Lakelse Lake Sockeye Salmon

Fry Outplant Program

2011 - 2012

Prepared For:

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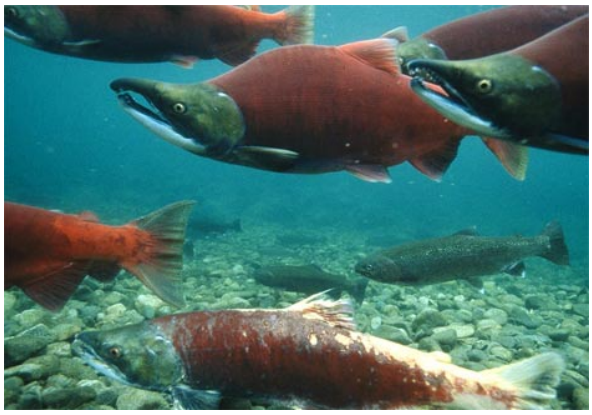

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Executive Summary

Lakelse Lake Sockeye are one of an estimated 28 wild Skeena River drainage Sockeye salmon stocks harvested during mixed stock fisheries in southeast Alaska and northern B.C. In 2004, Lakelse Lake Sockeye were determined to be significantly depressed, even at relatively low levels of exploitation (Cox-Rogers 2004). Enumeration programs on Lakelse spawning grounds by Fisheries and Oceans Canada (DFO) Stock Assessment staff in 2010 and 2011 indicated some improvement although final estimates for 2011 have not been formally released. During the past 10 years these stocks have declined in Lakelse tributaries from historical runs in the ten's of thousands to recent numbers in the low thousands and hundreds (Rabnett 2008).

In 2006, as part of the Lakelse Lake Sockeye Salmon Recovery Plan (Fisheries and Oceans Canada 2006), DFO received funding from the Pacific Salmon Commission (PSC) Northern Fund for the *Satellite Sockeye Hatchery: Fry Outplant Project Year 1*. The goal of this project was to enhance one full four year cycle of Lakelse area sockeye in concert with other habitat restoration, protection, assessment, and public awareness projects in the area.

In August of 2011, gametes and disease related samples were collected from 226 Williams Creek Sockeye. The eggs and milt were air lifted to the Snootli Creek Hatchery for fertilization, incubation, rearing to between 0.7g. and 0.9g and adipose fin clipping. Kidney and ovarian fluid samples from all females were sent to DFO's Pacific Biological Station (PBS) in Nanaimo, BC for disease testing. Prior to release, PBS conducted fish health tests on a sample of fry. In early May of 2012, approximately 315,000 fry were airlifted to Williams Creek, held for several hours in pens and then released at dusk.

Finally, 2011 represented the second year in which marked adults from previous enhanced fry releases could be assessed. Returning salmon in 2011 included 5 year olds from the first fry release of 100,000 in 2007 (Brood Year 2006) and four year olds from the release of 300,000 fry in 2008 (2007 Brood Year). North Coast Stock Assessment staff conducted one beach seine in August at the mouth of Williams Creek to assess adipose fin clipped fish and encountered 23 clipped fish in a sample of 367. Marked fish were also noted during brood stock capture and all fish killed from broodstock were otolith sampled for age to determine ration of 4 vs 5 year olds. Regular stream walks were also conducted to enumerate Williams and Sockeye Creeks and although final estimates have not yet been released, estimates for the 2011 return are greater than 10,000 (Fisheries and Oceans, 2011). Otolith data indicated that returning sockeye to Williams Creek in 2011 were comprised of 96% five year olds and 4% four year olds. This is significantly different than age results for sockeye returning in 2010 which were comprised of 45% five year olds and 55% four year olds.

Acknowledgements

The Lakelse Fry Outplant Project for 2011/2012, funded by the Pacific Salmon Commission Northern Fund was a collaborative effort between Fisheries and Oceans Canada (DFO), Lakelse Watershed Society volunteers, personnel from Snootli Creek Hatchery in Bella Coola, and fisheries technicians from the Nuxalk First Nations. Through a coordinated effort they provided personnel, labour, equipment, and technical expertise as "in-kind" contributions.
Project personnel included:

Margaret Kujat –Consultant – Project Coordinator, Terrace

Lakelse Watershed Society – volunteers

John Willis –Asst. Operations Manager – Snootli Creek Hatchery, Bella Coola

Marshall Hans – Hatchery Technician – Snootli Creek Hatchery

Mitch Drewes – Habitat Technician/OHEB – Terrace

Rob Dams – Community Advisor - Terrace

Lana Miller – Resource Restoration Biologist/OHEB– North Coast

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Doug Wilson – Administration Officer – Prince Rupert

Sandra Devcic – Resource Restoration Engineer – North Coast

James Powell – A/Resource Restoration Technician – North Coast

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Additional assistance was provided by BCParks, DFO Stock Assessment, and Regional District of Kitimat Stikine.

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1.0 Introduction and Background

Sockeye salmon (Oncorhynchus nerka) have the highest commercial value of the five species of Pacific salmon in British Columbia. Historically the Lakelse area has been considered the most productive salmon ecosystem in the Skeena watershed. (Rabnett 2008). Sockeye salmon stocks in the Lakelse watershed have undergone ecological pressure with ongoing cumulative effects. Impacts from logging, linear development of highways, pipelines and hydroelectric lines, lakeside residential development with the resulting channel modification, and restricted fish passage due to beaver activity have all contributed to the decline in Lakelse sockeye abundance.

In 2003 a drastic decline in the Lakelse Lake sockeye salmon population was noted by the Lakelse Watershed Society (LWS). LWS brought their concerns to Fisheries & Oceans Canada (DFO) noting that stock escapements to Lakelse Lake appeared to be depressed relative to historic levels. DFO's Stock Assessment Branch had also concluded in 2003 that lake densities of juvenile sockeye in Lakelse Lake accounted for less than 5% of available lake rearing capacity, representing the offspring from just 750 spawners. Further studies from 2004 through 2007 have indicated that the trend in stock declines continues (Davies, 2007). Commercial interception rates for Lakelse sockeye are believed to be low because historical data indicate they migrate early (June) prior to most commercial fisheries through marine waters into the Skeena River and appear to reside in Lakelse Lake for a month or more before spawning in August through October.

In response to the concerns surrounding degradation of this stock and its habitat, the Lakelse Sockeye Recovery Program was launched in 2005 and a recovery plan document drafted (Fisheries and Oceans Canada 2006). Several stakeholders continue to participate in the program to varying degrees: the Lakelse Watershed Society, the Terrace Salmonid Enhancement Society, Kitselas First Nations, Federal and Provincial government agencies including Fisheries and Oceans Canada, BC Parks, BC Ministry of Forests, BC Ministry of Environment, and the crown corporation BC Timber Sales.

The recovery plan contains lists of prioritised projects in three categories: improved information, habitat restoration and enhancement. The Lakelse Sockeye Fry Outplant Project was the first project on the enhancement list. Since 2006, funding for the Lakelse Fry Outplant Project has been provided by the Pacific Salmon Commission (PSC) Northern Fund.

The 2011/2012 program included stock enhancement as well as stock assessment of both adult returns and some attempts to examine fry rearing in the lake and smolt output.

DFO Stock Assessment staff carried out a mark/recapture program in 2011 through a weekly beach seine at the mouth of Williams Creek for three weeks in August to assess possible returns of the Lakelse Fry Outplant program's 2006 and 2007 brood year fry releases. Adipose clipped fish were recorded and all adult sockeye captured

were marked with an operculum punch. Data was later collected and recorded at the spawning grounds during brood stock collection.

The Terrace-area DFO Community Advisor in partnership with the Lakelse Watershed Society ran a very successful enumeration of Scully Creek sockeye returns using a camera and recording system in August and September of 2011. Stream walks on this creek are no longer attempted due to safety concerns with respect to high bear activity.

The Fry Outplant project strives to conserve this stock while the Lakelse Sockeye Recovery Program stakeholders continue to target other habitat protection and restoration projects. Stable off-channel habitat is currently under construction in Williams Creek, the main spawning tributary. It is believed that in many years, much scouring of redds occurs in the main stem of this unstable system. The Fry Outplant Program is providing an essential safe-guard for this stock as the creation of off-channel habitat is underway.

2.0 Study Area

Although most of the tributaries entering into Lakelse Lake have previously provided spawning opportunities for sockeye, recently this has been reduced to two main tributaries, Williams Creek and Schulbuckhand (Scully) Creek. The focus of Lakelse Sockeye Recovery Program is Williams Creek, currently and historically the most productive spawning area for Lakelse Sockeye.
Williams Creek is located near Lakelse Lake approximately 20 kilometres south of the City of Terrace in northern British Columbia. It drains a westward facing basin and flows into Lakelse Lake which flows into the 18 kilometre long Lakelse River. The Lakelse River is a Skeena River tributary that enters the Skeena approximately 150 kms from its mouth.

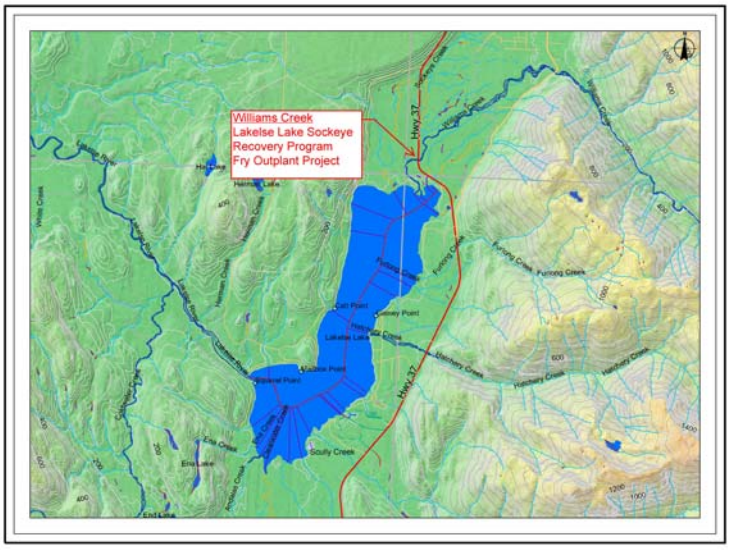

Figure 1. Project Location Map

3.0 Methods

3.1 Pre-Operation

3.1.1 Permits and Notifications

The Application for the Introduction or Transfer of Fish or Aquatic Invertebrates is now part of a larger production planning process for all enhanced North Coast stocks. This process is finalised in January/February of each year and a broad application is made that encompasses all North Coast facilities and stocks. Lakelse enhancement fall under the Snootli Hatchery Aquaculture License and an individual application for this program is no longer required.

As a courtesy, BC Parks, BC Ministry of Environment and BC Ministry of Transportation and Infrastructure were also informed of the project.

3.1.2 Equipment Preparations

Equipment required for brood stock collection, egg takes, disease sampling and other logistics for this project was readied or expedited by the subcontractor prior to the egg take operations. This equipment is identified in a separate attached file.

- Disease sampling equipment was specific for the collection of 2 ml of ovarian fluid per female to test for IHN. Fluid was removed from egg containers with individual pipettes (100) and transferred to sterilized screw cap vials. These were individually labelled and numbered prior to field operations. 100 vials were readied – 109 were used.
- BKD samples were collected and placed in individually labelled 'whirl-pak'- 4 oz. bags. (109) Each female was tagged with an individually numbered tag (1-109)
- Spawning bowls were removed from the field each egg take. They were rinsed, washed, disinfected in a solution of 1:100 iodophor, rinsed, dried and re-packaged for field use. (85)
- Egg containers were purchased and initially washed, rinsed, dried and individually numbered and packaged for field use. (109) Once they were shipped to Snootli Creek Hatchery with eggs, they were similarly treated as spawning bowls above and returned to the field for use.
- Milt was collected in individually numbered, 'whirl-pak' bags for field use (113). Sufficient male donors were used to enable a 2 X 2 spawning matrix at Snootli Creek Hatchery and this should be adopted as the norm if possible.
- Tangle nets, fish tubes and holding pens have been purchased through this project and are on hand.
- Once removed from the field, nets and cages were washed and dried. Cages used from other locations were to be washed, disinfected and dried (Done by others)

3.1.3 Logistics

The following preparations were also made prior to the field operations:

1. Contract for program coordination and related Purchase Order
2. Schedule of field operation with returning spawning stocks.

3. Liaison with Snootli Creek Hatchery regarding schedule and availability of staff.
4. Availability of sufficient personnel.
5. Aircraft availability and scheduling.
6. Orientation, training and safety meetings each day prior to brood stock collection and egg takes.
7. Liaison with DFO Stock Assessment regarding data collection on marked returns during brood stock collection.
8. Liaison with DFO Stock Assessment and DFO project lead regarding otolith sampling of all brood stock collected.
9. Field support from DFO with respect to equipment and personnel transfer.
10. Coordination with PBS on disease sampling tentative scheduling.
11. Liaison with Terrace-Kitimat Airport Authority for access to charter aircraft.
12. Liaison with BC Parks due to field location and for secured equipment storage between aspects of the project on site at Lakelse.

Because of the collaborative, interagency nature of this project, there was significant support to LWS and the project coordinator from DFO, MoE, BC Parks and the LWS membership.

Sockeye spawners were reported in Williams Creek as early as the first week of August 2011, but high water conditions also prevailed making enumeration assessment difficult. The egg take dates were tentatively scheduled for the week of August 15th.

3.2 Brood Stock Collection

Potential brood stock was captured in Williams Creek using 5" mesh tangle gill nets beginning August 15, 2011 and continuing through until the day of egg takes, August 18, 2011. Brood stock collection was conducted by DFO, BC Parks and the project coordinator with additional assistance on August 18th by members of the Lakelse Watershed Society.

Prior to net sets, a review of the background of the project and safety meetings were conducted by the Project Lead. Sets were done both below and above the bridge on Highway 37 South. Data on sex, marks (operculum punched from lower river enumeration) and adipose clips (hatchery returns) was recorded. Fish were held in a deep pool in stream in net cages and monitored daily until the day of egg takes.

Photo 1: Brood Stock Collection

3.3 Egg Take/Spawning

Of particular importance to the Lakelse Lake Sockeye Recovery Program is the prevention of the horizontally transmitted infectious hematopoietic necrosis virus or IHN. In the late 1970's almost 70% of the Alaskan sockeye hatchery production was lost due to this virus (McDaniel et al., 1994). IHN typically causes high mortality within juvenile populations through the destruction of major organs, primarily the kidney and liver. Prevention of IHN transmission is therefore essential and is achieved through disease screening, stringent disinfection protocols, use of virus free water supplies, effluent disposal, and segregation of eggs and fry throughout the production process.

Another principal disease, bacterial kidney disease (BKD) was also screened for during disease sampling of the Fry Outplant project. BKD is a systemic infectious disease that is slowly progressive, frequently fatal and seldom presents itself in fish until they are 6 - 12 months old. It readily cultures at 15–18 C and can be transmitted vertically and horizontally. Although it occurs mainly in freshwater, significant fish mortality can also occur in salt water (Banner, et al, 1983) where, as a result of pre-existing infection, juvenile anadromous salmonids such as Sockeye are unable to acclimatize to salt water.

The Alaskan sockeye salmon protocols (McDaniel et al, 1994) to prevent disease transfer identify stringent procedures with respect to brood stock collection and ideally a team of 6 – 7 individuals are required to handle these procedures separately in an efficient manner. These protocols were strictly adhered to during egg takes.

Spawning was done in the field. Sufficient on-hand personnel provided primarily by the Lakelse Watershed Society and DFO allowed for simultaneous collection of milt from the males while egg-takes with females were done a short distance away. Eggs and milt were immediately stored in large ice filled 'coolers' and kept chilled enroute to Northwest Regional Airport and the flight to Bella Coola.

Throughout the procedure, a solution of 1:100 iodophor (Ovadine) was used between each fish to disinfect tools, equipment and personnel involved in the various procedures.

Where applicable, all personnel wore disposable, surgical-style gloves. Fresh gloves were used when handling each fish. Each step in the sockeye protocol procedure was done by one individual.
The females were dispatched with a sharp blow to the head. The ventral area was washed down with the disinfecting solution and a 'j-cloth'. This cloth was returned to the disinfecting solution each fish. The female was then immediately hung, tail up, on a portable spawning rack using lightweight twine "tailers", on individual pegs spaced to ensure and maintain physical separation. The females were by cutting the gills with a disinfected knife.

Photo 2: Stripping eggs

After being removed from the spawning rack, each female was held tail down by one technician while the vent area and belly was wiped down with dry paper towel by another. This second technician cut the fish anteriorally from the vent upward carefully allowing the eggs to drop into a disinfected, smooth plastic collection bowl. Collection bowls were replaced between each fish.
The eggs were then transferred from the initial collection bowl to disposable, individually numbered plastic, lidded containers. Ovarian fluid (2 ml) was removed, (see Disease Screening below) the lid was then secured and the container placed on crushed ice in a large portable cooler to maintain cool temperatures during the operation and throughout transport to Snootli Hatchery. Each female fish was then tagged with a waterproof, sequentially numbered tag and transferred to the disease sampling area for collection of tissue samples for BKD disease screening. (See also Disease Screening below for IHN procedures).

Males were handled with the same disinfecting protocols as the females. Tasks are segregated so that individual personnel are responsible for individual tasks related to fish handling to avoid any cross-contamination. Gloves, j-cloths and paper towels were all replaced between each fish. Males were dispatched and had their vents swabbed with disinfectant solution and dried with clean, dry paper towels. They were then held, tail slightly down, and milt was physically expressed into an individually pre-labelled, sequentially numbered "whirl-pak" bag. Each bag was sealed and placed in a large cooler on ice in preparation for transport.

The portable cooler (containing eggs and milt) were transported by truck to the Northwest Regional Airport and by charter aircraft to Bella Coola, accompanied by Snootli Creek Operations Manager. The flight length is approximately 1 hour and 20 minutes via a chartered Cessna 185/172. Similar to previous years, the first eggs are typically stripped at approximately 11am and fertilization and planting typically begins at approximately 5pm at Snootli Hatchery.

Egg Take Collection was as follows:
Collection Procedures:

- Upon collection, eggs and milt were immediately stored in large ice filled 'coolers' and kept chilled until delivered to Bella Coola.
- The disease samples were kept in a smaller cooler chilled with frozen ice paks.
- Spawning procedures adhered strictly to the Alaskan sockeye protocol (McDaniel et al, 1994) to reduce potential transmission of IHN virus and BKD. All personnel who were assisting with the procedure were trained and familiarized with these steps prior to the egg take
- Spawning was done in the field with nearly simultaneous collection of milt from the males while egg-takes with females were done a short distance away. Eggs and milt were immediately stored in large ice filled 'coolers' (*'Rubbermaid'*™ totes lined with foam insulation cut to fit the insides of the *Rubbermaid*™) and kept chilled en-route to Terrace-Kitimat Regional Airport onward to Bella Coola.
- This operation was done over a three day period. Brood stock collection occurred on August 15th in an area just downstream and just upstream of the Highway 37 Bridge at Williams Creek.
- Egg takes were conducted in an area just downstream of the Highway 37 Bridge on a gravel beach on river right. Personnel and equipment were staged out of the BC Park's "Gruchy's Beach" parking area.

3.4 Disease Screening

For the purposes of disease screening for BKD:

- Females were tagged with a waterproof identification number immediately following spawning and sampled.
- Surgical scalpels used for sampling were initially disinfected in isopropyl alcohol and then further disinfected/dried by flame using a small, portable butane torch.
- A posterior kidney sample was removed from each female, placed in sterilized, individually labeled whirl-pak bag and placed in a small cooler with frozen gel 'paks' at the bottom of the cooler. Disinfection procedures as described above occurred between each sampling.

Photo 3: Disease sampling (BKD)

For the purposes of disease sampling for IHN:

- 2ml sterilized disposable pipettes were used to collect ovarian fluid from each female's eggs. Fluid was drawn from the numbered egg containers using a pipette and placed in corresponding numbered, sterilized, screw cap vials. These vials were then placed in a small cooler containing gel ice 'paks'.

Kidney samples and ovarian fluid samples were combined in one small cooler, addressed to PBS and shipped via AIR CANADA CARGO within 24 hours. PBS was informed of how many samples to expect at the end of each day. The number of samples plus the flight, time of expected arrival, and weigh bill number were conveyed directly to the lab.

3.5 Fertilization and Planting

At the Snootli Creek Hatchery, the fertilization took place in a segregated building under stringent disinfection procedures. Several technicians worked on samples as the eggs and milt underwent a 2 X 2 matrix fertilization procedure to promote genetic diversity and ensure fertilisation.

The eggs from each female were divided evenly into 2 separate containers and each of these was gently mixed with half of the milt from 2 individual males. These were then recombined and water was added to the eggs/milt mixture to activate fertilization. The samples were then rinsed with a 100ppm iodine solution. Disposable surgical type gloves were worn by the technician and were discarded between all samples.

The samples were then transferred to the incubation area by an additional staff member waiting outside the facility. The eggs were placed in individually numbered and labelled heath trays containing 100ppm iodine. After 15 minutes, the tray was gently pushed back into place. Water flows were set at 15/lpm.

Segregation of each female's eggs is one of several stringent criteria related to the operational and one of the main reasons Snootli Creek Hatchery has been chosen for this type of project in recent years. The necessary infrastructure, expertise and staff already exist without large capital expense and are notable for consistently operating under stringent standards.

Results from disease screening were forwarded by Pacific Biological Station to Snootli Creek Hatchery (Appendix 3).
The prevalence of low levels of BKD in almost all samples was a concern that was discussed with staff at PBS labs and at the technical review. According to staff at PBS labs and Doug Lofthouse, DFO Enhancement Biologist, this was not the only BC stock to experience a high prevalence of low level BKD. The recommended treatment for this is limited rearing in a hatchery setting. No changes were necessary as the Lakelse sockeye at Snootli are only reared for a few weeks until they are large enough to adipose clip. Disease rates will continue to be monitored in future years.

3.6 Hatchery Operations: Incubation, Rearing, Ponding and Marking

Water flows were monitored and maintained at 15 lpm in all heath tray stacks. Central Coast Fisherman's Protective Association technical staff were involved in monitoring and rearing of the Lakelse stock.
As per standard procedures, average weight and diameter were assessed, eggs were picked and dead eggs were removed. Plastic saddles were added to the heath trays and remained in place until ponding. Eggs were graded by size to ensure ponding of like-sized fish and reduce the number of pinheads.
Lakelse sockeye were ponded in February, 2012, at an average size of 0.21g. They are ponded into 6ft circular tubs with a water volume of 2.58 m3 and into 4ft oval tubs with water volume of 1.12m3. Fish are ponded 2 trays at a time and allowed to swim up before the next batch are ponded. The smaller fish are ponded into the oval tubs which improves their growth and survival. Fish are fed 6-8 times per day when they are first ponded to ensure good feeding. Once they are feeding well, frequency of feeding is reduced to 2-4 times/day with the same daily ration. Flows are maintained at approximately two litres per minute per kg of fish. At an average size of 0.9 grams, fry were anesthetised with MS222 and adipose fins removed to distinguish them from wild sockeye stocks (John Willis 2012, pers. comm.). This work was done by local technical staff from the Central Coast Fisherman's Protective Association in Bella Coola. A percentage of the fry not yet at appropriate size (pinheads) were not clipped.

3.7 Fry Release

Previous data collected on Williams Creek has indicated that wild sockeye fry emerge in late April to early May. Pending aircraft availability, DFO personnel availability, and food conversions, the fry release was tentatively scheduled for May 2-3, 2012 and completed on those days.

Fry were removed from the ponding area at Snootli Creek Hatchery, transferred to 40 kg of water in 77 litre containers with air stones and compressed oxygen supply. O_2 was delivered from portable cylinders through a flow meter and manifold system at a rate of 0.125 to 0.5 lpm. Fry were ground transported to Bella Coola Airport, transferred to aircraft and flown to Northwest Regional Airport (Kitimat-Terrace). A technician from Snootli Creek accompanied each flight to monitor the fry en-route.

Photo 4: Snootli Hatchery staff delivering fry

At the Terrace Regional Airport (YXT), fry were transferred from aircraft to vehicles, air supplies established via cylinder and manifold similar to the flight system and transported to Williams Creek. Access to aircraft was gained via Executive Flight Services east of the main terminal.

Fry were transferred to 4 in-stream holding pens for acclimatization and released in the early evening (approx. 2100 hrs). Release from each pen was staggered by approximately 20 minutes.

3.8 Enumeration and Mark/Recapture

Stream Walks:

Fisheries and Oceans Canada Stock Assessment Division carried out stock enumeration on Williams Creek to assess returning stocks. Two teams of two trained stock assessment technicians conduct stream walks by walking in the creek and on stream banks from different directions. Two technicians start from Strymecki Road in Jack Pine Flats subdivision on the upstream end (approximately 2km upstream from the stream mouth) and walk downstream ~1km to the Hwy 37S bridge. They also walk up Sockeye Creek tributary to the first beaver dam barrier and back down

to its confluence with Williams Creek (~300m upstream from the Hwy 37S bridge). The other two technicians start from the mouth of Williams Creek near Gruchy's beach (confluence of Williams Creek and Lakelse Lake) and walk upstream approximately 1km to the Hwy 37S bridge. Stream walks typically begin in early August and continue until mid-late September. Stream walks are generally conducted twice a week over this time period. Due to the highwater conditions and difficulty enumerating sockeye, a helicopter overflight was also conducted in September to confirm fish numbers and extent of spawning.

Scully Creek

The second highest sockeye spawning tributary in Lakelse is Schulbuckhand (Scully) Creek. Stream walks used to take place on this system but were discontinued in 2006 due to aggressive bear behaviour. In 2011, the Lakelse Watershed Society working with DFO Community Advisor, Rob Dams, used an underwater camera system combined with a broomstick fence to enumerate sockeye returning to Scully Creek. The fence and camera were located on private property with power provided by the landowner who lives at the mouth of Scully Creek (Marius Pienaar). 2011 was the second year using this method with some technology upgrades (new camera and recording equipment) which resulted in an excellent count.

Mark / Recapture:

Due to high water conditions, Stock Assessment staff were only able to complete one beach seine near the mouth of Williams Creek to determine estimate the adipose fin clip (AFC) mark-ratio on August 12, 2011. Adults caught in the seines were marked with vermillion orange spaghetti tags and some recovered during brood stock capture and observed during streamwalks.

4.0 Results and Discussion

4.1 Broodstock Capture/Spawning

Target collection numbers for 2011-2012 were set at ~350,000. The bulk of brood stock was collected prior to egg takes (August 15-17th, 2011) which enabled egg takes and disease sampling of all 113 females to take place in one day, August 18th. Removing fish from the tangle nets was a bit problematic with new nets being used in 2011 with a 5" mesh size. A smaller mesh size (4.75") is recommended for future operations.

Sockeye eggs were transported to Snootli Creek Hatchery on the afternoon of August 18th for fertilization, incubation and rearing. As in previous years suitable weather for air transport was a factor due to rain, low ceiling and visibility. The decision to complete the egg takes in one day was made through joint discussions with personnel and Bella Coola Air owner/pilot.

Disease samples were transported to PBS labs in the evening of August 18th on the commercial Air Canada flight from Terrace Airport. Disease samples received by PBS labs indicated sample quality was compromised due to inadequate ice packs. As recommended, ice packs on top and bottom of samples will be employed in future years.

4.2 Hatchery Operations: Incubation, Ponding, Rearing and Marking

Average fucundity of Lakelse females was approximately 4020 eggs per female resulting in 454,213 eggs provided to Snootli Hatchery (back-calculated from estimates at eyed stage). 118,605 egg mortalities had occurred by eyed stage due to natural mortality including some disease presence resulting in a survival to eyed stage of 73.89% (Willis, 2011a). Lakelse stocks were eyed at approximately 383 ATU's. Two trays of eggs were culled due to disease during incubation, one tray was high BKD positive and the other was IHN positive. Fish were ponded at approximately 1160 ATU's starting on February 18, 2012. Total number ponded was 335,078, for a percentage survival from eyed to ponding of 99.84%. Natural mortalities of 9,023 occurred during rearing for a survival from ponded to release of 97.3%. Overall survival from green eggs to released fry was 71.8%. See appendices 2 and 4 for detailed numbers (Willis 2012).
In late April of 2012, approximately 303,418 of the 325,731 fry were marked with an adipose fin clip. The remaining 22,313 were too small to be clipped.

4.3 Fry Release

Fry were transported on May 2 and 3rd at an average weight of 0.75 – 0.90 grams and a density of approximately 225 grams per liter of water.
Oxygen was set to be released into each pail at 0.12 to 0.50 lpm. Almost all fry arrived in good condition with the exception of approximately 700 mortalities (primarily pinheads).

Fry were brought by truck to Williams Creek and evenly distributed into 4 in-stream holding pens where they were held until dusk for acclimatization. The fry were released from these pens at 20 minute intervals starting at approximately 2100 hrs. each evening. One bucket of smaller unmarked fish representing 22,313 'pinheads' was also released.

LAKELSE STOCK – SURVIVAL RATES – 2011/2012

# Eggs Planted	% Survival Green to Eyed	% Survival Green to Ponding	% Survival Green to Release
454,213	**73.89%**	**73.77**	**71.8%**

Table 1. Summary of Egg-Fry Survival

4.4 Enumeration and Mark/Recapture

Final estimates have not yet been released but the Post-Season Review: Salmon North Coast Areas 1-6 & Central Coast Areas 7-10 (Fisheries and Oceans, 2011) indicated that greater than 10,000 sockeye returned to Williams and Sockeye Creeks in Lakelse in 2011. Due to higher water conditions, only one beach seine was conducted to determine mark ratio (hatchery vs wild) on August 12, 2011. 367 large fish and 4 jacks were captured in the seine. 14 of the 167 males had an adipose clip and 9 of the 177 females had an adipose clip. The data has yet to be analysed and expanded to determine a return rate for wild vs hatchery fish.
Otolith sampling was also conducted in conjunction with brood stock collection and egg takes and the results were significantly different from 2010. In 2010, 55% of returning sockeye were four year olds and 45% were five year olds. A sample of approximately 200 otoliths (100 females and 100 males) in 2011 revealed that 96% of returning adults were 5 yrs olds and the remaining 4% were 4 year olds. It is important to note that with returns dominated by 5 year olds, 2011 adult returns would mostly represent 5 yrs olds from the 2006 broody year which included a release of only 100,000 marked hatchery fry from the pilot year of this program.

Scully Creek remains a safety concern for stream walkers due to bear activity. The Terrace DFO Community Advisor is continuing to improve on the enumeration of sockeye in Scully Creek using a camera system at the mouth in partnership with the Lakelse Watershed Society and local landowner. The technology was upgraded in 2011 and an excellent count of 1844 returning spawners was obtained in 2011 (Seibel, 2011). The enumeration report can be found in Appendix 6.

In summary, Lakelse stocks appear to have improved significantly in 2011 (>10,000) from 2006 (<2000), when the fry outplant program began. It is hopeful that the official estimate will be released soon and assessments will continue in 2012.
Ongoing efforts by DFO towards habitat improvement and restoration continue while the fry outplant program continues to provide some level of protection for this stock. The main spawning tributary, Williams Creek, is unstable and eggs/redds are subject to scour during fall high water events. Stable off-channel habitat is currently under construction with the Williams upper channel is expected to be operational in 2012.
Additional positive aspects of the fry outplant program include heightened local and regional attention on Lakelse Lake sockeye which promotes stewardship and collaborative partnerships in the watershed. The project also provides an opportunity for hands-on participation by many volunteers, industry and agency personnel including federal, provincial and regional government involvement. The project also safeguards a small portion of the population against destruction by floods and egg scour in mainstem of Williams Creek.

6.0 LIST OF REFERENCES

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Appendix 1: Proponent Information

Proponent Information

Department of Fisheries and Oceans Canada
Resource Restoration Unit
417 – 2nd Ave West
Prince Rupert, BC V8J 1G8
Lana Miller – Restoration Biologist
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Department of Fisheries and Oceans Canada
Snootli Creek Hatchery
Box 95
Bella Coola, BC VOT 1C0
250-982-2214
John Willis – Asst. Operations Manager
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Project Coordination
Consultant
Margaret Kujat
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Appendix 2: Brood Summary Report
Lakelse 2011

Date Printed	July 06,2012
Audited By	

1.1 Brood Summary Identification

Hatchery	Snootli Creek Hatchery (140)
Species	Sockeye (118)
Brood Year	2011
Stock	Williams Cr (1309)
Run	Fall (3)
Stock Type	Wild

1.2 Brood Stock Collection and Spawning

Number of Females Used	113
Number of Adult Males Used	113

Brood Stock Selection — Random ☑ Selected ☐ Selected For N/A

Method of Fertilization	1 Male to 1 Female	Alpha Beta 2M:1F	> 1 Male per Fem	Matrix Spawning
Percentage of Eggs	100	0	0	0

Female Mortalities	Type	No. of Females

% of Female Prespawn Mortalities	0.00

Date of Adult Collection	Start	Thursday, August 18, 2011
	End	Thursday, August 18, 2011
Date of Egg Takes	Start	Thursday, August 18, 2011
	End	Thursday, August 18, 2011

2.1 Green Eggs

Initial Green Eggs Taken		454,213
Adjusted Eggs Taken	(Back-Calculated From Eyed)	454,213
Discrepancy	(loss - / gain +)	0
Initial Egg Imports		0
Adjusted Egg Imports	(Back-Calculated From Eyed)	0
Discrepancy	(loss - / gain +)	0

Method of Inventory for Original Estimates	Percentage
Volume	0.00
Weight	0.00
Females	100.00
Adjusted Eggs Per Female	4,020

Natural Mortalities	118,605
Unnatural Mortalities	0
Cull Mortalites	0
Predation	0
Disease Mortalities	0
Aquaculture Exports	0
Public Exports	0
Pathological Exports	0
Research Exports	0
Production Exports	0
Egg Plants	0
Total Eyed Eggs	335,608

Percent Survival (Green to Eyed)	73.89

2.2 Eyed Eggs and Alevins

Weighted Mean ATU's at Eyed	382.71
Total Eyed Eggs	335,608

Method of Inventory for Eyed Counts

	Percentage
Volume	0.00
Weight	0.00
Actual Egg Count	100.00

Natural Mortalities	530
Unnatural Mortalities	0
Cull Mortalites	0
Predation	0
Disease Mortalities	0
Aquaculture Exports	0
Public Exports	0
Pathological Exports	0
Research Exports	0
Production Exports	0
Egg Plants	0
Imports	0
Total Ponded	335,078

Percent Survival (Green to Ponding)	73.77
Percent Survival (Eyed toPonding)	99.84

Incubation Comments

Date: Nov 1, 2012 Entered By: Administrator

Two trays of eggs (tray 13-5 & 14-6) were culled due to disease during incubation.
One tray was high BKD positive, the other was IHN positive.

3.1 Juvenile Rearing

Rearing Group	Atu's At Ponding	Total Fry Ponded	Ponding Weight	Measurement Type		Date of Ponding	
				Bulk %	Len/Wt %	Start	Finish
2011 Williams Creek Sockeye	1,160	335,078	0.21	100	0	18-Feb-12	18-Feb-12

Rearing Group	Ponding Sample Averages			Ponding Sample Std Dev		
	Weight (gm)	Length (mm)	KC	Weight	Length	KC
2011 Williams Creek Sockeye	0.21	0.00	0.00	0.00	0.00	0.00

Rearing Group	Ponded (+)	Imports (+)	Transfers Out / Exports (-)		
			Exports	Research	Sales
2011 Williams Creek Sockeye	335,078	0	0	0	0

Rearing Group	Mortalities (-)			Inventory Loss/Gain (-/+)	Released
	Disease	Natural	Unnatural		
2011 Williams Creek Sockeye	0	9,023	0	-302	325,731

Rearing Group	Survival Rates					
	Green Eggs			Eyed Eggs		Ponded Fry
	To Eyed	To Pond	To Release	To Pond	To Release	To Release
2011 Williams Creek Sockeye	73.9	73.8	71.8	99.8	97.2	97.3

Rearing Group	Rearing Location	From	To	Days
2011 Williams Creek Sockeye				
	4 Sockeye	18-Feb-12	25-Apr-12	67
	3 Sockeye	18-Feb-12	05-May-12	77
	2 Sockeye	18-Feb-12	19-Apr-12	61
	15 Sockeye	18-Feb-12	11-Apr-12	53
	14 Sockeye	18-Feb-12	05-May-12	77
	13 Sockeye	18-Feb-12	13-Apr-12	55
	12 Sockeye	18-Feb-12	03-May-12	75
	01sockeye	18-Feb-12	02-May-12	74
	6 Sockeye	10-Apr-12	02-May-12	22
	10 Sockeye	10-Apr-12	03-May-12	23
	5 Sockeye	11-Apr-12	02-May-12	21
	15 Sockeye	13-Apr-12	03-May-12	20
	13 Sockeye	17-Apr-12	03-May-12	16
	2 Sockeye	23-Apr-12	02-May-12	9

3.2 Juvenile Feeding

Rearing Location	Feed Type	Kilograms Fed
2011 Williams Creek Sockeye		
01sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.380
	Moore-Clark : Bio-Vita Starter #0	11.685
12 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.380
	Moore-Clark : Bio-Vita Starter #0	13.415
13 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.380
	Moore-Clark : Bio-Vita Starter #0	11.815
14 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.380
	Moore-Clark : Bio-Vita Starter #0	11.115
15 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	7.330
	Moore-Clark : Bio-Vita Starter #0	12.140
2 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.430
	Moore-Clark : Bio-Vita Starter #0	10.962
3 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	6.430
	Moore-Clark : Bio-Vita Starter #0	11.216
4 Sockeye		
	Moore-Clark : Bio Vita Starter Mash	11.830
	Moore-Clark : Bio-Vita Starter #0	11.565
10 Sockeye		
	Moore-Clark : Bio-Vita Starter #0	2.890
6 Sockeye		
	Moore-Clark : Bio-Vita Starter #0	7.850
5 Sockeye		
	Moore-Clark : Bio-Vita Starter #0	7.900

3.4 Juvenile Marking

Release Group	Tag Code	Fin Clip	Quantity	Marking Dates		Weight
2011 Williams Creek Sockeye	NONE	AD	303,418	10-Apr-12	25-Apr-12	0.6

Release Group	Tag Code	Fin Clip	Fin Clip Quality			Retention Information		
			1st Fin	2nd Fin	Both Fins	Tag Loss %	Loss Days	Sample Size
2011 Williams Creek Sockeye	NONE	AD	100.0	0.0	0.0	0.0	0	0

Tag Code	Fin Clip	Anaesthetic (%)					Mark Selection Method (%)			Appearance (%)		
		Ms222	2-Phenoxy	Buffer	C02	Buffer	Random	Crowd	Graded	Healthy	Smolt	Unhealthy
2011 Williams Creek Sockeye												
NONE	AD	100	0	0	0	0	0	100	0	100	0	0

3.5 Releases

Release Group	Fin Clip	Wire Tag	Quantity
2011 Williams Creek Sockeye			
	AD	NONE	302,507
	NOMK	NONE	23,224
	WILLIAMS CR		**325,731**

Release Group	Release Sample Averages			Rel Samp Std Dev (Len/Wt Only)		
	Weight (gm)	Length (mm)	KC	Weight	Length	KC
2011 Williams Creek Sockeye	0.77	0.00	0.00	0.00	0.00	0.00

Release Group	Start Date	End Date	Normal Release? (% of Group)		Release Method (% of Group)		Scatter Distance (KM)
			Yes	No	Point	Scattered	
2011 Williams Creek Sockeye	02-May-12	03-May-12	100	0	100	0	0.0

Release Group	Release group is representative of:										
	Prod-uction	Con-trol	Size/ Time	Repli-cation	Mark Morts	Diet	Disease	Colon-ization	Sci. Experi-ment	Other Experi-ment	Surplus To Req'mt
2011 Williams Creek Sockeye	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Release Group	Release Type (% of Group)				
	Day	Forced	Night	Transported	Volitional
2011 Williams Creek Sockeye	0	0	0	100	0

Release Group	Quality of Release Group (% of Group)					Quality Comments
	Good	Average	Poor	Diseased	Smolting	
2011 Williams Creek Sockeye	0	100	0	0	0	

Release Group	Enumeration Method (% of Group)					Enumeration Method Comments
	Book Value	Adjust. Book	Displace-ment	Petersen Estimate	Smolt Counter	
2011 Williams Creek Sockeye	0	100	0	0	0	Confirmed by clipping

Release Group	Receiving Stream Condition (% of Group)				
	Normal	Clear	Drought	Freshet	Turbid
2011 Williams Creek Sockeye	100	0	0	0	0

Release Group	Release Date Decided By (% of Group)							
	Fish Behaviour	River Flow	Past Results	Plankton Watch	Smolt Readiness	Needed Space	Tides	Match to Wild
2011 Williams Creek Sockeye	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0

Release Group	Release Comments
2011 Williams Creek Sockeye	Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

3.6 Release Transport

Release Group	Transportation Method	Time (Hrs)	Starved before release?		Acclimatized before Release?	
			Yes/No	Time (Days)	Yes/No	Time (Days)
2011 Williams Creek Sockeye	Air	3	☑	3	☑	.5

Release Group	Temperature (°C)			Dissolved Oxygen (PPM)			Oxygen (% Saturation)		
	Transport Water		Receiving	Transport Water		Receiving	Transport Water		Receiving
	Start	Finish	Stream	Start	Finish	Stream	Start	Finish	Stream
2011 Williams Creek Sockeye	5.5		4.5						

Appendix 3: Disease Screening Results

Fisheries and Oceans | Pêches et Océans

MEMORANDUM **NOTE DE SERVICE**

To / À: Margaret Kujat, John Willis, Lana Miller

From / De: Fish Path Lab PBS

Security Classification - Classification de sécurité
UNCLASSIFIED
Our file - Notre référence
2011-104
Your File - Votre référence
Date
September 26, 2011

Subject / Object: **BROODSTOCK SCREENING RESULTS**

2011-104: Lakelse Sockeye - 113 kidney and ovarian fluid samples were received August 19.

Note: kidneys samples at the top of the package felt warm on arrival despite ice paks in the bottom of the cooler still being frozen; additional icepaks on top of the samples would have been beneficial to maintain sample quality.

ELISA for *Renibacterium salmoninarum* (BKD):
Neg/LLD: 3, 10, 35, 45, 87, 88, 89, 91, 95, 97, 99, 100, 101

LP: all other samples

HP: 96 (0.975) – destroy these eggs

Note: another very high year for this stock, with only 11% negative or positive at a low level of detection. Prolonged rearing of this stock is inadvisable due to the increased risk of horizontal transmission of this disease.

Virology for IHNV:
All samples were negative for virus, except for ovarian fluid sample #88 (confirmed by PCR as IHN virus). For a single tray, you can either destroy these eggs or else retain if you are confident in your egg disinfection protocols.

If you have any questions about these results, please give me a call 250-729-8377.

Christine MacWilliams

Canada

Appendix 4: Lakelse Incubation Report
2011 Brood Year (BY)

Lakelse 2011 BROOD

DATE	Fem. #	# M	Loc. Plant	UNIT #	# Eggs Planted	Live WT Eyed	400.00 Egg Sample	Total Eggs 2nd	Morts at Eyed	Total Live Eggs	% Surv.	Morts 2nd Pick	Live Alevins	% Surv.	Morts At Ponding	# Ponded	Total % Surv.	Ponding Tub
18/08/2011	1	2	S Inc	1-2	3634	648.10	56.20	4821	208	4613	95.69%	0	4613	95.69%		4613	95.69%	
18/08/2011	2	2	S Inc	1-3	3634	291.10	60.70	2052	134	1918	93.47%	2	1916	93.37%		1916	93.37%	
18/08/2011	3	2	S Inc	1-4	3634	699.50	62.70	4573	110	4463	97.59%	2	4461	97.55%		4461	97.55%	
18/08/2011	4	2	S Inc	1-5	3634	660.50	59.10	4667	197	4470	95.78%	1	4469	95.76%		4469	95.76%	
18/08/2011	5	2	S Inc	1-6	3634	610.60	52.40	4875	214	4661	95.61%	3	4658	95.55%		4658	95.55%	
18/08/2011	6	2	S Inc	1-7	3634	712.60	61.40	5013	371	4642	92.60%	2	4640	92.56%		4640	92.56%	
18/08/2011	7	2	S Inc	1-8	3634	649.60	61.20	4781	535	4246	88.81%	2	4244	88.77%		4244	88.77%	
18/08/2011	8	2	S Inc	2-2	3634	398.50	63.60	3411	905	2506	73.47%	41	2465	72.27%		2465	72.27%	
18/08/2011	9	2	S Inc	2-3	3634	310.60	56.00	2985	766	2219	74.33%	13	2206	73.90%		2206	73.90%	
18/08/2011	10	2	S Inc	2-4	3634	683.30	51.40	5767	449	5318	92.21%	2	5316	92.18%		5316	92.18%	
18/08/2011	11	2	S Inc	2-5	3634	319.50	61.10	3929	1837	2092	53.24%	23	2069	52.66%		2069	52.66%	
18/08/2011	12	2	S Inc	2-6	3634	213.30	56.10	3351	1830	1521	45.39%	5	1516	45.24%		1516	45.24%	
18/08/2011	13	2	S Inc	2-7	3634	417.60	62.90	4190	1534	2656	63.39%	5	2651	63.27%		2651	63.27%	
18/08/2011	14	2	S Inc	2-8	3634	506.80	67.30	4540	1528	3012	66.34%	20	2992	65.90%		2992	65.90%	
18/08/2011	15	2	S Inc	3-2	3634	448.00	55.50	4176	947	3229	77.32%	1	3228	77.30%		3228	77.30%	
18/08/2011	16	2	S Inc	3-3	3634	331.80	66.40	4454	2455	1999	44.88%	4	1995	44.79%		1995	44.79%	
18/08/2011	17	2	S Inc	3-4	3634	671.50	63.00	4397	134	4263	96.95%	1	4262	96.93%		4262	96.93%	
18/08/2011	18	2	S Inc	3-5	3634	629.70	57.20	4665	262	4403	94.38%	2	4401	94.34%		4401	94.34%	
18/08/2011	19	2	S Inc	3-6	3634	703.80	61.50	4774	196	4578	95.89%	2	4576	95.85%		4576	95.85%	
18/08/2011	20	2	S Inc	3-7	3634	529.80	60.90	3744	264	3480	92.95%	3	3477	92.87%		3477	92.87%	
18/08/2011	21	2	S Inc	3-8	3634	694.50	61.30	4868	336	4532	93.10%	3	4529	93.04%		4529	93.04%	
18/08/2011	22	2	S Inc	4-2	3634	657.10	55.50	5076	340	4736	93.30%	0	4736	93.30%		4736	93.30%	
18/08/2011	23	2	S Inc	4-3	3634	661.20	58.50	4858	337	4521	93.06%	0	4521	93.06%		4521	93.06%	
18/08/2011	24	2	S Inc	4-4	3634	507.50	55.30	4456	785	3671	82.38%	61	3610	81.01%		3610	81.01%	
18/08/2011	25	2	S Inc	4-5	3634	682.70	52.30	5654	433	5221	92.34%	2	5219	92.31%		5219	92.31%	
18/08/2011	26	2	S Inc	4-6	3634	658.10	58.10	4747	216	4531	95.45%	0	4531	95.45%		4531	95.45%	
18/08/2011	27	2	S Inc	4-7	3634	455.00	62.10	3165	234	2931	92.61%	1	2930	92.57%		2930	92.57%	
18/08/2011	28	2	S Inc	4-8	3634	530.00	59.20	3671	90	3581	97.55%	0	3581	97.55%		3581	97.55%	
18/08/2011	29	2	S Inc	5-2	3634	646.90	66.70	4179	300	3879	92.82%	5	3874	92.70%		3874	92.70%	
18/08/2011	30	2	S Inc	5-3	3634	449.00	55.80	3514	295	3219	91.60%	8	3211	91.38%		3211	91.38%	
18/08/2011	31	2	S Inc	5-4	3634	616.90	64.60	4129	309	3820	92.52%	1	3819	92.49%		3819	92.49%	
18/08/2011	32	2	S Inc	5-5	3634	453.00	57.80	4180	1045	3135	75.00%	3	3132	74.93%		3132	74.93%	
18/08/2011	33	2	S Inc	5-6	3634	457.00	53.80	3605	207	3398	94.26%	0	3398	94.26%		3398	94.26%	
18/08/2011	34	2	S Inc	5-7	3634	532.90	58.30	3814	158	3656	95.86%	1	3655	95.83%		3655	95.83%	
18/08/2011	35	2	S Inc	5-8	3634	443.00	70.00	4290	1759	2531	59.00%	4	2527	58.91%		2527	58.91%	
18/08/2011	36	2	S Inc	6-2	3634		65.10	4362	4318	44	1.01%	1	43	0.99%		43	0.99%	
18/08/2011	37	2	S Inc	6-3	3634	661.30	64.30	4368	254	4114	94.18%	0	4114	94.18%		4114	94.18%	
18/08/2011	38	2	S Inc	6-4	3634	325.70	52.30	3922	1431	2491	63.51%	0	2491	63.51%		2491	63.51%	
18/08/2011	39	2	S Inc	6-5	3634	573.00	59.00	4121	236	3885	94.27%	4	3881	94.18%		3881	94.18%	
18/08/2011	40	2	S Inc	6-6	3634	526.60	69.70	3649	627	3022	82.82%	1	3021	82.79%		3021	82.79%	
18/08/2011	41	2	S Inc	6-7	3634	371.80	62.10	2520	125	2395	95.04%	0	2395	95.04%		2395	95.04%	
18/08/2011	42	2	S Inc	6-8	3634	592.80	62.40	4632	832	3800	82.04%	0	3800	82.04%		3800	82.04%	
18/08/2011	43	2	S Inc	7-2	3634	702.80	65.00	4554	229	4325	94.97%	3	4322	94.91%		4322	94.91%	
18/08/2011	44	2	S Inc	7-3	3634	610.70	60.90	4644	633	4011	86.37%	40	3971	85.51%		3971	85.51%	
18/08/2011	45	2	S Inc	7-4	3634	746.10	63.80	4957	279	4678	94.37%	1	4677	94.35%		4677	94.35%	
18/08/2011	46	2	S Inc	7-5	3634	506.80	57.00	5098	1542	3556	69.76%	7	3549	69.62%		3549	69.62%	
18/08/2011	47	2	S Inc	7-6	3634	415.10	56.30	3954	1005	2949	74.58%	6	2943	74.43%		2943	74.43%	
18/08/2011	48	2	S Inc	7-7	3634	217.40	60.50	3339	1902	1437	43.04%	4	1433	42.92%		1433	42.92%	
18/08/2011	49	2	S Inc	7-8	3634	641.5	61.4	4694	515	4179	89.03%	3	4176	88.96%		4176	88.96%	
18/08/2011	50	2	S Inc	8-2	3634	308.40	58.70	4534	2432	2102	46.36%	6	2096	46.22%		2096	46.22%	
18/08/2011	51	2	S Inc	8-3	3634	483.90	54.50	3686	134	3552	96.36%	4	3548	96.26%		3548	96.26%	
18/08/2011	52	2	S Inc	8-4	3634	612.00	60.30	4508	448	4060	90.06%	1	4059	90.04%		4059	90.04%	
18/08/2011	53	2	S Inc	8-5	3634	139.60	62.40	3804	2909	895	23.53%	4	891	23.42%		891	23.42%	
18/08/2011	54	2	S Inc	8-6	3634	649.50	57.20	5137	595	4542	88.42%	2	4540	88.38%		4540	88.38%	
18/08/2011	55	2	S Inc	8-7	3634	210.10	58.60	5664	4230	1434	25.32%	2	1432	25.28%		1432	25.28%	

18/08/2011	56	2	S Inc	8-8	3634		61.90	3634	3569	65	1.79%	0	65	1.79%		65	1.79%	
18/08/2011	57	2	S Inc	9-2	3634	527.50	62.30	4016	629	3387	84.34%	6	3381	84.19%		3381	84.19%	
18/08/2011	58	2	S Inc	9-3	3634	486.40	62.00	3411	273	3138	92.00%	5	3133	91.85%		3133	91.85%	
18/08/2011	59	2	S Inc	9-4	3634	343.00	60.60	2379	115	2264	95.17%	25	2239	94.12%		2239	94.12%	
18/08/2011	60	2	S Inc	9-5	3634	703.90	57.80	5168	297	4871	94.25%	3	4868	94.20%		4868	94.20%	
18/08/2011	61	2	S Inc	9-6	3634	532.40	53.50	4346	365	3981	91.60%	6	3975	91.46%		3975	91.46%	
18/08/2011	62	2	S Inc	9-7	3634	703.50	67.30	4941	760	4181	84.62%	3	4178	84.56%		4178	84.56%	
18/08/2011	63	2	S Inc	9-8	3634	400.10	56.50	3439	606	2833	82.38%	0	2833	82.38%		2833	82.38%	
18/08/2011	64	2	S Inc	10-2	3634	336.70	53.40	3671	1149	2522	68.70%	1	2521	68.67%		2521	68.67%	
18/08/2011	65	2	S Inc	10-3	3634	493.00	62.60	3300	150	3150	95.45%	2	3148	95.39%		3148	95.39%	
18/08/2011	66	2	S Inc	10-4	3634	354.30	59.70	2649	275	2374	89.62%	0	2374	89.62%		2374	89.62%	
18/08/2011	67	2	S Inc	10-5	3634		60.90	4053	3814	239	5.90%	0	239	5.90%		239	5.90%	
18/08/2011	68	2	S Inc	10-6	3634	147.40	56.40	3617	2572	1045	28.90%	4	1041	28.79%		1041	28.79%	
18/08/2011	69	2	S Inc	10-7	3634	485.20	59.90	3768	528	3240	85.99%	2	3238	85.93%		3238	85.93%	
18/08/2011	70	2	S Inc	10-8	3634	690.70	69.40	4111	130	3981	96.84%	2	3979	96.79%		3979	96.79%	
18/08/2011	71	2	S Inc	11-2	3634	554.10	59.30	3994	256	3738	93.59%	3	3735	93.51%		3735	93.51%	
18/08/2011	72	2	S Inc	11-3	3634	359.50	61.30	2569	223	2346	91.32%	3	2343	91.20%		2343	91.20%	
18/08/2011	73	2	S Inc	11-4	3634	393.70	64.40	2811	366	2445	86.98%	2	2443	86.91%		2443	86.91%	
18/08/2011	74	2	S Inc	11-5	3634	422.90	63.90	2818	171	2647	93.93%	1	2646	93.90%		2646	93.90%	
18/08/2011	75	2	S Inc	11-6	3634	495.90	52.20	4404	604	3800	86.29%	2	3798	86.24%		3798	86.24%	
18/08/2011	76	2	S Inc	11-7	3634	490.30	54.90	4300	728	3572	83.07%	29	3543	82.40%		3543	82.40%	
18/08/2011	77	2	S Inc	11-8	3634	415.70	57.40	4537	1640	2897	63.85%	4	2893	63.76%		2893	63.76%	
18/08/2011	78	2	S Inc	12-2	3634	188.70	54.80	5547	4160	1387	25.00%	0	1387	25.00%		1387	25.00%	
18/08/2011	79	2	S Inc	12-3	3634	334.40	64.90	3893	1832	2061	52.94%	10	2051	52.68%		2051	52.68%	
18/08/2011	80	2	S Inc	12-4	3634	428.60	63.10	4232	1515	2717	64.20%	3	2714	64.13%		2714	64.13%	
18/08/2011	81	2	S Inc	12-5	3634	511.50	60.30	4260	867	3393	79.65%	1	3392	79.62%		3392	79.62%	
18/08/2011	82	2	S Inc	12-6	3634	588.30	64.60	4512	869	3643	80.74%	4	3639	80.65%		3639	80.65%	
18/08/2011	83	2	S Inc	12-7	3634	171.40	58.50	3553	2381	1172	32.99%	0	1172	32.99%		1172	32.99%	
18/08/2011	84	2	S Inc	12-8	3634	100.10	70.80	3517	2951	566	16.08%	0	566	16.08%		566	16.08%	
18/08/2011	85	2	S Inc	13-2	3634	704.70	64.60	4775	412	4363	91.37%	6	4357	91.25%		4357	91.25%	
18/08/2011	86	2	S Inc	13-3	3634	601.90	62.40	4215	357	3858	91.53%	4	3854	91.44%		3854	91.44%	
18/08/2011	87	2	S Inc	13-4	3634	584.70	64.40	3758	126	3632	96.65%	1	3631	96.62%		3631	96.62%	
18/08/2011	88	2	S Inc	13-5	3634			3634	3634	0	0.00%	0	0	0.00%		0	0.00%	
18/08/2011	89	2	S Inc	13-6	3634	493.80	61.00	3425	187	3238	94.54%	1	3237	94.51%		3237	94.51%	
18/08/2011	90	2	S Inc	13-7	3634	344.20	63.60	2320	155	2165	93.32%	3	2162	93.19%		2162	93.19%	
18/08/2011	91	2	S Inc	13-8	3634	508.60	62.10	4346	1070	3276	75.38%	0	3276	75.38%		3276	75.38%	
18/08/2011	92	2	S Inc	14-2	3634	158.70	57.40	5422	4311	1111	20.49%	3	1108	20.44%		1108	20.44%	
18/08/2011	93	2	S Inc	14-3	3634	153.40	55.80	3488	2388	1100	31.53%	1	1099	31.50%		1099	31.50%	
18/08/2011	94	2	S Inc	14-4	3634	468.40	59.60	4823	1679	3144	65.18%	1	3143	65.16%		3143	65.16%	
18/08/2011	95	2	S Inc	14-5	3634	527.60	54.00	4219	311	3908	92.63%	2	3906	92.58%		3906	92.58%	
18/08/2011	96	2	S Inc	14-6	3634			3634	3634	0	0.00%	0	0	0.00%		0	0.00%	
18/08/2011	97	2	S Inc	14-7	3634	84.00	41.60	3245	2529	716	22.06%	3	713	21.97%		713	21.97%	
18/08/2011	98	2	S Inc	14-8	3634		62.56	4108	4069	39	0.95%	0	39	0.95%		39	0.95%	
18/08/2011	99	2	S Inc	15-2	3634	295.40	71.90	2007	364	1643	81.87%	2	1641	81.77%		1641	81.77%	
18/08/2011	100	2	S Inc	15-3	3634	540.50	62.50	3681	222	3459	93.97%	2	3457	93.92%		3457	93.92%	
18/08/2011	101	2	S Inc	15-4	3634	256.90	63.40	1769	148	1621	91.63%	4	1617	91.41%		1617	91.41%	
18/08/2011	102	2	S Inc	15-5	3634	316.90	62.70	2195	173	2022	92.12%	0	2022	92.12%		2022	92.12%	
18/08/2011	103	2	S Inc	15-6	3634	620.30	62.80	4297	346	3951	91.95%	7	3944	91.78%		3944	91.78%	
18/08/2011	104	2	S Inc	15-7	3634	367.60	56.40	2772	165	2607	94.05%	4	2603	93.90%		2603	93.90%	
18/08/2011	105	2	S Inc	15-8	3634	556.80	68.40	3495	239	3256	93.16%	1	3255	93.13%		3255	93.13%	
18/08/2011	106	2	S Inc	16-2	3634	639.70	58.30	4638	249	4389	94.63%	2	4387	94.59%		4387	94.59%	
18/08/2011	107	2	S Inc	16-3	3634	104.60	63.30	2176	1517	659	30.28%	0	659	30.28%		659	30.28%	
18/08/2011	108	2	S Inc	16-4	3634	156.40	55.30	4877	3746	1131	23.19%	2	1129	23.15%		1129	23.15%	
18/08/2011	109	2	S Inc	16-5	3634	453.60	61.70	3347	406	2941	87.87%	1	2940	87.84%		2940	87.84%	
18/08/2011	110	2	S Inc	16-6	3634	170.60	57.30	1550	359	1191	76.84%	36	1155	74.51%		1155	74.51%	
18/08/2011	111	2	S Inc	16-7	3634	392.40	55.20	4542	1699	2843	62.60%	7	2836	62.44%		2836	62.44%	
18/08/2011	112	2	S Inc	16-8	3634	178.30	51.10	4955	3559	1396	28.17%	3	1393	28.11%		1393	28.11%	
18/08/2011	113	2	S Inc	17-2	3634	778.70	60.20	5534	360	5174	93.49%	1	5173	93.48%		5173	93.48%	
					410642			454213	118605	335608	73.89%	530	335078			335078		

Appendix 5: Lakelse Fry Release Plan and Report

2011 Lakelse SX Transport

Container	# fish	Weight	Biomass (kg)	Biomass +9.5%	Weight of fish (kg)
SX Tub 5	34889	0.88	30.70232	33.66509388	**Number of Buckets**
SX Tub 6	34429	0.85	29.26465	32.08868873	**Total Weight per bucket (kg)**
SX Tub 15	35081	0.88	30.87128	33.85035852	**KG of water per bucket**
SX Tub 14	35094	0.82	28.77708	31.55406822	**At 7 buckets per set of flights**
SX Tub 13	35234	0.78	27.48252	30.13458318	**Kg fish per L water**
SX Tub 12	35319	0.79	27.90201	30.59455397	
SX Tub 1	29883	0.73	21.81459	23.91969794	
SX Tub 2	41952	0.71	29.78592	32.66026128	
SX Tub 3	21065	0.75	15.79875	17.32332938	
SX Tub 10	24987	0.3	7.4961	8.21947365	
Current Total	**327933**		249.89522	274.0101087	

Flights starting May 2nd 2012

Release Details

External Mark	Internal Mark	Inventory Released	Retention Rate	Internal Marks	External Marks Only	Unmarked	Total Released	Release Biosample Len (mm)	WT (Gm)	KC

2011 Williams Cr Fall Sockeye (Wild) (2011-118-3-1309-W)

Juvenile Releases

Release Details

External Mark	Internal Mark	Inventory Released	Retention Rate	Internal Marks	External Marks Only	Unmarked	Total Released	Release Biosample Len (mm)	WT (Gm)	KC

2011 Williams Cr Fall Sockeye (Wild) (2011-118-3-1309-W)

Release Site: WILLIAMS CR

Release Group: 2011 Williams Creek Sockeye - Release Stage: Fed Fry Released in Spring

May 2, 2012 09:00 AM Release from 01sockeye to (1309) Williams Cr — **Bulk Wt.** N/A .73 N/A

AD	NONE	29,786	N/A	0	29,786	0	29,786			

Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

May 2, 2012 09:01 AM Release from 2 Sockeye to (1309) Williams Cr — **Bulk Wt.** N/A .71 N/A

AD	NONE	41,877	N/A	0	41,877	0	41,877			

Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

May 2, 2012 09:02 AM Release from 3 Sockeye to (1309) Williams Cr — **Bulk Wt.** N/A .75 N/A

AD	NONE	21,045	N/A	0	21,045	0	21,045			

Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

May 2, 2012 09:03 AM Release from 5 Sockeye to (1309) Williams Cr — **Bulk Wt.** N/A .88 N/A

AD	NONE	34,799	N/A	0	34,799	0	34,799			

Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

May 2, 2012 09:04 AM Release from 6 Sockeye to (1309) Williams Cr — **Bulk Wt.** N/A .85 N/A

AD	NONE	34,397	N/A	0	34,397	0	34,397			

Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.

Release Details

External Mark	Internal Mark	Inventory Released	Retention Rate	Internal Marks	External Marks Only	Unmarked	Total Released	Release Biosample Len (mm)	WT (Gm)	KC
2011 Williams Cr Fall Sockeye (Wild) (2011-118-3-1309-W)										
May 3, 2012 09:05 AM Release from 10 Sockeye to (1309) Williams Cr							**Bulk Wt.**	**N/A**	**.3**	**N/A**
NOMK	NONE	23,224	N/A	0	0	23,224	23,224			
Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.										
May 3, 2012 09:06 AM Release from 12 Sockeye to (1309) Williams Cr							**Bulk Wt.**	**N/A**	**.79**	**N/A**
AD	NONE	35,262	N/A	0	35,262	0	35,262			
Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.										
May 3, 2012 09:07 AM Release from 13 Sockeye to (1309) Williams Cr							**Bulk Wt.**	**N/A**	**.78**	**N/A**
AD	NONE	35,209	N/A	0	35,209	0	35,209			
Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.										
May 3, 2012 09:08 AM Release from 14 Sockeye to (1309) Williams Cr							**Bulk Wt.**	**N/A**	**.82**	**N/A**
AD	NONE	35,072	N/A	0	35,072	0	35,072			
Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.										
May 3, 2012 09:09 AM Release from 15 Sockeye to (1309) Williams Cr							**Bulk Wt.**	**N/A**	**.88**	**N/A**
AD	NONE	35,060	N/A	0	35,060	0	35,060			
Transpoted by plane to Terrace airport and trucked to holding pens in Williams Creek. Released at dark.										
2011 Williams Creek Sockeye		**325,731**		**0**	**302,507**	**23,224**	**325,731**			
WILLIAMS CR		**325,731**		**0**	**302,507**	**23,224**	**325,731**			
Juvenile Releases		**325,731**		**0**	**302,507**	**23,224**	**325,731**			

Release Details

External Mark	Internal Mark	Inventory Released	Retention Rate	Internal Marks	External Marks Only	Unmarked	Total Released	Release Biosample Len (mm)	WT (Gm)	KC
2011 Williams Cr Fall Sockeye (Wild) (2011-118-3-1309-W)										
Total Released		325,731		0	302,507	23,224	325,731			

Appendix 6: Scully Creek Adult Enumeration Report 2011

The 2011 Sockeye Camera Enumeration Project- (Groundwater) Scully Creek

Prepared by: Kristine Seibel- Technical Support
Department of Fisheries & Oceans Canada
Pacific Region
5235 A Keith Avenue
Terrace, B.C. V8G 1L2

Date: December 14th, 2011

1.0 Proponent Information

Department of Fisheries and Oceans
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Partners

Lakelse Watershed Society Members
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A special thanks to Ian Maxwell, Patty Burt, Dean Miller, DFO Terrace Resource Restoration Unit, Steve Cox-Rogers, and the Pienaar Family.

Table of Contents

2.0 Introduction

Schulbuckhand Creek, hereafter referred to as (Groundwater) Scully Creek, is located approximately 20 km south of Terrace, British Columbia. It flows into the southern end of Lakelse Lake and is part of the Skeena watershed. In the early 1990s, a flood event redirected surface water away from the original channel. As a result, the south fork of Scully Creek is sustained by groundwater (Rob Dams, DFO, Pers.Comm).

In 2003, the issue of depressed and apparently declining sockeye stocks in Lakelse Lake was raised by the Lakelse Watershed Society. This resulted in the development of the Lakelse Lake Sockeye Recovery Plan (LLSRP). The LLSRP outlines a recovery strategy, including goals and objectives, and an action plan focused on implementation and monitoring (Cox- Rogers, 2005).

Historically, Scully Creek had a significant number of returning sockeye spawners: 6800 in 1967 and 5500 in 1982. In the past four years, escapement estimates for Scully Creek have been variable: the highest was in 1070 in 2007; the lowest of 115 in 2008; and 142 in 2009 (Barb Spencer, DFO). An estimate for 2010 was approximately 150[1] (Rob Dams, DFO, Pers. Comm.).

Scully Creek contains high value spawning habitat. This habitat is used by sockeye, pink, and possibly kokanee, whitefish, cutthroat trout, and Dolly Varden (Mitch Drewes, DFO, Pers. Comm). Unlike most lakes in the Skeena system, shore spawning has not been reported in Lakelse Lake. The primary sockeye spawning tributaries are Williams and Scully Creeks (Cox-Rogers, 2005). Most of the returning sockeye are 4 to 5 years of age, with a few 3 year jacks as well (Cox-Rogers, 2005).

This report summarizes findings from the 2011 sockeye viewing camera, located near the confluence of Scully Creek with Lakelse Lake. The purpose of this study was to enumerate sockeye spawners in Scully Creek, and contribute escapement data for the Lakelse watershed. In addition, this study will help to assess the potential presence of adipose-clipped hatchery sockeye that may have strayed from Williams Creek releases.

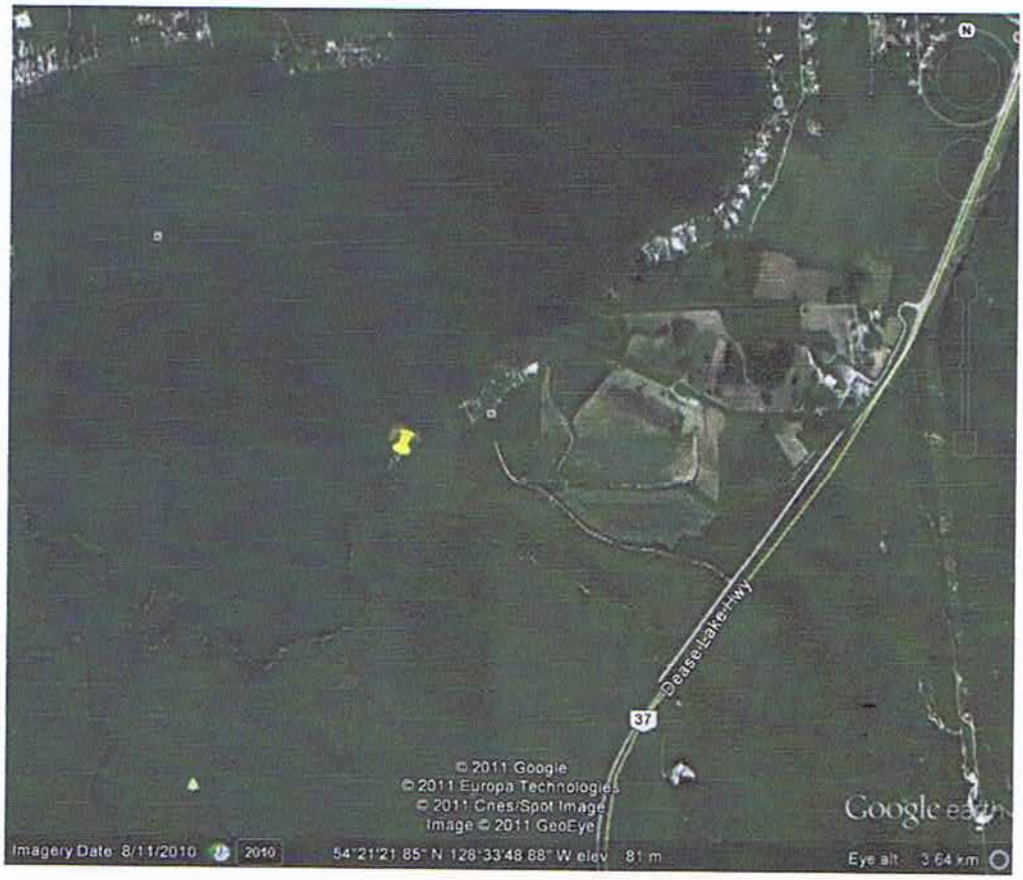
[1] The estimate of 150 sockeye spawners was derived from the camera project run in 2010. This is only an approximation because of technical problems with the camera and recording device.

3.0 Background and Methods

Background

The camera enumeration study was conducted on Scully Creek, approximately 100 m upstream from Lakelse Lake. The camera and adult fence were installed on private land.

The study site is located in the Skeena River Watershed. The specific location is at 54°21′19.40″N and 128°34′15.57″W.



Photograph 1. The location of the camera enumeration project near Scully Creek's outlet in to Lakelse Lake (indicated by the thumbtack marker on map).

Due to concern over bear encounters, visual stream inspections within Scully Creek have not been conducted on a regular basis. In 2010, an adult fence, digital recorder and underwater camera were installed as a pilot enumeration project.

The ongoing camera enumeration project is collaborative effort between DFO, the Lakelse Watershed Society (LWS), and lakeshore residents. Two new Specotech 4 TH model DVRs and an underwater camera were purchased by DFO in 2011.

The project began on August 11th, 2011 and continued until September 15th, 2011. The project timing was based on data gathered during the 2010 pilot project.

Methods

This project was based on similar camera enumeration studies done in the Nass Valley by Nisga'a Fisheries.

The materials used in the construction of the project are listed as follows:
Aluminum and plastic viewing box, aluminum doweling, metal bracing, camera, digital video recorders (DVRs), lights and sandbags.

Initial installation of the viewing box and adult fence was completed in early August 2011. This was done, at the request of DFO Habitat staff, in order to avoid the potential disturbance of pink spawners (Mitch Drewes, DFO, Pers. Comm.). The DVR and electrical system was installed and began operating on August 11th, 2011. Lights for night viewing were added on August 16th, 2011. The viewing box and camera were set up, under a small walking bridge, in the deepest part of the channel- parallel to the direction of flow. The box was held in place by pieces of aluminum doweling. During this study, the adult fence and viewing box did not prevent the upstream migration of adult sockeye at any time.

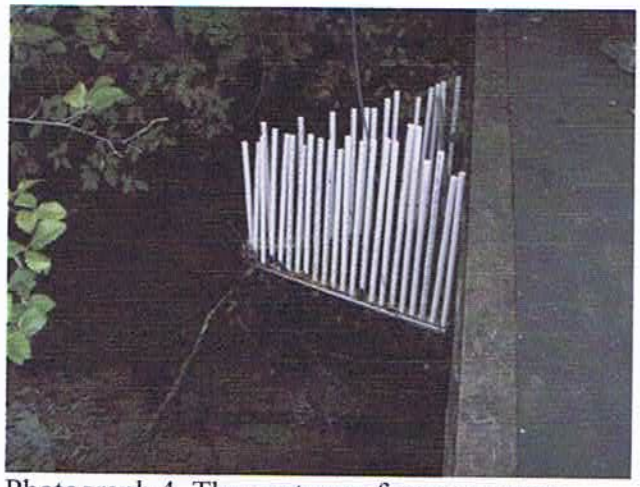
Two DVRs were used to record the events captured by the camera. They were set up at the office and brought into the field. Settings and instructions for DVR use are located in Appendix 1. Electricity to run both the camera and lights was donated by the local private landowner.

Aluminum dowel fencing was placed outward towards the banks, downstream from the viewing box (see Photograph 2). Gaps along each bank were filled with sand bags (see Photograph 3). On the upstream side of the bridge, another short section of fencing was installed (in an inverted V), to prevent salmon from re-entering the viewing box (see Photograph 4). The upstream fencing was not installed until the project was well underway.

As adult sockeye entered Scully Creek, they were funnelled through the viewing box and past the underwater camera. This camera detected motion and recorded the events. The final camera settings were determined, mainly through trail and error, and are listed in Appendix 1.

Photograph 2. Fence structure downstream of box. Photo was taken on the downstream side of viewing box, looking upstream.

Photograph 3. Downstream fence segment to bank join blocked with sand bags.



Photograph 4. The upstream fence segment

Recorded camera data was viewed by volunteers from Lakelse Watershed Society and DFO staff. Specific information on date, time, gender, and when possible the presence or absence of adipose fins were recorded. An example of the record sheet can be found in Appendix 2.

Two DVR hard-drives were rotated every four days; allowing for the recorded data to be viewed while the project was ongoing. The camera lens and the Plexiglas in the viewing box were cleaned at the same time: preventing algae growth and sediment build up. The fence was maintained and kept free of carcasses and debris.

4.0 Results and Discussion

Escapement results from the 2011 Scully Creek Camera Enumeration Project were excellent, when compared to the previous six years (see Chart 1). The total recorded escapement for 2011 was 1844: the daily break down can be seen in Chart 2. The largest daily count was on the 12th of August, but due to deletion of the source video this number was estimated from a firsthand observer account.

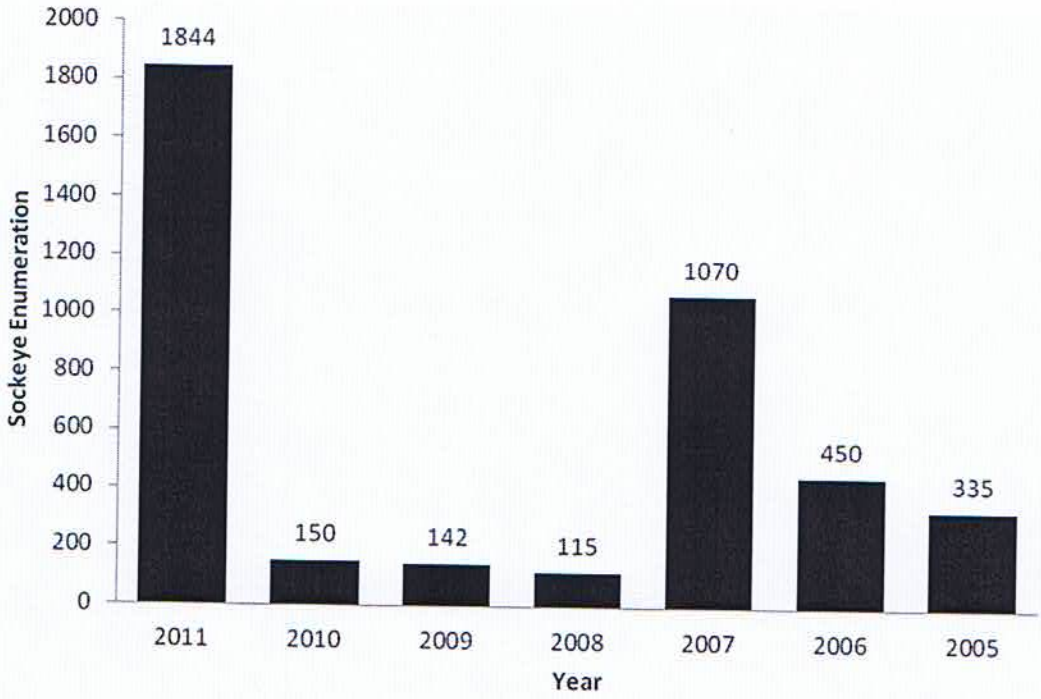


Chart 1. A comparison of enumeration data from 2011 to the previous six years. Historical return information for Scully Creek was obtained from DFO data entry. The 2011 adult return was primarily comprised of fish from the 2006 (the age 5) and 2007 (the age 4) brood years.

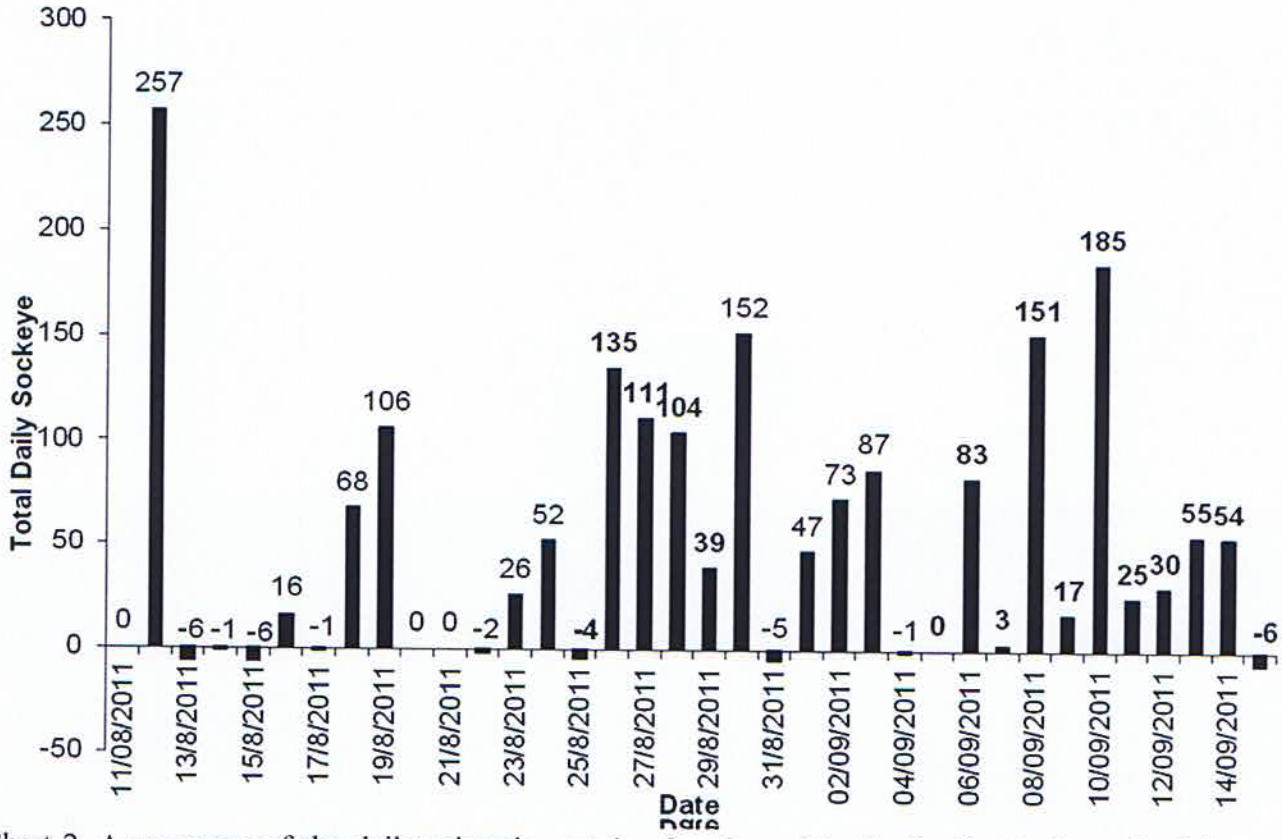


Chart 2. A summary of the daily migration totals of sockeye into Scully Creek. Several of the days with no values or negative values were affected by power outages or limited viewing time. Daily totals are listed above each bar in graph. Bolded daily totals were viewed completely (not just from the recorded event list).

There were a few problems with the camera project in 2011. The main one affecting this project was that the events recorded by the camera would cut-out before 30 seconds, even if motion was still being detected. Initial viewings of the data were done by referencing the motion-triggered event list compiled by the camera. Only fish seen within these events were recorded by observers on a record sheet. There is an unknown number of fish that could have passed through the camera without triggering it, or that were not recorded during a motion event. After a portion of the data had been viewed, it was determined that the camera was recording continuously and not just when motion-triggered. The remaining dates- August 25th to 28th and September 5th to 15th- were viewed by looking at the complete record and not just the event list (see bolded daily totals in Chart 2). The complete record was viewed 4x or 8x fast forward, providing a more accurate count. Unfortunately, some data was deleted before there was the opportunity to view it more thoroughly- ie August 12th.

The camera recordings were in colour, but only if there was adequate natural light. During the night and some overcast days, recordings were in black and white. Having no colour contrast made species identification difficult, because pinks were also present in the stream. The observed 2011 pink run was small; so it is believed very few pinks could have been recorded as sockeye. Power and lighting issues, related to the camera, may have resulted in an artificially low 2011 enumeration. There were four days in August, 19th to 22nd, that were affected by a power outage to some degree. Lights were not installed for the first four days. As a result night data is not

available prior to August 15th, 2011. Near the end of the project, the days were growing shorter and the timer on the lights was not adjusted, resulting in thirty minutes to an hour of undecipherable recording.

Migration of the sockeye spawners was not limited to a certain time of day. At night there seemed to be more spawning activity: a lot of upstream and downstream movement of the fish. Spawning activity, as well as other disturbance upstream resulted in debris clouds that made viewing difficult.

A table providing a break down of the daily counts by gender was not provided due to difficulty with gender identification. Identification was difficult during large pulses of fish, or when viewing the event list.

No adipose-clipped (hatchery) sockeye were observed in Scully Creek throughout this study. Camera image quality was not high enough to conclusively determine if there were any adipose fin clipped sockeye.

Photograph 5. A male sockeye spawner, upstream of viewing box, near fence.

5.0 Conclusions and Recommendations

Overall, the return of sockeye to Scully Creek was greatly improved when compared to the last decade.

There are some recommendations to be made to improve the study in future years.

- Having lights in place before project recording begins.
- Cleaning off camera lens and protective Plexiglas more often to prevent foggy/blurred video. At least every two to four days.
- Narrowing the viewing box to improve counting ability during periods of high turbidity.
- Updating automatic light timer as the days get shorter: so lights stay on longer.
- Have the area threshold set to 6% and sensitivity to 96%.
- Leaving camera in longer to ensure the whole run has been recorded.
- Do not delete any video: hard drives are large enough to capture it all.
- Do not depend on the event list: look at all data instead. Suggested at 4X fast forward or 8X if few events on event list.
- Have a backup power system in place: a 12V battery. This will avoid the data blackouts.
- Check on camera more often to ensure power supply is still running.
- Put in the upstream V before migration starts. This will hopefully cut down on the number of fish going back and forth through the viewing box.
- Seal the camera so debris cannot enter the camera compartment and trigger events. Include a door to make camera cleaning easier.
- Construct a unit to hold the DVR and the monitor, at the site, to protect it from the elements.
- A daily log should be kept. Record information on any setting that have been changed and the days the hard-drives were rotated.

Appendix 1- Camera Settings and Use Instructions

Settings

Main Menu

4. Record Setup
    4.1 Record Mode Setup
        4.1.1. Record Resolution: 720*240
        4.1.2 Record Format: MP4

    4.2 Schedule Set up
        4.2.1 Day Time Start AM 6:00
        4.2.2 Day Time End PM 6:00
        4.2.3 Night Time Start PM 6:00
        4.2.4 Night Time End AM 6:00
        4.2.5 Weekend Schedule ON
        4.2.6 Weekend Start FRI. PM 6:00
        4.2.7 Weekend End MON. AM 6:00

    4.3 Preset Config OFF

    4.4 Per Camera Config
        -Camera Select CH01

	Day	Night	Weekend
Normal PPS	30	30	30
Normal Quality	Mid	Mid	Mid
ABR (KByte)	36	36	36
Event Max PPS	30	30	30
Event Quality	Best	Best	Best
Event Act	Motion	Motion	Motion

    4.7 Pre-Alarm Recording 5 Sec
    4.8 Circular Recording ON
    4.9 Audio Recording OFF

6 Event Setup
    6.1 Internal Buzzer OFF
    6.2 Event Icon OFF
    6.3 Email Notice OFF
    6.4 Email Attachment OFF
    6.6 Event Full Screen NONE
    6.7 Event Duration 5 sec
    6.8 Per Channel Config
        6.8.1 Channel Select CH01
        6.8.2 Video Loss Detect OFF
        6.8.3 Motion Detect ALL
        6.8.4 Detection Config

6.8.4.2 Sensitivity	96%
6.8.4.3 Area Thresh	6%
6.8.5 to 6.8.9	OFF or NONE
6.8.10 Event Trigger Preset	0

Set up

- Connect all parts to DVR before turning unit on: camera and monitor (if outside)
monitor, usb mouse, keyboard (if viewing)

-Plug camera into **Channel/Input 1**

-Power switch on back of DVR unit. No power switch for camera

Changing Hard drives

*****SHUT DOWN FIRST**** shut down instructions located below**

To open/ Take out hard-drive:

- push on silver button on top left hand corner (it says 'push' on it)
- it will pop open and there will be a lock underneath.
- place key in lock and turn from 3 o'clock position to 12 o'clock position.
- once unlocked. Pull open front panel using the silver push button
- remove hard drive; using front panel

To reinsert new hard-drive:

- put new hard-drive in and slide in.
- to slide hard-drive in the whole way the front panel must be extended.
- once fully in, push in front panel, lock (when lock is at 3 o'clock position)and then push 'push' button back into place

Viewing Video

- attach monitor and USB mouse to DVR unit at the back (can also attach key board if do not want to use remote)
- Turn on DVR and make sure monitor is on
- DVR takes a minute or two to start up.

-on remote : search→look under heading 'search by event'→event list→enter→select event wanted→enter
-to stop press freeze
-press play/stop to return to main mode
-press esc to exit event list
-if want to watch all video at once: in main search menu go to playback (under heading search by time)

- you can also use the button on the front of the unit to view the data, instead of the remote.

- when watching data please use the attached spreadsheet. It makes tallying the data much easier.

- Do not use event list to watch data. Event list can be used as a guide for the possible number of fish going through the camera. Please review the data by going to search and then under select put the day and time you would like to watch from. Viewing the data works best at 4X, but if few hits on event list 8X also works well. If you view any faster, fish are missed.

To Delete video or events****

-hit menu- enter password and user name
-select record setup and hit enter
-select purge data- chose purge event data and change to 'yes'

- go to option 4 'start to purge'; and change to 'yes'
  -wait for data to be purged.

****please do not delete data

Shut Down

Do not turn off DVR until you have shut it down.

- Hit menu on remote or unit
- Select 'Shutdown' from the menu (Option 11)
- Select power off (option 1) hit ok to execute command
- Turn off DVR when monitor reads "You can safely turn off DVR now"

User Name: admin*
Password: 1234

* user name is case sensitive

Appendix 2- Example Record Sheet

SOCKEYE VIEWING TALLY

Date (MM/DD/YY)	Time (24hrs)	MALE	FEMALE	TAIL only	OTHER	UP STREAM	DOWN STREAM	ADIPOSE

Resources

Cox-Rogers, Steve. 2005. Recovering Lakelse Lake Sockeye Salmon- Lakesle Lake Sockeye Recovery Plan.

Dams, Rob.2011. Personnel Communication. Terrace, B.C.

Drewes, Mitch. 2011. Personnel Communication. Terrace, B.C.

Spencer, Brenda. 2011. Lakelse Streams Sockeye 1950 to 2010

Appendix 7: Lakelse River Smolt Assessment 2012

TRITON
ENVIRONMENTAL CONSULTANTS LTD.

#300 – 4546 Park Avenue
Terrace, BC V8G 1V4

Phone 250 635 1494
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June 20, 2012

Reference: 4657/WP

Fisheries and Oceans Canada
Resource Restoration Unit
3177 Tatlow Road
Smithers, BC
V0J 2N0

Attention: Lana Miller – Resource Restoration Biologist – North Coast

Lakelse Sockeye Smolt Assessment Report

Introduction

Lakelse Sockeye runs have been a concern for Fisheries and Oceans Canada (DFO) for the last decade. In 2005 a "Lakelse Sockeye Recovery Program" was initiated and during subsequent years, funding was provided by the Pacific Salmon Commission for various rehabilitation, restoration and enhancement projects for this stock. Questions remain on what are the limiting factors that affect the survival of the wild and enhanced fish.

One method of determining freshwater survival for juvenile salmonids is to install a trap on their migratory route to the ocean to enumerate the number of fry/smolts. Ideally for Lakelse Sockeye, the best location and means of assessment is to install a smolt fence and a trap on the outlet of the Lakelse Lake but this is both costly and labour intensive. Over the last 5 years, DFO has tried to capture a snapshot of the migration of Lakelse Sockeye using both a small smolt fence and a rotary screw trap. Both were unsuccessful at catching any Sockeye smolts.

On May 8, 2012, Triton Environmental Consultants were awarded a contract to attempt to obtain information regarding Sockeye smolts leaving Lakelse Lake. This project would also possibly provide an indication of relative numbers of marked (enhanced) vs. unmarked (wild) and physical data from both to determine the condition factor. The following is a brief summary of this project.

Methods

A *Fyke* net with a 4'X4' opening was first installed on the lower Lakelse River in the vicinity of the *BC Hydro* transmission line crossing approximately 2 km upstream of its confluence with the Skeena River. (photo 1) The *Fyke* net funnelled down to an eight inch opening. This opening was clamped to an eight inch PVC pipe approximately 10 feet in length and ran into a floating trap box. This was fitted with an upturned pipe elbow preventing fish from swimming back out.

Photo 1: Smolt Trap - Lakelse River - First Location

The trap was fished twice a week between May 10th and June 8th. In general it was fished for a 12 – 14 hour period between the hours of 1730 through to 0900 the following morning in an attempt to capture the nightly migration. The *Fyke* net was set up at a location to capture a part of the main current of the river to minimize fish avoidance. The trap was relocated May 22 to a second location on the opposite side in an attempt to move it more directly into the main currents.

Photo 2: Lakelse River - Second Location

After each set, the trap was subsequently emptied and the resulting fry/smolts were placed in basins where they were identified and counted. Smolts were also assessed for weight and length. All captured fish were released.

Photo 3: Emptying the Trap

Photo 4: Captured Fry

Photo 5: Coho and Chinook Fry

Photo 6: Sockeye Smolt

Results

The trap seemed to "fish" well judging by the amount of fry that were caught. Unfortunately, only one sockeye smolt was caught compared to 22 coho smolts during the project period.
(see attached file – Appendix 1)

Discussion

Based on the results, a few possibilities may explain why the *Fyke* net was unsuccessful in catching Sockeye smolts.

- Timing:
  Past data for Lakelse shows that the majority of migration happens between May 20th and May 30th. It's possible but seems unlikely that this year's migration may have occurred earlier than the project timing.
- Avoidance/Location Logistics:
  It was not feasible to set the smolt trap directly in the main current of the river, so to some degree, smolts were both able to avoid the trap or were in the main current.

- Low Productivity:
  It is a possibility that Sockeye smolt production from Lakelse Lake was minimal this year.

Recommendations

- Installation of a smolt fence and trap in the location (or similar location) where it had previously operated in the 1950s at the outlet of Lakelse Lake. Though this may not be viable due to costs, it would provide more extensive coverage of the river.

- Installation and operation of a rotary screw trap functioning in the thalwag of the Lakelse River would likely be less costly than the smolt fence.

- Timing of trapping could be started at the beginning of May.

If you have any further questions or concerns please feel free to call and discuss.

Sincerely,

Mitch Drewes
Triton Environmental Consultants Ltd.

cc: Codey Latimer - Triton

Appendix 8: Financial Summary

2011 Project Budget Form

Name of Project: Lakelse Sockeye Recovery Program:

FRY OUTPLANT PROJECT – Year 6

ELIGIBLE COSTS

Labour
Wages & Salaries

Position	# of crew	# of work days	hrs per day	rate per hour	TOTAL PROJECT BUDGET Total (In-kind & cash + PSC Amount)	OTHER FUNDING In-Kind & Cash	PSC N. FUND GRANT AMOUNT PSC Amount	ACTUAL AMOUNT SPENT	VARIANCE EXPLANATION
Nuxalk First Nation (egg picking, feed)	2	45	8	30	21,600	6,000	15,600	16,030.00	
Restoration Biologist	1	20	8	40	6,400	6,400			
Technical assistance	3	12	8	30	8,640	3,000	5,640	5,167.89	
Financial administration (DFO in-kind)	2	14	8	25	5,600	5,600			
Person Days (# of crew x work days)				sub total	42,240	21,000	21,240		

Labour - Employer Costs (percent of wages subtotal amount)

rate	0%	sub total				

Subcontractors & Consultants

	# of crew	# of work days	hrs per day	rate per hour					
Project Coordination, report writing	1	70	8	31.25	17,500	2,000	15,500	16,500.00	
Marking crews	6	14	8	23	15,456		15,456	16,200.00	
Insurance if applicable	rate	0%							
				sub total	32,956	2,000	30,956		

Volunteer Labour

	# of crew	# of work days	hrs per day					
Skilled	6	6	8	25	7,200	7,200		
Un-skilled	6	6	8	15	4,320	4,320		
Insurance if applicable	rate	0%			1,200		1,200	
				sub total	12,720	11,520	1,200	985.00

Total Labour Costs 87,916 | 34,520 | 53,396

Site / Project Costs	Provide details in the space below (use an additional page if needed)				
Travel (do not include to & from work)	Air charters, equip/personnel transfers	29,000.00	2,000	27,000	21,528.00
Small Tools & Equipment					
Site Supplies & Materials	Project consumables, PPE, cages, nets, etc.	12,500	6,000	6,500	5,614.58
Equipment Rental					
Work & Safety Gear					
Repairs & Maintenace	Net repairs	1,000	1,000		
Permits					
Technical Monitoring	Temperature loggers, DO meter, etc.	1,500	1,500		
Other site costs	Disease sampling	2,000		2,000	2,071.59
	Total Site / Project Costs	46,000	10,500	35,500	

ELIGIBLE COSTS

Training (e.g Swiftwater, bear aware, electrofishing, etc).				BUDGET Total (PSC + In-kind + cash)	OTHER FUNDING In-Kind & Cash	CONTRIBUTION FUNDING PSC Amount
Name of course	# of crew	# of days				
Bear Aware	4	1		800	800	
Swift Water Rescue	2	2		1,200	1,200	
Standard First Aid	4	1		800	800	
			Total Training Costs	2,800	2,800	-

Overhead / Indirect Costs	(If the PSC contribution to Indirect costs exceeds 20% of the total PSC grant you will be required to submit back-up documentation justifying the expense).				
Office space; including utilities, etc.					
Office supplies					
Telephone & long Distance					
Photocopies & printing					
Other overhead costs	Courier, postage, shipping, etc.				
	Total Overhead Costs	13,104	8,000	5,104	5,156.03

Capital Costs / Assets — **Provide details in the space below (use an additional page if needed)**

Assets are things of value that have an initial cost of $250 or more and which can be readily misappropriated for personal use or gain or which are not, or will not be, fully consumed during the term of the project.

Weigh scale for Snootli Hatchery						1,960.00	1960 Note
		Total Capital Costs					
		Project Total Costs	149,820	55,820	94,000	91,213.09	

Budget Summary

(PSC + in-kind + cash)

Total Labour Costs	87,916
Total Site / Project Costs	46,000
Total Training Costs	2,800
Total Overhead Costs	13,104
Total Capital Costs	-
Project Total	149,820