011	472	23,342	0	0
8/31/2011	286	23,628	0	0
9/1/2011	326	23,954	0	0
9/2/2011	273	24,227	0	0
9/3/2011	81	24,308	0	0
9/4/2011	67	24,375	0	0
9/5/2011	196	24,571	0	0

Appendix F. Continued

Date	Sockeye Salmon	Coho Salmon		
	Daily Count	Cumulative Count	Daily Count	Cumulative Count
9/6/2011	38	24,609	0	0
9/7/2011	20	24,629	0	0
9/8/2011	67	24,696	0	0
9/9/2011	57	24,753	0	0
9/10/2011	89	24,842	0	0
9/11/2011	39	24,881	0	0
9/12/2011	63	24,944	0	0
9/13/2011	3	24,947	0	0
9/14/2011	0	24,947	0	0
9/15/2011	0	24,947	0	0
9/16/2011	0	24,947	0	0
9/17/2011	263	25,210	0	0
9/18/2011	10	25,220	0	0
9/19/2011	7	25,227	1	1
9/20/2011	268	25,495	9	10
9/21/2011	164	25,659	12	22
9/22/2011	19	25,678	18	40
9/23/2011	23	25,701	11	51
9/24/2011	3	25,704	43	94
9/25/2011	32	25,736	5	99

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