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Office of Subsistence Management
Fisheries Resource Monitoring Program

Neva Lake Sockeye Salmon Stock Assessment, 2018

Final Report for Study 18-XXX

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(Cover photo: Student Conservation Association Intern Brian Donovan and Hoonah Indian Association employees Michael J. Williams, Gerard White Sr., and Gerard White Jr., L-R, at the newly installed video weir at the outlet of Neva Lake, 22 June 2018.)

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ABSTRACT

In 2018, we estimate that the escapement of adult and jack Sockeye Salmon (*Oncorhynchus nerka*) into Neva Lake was 5,740 fish. The escapement was estimated using counts from a remotely monitored, two weir, four camera, video-weir at the outlet of the lake from 22 June to 9 October. Motion-triggered video clips from each camera were viewed simultaneously so passing fish could be seen from multiple angles and counted as accurately and efficiently as possible. The run timing in 2018 was later than normal, as the first Sockeye Salmon was not counted until 10 July, approximately the normal 15% completion date, and the 90% completion date was 25 September, 12 days later than the previous record. Half of the Sockeye Salmon entered the lake by 9 August and 80% between 14 July and 24 September. Project personnel also counted 414 Coho Salmon, 7 Pink salmon, 4,795 Dolly Varden, and 619 Cutthroat Trout into Neva Lake in 2018.

Key words: Sockeye Salmon, *Oncorhynchus nerka*, Neva Lake, escapement, video weir, remote monitoring, age composition

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INTRODUCTION

The Sockeye Salmon return to Neva Lake (ADF&G, Division of Commercial Fisheries stream No. 114-80-045) has long been an important subsistence fishery for Tlingit families living in Excursion Inlet, Hoonah, and other areas of northern Southeast Alaska (de Laguna 1960; Schroeder and Kookesh 1990; Goldschmidt and Haas 1998; Ratner and Dizard 2005; Langdon 2006; Figure 1).

Little was known about the health of the Neva Sockeye run prior to 2002. From 2002 to 2018, the U.S. Forest Service has funded, through the U.S. Fish and Wildlife Service, Office of Subsistence Management, Fishery Resource Monitoring Program, a project to estimate the escapement and age, sex, and length composition of Sockeye Salmon into Neva Lake. This has been a cooperative project with the Hoonah Indian Association employing the field personnel, the Alaska Department of Fish and Game processing the scale (age), sex, and length data, and the U. S. Forest Service taking the lead in project planning, implementation, analysis, and reporting.

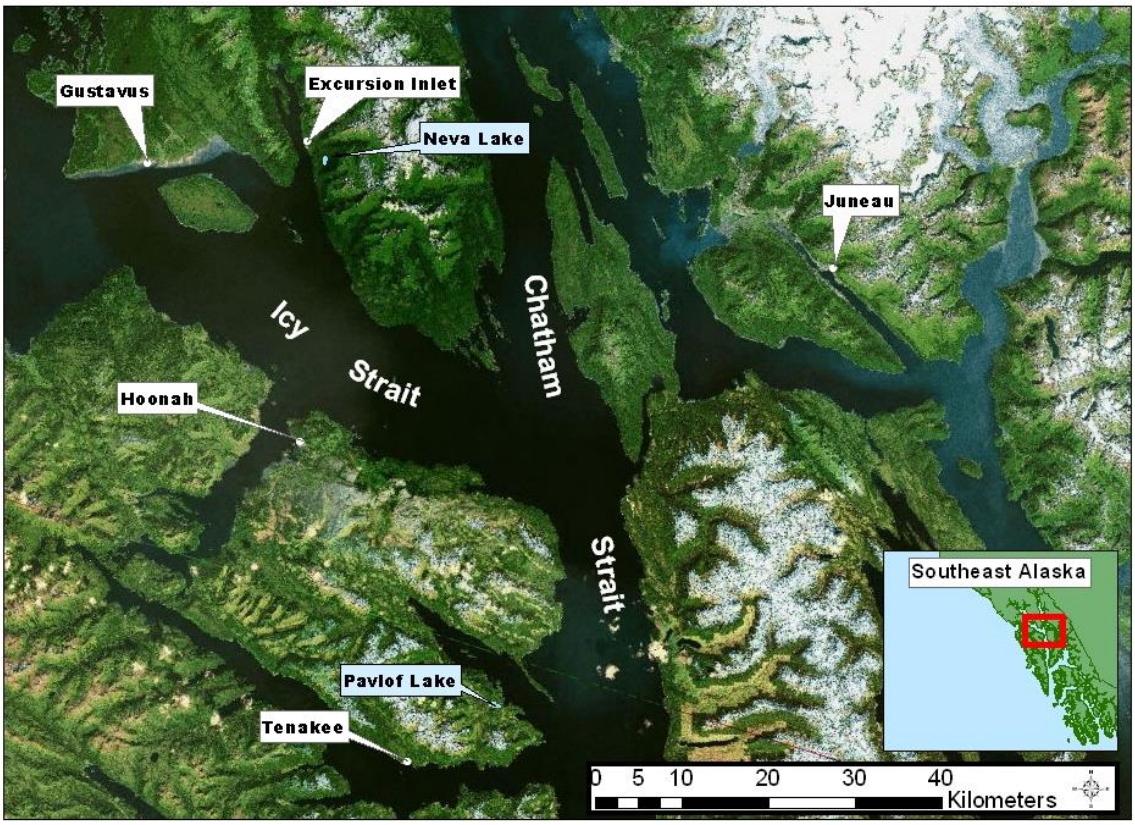


Figure 1. Map of northern southeast Alaska showing Neva Lake and surrounding area.

From 2002 to 2008, the total Sockeye escapement was estimated using weir-to-spawning area mark-recapture studies (Van Alen 2004, 2005, 2008b, and 2009). The weir was a standard channel and picket weir with trap that was set across Neva Creek just below the outlet of Neva Lake. In 2002 to 2005 and 2008, the mark-recapture estimates validated the weir counts that were used to estimate the daily migration of Sockeye Salmon into the lake. In 2008, video technology (see Appendix F in Van Alen 2008a) was used to passively and remotely estimate the proportion of marked (adipose-clipped) fish entering the main inlet stream so these fish did not have to be physically captured and sampled (Van Alen 2009). In 2009, a "video weir" was installed at the outlet of the lake (upstream from the picket weir) and video technology was used to estimate the proportion of marked fish entering the lake and to get a second count of the daily escapement (Van Alen and Mahara 2011b). In 2010 (Van Alen and Mahara 2011b), 2011 (Van Alen and Mahara 2011c), 2012 (Van Alen and Mahara 2012), 2013 (Van Alen, Eide, and Mahara 2013), 2014 (Van Alen and Musslewhite 2014), 2015 (Van Alen and Musslewhite 2015), 2016 (Van Alen and Musslewhite 2016), 2017 (Van Alen and Musslewhite 2017) and 2018 the upstream picket weir was not operated at all. Instead, the fish were counted, and counts were validated, as they swam unimpeded through a double video weir placed at the outlet of the lake. This report summarizes the project results through 2018.

Neva Lake (outlet at 58˚24.332’ N, 135˚24.632’ W; NAD83/WGS84 datum) is located on the mainland on the east side of Excursion Inlet (Figure 1). The lake is about 2 km southeast of the unincorporated community of Excursion Inlet, about 22 km east of Gustavus, and about 40 km across Icy Strait from Hoonah. The lake is at an elevation of 44m, has a surface area of 36.1ha, and has a maximum depth of 19m (Figure 2). The main inlet stream flows into the northeast portion of the lake at 58˚24.352’N, 135˚24.243’W. Neva Creek, the outlet of Neva Lake, flows 1.2 km to South Creek, then 1 km to Excursion Inlet on the south side of the Ocean Beauty Seafoods cannery complex.

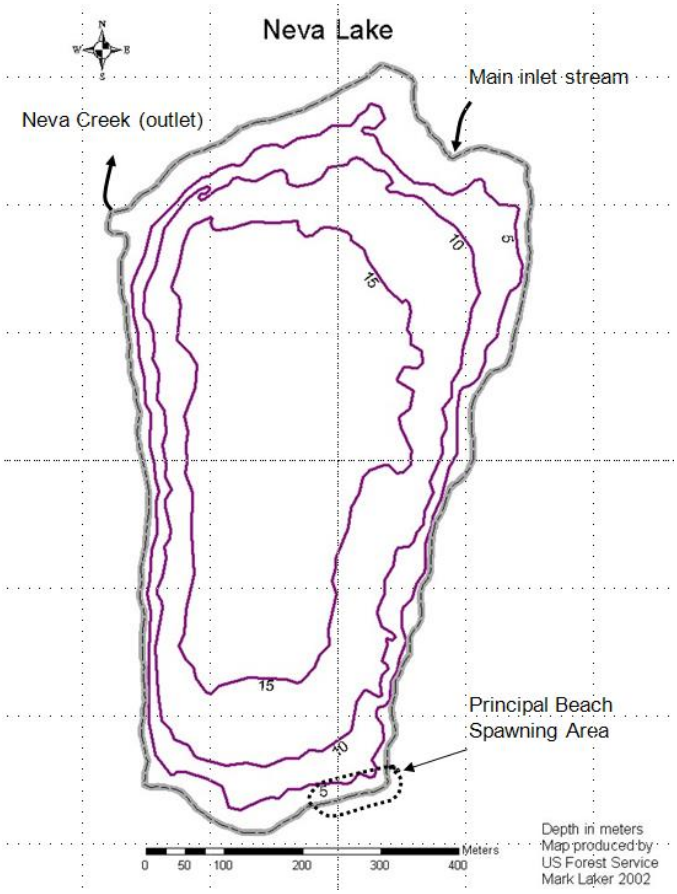


Figure 2. Bathymetric map of Neva Lake showing the outlet stream, the main inlet stream, and the principal beach spawning area.

Any resident of the State of Alaska can subsistence fish in fresh or marine waters for Neva Sockeye Salmon under the authority of a State subsistence/personal use permit. Federal subsistence fishing permits are also available but can only be used by rural residents in the area and only used for fishing in freshwater. The daily and annual harvest limits on the Federal permits is the same as those listed on the State permits. Daily and annual harvest limits were 10 Sockeye Salmon per household prior to 2002, 25 Sockeye Salmon per household in 2003, 40 per household from 2004 through 2015, and back to 10 per household since 2016. In 2004, the State extended the subsistence fishing season from 1 June-31 July to 1 June-15 August. Federal

permits do not list season dates. Both State and Federal subsistence fishing regulations allow take by gill net, seine, dip net, hand lines, and gaffs but the Federal permits also allow the use of rod and reel. Harvest and effort data is available from State permits starting in 1985 and from Federal permits starting in 2002 (Table 1). Project personnel observed more subsistence Sockeye taken in 2002, 2003, and 2005 than that reported on permits (Van Alen 2008a) so actual effort and harvest numbers might be higher (Ratner and Dizard 2005). There was no reported subsistence effort at Neva from 1985 to 1989.

Table 1. Subsistence effort and harvest of salmon at Neva from 1985 to 2016 as reported on State and Federal subsistence fishing permits.

	State Subsistence/Personal Use Permits[a]						Federal Subsistence Permits[b]		
Year	Permits Fished	Chinook	Sockeye	Coho	Pink	Chum	Permits Fished	Sockeye	Coho
1985	0	0	0	0	0	0			
1986	0	0	0	0	0	0			
1987	0	0	0	0	0	0			
1988	0	0	0	0	0	0			
1989	0	0	0	0	0	0			
1990	1	0	25	0	0	0			
1991	2	0	40	0	0	0			
1992	16	0	348	0	0	14			
1993	8	0	127	0	0	201			
1994	5	0	151	0	52	0			
1995	6	0	90	0	247	28			
1996	19	0	411	0	216	872			
1997	9	0	126	5	13	1156			
1998	4	0	25	0	89	50			
1999	5	0	50	0	46	73			
2000	22	0	197	0	23	53			
2001	7	0	157	30	15	23			
2002	6	0	36	0	0	0	0	0	0
2003	6	0	87	12	0	0	0	0	0
2004	23	0	397	0	6	3	0	0	0
2005	14	0	276	0	23	10	1	34	0
2006	11	0	140	0	23	12	0	0	0
2007	11	0	219	31	0	0	2	50	36
2008	26	0	601	113	5	14	0	0	0
2009	39	0	780	34	31	8	0	0	0
2010	26	1	329	29	6	1	1	13	2
2011	31	0	448	110	59	1	1	10	10
2012	38	0	607	42	66	23	1	20	18
2013	39		510				1	21	36
2014	36	0	459	66	4	4	2	6	32
2015	40	0	312	58	195	2	0	0	0
2016	24	0	136	23	0	3	2	8	0
2017	18	0	110	37	40	0	1	0	10

[a]State subsistence data from ADF&G November 2018.

[b]Federal subsistence fishing permits were not issued before 2002.

Until recently, the effort and Sockeye harvest has peaked every four to five years – 1992, 1996, 2000, 2004, 2009, and 2013 (Table 1; Figure 3). Since 2013, both harvest and effort have declined, likely due to harvest restrictions and declining abundance. A Federal regulatory proposal (FP19-19) to restrict the harvest of Sockeye Salmon in the Federal (i.e. freshwater) waters of Neva system to Federally qualified rural residents is currently being considered by the Federal Subsistence Board (OSM 2019).

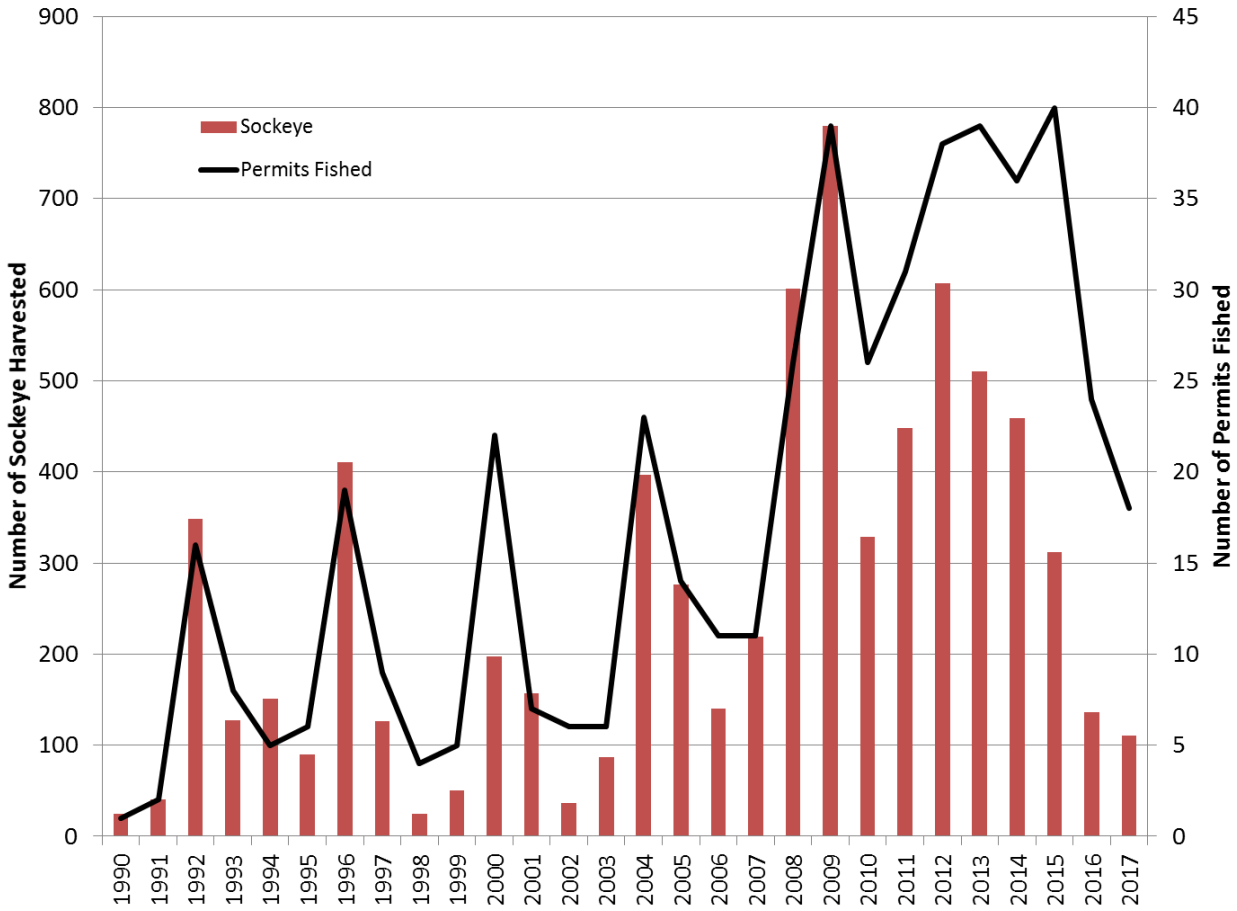


Figure 3. Subsistence effort and harvest of Sockeye Salmon at Neva from 1990 to 2017 as reported on permits returned to ADF&G.

Subsistence fishing in the Neva area is done in both the freshwater and saltwater (Van Alen 2004, 2005, 2008b). Most of the subsistence harvest of Neva Sockeye Salmon is done with seines or gill nets in the intertidal area at the outlet of South Creek from early July to the end of the State season on 15 August. (Figure 4). A pool in the lower part of Neva Creek is a traditional site for taking Sockeye Salmon with a gaff (Langdon 2006).

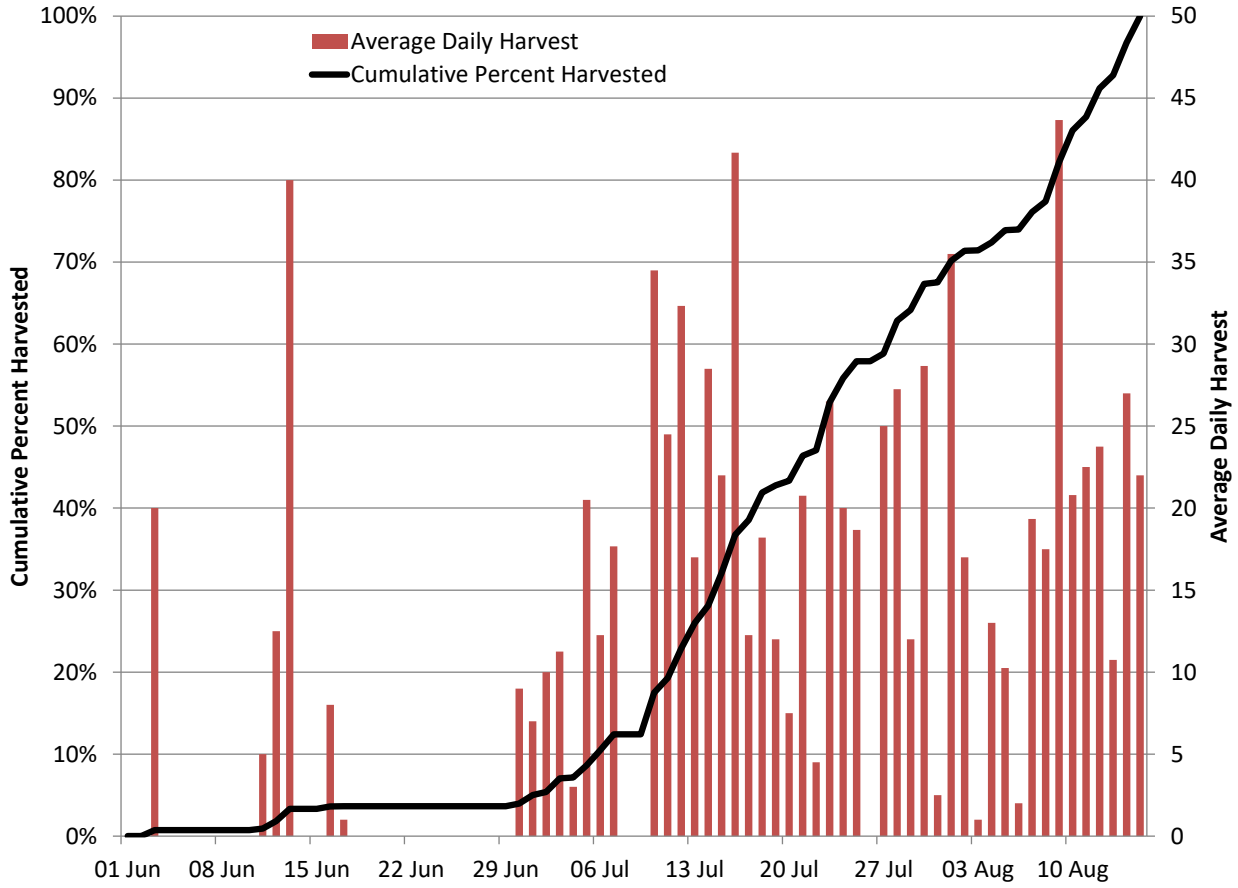


Figure 4. Cumulative percent harvest, and average daily harvest, of Sockeye Salmon reported on State subsistence/personal use permits at Neva during the 1 June to 15 August State subsistence season, 2005 to 2011.

The harvest of Neva Sockeye Salmon in sport and commercial fisheries is unknown. The Alaska Department of Fish and Game (ADF&G) Division of Sport Fish estimates sport effort, catch, and harvest from an annual statewide mail survey sent to both resident and non-resident license holders (Jennings et. al. 2015). In recent years, an average of less than one surveyed angler reported fishing at Neva or South Creeks, which does not provide enough data to make a statistically valid estimate of effort or catch. (Teske 2018, pers. comm.).

Commercial purse seine openings in Excursion Inlet and Icy Strait harvest Sockeye Salmon bound for Neva Lake and other systems in northern inside waters. Between 2004 and 2017, the commercial purse seine catch of Sockeye Salmon in subdistrict 114-80 (Excursion Inlet) has ranged from 53 to 2,968 fish, with no catch reported in eight of the fourteen years (ADF&G 2018).

OBJECTIVES

1) Count (census) the annual escapement of adult and jack Sockeye Salmon into Neva Lake using double-redundant video weirs.

2) Determine, with 90% certainty, if at least 90% of the Sockeye Salmon spawners in Neva Lake are freshwater age-1.

METHODS

Sockeye Escapement Assessment

In 2018, as in 2010 through 2017, we used a "double redundant" two-weir, four-camera video system (Van Alen 2008a; Van Alen and Mahara 2011a, 2011b, 2011c, and 2012; Van Alen, Eide, and Mahara 2013, Van Alen and Musslewhite 2014, 2015, 2016, 2017) to get a validated estimate of the escapement of Sockeye Salmon into Neva Lake (Figure 5). Starting in 2016, the underwater video chute cameras and surveillance cameras were wirelessly linked to an off-site computer so project personnel could remotely monitor the project site and simultaneously review the motion-triggered video files of fish passing through the weir.

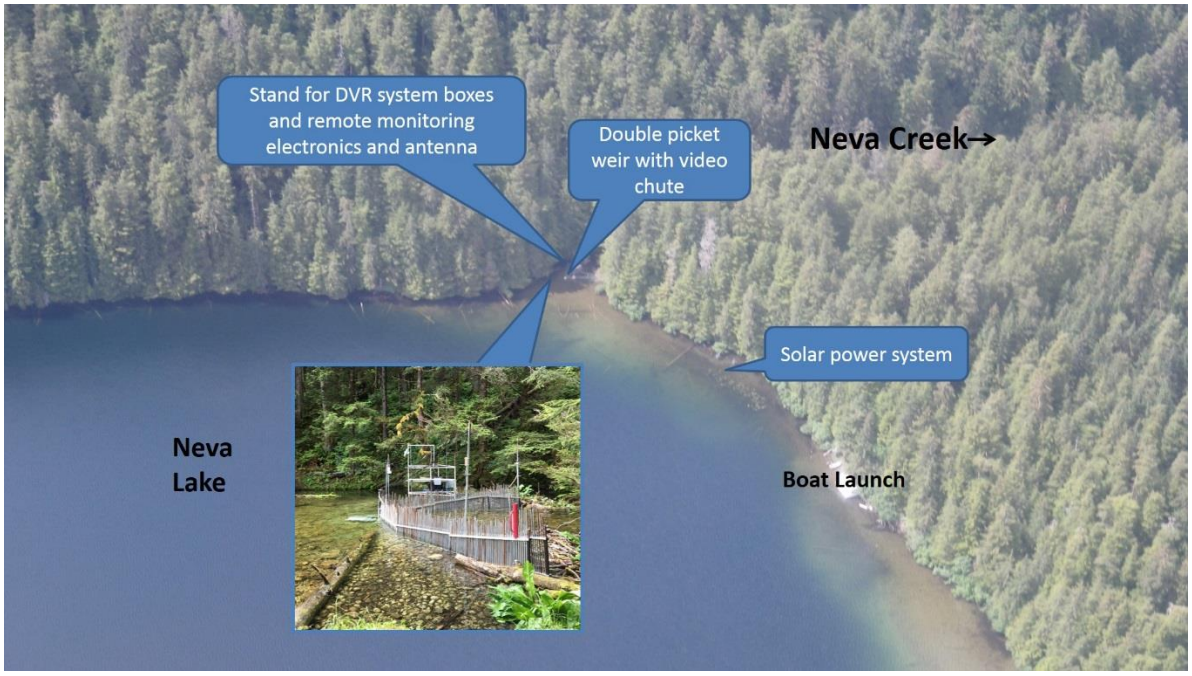


Figure 5. Annotated photo of the outlet (north) end of Neva Lake showing the basic layout of the weirs and solar panels.

The video fish counting system consisted of three stations: a weir station, a repeater station, and a recording station. The weir station was designed to capture video of fish passing through the

weir and transmit it to a repeater station located on a nearby mountain; the repeater then relayed the video to the recording station. At the recording station, a computer with video surveillance software was used to receive, record, and review video from the weir. The stations were connected using Ubiquiti wireless bridges to form a local area network (LAN) controlled by a single router. The entire system could be accessed and controlled over the internet using a wireless link from Excursion Inlet to Hoonah.

Weir Station

Fish entering Neva Lake through the double weirs passed through an aluminum video chute (Figure 6, Figure 7, Appendix A) equipped with underwater video cameras and lit by LED lights (Figure 8 and Figure 9). Both weirs led fish through a common chute entrance. The 70cm long chute had two underwater cameras on each side, two white LED strip lights on the ceiling, and a visor to shade the chute's interior from light reflections. The lights were separately powered through a remotely operated relay that could turn the lights on and off as needed. For most of the season, one of the strip lights was left on continuously, and the second light was automatically turned on between the hours of 6 pm and 8 am. In addition, LED lights were integrated into several of the underwater cameras, and were on continuously. The interior of the aluminum chutes were primed and painted with green marine paint. A meter stick and chute/camera label (i.e., "Neva 2018 Left" – for left camera) was in the field of view of each camera.

Figure 6. Photo of the double “V” video picket weir setup at the outlet of Neva Lake, 22 June 2018.

Figure 7. Photo of video chute used at Neva Lake weir, 2018.

Figure 8. Shop photo of the upstream side of the “kite” video chute and weir connection, Neva weir, 2018.

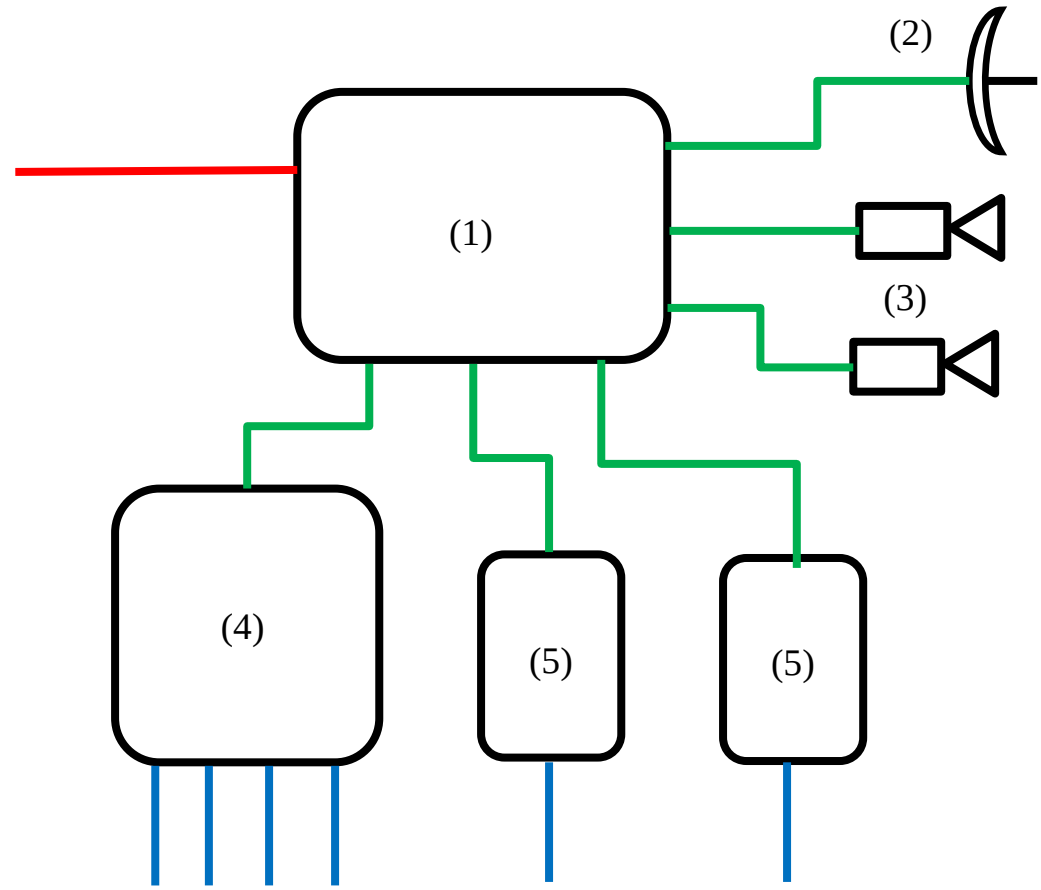
Figure 9. Shop photo of the inside of the “kite” video chute with adjustable camera mounts, chute height, and entrance, Neva weir, 2018.

The cameras were on opposite sides of the chute, two on each side and were aimed to view the entire chute, from entrance to exit. The cameras were 8.47mm (1/3in) Sony super HAD color CCD with 420 TVL high resolution and 3.6mm fixed board lenses in 34mm diameter x 60mm long waterproof stainless steel cylinders with Pyrex glass windows.

Waterproof video cables transported the feed from the cameras to two "video boxes," one for each side of the chute (Figure 10). The cables were encased in ABS pipe to prevent damage from chewing by beavers. These plastic battery boxes each contained two individual mini-DVR's which recorded motion-detected, 30-frames-per-second, MPEG4 compressed, .ASF video files, on removable SDHC (secure data high capacity) memory cards (SD cards). The mini-DVR's have user selectable settings for the frame rate, image quality, image size, date/time stamp, and motion detection threshold. The mini-DVR's also have a full suite of video review controls allowing the user to select video recorded at specific dates and times and play the video backward or forward at varying speeds. These video system boxes were the same design that has been used for this project since 2008 (Appendix B).

Figure 10. Mini-DVR fish video systems showing the mini-DVR's and monitor in a plastic marine battery box.

After passing through the DVRs, the video signal was carried over RCA video cables to the remote monitoring system box for encoding and transmission through the network. The electronics used to encode and transmit video from the weir site (Figure 11) were contained in a weatherproof metal system box mounted on a structure constructed of surplus weir parts, located next to the weir.



24V DC power from power distribution box

POE power + data

Analog video input

(1) Netonix WS-12-250-DC managed Ethernet switch
(2) Ubiquiti PowerBeam 400 wireless bridge
(3) Amcrest IP3M IP surveillance cameras
(4) Axis M7014 4-channel video encoder
(5) Axis M7001 1-channel video encoders

Figure 11. Schematic of weir station system box used at Neva weir, 2017.

A four-channel Axis video encoder and two single-channel Axis video encoders were used to convert the analog camera feed into a digital format. The four channel encoder was used to encode video from the four underwater cameras in the video chutes, and one of the single-channel encoders was connected to a stand-alone underwater camera viewing the weir entrance. The encoders were connected to a Netonix Ethernet switch, which provided power-over-Ethernet (POE), and served as both a network device and a power source for the system's components. Also mounted on the metal structure was a Ubiquiti PowerBeam 400 wireless bridge, which connected the station to the repeater site on a nearby ridge. Two Amcrest surveillance cameras were mounted nearby to provide aboveground views of the weir site. All of these devices had built-in user interfaces that could be accessed over the internet using a web browser. Using the web-page style interfaces, we could turn devices on and off, view cameras, adjust settings, and collect diagnostic information from anywhere with internet access.

Electric power for the weir station was provided by an array of twelve solar panels located on the lakeshore about 250 feet from the weir site (Figure 12). The 145-watt solar panels were wired to form four separate arrays of three panels each, wired in series. Two junction boxes were used to connect the four arrays, and each junction box contained a Victron BlueSolar charge controller, which charged a bank of two 12V absorbed glass matt (AGM) batteries wired to provide 24V. This configuration created two independent systems, each using six panels to charge two batteries. Power from the battery banks was transmitted to the weir station over a pair of 100-meter long suspended power lines, with a third cable serving as a common ground line.

At the weir site, a power distribution box (Figure 13) was used to deliver power from the solar system to the various components of the video system. The two powerlines were connected to a diode battery combiner, and the 24 volt power was stepped down to 12 volts with a voltage converter. A marine wiring bus was used to distribute power to the video boxes, the chute lights, and the remote monitoring system. A Tycon TP-DIN monitor provided the ability to remotely monitor and control the power system through its web interface.

Figure 12. Solar panels, batteries, and charge controllers were supported on weir picket "quadrapods" set on the shore of Neva Lake about 100 meters to the East of the weirs where there is more sun exposure.

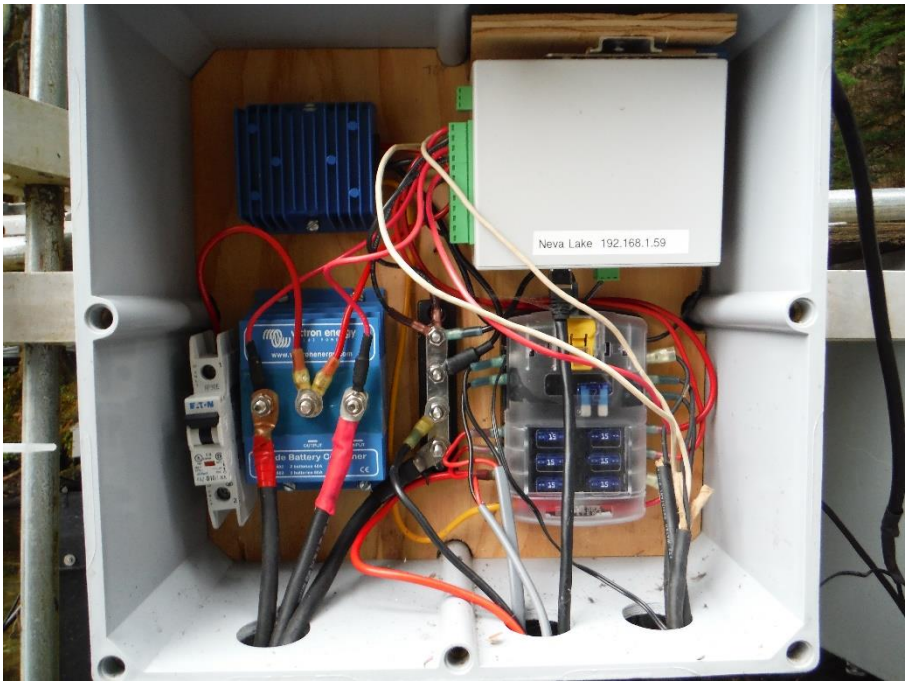


Figure 13. Power distribution box used at the Neva video weir, 2018.

Mountaintop Repeater Station

Since the recording station was not within line of sight of the weir station, we had to use an intermediate repeater station to relay data between the two stations. A repeater station was located on a mountain ridge overlooking both the weir site on Neva Lake and the recording station in Excursion Inlet village. The repeater was located at 58.39628°, -135.37795°, at an elevation of 2,778 feet (Figure 14). The repeater is about 2.2 km from the weir site, and about 4.8 km from the recording station.

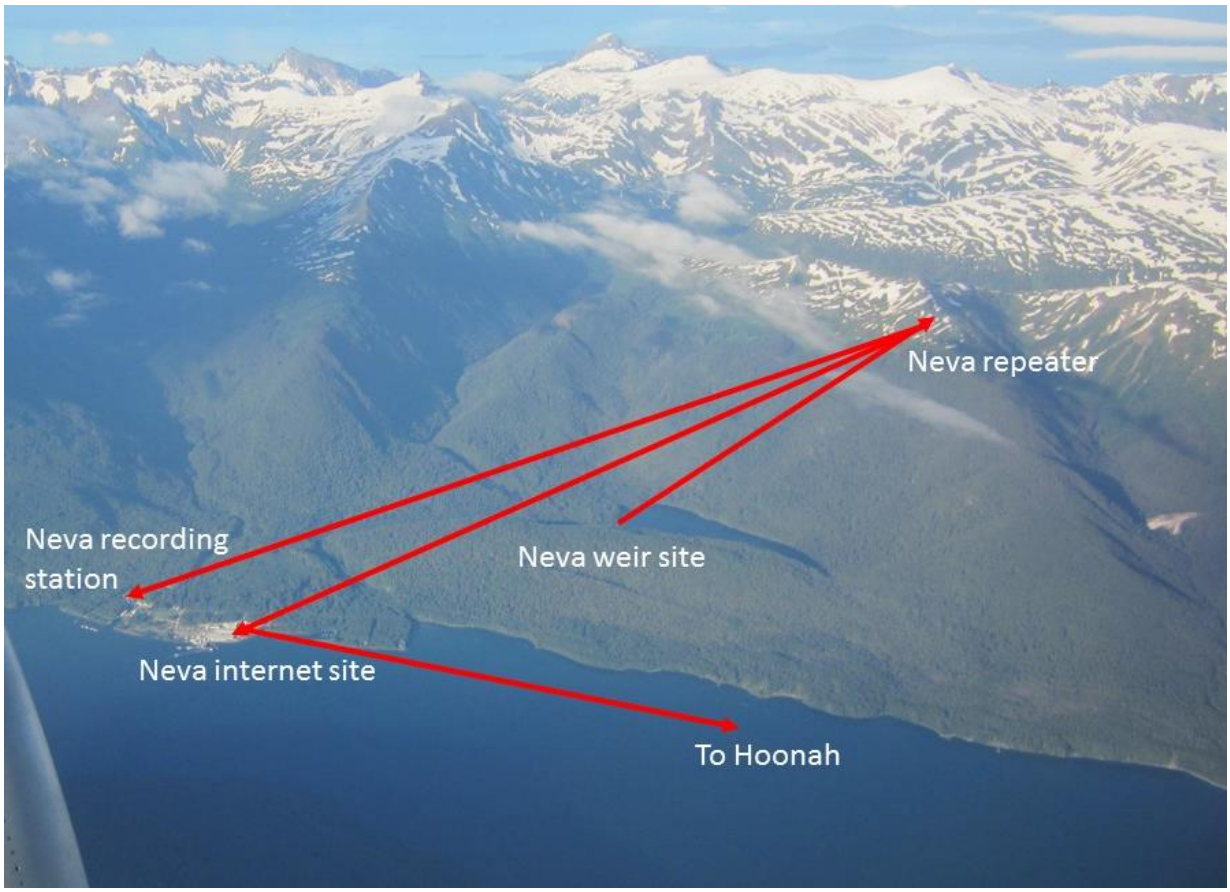
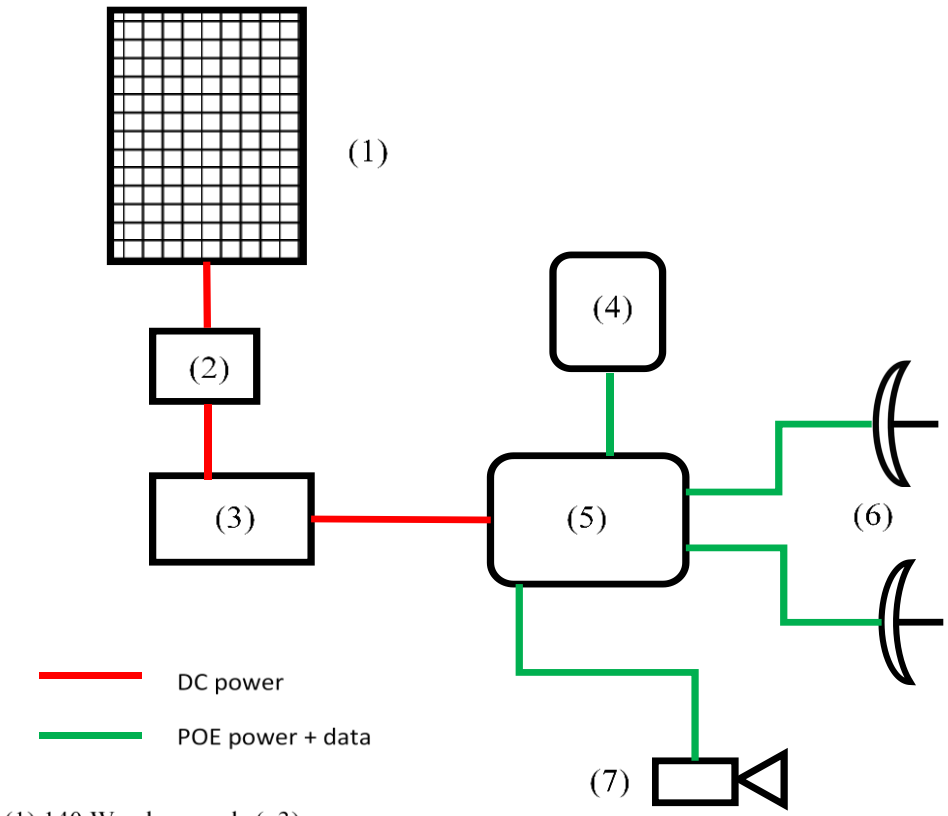


Figure 14. Neva Lake remote monitoring system stations and wireless transmission paths, 2018.

The repeater used a pair of Ubiquiti PowerBeam 400 wireless bridges to relay the signal from the weir site to the recording station, one receiving the signal from the weir and another transmitting to Excursion Inlet village (Figure 15). The radios were connected to a Netonix Ethernet switch, which also provided power with POE. A Tycon TP-DIN monitor was used to monitor and record solar panel input voltage and battery bank voltage. An Amcrest surveillance camera was attached to the repeater structure to provide a live view of the site. Power for the station was supplied by three 145-watt solar panels, regulated by a Morningstar MPPT charge controller charging a bank of six 12 volt 100 amp-hour batteries. The battery bank was connected to the Netonix switch, which distributed power to the various devices with POE.



(1) 140 W solar panels (x3)
(2) Morningstar SunSaver SS-MPPT-15 solar controller
(3) Battery bank (6 x 12V/100 Ah AGM batteries)
(4) Tycon TP-DIN remote monitor
(5) Netonix WS-12-250-DC managed Ethernet switch
(6) Ubiquiti PowerBeam 400-ISO wireless bridges
(7) Amcrest IP3M IP surveillance camera

Figure 15. Schematic of Neva repeater station.

The electronics and battery bank for the repeater were enclosed in a large plastic toolbox which was lined with rigid foam insulation and sealed with a gasketed lid. The electronics box, solar panels, and wireless bridge antennas were all mounted on an aluminum structure which was anchored to the ground with ground line (Figure 16). The structure, electronics box, and solar panels were lifted to the site by helicopter, and installed in the summer of 2016.

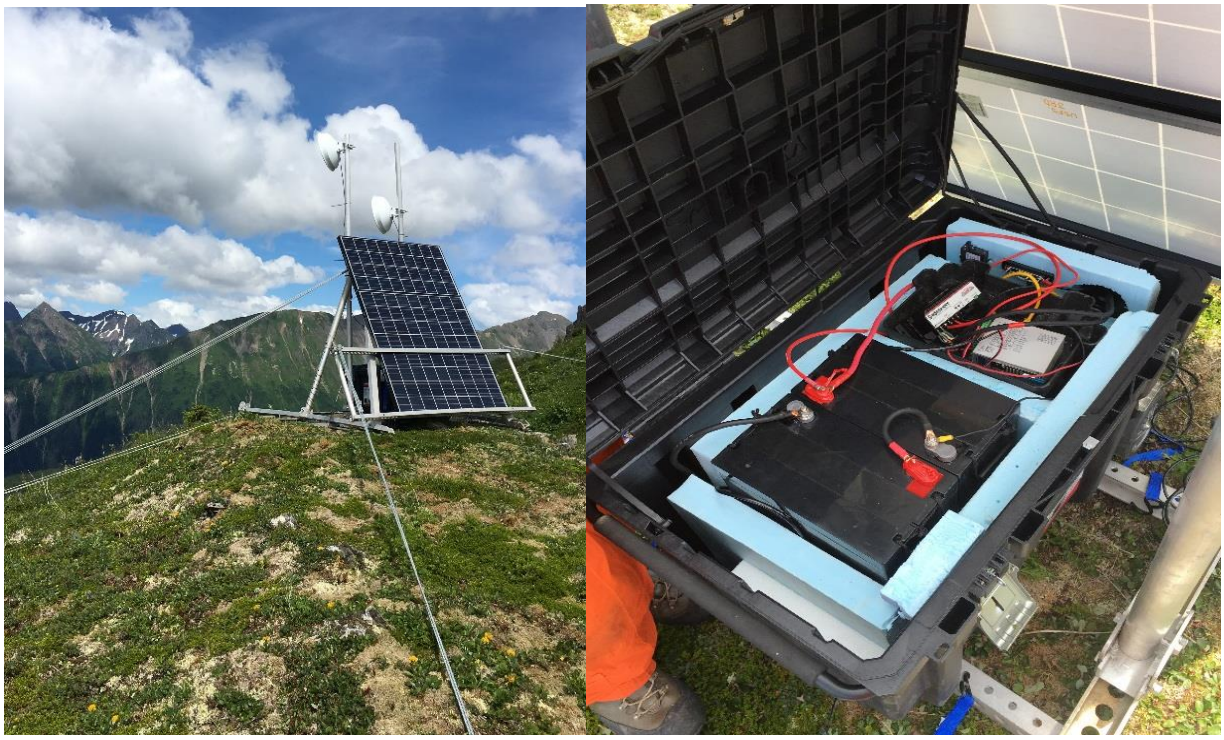


Figure 16. Neva repeater installation (left) and electronics storage box (right), 2016.

Recording Station

The recording station was located in a cabin in Excursion Inlet village, a small community centered on the Ocean Beauty Seafoods processing plant. This station was used to receive and record the video feed relayed from the weir station, and review the video to count fish passing through the weir. A Ubiquiti PowerBeam 400 wireless bridge mounted on the cabin received the signal from the repeater, and the video was recorded on a personal computer. A LinkSys WRT54G router in the cabin was used to control all of the networked devices over the entire LAN (i.e. at all three of the stations).

Video from the weir site was recorded and reviewed using Blue Iris, a software package designed for video surveillance applications. The computer was located in the main living space of the cabin, and constantly displayed live video from all of the cameras at the weir site, including both the underwater and above ground cameras (Figure 17, Figure 18). Using the software's motion-detection feature, video was recorded to the computer's hard drive whenever the motion detection was triggered. The video from the four cameras in the video chutes were grouped so that video from all four cameras was recorded if motion was detected in any of them. All video was backed up hourly to an external hard drive. In addition, Blue Iris has a "webserver" feature that allows access from the internet to view live video and stored video clips (Figure 19).

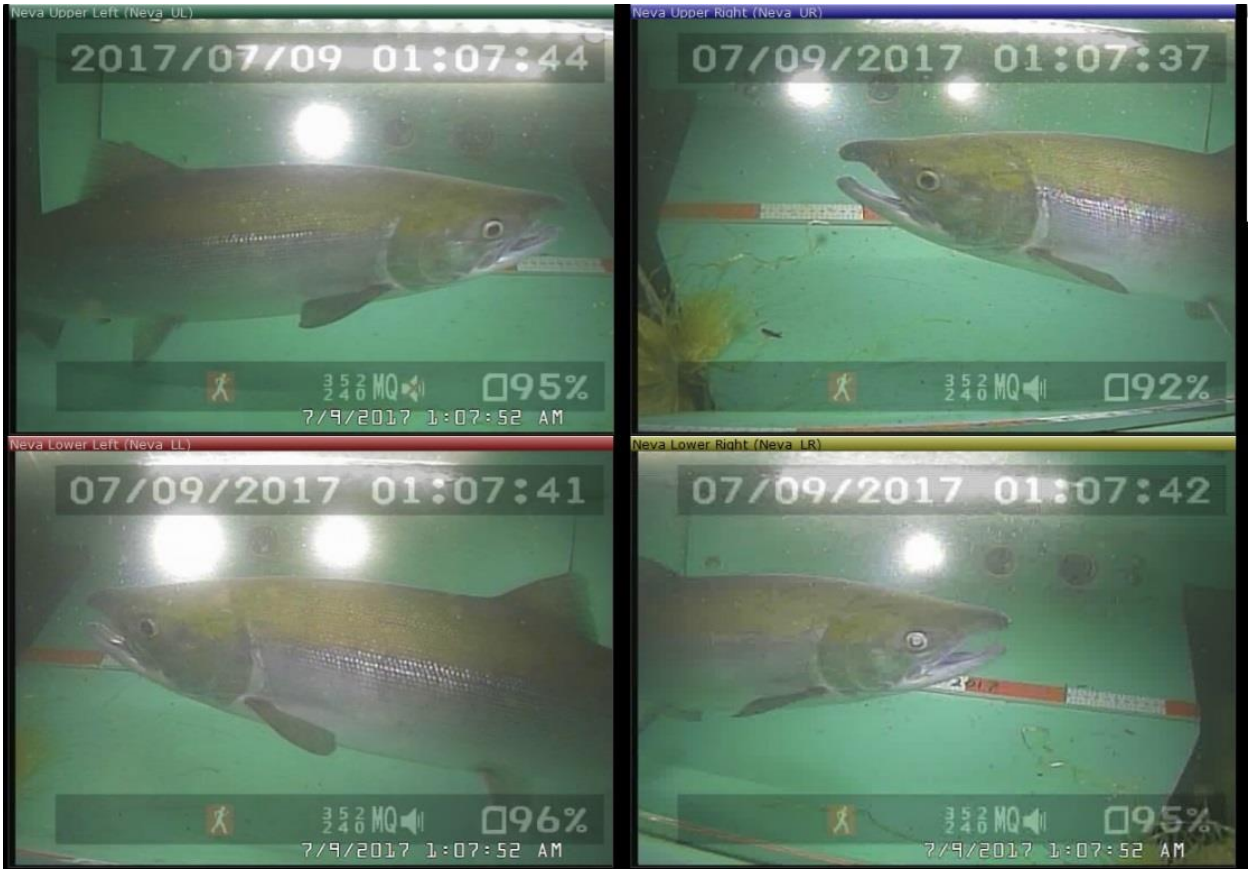


Figure 17. Four-camera video image of a Sockeye Salmon passing through the Neva lake weir, 2017.

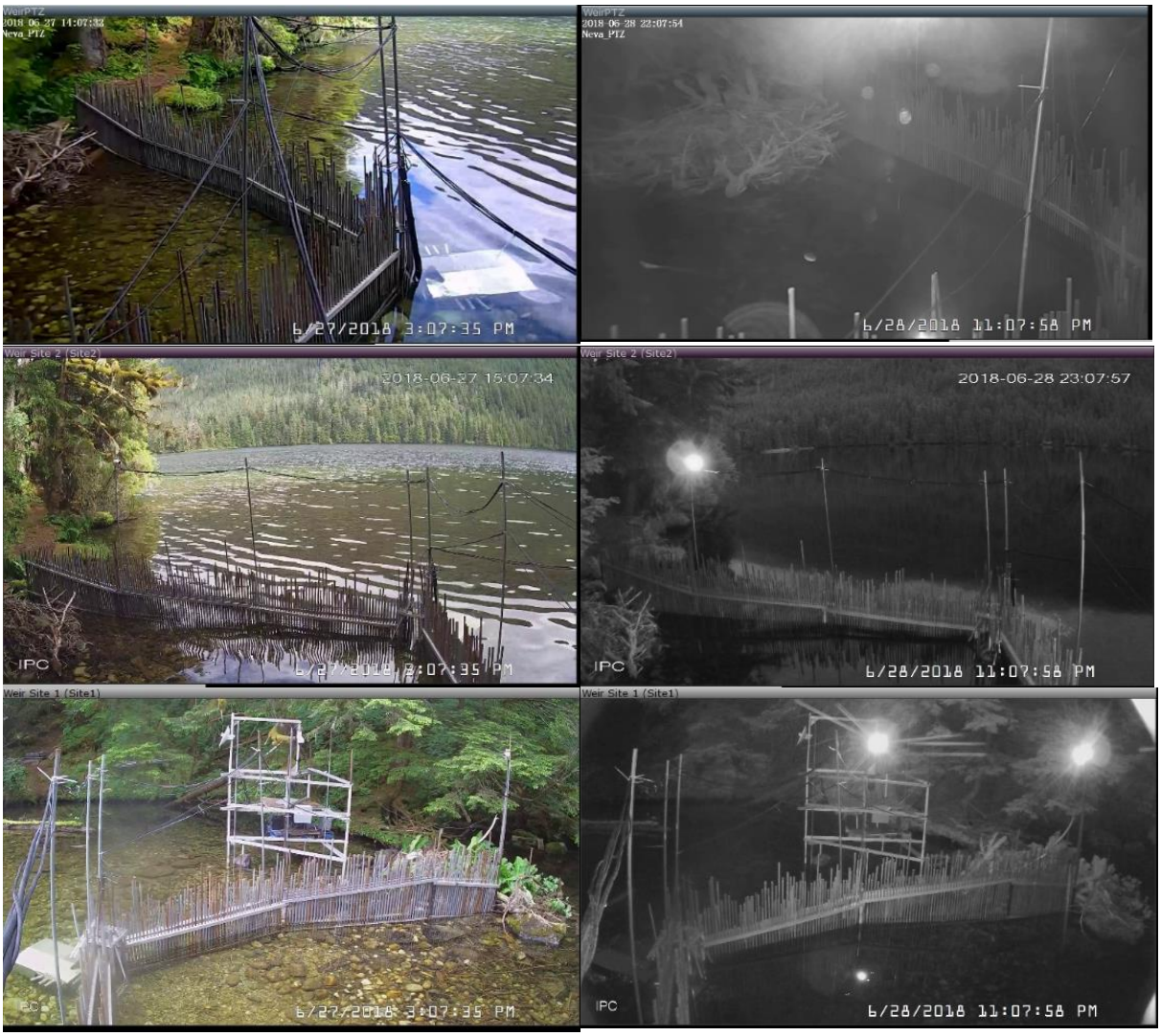


Figure 18. Daytime (left) and nighttime (right) video images from the site surveillance cameras at the Neva Lake weir, 2018.

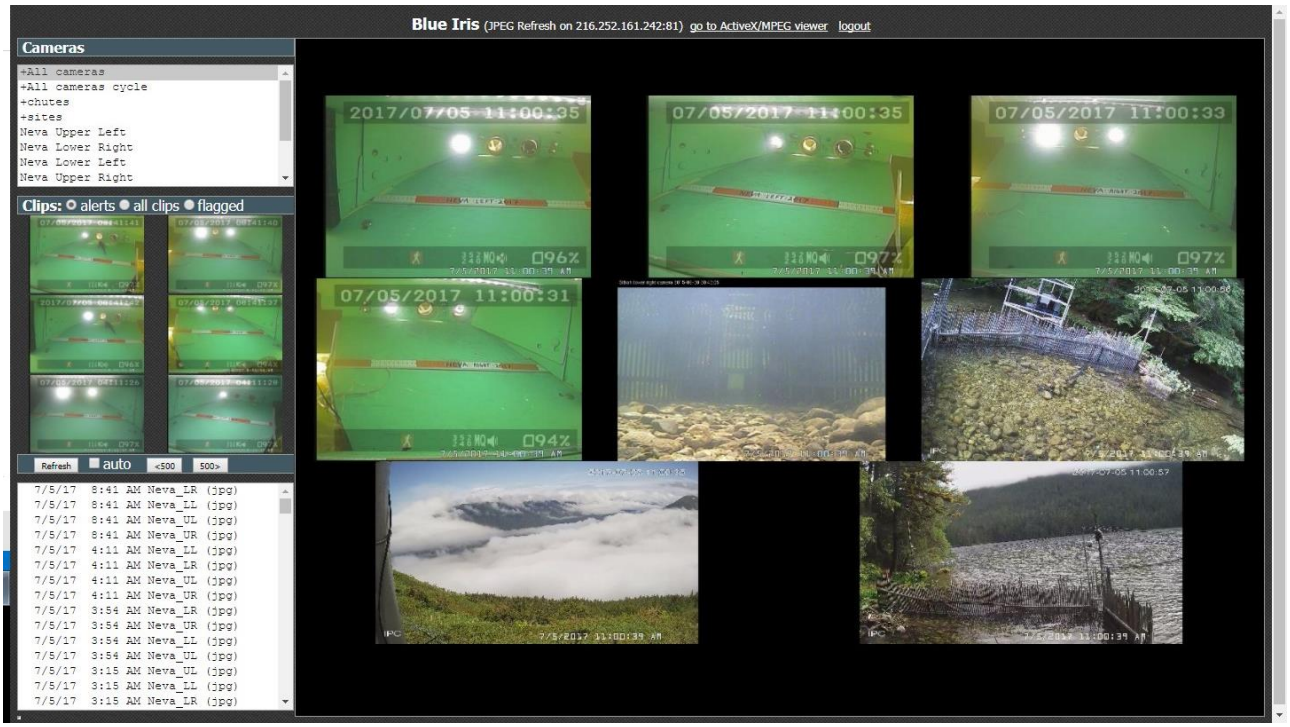


Figure 19. Screen capture of the Blue Iris web-accessible interface, showing views from the underwater and aboveground cameras.

Internet access to the entire system was provided by a wireless link across Icy Strait to Hoonah. Two Ubiquiti AirFiber AF5X radios were used; one mounted on a radio tower on the Ocean Beauty Seafoods office building, and another at a telecommunications tower on Hoonah Mountain 32km away. At the Hoonah Mountain site, the AirFiber radio was connected to the network of a local internet service provider. The mountaintop repeater was used to relay data between the internet-connected AirFiber station, the recording station, and the weir station (Figure 14). With the monitoring system connected to the internet, all of the system's devices could be remotely controlled and configured from anywhere with internet access. The internet connection was also used to maintain communication with the field crew, through email, video chat, and online data file sharing.

Each morning, project personnel would use the Blue Iris software to review the motion-triggered footage from the previous day. Reviewers were instructed to record hourly counts on the daily data sheet in this year's bound data notebook. Video review focused on getting complete and consistent counts of adult and jack Sockeye Salmon into the lake. Other species were usually counted but these counts were not validated and are incomplete. The time period for each hourly count was based on the time stamp from the Blue Iris software, which was derived from an internet time server and synchronized for all cameras. In previous years, project personnel reviewed video and recorded counts from all cameras in the chutes independently, but the

synchronized review of video from all four cameras made it possible to make a single hourly count of Sockeye instead.

For the majority of the season, the recording station was located in the Excursion Inlet cabin where project personnel lived and worked. However, the Ocean Beauty Seafoods plant closes at the end of the fishing season in early September, making the cabin no longer available for use. The computer used for recording video was moved to the Hoonah Indian Association office in Hoonah on August 10, where it was configured to connect to the monitoring system network over the internet. For the remainder of the season, the crew recorded and reviewed video in Hoonah rather than Excursion Inlet.

Age, Sex, and Length

The age-sex-length (ASL) sample target for Neva Lake was 60 to 120 Sockeye Salmon, with roughly equal numbers to be sampled from both main inlet stream spawners and from beach spawners. A beach seine was used to capture the fish when they schooled off the mouth of the main inlet stream in August and September and when they moved onto the principal beach spawning areas at the Southeast corner of the lake in September and October.

Adult and jack Sockeye Salmon were measured from the mid-eye to fork-of-tail length in millimeters in an aluminum fish-measuring trough. Sex and length measurements were recorded on mark-sense AWL (age-weight-length) forms supplied by Alaska Department of Fish and Game (ADF&G). Three scales were plucked from the left side of the fish, two rows above the lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963). The scales were then mounted on numbered gummed “scale cards” so that the scales could be matched with the same fish on the mark-sense form (see ADF&G 2001 for specific sampling procedures).

The scales were aged by personnel at the ADF&G Commercial Fisheries Division Aging Lab in Juneau, Alaska. Ages were reported in European notation where a period separates the number of fresh water and marine annuli (Koo 1962; ADF&G 2010). The total age of the fish is the sum of these two numbers plus one for the winter the egg/alevin was in the redd.

Stream Temperature and Depth

We have used temperature and temperature and pressure data loggers manufactured by the Onset Computer Corporation to measure air temperatures and inlet and outlet stream temperatures and depths at set time intervals each day. We started using temperature data loggers on 27 July 2002 and temperature and pressure data loggers on 13 July 2005. The temperature data loggers (Onset model Optic Stowaway Temp) were placed in 30cm long, 52mm I.D. aluminum pipes positioned just below the stream bottom at the outlet (58˚24.255’N, 135˚24.658’W) and main inlet stream (58˚24.255’N, 135˚24.658’W) of Neva Lake. They were set to record a temperature reading

every four hours. We downloaded readings from these temperature data loggers once or twice a year and the last readings were through 21 October 2009.

On 13 July 2005, we deployed two temperature and pressure data loggers (Onset model U20-001-01) - one cabled under a large rock right at the outlet of the lake (58° 24.338'N, 135° 24.635'W) and one cabled up in a tree near the lake outlet at 58° 24.34'N, 135° 24.661'W. On 13 June 2006, we cabled another temperature and pressure data logger in a pipe driven into the bottom of the main inlet stream at 58˚24.255'N, 135˚24.658'W. All three loggers were protected in 30cm long x 38mm ID ABS plastic pipes. The temperature and depth data logger in the main inlet stream was lost in 2008 when the stream channel shifted during high water events. On 1 August 2012 we secured another temperature and pressure data logger to a root wad 100 meters upstream. All loggers were set to record measurements at one hour intervals. The pressure readings from the loggers in the water were corrected for barometric pressure changes using the pressure readings from the logger in the tree using Onset Computer Corporation's "HOBOware"™ software. The readings from the logger in the main inlet stream were also calibrated to staff gauge readings taken each time the data logger was checked.

Another pair of Onset air and water temperature loggers was deployed at the outlet in July 2008. The air data logger was placed in a tree about 80 meters downstream of the outlet (58˚24.34'N, 135˚24.661'W) and the water temperature logger was added to the cable holding the temperature and pressure logger under the big rock at the outlet of the lake. Data from these loggers is maintained by the Office of Subsistence Management (ARRI 2013).

RESULTS

Weir counts, Escapement Estimates, and Run Timing

The two independent "V" shaped picket weirs with independently powered underwater motion-detect video camera systems were in place from 22 June to 9 October 2018. Project personnel reviewed the video each day during the season and recorded the hourly passage of each species of fish through the weirs. Separate counts were made for adult and jack Sockeye Salmon.

Fish counting was done using the Blue Iris program on the personal computer and simultaneous replay of video from each of the four chute cameras. The SD card backups were used to maintain continuous video recording while the computer system was being moved to Hoonah in late August, and to maintain continuous recording when the Blue Iris recordings were not available.

The raw hourly and daily counts of Sockeye Salmon through the video weirs totaled 5,737 fish, including 5,561 adults and 176 jacks (Table 2, Table 3). The first Sockeye Salmon was seen at the weir on 10 July and there were still a few Sockeye Salmon present when the weirs were dismantled on 9 October. Using the E-M algorithm (McLachlan and Krishnan 1997) to fill in

missing data, we estimate that an additional three Sockeye Salmon entered the lake after the weir was removed for the season (Table 4), for a total estimate of 5,740 for the season. Also counted at the weirs were 436 Coho Salmon, 7 Pink Salmon, 4,795 Dolly Varden, and 619 Cutthroat Trout.

The run timing in 2018 was later than normal, as the first Sockeye Salmon was not counted until 10 July, approximately the normal 15% completion date, and the 90% completion date was 25 September, 12 days later than the previous record. The mid-point of the run was on 9 August and 80% of the Sockeye Salmon had entered Neva Lake between 14 July and 24 September (Table 5, Figure 20). Most of the Sockeye Salmon migrated into the lake during evening hours. Nearly half (46%) passed through the weir between 23hr and 04hr (Table 3).

Table 2. Daily numbers of fish counted at the Neva Creek video weirs, 22 June to 9 October 2018.

Date	Adult Sockeye Salmon	Jack Sockeye Salmon	Total Sockeye Salmon	Coho Salmon	Pink Salmon	Dolly Varden	Cutthroat
22-Jun	0	0	0	0	0	0	0
23-Jun	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0
26-Jun	0	0	0	0	0	17	0
27-Jun	0	0	0	0	0	24	0
28-Jun	0	0	0	0	0	10	0
29-Jun	0	0	0	0	0	9	0
30-Jun	0	0	0	0	0	3	1
1-Jul	0	0	0	0	0	14	0
2-Jul	0	0	0	0	0	14	1
3-Jul	0	0	0	0	0	18	0
4-Jul	0	0	0	0	0	2	1
5-Jul	0	0	0	0	0	0	1
6-Jul	0	0	0	0	0	0	0
7-Jul	0	0	0	0	0	0	0
8-Jul	0	0	0	0	0	0	0
9-Jul	0	0	0	0	0	2	0
10-Jul	5	4	9	0	0	3	0
11-Jul	182	6	188	0	0	16	0
12-Jul	7	0	7	0	0	4	0
13-Jul	218	0	218	0	0	3	0
14-Jul	344	12	356	0	0	15	0
15-Jul	116	2	118	0	0	7	0
16-Jul	10	1	11	0	0	4	0
17-Jul	5	0	5	0	0	4	0
18-Jul	0	0	0	0	0	2	1
19-Jul	0	0	0	0	0	2	0
20-Jul	0	0	0	0	0	0	0
21-Jul	4	0	4	0	0	4	0
22-Jul	0	0	0	0	0	2	0
23-Jul	1	0	1	0	0	0	1
24-Jul	9	2	11	0	0	0	0
25-Jul	10	6	16	0	0	2	0
26-Jul	10	4	14	0	0	2	0
27-Jul	1	0	1	0	0	0	0
28-Jul	0	0	0	0	0	0	0
29-Jul	3	0	3	1	0	1	0
30-Jul	2	0	2	0	0	0	0
31-Jul	2	0	2	0	0	0	0

(continued)

Table 2. (page 2 of 3)

Date	Adult Sockeye Salmon	Jack Sockeye Salmon	Total Sockeye Salmon	Coho Salmon	Pink Salmon	Dolly Varden	Cutthroat
1-Aug	0	0	0	0	0	1	0
2-Aug	12	0	12	0	0	2	0
3-Aug	45	1	46	0	0	35	1
4-Aug	401	17	418	0	0	341	56
5-Aug	18	1	19	0	0	3	3
6-Aug	2	0	2	0	0	0	1
7-Aug	37	0	37	0	0	3	2
8-Aug	1064	36	1100	20	0	54	22
9-Aug	392	35	427	5	1	88	0
10-Aug	288	15	303	4	0	33	3
11-Aug	31	2	33	11	1	95	3
12-Aug	68	1	69	4	0	102	0
13-Aug	62	5	67	4	0	54	4
14-Aug	155	13	168	83	0	15	6
15-Aug	38	3	41	0	4	4	9
16-Aug	35	2	37	3	0	2	5
17-Aug	24	0	24	0	0	9	3
18-Aug	42	0	42	0	0	4	9
19-Aug	42	1	43	0	0	1	5
20-Aug	157	0	157	2	0	5	3
21-Aug	70	0	70	2	0	5	27
22-Aug	140	0	140	44	0	12	7
23-Aug	30	0	30	22	0	1	1
24-Aug	66	1	67	2	0	8	1
25-Aug	73	0	73	3	0	6	0
26-Aug	16	0	16	0	0	8	0
27-Aug	16	0	16	1	0	4	0
28-Aug	179	0	179	24	0	14	5
29-Aug	29	0	29	12	0	15	0
30-Aug	15	0	15	15	0	5	4
31-Aug	10	1	11	5	0	7	8
1-Sep	3	0	3	2	0	2	1
2-Sep	15	0	15	17	0	14	0
3-Sep	10	0	10	5	1	0	0
4-Sep	5	0	5	1	0	2	0
5-Sep	3	0	3	1	0	7	5
6-Sep	4	0	4	4	0	73	0
7-Sep	64	0	64	9	0	58	2
8-Sep	10	0	10	4	0	42	1
9-Sep	16	0	16	3	0	202	8
10-Sep	27	1	28	7	0	212	2
11-Sep	20	0	20	3	0	456	4
12-Sep	76	2	78	0	0	288	0
13-Sep	12	0	12	0	0	39	1
14-Sep	20	0	20	1	0	255	20
15-Sep	12	0	12	3	0	280	13

Table 2. (page 3 of 3)

Date	Adult Sockeye Salmon	Jack Sockeye Salmon	Total Sockeye Salmon	Coho Salmon	Pink Salmon	Dolly Varden	Cutthroat
16-Sep	7	0	7	5	0	201	29
17-Sep	10	0	10	3	0	103	12
18-Sep	12	0	12	0	0	99	21
19-Sep	16	0	16	3	0	49	24
20-Sep	29	0	29	0	0	81	23
21-Sep	3	0	3	0	0	35	1
22-Sep	5	0	5	0	0	1	0
23-Sep	15	1	16	1	0	1	0
24-Sep	15	1	16	2	0	0	2
25-Sep	102	0	102	1	0	51	11
26-Sep	265	0	265	76	0	91	58
27-Sep	93	0	93	4	0	83	11
28-Sep	73	0	73	0	0	140	19
29-Sep	47	0	47	3	0	164	13
30-Sep	23	0	23	1	0	307	16
1-Oct	35	0	35	0	0	69	15
2-Oct	6	0	6	2	0	56	26
3-Oct	1	0	1	0	0	14	17
4-Oct	5	0	5	1	0	49	7
5-Oct	4	0	4	1	0	28	0
6-Oct	5	0	5	4	0	62	33
7-Oct	2	0	2	1	0	30	29
8-Oct	1	0	1	0	0	31	0
9-Oct	4	0	4	1	0	0	1
Total[a]	5,561	176	5,737	436	7	4,795	619

[a]The weirs were operational from 17:00 on June 22 through 23:59 on 9 October.

Table 3. Daily and hourly counts of Sockeye Salmon adults and jacks through the double video weirs at the outlet of Neva Lake, 2018.

	Hour																							
Date	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
22-Jun																		0	0	0	0	0	0	0	0
23-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Jul	0	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
11-Jul	9	110	52	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	188
12-Jul	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
13-Jul	0	0	3	7	39	153	5	1	0	0	0	0	0	3	1	0	0	0	0	0	0	0	2	4	218
14-Jul	11	86	41	141	48	0	0	4	0	0	0	2	0	0	0	0	0	9	0	0	0	0	2	12	356
15-Jul	40	7	19	21	7	0	0	0	0	0	1	0	0	0	22	0	0	0	0	0	0	1	0	0	118
16-Jul	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
17-Jul	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
18-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Jul	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
22-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Jul	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
24-Jul	0	1	1	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	4	11
25-Jul	0	1	5	3	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	4	16
26-Jul	1	3	8	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	14
27-Jul	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
28-Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Jul	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
30-Jul	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
31-Jul	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

(continued)

Table 3. (page 2 of 3)

	Hour																								
Date	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
1-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Aug	0	0	8	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
3-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	10	8	17	46
4-Aug	70	57	111	166	6	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	418
5-Aug	6	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
6-Aug	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7-Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	26	2	0	0	37
8-Aug	1	0	3	7	1	0	1	8	15	33	247	235	129	145	159	78	0	7	1	0	0	0	14	16	1100
9-Aug	10	1	0	0	0	0	0	0	0	0	0	0	0	0	8	24	70	42	107	48	25	33	27	32	427
10-Aug	92	33	23	14	3	11	1	6	0	0	0	0	0	5	0	8	10	4	10	40	3	4	4	32	303
11-Aug	15	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	33
12-Aug	7	14	17	13	10	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	69
13-Aug	17	14	9	4	11	1	2	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	67
14-Aug	13	23	60	21	30	11	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	2	4	168
15-Aug	5	4	12	14	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	41
16-Aug	2	9	7	6	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	37
17-Aug	1	4	6	8	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	24
18-Aug	6	5	8	14	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
19-Aug	1	6	10	7	8	7	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	43
20-Aug	4	14	14	108	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	157
21-Aug	7	8	11	8	6	4	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2	4	15	70
22-Aug	19	32	37	22	18	5	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	140
23-Aug	4	2	3	8	8	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	30
24-Aug	6	14	12	11	9	5	8	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	67
25-Aug	6	14	17	10	11	5	8	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	73
26-Aug	4	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	16
27-Aug	1	3	4	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
28-Aug	0	0	0	0	0	0	0	0	1	1	0	0	6	9	12	122	20	3	2	0	0	1	0	2	179
29-Aug	2	5	3	0	4	0	0	0	1	0	0	0	6	0	0	0	0	0	1	0	1	1	2	3	29
30-Aug	3	1	1	4	1	2	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	15
31-Aug	0	3	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	11
1-Sep	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
2-Sep	7	4	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
3-Sep	1	1	5	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	10
4-Sep	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5
5-Sep	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3
6-Sep	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4
7-Sep	18	13	15	1	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	7	64

(continued)

Table 3. (page 3 of 3)

	Hour																							
Date	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	Total
8-Sep	1	4	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
9-Sep	6	6	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16
10-Sep	4	6	6	3	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
11-Sep	5	8	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	20
12-Sep	22	19	13	8	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	78
13-Sep	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	1	8	12
14-Sep	3	3	4	2	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	20
15-Sep	3	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	12
16-Sep	0	0	1	4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
17-Sep	0	8	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
18-Sep	4	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	12
19-Sep	0	3	1	2	2	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	16
20-Sep	2	1	3	0	8	9	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
21-Sep	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
22-Sep	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
23-Sep	1	2	2	0	3	5	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
24-Sep	0	0	0	0	0	0	0	0	2	6	0	1	0	0	2	3	1	1	0	0	0	0	0	0	16
25-Sep	0	0	0	0	0	0	0	2	2	8	10	9	0	18	14	6	11	0	3	2	2	0	13	2	102
26-Sep	5	8	18	47	17	16	12	5	10	3	31	27	8	8	15	5	7	2	4	1	4	3	5	4	265
27-Sep	0	1	0	2	0	0	3	2	10	9	10	9	10	12	8	1	5	8	0	0	2	0	0	1	93
28-Sep	2	0	3	0	0	1	0	10	8	8	6	5	0	6	0	5	4	7	5	0	0	0	3	0	73
29-Sep	0	0	5	4	1	4	1	6	1	0	0	11	4	3	0	1	4	0	1	0	0	0	1	0	47
30-Sep	0	1	1	0	0	1	2	0	2	0	2	0	0	1	1	0	1	1	8	0	0	1	0	1	23
1-Oct	4	2	3	2	1	6	1	1	3	3	0	0	1	1	2	0	2	0	0	0	2	0	1	0	35
2-Oct	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	6
3-Oct	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4-Oct	0	0	2	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5
5-Oct	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4
6-Oct	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
7-Oct	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8-Oct	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
9-Oct	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4
Total	465	597	622	756	298	291	65	54	72	75	308	303	170	215	244	255	136	86	146	110	73	66	107	223	5737
Percent	8%	10%	11%	13%	5%	5%	1%	1%	1%	1%	5%	5%	3%	4%	4%	4%	2%	1%	3%	2%	1%	1%	2%	4%	

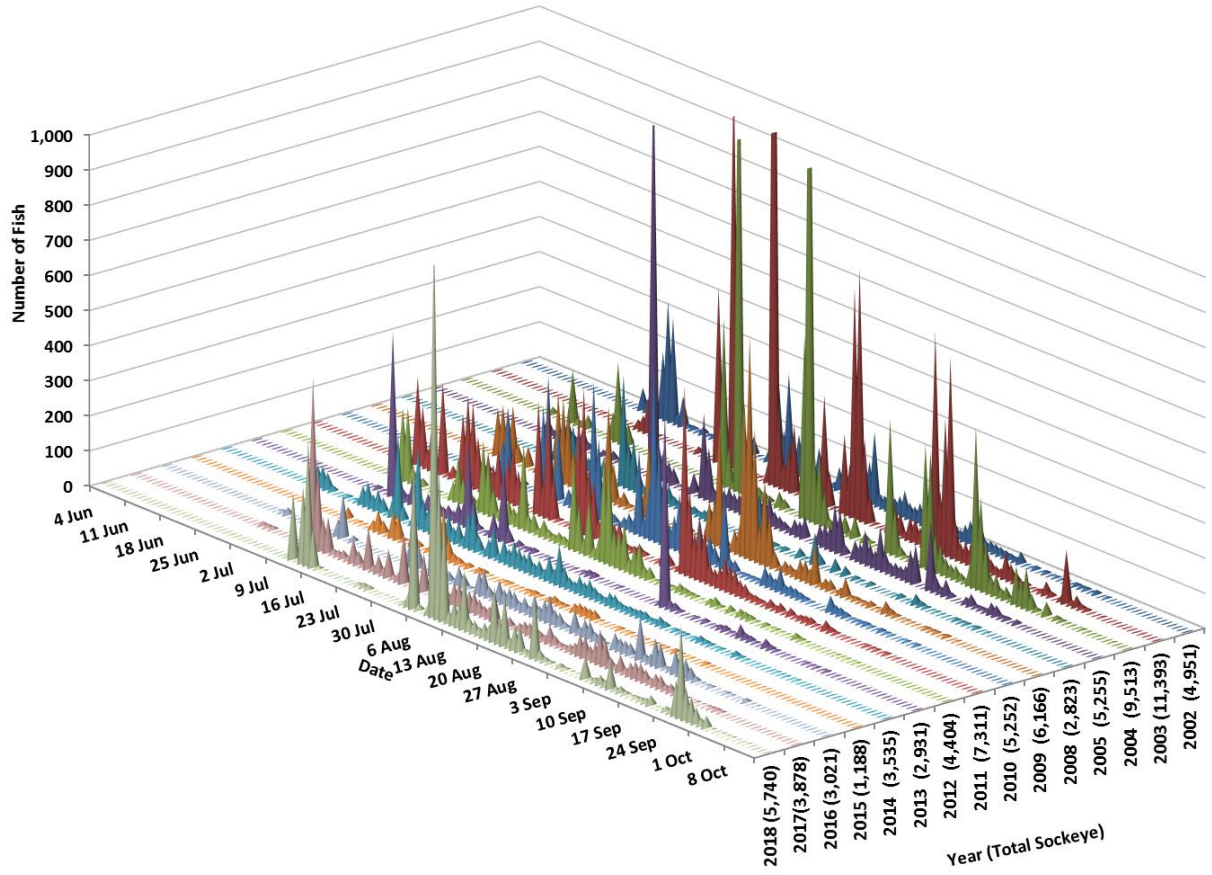


Figure 20. Estimated daily escapement of Sockeye Salmon into Neva Lake, 4 June to 13 October 2002 to 2005 and 2008 to 2018.

Table 4. Estimated daily escapement of adult and jack Sockeye Salmon into Neva Lake, from 4 June to 13 October 2002 to 2005 and 2008 to 2018.

Date	2002	2003	2004	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
4 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 Jun	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 Jun	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
14 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 Jun	0	0	0	0.0	0	0	0	0.0	0.0	5	0.5	0.0	0	0	0
17 Jun	1	0	0	0.2	0	0	0	1.1	0.6	0	0	0.0	0	0	0
18 Jun	2	0	0	0.5	0	0	0	2.2	1.2	0	0	0.0	0	0	0
19 Jun	0	0	0	0.0	0	0	0	0.0	0.0	0	0	0.0	0	0	0
20 Jun	1	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0
21 Jun	0	0	22	0	0	0	0	14.0	1	0	40	0	0	2	0
22 Jun	1	1	0	0	0	0	0	0	1	0	60	0	0	0	0
23 Jun	1	5	0	0	0	0	0	3	0	0	62	0	0	0	0
24 Jun	0	0	0	0	0	0	0	248	0	0	49	0	0	0	0
25 Jun	0	6	149	0	0	0	0	170	1	0	19	0	1	0	0
26 Jun	1	2	17	49	0	0	0	54	35	0	2	0	5	0	0
27 Jun	62	0	22	18	0	0	0	156	201	5	4	0	12	0	0
28 Jun	35	0	40	27	0	133	1	43	208	13	10	0	22	0	0
29 Jun	0	6	1	44	4	147	8	261	46	6	5	0	0	13	0
30 Jun	31	2	4	66	0	142	14	11	26	2	10	0	0	12	0
1 Jul	188	0	4	34	0	156	14	36	25	468	52	0	0	12	0
2 Jul	340	26	0	31	15	55	19	4	2	119	68	0	0	0	0
3 Jul	295	43	77	60	11	0	0	195	6	31	39	0	15	1	0
4 Jul	28	99	225	23	137	58	2	253	6	22	58	34	5	1	0
5 Jul	84	32	89	0	78	0	110	239	2	77	42	0	0	0	0
6 Jul	12	6	63	0	151	22	205	146	2	29	9	7	0	0	0
7 Jul	14	3	2	18	111	29	2	35	49	8	57	5	0	0	0
8 Jul	8	0	0	0	97	16	0	112	125	46	239	1	48	11	0
9 Jul	21	0	0	27	55	0	21	85	70	24	43	26	126	482	0
10 Jul	8	0	0	9	38	244	0	140	3	42	4	58	0	231	9
11 Jul	11	0	0	2	10	235	0	55	34	27	21	36	18	94	188
12 Jul	11	0	0	65	20	213	0	128	33	38	233	8	2	101	7
13 Jul	4	0	0	4	48	101	250	162	203	28	87	77	0	17	218
14 Jul	37	19	0	2	17	137	344	98	157	56	66	72	0	19	356
15 Jul	40	3	0	2	0	30	35	27	78	60	59	12	0	25	118
16 Jul	21	0	0	0	0	22	209	1	21	249	61	2	0	14	11
17 Jul	10	0	0	1185	313	4	5	2	99	90	60	56	1	67	5
18 Jul	43	496	0	105	131	0	44	319	63	19	72	21	0	41	0
19 Jul	52	361	1	88	146	53	30	94	47	6	40	4	2	14	0
20 Jul	5	45	0	61	66	265	4	336	51	12	61	14	2	118	0
21 Jul	2	1135	0	49	22	109	24	127	239	68	26	11	1	18	4
22 Jul	31	92	2	7	40	22	45	11	43	33	107	20	47	51	0
23 Jul	4	7	0	0	42	41	380	3	54	229	130	144	238	24	1
24 Jul	239	0	3	10	75	14	222	7	19	43	47	63	66	79	11
25 Jul	103	1	474	57	8	6	119	24	47	5	12	26	4	14	16
26 Jul	273	6	111	0	51	0	53	340	25	20	47	20	8	27	14
27 Jul	94	4	24	239	28	61	26	412	19	8	90	10	342	148	1
28 Jul	110	67	1402	146	16	213	10	196	29	12	17	17	11	7	0
29 Jul	39	1914	256	38	15	23	29	158	24	16	64	0	26	3	3
30 Jul	23	231	199	57	20	77	45	51	18	1	43	15	28	9	2
31 Jul	49	76	60	41	23	0	35	32	264	5	68	16	11	109	2
1 Aug	96	142	34	59	14	1	236	61	131	7	58	5	54	4	0
2 Aug	25	192	29	47	23	0	51	59	40	2	46	0	39	12	12
3 Aug	8	9	21	50	41	0	146	68	159	1	57	3	10	227	46
4 Aug	17	11	5	94	17	6	488	19	26	0	32	8	1	73	418
5 Aug	64	367	44	5	4	18	280	13	64	0	45	9	62	26	19
6 Aug	7	125	29	97	0	5	107	18	310	6	26	4	76	62	2
7 Aug	23	79	7	70	0	0	61	29	292	0	70	5	32	69	37
8 Aug	361	311	0	84	0	0	92	16	103	10	39	6	14	39	1,100
9 Aug	206	103	1	78	0	116	158	2	106	18	113	10	62	55	427
10 Aug	146	7	522	41	0	125	85	2	131	17	58	14	40	59	303
11 Aug	116	4	1633	33	0	345	17	10	38	5	32	9	51	43	33
12 Aug	206	224	197	25	216	55	42	76	78	2	27	2	46	31	69
13 Aug	37	143	198	13	125	7	118	34	91	1	48	13	25	34	67
14 Aug	35	653	95	43	125	63	28	7	31	1	36	22	42	88	168

(continued)

Table 4. (page 2 of 2)

Date	2002	2003	2004	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
15 Aug	80	716	26	42	16	81	78	19	36	7	49	13	23	8	41
16 Aug	41	233	24	61	13	437	53	532	7	3	34	11	59	7	37
17 Aug	52	84	41	0	7	630	15	251	10	0	23	4	35	28	24
18 Aug	74	8	53	0	14	372	231	130	16	1	18	23	58	9	42
19 Aug	45	3	16	57	0	106	36	169	9	2	36	30	76	23	43
20 Aug	40	6	64	65	0	239	35	152	10	2	35	28	43	33	157
21 Aug	56	48	4	65	27	144	8	59	24	3	22	26	39	35	70
22 Aug	79	83	25	133	7	46	10	47	18	3	17	28	18	47	140
23 Aug	47	67	11	124	0	13	10	59	13	13	20	6	9	24	30
24 Aug	29	17	5	29	87	32	10	92	10	555	19	3	63	18	67
25 Aug	40	64	2	0	33	28	10	76	4	24	22	2	23	52	73
26 Aug	27	67	2	52	0	20	53	71	2	23	23	4	49	28	16
27 Aug	35	45	379	50	0	53	41	44	17	11	13	9	50	15	16
28 Aug	40	50	133	93	38	58	31	39	27	2	14	4	25	14	179
29 Aug	27	15	30	61	0	40	66	20	11	2	26	7	30	21	29
30 Aug	46.5	621	10	47	28	116	24	19	2	9	18	1	9	31	15
31 Aug	66	173	9	120	0	12	28	15	21	4	3	2	5	60	11
1 Sep	26	385	2	56	13	29	26	9	6	14	10	5	46	63	3
2 Sep	80	567	0	31	7	32	20	25	22	4	8	2	37	41	15
3 Sep	27	109	348	36	0	8	14	14	20	7	9	6	36	54	10
4 Sep	31	49	334	33	14	20	7	26	17	14	4	6	35	99	5
5 Sep	27.8	57	104	39	0	54	0	8	7	18	9	7	8	81	3
6 Sep	24.6	55	81	91	0	11	0	23	2	8	19	3	123	32	4
7 Sep	21.4	49	49	111	0	13.5	0	9	13	8	13	13	22	17	64
8 Sep	18.2	69	37	0	0	10.2	45	16	5.2	38	10	6	28	50	10
9 Sep	15	76	38	0	6.6	9.8	25	19	8	19	5	2.9	78	19	16
10 Sep	35	38	23	197	15.0	18.5	24	21	5	17	8	5.2	70	39	28
11 Sep	5	25	14	46	4.6	6.4	17	8	3.3	8	3.1	1.8	11	49	20
12 Sep	5	24	72	22	6.3	7.6	7	7	3.9	5.7	3.6	2.1	16	50	78
13 Sep	13	75	456	47	30.2	34.9	8	29.4	17.8	26.3	16.6	9.8	71	37	12
14 Sep	3	48	262	17	16.9	19.8	10	16.7	10.1	14.9	9.4	5.6	40	20	20
15 Sep	12	31	143	0	9.5	11.6	13	9.8	5.9	8.7	5.5	3.3	55	37	12
16 Sep	5.3	11	51	0	3.8	4.4	8	3.7	2.2	3.3	2.1	1.2	37	38	7
17 Sep	7.8	16	61	21	6.0	6.5	5	5.4	3.3	4.9	3.1	1.8	17	19	10
18 Sep	6.0	4	27	35	4.0	5.0	13	4.2	2.5	3.7	2.4	1.4	6	26	12
19 Sep	4.8	7	37	12	3.4	4.0	8	3.4	2.0	3.0	1.9	1.1	6	18	16
20 Sep	3.3	13	12	12	2.3	2.8	7	2.3	1.4	2.1	1.3	0.8	9	8	29
21 Sep	12.1	39	107	13	9.7	10.1	2	8.5	5.2	7.6	4.8	2.9	3	6	3
22 Sep	10.0	17	77	34	7.8	8.3	5	7.0	4.3	6.3	4.0	2.4	2	3	5
23 Sep	11.7	2	114	32	9.0	9.8	7.9	8.2	5.0	7.4	4.7	2.8	9	7	16
24 Sep	6.0	17	47	12	4.6	5.0	4.0	4.2	2.6	3.8	2.4	1.4	7	4	16
25 Sep	14.2	152	14	13	10.9	11.8	9.5	9.9	6.0	8.9	5.6	3.3	2	6	102
26 Sep	2.1	16	6	4.5	1.7	1.8	1.4	1.5	0.9	1.3	0.8	0.5	5	9	265
27 Sep	7.2	34	41	15.3	5.7	6.0	4.8	5.0	3.0	4.5	2.9	1.7	2	11	93
28 Sep	1.8	16	3	3.9	1.4	1.5	1.2	1.3	0.8	1.1	0.7	0.4	3.3	9	73
29 Sep	2.5	12	14	5.3	2.0	2.1	1.7	1.7	1.1	1.6	1.0	0.6	4.6	0.0	47
30 Sep	1.2	3	10	2.7	1.0	1.0	0.8	0.9	0.5	0.8	0.5	0.3	2.3	1.4	23
1 Oct	0.7	2	5	1.4	0.5	0.6	0.4	0.5	0.3	0.4	0.3	0.2	1.2	0.8	35
2 Oct	0.9	5	4	1.8	0.7	0.7	0.6	0.6	0.4	0.5	0.3	0.2	1.6	1.0	6
3 Oct	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
4 Oct	0.9	2	7	1.8	0.7	0.7	0.6	0.6	0.4	0.5	0.3	0.2	1.6	1.0	5
5 Oct	0.7	3	4	1.4	0.5	0.6	0.4	0.5	0.3	0.4	0.3	0.2	1.2	0.8	4
6 Oct	0.3	0	3	0.6	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.5	0.3	5
7 Oct	0.4	0	4	0.8	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.7	0.4	2
8 Oct	0.2	2	0	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.4	0.2	1
9 Oct	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4
10 Oct	0.7	3.1	4	1.5	0.3	0.6	0.5	0.5	0.3	0.4	0.3	0.2	1.2	0.8	1.5
11 Oct	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
12 Oct	0.2	0.8	1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.5
13 Oct	0.2	0.8	1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.2	0.3
Total	**4,951**	**11,393**	**9,513**	**5,255**	**2,823**	**6,166**	**5,252**	**7,311**	**4,404**	**2,931**	**3,535**	**1,188**	**3,009**	**3,898**	**5,740**
Weir Count	4,471	11,388	9,513	5,212	2,657	5,950	5,217	7,182	4,313	2,812	3,460	1,134	2,990	3,891	5,737
Difference	532	5	0	43	166	216	35	130	91	119	75	54	19	7	3

Shaded cells with whole numbers entries are the estimated best guess and shaded cells with values to one decimal place are interpolated (see below).
Missing values prior to 16 June were assumed to be zero.
Missing values between 16 and 21 June were filled-in using the EM algorithm applied to counts in June.
Missing values after 6 September were filled-in using the EM algorithm applied to counts in September and October.

Notes for 2002:

The 4,951 total is the Darroch estimates of 3,738 adults and 1,213 jacks (Van Alen 2004). Missing values on 30 August and 5 to 8 September were linerally interpolated and the remaining 295 fish were listed on 3 July when fish had passed through pulled pickets on the weir.

Notes for 2003:

The 11,393 total is the Darroch estimates with adults and jacks combined and three release and two recovery strata (Van Alen 2005). The 287 fish difference between the weir count that the Darroch estimate were added to the 98 fish actually counted on 1 September since many fish were known to have passed uncounted through pulled pickets on this date. These fish were apportioned between adults and jacks in the same proportion as the 98 fish counted.

Notes for 2008:

The 2,823 total is the sum of the Peterson mark-recapture estimate of 2,655 adults (SE=159, CV=6%) and 168 jacks (SE=53, CV=32%). We used the estimated daily proportions from an 2002 to 2005 EM fill-in to estimate the daily counts after 8 September (Van Alen 2009).

Table 5. Estimated cumulative daily proportion of adult and jack Sockeye Salmon escapement into Neva Lake, from 4 June to 12 October 2002 to 2005 and 2008 to 2018.

Date	2002	2003	2004	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average
4 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
17 Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
18 Jun	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
19 Jun	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
20 Jun	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
21 Jun	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.002	0.001	0.002	0.011	0.000	0.000	0.001	0.000	0.001
22 Jun	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.002	0.001	0.002	0.028	0.000	0.000	0.001	0.000	0.003
23 Jun	0.001	0.001	0.002	0.000	0.000	0.000	0.000	0.003	0.001	0.002	0.046	0.000	0.000	0.001	0.000	0.004
24 Jun	0.001	0.001	0.002	0.000	0.000	0.000	0.000	0.037	0.001	0.002	0.060	0.000	0.000	0.001	0.000	0.007
25 Jun	0.001	0.001	0.018	0.000	0.000	0.000	0.000	0.060	0.001	0.002	0.065	0.000	0.000	0.001	0.000	0.010
26 Jun	0.002	0.001	0.020	0.009	0.000	0.000	0.000	0.067	0.009	0.002	0.066	0.000	0.002	0.001	0.000	0.012
27 Jun	0.014	0.001	0.022	0.013	0.000	0.000	0.000	0.089	0.055	0.004	0.067	0.000	0.006	0.001	0.000	0.018
28 Jun	0.021	0.001	0.026	0.018	0.000	0.022	0.000	0.095	0.102	0.008	0.070	0.000	0.013	0.001	0.000	0.025
29 Jun	0.021	0.002	0.026	0.026	0.001	0.045	0.002	0.130	0.112	0.010	0.071	0.000	0.013	0.004	0.000	0.031
30 Jun	0.027	0.002	0.027	0.039	0.001	0.068	0.004	0.132	0.118	0.011	0.074	0.000	0.013	0.007	0.000	0.035
1 Jul	0.065	0.002	0.027	0.045	0.001	0.094	0.007	0.137	0.124	0.171	0.089	0.000	0.013	0.010	0.000	0.052
2 Jul	0.134	0.004	0.027	0.051	0.007	0.103	0.011	0.137	0.124	0.211	0.108	0.000	0.013	0.010	0.000	0.063
3 Jul	0.194	0.008	0.035	0.063	0.011	0.103	0.011	0.164	0.126	0.222	0.119	0.000	0.018	0.010	0.000	0.072
4 Jul	0.199	0.017	0.059	0.067	0.059	0.112	0.011	0.199	0.127	0.229	0.135	0.029	0.020	0.011	0.000	0.085
5 Jul	0.216	0.019	0.068	0.067	0.087	0.112	0.032	0.231	0.128	0.256	0.147	0.029	0.020	0.011	0.000	0.095
6 Jul	0.219	0.020	0.075	0.067	0.140	0.116	0.071	0.251	0.128	0.265	0.150	0.034	0.020	0.011	0.000	0.104
7 Jul	0.222	0.020	0.075	0.071	0.180	0.120	0.071	0.256	0.139	0.268	0.166	0.039	0.020	0.011	0.000	0.110
8 Jul	0.223	0.020	0.075	0.071	0.214	0.123	0.071	0.271	0.168	0.284	0.234	0.040	0.036	0.013	0.000	0.123
9 Jul	0.227	0.020	0.075	0.076	0.233	0.123	0.075	0.283	0.183	0.292	0.246	0.061	0.078	0.137	0.000	0.141
10 Jul	0.229	0.020	0.075	0.077	0.247	0.162	0.075	0.302	0.184	0.306	0.247	0.110	0.078	0.196	0.002	0.154
11 Jul	0.231	0.020	0.075	0.078	0.250	0.201	0.075	0.310	0.192	0.316	0.253	0.141	0.084	0.220	0.034	0.165
12 Jul	0.233	0.020	0.075	0.090	0.258	0.235	0.075	0.327	0.199	0.329	0.319	0.147	0.084	0.246	0.036	0.178
13 Jul	0.234	0.020	0.075	0.091	0.275	0.252	0.123	0.349	0.245	0.338	0.343	0.212	0.084	0.251	0.074	0.198
14 Jul	0.242	0.022	0.075	0.091	0.281	0.274	0.189	0.363	0.281	0.357	0.362	0.273	0.084	0.256	0.136	0.219
15 Jul	0.250	0.022	0.075	0.092	0.281	0.279	0.195	0.366	0.299	0.378	0.379	0.283	0.084	0.262	0.156	0.227
16 Jul	0.254	0.022	0.075	0.092	0.281	0.282	0.235	0.367	0.304	0.463	0.396	0.284	0.084	0.266	0.158	0.237
17 Jul	0.256	0.022	0.075	0.317	0.391	0.283	0.236	0.367	0.326	0.493	0.413	0.332	0.085	0.283	0.159	0.269
18 Jul	0.265	0.066	0.075	0.337	0.438	0.283	0.244	0.410	0.340	0.500	0.433	0.349	0.085	0.293	0.159	0.285
19 Jul	0.275	0.097	0.075	0.354	0.490	0.291	0.250	0.423	0.351	0.502	0.444	0.353	0.085	0.297	0.159	0.296
20 Jul	0.276	0.101	0.075	0.366	0.513	0.334	0.251	0.469	0.363	0.506	0.462	0.364	0.086	0.327	0.159	0.310
21 Jul	0.277	0.201	0.075	0.375	0.521	0.352	0.255	0.487	0.417	0.529	0.469	0.374	0.086	0.332	0.160	0.327
22 Jul	0.283	0.209	0.075	0.376	0.535	0.356	0.264	0.488	0.427	0.540	0.499	0.390	0.102	0.345	0.160	0.337
23 Jul	0.284	0.210	0.075	0.376	0.550	0.362	0.336	0.489	0.439	0.619	0.536	0.512	0.181	0.351	0.160	0.365
24 Jul	0.332	0.210	0.076	0.378	0.576	0.365	0.379	0.489	0.443	0.633	0.549	0.565	0.203	0.371	0.162	0.382
25 Jul	0.353	0.210	0.126	0.389	0.579	0.366	0.401	0.493	0.454	0.635	0.553	0.586	0.204	0.375	0.164	0.392
26 Jul	0.408	0.210	0.137	0.389	0.597	0.366	0.411	0.539	0.460	0.642	0.566	0.603	0.207	0.382	0.167	0.406
27 Jul	0.427	0.211	0.140	0.434	0.607	0.375	0.416	0.596	0.464	0.644	0.591	0.612	0.321	0.420	0.167	0.428
28 Jul	0.449	0.217	0.287	0.462	0.613	0.410	0.418	0.622	0.470	0.649	0.596	0.626	0.324	0.422	0.167	0.449
29 Jul	0.457	0.385	0.314	0.469	0.618	0.414	0.424	0.644	0.476	0.654	0.614	0.626	0.333	0.422	0.168	0.468
30 Jul	0.462	0.405	0.335	0.480	0.625	0.426	0.432	0.651	0.480	0.654	0.627	0.639	0.342	0.425	0.168	0.477
31 Jul	0.472	0.411	0.341	0.488	0.633	0.426	0.439	0.655	0.540	0.656	0.646	0.652	0.346	0.453	0.168	0.488
1 Aug	0.491	0.424	0.345	0.499	0.638	0.426	0.484	0.664	0.570	0.658	0.662	0.656	0.364	0.454	0.168	0.500
2 Aug	0.496	0.441	0.348	0.508	0.646	0.426	0.494	0.672	0.579	0.659	0.675	0.656	0.377	0.457	0.170	0.507
3 Aug	0.498	0.442	0.350	0.518	0.661	0.426	0.521	0.681	0.615	0.660	0.691	0.659	0.380	0.515	0.178	0.520
4 Aug	0.501	0.443	0.351	0.536	0.667	0.427	0.614	0.684	0.621	0.660	0.700	0.666	0.380	0.534	0.251	0.536
5 Aug	0.514	0.475	0.355	0.537	0.668	0.430	0.668	0.685	0.635	0.660	0.713	0.673	0.401	0.540	0.255	0.547
6 Aug	0.515	0.486	0.358	0.555	0.668	0.431	0.688	0.688	0.706	0.662	0.720	0.677	0.426	0.556	0.255	0.559

(continued)

Table 5. (page 2 of 2)

Date	2002	2003	2004	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average
7 Aug	0.520	0.493	0.359	0.568	0.668	0.431	0.700	0.692	0.772	0.662	0.740	0.681	0.437	0.574	0.261	0.571
8 Aug	0.593	0.520	0.359	0.584	0.668	0.431	0.717	0.694	0.795	0.665	0.751	0.686	0.442	0.584	0.453	0.596
9 Aug	0.635	0.529	0.359	0.599	0.668	0.450	0.747	0.694	0.819	0.671	0.783	0.694	0.462	0.598	0.527	0.616
10 Aug	0.664	0.530	0.414	0.607	0.668	0.470	0.763	0.695	0.849	0.677	0.800	0.706	0.476	0.613	0.580	0.634
11 Aug	0.687	0.530	0.586	0.613	0.668	0.526	0.767	0.696	0.858	0.679	0.809	0.714	0.492	0.624	0.586	0.656
12 Aug	0.729	0.550	0.606	0.618	0.745	0.535	0.775	0.706	0.876	0.679	0.816	0.715	0.508	0.632	0.598	0.673
13 Aug	0.737	0.562	0.627	0.620	0.789	0.536	0.797	0.711	0.896	0.680	0.830	0.726	0.516	0.641	0.610	0.685
14 Aug	0.744	0.620	0.637	0.629	0.834	0.546	0.802	0.712	0.903	0.680	0.840	0.745	0.530	0.663	0.639	0.702
15 Aug	0.760	0.682	0.640	0.637	0.839	0.559	0.817	0.715	0.911	0.682	0.854	0.756	0.538	0.665	0.646	0.713
16 Aug	0.768	0.703	0.642	0.648	0.844	0.630	0.827	0.787	0.913	0.683	0.864	0.765	0.557	0.667	0.652	0.730
17 Aug	0.779	0.710	0.647	0.648	0.846	0.733	0.830	0.822	0.915	0.683	0.870	0.768	0.569	0.674	0.657	0.743
18 Aug	0.793	0.711	0.652	0.648	0.851	0.793	0.874	0.839	0.919	0.684	0.875	0.788	0.588	0.677	0.664	0.757
19 Aug	0.803	0.711	0.654	0.659	0.851	0.810	0.881	0.863	0.921	0.684	0.885	0.813	0.613	0.683	0.671	0.767
20 Aug	0.811	0.712	0.661	0.671	0.851	0.849	0.888	0.883	0.923	0.685	0.895	0.836	0.628	0.691	0.699	0.779
21 Aug	0.822	0.716	0.661	0.684	0.861	0.872	0.889	0.891	0.929	0.686	0.901	0.858	0.641	0.700	0.711	0.788
22 Aug	0.838	0.723	0.664	0.709	0.863	0.880	0.891	0.898	0.933	0.687	0.906	0.882	0.647	0.712	0.735	0.798
23 Aug	0.847	0.729	0.665	0.733	0.863	0.882	0.893	0.906	0.936	0.692	0.912	0.887	0.650	0.718	0.741	0.804
24 Aug	0.853	0.731	0.666	0.738	0.894	0.887	0.895	0.919	0.938	0.881	0.917	0.889	0.671	0.723	0.752	0.824
25 Aug	0.861	0.736	0.666	0.738	0.906	0.891	0.897	0.929	0.939	0.889	0.924	0.891	0.678	0.736	0.765	0.830
26 Aug	0.867	0.742	0.666	0.748	0.906	0.895	0.907	0.939	0.939	0.897	0.930	0.894	0.695	0.743	0.768	0.836
27 Aug	0.874	0.746	0.706	0.758	0.906	0.903	0.915	0.945	0.943	0.901	0.934	0.902	0.711	0.747	0.771	0.844
28 Aug	0.882	0.750	0.720	0.775	0.919	0.913	0.921	0.950	0.949	0.901	0.938	0.905	0.719	0.751	0.802	0.853
29 Aug	0.887	0.752	0.723	0.787	0.919	0.919	0.933	0.953	0.952	0.902	0.945	0.911	0.729	0.756	0.807	0.858
30 Aug	0.897	0.806	0.724	0.796	0.929	0.938	0.938	0.955	0.952	0.905	0.950	0.912	0.732	0.764	0.809	0.867
31 Aug	0.910	0.821	0.725	0.819	0.929	0.940	0.943	0.957	0.957	0.907	0.951	0.914	0.734	0.780	0.811	0.873
1 Sep	0.915	0.855	0.725	0.829	0.934	0.945	0.948	0.959	0.958	0.911	0.954	0.918	0.749	0.796	0.812	0.881
2 Sep	0.932	0.905	0.725	0.835	0.936	0.950	0.952	0.962	0.963	0.913	0.956	0.920	0.762	0.806	0.814	0.889
3 Sep	0.937	0.915	0.762	0.842	0.936	0.951	0.955	0.964	0.968	0.915	0.959	0.925	0.774	0.820	0.816	0.896
4 Sep	0.943	0.919	0.797	0.848	0.941	0.954	0.956	0.968	0.972	0.920	0.960	0.930	0.785	0.846	0.817	0.904
5 Sep	0.949	0.924	0.808	0.856	0.941	0.963	0.956	0.969	0.973	0.926	0.962	0.936	0.788	0.866	0.818	0.909
6 Sep	0.954	0.929	0.816	0.873	0.941	0.965	0.956	0.972	0.974	0.929	0.968	0.938	0.829	0.875	0.818	0.916
7 Sep	0.958	0.933	0.821	0.894	0.941	0.967	0.956	0.973	0.977	0.931	0.971	0.949	0.836	0.879	0.829	0.921
8 Sep	0.962	0.939	0.825	0.894	0.941	0.969	0.964	0.975	0.978	0.944	0.974	0.954	0.845	0.892	0.831	0.926
9 Sep	0.965	0.946	0.829	0.894	0.944	0.970	0.969	0.978	0.980	0.951	0.976	0.957	0.871	0.897	0.834	0.931
10 Sep	0.972	0.949	0.832	0.932	0.949	0.973	0.974	0.981	0.981	0.957	0.978	0.961	0.895	0.907	0.839	0.939
11 Sep	0.973	0.951	0.833	0.941	0.950	0.974	0.977	0.982	0.982	0.959	0.979	0.963	0.898	0.919	0.842	0.942
12 Sep	0.974	0.953	0.841	0.945	0.953	0.976	0.978	0.983	0.983	0.961	0.980	0.964	0.904	0.932	0.856	0.945
13 Sep	0.977	0.960	0.889	0.954	0.963	0.981	0.980	0.987	0.987	0.970	0.984	0.973	0.927	0.942	0.858	0.955
14 Sep	0.977	0.964	0.916	0.957	0.969	0.984	0.982	0.989	0.989	0.975	0.987	0.977	0.940	0.947	0.862	0.961
15 Sep	0.980	0.967	0.931	0.957	0.973	0.986	0.984	0.990	0.990	0.978	0.989	0.980	0.959	0.956	0.864	0.966
16 Sep	0.981	0.968	0.937	0.957	0.974	0.987	0.986	0.991	0.991	0.980	0.989	0.981	0.971	0.966	0.865	0.968
17 Sep	0.982	0.969	0.943	0.961	0.976	0.988	0.987	0.992	0.992	0.981	0.990	0.983	0.977	0.971	0.867	0.971
18 Sep	0.983	0.970	0.946	0.968	0.978	0.989	0.989	0.992	0.992	0.982	0.991	0.984	0.979	0.977	0.869	0.973
19 Sep	0.984	0.970	0.950	0.970	0.979	0.990	0.991	0.993	0.993	0.983	0.991	0.985	0.981	0.982	0.871	0.974
20 Sep	0.985	0.971	0.951	0.972	0.980	0.990	0.992	0.993	0.993	0.984	0.992	0.985	0.984	0.984	0.877	0.976
21 Sep	0.988	0.975	0.962	0.975	0.983	0.992	0.992	0.994	0.994	0.987	0.993	0.988	0.985	0.986	0.877	0.978
22 Sep	0.990	0.976	0.970	0.981	0.986	0.993	0.993	0.995	0.995	0.989	0.994	0.990	0.985	0.986	0.878	0.980
23 Sep	0.992	0.976	0.982	0.987	0.989	0.995	0.995	0.996	0.996	0.991	0.996	0.992	0.988	0.988	0.881	0.983
24 Sep	0.993	0.978	0.987	0.989	0.991	0.995	0.996	0.997	0.997	0.993	0.996	0.993	0.991	0.989	0.883	0.985
25 Sep	0.996	0.991	0.989	0.992	0.995	0.997	0.997	0.998	0.998	0.996	0.998	0.996	0.991	0.991	0.901	0.988
26 Sep	0.996	0.993	0.989	0.993	0.995	0.998	0.998	0.998	0.998	0.996	0.998	0.997	0.993	0.993	0.947	0.992
27 Sep	0.998	0.996	0.994	0.996	0.997	0.999	0.999	0.999	0.999	0.998	0.999	0.998	0.994	0.996	0.964	0.995
28 Sep	0.998	0.997	0.994	0.996	0.998	0.999	0.999	0.999	0.999	0.998	0.999	0.998	0.995	0.998	0.976	0.996
29 Sep	0.999	0.998	0.995	0.997	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.996	0.998	0.985	0.997
30 Sep	0.999	0.998	0.997	0.998	0.999	0.999	0.999	1.000	1.000	0.999	0.999	0.999	0.997	0.999	0.989	0.998
1 Oct	0.999	0.999	0.997	0.998	0.999	0.999	0.999	1.000	1.000	0.999	1.000	0.999	0.997	0.999	0.995	0.999
2 Oct	0.999	0.999	0.997	0.999	0.999	1.000	1.000	1.000	1.000	0.999	1.000	0.999	0.998	0.999	0.996	0.999
3 Oct	0.999	0.999	0.997	0.999	0.999	1.000	1.000	1.000	1.000	0.999	1.000	0.999	0.998	0.999	0.996	0.999
4 Oct	0.999	0.999	0.998	0.999	0.999	1.000	1.000	1.000	1.000	0.999	1.000	0.999	0.998	0.999	0.997	0.999
5 Oct	1.000	0.999	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	0.999	0.997	0.999
6 Oct	1.000	0.999	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	0.998	0.999
7 Oct	1.000	0.999	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	0.999	1.000
8 Oct	1.000	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	0.999	1.000
9 Oct	1.000	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.000
10 Oct	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
11 Oct	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
12 Oct	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
13 Oct	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

The boxes and lines delineate the median, second and third quartiles, and 80% fish passage dates.

Age, Sex, and Length Composition

In 2018, 100 Sockeye Salmon were sampled for age (three scales/fish), sex, and length (mid-eye-to-fork) data. Project personnel captured 70 fish beach seining off the mouth of the main inlet stream on 7 September and 30 fish seining beach spawners at the southeast end of the lake on 10 October. Both freshwater and marine ages could be determined from only 6 of the 100 fish sampled due to scales that were regenerated, resorbed, mounted upside down, or obscured. The freshwater ages alone were readable from 51 females and 31 males and all were freshwater-age-1.

Comparing the age compositions of the Neva Lake Sockeye escapements from 2002 to 2016 shows that freshwater-age-1 fish have typically dominated the runs, with age-1.2 and 1.3 being the most abundant (Table 6). Nevertheless, freshwater-age-2 fish were 30% , 32%, 73%, and 20% of the Sockeye Salmon aged in 2006, 2010, 2012, and 2014, respectively.

Table 6. Age composition of the Sockeye Salmon escapement into Neva Lake, 2002 through 2018.

		Age							
Year	Sample Size	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2
2002	606	22%	45%	28%		4%			
2003	1054	20%	71%	5%	2%	2%	1%		
2004	480	10%	70%	16%		4%			
2005	444	3%	43%	40%	2%	11%	2%		
2006	205		19%	51%		28%	2%		
2007	115	15%	61%	16%	6%		3%		
2008	360	6%	58%	25%	3%	7%	1%		
2009	290	9%	33%	49%	2%	6%	1%		
2010	87	9%	35%	24%	5%	26%	1%		
2011	90		33%	52%	2%	6%	7%		
2012	91	1%	7%	19%		16%	2%		55%
2013	147	1%	90%	2%		3%		2%	2%
2014	92	4%	22%	53%		10%	1%		10%
2015	59		90%			2%	5%		3%
2016	20	40%	5%	50%		5%			
2017	2	50%		50%					
2018	6	33%	67%						

Stream Temperature and Depth

We have only limited new data to report from the temperature and temperature and pressure (depth) data loggers in Neva Lake's inlet and outlet streams since 28 September 2016. On 28 September 2017, the files on the three temperature and pressure data loggers were downloaded onto a data shuttle but an unrecoverable error occurred when trying to upload and process the

files. Several attempts were made during the 2018 field season to download and recover the logger data, but they were mostly unsuccessful. The only temperature data that could be recovered was from an outlet stream temperature logger, which recorded the temperature between 28 September 2017 and 7 September 2018 (**Error! Reference source not found.**).

We will continue to attempt to download the loggers at the start of the 2019 season. On 28 September 2017 we also switched out the stream and air temperature data loggers at the outlet and sent them to the Aquatic Restoration and Research Institute (ARRI 2013). The temperature data from these loggers is not available for this report but will be available for future reports.

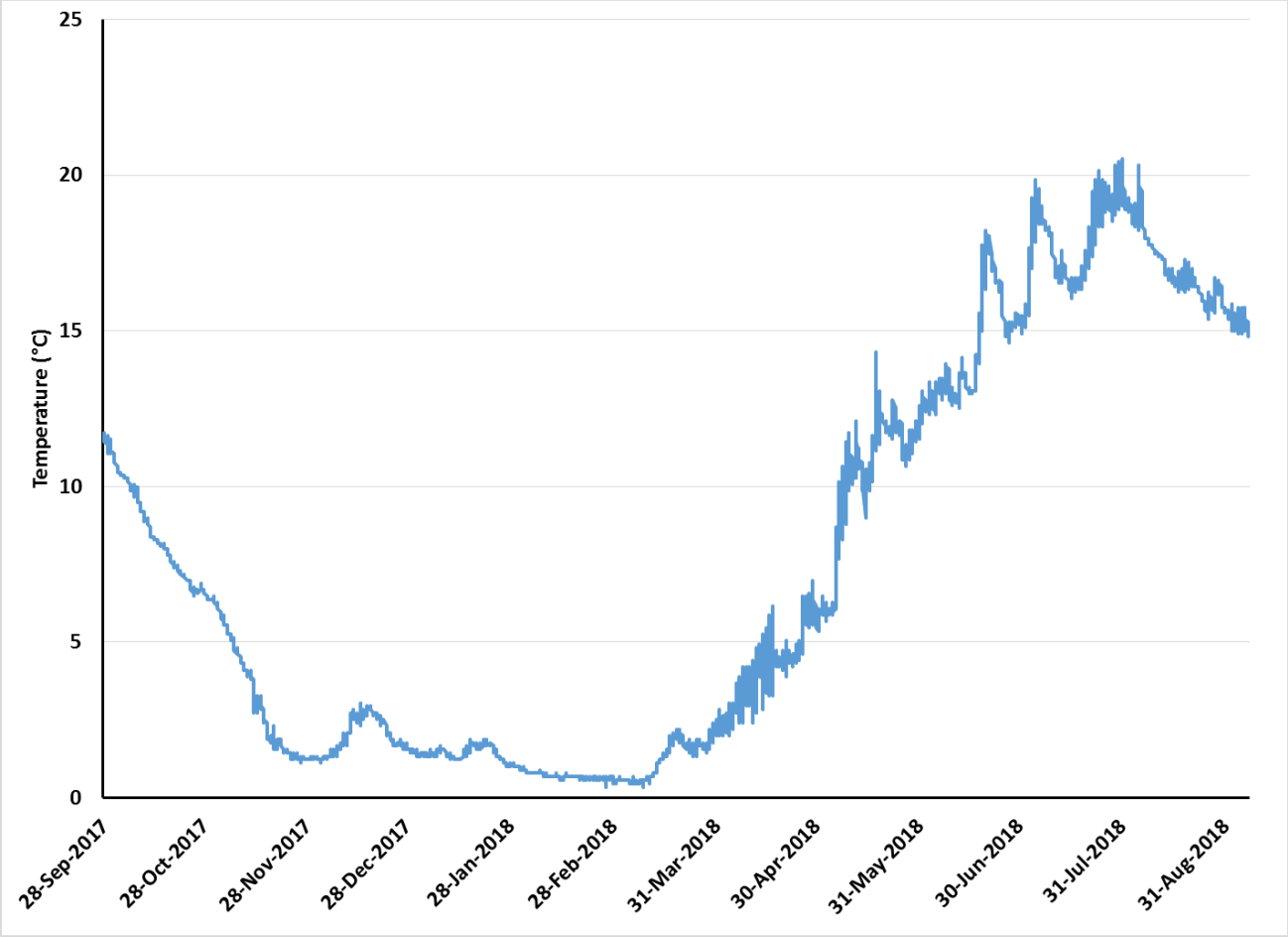


Figure 21. Water temperature at the Neva Lake outlet stream, 28 September 2017 through 7 September 2018.

DISCUSSION

In 2018, we estimate that 5,740 Sockeye Salmon escaped into Neva Lake. This was the cumulative maximum daily count of 5,737 fish through the video chutes plus 3 fish that were estimated to have entered the lake after the weir was pulled for the season (

Table 3). This was the third year of increasing escapements into Neva Lake, reversing a trend of declining escapements between 2011 and 2015. (Table 7). This increase in escapement is a welcome development given the importance of Neva Lake Sockeye Salmon as a subsistence resource for the area. The lower escapements of recent years has prompted a reduction in subsistence harvest limits and made it more difficult for users to meet their subsistence needs.

Table 7. Annual estimates of the escapement of Sockeye Salmon into Neva Lake, 2002 to 2018.

Year	Total	Escapement Estimate Method
2002	4,951	picket weir to spawning area mark-recapture
2003	11,393	picket weir to spawning area mark-recapture
2004	9,513	picket weir to spawning area mark-recapture
2005	5,255	picket weir to spawning area mark-recapture
2006	5,931	picket weir to spawning area mark-recapture
2007	5,993	picket weir to spawning area mark-recapture
2008	2,823	picket weir to video and spawning area mark-recapture
2009	6,166	picket weir to video weir mark-recapture
2010	5,252	redundant video weirs
2011	7,311	redundant video weirs
2012	4,404	redundant video weirs
2013	2,931	redundant video weirs
2014	3,535	redundant video weirs
2015	1,188	redundant video weirs
2016	3,009	redundant video weirs w/syncronized cameras
2017	3,878	redundant video weirs w/syncronized cameras
2018	5,747	redundant video weirs w/syncronized cameras

In 2018, the video counts appear to be reliable estimates of the daily escapement of Sockeye Salmon into the lake. With the ability to view synchronized video from all chute cameras at the same time using the Blue Iris program on the computer, project personnel were able to reliably track and count each Sockeye Salmon that swam through the chute and into the lake. However, it was difficult to distinguish between adult and jack Sockeye Salmon in the video review and jacks were often counted as adults.

The counts of Dolly Varden and Cutthroat Trout should be regarded as a rough indicator of abundance, rather than absolute counts. Some individuals of these two species were seen to pass back and forth through the weir many times, confounding attempts to reliably count each fish only once. The author re-reviewed several days of video after the season and found the counts of Sockeye Salmon were consistent with the counts made inseason.

Unlike the traditional picket weirs, where fish are physically passed or visually counted at the schedule of project personnel, the video technology used by this project allowed the fish to migrate into the lake whenever they choose and with less exposure to predators. From 2002 to 2009, there were often bears fishing behind the weir or trying to get into the trap. Since the transition to swim-through weirs, without the weir holding fish back, project personnel have only observed bears transiting the area and none actively feeding at the weir site.

While bear predation was not an issue in 2018, beaver activity at the weir was. Beavers frequently attempted to plug the video chute with rocks, wood, and vegetation, which obstructed fish passage through the chute. While they were stationed in Excursion Inlet, the project crew could remove any beaver-placed debris within hours, but once they moved to Hoonah, frequent visits to the site weren't feasible. To exclude beavers from the chute, we placed a cage of heavy fencing material with 8" square mesh openings around the chute (**Error! Reference source not found.**). To allow fish to pass through the cage, we fastened several "crab finger" devices, designed for use in crab pots, to the exit of the cage. The beaver excluder worked well, and no beavers placed debris in the chute after it was installed. However, we observed more fish circling in the cage or passing downstream back through the chute, which complicated counting and likely reduced the accuracy of the count. We also monitored the inside of the cage with a separate camera after it was installed, and observed that Sockeye Salmon and other fish could pass easily through the fencing mesh as well as through the crab fingers, and that many fish swam freely in and out through the mesh. In future seasons, we will attempt to develop a way to exclude beavers from the video chute while still encouraging fish to pass through unimpeded.

Figure 22. Beaver-excluding fencing with "crab finger" exit gate around the Neva Lake weir video chute, 2018.

The timing of Sockeye Salmon passing through the weir was later than usual, which appeared to be the result of a dryer than usual summer. The June-September total rainfall in Juneau was 15.12 inches, which was 7.13 inches below normal (National Weather Service 2018). The first Sockeye Salmon was counted at the weir twelve days later than the previous record, and relatively few fish were counted through the month of July, which is typically the peak of passage into the lake. Pulses of Sockeye Salmon entering the lake tended to be associated with rain events when they did occur (**Error! Reference source not found.**).

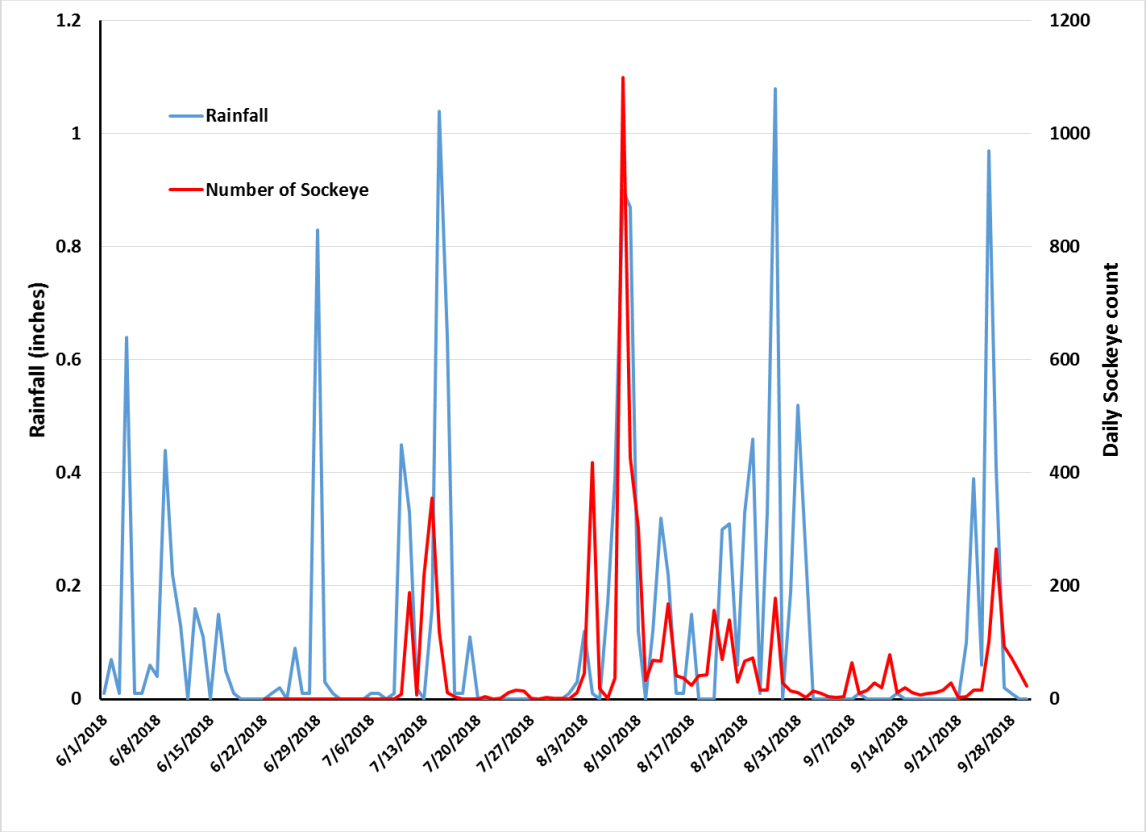


Figure 23. Number of Sockeye Salmon counted at the Neva Lake weir and daily rainfall at the National Weather Service Station, Juneau.

In previous years, scale sampling was intended to determine the age structure (i.e. freshwater and saltwater ages) of Neva Lake Sockeye Salmon. In the past few years, complete ages could be determined for only a small fraction of fish sampled, which prevented making meaningful estimates of age structure (Table 6). In many cases, the outer circuli of most sampled scales were resorbed, preventing the determination of marine ages. The exact reasons for this are unclear, but a similar pattern has been seen in other Sockeye Salmon stocks in the region, and may be related to poor marine growth in the later years at sea (Iris Frank, ADF&G, pers. Comm.).

Under current rates of scale ageability, the number of scale samples needed for valid estimates of age composition would be prohibitive. In response, we have adjusted the study objectives to assessing the freshwater life history of returning fish, rather than the complete age structure. The age at outmigration is related to the growth rate of rearing juveniles (Groot and Margolis 1991; Honnold and Schrof 2004), so the proportion of fish that smolt at age 1 is an indirect measure of rearing conditions. All 88 of the Sockeye Salmon sampled were freshwater age 1, suggesting that the population of rearing juveniles is within the carrying capacity of Neva Lake, and production is likely not being limited by the quantity or quality of rearing habitat in the lake.

CONCLUSIONS

1. The Sockeye Salmon run into Neva Lake is an important subsistence resource for rural residents from Hoonah, Excursion Inlet, and Gustavus and non-rural residents from Juneau. Subsistence harvests have declined in recent years due to lower abundance and reduced harvest limits.

2. This project was the result of the cooperative effort between the Alaska Department of Fish and Game, the Hoonah Indian Association, and the U.S. Forest Service to estimate the escapement and age composition of Sockeye Salmon into Neva Lake. This report for the Fisheries Resource Monitoring Program study 14-612 summarizes the 2018 escapement and age composition, as well as results back to the project's inception in 2002.

3. We estimate that 5,740 Sockeye Salmon escaped into Neva Lake in 2018. For comparison, the escapement estimates were 4,951; 11,393; 9,513; 5,255; 5,931; 5,993; 2,823; 6,166; 5,252; 7,311, 4,404, 2,931, 3,535, 1,188, 3,009, and 3,898 fish from 2002 to 2017, respectively.

4. The 2018 run timing was later than normal, likely due to a dry summer and low stream flows. The first Sockeye Salmon was late to arrive, and the run continued longer than usual into the fall. In 2018, the midpoint of the run was on 9 August and 80% of the run had entered into Neva Lake between 14 July and 24 September. On average, from 2002 through 2016, the midpoint is on 30 July and 80% of the Sockeye Salmon have migrated into Neva Lake between 4 July and 2 September.

5. There are two main runs of Sockeye Salmon into Neva Lake – an earlier run of fish that spawn in the main inlet stream and a later run of fish that spawn in beach spawning areas.

6. Freshwater-age-1 fish usually dominate the Sockeye escapement but in 2006, 2010, 2010, and 2014, freshwater-age-2 and 3 fish comprised 30%, 32%, 73%, and 20% of the samples. In 2018, all 88 the fish sampled with readable freshwater ages was freshwater-age-1.

RECOMMENDATIONS

We recommend the continued monitoring and assessment of the Neva Lake Sockeye Salmon stock using this remotely monitored, double-redundant, 24/7 swim through video weir system. This system has proven to be a reliable way of counting fish as they migrate freely into Neva Lake. Analog cameras and recorders should probably be replaced with digital POE (Power-Over-Ethernet) cameras and recorders to simplify wiring and improve system performance. Motion-triggered video from the chute cameras should continue to be saved on recorders both on- and off-site for redundancy.

ACKNOWLEDGEMENTS

This study is a cooperative effort among the Hoonah Indian Association (HIA), the Alaska Department of Fish and Game (ADF&G), and the USDA Forest Service (USFS). Thank you to David See for managing the HIA contract and the employees. We would also like to thank HIA employees Gerard White Jr., Gerard White Sr., and Michael J. Williams. These folks worked hard this year to accomplish project objectives safely and efficiently.

We thank Iris Frank at ADF&G for processing the salmon age, sex, and length data that we needed to understand the composition of the Sockeye Salmon stock that escaped into Neva Lake.

We thank the Southeast Alaska Regional Advisory Council and the Federal Subsistence Board for recognizing the importance of this project to maintaining healthy Sockeye Salmon runs into Neva Lake. Lastly, we thank the residents of Hoonah who have long valued the wise management of Neva Lake Sockeye Salmon.

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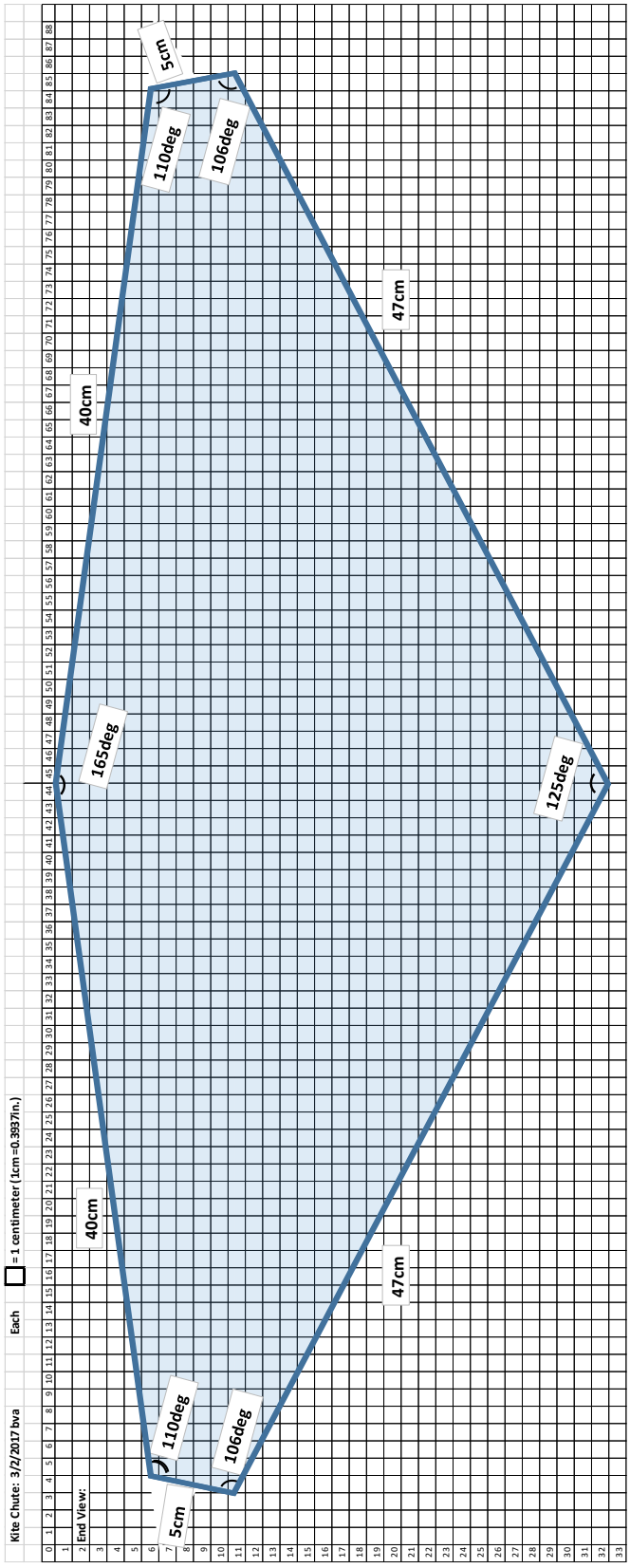
APPENDICES

Appendix A. End view of the 70cm long “kite” chute used at Neva Lake video weir, 2018.



Appendix B. Parts list for the mini-DVR-based fish video system used at Neva Lake, 2011-2018.

Component	Description	Cost Each (plus shipping)
Mini-DVR (digital video recorder). A mini-DVR is needed for each camera and for each video review station. YOKO Technology Corporation, "SecuMate Pro Portable Security Recorder", (Model RYK-9122 has MPEG4 video compression and Model RYK-9114 has H.264 video compression). We recommend using the MPEG4 model.	Portable, pocket size, solid state, one channel DVR for compressed motion detect recording and full-featured playback of video files in non-proprietary format. Video files are stored on SD or SDHC memory cards with capacity up to 32GB. Available from multiple vendors on the Web.	$125 to $190
SD or SDHC Memory Card(s). One or more pairs of SD cards are needed for each camera/mini-DVR unit.	Class 2, 4, or 6 SD (secure digital) or SDHC (secure digital high capacity) memory cards. Available from multiple vendors on the Web or local stores.	8Gb - <$12ea
Underwater Camera(s). There can be two cameras in each video chute - a left camera and a right camera.	Model YCC-350LWW-6S from Jet Security USA, Inc. (www.jetsecurityusa.com). 1/3" Sony Super HAD CCD color camera with 3.6mm lens in underwater housing with independently powered bright white LED lights built into the housing. Put heat shrink tubing over both the camera body and cable connection (i.e., 1.3 in 6:1 Dual Wall Heat Shrink from www.cableorganizer.com).	$240 (camera w/LEDs), $60 (10M cable), $170 (50M cable)
Monitor(s). Monitors are needed to check video quality and DVR settings in the field and to review video footage back in the camp or office. If both DVR's are in the same system (battery) box then the operator can use one, two-channel, monitor to view both DVR's.	Portable, 12V dc powered, 7" diagonal, TFT LCD, 2 channel, color monitor with auto on/off. Available from multiple vendors on the Web.	$100
LED light bar(s). One to four light bars are used to illuminate the inside of the video chute.	SeaMaster Lights (www.SeaMasterLights.com), 12V dc, 0.20 watt, 25cm light bar with 15 white LED's in a IP68 rated waterproof housing. Purchased from local or online marine supply vendor	$34
Dusk-to-Dawn Sensor. Photoelectric switch for turning the lights on at dusk and off at dawn.	Flexcharge (www.flexcharge.com), Night Watchman 10A Dusk to Dawn Controller. Multiple vendors on Web.	$30
Solar Panel.	Kyocera KD-135SX-UPU 135W panel (7.63 Amps @ 17.7Vmp) with standard junction box. Available from multiple vendors on the Web.	$431
Charge controller.	Morningstar ProStar-30M (12V dc 30 amp w/ meter). Multiple vendors on the Web.	$164
Battery. 12V DC AGM 80-115Ah w/ bolt terminals	Purchased from local vendor.	$241
Converters. 12V-12V dc converter for powering CCD camera, LED lights, and monitors and 12V-5V dc converter for powering mini-DVRs.	DC/DC converters should be IP67+ rated and have continuous short circuit protection (www.dogcamsport.co.uk sells 12V and 5V wiring kits with the converters encapsulated in rubber).	$34 (per kit)
Enclosure. Weatherproof housing for battery, charge controller, DC/DC voltage converters, two mini-DVRs, two channel monitor, and associated wiring.	Group 27 or 31 size plastic battery box (from local marine and auto parts stores) with custom hinged lid(s).	$17
2.1MM plugs, male, 18 AWG	Available from multiple vendors on the Web.	$3
Video Chute. Aluminum w/ visor.	Custom welded from 1/8" sheet aluminum (Appendix B). Primed and painted (Pettit Marine Paint, Shipendec, 3333 Newport Green) inside. Mounts/holes for one to four 25cm LED light strips on top and paired cameras, meter sticks, location plates, sun visor on upstream end, and attachment for picket or net weir on downstream end.	$300 for materials

Appendix C. Parts list for the remote monitoring system used at Neva Lake, 2018.

Component	Description	Approx. cost each (plus shipping)
Weir station		
Wireless bridge	Ubiquiti Networks PowerBeam M5 400	$100
Managed network switch	Netonix WS-12-250-DC	$380
Video encoder (4 channel)	Axis M7014	$260
Video encoder (1 channel)	Axis M7001	$210
Solar charge controller	Victron BlueSolar MPPT 100/30	$200
IP video cameras (2)	Amcrest IP3M-954EW	$110
Solar panels (12)	Kyocera KD-145SX-UPU, 145 watt	$431
Batteries (4)	12 volt, 80 amp-hour absorbed glass mat (AGM)	$240
Repeater station		
Wireless bridges (2)	Ubiquiti Networks PowerBeam M5 400 ISO	$120
Managed network switch	Netonix WS-12-250-DC	$380
Remote system monitor	Tycon Power Systems TP-DIN-Monitor-WEB	$125
Solar charge controller	Morningstar SunSaver SS-MPPT-15L	$210
IP video camera	Amcrest IP3M-954EW	$110
Batteries (6)	12 volt, 115 amp-hour absorbed glass mat (AGM)	$240
Solar panels (3)	Kyocera KD-145SX-UPU, 145 watt	$431
Recording station		
Wireless bridge (to repeater)	Ubiquiti Networks PowerBeam M5 400	$100
Router	Linksys WRT-54G wireless broadband router	$40
Computer workstation	Hewlett-Packard EliteDesk 800	$500
Surveillance software	Perspective Software Blue Iris v. 4.3.9.7	$60

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