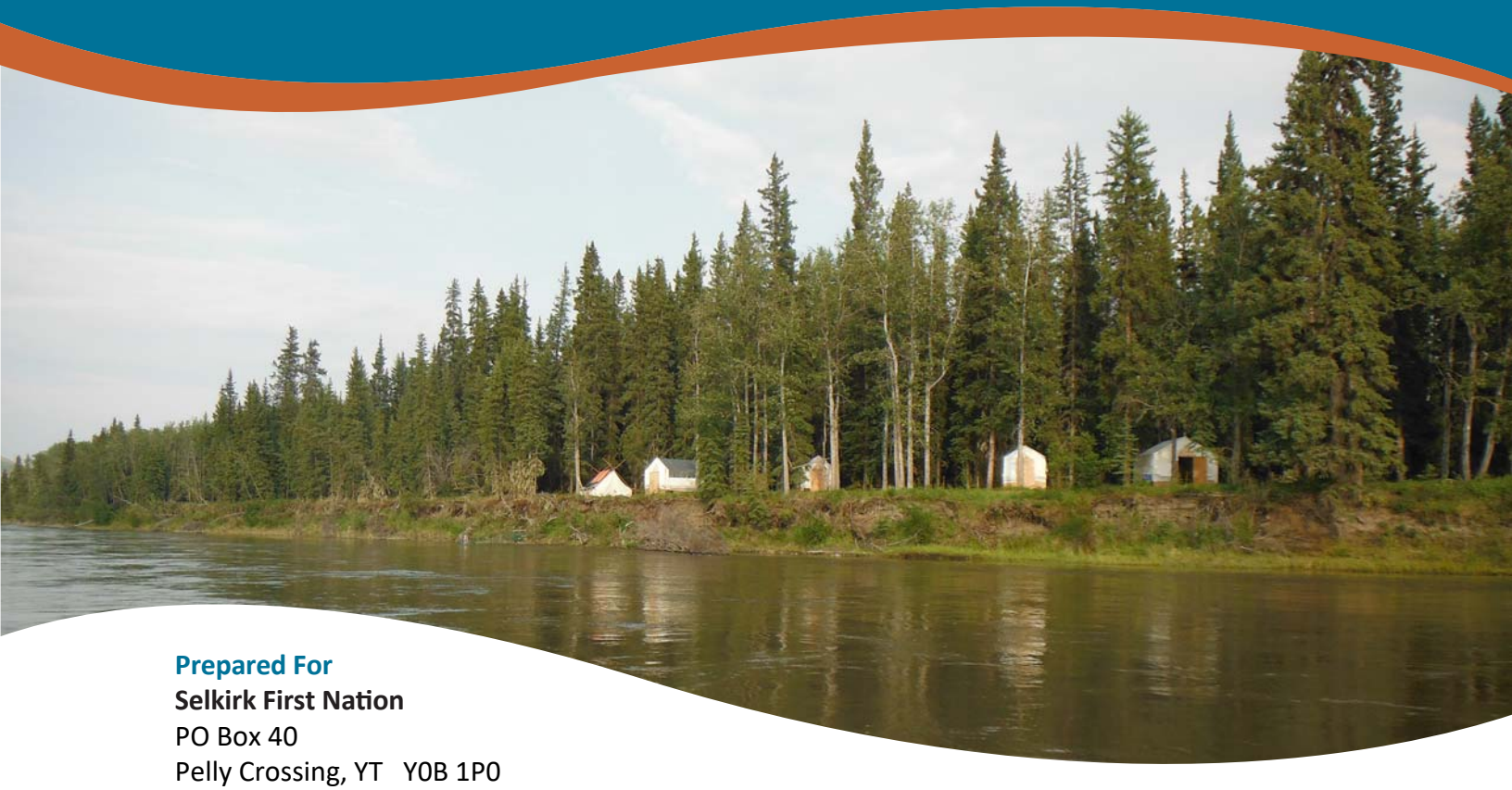
# 2017 Pelly River Chinook Salmon Sonar Program

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Down to Earth Biology

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# EXECUTIVE SUMMARY

In 2017, Selkirk First Nation conducted the second year of a Chinook salmon sonar enumeration program at a location on the Pelly River approximately 24 km downstream of the community of Pelly Crossing, Yukon. The objectives of this project were to enumerate Chinook salmon in the lower Pelly River, conduct test netting to confirm sonar counts between Chinook and other fish species, to collect age, sex, and length data from captured Chinook, and to build capacity for sonar and fisheries research projects in Pelly Crossing.

A Simrad EK60 split-beam sonar system and an ARIS Explorer 1800 multi-beam sonar system were used to enumerate Chinook salmon passing the sonar site from July 3 to August 15, 2017. In conjunction with the sonar data collection, set netting and drift netting (both onshore and offshore) were conducted near the sonar site to determine the extent of utilization of the sonar site by adult freshwater fish during the period of operation. Local Selkirk First Nation technicians assisted with much of the field work for this program, and received technical training related to the operation of a sonar system, fisheries data management, and test netting.

A net raw upstream total of 8,588 fish targets were counted during the period of operation of this program. Set netting from July 4 to August 15 captured a total of 18 Chinook salmon, 16 adult freshwater fish and no chum salmon. Offshore drift netting was conducted from July 4 to August 15 with the goal of capturing any Chinook salmon that were moving through the non-ensonified section of the river due to the gap between the sonar beams; no fish were captured. Onshore drift netting was conducted from August 2 to 15 to specifically target early migrating chum salmon; no chum salmon were captured. It is believed that no co-migrating chum salmon occurred during operation of the sonar program. Test netting and sonar data indicated that adult freshwater fish were present in small numbers relative to the amount of migrating Chinook salmon.

Post-season interpolation of missing data periods increased the net upstream Chinook salmon passage estimate to 8,778 for the period from July 3 to August 15. Run expansion of the Chinook sonar counts was conducted; an additional 303 Chinook salmon are estimated to have migrated past the sonar site after the field program operations ceased on August 15. Including run expansion data, a final interpolated estimate of 9,081 Chinook salmon migrated past the Pelly River sonar site in 2017.

## ACKNOWLEDGEMENTS

Funding for this project was provided by the Yukon River Panel Restoration and Enhancement Fund. Eugene Alfred and Jennifer Lee of the Selkirk First Nation Government provided general project direction and assistance with logistics. Vesta Mather and Joel Harding (Fisheries and Oceans Canada) provided technical advice during this project. Local field crew members Keifer Johnnie, Thor Harper, and Daniel Jules provided field support to ensure the project's success. Staff including Styd Johnson from the Selkirk First Nation Lands Department also contributed logistical support.

## AUTHORSHIP

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Joel MacFabe, Emily McDougall, and Kristina Beckmann of EDI were additional field crew members who also contributed to the success of the program.

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# 1 INTRODUCTION

Information on background, objectives, and study area are presented in the following sections.

## 1.1 BACKGROUND

The Pelly River is a major tributary to the Yukon River and supports the Selkirk First Nation's (SFN) Chinook salmon (*Oncorhynchus tshawtychya*) fishery. This river is a large contributor of Canadian origin Yukon River Chinook salmon as determined from genetic sampling at the Eagle, Alaska sonar site just downstream of the Canada/U.S. border. Genetic samples collected at the border indicate that on average, 12.9% of the Chinook salmon entering the Canadian portion of the Yukon River are destined for spawning areas within the Pelly River[1] (JTC 2016).

Although the Chinook salmon enumeration weir on Blind Creek (near Faro, Yukon) did not operate in 2017 due to extreme high-water levels, the weir normally provides an index of escapement on an important spawning tributary to the upper Pelly River. The weir is located approximately 350 km upstream of the community of Pelly Crossing and does not provide an in-season estimate of Chinook salmon in the Pelly River downstream of Pelly Crossing (hereafter referred to as the lower Pelly River). Until the establishment of the Pelly River Chinook sonar program, there was no stock assessment of Chinook salmon in the lower Pelly River to gauge the accuracy of the estimate produced through genetic stock identification. The results of genetic analyses are not available until after the Chinook run has finished; therefore, this technique cannot be used to manage harvest in-season. Current in-season harvest management is dictated by the Canada/U.S. border escapement estimates. This system does not allow for localized management of specific salmon stocks that may have higher or lower returns than what is indicated by the border estimates.

SFN has taken an active role in the management and conservation of Chinook salmon in the Pelly River through a locally developed Salmon Management Plan. A significant component of the plan includes developing an SFN operated stock assessment program for Chinook salmon on the Pelly River. In support of this goal, SFN located a candidate site in 2015 and completed the first season of sonar enumeration for Chinook salmon from July 1 to August 3, 2016. A second season of sonar enumeration was completed from July 1 to August 15, 2017 (this season).

## 1.2 OBJECTIVES

SFN is committed to improving the management capacity for Chinook salmon in the Pelly River. SFN applied for and received funding from the Yukon River Panel's Restoration and Enhancement Fund to complete the 2017 Chinook salmon sonar enumeration program. The field portion of this program was

[1] Proportion of Canadian origin Chinook salmon destined for the Pelly River averaged 12.9% from 2008 to 2014; the minimum and maximum range was 9.3% to 23.9%, respectively, since 2005; and was 18.2% in 2015 (JTC 2016).

planned for up to seven weeks and was conducted from the end of June to mid August. The primary objectives of the 2017 Pelly River Chinook salmon sonar program were to:

- Develop an accurate, in-season stock assessment tool to estimate the annual passage rates for Chinook salmon in the Pelly River;
- Conduct test netting to confirm species in the sonar count data between Chinook salmon and all other fish species (including chum salmon [*Oncorhynchus keta*] and larger freshwater fish species); and
- Build local capacity, through technical training and full-time employment for local SFN citizens throughout the program.

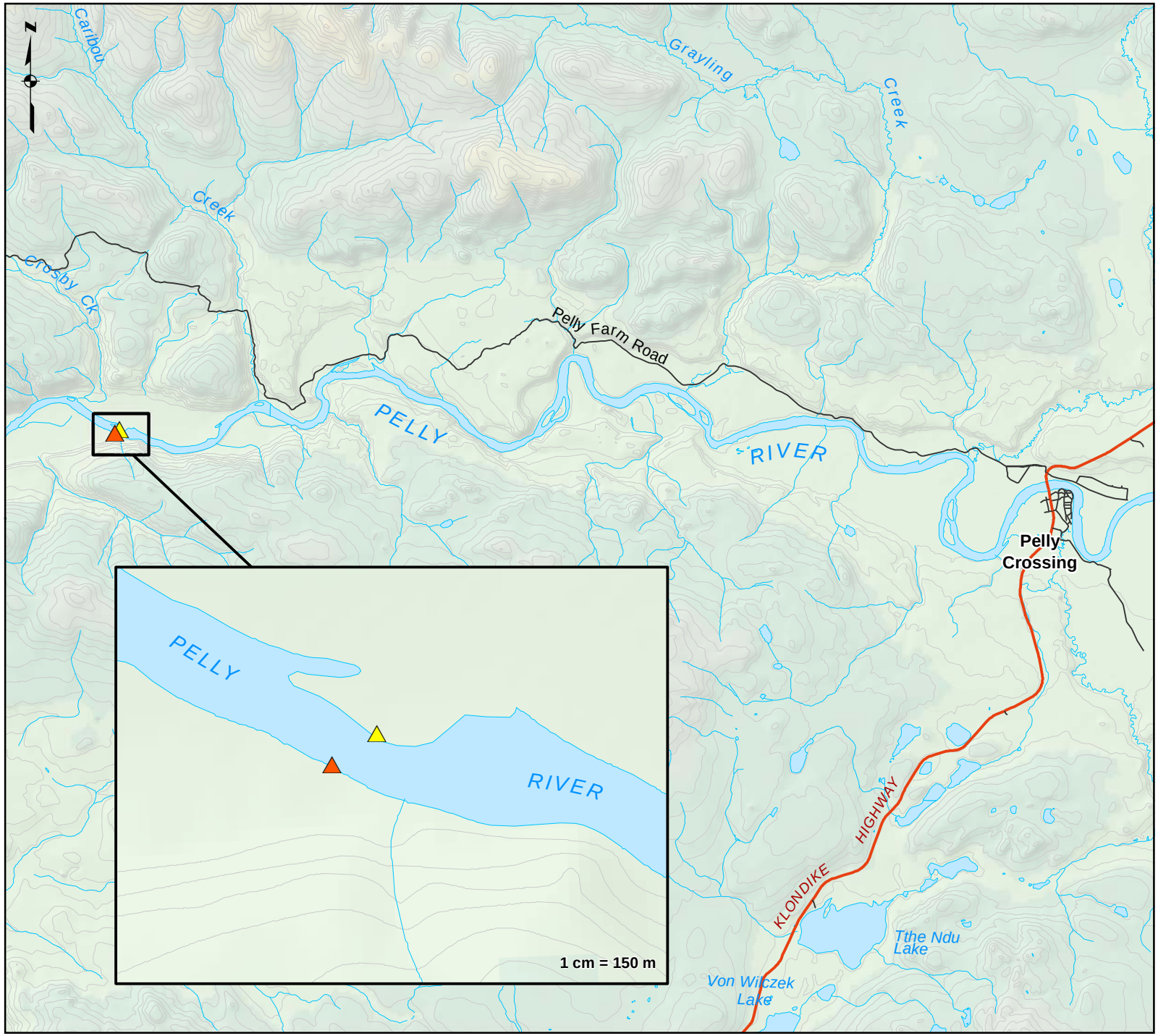
Additional objectives of the project include:

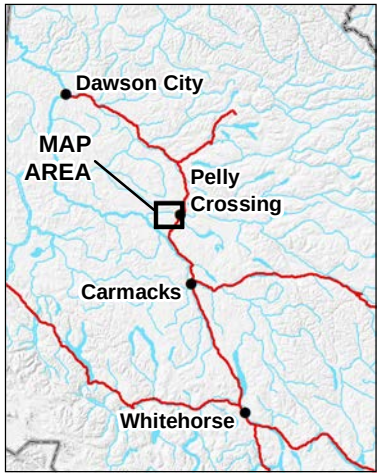
- Collect age, sex and length (ASL) data from Chinook salmon that are captured in the test fishery; and
- Foster a stronger understanding of the Chinook salmon run in the community through community engagement.

## 1.3 STUDY AREA

The Pelly River is a large tributary in the Yukon River Watershed (Map 1). It joins the Yukon River just upstream of the settlement of Fort Selkirk, Yukon. The Pelly River has a number of large tributaries, including the Macmillan, Tay, Lapie, and Ross Rivers. Communities located within the Pelly River watershed include Pelly Crossing, Faro, and Ross River. Pelly Crossing has a population of approximately 300 people.

The Pelly River Chinook salmon sonar site (Pelly River sonar site) is located in the lower Pelly River approximately 24 km downstream of the community of Pelly Crossing and 12 km upstream of the Pelly River Farm; 24 km upstream from the confluence of the Pelly and Yukon Rivers (Map 1). This location was selected following a 2015 study that evaluated a number of potential sonar sites in the lower Pelly River (EDI 2015). Cross-sectional bathymetry data showed that the site was suitable for the operation of sonar, with a shallow and even sloped river bottom on both the right and left banks of the site.




## Legend

- Right downstream bank sonar transducer
- Left downstream bank sonar transducer

# Overview of the 2017 Pelly River Chinook Salmon Sonar Program - Site Location

Data Sources
1:50,000 and 1:2,000,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model and 1:50,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2017) was obtained using Garmin GPS technology.

Disclaimer
This document is not an official land survey and the spatial data presented is subject to change.

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Kilometres

Map scale 1:150,000 (printed at 8.5x11)
Map Projection: NAD 1983 UTM Zone 8N

| Drawn: | Checked: | Date: | |
|---|---|---|---|
| HG | MP/JL | 3/9/2018 | **MAP 1** |

EDI

Path: O:\2016\16Y0137_PellyRiverSonar\Mapping\FinalMaps\Map1_PellySonar_Overview.mxd

# 2 METHODS

Methods are presented by project component in the following sections.

## 2.1 FIELD CREW AND CAMP SETUP

A crew of three people travelled to the Pelly River sonar site on June 28, 2017, to construct the field camp. This crew consisted of the project biologist and a technician from EDI Environmental Dynamics Inc. (EDI) as well as a local SFN technician. An additional field crew from the SFN Lands Department also assisted with material transportation and initial camp set up.

Following initial setup, two EDI technicians and one or two local SFN technicians conducted the day to day operations of the field program, with offsite support from EDI biologists in Whitehorse. EDI and SFN staff operated on a rotation-based schedule for the duration of the program.

## 2.2 SONAR DEPLOYMENT

On July 3, 2017, one rented Simrad EK60 split-beam sonar system and one ARIS Explorer 1800 multi-beam sonar system (provided in-kind by Fisheries and Oceans Canada) were deployed on the right and left banks, respectively, of the Pelly River sonar site (one system on each bank). The sonar systems were deployed across the river from one another. Each sonar system consisted of a sonar transducer, power/data cable, and command module. The power/data cable carried the sonar data from the submerged transducers to the command module, which was located onshore and allowed for control of the system power (on/off switch) and interfacing with a laptop computer through an Ethernet cable connection. The sonar transducers were affixed to aluminum 'goal post' type mounts, which were purchased and custom built in Whitehorse for this project. The mounts allowed for easy adjustment of the transducer pitch and depth within the water column.

On each bank of the river, sonar data was transmitted from the sonar command module to a laptop computer, to allow for data capture and review. On the left bank (when looking in a downstream direction), the command module was connected to the laptop computer by wired Ethernet connection. On the right bank, the command module was connected to a wireless Ethernet bridge and data was transmitted across the river wirelessly to a second laptop computer on the left bank. This configuration allowed all equipment to be operated from the left bank. The equipment was powered using two portable 2000-watt gas powered generators on each bank.

This sonar setup allowed for ensonification of approximately 110 m of the river channel (35 m from the left bank, 75 m from the right bank). The width of the wetted portion of the Pelly River at the sonar site was estimated to be approximately 140 m using a range finder at the initial onset of the project, which meant that approximately 30 m of channel was not ensonified. The section of the river that was not ensonified was primarily across the thalweg (i.e., deepest part) of the river.

### 2.2.1 TARGET TESTING

At the initial onset of sonar operation, target testing was conducted to ensure that targets in all areas of the water column were covered adequately by the sonar beam. Target testing consisted of one crew member watching the sonar screen in real time, while the other crew members drifted through the sonar beam in a boat at various distances from the sonar transducer. A reflective target (a large rock) was drifted beneath the boat to determine if it could be seen on the sonar. Targets were drifted at various depths from surface to bottom. Surface detection was also confirmed by visual detection of the hull of the boat in some cases. Once complete, any major gaps in sonar coverage were noted and adjustments to the sonar aim were made where feasible.

### 2.2.2 FISH DEFLECTION FENCE

To ensure fish did not migrate behind the sonar or the ensonified area, a fish deflection fence was set up to force fish away from the shore and out in front of the transducer. Flexible plastic link fencing was erected perpendicular to the river channel to extend the fence out into deeper water (to a depth of approximately 1 m; see Appendix A for site photos). The fencing was supported using steel T-rail type stakes, which were pounded into the river bed to secure the fence. After the fencing was erected, field staff keyed the bottom of the fence into the river bed material, to ensure that no salmon could pass underneath. The approximate total length of fence was 2 to 3 m on the left bank and up to 5 m on the right bank. The fence was deployed approximately 1 m downstream of the sonar transducer on both banks. The transducers and mounts were typically placed a minimum of 3 m back from the end of each fence (towards the shore) to ensure that all fish passing in front of the fence were a sufficient distance away from the face of the transducer to allow them to be easily detected.

### 2.2.3 SONAR SOFTWARE SETUP AND DATA COLLECTION

The proprietary data collection software for the Simrad sonar system, Simrad EK60 Scientific Echo Sounder (version 2.4.0), and ARIScope (version 2.4.7013.0) for the ARIS sonar system, were used to control the operation of the two sonars and to record all collected sonar data. The relevant settings of this software that were used during this project are shown in Table 1. Both sonars were set to record data continuously (24 hours per day), and all sonar data was recorded to a network-attached storage (NAS) drive. Data recorded to the NAS drive was stored on three 1 Terabyte (TB) and one 3 TB hard drives, which were configured in a mirrored RAID-array, to ensure data redundancy. This array ensured that all recorded sonar data was secured in the event of a hard drive failure.

The sonar systems were powered on after the initial setup was completed, the sonar aim was checked, and fine scale pitch and depth adjustments were made to optimize the sonar positioning. Periodic adjustments to the sonar positioning were made throughout the field program, primarily in response to changing water levels. Sonar data was collected from July 3 to August 15, 2017. No sonar data was collected between July 7 and July 11, 2017, when the sonar equipment was removed from the river due to an extreme high-water

event. An additional 55 hours of data (totaled for both left and right bank sonar units) were not recorded due to instances of temporary generator failures, equipment maintenance and updates, and other high water related events.

**Table 1. Summary of ARIS Explorer 1800 and Simrad EK60 data collection parameter values and settings used during the 2017 Pelly River Chinook salmon sonar program.**

| Parameters | Left Bank Sonar | Right Bank Sonar |
|---|---|---|
| Model | ARIS Explorer 1800 | Simard EK60 |
| Frequency Low/High (kHz) | High (1.8 MHz)/Low (1.1 MHz) | High (120 kHz) |
| Beam Width (Horizontal/Vertical) | 8° H/14° V | 9.5° H/2.5° V |
| Window Range | 35 m | 75 m |

## 2.3 ENUMERATION OF CHINOOK SALMON

Sonar data was reviewed using Echotastic version 3.0b1, a software package developed by Carl Pfisterer of the Alaska Department of Fish and Game. Echotastic allows for sonar data files to be reviewed and for detected fish targets to be tallied. The enumeration methods used for this project consisted of reviewing an echogram of each collected sonar file, identifying fish targets with upstream and downstream motion and tallying all such targets within each file. An explanation of the enumeration process is detailed in the following sections.

### 2.3.1 ECHOGRAM INTERPOLATION

An echogram is the visual representation of sonar data; it provides an image based on the intensity of returned echoes and time of reception. Echotastic provides a means to generate colour echograms from recorded Simrad and ARIS sonar data files. Time can be displayed on the horizontal axis of the image, and the distance from the front of the sonar transducer can be displayed on the vertical axis of the image. When using the echogram configuration described above to enumerate riverine fish, the series of horizontal lines through the Echogram indicates ensonification of the river bottom.

### 2.3.2 DATA PROCESSING PARAMETERS

Echotastic allows the user to specify a number of data processing options, to assist in viewing and interpreting the echogram data. A summary of the processing options used during the 2017 Chinook sonar program and the rationale for each option are presented in Table 2. The field crew found these settings to be the most suitable for review of the collected data.

**Table 2. Echotastic data processing options used during the review of sonar data collected during the operation of the 2017 Pelly River Chinook salmon sonar program.**

| Processing Option | Setting Used | Explanation of Setting | Rationale |
|---|---|---|---|
| Colour Map | Simrad | Provides a full colour spectrum picture of echogram | Ease of viewing |
| Colour By Angle | On | Colours echogram data based on direction of horizontal travel of fish targets | Allows differentiation of upstream and downstream moving sonar targets |
| Lower Threshold | -50 dB | Displays all sonar data stronger than -50 dB | Excludes sonar signals of lower intensity than -50 dB from the echogram; removes noise from image |
| Colour Background | Black | Displays sonar data against a black background | Ease of viewing |

### 2.3.3 DISTINGUISHING MIGRATING SALMON ON ECHOGRAM

Migrating salmon can be identified from Echotastic echograms based on shape and shadowing. Salmon generally appear as characteristic crescents or "wavy" traces on the echogram that are usually oriented parallel to the river current (Figure 1). This shape and orientation can aid in the separation of salmon targets from non-salmon targets. In addition to the shape, the relative size of the target on the echogram and intensity (brightness) of the trace on the echogram were also used to help distinguish between salmon and non-salmon traces; salmon traces are generally brighter and larger than freshwater fish. Larger salmon also block a portion of the sonar beam as they travel through it, causing a shadowing of the area of the echogram directly behind the fish. Shadowing is visible on an echogram as a dark vertical line behind the fish, extending away from the transducer. This shadowing effect is visible behind the fish in the example echograms in Figure 1 and Figure 2.

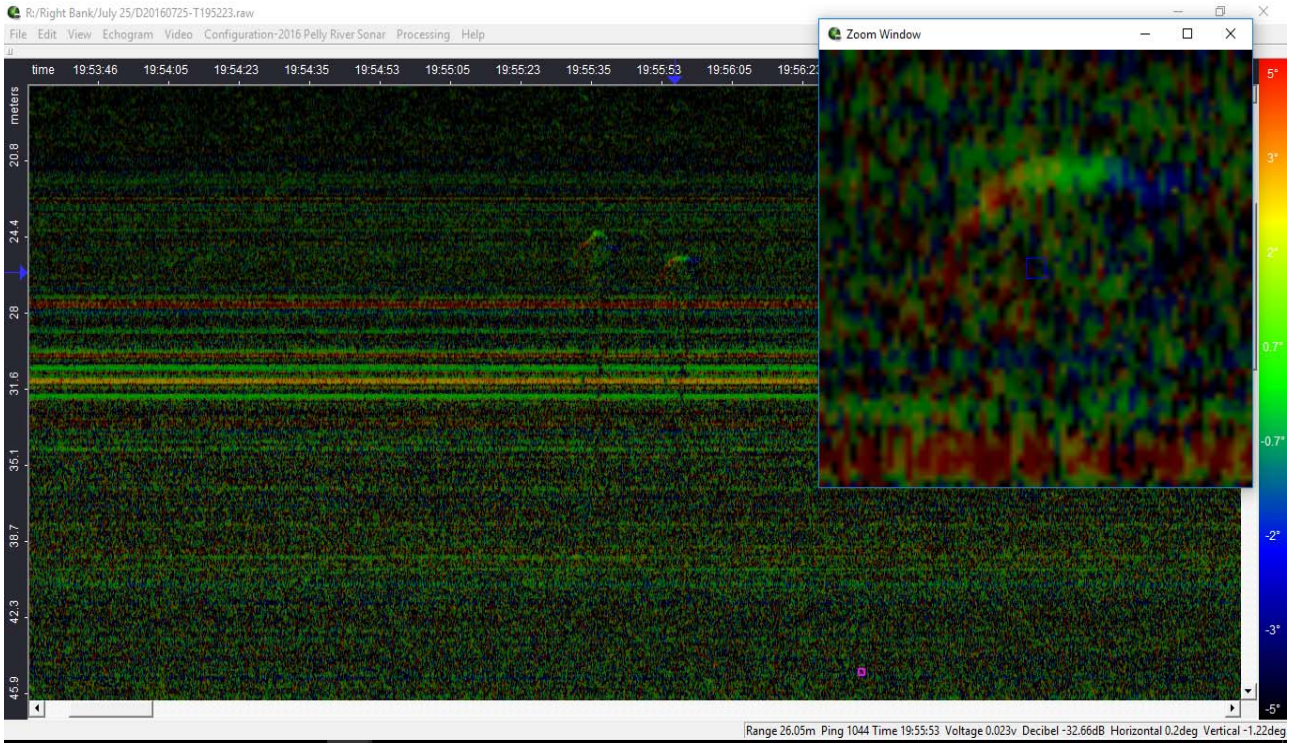


**Figure 1.** Echotastic echogram showing the crescent shaped sonar target and shadowing typical of a fish target. Image is from the Pelly River right bank sonar unit.

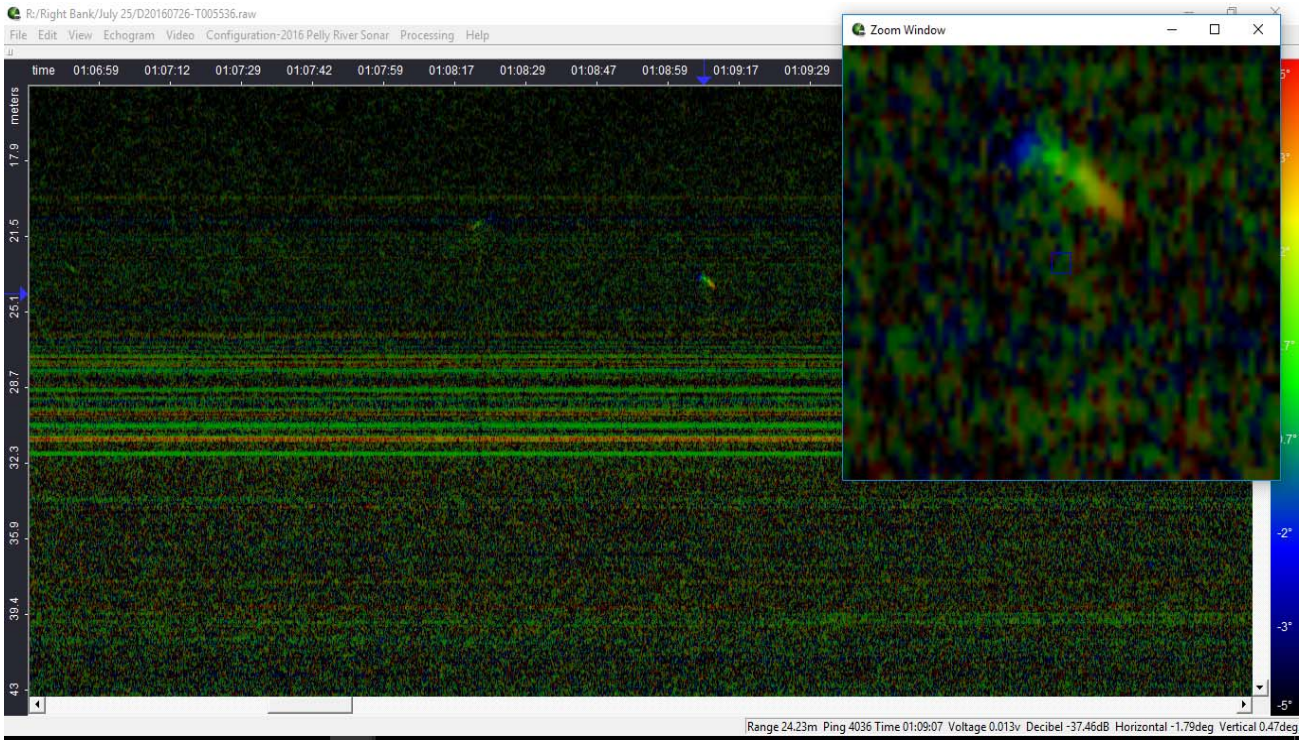


**Figure 2.** Echotastic echogram window showing two fish travelling in opposite directions. Note the left fish is traveling upstream and the right fish is traveling downstream. Image is from the Pelly River right bank sonar unit.

Instream debris (non-fish targets) can be distinguished from fish targets based on the fact that debris is always downstream moving with the current. Instream debris and animals such as a beaver or muskrat often show a fainter, longer trace on the echogram than fish targets.

The ability to detect and discern fish targets is a skill that must be developed through practice; sonar technicians completed a comprehensive training module, created by Whitehorse Fisheries and Oceans Canada (DFO) biologist Elizabeth MacDonald in 2016, at the beginning of the 2017 season prior to reviewing the Pelly River sonar data. This training module was comprised of example data files and practice enumeration tests to develop the sonar technicians' ability to distinguish salmon targets, freshwater fish targets, and non-fish targets on the sonar echograms. This module was designed to help standardize the training and review techniques used across Yukon salmon sonar programs.

Staff training was supervised by the EDI project biologist and all staff were tested on the training files to ensure that they could effectively differentiate between different sonar targets (salmon, freshwater fish, and instream debris). Additional training was conducted when deemed necessary by the supervising biologist. Throughout the training program, staff were encouraged to work as a team and to maintain dialogue and consultation with the project biologist if challenging and/or unclear data files were encountered during the review process. Staff were also instructed to be conservative when enumerating salmon targets; if the identity of a particular trace was still questionable after consultation with other project staff, it was not counted as a migrating salmon. The training also included basic instruction on weir building and maintenance, software and equipment troubleshooting, data entry, and other operational tasks.

### 2.3.4 DETERMINING DIRECTION OF TRAVEL

The direction of travel (upstream or downstream) was determined for each salmon identified during review of the collected sonar data. Direction of travel is determined by the change in the horizontal angular position of a fish as it passes through the area of ensonification, relative to the center of the acoustic beam (measured in degrees). The change of angle position for a fish moving upstream is the opposite of that for a fish moving downstream and can be used to differentiate between directions of travel.

When the reviewer enables the colour by angle option in Echotastic, the echogram colour scale provides a visual representation of the changes in angular position. Hot colours (reds) represent movement in one direction while cold colours (blues) represent movement in the opposite direction. In this manner, fish moving upstream can be easily identified since they possess the opposite colour spectrum orientation to those fish which are moving downstream (Figure 2).

Once onsite technicians were confident that a detected acoustic target was a migrating salmon, the salmon target in question was marked on the Echotastic echogram. The was done by left clicking on the location of the fish on the echogram window and marking the upstream migrating salmon target with a pink square. In the same manner, if the reviewer identified a salmon target that was moving downstream, they would right click on the location of the fish, which marked the target with a blue square. Echotastic records the total number of marks in either direction. Field staff recorded these totals for each file, as well as a net total of

upstream salmon migrants (total number of upstream salmon targets minus the total number of downstream salmon targets). These counts were then entered into a Microsoft Excel spreadsheet as well as a paper backup copy. Saved marks on the Echotastic echogram were then output to a text file for post-season processing and data analysis.

### 2.3.5 INTERPOLATION OF COUNT DATA

During the operation of the sonar program, high water events, equipment malfunctions and maintenance requirements resulted in periods when sonar data was not collected. For in-season reporting, missing data was interpolated by multiplying raw daily counts by the percentage of the day that was missing. If five hours of data was missing, data was interpolated by taking an average of the preceding and following five hours of count data. This method provided a simple means for field staff to generate preliminary adjusted counts in time for in-season updates to be delivered to fisheries managers.

Post-season (i.e. in this report), missing data was interpolated using different methods. The post-season methods of interpolation for periods when portions of a day's data were missing followed the methods used at the Eagle sonar station in Alaska (Crane and Dunbar 2009). Three different interpolation methods were used depending on how much data was being interpolated. All three methods are detailed below (Crane and Dunbar 2009):

> "When a portion of a sample was missing, on either bank, passage was estimated by expansion based on the known portion of the sample. The number of minutes in a complete sample period ($m_s$) was divided by the number of minutes counted ($m_i$), and then multiplied by the number of fish counted ($x$) in that period ($i$). Passage ($y_i$) was estimated as:
>
> $$\hat{y}_i = \left(m_s / m_i\right) x_i$$
>
> If data from one or more complete sample periods was missing, passage for that portion of the day ($y_m$) was estimated by averaging passage from the [equivalent number of] sample periods immediately before ($y_b$) and after ($y_a$) the missing sample period(s), and then multiplying by the number of sample periods missing ($n$) [$n$ is generally 1 if the equivalent number of sample periods is available]:
>
> $$\hat{y}_m = \left( \frac{y_b + y_a}{2} \right) n$$
>
> When multiple days were missing on only one side of the river, passage for the period of missing days was estimated by determining a proportion of fish passing one bank, compared to the amount of fish passing the other bank, and averaging the proportions for the amount of days missing immediately before and after the missing sample period(s)."

In cases where interpolation formulas resulted in non-integer values (i.e. counts with decimals), these values were lowered to the nearest integer value.

### 2.3.6 SONAR DATA QUALITY ASSURANCE/QUALITY CONTROL

To ensure a high quality data set, quality assurance and quality control (QA/QC) measures were implemented for review of the sonar files during the field component of the program. To verify that onsite staff were counting files in the same manner, sonar technicians completed a training module at the beginning of the season prior to reviewing the Pelly River sonar data to develop their ability to distinguish fish and non-fish targets on the sonar echograms. This module was created by DFO biologist Elizabeth MacDonald and was designed to help standardize the training and review techniques used across Yukon sonar programs.

Sonar technicians also reviewed a subset of each other's count data as a means to QA/QC the data in the field. Approximately 10% of the daily files (i.e. three files per bank, per day) were re-opened without saved fish marks and re-counted by a second technician onsite. Any differences in counts were recorded, but no changes were made to the original counts as the goal was to quantify person to person variability. Some subjectivity exists when interpreting sonar target data and differences in interpretation between technicians is expected; therefore, it is important the counting and review process is standardized amongst technicians and sonar programs to provide the most accurate and consistent data.

## 2.4 TEST NETTING

The 2017 test netting program included both set netting and drift netting to confirm sonar count data between Chinook salmon, larger freshwater fish, and any other salmon species that have the potential to co-migrate with the Chinook. The test netting program included set netting and offshore drift netting during the entire program's operation to target Chinook salmon and larger freshwater fish species, while onshore drift netting was completed in the final two weeks of the program to determine whether other species of salmon were co-migrating with the Chinook salmon.

Out of respect for Doòli, SFN's way of respecting and living in harmony with the natural world, all captured fish were handled as gently and minimally as possible, quickly removed from nets, and placed in a water filled tote to recover while sampling. Scale samples were collected from all captured Chinook (five scales per individual and delivered to DFO for processing); all salmon were sexed, measured, and released. Genetic samples (axillary process clippings) were also collected during the last week of the program and were delivered to DFO for analysis. All other captured fish were identified to species, measured and released. Both set netting and drift netting used nets that were hung at a relatively loose ratio of 3:1.

### 2.4.1 SET NETTING

Set netting was conducted from July 4 to August 15, 2017. Set netting was conducted on both banks of the river in the vicinity of the sonar site, however the most suitable sites were located on the right bank upstream from the sonar. Nets were set for a targeted 8 hours per day and checked on a frequent and regular basis. Net mesh sizes included 5.25, 6.75, 7.5, and 8.5 inches (13.3, 17.1, 19.1, and 21.6 cm stretch diameter) specifically to target Chinook and any larger freshwater fish. Nets were 100 feet (30.5 m) long, with mesh depths equivalent to net depths of 12 to 16 feet. Net mesh sizes were chosen to replicate the sampling methods used for the Eagle sonar program (Lozori and Borden 2015). However, a 6.5 inch mesh size is typically used at the Eagle sonar site, but due to stock availability, the closest mesh size (6.75 inch) was purchased.

#### 2.4.1.1 Chinook Salmon Age Analysis

In both 2016 and 2017, scales were collected from Chinook salmon captured during set netting and provided to DFO for age analysis. The 2016 results were not provided prior to submission of the 2016 final report, therefore they have been presented with the 2017 results. Methods for scale collection followed protocols provided by DFO and included the collection of five scales from each Chinook salmon, taken from just above the lateral line between the dorsal and anal fins of the fish. Scales were placed in scale card books (also provided by DFO) and allowed to dry each day. Unique ID information was recorded to identify the scales to each specific fish post season.

### 2.4.2 DRIFT NETTING

Both onshore (beach walks) and offshore (mid-channel) drift netting was conducted. Offshore drift netting was completed for the full duration of the program (July 4 to August 14, 2017) with the goal of capturing Chinook salmon that were possibly migrating through the non-ensonified section of the river between the two sonar systems. Onshore drift netting was conducted from August 2 to August 15, 2017. Although the Pelly River is not known to be a major chum salmon spawning destination, onshore drift netting was conducted with the goal of capturing any early migrating chum salmon that may co-migrate with the Chinook salmon past the sonar site in early to mid August. Drift netting has been used successfully to capture chum salmon at the Porcupine River and Eagle sonar sites (EDI 2014; Lozori and Borden 2015). The choice of the August 2 start date for the drift netting program was based on the timing of earliest running fall chum salmon as observed at the Eagle sonar site in 2016. Onshore drifts were conducted at the edges of the river channel; one end of the net was affixed to the drifting boat while a field crew member pulled the other end downstream along the water's edge. The majority of the drift netting was conducted offshore downstream of the sonar site.

Net mesh sizes used were the same as the set netting program and included 5.25, 6.75, 7.5, and 8.5 inches. Drift nets were 100 feet long with mesh depths equivalent to net depths of 12 to 16 feet.

# 3 RESULTS

Results are presented by project component in the below sections.

## 3.1 SONAR DATA

### 3.1.1 RAW WEEKLY SONAR COUNTS

A summary of unadjusted, weekly sonar counts is presented in Table 3; daily count data is provided in Appendix B. The weekly net upstream count is calculated by subtracting the total weekly count of fish moving downstream from the total weekly count of fish moving upstream. A raw net total of 8,588 upstream moving fish were identified from the collected sonar data. During all program weeks, the number of fish moving upstream substantially exceeded the number of fish moving downstream (inclusive of both the right and left banks). The majority of both upstream and downstream moving fish were counted on the right bank of the sonar site (Table 3). The highest weekly upstream fish passage counts on the right bank occurred during the fourth week of program operation from July 22 to July 28, while the highest downstream fish passage counts occurred during the third week of the program (July 15 to July 21). On the left bank, upstream weekly counts also peaked during the fourth week of the program from July 22 to July 28. Downstream weekly counts peaked during the second week of the program from July 8 to July 14. Sonar counts occurred from July 3 to August 15.

**Table 3. Raw weekly counts of fish at the Pelly River sonar site from July 3 to August 15, 2017.**

| Program Week | Right Bank | | | Left Bank | | | Both Banks Combined |
|---|---|---|---|---|---|---|---|
| | Upstream | Downstream | Net Upstream Total | Upstream | Downstream | Net Upstream Total | Net Upstream Total |
| July 3-7[A] | 2 | 4 | -2 | 12 | 5 | 7 | 5 |
| Jul 8-14[B] | 85 | 5 | 80 | 75 | 8 | 67 | 147 |
| Jul 15-21[C] | 763 | 11 | 752 | 623 | 7 | 616 | 1368 |
| Jul 22-28[D] | 1790 | 4 | 1786 | 1415 | 4 | 1411 | 3197 |
| Jul 29-Aug 4[E] | 1212 | 1 | 1211 | 885 | 0 | 885 | 2096 |
| Aug 5-11[F] | 741 | 1 | 740 | 604 | 1 | 603 | 1343 |
| Aug 12-15 | 234 | 0 | 234 | 198 | 0 | 198 | 432 |
| **Totals** | **4,827** | **26** | **4,801** | **3,812** | **25** | **3,787** | **8,588** |

[A] Right bank sonar down due to Simrad program error; missing data for 11 hours over July 6-7

[B] Right bank and left bank sonars pulled due to extreme high water; missing data for July 7-11. Right bank sonar down for unknown reason; missing data for 3 hours on July 11. Right bank sonar down due to computer update; missing data for 5 hours on July 12. Right bank sonar down for unknown reason; missing data for 8 hours on July 14

[C] Right bank and left bank sonars down due to computer updates; missing data for 1 hour on July 21

[D] Right bank sonar down due to hard drive changeout; missing data for 2 hours on July 25. Left bank sonar down due to power failure; missing data for 2 hours on July 26.

[E] Right bank sonar knocked over; missing data for 14 hours over July 31 – Aug 1.

[F] Right bank sonar down due to computer update; missing data for 4 hours on Aug 9

Daily counts suggest the sonar site was in operation at the very initial onset of the Chinook migration; no Chinook were recorded on the first partial day of operation (July 3) and the total daily count for the subsequent four days was less than ten upstream targets. Although the data indicates the peak (July 28) of the Chinook run had passed, the daily counts show Chinook were still migrating past the sonar site after program operations ceased. On August 15, the final day of sonar operation, a total of 37 upstream moving fish targets were counted (Appendix B).

### 3.1.2 SONAR DATA QUALITY ASSURANCE/QUALITY CONTROL

The QA/QC included re-counting three sonar files (i.e. three hours of data) daily for both the left and right banks. A total of 352 sonar files were re-counted for QA/QC purposes; 131 on the right bank and 251 on the left bank. A larger number of files on the left bank were re-counted since each hour of data was recorded in two files (30 minutes each). In 2017, a significant number of the QA/QC files were counted differently by the original technician counting and recording the targets. Of these files, 60 from the right bank and 50 from the left bank were counted differently by the technicians, resulting in a 46% and 22% difference in counts, respectively. Typically, the targeted difference in the original versus the QA/QC files is less than a 10% difference, therefore, additional QA/QC was completed on the sonar count data to investigate how this may have affected the overall total estimated Chinook salmon counts.

All QA/QC sonar files were reviewed and the margin of error (i.e., the difference in either a positive or negative direction) between the originally counted file and the QA/QC'd file was documented and reviewed for both the left and right banks, separately. On the left bank, the difference in counts ranged from -3 to +3 and the average was 0.5 targets, that is, the QA/QC'd files, on average, were higher than the original count by 0.5. For the right bank, the range was considerably larger, ranging from a difference of -10 to +5. Surprisingly, the average in the difference of the counts was zero. The additional QA/QC check was completed by an experienced sonar biologist from EDI. A subset of the original sonar data files was reviewed, and it was determined that a large portion of the files with significant differences showed that the QA/QC file was a low count. The range of -10 indicates that the QA/QC counter was counting 10 less upstream targets, i.e., they were being conservative. During the sonar training, it was emphasized to the technicians that if there is uncertainty of whether a target is a salmon, they are not to count the target. The difference in the counts is an example of the subjectivity that exists when interpreting sonar target data and differences in interpretation between technicians. This difference in the QA/QC files is most likely the result of particular technicians being conservative; therefore, EDI does not believe the total Chinook salmon count has been over estimated.

## 3.2 TEST NETTING

### 3.2.1 SET NETTING

A summary of the weekly set netting sampling effort and results is presented in Table 4; daily set netting results are included in Appendix C. Set netting occurred from July 4 to August 15. On an average day during the field program, two set nets were deployed. The field crew rotated through the four mesh net sizes, using a smaller and larger sized net each day. There were 11 days where no set nets were deployed, due to high water levels, large debris in the water, and/or crew changes. The goal was to accumulate 8 hours of set netting per day by switching out nets halfway throughout the day. A total of 217.4 hours of set netting was completed, resulting in an average of 3.8 hours per set. The majority of the fish captured during the set netting program were Chinook salmon (18 or 53% of the total catch). Other fish captured included 14 inconnu (*Stenodus leucichthys*) and two northern pike (*Esox lucius*) (Table 4; Appendix C). No chum salmon were captured.

**Table 4. Summary of weekly set netting effort and catches at the Pelly River sonar site in 2017.**

| Program Week | Number of Net Sets | Set Netting Effort (Hours) | Chinook Salmon Captured | Chum Salmon Captured | Other Fish Species Captured | Total Fish Captured |
|---|---|---|---|---|---|---|
| Jul 2-8[A] | 2 | 8.0 | 0 | 0 | 0 | 0 |
| Jul 9-15[B] | 4 | 12.2 | 0 | 0 | 0 | 0 |
| Jul 16-22 | 13 | 40.0 | 1 | 0 | 4 | 5 |
| Jul 23-29 | 10 | 49.3 | 9 | 0 | 2 | 11 |
| Jul 30-Aug 5[C] | 10 | 34.4 | 2 | 0 | 1 | 3 |
| Aug 6-12 | 13 | 53.5 | 6 | 0 | 7 | 13 |
| Aug 13-15 | 5 | 20.1 | 0 | 0 | 2 | 2 |
| **Total** | **57** | **217.4** | **18** | **0** | **16** | **34** |

[A] No set netting on July 6, 7, and 8 due to high water levels and significant debris in river.
[B] No set netting on July 9, 10, 11, 14, and 15 due to high water levels and significant debris in river as well as crew change.
[C] No set netting on August 2 due to crew change.

Sex ratios and fork lengths of captured Chinook during the set netting program between July 2 and August 15, 2017 were recorded (Table 5; Appendix C). The average fork length was 92 cm for captured male Chinook and 78 cm for captured female Chinook. The sex and length of one Chinook were unconfirmed as it escaped from the net when it was checked on July 30.

**Table 5. Weekly summary of sex and fork length data from Chinook salmon captured by set netting during the 2017 Pelly River Chinook sonar program.**

| Program Week [A] | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Total Weekly Captures | % of Weekly Total | Mean Length (cm) | Total Weekly Captures | % of Weekly Total | Mean Length (cm) |
| Jul 16-22 | - | - | - | 1 | 100 | 70 |
| Jul 23-29 | 5 | 55 | 83 | 4 | 45 | 74.5 |
| Jul 30-Aug 5[B] | 1 | 100 | 92 | - | - | - |
| Aug 6-12 | 2 | 33 | 101 | 4 | 67 | 89.5 |
| **Program Mean** | **8** | **62.7** | **92** | **9** | **70.7** | **78** |

[A] No Chinook were caught July 2-15; these two weeks are not shown.

[B] Escaped Chinook not included; sex and length were not recorded.

#### 3.2.1.1 Chinook Salmon Age Analysis

In 2017, a total of 17 scale samples were collected from Chinook salmon captured in set nets. Of these, 12 were used to complete an age analysis. Ages were not determined for the remaining five samples due to sample conditions; regenerate scales as well as samples that were preserved upside down could not be read accurately. Salmon ages ranged from four to six years, with six-year-old fish being the most common (eight individuals) followed by four- and five-year-old fish (two individuals each). In 2016, a total of 16 scale samples were sent in for analysis; of these, only 12 samples were confidently aged. The 2016 samples were made up almost exclusively of five-year-old fish (11 individuals), with one four-year-old fish.

### 3.2.2 DRIFT NETTING

Two methods of drift netting were used during the 2017 Pelly River sonar program. The left bank ARIS sonar unit was a short range sonar system; this unit was only effective to approximately 35 m. As a result, a large gap (approximately 30 m to 40 m) between the sonar units was present during ensonification with the potential of missing targets. This gap was located primarily within the thalweg (deepest section of the river) where it is suspected Chinook salmon were not likely migrating as it is the fastest flowing section within the river and they have been shown to be bank orientated and travel in sections where the flow is reduced. Offshore drift netting was conducted throughout this section of the river in an attempt to determine if Chinook salmon were migrating between the sonar units where they would not be visible and counted by the sonar. Offshore drift netting was completed for the full duration of the field program. Onshore drift netting (i.e., beach walks) was conducted in the last two weeks of the program to target co-migrating chum salmon.

### 3.2.2.1 Offshore Drift Netting

A summary of the weekly onshore drift netting sampling effort and results is presented in Table 6; daily offshore drift netting results are included in Appendix C. A total of 209 six-minute-long offshore drift net sets were completed between July 4 and August 14, 2017. This sampling included approximately 21.37 drift netting hours (Table 6). No fish were captured during the offshore drift netting program.

**Table 6. Summary of weekly offshore drift netting effort and catches at the Pelly River sonar site in 2017.**

| Program Week | Number of Offshore Drift Net Sets | Drift Netting Effort (Hours) | Chinook Salmon Captured | Chum Salmon Captured | Other Fish Species Captured | Total Fish Captured |
|---|---|---|---|---|---|---|
| Jul 4-8[A] | 14 | 1.9 | 0 | 0 | 0 | 0 |
| Jul 9-15[B] | 17 | 1.67 | 0 | 0 | 0 | 0 |
| Jul 16-22[C] | 24 | 2.38 | 0 | 0 | 0 | 0 |
| Jul 23-29[D] | 26 | 2.6 | 0 | 0 | 0 | 0 |
| Jul 30-Aug 5[E] | 49 | 4.9 | 0 | 0 | 0 | 0 |
| Aug 6-12 | 61 | 6.12 | 0 | 0 | 0 | 0 |
| Aug 13-15 | 18 | 1.8 | 0 | 0 | 0 | 0 |
| **Total** | **209** | **21.37** | **0** | **0** | **0** | **0** |

[A] No drift netting on July 6, 7, and 8 due to large debris in the water.
[B] No drift netting on July 9, 10, and 11 due to large debris in the water. No drift netting on July 14 and 15 due to crew change.
[C] No drift netting on July 17, 21, and 22 due to camp tasks.
[D] No drift netting on July 23, 24, and 25 due to camp tasks. No drift netting on July 27 and 29 due to crew change.
[E] No drift netting on July 31, August 2, and August 4 due to crew change.
[F] No drift netting on August 12 due to crew change.
[G] No drift netting on August 15 due to camp take down and sonar program end.

### 3.2.2.2 Onshore Drift Netting

A summary of the weekly onshore drift netting sampling effort and results is presented in Table 7; daily onshore drift netting results are included in Appendix C. A total of 36 six-minute-long onshore drift net sets were completed between August 2 and August 15, 2017. This sampling included approximately 3.62 drift netting hours (Table 7). During the onshore drift netting program, a single male Chinook salmon was captured on August 9; however, it escaped from the net before it could be measured. No other fish species were captured during the drift netting program.

**Table 7. Summary of weekly onshore drift netting effort and catches at the Pelly River sonar site in 2017.**

| Program Week | Number of Onshore Drift Net Sets | Drift Netting Effort (Hours) | Chinook Salmon Captured | Chum Salmon Captured | Other Fish Species Captured | Total Fish Captured |
|---|---|---|---|---|---|---|
| Aug 2-8 | 18 | 1.82 | 0 | 0 | 0 | 0 |
| Aug 9-15 | 18 | 1.8 | 1 | 0 | 0 | 1 |
| **Total** | **36** | **3.62** | **1** | **0** | **0** | **1** |

# 4 DISCUSSION

Results are discussed in the following sections.

## 4.1 INTERPOLATION OF RUN DATA

### 4.1.1 INTERPOLATION OF MISSING COUNT DATA

Interpolation of several hours of missing sonar data was required due to periodic power failures with the generators and movement of the sonar systems during high water events, including removal of the sonar for three days at the beginning of July due to flooding. Interpolation was conducted according to the methods outlined in Section 2.3.5 and interpolated net upstream sonar counts were calculated for each week of program operation (Table 8). Daily interpolated count data is included in Appendix B.

After interpolating missing count data, a total of 8,780 fish were estimated to have passed the sonar site from July 3 to August 15, 2017 (Table 8). The general trends in fish passage rates and relative distribution of counts (right vs. left bank) were unchanged from the raw weekly sonar counts (Table 3). Overall, the sonar system operated well, however, due to high water present throughout a large portion of the field program, additional hours of data had to be interpolated as compared to the 2016 field program.

**Table 8. Interpolated net upstream weekly counts at the Pelly River sonar site from July 3 to August 15, 2017.**

| Program Week | Right Bank | Left Bank | Both Banks Combined Interpolated Net Upstream Total |
|---|---|---|---|
| July 3-7 | -1[1] | 7 | 6 |
| Jul 8-14 | 108 | 67 | 175 |
| Jul 15-21 | 756 | 616 | 1,372 |
| Jul 22-28 | 1,796 | 1,419 | 3,215 |
| Jul 29-Aug 4 | 1,283 | 885 | 2,168 |
| Aug 5-11 | 768 | 605 | 1,373 |
| Aug 12-15 | 255 | 214 | 469 |
| **Totals** | **4,965** | **3,813** | **8,778** |

[1] Negative upstream counts are a result of a higher number of downstream targets counted

A total of 135 hours of right bank sonar data were interpolated, resulting in 166 estimated fish counts. High water events including knock down from debris and removal of the sonars from July 7 to 11 accounted for 99 hours and 51 estimated fish counts. Sonar/computer system outages accounted for 24 hours and 94 estimated fish counts. Interpolation of the remaining hours of the day on August 15 after the sonar was removed accounted for 12 hours and 21 estimated fish counts, signifying the end of the program. A total of 99 hours of left bank data was interpolated, resulting in only 26 estimated fish counts. A total of 97 hours were related to the high-water event from July 7 to 11, resulting in only two fish counts. Only two hours were estimated for sonar/computer system outages, resulting in an estimated 8 fish. Following removal of the sonar on August 15, twelve hours of sonar data were interpolated, resulting in 16 estimated fish counts

for the left bank (Appendix B). Fortunately, the high water event from July 7 to 11 where both sonars were removed from the river occurred prior to/during the very early onset of the Chinook salmon run, prior to fish passing the sonar site.

### 4.1.2 CHUM SALMON RUN OVERLAP

It is understood, through anecdotal information from Selkirk First Nation members, that the Pelly River is not known to be a spawning destination for fall chum; however, chum are known to travel and spawn in the mainstem of the Yukon River near the confluence with the Pelly River. To accurately estimate the escapement of Chinook within the lower Pelly River, an estimate of the total chum that passed the sonar site must be subtracted from the total count of Chinook. Due to the potential for chum to be present in the Pelly River and co-migrate with the Chinook in early to late August, onshore drift netting was conducted as part of the test netting program to target chum. Onshore drift netting was completed in the last two weeks of the sonar program (August 2 to 15, 2017); no chum salmon were captured in any of the test netting, including both set and drift netting from the program start to end in 2017 (Appendix C), nor were any chum salmon captured during the 2016 test netting program (EDI 2017).

The estimated run timing for chum salmon past the Pelly River sonar site was estimated to be between August 25 to 28 in 2016. It is suspected that chum salmon were not present during the 2017 sonar operation, however, to further support this notion, the run timing of chum salmon in 2017 was reviewed. The run timing and travel rates of chum within the Yukon River were reviewed to estimate the approximate arrival date of chum at the sonar site. The distance from the Eagle sonar site to the Pelly River sonar site is approximately 456 km. The travel rate for chum salmon has been estimated at 29 miles per day (46.7 km/day) (Zuray 2015). The fall chum count began at the Eagle sonar site on August 21, 2017 with a daily count of 156 chum (ADF&G 2018). Based on this information, the first arrival of chum at the Pelly River sonar site was estimated to be approximately August 27 to 30.

For the purposes of estimating the final Chinook salmon counts to the end of the migration after the sonar program was no longer operating, it has been assumed that no chum were present during the operation of the 2017 Pelly River sonar program, given the lack of chum salmon captures during test netting and the estimated arrival of chum at the sonar site (post operation). It is assumed that all net upstream sonar targets counted and estimated were enumerated as Chinook salmon.

### 4.1.3 FINAL CHINOOK SALMON PASSAGE ESTIMATE

Although the 2017 program ran longer into August than in 2016 (August 15 versus August 3, respectively) Chinook salmon were still observed to be migrating past the sonar site on August 15, 2017 when the sonar shut down. To gather an estimate of the total escapement of Chinook salmon in the lower Pelly River, a post-season estimate was calculated as part of the goals of the program. In subsequent years, the end date for the Pelly River sonar program may continue to be refined as the Chinook migration at the sonar site is better understood.

Expansion of Chinook counts for the period prior to the beginning of this project (i.e. late June/early July) was not required as the program effectively captured the beginning of the run. As conducted for the 2016 post-season estimate, the final passage date of Chinook for the Pelly River sonar site was chosen by comparing to the Chinook counts recorded at the Eagle sonar site since the migration patterns at these two sites followed similar patterns throughout both the 2016 and 2017 seasons. It was noted that the peak in daily counts at the Pelly River sonar site generally occurred five days after the peak daily count at the Eagle sonar site. In addition, a pulse was observed earlier in the season at both sonar sites, also occurring five days apart. The Chinook count ended at the Eagle sonar site on August 20, 2017 with a daily count of 158 Chinook (ADFG 2018). The distance from the Eagle sonar site to the Pelly River sonar site is approximately 456 km, resulting in approximately 7.5 days travel days. The final passage of Chinook at the Pelly River sonar site is estimated to be August 27.

The preliminary period of August 16 to August 27 was used to extrapolate Chinook salmon passage rates past the end date of the 2017 sonar program (after August 15). Extrapolated Chinook counts were calculated for the period of August 16 to 27 using the following second order polynomial equation (MacDonald pers. comm. 2017; same methods as for the 2016 Pelly River sonar program):

$$y_i = \frac{L}{d^2} \times (x_i - d)^2$$

Where $y_i$ is the $i$th daily salmon passage estimate at the sonar site, $L$ is the count on the last day of the period of extrapolation, $d$ is the total number of days that are being extrapolated, and $x_i$ is the number of the day that is being estimated (i.e. day number within the period of extrapolation).

A total of 303 Chinook salmon are estimated to have passed the site after sonar operations ceased; the total extrapolated daily Chinook salmon passage estimates are shown below (Table 9). When added to the interpolated total estimate of 8,778 (Table 8), this post-season expansion data results in a final Chinook salmon passage estimate of 9,081. Based on the test netting data collected during the 2017 program and the local knowledge of salmon species present in the Pelly River, this estimate is fully apportioned as Chinook salmon.

Table 9. Extrapolated daily Chinook salmon counts at the 2017 Pelly River sonar site from August 16 to 27, 2017.

| Date | Both Banks Combined Extrapolated Net Upstream Total |
|---|---|
| August 16 | 63 |
| August 17 | 54 |
| August 18 | 45 |
| August 19 | 37 |
| August 20 | 30 |
| August 21 | 24 |
| August 22 | 18 |
| August 23 | 13 |
| August 24 | 9 |
| August 25 | 6 |
| August 26 | 3 |
| August 27 | 1 |
| **Total** | **303** |

## 4.2 PELLY RIVER CHINOOK SALMON MIGRATION DYNAMICS

The following sections include data on the migration dynamics observed, including run timing and run strength, bank orientation, and water levels. As this was the second year of operation for this program, the data presented in the following sections cannot yet be used to determine long-term trends, but is presented here as baseline information with the intention that these components will be further developed in future years.

### 4.2.1 RUN TIMING AND RUN STRENGTH

Sonar data collected during the 2017 Pelly River sonar program (second season of sonar operation) provides additional insight on the run timing and strength of the lower Pelly River Chinook salmon migration and will provide important information on these aspects of the run in future years. The daily and cumulative net upstream Chinook counts are shown in Figure 3 and Figure 4.

The first upstream Chinook salmon recorded at the Pelly River sonar site was on July 5, 2017, only a couple of days later than in 2016. During the first five days of sonar operation, only 15 salmon were recorded to have passed the sonar site, with zero upstream targets identified in the first two days, indicating the project successfully captured the start of the Chinook salmon run. Between July 7 and 10, 2017, a high-water event resulted in both sonars being removed from the river to prevent loss of and damage to equipment. The data following these days shows the daily counts began to spike around July 10 or 11 and this increasing trend continued throughout the sonar operation (Figure 3; Appendix B). The peak daily upstream count of 651 Chinook salmon occurred on July 28, 2017, one week later than in 2016. The distribution of the daily counts

is relatively unimodal with the exception of a quick drop in daily counts two to three days following the peak; a small pulse was also observed following the peak on August 9, 2017. Excluding the drop in daily counts following the peak, the cumulative net upstream counts show the Chinook salmon passage rates were relatively consistent throughout the run (Figure 3 and Figure 4). The final day of sonar operation (August 15, 2017) recorded a raw count of 37 Chinook salmon with an interpolated total daily count of 74 Chinook, approximately 11% (interpolated count) of what was observed on the day the run peaked, indicating the project captured the majority of the run.

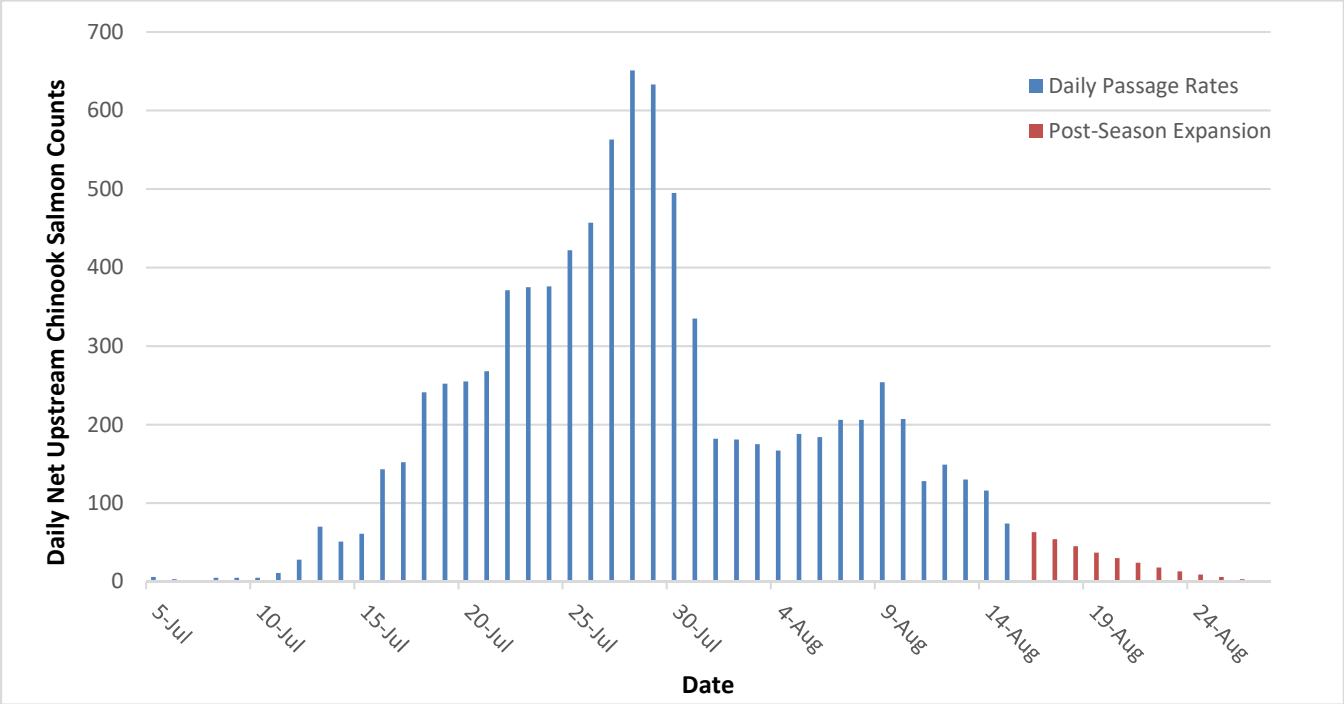


**Figure 3. Daily net upstream Chinook salmon counts at the Pelly River Chinook sonar site in 2017, including the post-season extrapolated data.**

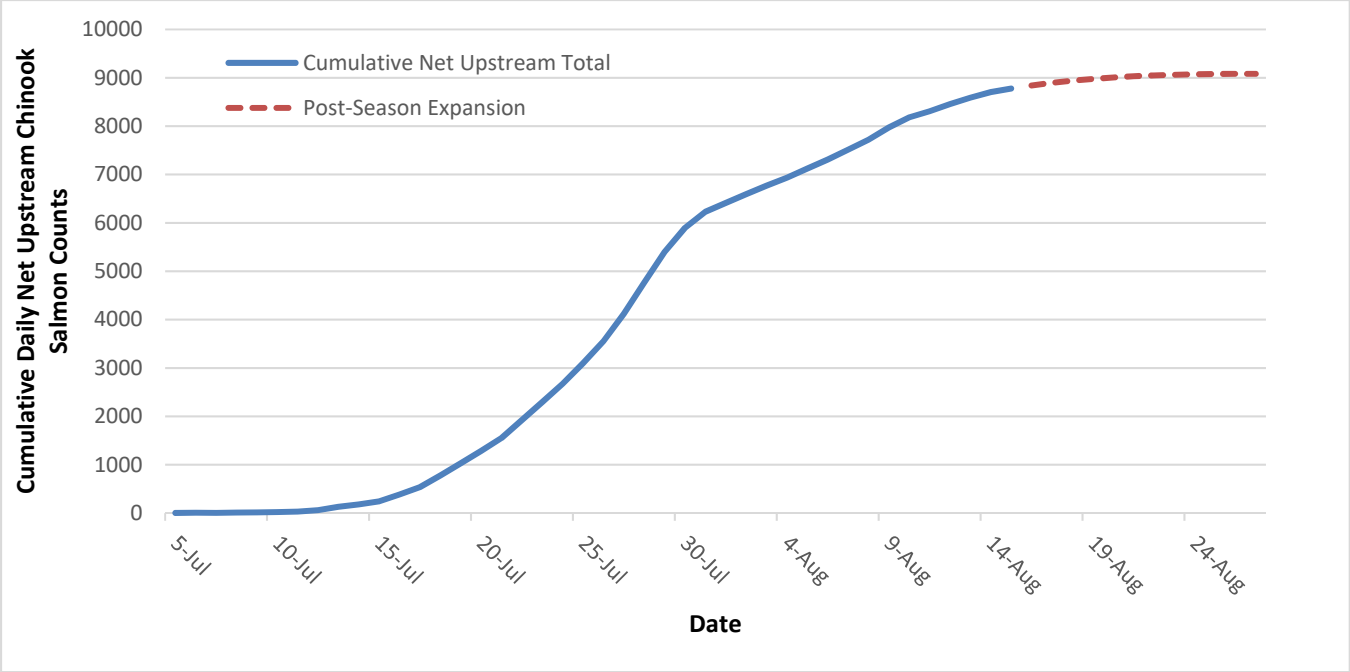


**Figure 4. Daily cumulative net upstream Chinook salmon counts at the Pelly River sonar site in 2017, including post-season extrapolated data.**

### 4.2.2 CHINOOK SALMON BANK ORIENTATION

The review of collected sonar data using Echotastic produces a text file record, which includes a measurement of the distance of each fish target from the sonar transducer. This data can be used to detect patterns in fish movements; for example, whether salmon are bank oriented at a particular location within the river. The target range data was graphed separately for each bank of the river to investigate potential patterns in the movement of Chinook as they pass through the zones of ensonification on each side of the river (Figures 5 and 6). It should be noted there could be several factors that may affect the spatial migration patterns of Chinook salmon (e.g. river discharge, water clarity, water temperature). Review of the target range data is intended as a preliminary assessment of the spatial distribution of fish targets with the understanding that additional years of data collection are required to determine if identified trends are consistent over a multi-year period.

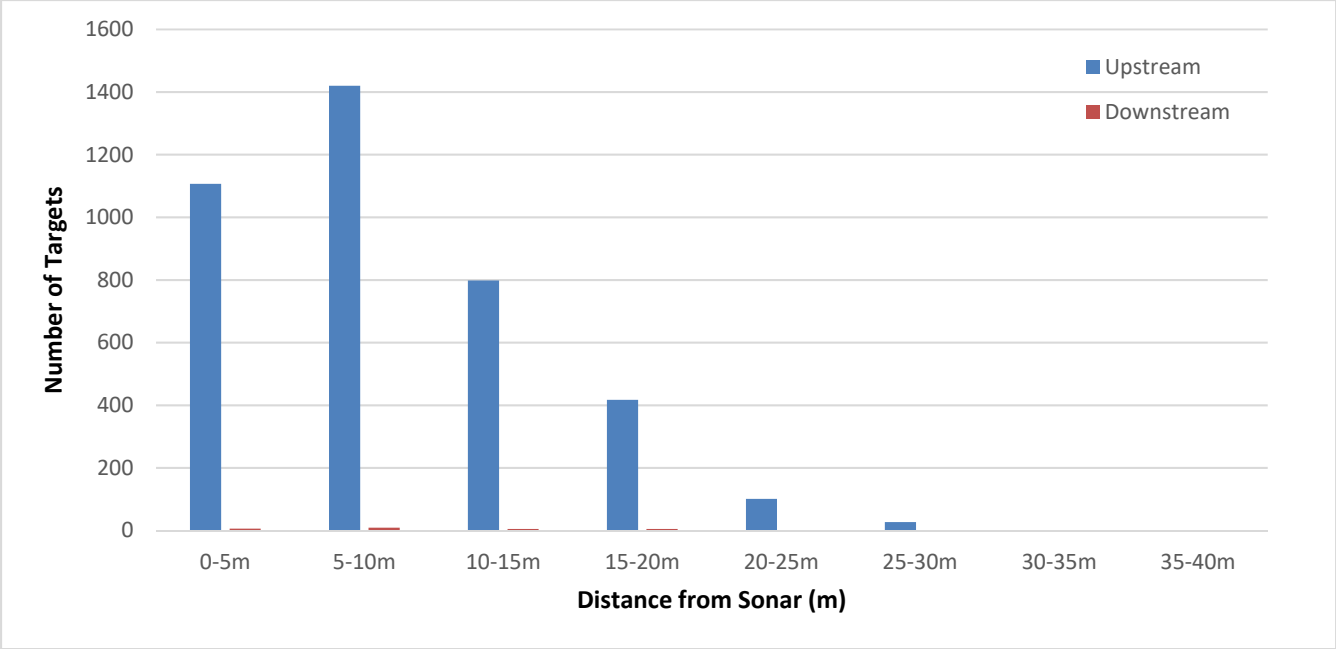


**Figure 5. Ranges of upstream and downstream moving fish targets detected on the left bank of the Pelly River sonar site in 2017 (Note: there were two marked targets beyond 70 m not represented in this graph).**

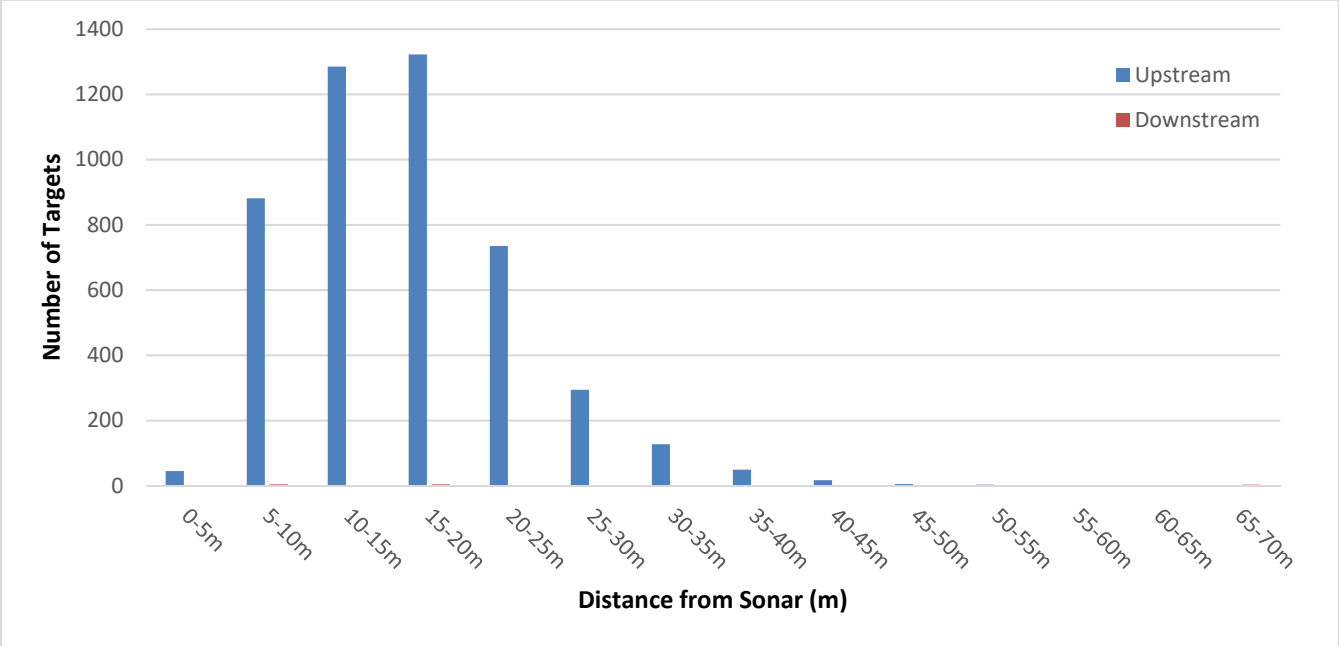


**Figure 6. Ranges of upstream and downstream moving fish targets detected on the right bank of the Pelly River sonar site in 2017.**

The target range data suggests that upstream migrating fish targets were strongly bank oriented in the vicinity of the Pelly River sonar site during operation in 2017. A total of 8,638 upstream moving targets were

analyzed[2]; 45% were observed on the left bank and 55% on the right bank (Table 10 and Table 11; Figure 5 and Figure 6). The majority of upstream moving sonar targets were detected within 5 to 10 m (left bank) and 10 to 20 m (right bank) of the sonar transducers. Very few (<4%) of the upstream moving targets were detected beyond 30 m from the sonar transducer on both banks. Downstream moving targets also appeared to be bank oriented with the majority (89% and 46%, left and right banks, respectively) of the targets observed within 25 m of the sonar transducers (Table 10 and Table 11; Figure 5 and Figure 6). It is interesting to note that on the right bank, a few downstream targets were observed longer distances out from the sonar beam, including one target as far as 80 m from the right bank.

**Table 10. Ranges of upstream and downstream moving fish targets detected on the left bank of the Pelly River sonar site in 2017.**

| Target Range | Upstream Targets | | Downstream Targets | |
|---|---|---|---|---|
| | Number of Targets | Proportion of Total Targets (%) | Number of Targets | Proportion of Total Targets (%) |
| 0-5m | 1107 | 28.60 | 6 | 21.43 |
| 5-10m | 1420 | 36.69 | 9 | 32.14 |
| 10-15m | 798 | 20.62 | 5 | 17.86 |
| 15-20m | 417 | 10.78 | 5 | 17.86 |
| 20-25m | 101 | 2.61 | 1 | 3.57 |
| 25-30m | 27 | 0.70 | 1 | 3.57 |
| 30-35m | 0 | 0.00 | 0 | 0.00 |
| 35-40m | 0 | 0.00 | 1 | 3.57 |
| **Total** | **3,870** | **100** | **28** | **100** |

[2] Note that 3,870 is the total raw moving target count, including upstream and downstream targets. This total is lower than what was reported as there is some error in saving of the text files following review of each sonar file.

**Table 11. Ranges of upstream and downstream moving fish targets detected on the right bank of the Pelly River sonar site in 2017.**

| Target Range | Upstream Targets | | Downstream Targets | |
|---|---|---|---|---|
| | Number of Targets | Proportion of Total Targets (%) | Number of Targets | Proportion of Total Targets (%) |
| 0-5m | 45 | 0.94 | 2 | |
| 5-10m | 881 | 18.48 | 4 | 15.38 |
| 10-15m | 1285 | 26.95 | 2 | 7.69 |
| 15-20m | 1322 | 27.73 | 4 | 15.38 |
| 20-25m | 735 | 15.42 | 0 | 0.00 |
| 25-30m | 294 | 6.17 | 1 | 3.85 |
| 30-35m | 127 | 2.66 | 2 | 7.69 |
| 35-40m | 49 | 1.03 | 2 | 7.69 |
| 40-45m | 17 | 0.36 | 0 | 0.00 |
| 45-50m | 5 | 0.10 | 2 | 7.69 |
| 50-55m | 3 | 0.06 | 1 | 3.85 |
| 55-60m | 2 | 0.04 | 1 | 3.85 |
| 60-65m | 2 | 0.04 | 1 | 3.85 |
| 65-70m | 0 | 0.00 | 3 | 11.54 |
| 70-75m | 0 | 0.00 | 0 | 0.00 |
| 75-80m | 0 | 0.00 | 0 | 0.00 |
| 80-85m | 0 | 0.00 | 1 | 3.85 |
| **Total** | **4,768** | **100** | **26** | **100** |

A higher percentage of upstream targets were identified with the left bank in 2017 (45%) as compared to 2016 (24%). The sonar transducer used on the left bank was a short-range transducer, therefore there was good clarity observed in sonar images up to approximately 35 m. The ARIS sonar unit used on the left bank also contained recorded video image (whereas the SIMRAD did not have this feature) which would have aided in identifying fish targets as salmon.

Differences in the slope of the shoreline between the left and right banks at the Pelly River sonar site were observed by the field crew (see photos in Appendix A) and were documented during the 2015 Pelly River sonar reconnaissance survey (EDI 2015). Both banks near shore were characterized by a shallow, even slope; however, the left bank was noted as being steeper than the right. The thalweg of the river at the sonar site was oriented closer to the left bank (EDI 2015), indicating flows are likely higher towards the left bank. This may have influenced the Chinook in their migration patterns as they were oriented more towards the right bank where velocities were lower.

### 4.2.3 PELLY RIVER WATER LEVELS

Water levels can have an important effect on salmon run timing; higher water levels and corresponding increased river discharge can slow migration rates, and vice versa. Daily water level data is recorded at a Water Survey of Canada gauging station on the Pelly River near the community of Pelly Crossing, approximately 24 km upstream from the Pelly River sonar site (Station Number 09BC001). This station operates on a continuous basis and there are no major watercourses that enter the Pelly River between this station and the sonar site. The proximity of this station to the sonar site provides a good indication of the water level at the sonar site during summer months. The available water level data was reviewed to investigate the water levels during the operation of the sonar, as compared to the mean, minimum, and maximum levels over the same period (including data from 2011 to 2017; Figure 7). High water levels in the Pelly River drainage were also known to be a result of heavy rainfall throughout the summer. Rainfall in the Faro area was also reviewed (Figure 8).

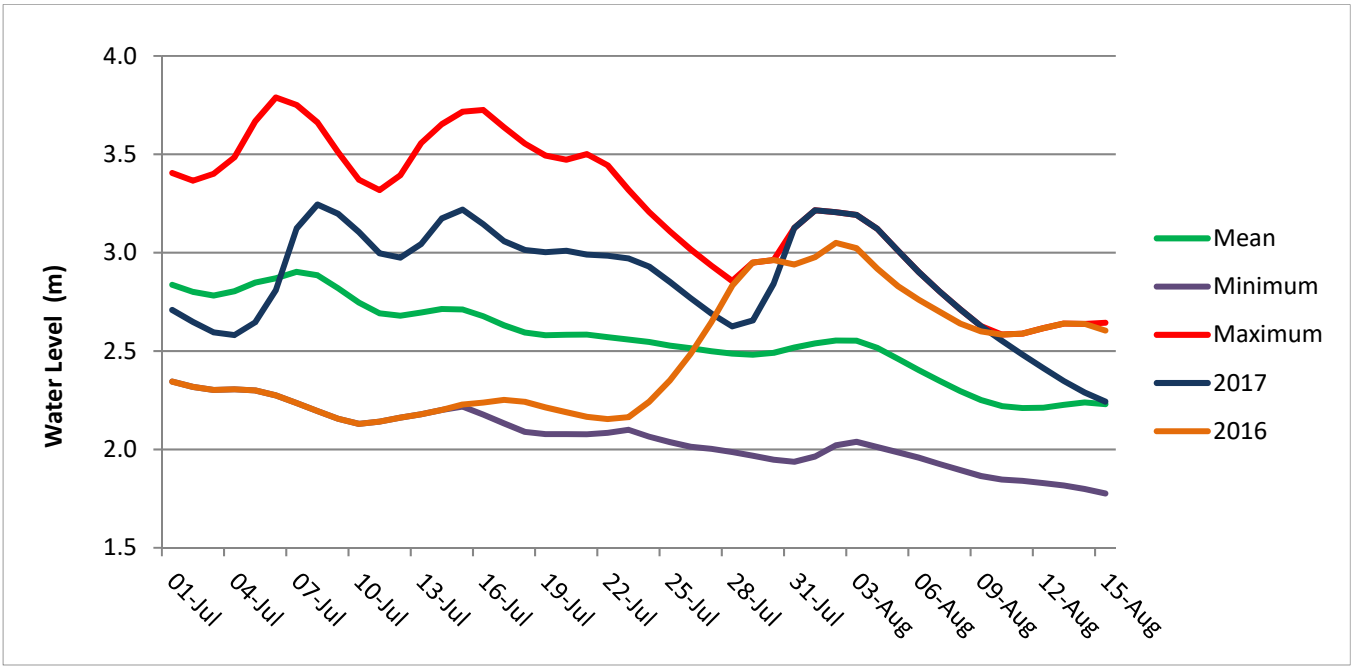


**Figure 7. July 1 to August 15, 2017 Pelly River water levels as compared to the mean, minimum, and maximum daily raw water levels from 2011 to 2017. Water levels measured at Water Survey of Canada gauging station 09BC001 near the community of Pelly Crossing. Earliest year available for water levels at this station was 2011.**

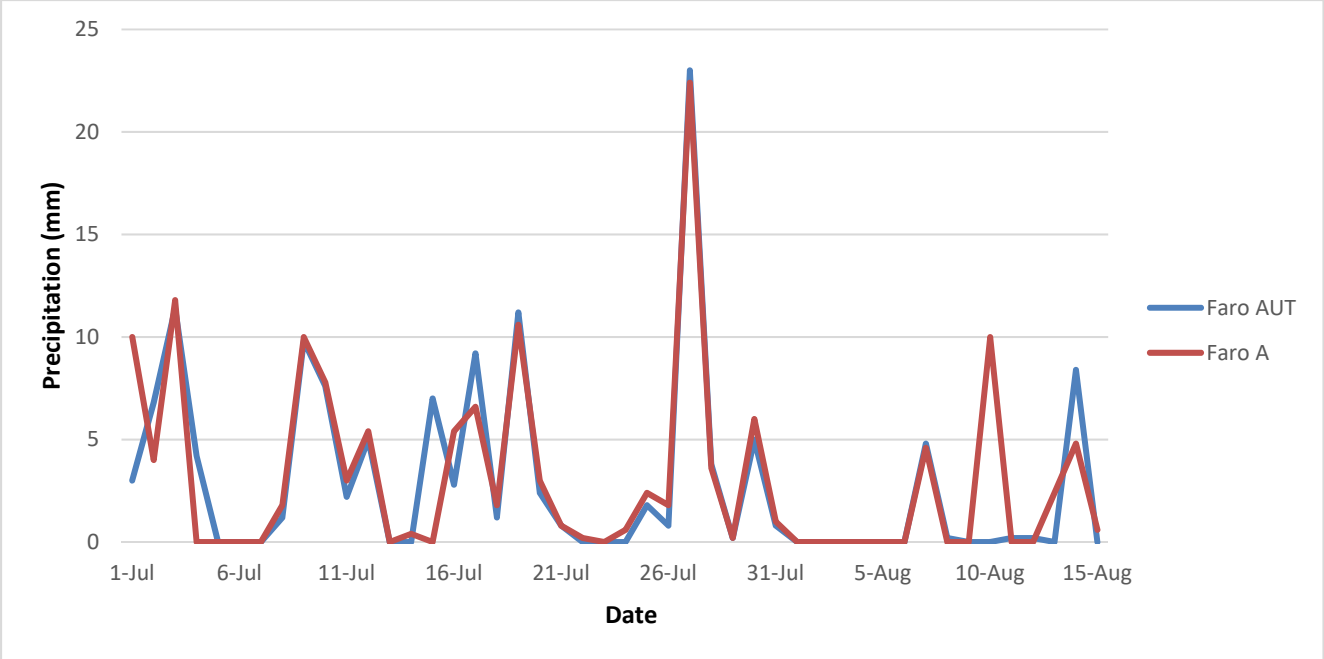


**Figure 8. Daily precipitation from Environment Canada weather stations Faro AUT and Faro A from July 1, 2017 to August 15, 2017, located near the community of Faro.**

Large amounts of rain explain the higher than normal water levels on the Pelly River during the field program in 2017 (Figure 8). Looking at precipitation data from weather stations near Faro (Faro A and Faro AUT), there were 28 of 46 days of rain at Faro AUT during the field program with a total of 135 mm of rain. Similarly, at the Faro A station there were 29 days of rain during the 46-day field program with a total of 143 mm of rain. This large amount of water in the Pelly River headwaters made for difficult conditions during the field program in 2017, including requiring continuous maintenance of sonar units and weirs and increased time periods where the sonar units were down.

As shown in Figure 7, water levels at the start of the 2017 sonar program were lower than the mean water levels, but still higher than the minimum water levels recorded for the same period from 2011 to 2017. On approximately July 5, 2017 water levels began to rise above the mean water levels and stayed above them for the duration of the field program (Figure 7). On July 7, 2017 field crews observed multiple instances where sonar units were bumped or knocked down by debris. By approximately 22:00 on July 7, the field crew decided to pull the sonar units from the water to avoid any damage or loss of equipment. The sonar units remained out of the water until July 11, 2017 when it was safe enough to return them to the water. High water levels throughout the 2017 field program were a constant challenge for field staff (see photos 14 to 20 in Appendix A). Debris and driftwood, including large logs, were constantly bumping and knocking over sonar units and damaging fish deflection weirs (see photos 19 and 20 in Appendix A). Similar to high water events in 2016, the high-water levels in 2017 allowed the back channel behind the right bank island to become connected to the mainstem of the Pelly River and remained connected for the duration of the season. Water levels were sufficient to allow for the passage of salmon through the side channel behind the right bank sonar (see photo 17 in Appendix A). As shown in Figure 7, high water events larger in magnitude than what occurred in 2017 are possible during the period of sonar operation. These high-water events can

be challenging for the operation of the sonar program; however, viable sonar counts can be maintained as long as field staff are alert and responsive to the changing water levels.

Due to the high-water levels during the 2017 field program, field personnel conducted visual monitoring for migrating salmon in the side channel behind the right sonar system. A total of four nets were set at the downstream extent of the side channel in an attempt to determine if any Chinook salmon were using the side channel to migrate up river. The width of the side channel was greater than the combined length of the nets, so the entire width of the side channel was unable to be completely blocked off. No salmon were observed migrating upstream in the side channel and two inconnu and one northern pike were captured in the nets. Due to the amount of debris in the side channel and swift currents, no additional nets were set in this location.

## 4.3 TEST NETTING EFFECTIVENESS

The 2017 Pelly River test netting program had two primary goals:

- Provide data on the extent of chum salmon co-migration, if any, during the latter part of the Chinook salmon run (after August 1, 2017); and
- Provide data on the extent of larger freshwater fish species that may be present during the Chinook salmon run (late June to early August).

The test netting program achieved both of these goals. Drift netting has been demonstrated to be effective in capturing chum salmon at other sonar projects such as the Porcupine River and Eagle sonar sites (EDI 2013; EDI 2014), provided chum are present in the river in substantial numbers. Given that no chum were captured in 36 onshore and 209 offshore drift net sets completed late in the sonar operation, the number of chum that co-migrated with Chinook salmon during the operational period of this program appeared to be low (or more likely zero, as speculated from the run timing of chum salmon at the Eagle sonar site). This assumption is further supported by the fact that no chum salmon were captured in the set netting program. Considering the amount of drift and set netting conducted, the Chinook and chum salmon overlap was likely negligible.

Observations in the sonar count files and set netting captures (of inconnu and northern pike) showed there was a presence of larger freshwater species in the vicinity of the Pelly River sonar site. As compared to 2016, there was an increase in the number of freshwater fish (particularly inconnu) captured during the set netting program (4 in 2016, 16 in 2017). It was noted by field crews in late July that there were several upstream targets exhibiting slow movements across the sonar beams and behaviours not typical of migrating salmon; it was presumed these were freshwater fish, and therefore not counted. These observations highlight the importance of the test netting program in confirming what is being recorded in the sonar files and developing a stronger understanding of the local conditions at the sonar site.

## 4.4 DEVELOPMENT OF LOCAL CAPACITY

An important goal of the 2017 Pelly River Chinook sonar program was to continue developing local capacity within the Selkirk First Nation and community of Pelly Crossing to conduct fisheries research programs. This program provided approximately 7.5 weeks of fisheries related work for two local technicians, including the opportunity to gain skills in the operation of sonar systems and conduct set and drift netting. Three local field technicians were trained and participated in this program, two of which were returning SFN employees from the 2016 program. There remains a strong interest within the community of Pelly Crossing to pursue future sonar programs for Chinook salmon stock assessment purposes and to continue building skills and experience amongst SFN community members. SFN and EDI continue to collaborate to expand the roles and build the responsibilities of SFN employees. The 2018 Chinook sonar program is again proposing the use of two full time local technicians for the field component of the program, as well as looking to increase the office-based task and preparation duties for SFN members. Currently, the long-term goal of the Chinook sonar program is to develop it into a permanent stock assessment initiative, entirely operated by SFN and local field technicians with professional assistance and support provided as needed.

# 5 RECOMMENDATIONS

Overall, the 2017 Pelly River Chinook Salmon Sonar Program was successful in meeting the goals and objectives as outlined in the 2017 Pelly River Chinook Salmon Sonar Program Proposal submitted to the Yukon River Panel Restoration and Enhancement Fund. Two local technicians were present onsite for nearly the full duration of the sonar program (7.5 weeks) and test netting was achieved and successful at capturing Chinook and other freshwater fish species. This sonar program provided a count that is local to Pelly Crossing, is accurate, and available in-season.

Recommendations for future Pelly River Chinook salmon sonar programs include:

- Continued collaboration between SFN and EDI to increase local capacity in other roles and responsibilities (in addition to the field program, i.e., SFN technician involvement in field preparation and post field reporting, etc.);
- Request a long-range sonar unit for both river banks to ensure as much coverage of the river as possible (i.e., 80 m range ARIS sonar unit from DFO, if possible);
- Discontinue onshore drift netting (targeting chum salmon) as the Chinook salmon migration is not shown to overlap with the earliest migrating chum salmon;
- An investigation should be completed for additional sonar locations during high water events when the back channel (behind the right bank sonar unit) becomes connected to the mainstem of the river, or, development of an effective plan to block off the back channel during high water events to prevent upstream fish passage;
- Adequate fencing and materials should be available onsite in preparation for high water events for weir construction;
- All test nets should be repaired prior to or at the very onset of the 2018 program;
- Continue improving upon the data QA/QC protocols by ensuring field personnel are regularly re-counting 10% of the daily sonar files throughout the entire duration of the sonar operation and that crew members are communicating to maintain counting consistency.
- Increased community involvement through the encouragement of site visits by locals, including youth and Elders, to the sonar camp;
- The local fishery should be monitored, and information communicated with the EDI biologist and Pelly River sonar personnel. This will provide valuable data to assist in documenting the beginning and end of the Chinook migration in the lower Pelly River and will be used to refine the extrapolated data for more accurate total escapement estimates. Communication between SFN members and the sonar camp personnel will also assist in fostering community engagement.

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# APPENDIX A. PHOTOGRAPHS

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Photo 1. View of Pelly River Chinook sonar camp from the river, facing upstream (July 16, 2017)

Photo 2. View of inside the sonar tent and field office (July 2, 2017)

Photo 3. View of the right bank Simrad sonar in the Pelly River, facing upstream (July 17, 2017)

Photo 4. View of the right bank sonar, network and internet electrical setup (July 1, 2017)

Photo 5. View of the left bank Aris sonar in the Pelly River, facing upstream (July 17, 2017)

Photo 6. View of the net storage along the left bank near camp (July 4, 2017)

Photo 7. View of a set net located at PR 1 near sonar camp, facing upstream (August 11, 2017)

Photo 8. View of a mid channel drift net (July 2017)

Photo 9. View of a female Chinook salmon captured during test netting (July 25, 2017)

Photo 10. View of a male Chinook salmon captured during test netting (July 29, 2017)

Photo 11. View of a female Chinook salmon captured during test netting (July 25, 2017)

Photo 12. View of a male Chinook salmon captured during test netting (August 7, 2017)

Photo 13. View of a large Inconnu captured during test netting (August 14, 2017)

Photo 14. View of right bank sonar and fish deflection weir during high water (July 2017)

Photo 15. View of the right bank sonar equipment during water (July 2017)

Photo 16. View of the right bank sonar equipment during high water with rock weir extension (July 2017)

Photo 17. View of the right bank side channel during high water, facing downstream (July 19, 2017)

Photo 18. View of left bank net storage near camp during high water (July 2017)

Photo 19. View of large amounts of debris caught in weir and sonar knocked over (July 15, 2017)

Photo 20. View of large tree caught in a set net (July 2017)

# APPENDIX B. RAW AND INTERPOLATED PELLY RIVER DAILY SONAR COUNTS

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**Table B1. Daily raw sonar counts from the 2017 Pelly River Chinook salmon sonar program.**

| Date | Left Bank | | | Right Bank | | | Both Banks Combined Net Total Upstream |
|---|---|---|---|---|---|---|---|
| | Upstream | Downstream | Net Total Upstream | Upstream | Downstream | Net Total Upstream | |
| 1-Jul-2017 | - | - | 0 | - | - | 0 | 0 |
| 2-Jul-2017 | - | - | 0 | - | - | 0 | 0 |
| 3-Jul-2017 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4-Jul-2017 | 1 | 1 | 0 | 2 | 4 | -2 | -2 |
| 5-Jul-2017 | 6 | 0 | 6 | 0 | 0 | 0 | 6 |
| 6-Jul-2017 | 5 | 2 | 3 | 0 | 0 | 0 | 3 |
| 7-Jul-2017 | 0 | 2 | -2 | 0 | 0 | 0 | -2 |
| 8-Jul-2017 | - | - | 0 | - | - | 0 | 0 |
| 9-Jul-2017 | - | - | 0 | - | - | 0 | 0 |
| 10-Jul-2017 | - | - | 0 | 0 | 0 | 0 | 0 |
| 11-Jul-2017 | 2 | 4 | -2 | 12 | 1 | 11 | 9 |
| 12-Jul-2017 | 10 | 4 | 6 | 19 | 2 | 17 | 23 |
| 13-Jul-2017 | 34 | 0 | 34 | 38 | 2 | 36 | 70 |
| 14-Jul-2017 | 29 | 0 | 29 | 16 | 0 | 16 | 45 |
| 15-Jul-2017 | 25 | 1 | 24 | 41 | 4 | 37 | 61 |
| 16-Jul-2017 | 69 | 1 | 68 | 75 | 0 | 75 | 143 |
| 17-Jul-2017 | 43 | 0 | 43 | 110 | 1 | 109 | 152 |
| 18-Jul-2017 | 86 | 3 | 83 | 161 | 3 | 158 | 241 |
| 19-Jul-2017 | 109 | 0 | 109 | 144 | 1 | 143 | 252 |
| 20-Jul-2017 | 137 | 2 | 135 | 122 | 2 | 120 | 255 |
| 21-Jul-2017 | 154 | 0 | 154 | 110 | 0 | 110 | 264 |
| 22-Jul-2017 | 246 | 0 | 246 | 125 | 0 | 125 | 371 |
| 23-Jul-2017 | 215 | 0 | 215 | 162 | 2 | 160 | 375 |
| 24-Jul-2017 | 153 | 0 | 153 | 223 | 0 | 223 | 376 |
| 25-Jul-2017 | 210 | 0 | 210 | 203 | 1 | 202 | 412 |
| 26-Jul-2017 | 185 | 2 | 183 | 266 | 0 | 266 | 449 |

| Date | Left Bank | | | Right Bank | | | Both Banks Combined Net Total Upstream |
|---|---|---|---|---|---|---|---|
| | Upstream | Downstream | Net Total Upstream | Upstream | Downstream | Net Total Upstream | |
| 27-Jul-2017 | 187 | 2 | 185 | 378 | 0 | 378 | 563 |
| 28-Jul-2017 | 219 | 0 | 219 | 433 | 1 | 432 | 651 |
| 29-Jul-2017 | 204 | 0 | 204 | 430 | 1 | 429 | 633 |
| 30-Jul-2017 | 143 | 0 | 143 | 352 | 0 | 352 | 495 |
| 31-Jul-2017 | 163 | 0 | 163 | 151 | 0 | 151 | 314 |
| 1-Aug-2017 | 93 | 0 | 93 | 38 | 0 | 38 | 131 |
| 2-Aug-2017 | 99 | 0 | 99 | 82 | 0 | 82 | 181 |
| 3-Aug-2017 | 95 | 0 | 95 | 80 | 0 | 80 | 175 |
| 4-Aug-2017 | 88 | 0 | 88 | 79 | 0 | 79 | 167 |
| 5-Aug-2017 | 83 | 0 | 83 | 105 | 0 | 105 | 188 |
| 6-Aug-2017 | 85 | 0 | 85 | 99 | 0 | 99 | 184 |
| 7-Aug-2017 | 87 | 0 | 87 | 119 | 0 | 119 | 206 |
| 8-Aug-2017 | 67 | 0 | 67 | 139 | 0 | 139 | 206 |
| 9-Aug-2017 | 116 | 0 | 116 | 110 | 0 | 110 | 226 |
| 10-Aug-2017 | 113 | 1 | 112 | 95 | 0 | 95 | 207 |
| 11-Aug-2017 | 53 | 0 | 53 | 74 | 1 | 73 | 126 |
| 12-Aug-2017 | 78 | 0 | 78 | 71 | 0 | 71 | 149 |
| 13-Aug-2017 | 53 | 0 | 53 | 77 | 0 | 77 | 130 |
| 14-Aug-2017 | 51 | 0 | 51 | 65 | 0 | 65 | 116 |
| 15-Aug-2017 | 16 | 0 | 16 | 21 | 0 | 21 | 37 |
| **Total** | **3812** | **25** | **3787** | **4827** | **26** | **4801** | **8588** |

**Table B2. Daily interpolated sonar counts from the 2017 Pelly River Chinook salmon sonar program.**

| Date | Left Bank | | | | Right Bank | | | | Both Banks Combined Net Total Upstream |
|---|---|---|---|---|---|---|---|---|---|
| | Raw Upstream Count | Raw Downstream Count | Upstream Interpolated | Net Total Upstream Interpolated | Raw Upstream Count | Raw Downstream Count | Upstream Interpolated | Net Total Upstream Interpolated | |
| 1-Jul | - | - | - | 0.0 | - | - | - | 0.0 | 0.0 |
| 2-Jul | - | - | - | 0.0 | - | - | - | 0.0 | 0.0 |
| 3-Jul | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 4-Jul | 1.0 | 1.0 | - | 0.0 | 2.0 | 4.0 | - | -2.0 | -2.0 |
| 5-Jul | 6.0 | 0.0 | - | 6.0 | 0.0 | 0.0 | - | 0.0 | 6.0 |
| 6-Jul | 5.0 | 2.0 | - | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.0 |
| 7-Jul | 0.0 | 2.0 | 0.0 | -2.0 | 0.0 | 0.0 | 1.1 | 1.1 | -0.9 |
| 8-Jul | - | - | 0.0 | 0.0 | - | - | 5.3 | 5.3 | 5.3 |
| 9-Jul | - | - | 0.0 | 0.0 | - | - | 5.3 | 5.3 | 5.3 |
| 10-Jul | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 4.8 | 4.8 | 4.8 |
| 11-Jul | 2.0 | 4.0 | 0.5 | -1.5 | 12.0 | 1.0 | 2.0 | 13.0 | 11.5 |
| 12-Jul | 10.0 | 4.0 | - | 6.0 | 19.0 | 2.0 | 5.0 | 22.0 | 28.0 |
| 13-Jul | 34.0 | 0.0 | - | 34.0 | 38.0 | 2.0 | 0.0 | 36.0 | 70.0 |
| 14-Jul | 29.0 | 0.0 | - | 29.0 | 16.0 | 0.0 | 6.9 | 22.9 | 51.9 |
| 15-Jul | 25.0 | 1.0 | - | 24.0 | 41.0 | 4.0 | - | 37.0 | 61.0 |
| 16-Jul | 69.0 | 1.0 | - | 68.0 | 75.0 | 0.0 | - | 75.0 | 143.0 |
| 17-Jul | 43.0 | 0.0 | - | 43.0 | 110.0 | 1.0 | - | 109.0 | 152.0 |
| 18-Jul | 86.0 | 3.0 | - | 83.0 | 161.0 | 3.0 | - | 158.0 | 241.0 |
| 19-Jul | 109.0 | 0.0 | - | 109.0 | 144.0 | 1.0 | - | 143.0 | 252.0 |
| 20-Jul | 137.0 | 2.0 | - | 135.0 | 122.0 | 2.0 | - | 120.0 | 255.0 |
| 21-Jul | 154.0 | 0.0 | - | 154.0 | 110.0 | 0.0 | 4.5 | 114.5 | 268.5 |
| 22-Jul | 246.0 | 0.0 | - | 246.0 | 125.0 | 0.0 | - | 125.0 | 371.0 |
| 23-Jul | 215.0 | 0.0 | - | 215.0 | 162.0 | 2.0 | - | 160.0 | 375.0 |
| 24-Jul | 153.0 | 0.0 | - | 153.0 | 223.0 | 0.0 | - | 223.0 | 376.0 |
| 25-Jul | 210.0 | 0.0 | - | 210.0 | 203.0 | 1.0 | 10.0 | 212.0 | 422.0 |

| Date | Left Bank | | | | Right Bank | | | | Both Banks Combined Net Total Upstream |
|---|---|---|---|---|---|---|---|---|---|
| | Raw Upstream Count | Raw Downstream Count | Upstream Interpolated | Net Total Upstream Interpolated | Raw Upstream Count | Raw Downstream Count | Upstream Interpolated | Net Total Upstream Interpolated | |
| 26-Jul | 185.0 | 2.0 | 8.5 | 191.5 | 266.0 | 0.0 | - | 266.0 | 457.5 |
| 27-Jul | 187.0 | 2.0 | - | 185.0 | 378.0 | 0.0 | - | 378.0 | 563.0 |
| 28-Jul | 219.0 | 0.0 | - | 219.0 | 433.0 | 1.0 | - | 432.0 | 651.0 |
| 29-Jul | 204.0 | 0.0 | - | 204.0 | 430.0 | 1.0 | - | 429.0 | 633.0 |
| 30-Jul | 143.0 | 0.0 | - | 143.0 | 352.0 | 0.0 | - | 352.0 | 495.0 |
| 31-Jul | 163.0 | 0.0 | - | 163.0 | 151.0 | 0.0 | 21.1 | 172.1 | 335.1 |
| 1-Aug | 93.0 | 0.0 | - | 93.0 | 38.0 | 0.0 | 51.9 | 89.9 | 182.9 |
| 2-Aug | 99.0 | 0.0 | - | 99.0 | 82.0 | 0.0 | - | 82.0 | 181.0 |
| 3-Aug | 95.0 | 0.0 | - | 95.0 | 80.0 | 0.0 | - | 80.0 | 175.0 |
| 4-Aug | 88.0 | 0.0 | - | 88.0 | 79.0 | 0.0 | - | 79.0 | 167.0 |
| 5-Aug | 83.0 | 0.0 | - | 83.0 | 105.0 | 0.0 | - | 105.0 | 188.0 |
| 6-Aug | 85.0 | 0.0 | - | 85.0 | 99.0 | 0.0 | - | 99.0 | 184.0 |
| 7-Aug | 87.0 | 0.0 | - | 87.0 | 119.0 | 0.0 | - | 119.0 | 206.0 |
| 8-Aug | 67.0 | 0.0 | - | 67.0 | 139.0 | 0.0 | - | 139.0 | 206.0 |
| 9-Aug | 116.0 | 0.0 | - | 116.0 | 110.0 | 0.0 | 28.0 | 138.0 | 254.0 |
| 10-Aug | 113.0 | 1.0 | - | 112.0 | 95.0 | 0.0 | - | 95.0 | 207.0 |
| 11-Aug | 53.0 | 0.0 | 2.0 | 55.0 | 74.0 | 1.0 | - | 73.0 | 128.0 |
| 12-Aug | 78.0 | 0.0 | - | 78.0 | 71.0 | 0.0 | - | 71.0 | 149.0 |
| 13-Aug | 53.0 | 0.0 | - | 53.0 | 77.0 | 0.0 | - | 77.0 | 130.0 |
| 14-Aug | 51.0 | 0.0 | - | 51.0 | 65.0 | 0.0 | - | 65.0 | 116.0 |
| 15-Aug | 16.0 | 0.0 | 16.0 | 32.0 | 21.0 | 0.0 | 21.0 | 42.0 | 37.0 |
| **Total** | **3812.0** | **25.0** | **27.0** | **3814.0** | **4827.0** | **26.0** | **166.8** | **4967.8** | **8744.8** |

# APPENDIX C. TEST NETTING CAPTURES

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## Table C1. Net locations from the 2017 Pelly River Chinook Salmon Sonar Program.

| Site Name | Location | Description |
|---|---|---|
| PR1 | 08V 0391300 6969338 | Upstream of camp on right bank, near fallen down beaver chewed tree |
| PR2 | 08V 0390853 6968772 | Left bank at camp eddy near boat launch |
| PR3 | 08V 0390753 6968954 | Downstream end of backchannel near right bank sonar set-up |
| PR4 | 08V 0393303 6969172 | 1.5 - 2 KM upstream of camp on left bank, big eddy |
| DS Camp | 08V 0390677 6968551 | Downstream of camp on left bank |
| US Camp | 08V 0391842 6969556 | Upstream of camp on left bank on cobble beach |
| Offshore Drift Netting | 08V 0390885 6968890 | Mid-channel in front of camp (all offshore drift netting completed here) |

## Table C2. Set netting effort and fish captures from the 2017 Pelly River Chinook Salmon Sonar Program.

| Date | Set Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 4-Jul-2017 | 1 | PR1 | 15:55 | 17:08 | 01:13 | 8.5 | NFC | - | - |
| 5-Jul-2017 | 2 | PR1 | 10:00 | 16:50 | 06:50 | 7.5 | NFC | - | - |
| 6-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 7-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 8-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 9-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 10-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 11-Jul-2017 | No Set Netting Completed | | | | | | | | |
| 12-Jul-2017 | 3 | PR1 | 11:29 | 16:56 | 05:27 | 5.25 | NFC | - | - |
| 12-Jul-2017 | 4 | PR2 | 17:43 | 20:30 | 02:47 | 8.5 | NFC | - | - |
| 13-Jul-2017 | 5 | PR1 | 13:19 | 16:00 | 02:41 | 7.5 | NFC | - | - |
| 13-Jul-2017 | 6 | PR1 | 16:19 | 17:37 | 01:18 | 6.75 | NFC | - | - |
| 14-Jul-2017 | No Set Netting Completed | | | | | | | | |

| Date | Set Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 15-Jul-2017 | | | | | No Set Netting Completed | | | | |
| 16-Jul-2017 | 7 | PR2 | 12:27 | 15:45 | 03:18 | 5.25 | NFC | - | - |
| 16-Jul-2017 | 8 | PR1 | 16:00 | 18:47 | 02:47 | 5.25 | NFC | - | - |
| 17-Jul-2017 | 9 | PR1 | 13:53 | 16:25 | 02:32 | 5.25 | Chinook | 70 | F |
| 17-Jul-2017 | 10 | PR1 | 16:40 | 18:15 | 01:35 | 8.5 | NFC | - | - |
| 18-Jul-2017 | 11 | PR1 | 15:45 | 17:07 | 01:22 | 6.75 | NFC | - | - |
| 18-Jul-2017 | 12 | PR1 | 17:15 | 18:23 | 01:08 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 13 | PR1 | 10:35 | 13:55 | 03:20 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 14 | PR1 | 14:11 | 17:30 | 03:19 | 6.75 | NFC | - | - |
| 19-Jul-2017 | 15 | PR3 | 17:18 | 19:20 | 02:02 | 7.5 | Inconnu | 86 | - |
| 20-Jul-2017 | 16 | PR3 | 11:05 | 16:50 | 05:45 | 5.25 | Inconnu | 54 | - |
| 20-Jul-2017 | 16 | PR3 | 11:05 | 16:50 | 05:45 | 5.25 | Northern Pike | 56 | - |
| 20-Jul-2017 | 17 | PR1 | 14:05 | 17:15 | 03:10 | 7.5 | NFC | - | - |
| 21-Jul-2017 | 18 | PR1 | 10:51 | 16:45 | 05:54 | 6.75 | NFC | - | - |
| 21-Jul-2017 | 19 | PR1 | 16:50 | 20:40 | 03:50 | 7.5 | Inconnu | 82 | - |
| 22-Jul-2017 | | | | | No Set Netting Completed | | | | |
| 23-Jul-2017 | 20 | PR1 | 09:07 | 16:10 | 07:03 | 5.25 | Chinook | 92 | M |
| 24-Jul-2017 | 21 | PR3 | 09:40 | 13:40 | 04:00 | 8.5 | NFC | - | - |
| 24-Jul-2017 | 22 | PR1 | 13:55 | 18:45 | 04:50 | 6.75 | NFC | - | - |
| 25-Jul-2017 | 23 | PR1 | 09:05 | 17:00 | 07:55 | 7.5 | Chinook | 77 | F |
| 25-Jul-2017 | 23 | PR1 | 09:05 | 17:00 | 07:55 | 7.5 | Inconnu | 84 | - |
| 25-Jul-2017 | 23 | PR1 | 09:05 | 17:00 | 07:55 | 7.5 | Chinook | 68 | F |
| 26-Jul-2017 | 24 | PR1 | 10:55 | 15:00 | 04:05 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 25 | PR1 | 15:15 | 19:35 | 04:20 | 8.5 | Inconnu | 82 | |
| 26-Jul-2017 | 25 | PR1 | 15:15 | 19:35 | 04:20 | 8.5 | Chinook | 69 | F |
| 27-Jul-2017 | | | | | No Set Netting Completed | | | | |
| 28-Jul-2017 | 26 | PR1 | 09:38 | 14:00 | 04:22 | 6.75 | Chinook | 85 | M |
| 28-Jul-2017 | 27 | PR1 | 14:25 | 18:00 | 03:35 | 7.5 | Chinook | 84 | F |

| Date | Set Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 29-Jul-2017 | 28 | PR1 | 09:32 | 13:19 | 03:47 | 5.25 | NFC | - | - |
| 29-Jul-2017 | 29 | PR1 | 13:27 | 18:45 | 05:18 | 8.5 | Chinook | 70 | M |
| 29-Jul-2017 | 29 | PR1 | 13:27 | 18:45 | 05:18 | 8.5 | Chinook | 75 | M |
| 29-Jul-2017 | 29 | PR1 | 13:27 | 18:45 | 05:18 | 8.5 | Chinook | 93 | M |
| 30-Jul-2017 | 30 | PR1 | 09:35 | 13:50 | 04:15 | 6.75 | Chinook | Escaped before sampling | |
| 30-Jul-2017 | 31 | PR1 | 13:58 | 17:12 | 03:14 | 7.5 | NFC | - | - |
| 31-Jul-2017 | 32 | PR1 | 13:00 | 16:30 | 03:30 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 33 | PR1 | 11:58 | 13:38 | 01:40 | 5.25 | NFC | - | - |
| 1-Aug-2017 | 34 | PR3 | 17:27 | 18:35 | 01:08 | 5.25 | NFC | - | - |
| 2-Aug-2017 | | | | | No Set Netting Completed | | | | |
| 3-Aug-2017 | 35 | PR1 | 10:50 | 15:06 | 04:16 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 36 | PR1 | 15:10 | 18:00 | 02:50 | 6.75 | NFC | - | - |
| 4-Aug-2017 | 37 | PR4 | 11:20 | 16:55 | 05:35 | 5.25 | Chinook | 92 | M |
| 4-Aug-2017 | 37 | PR4 | 11:20 | 16:55 | 05:35 | 5.25 | Inconnu | 59 | - |
| 5-Aug-2017 | 38 | PR4 | 09:43 | 14:12 | 04:29 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 39 | PR1 | 14:26 | 17:50 | 03:24 | 7.5 | NFC | - | - |
| 6-Aug-2017 | 40 | PR1 | 09:27 | 13:38 | 04:11 | 5.25 | Inconnu | 70 | - |
| 6-Aug-2017 | 41 | PR1 | 13:45 | 17:50 | 04:05 | 6.75 | Inconnu | 86 | - |
| 6-Aug-2017 | 41 | PR1 | 13:45 | 17:50 | 04:05 | 6.75 | Inconnu | 79 | - |
| 7-Aug-2017 | 42 | PR1 | 09:45 | 14:05 | 04:20 | 8.5 | Chinook | 102 | M |
| 7-Aug-2017 | 42 | PR1 | 09:45 | 14:05 | 04:20 | 8.5 | Chinook | 100 | M |
| 7-Aug-2017 | 42 | PR1 | 09:45 | 14:05 | 04:20 | 8.5 | Northern Pike | 33 | - |
| 7-Aug-2017 | 43 | PR1 | 14:20 | 18:22 | 04:02 | 7.5 | NFC | - | - |
| 8-Aug-2017 | 44 | PR1 | 09:50 | 14:12 | 04:22 | 6.75 | Inconnu | 81 | - |
| 8-Aug-2017 | 44 | PR1 | 09:50 | 14:12 | 04:22 | 6.75 | Inconnu | 69 | - |
| 8-Aug-2017 | 45 | PR1 | 14:13 | 18:29 | 04:16 | 5.25 | Chinook | 95 | F |
| 8-Aug-2017 | 45 | PR1 | 14:13 | 18:29 | 04:16 | 5.25 | Chinook | 80 | F |
| 8-Aug-2017 | 45 | PR1 | 14:13 | 18:29 | 04:16 | 5.25 | Inconnu | 77 | - |

| Date | Set Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 9-Aug-2017 | 46 | PR1 | 09:53 | 14:08 | 04:15 | 8.5 | NFC | - | - |
| 9-Aug-2017 | 47 | PR1 | 14:09 | 18:40 | 04:31 | 7.5 | Chinook | 97 | F |
| 9-Aug-2017 | 47 | PR1 | 14:09 | 18:40 | 04:31 | 7.5 | Chinook | 86 | F |
| 10-Aug-2017 | 48 | PR1 | 09:44 | 13:50 | 04:06 | 6.75 | NFC | - | - |
| 10-Aug-2017 | 49 | PR1 | 13:51 | 17:55 | 04:04 | 5.25 | NFC | - | - |
| 11-Aug-2017 | 50 | PR1 | 09:46 | 13:47 | 04:01 | 7.5 | NFC | - | - |
| 11-Aug-2017 | 51 | PR1 | 13:48 | 18:12 | 04:24 | 8.5 | NFC | - | - |
| 12-Aug-2017 | 52 | PR1 | 07:55 | 10:45 | 02:50 | 6.75 | NFC | - | - |
| 13-Aug-2017 | 53 | PR4 | 09:17 | 13:25 | 04:08 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 54 | PR4 | 13:35 | 17:55 | 04:20 | 7.5 | NFC | - | - |
| 14-Aug-2017 | 55 | PR1 | 09:13 | 14:20 | 05:07 | 8.5 | Inconnu | 81 | - |
| 14-Aug-2017 | 56 | PR1 | 14:25 | 18:58 | 04:33 | 6.75 | NFC | - | - |
| 15-Aug-2017 | 57 | PR1 | 09:43 | 11:40 | 01:57 | 5.25 | Inconnu | 55 | - |

[A]NFC = No Fish Caught

Table C3. Offshore drift netting effort and fish captures from the 2017 Pelly River Chinook Salmon Sonar Program.

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 4-Jul-2017 | 1 | 16:04 | 16:10 | 00:06 | 5.25 | NFC | - | - |
| 4-Jul-2017 | 2 | 16:17 | 16:23 | 00:06 | 5.25 | NFC | - | - |
| 4-Jul-2017 | 3 | 16:30 | 16:36 | 00:06 | 5.25 | NFC | - | - |
| 4-Jul-2017 | 4 | 16:42 | 16:48 | 00:06 | 5.25 | NFC | - | - |
| 5-Jul-2017 | 1 | 10:05 | 10:11 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 2 | 10:20 | 10:26 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 3 | 10:30 | 10:36 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 4 | 10:40 | 10:46 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 5 | 13:08 | 13:14 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 6 | 13:38 | 13:44 | 00:06 | 6.75 | NFC | - | - |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 5-Jul-2017 | 7 | 13:50 | 13:56 | 00:06 | 6.7 | NFC | - | - |
| 5-Jul-2017 | 8 | 14:00 | 14:06 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 9 | 14:12 | 14:18 | 00:06 | 6.75 | NFC | - | - |
| 5-Jul-2017 | 10 | 14:22 | 14:28 | 00:06 | 6.75 | NFC | - | - |
| 6-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 7-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 8-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 9-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 10-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 11-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 12-Jul-2017 | 1 | 12:14 | 12:20 | 00:06 | 8.5 | NFC | - | - |
| 12-Jul-2017 | 2 | 12:29 | 12:35 | 00:06 | 8.5 | NFC | - | - |
| 12-Jul-2017 | 3 | 15:18 | 15:24 | 00:06 | 8.5 | NFC | - | - |
| 12-Jul-2017 | 4 | 16:29 | 16:35 | 00:06 | 8.5 | NFC | - | - |
| 12-Jul-2017 | 5 | 16:40 | 16:46 | 00:06 | 8.5 | NFC | - | - |
| 12-Jul-2017 | 6 | 17:40 | 17:46 | 00:06 | 5.25 | NFC | - | - |
| 12-Jul-2017 | 7 | 17:52 | 17:58 | 00:06 | 5.25 | NFC | - | - |
| 13-Jul-2017 | 1 | 13:32 | 13:38 | 00:06 | 6.75 | NFC | - | - |
| 13-Jul-2017 | 2 | 13:44 | 13:50 | 00:06 | 6.75 | NFC | - | - |
| 13-Jul-2017 | 3 | 13:56 | 14:02 | 00:06 | 6.75 | NFC | - | - |
| 13-Jul-2017 | 4 | 14:07 | 14:13 | 00:06 | 6.75 | NFC | - | - |
| 13-Jul-2017 | 5 | 14:18 | 14:22 | 00:04 | 6.75 | NFC | - | - |
| 13-Jul-2017 | 6 | 16:22 | 16:28 | 00:06 | 7.5 | NFC | - | - |
| 13-Jul-2017 | 7 | 16:33 | 16:39 | 00:06 | 7.5 | NFC | - | - |
| 13-Jul-2017 | 8 | 16:44 | 16:50 | 00:06 | 7.5 | NFC | - | - |
| 13-Jul-2017 | 9 | 16:58 | 17:04 | 00:06 | 7.5 | NFC | - | - |
| 13-Jul-2017 | 10 | 17:09 | 17:15 | 00:06 | 7.5 | NFC | - | - |
| 14-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 15-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 16-Jul-2017 | 1 | 14:39 | 14:44 | 00:05 | 8.5 | NFC | - | - |
| 16-Jul-2017 | 2 | 14:54 | 15:00 | 00:06 | 8.5 | NFC | - | - |
| 16-Jul-2017 | 3 | 15:09 | 15:15 | 00:06 | 8.5 | NFC | - | - |
| 16-Jul-2017 | 4 | 15:23 | 15:29 | 00:06 | 8.5 | NFC | - | - |
| 17-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 18-Jul-2017 | 1 | 16:07 | 16:13 | 00:06 | 7.5 | NFC | - | - |
| 18-Jul-2017 | 2 | 16:20 | 16:26 | 00:06 | 7.5 | NFC | - | - |
| 18-Jul-2017 | 3 | 16:34 | 16:40 | 00:06 | 7.5 | NFC | - | - |
| 18-Jul-2017 | 4 | 16:49 | 16:55 | 00:06 | 7.5 | NFC | - | - |
| 18-Jul-2017 | 5 | 17:25 | 17:31 | 00:06 | 6.75 | NFC | - | - |
| 18-Jul-2017 | 6 | 17:38 | 17:44 | 00:06 | 6.75 | NFC | - | - |
| 18-Jul-2017 | 7 | 17:51 | 17:57 | 00:06 | 6.75 | NFC | - | - |
| 18-Jul-2017 | 8 | 18:05 | 18:11 | 00:06 | 6.75 | NFC | - | - |
| 19-Jul-2017 | 1 | 10:42 | 10:48 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 2 | 11:15 | 11:21 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 3 | 11:27 | 11:33 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 4 | 11:49 | 11:55 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 5 | 12:02 | 12:08 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 6 | 14:30 | 14:36 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 7 | 14:46 | 14:52 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 8 | 15:02 | 15:08 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 9 | 15:14 | 15:20 | 00:06 | 7.5 | NFC | - | - |
| 19-Jul-2017 | 10 | 15:26 | 15:32 | 00:06 | 7.5 | NFC | - | - |
| 20-Jul-2017 | 1 | 17:23 | 17:29 | 00:06 | 5.25 | NFC | - | - |
| 20-Jul-2017 | 2 | 17:35 | 17:41 | 00:06 | 5.25 | NFC | - | - |
| 21-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 22-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 23-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 24-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 25-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 26-Jul-2017 | 1 | 11:03 | 11:09 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 2 | 11:15 | 11:21 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 3 | 11:28 | 11:34 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 4 | 11:47 | 11:53 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 5 | 12:10 | 12:16 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 6 | 12:25 | 12:31 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 7 | 12:38 | 12:44 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 8 | 14:21 | 14:27 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 9 | 14:33 | 14:39 | 00:06 | 8.5 | NFC | - | - |
| 26-Jul-2017 | 10 | 15:50 | 15:56 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 11 | 16:01 | 16:07 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 12 | 16:14 | 16:20 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 13 | 16:36 | 16:42 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 14 | 16:48 | 16:54 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 15 | 17:01 | 17:07 | 00:06 | 5.25 | NFC | - | - |
| 26-Jul-2017 | 16 | 17:13 | 17:19 | 00:06 | 5.25 | NFC | - | - |
| 27-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 28-Jul-2017 | 1 | 14:29 | 14:35 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 2 | 14:39 | 14:45 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 3 | 14:50 | 14:56 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 4 | 15:01 | 15:07 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 5 | 15:11 | 15:17 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 6 | 15:31 | 15:37 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 7 | 15:42 | 15:48 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 8 | 15:54 | 16:00 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 9 | 16:05 | 16:11 | 00:06 | 6.75 | NFC | - | - |
| 28-Jul-2017 | 10 | 16:17 | 16:23 | 00:06 | 6.75 | NFC | - | - |
| 29-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 30-Jul-2017 | 1 | 10:10 | 10:16 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 2 | 10:20 | 10:26 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 3 | 10:40 | 10:46 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 4 | 10:51 | 10:57 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 5 | 11:02 | 11:08 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 6 | 11:14 | 11:20 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 7 | 11:25 | 11:31 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 8 | 11:43 | 11:49 | 00:06 | 7.5 | NFC | - | - |
| 30-Jul-2017 | 9 | 14:04 | 14:10 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 10 | 14:15 | 14:21 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 11 | 14:25 | 14:31 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 12 | 14:36 | 14:42 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 13 | 14:47 | 14:53 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 14 | 15:06 | 15:12 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 15 | 15:18 | 15:24 | 00:06 | 6.75 | NFC | - | - |
| 30-Jul-2017 | 16 | 15:30 | 15:36 | 00:06 | 6.75 | NFC | - | - |
| 31-Jul-2017 | | | | No Offshore Drift Netting Completed | | | | |
| 1-Aug-2017 | 1 | 12:12 | 12:18 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 2 | 12:24 | 12:30 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 3 | 12:38 | 12:44 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 4 | 12:52 | 12:58 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 5 | 14:38 | 14:44 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 6 | 14:50 | 14:56 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 7 | 15:28 | 15:34 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 8 | 15:41 | 15:47 | 00:06 | 8.5 | NFC | - | - |
| 1-Aug-2017 | 9 | 16:05 | 16:11 | 00:06 | 5.25 | NFC | - | - |
| 1-Aug-2017 | 10 | 16:17 | 16:23 | 00:06 | 5.25 | NFC | - | - |
| 1-Aug-2017 | 11 | 16:29 | 16:35 | 00:06 | 5.25 | NFC | - | - |
| 1-Aug-2017 | 12 | 16:40 | 16:46 | 00:06 | 5.25 | NFC | - | - |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 1-Aug-2017 | 13 | 16:51 | 16:57 | 00:06 | 5.25 | NFC | - | - |
| 1-Aug-2017 | 14 | 17:01 | 17:07 | 00:06 | 5.25 | NFC | - | - |
| 2-Aug-2017 | No Offshore Drift Netting Completed | | | | | | | |
| 3-Aug-2017 | 1 | 14:25 | 14:31 | 00:06 | 6.75 | NFC | - | - |
| 3-Aug-2017 | 2 | 14:35 | 14:41 | 00:06 | 6.75 | NFC | - | - |
| 3-Aug-2017 | 3 | 14:45 | 14:51 | 00:06 | 6.75 | NFC | - | - |
| 3-Aug-2017 | 4 | 15:15 | 15:21 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 5 | 15:28 | 15:34 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 6 | 15:39 | 15:45 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 7 | 15:49 | 15:55 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 8 | 17:21 | 17:27 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 9 | 17:30 | 17:36 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 10 | 17:40 | 17:46 | 00:06 | 7.5 | NFC | - | - |
| 3-Aug-2017 | 11 | 17:51 | 17:57 | 00:06 | 7.5 | NFC | - | - |
| 4-Aug-2017 | No Offshore Drift Netting Completed | | | | | | | |
| 5-Aug-2017 | 1 | 14:33 | 14:39 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 2 | 14:46 | 14:52 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 3 | 14:59 | 15:05 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 4 | 15:10 | 15:16 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 5 | 15:29 | 15:35 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 6 | 15:42 | 15:48 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 7 | 15:52 | 15:58 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 8 | 16:02 | 16:08 | 00:06 | 8.5 | NFC | - | - |
| 6-Aug-2017 | 1 | 10:01 | 10:07 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 2 | 10:32 | 10:38 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 3 | 10:42 | 10:48 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 4 | 10:53 | 10:59 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 5 | 11:04 | 11:10 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 6 | 11:14 | 11:20 | 00:06 | 6.75 | NFC | - | - |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 6-Aug-2017 | 7 | 15:00 | 15:06 | 00:06 | 5.25 | NFC | - | - |
| 6-Aug-2017 | 8 | 15:12 | 15:18 | 00:06 | 5.25 | NFC | - | - |
| 6-Aug-2017 | 9 | 15:24 | 15:30 | 00:06 | 5.25 | NFC | - | - |
| 6-Aug-2017 | 10 | 15:37 | 15:43 | 00:06 | 5.25 | NFC | - | - |
| 7-Aug-2017 | 1 | 16:07 | 16:13 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 2 | 16:19 | 16:26 | 00:07 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 3 | 16:30 | 16:36 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 4 | 16:51 | 16:57 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 5 | 17:04 | 17:10 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 6 | 17:16 | 17:22 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 7 | 17:27 | 17:33 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 8 | 17:38 | 17:44 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 9 | 17:56 | 18:02 | 00:06 | 8.5 | NFC | - | - |
| 7-Aug-2017 | 10 | 18:07 | 18:13 | 00:06 | 8.5 | NFC | - | - |
| 8-Aug-2017 | 1 | 14:17 | 14:23 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 2 | 14:27 | 14:33 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 3 | 14:37 | 14:43 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 4 | 14:47 | 14:53 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 5 | 14:57 | 15:03 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 6 | 15:12 | 15:18 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 7 | 15:22 | 15:28 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 8 | 15:32 | 15:38 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 9 | 15:42 | 15:48 | 00:06 | 6.75 | NFC | - | - |
| 8-Aug-2017 | 10 | 15:52 | 15:58 | 00:06 | 6.75 | NFC | - | - |
| 9-Aug-2017 | 1 | 11:02 | 11:08 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 2 | 11:16 | 11:22 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 3 | 11:28 | 11:34 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 4 | 11:42 | 11:48 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 5 | 13:22 | 13:28 | 00:06 | 7.5 | NFC | - | - |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 9-Aug-2017 | 6 | 13:33 | 13:39 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 7 | 13:43 | 13:49 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 8 | 14:12 | 14:18 | 00:06 | 8.5 | NFC | - | - |
| 9-Aug-2017 | 9 | 14:23 | 14:29 | 00:06 | 8.5 | NFC | - | - |
| 9-Aug-2017 | 10 | 14:34 | 14:40 | 00:06 | 8.5 | NFC | - | - |
| 10-Aug-2017 | 1 | 10:54 | 11:00 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 2 | 11:08 | 11:14 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 3 | 11:19 | 11:25 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 4 | 11:30 | 11:36 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 5 | 11:42 | 11:48 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 6 | 13:16 | 13:22 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 7 | 13:28 | 13:34 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 8 | 13:56 | 14:02 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 9 | 14:13 | 14:19 | 00:06 | 6.75 | NFC | - | - |
| 10-Aug-2017 | 10 | 14:24 | 14:30 | 00:06 | 6.75 | NFC | - | - |
| 10-Aug-2017 | 11 | 14:35 | 14:41 | 00:06 | 6.75 | NFC | - | - |
| 11-Aug-2017 | 1 | 11:25 | 11:31 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 2 | 11:36 | 11:42 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 3 | 11:46 | 11:52 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 4 | 11:56 | 12:02 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 5 | 12:07 | 12:13 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 6 | 14:17 | 14:23 | 00:06 | 7.5 | NFC | - | - |
| 11-Aug-2017 | 7 | 14:28 | 14:34 | 00:06 | 7.5 | NFC | - | - |
| 11-Aug-2017 | 8 | 14:38 | 14:44 | 00:06 | 7.5 | NFC | - | - |
| 11-Aug-2017 | 9 | 15:00 | 15:06 | 00:06 | 7.5 | NFC | - | - |
| 11-Aug-2017 | 10 | 15:11 | 15:17 | 00:06 | 7.5 | NFC | - | - |
| 12-Aug-2017 | No Offshore Drift Netting Completed | | | | | | | |
| 13-Aug-2017 | 1 | 13:40 | 13:46 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 2 | 13:53 | 13:59 | 00:06 | 5.25 | NFC | - | - |

| Date | Drift Number | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|
| 13-Aug-2017 | 3 | 14:04 | 14:10 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 4 | 14:15 | 14:21 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 5 | 14:44 | 14:50 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 6 | 14:55 | 15:01 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 7 | 15:06 | 15:12 | 00:06 | 5.25 | NFC | - | - |
| 13-Aug-2017 | 8 | 15:18 | 15:24 | 00:06 | 5.25 | NFC | - | - |
| 14-Aug-2017 | 1 | 13:39 | 13:45 | 00:06 | 6.75 | NFC | - | - |
| 14-Aug-2017 | 2 | 13:49 | 13:55 | 00:06 | 6.75 | NFC | - | - |
| 14-Aug-2017 | 3 | 14:00 | 14:06 | 00:06 | 6.75 | NFC | - | - |
| 14-Aug-2017 | 4 | 14:58 | 15:04 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 5 | 15:11 | 15:17 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 6 | 15:28 | 15:34 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 7 | 15:41 | 15:47 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 8 | 15:51 | 15:57 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 9 | 16:02 | 16:08 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 10 | 16:11 | 16:17 | 00:06 | 8.5 | NFC | - | - |
| 15-Aug-2017 | No Offshore Drift Netting Completed | | | | | | | |

[A]NFC = No Fish Caught

Table C4. Onshore drift netting effort and fish captures from the 2017 Pelly River Chinook Salmon Sonar Program.

| Date | Drift Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 2-Aug-2017 | 1 | DS Camp | 12:25 | 12:31 | 00:06 | 6.75 | NFC | - | - |
| 2-Aug-2017 | 2 | DS Camp | 12:34 | 12:40 | 00:06 | 6.75 | NFC | - | - |
| 2-Aug-2017 | 3 | DS Camp | 12:56 | 13:02 | 00:06 | 6.75 | NFC | - | - |
| 2-Aug-2017 | 4 | DS Camp | 13:07 | 13:13 | 00:06 | 6.75 | NFC | - | - |
| 3-Aug-2017 | No Onshore Drift Netting Completed | | | | | | | | |
| 4-Aug-2017 | No Onshore Drift Netting Completed | | | | | | | | |

| Date | Drift Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 5-Aug-2017 | 1 | DS Camp | 17:16 | 17:22 | 00:06 | 8.5 | NFC | - | - |
| 5-Aug-2017 | 2 | DS Camp | 17:27 | 17:33 | 00:06 | 8.5 | NFC | - | - |
| 6-Aug-2017 | 1 | DS Camp | 09:33 | 09:39 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 2 | DS Camp | 09:48 | 09:54 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 3 | DS Camp | 12:02 | 12:08 | 00:06 | 6.75 | NFC | - | - |
| 6-Aug-2017 | 4 | DS Camp | 12:19 | 12:25 | 00:06 | 6.75 | NFC | - | - |
| 7-Aug-2017 | No Onshore Drift Netting Completed | | | | | | | | |
| 8-Aug-2017 | 1 | DS Camp | 10:17 | 10:23 | 00:06 | 5.25 | NFC | - | - |
| 8-Aug-2017 | 2 | DS Camp | 10:33 | 10:39 | 00:06 | 5.25 | NFC | - | - |
| 8-Aug-2017 | 3 | DS Camp | 10:47 | 10:54 | 00:07 | 5.25 | NFC | - | - |
| 8-Aug-2017 | 4 | DS Camp | 11:01 | 11:07 | 00:06 | 5.25 | NFC | - | - |
| 9-Aug-2017 | 1 | DS Camp | 09:57 | 10:03 | 00:06 | 7.5 | CH | - | M |
| 9-Aug-2017 | 2 | DS Camp | 10:11 | 10:17 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 3 | DS Camp | 10:22 | 10:28 | 00:06 | 7.5 | NFC | - | - |
| 9-Aug-2017 | 4 | DS Camp | 10:35 | 10:41 | 00:06 | 7.5 | NFC | - | - |
| 10-Aug-2017 | 1 | DS Camp | 09:47 | 09:53 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 2 | DS Camp | 10:02 | 10:08 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 3 | DS Camp | 10:17 | 10:23 | 00:06 | 5.25 | NFC | - | - |
| 10-Aug-2017 | 4 | DS Camp | 10:31 | 10:37 | 00:06 | 5.25 | NFC | - | - |
| 11-Aug-2017 | 1 | DS Camp | 09:51 | 09:57 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 2 | DS Camp | 10:04 | 10:10 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 3 | DS Camp | 10:18 | 10:24 | 00:06 | 8.5 | NFC | - | - |
| 11-Aug-2017 | 4 | DS Camp | 10:32 | 10:38 | 00:06 | 8.5 | NFC | - | - |
| 12-Aug-2017 | No Onshore Drift Netting Completed | | | | | | | | |
| 13-Aug-2017 | 1 | US Camp | 10:55 | 11:01 | 00:06 | 7.5 | NFC | - | - |
| 13-Aug-2017 | 2 | US Camp | 11:24 | 11:30 | 00:06 | 7.5 | NFC | - | - |
| 13-Aug-2017 | 3 | US Camp | 11:36 | 11:42 | 00:06 | 7.5 | NFC | - | - |
| 13-Aug-2017 | 4 | US Camp | 11:49 | 11:55 | 00:06 | 7.5 | NFC | - | - |
| 14-Aug-2017 | 1 | US Camp | 13:15 | 13:21 | 00:06 | 6.75 | NFC | - | - |

| Date | Drift Number | Net Location | Net In | Net Out | Effort (Hours) | Mesh Size | Fish Species[A] | Length (cm) | Sex |
|---|---|---|---|---|---|---|---|---|---|
| 14-Aug-2017 | 2 | US Camp | 13:26 | 13:32 | 00:06 | 6.75 | NFC | - | - |
| 14-Aug-2017 | 3 | US Camp | 14:29 | 14:35 | 00:06 | 8.5 | NFC | - | - |
| 14-Aug-2017 | 4 | US Camp | 14:44 | 14:50 | 00:06 | 8.5 | NFC | - | - |
| 15-Aug-2017 | 1 | US Camp | 09:54 | 10:00 | 00:06 | 7.5 | NFC | - | - |
| 15-Aug-2017 | 2 | US Camp | 10:07 | 10:13 | 00:06 | 7.5 | NFC | - | - |

[A]NFC = No Fish Caught