Lakelse Lake Sockeye Salmon

Fry Outplant Program

2012 - 2013

Prepared For:

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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).

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). 2011 results from enumeration programs indicate a slight improvement of numbers and confirmed numbers of returning project brood stock.

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 2012, gametes and disease related samples were collected from 270 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. In addition, 30 female and 30 males were randomly sampled for other viruses at the request of PBS.

In early May of 2013, approximately 291,350 fry were airlifted to Williams Creek, held for several hours in pens and then released at dusk. Of these approximately 10,000 fry were released into the newly completed off-channel habitat on Upper Williams Creek.

This report is a summary of the project conducted in 2012 and 2013.

Acknowledgements

As an integral part of the Lakelse Lake Sockeye Salmon Recovery Program, plans were made to continue the Lakelse Fry Outplant project (2012/2013) utilizing facilities and expertise at Snootli Creek Hatchery to incubate and rear ~300,000 Lakelse sockeye fry in order to conserve sockeye populations in the Lakelse watershed. Conservation efforts are coupled with continued habitat restoration, protection and other assessment and monitoring projects identified in the overall Recovery Plan while building capacity in the Lakelse area.

Funding for this project was obtained by Fisheries and Oceans Canada (DFO) from the Pacific Salmon Commission Northern Fund in 2012.

This report is intended to summarize the Egg Take and Fry Release components of the Fry Outplant Project under the administration and guidance of Fisheries and Oceans Canada.

Project Personnel:

Margaret Kujat – Project Lead/Contracted Consultant
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In Kind Contributions:

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Rob Dams – Terrace-field assistance and logistics
Kristine Seibal – Terrace – field assistance
Sandra Devcic – OHEB, Engineer, RRU
Lana Miller – OHEB, Resource Biologist
Snootli Creek Hatchery –– administrative and technical expertise
Catherine Baynes – Technician- Pacific Biological Station
Brenda Donas – Acting Support Biologist – Community Involvement Program
Natalie Newman – Acting Community Advisor – Smithers Office

BC Ministry of Environment

Chris Broster (Environmental Eco. Specialist) field support

Other

Regional District Kitimat Stikine
Lakelse Watershed Stewards Society – volunteer members
Terrace Rod and Gun Club – volunteer members

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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 Stewards Society (LWSS). LWSS 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 Stewards Society, the Terrace Rod and Gun Club, Kitselas First Nations, Federal and Provincial government agencies including Fisheries and Oceans Canada, BC Parks, BC Ministry of Forests, Regional District Kitimat Stikine, 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 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 was developed in upper Williams Creek, the main spawning tributary. This included a variable flow water intake system.

This project has been underway since 2006.

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.

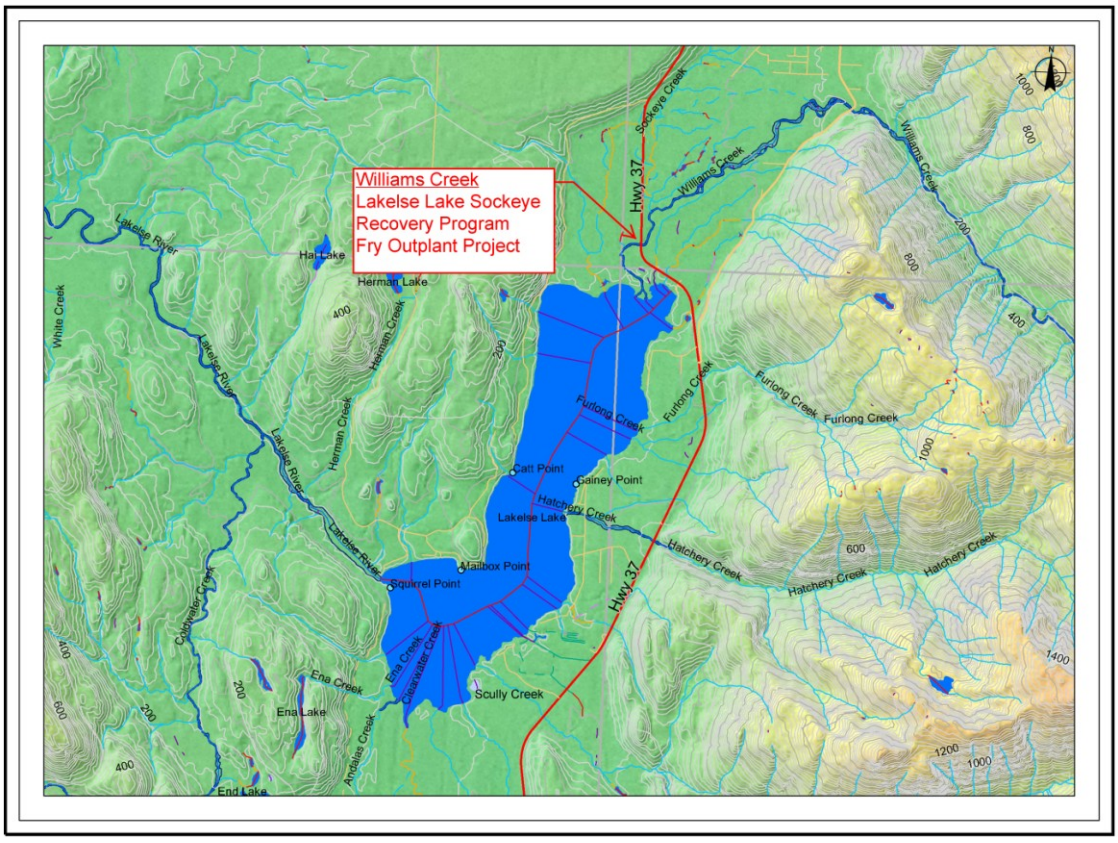

Figure 1. Project Location Map

3.0 Methods and Procedures – Egg Take – 2012:

3.1 Pre-Operations:

Permits:

Permits for the collection and transfer were undertaken by DFO.
Target egg collection/milt was for +300,000 to be collected from Williams Creek during the spawning period in August, 2012.

Project Lead/Coordinator

A project lead was established through a verbal agreement with the consultant in August of 2012. This arrangement provided the project with the technical and administrative relationship with the staff at Snootli Creek Hatchery.

Lana Miller, Resource Restoration Biologist was the funding proponent and project lead for Fisheries and Oceans Canada. Ms Miller has been involved with this project since Year 2005.

Equipment Preparations:

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

- Disease sampling equipment specific for investigation of IHN included: individually numbered 2 ml screw cap vials, sterile gloves and disposal pipettes for collection of ovarian fluid per female. These were readied prior to field operations. (105)
- Disease sampling equipment specific for investigation of BKD samples included: individually labelled 'whirl-pak'- 4 oz. bags, isopropyl alcohol, small 'beaker' or similar, surgical blades and handles, small propane torch, sterile gloves and fish labels. (105)
- Disease sampling equipment specific for investigation of other virus (as per request by Pacific Biological Station in Nanaimo, BC) included 30 additional pre-labelled sample bags for females (MIX) 30 additional sample bags for male BKD and 30 additional sample bags for males (MIX).
- Spawning bowls for initial egg collection were readied and this included disinfection in a solution of 1:100 iodophor, rinsed, dried and re-packaged for field use. (85) Additional spawning bowls were acquired on loan from Gitanyow Fisheries Authority (Mark Cleveland) for total of +105.
- Egg containers were washed, rinsed, dried and individually numbered and re-packaged for field use. (105)

- For the purposes of milt collection, individually numbered, 'whirl-pak' bags were individually numbered for field use (105). .
- Tangle nets and a total of 5 holding pens were readied for brood stock collection.
- Other miscellaneous equipment related to field logistics including consumables such as paper towels, 'Ovadine'™, tarps, etc were also readied.

Logistics:

Consideration for the following was made prior to the field operations:

1) Confirmation of pending funding from Pacific Salmon Commission.
2) Verbal Confirmation of consultant as coordinator.
3) Tentative schedule of field operation per returning spawning stocks.
4) Liaison with Snootli Creek Hatchery re: schedule and availability of staff.
5) Sufficient personnel.
6) Aircraft availability and scheduling.
7) Orientation, training and safety meetings each day prior to brood stock collection and egg takes.
8) Liaison with DFO Stock Assessment regarding data collection during brood stock collection.
9) Liaison with DFO Stock Assessment and DFO project lead regarding otilith sampling of all brood stock collected.
10) Field support from DFO with respect to equipment transfer, personnel transfer.
11) Coordination with PBS on disease sampling and tentative scheduling.
12) Liaison with Executive Flight Centre – Terrace for access to charter aircraft.
13) Liaison with BC Parks due to field location.

The Alaskan sockeye salmon protocols identify stringent procedures with respect to brood stock collection. Ideally a team of 6 – 7 individuals are required to handle these procedures in an efficient manner. Because of the collaborative, interagency nature of this project, there was field support to the Project Consultant from DFO, MoE, Lakelse Watershed Stewardship Society membership and the Terrace Rod and Gun Club representatives. Sufficient personnel was established and maintained throughout this operation. (up to 21 people)

Contact numbers for the consultant were shared with Snootli Creek Hatchery and Bella Coola Air charters prior to the project for emergency and logistic purposes.

Sockeye spawners were reported in Williams Creek as early as August 1, 2012. For 2012, the egg take dates were tentatively scheduled for the week of August 20 – 24, and planned that the target 105 disease samples, eggs and milt would be collected in a one day operation.

As a courtesy, BC Parks were informed of the project as Williams Creek project sites lies within Parks boundaries.

Brood stock collection was undertaken on the afternoon of on August 20 and 21. Only female sockeye salmon were held. Egg takes and disease sampling was planned for Wednesday August 22, 2012 however suitable weather for flying was a consideration. This resulted in a delay of operation as the pilot assessed weather conditions between Bella Coola and Terrace.

Planned start time was 0815 hours and this occurred later at 1030 hrs.

3.3 Operation

A review of the background of the project, and a safety discussion were conducted by the Project Coordinator prior to proceeding with any operation on each day including brood stock collection and egg takes.

In addition, the Acting Support Biologist, Community Involvement Program reviewed some Best Management Practices to be included into the 2012 operation (Draft, 2012).

4.0 Brood Stock Collection:

Potential brood stock was captured in Williams Creek using 4 1/8" mesh tangle gill nets beginning August 20 and continuing through until August 22. Brood Stock collection crew included DFO personnel, private consultants, members of the Lakelse Watershed Steward Society, Ministry of Environment and a representative of the Terrace Rod and Gun Club.

Net sets were done both below and above the bridge on Highway 37 in Williams Creek. Data on sex, marked (adipose clipped -Lakelse returns) or "wild salmon" and was recorded. Data on marked and captured is contained in a separate file attached. Fish were held in stream in net cages.

Spawning:

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Individual personnel handled individual tasks relating to the fish handling and each task was kept isolated from other tasks in the protocols. Personnel were disinfected between each fish. Where applicable, all personnel wore disposable, surgical-type gloves. Fresh gloves and/or disinfection procedures were deployed when handling each fish.

Each step in the sockeye protocol procedure was done by at least one individual.

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.

The females were dispatched with a sharp blow to the head and each was fully immersed in a 1:100 iodophor solution contained in a 20 litre pail. The female was then immediately hung, tail up, on a spawning rack using lightweight twine "tailers"; each on a single nail appropriately spaced to ensure and main-

tain physical separation from each other. Individually, the females were then bled out by cutting the gills with a disinfected knife.

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 person. 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 with a clean, dry, sterilized one. The eggs were then transferred from the initial spawning bowl to individually numbered, plastic lidded containers.

Ovarian fluid (2 ml) was removed using a clean disposable pipette. (as per disease screening' procedures below). The lid of the vial was then secured and the container placed in a cooler with frozen gel paks. This was intended to stabilize temperatures during the operation and throughout transportation.

Each female fish was then transferred to the disease sampling area, tagged with a corresponding numbered, tag for collection of kidney tissue samples related to BKD disease screening.

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.

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.

Spawning - Males ♂

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.
An equal + number of male milt sample to female egg containers were collected to enable a 2X2 spawning matrix.

Start time: Approximately 1045 hrs
Shipped: Approximately 1630 hrs
Planting complete: Approximately 2000 hours at

Complete Collection Procedures:

- Spawning was done in the field. Collection of milt from the males was conducted 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 en-route to Terrace-Kitimat Regional Airport onward 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.

- Field operation was done over a 3 day period. Brood stock collection occurred on August 20th, 21st and 22nd in an area just downstream and just upstream from the Highway 37 Bridge at Williams Creek.

- Egg takes were conducted in an area just downstream of the Highway 37 Bridge on available dry areas (beach). High water in this creek was notable this year and both egg takes and disease sampling was conducted on the adjacent trail area (temporarily closed to the public) Personnel and equipment were staged out of the BC Park's "Grunchy's Beach" parking area.

3.5 Disease Screening:

For the purposes of disease screening for BKD:

- The 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 mid-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'. Disinfection procedures as described above occurred between each sampling.

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.

Additional sampling per specific request of Pacific Biological Station (Nanaimo, BC) was also conducted. This involved 2 extra disease sampling stations and technicians.

Sampling included:

- Thirty (30) samples of 'head' kidney, spleen and gills were collected from numbered females. (MIX) – Various virus.
- Thirty (30) samples of mid kidney were collected from males (BKD)
- Thirty (30) samples of 'head kidney, spleen and gills were collected from the same 30 males (MIX) – various viruses.

3.6 Fertilization and Planting

Preparations at Snootli Hatchery were confirmed by the Asst. Operations Manager John Willis prior to brood stock collection.

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.

The eggs from each female were divided evenly into 2 separate containers and each of these received half the milt from 2 individual males and gently mixed. These egg samples 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 taken and transferred to the incubation area by an additional staff member waiting outside the facility. The eggs were place 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 process 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.

3.7 Hatchery Operations: Incubation, Rearing, Ponding and Marking

As in previous years, technical staff at Snootli Creek Hatchery were involved in monitoring and rearing of the Lakelse stock.

Water flows were monitored and maintained at 15 lpm in all heath tray stacks.

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 2013, at an average size of 0.15g. 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 were 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 feeding well the 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. Approximately 15,000 fry were not clipped.

3.8 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 the first week of May 2013 and was conducted on May 3rd and 4th due to weather conditions.

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.

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. This was conducted by the project consultant, DFO personnel and several members of the Lakelse Watershed Stewardship Society.

4.0 Results

4.1 Spawning

The Application for Introduction or Transfer of Fish or Aquatic Invertebrates was facilitated by DFO. Target collection numbers for 2012-2013 were set at ~300,000. Approximately 400,000 sockeye eggs were transported to Snootli Creek Hatchery for fertilization, incubation and rearing. The Project Coordinator, DFO, agency personnel from BC Parks worked with volunteer members of the Lakelse Watershed Stewards Society and the Terrace Rod and Gun Club over several days to collect brood stock. 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, as per the previous year, was made through joint discussions with personnel and Bella Coola Air owner/pilot.

4.2 Hatchery Operations: Incubation, Ponding, Rearing and Marking

4.3 Fry Release

Fry were transported on May 3rd and May 4th 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. All fry arrived in good condition.

The majority of 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.

Approximately 10,000 fry were transported to upper Williams Creek – downstream of the Old Lakelse Lake Bridge. They were released following a period of acclimatization.

5.0 Remarks

- Lakelse stocks appear to have improved in 2012-2013 from 2006, when the fry outplant program began, but remain depressed in comparison to historical numbers.
- Ongoing efforts by DFO towards habitat improvement and restoration continue.
- The fry outplant program continues to provide some level of protection for this stock.
- Stable off-channel habitat was created up-stream on Williams Creek and this area was seeded with a small number of fry during this release.
- Otolith sampling was also conducted in conjunction with brood stock collection and egg takes. Results can be obtained from DFO-Stock Assessment – Prince Rupert.

Some of the 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.

6.0 LIST OF REFERENCES

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Appendix 1 - Proponent Information

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