Tatsamenie Lake Sockeye Fry Rearing - 2011

Prepared for:
Transboundary Panel
Pacific Salmon Commission

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

LIST OF APPENDICES

Abstract

An ongoing sockeye enhancement program has been conducted at Tatsamenie Lake over the period 1990 through 2011. As part of continuing attempts to increase fry to smolt survivals of enhanced Tatsamenie sockeye, fry rearing experiments were conducted at Tatsamenie Lake in 2008, 2009, 2010 and 2011. The 2008 project which involved in-lake pen rearing resulted in the loss of all the fish to IHNV (Infectious Hematopoietic Necrosis Virus). The 2009 and 2010 projects involved onshore fry rearing using an IHNV free water source and 'Capilano' rearing troughs. The 2009 and 2010 projects were a qualified success with the release of 115,000 and 210,000 sockeye pre-smolts respectively into Tatsamenie Lake. Rearing mortalities in both years were low. The operational plan of the 2011 project was to build on this experience and duplicate the methods used in 2010. For the 2011 project approximately 250,000 eggs of the 2.1 million eggs that were obtained from the BY 2010 Tatsamenie Lake egg take were allocated to the 2011 rearing project. All fry from Snettisham hatchery possessed a separate unique thermal mark for the reared group and the directly planted group. In early June 2011 the four Capilano troughs used in the 2010 project were again made operational at the same location. Emergent fry were reared at Snettisham for approximately 30 days to a mean weight of 0.7 gm before delivery by floatplane to Tatsamenie Lake on June 9. The fry were fed EWOS brand fish food applicable to the fry size. Feed rates were set at 2% body weight/day. The fry were released into two net pens measuring 5m x 5m x 5m with ½ inch mesh for the final 10 days of in-lake rearing. The first group of 105,000 was released into net pens on July 22 and into the lake July 31 at a mean weight of 2.6 gm. The second group of fry was placed into the net pens August 2 and released into the lake on August 14 at a mean weight of 4.0 gm. A total of 210,000 pre-smolts were released into the lake. Total rearing mortalities were 653 fish. As occurred in 2010, experiments conducted during the 2011 project indicated the age 0+ fed smolts had osmo-regulatory competence equal to the wild age1+ smolts. Approximately 27,000 of the BY 2010 fed fry out-migrated as age 0+ fish. Results from the 2011 smolt sampling and population estimates indicate the combined age 0+ and age 1+ egg to smolt survival of the BY 2009 fed fry was 10.1%.

1. Introduction

Tatsamenie Lake is located in the upper watershed of the Taku River in northwestern British Columbia. It is a narrow partially glacial fed lake 14 km long with an average width of approximately 1.5 km. The lake surface area is approximately 22 km^2 and Maximum depth is 120 m. In some years it is a significant producer of Sockeye salmon (*Oncorhynchus nerka*) in the Taku River watershed with production contributing to the U.S. commercial and subsistence fisheries in southeast Alaska and Canadian fisheries on the lower Taku River in British Columbia. Tatsamenie Lake, along with other Transboundary lakes, has been the object of a Transboundary River (TBR) sockeye enhancement program with a primary aim of increasing overall sockeye production from lakes considered to have under-utilized sockeye fry rearing habitat. The TBR enhancement program is a joint Canada-U.S. program created and managed under the aegis of the Transboundary chapter of the Pacific Salmon Treaty.

Sockeye enhancement efforts at Tatsamenie Lake prior to 2008 were focused on unfed fry releases into the lake. The enhanced fry originate from eggs collected in the fall from adults returning to Tatsamenie Lake. The eggs are incubated at Snettisham Hatchery in southeast Alaska and resultant fry flown back to Tatsamenie Lake the following spring. The increased egg to fry survival as a result of hatchery incubation has been found to significantly increase sockeye smolt production in some Transboundary lakes (TTC 2009). However, at Tatsamenie Lake the enhanced sockeye egg to smolt survival is significantly lower than that obtained at other Transboundary sockeye enhancement projects. Tracking of egg to smolt survivals from 1998 to 2011 indicates Tatsamenie Lake has a relatively low wild egg to smolt survival (BY 1998 – 2009 average = 2.1%). Hatchery incubation of the enhanced fish has resulted in an average over the same period of 4.1% [1](Unpublished data, Enhancement Sub-committee of the Transboundary Technical Committee (TTC)). At observed levels of escapement to date the survivorship of Tatsamenie sockeye fry does not appear to be influenced by density dependent effects (Riffe and Mercer 2006). In order to further increase enhanced egg to smolt survivals beyond that provided by hatchery incubation the TTC Enhancement Sub-committee suggested experimenting with short term fry rearing to increase survivals beyond that provided through artificial incubation alone.

In 2006, the Enhancement Sub-committee of the TTC developed a proposal to rear Tatsamenie Lake sockeye fry to a "pre-smolt" stage of approximately four grams in net pens in the lake. This proposal was submitted to the Pacific Salmon Commission Northern Fund and accepted. The fry were to be released around August 1, prior to the commencement of adult returns to the lake. This type of pen rearing was utilized with considerable success at Hugh Smith Lake in southeast Alaska (Piston et al. 2006). Increased enhanced egg to smolt production through the release of pre-smolts could potentially achieve the sockeye enhancement goals of the system while reducing present egg collection targets and the corresponding reduction of the natural spawning population.

[1] After continued refinement of enhanced fry out plant techniques the average un-fed enhanced egg to smolt survivals has averaged 4.8% for BY's 2007-2009.

The project conducted in 2008 involved rearing 400,000 fry in Tatsamenie Lake in four net pens (Mercer and Gransden 2008). After 21 days of in-lake rearing, higher than expected mortalities were observed and samples were sent to the ADF&G pathology lab in Juneau for analysis. It was determined that IHNV was present in the samples. Over the following weeks an exponential increase in mortalities was observed in all rearing pens and as per prescribed TTC protocol all the fish were eventually destroyed and none released.

While it is known that IHNV is endemic to the Tatsamenie sockeye stock (PSC 1999) the contraction and rapid spread of the pathogen in the pen held fish was unforeseen. It is known that juvenile sockeye in high density rearing environments are more susceptible to the rapid horizontal transmission of IHNV. As all four pens eventually became infected, it is assumed the infection source was the lake water. In the free swimming lake environment with much lower fry densities the risk of horizontal transmission is significantly reduced (Plumb 1999).

In order to avoid exposure of the fry to the endemic IHN virus in Tatsamenie Lake during the early stages of the rearing, it was proposed for the following year, to rear the fish in on-shore tanks using IHNV free stream water. In 2009 the fry were reared in “Capilano” type troughs situated near the lake shore using a virus free water source piped into the troughs from a nearby stream (Mercer 2010). The 2009 project was a qualified success with the release of 115,000 sockeye pre-smolts into Tatsamenie Lake. Rearing mortalities in 2009 were negligible and it was estimated that approximately 106,000 0+ and 1+ smolts were produced. Concerns with the 2009 project centered on the high number of 0+ smolts (90 % of out planted fry) produced from the fry out plants. Despite 18 years of smolt sampling at Tatsamenie Lake age 0+ smolts had not previously been observed. There was concern regarding the viability of these fish and the smolt to adult survivorship of this age class. In addition, at this time there were concerns that the presence of a large 0+ freshwater age class would alter the life history of the stock.

The operational plan in 2010 was to continue with an expanded on-shore fry rearing project. The 2010 project would build on the experience and expertise gained during the sockeye fry rearing projects conducted in 2008 and 2009 and attempt to limit the production of 0+ smolts with later release dates. The 2010 fry rearing project was successful with the release of approximately 210,000 fry into Tatsamenie Lake (Mercer 2011). Of the fed fry released in 2010 only 5% of fry out-migrated as 0+ smolts. It was thought the reduced 0+ component was a result of later out-plant timing than occurred in 2009.

Since the fry rearing techniques used in 2010 were deemed a success the operation plan for the 2011 project was a repeat of the project of the previous year. Determination of the 2011 smolt population and composition would allow for the evaluation of the egg to smolt survival of the BY 2009 fed fry that over wintered in the lake.

Site Location

Tatsamenie Lake is located at the headwaters of the Taku River system within the upper Tatsatua Creek drainage in northwestern British Columbia (Figure 1). The lake lies on the eastern side of the coastal cordillera at 800 meters elevation within a transitional area between coastal and interior bio-geoclimatic zones. Tatsamenie Lake is within a remote area of British Columbia and is accessible only by air. It is approximately 160 km and 120 km respectively from Atlin, B.C. and Juneau, Alaska.

2. Methods

The methods employed for the 2011 fry rearing project were the same as those used in 2010 as detailed in a previous report (Mercer 2011). The same site, equipment, and water source used in 2010 was again used in 2011.

Due to a flood event precipitated by warm temperatures and high snow melt during the first week of June the plumbing and setup of the Capilano troughs was delayed by 3 days.

Impoundment Dam and Piping

In 2010 a small dam and water impoundment structure was constructed 50m upstream of the mouth of the creek. The dam was made from two logs (each one meter long and 25cm in diameter) stacked one on top of the other. Two openings were cut into the dam logs to allow insertion of two intake pipes (Figure 2). The top log was notched to allow for overflow to ensure a constant water level and flow rate into the intake. This structure was used again in 2011. In early June 2011 the intake structure was in-filled with debris and alluvium during a flood event (Figure 3). After the flows in the stream diminished on June 6 the intake was re-excavated, the debris was removed and in-take again made operational. The 2011 plumbing configuration was identical to that described in the 2010 report (Mercer 2011).

The plumbing of the system was finished on the 6^{th} of June and was capable of delivering approximately 500 litres per minute (L.P.M.) into each trough. Each trough was configured to hold 2.9 m^3 of useable water volume. Using the ball valves the flows were adjusted to 250 LPM into each trough. The fry ready troughs are illustrated in figure 4.

As fish food is a powerful bear attractant a 12-volt electric fence was positioned in a 5 m perimeter around the trough area. The fence stood 1.2 m tall and consisted of three wires evenly spaced 25cm vertically, a metal ground, a control box and a 12-volt deep cycle battery. The fence was electrified at all times, except when personnel were entering and exiting the perimeter.

Fry delivery

At 10:00 hours on the 7th of June a single engine Otter aircraft arrived from Snettisham hatchery carrying a load of approximately 99,300 sockeye fry. A second load of 99,200 fry was delivered at 14:00. Fry were divided into four equal groups into the troughs using volumetric displacement in hand carried buckets (Figure 5). Attempts were made to distribute fry evenly resulting in approximately 50,000 fish in each tank.

Feed/rate/schedule

The fry in the Cap troughs were hand fed every day beginning at 07:00hrs, at intervals of every 2 hours over a 12 hour period,. Quantities and size of feed were based on the standard Ewos™ feed chart, which factors in mean water temperature and fish size as its two primary determinants. Unlike typical hatchery conditions where water temperatures vary little, the creek fed troughs experienced wide daily fluctuations in water temperature. In order to standardize feed rates it was decided to feed at a rate of 2% body weight/day. Fry were fed a mixture of Ewos™ #0 and #1 crumble for the first 7 days. The fry were fed #1 for the period they remained in the troughs. After planting in pens in the lake the fry were fed a mixture of #1 and # 2 crumble.

Length and weight sampling

Sampling to determine feed rates, growth, biomass, densities and food conversion was conducted on a weekly basis commencing on June 14th. The fry were not sampled on June 7 as Snettisham Hatchery personnel reported a mean weight of 0.7gm on delivery. Bulk samples were taken using a portable "Ohaus" electronic scale, accurate to 0.1 gram, set up on the work platform at the trough site. A sample of the fry was removed to a bucket using a minimum of three separate scoops of a dip net. From this sample, a sub sample of 50 – 100 fry was netted, allowed to drip dry for 10 seconds and poured into a tared container of water to obtain a total weight. The fry were then counted back into the trough of origin. This procedure was repeated three times for each pen to obtain an average bulk weight. For length-weight samples, 20 fry were randomly selected from the initial sample and brought back to camp to be individually weighed on a Metzler electronic balance accurate to 0.01 grams. Individual fork length (tip of nose to fork in tail) was recorded to the nearest millimeter. In order to prevent contamination and/or cross contamination of the troughs, separate sampling equipment was used for each trough and all implements (nets, containers) were disinfected with 100 ppm iodine solution between each round of sampling.

Temperature and Dissolved Oxygen readings

Temperature and dissolved oxygen readings were taken twice each day around 07:00 and again at 19:00. An Oxy-guard ™ oxygen meter was used to obtain both readings, taken at a depth of 0.25M in the center of the trough. The oxygen meter malfunctioned on July 8th and dissolved oxygen values were not determined after that date. After the fish were transferred to in-lake holding pens temperature readings were obtained from the center of the pen at a 1 m depth.

Trough cleaning

The cap troughs were cleaned by gently sweeping accumulated debris, uneaten food and feces to the downstream end of the trough using short handled plastic brooms. The stand pipe on the downstream side of the screened trough outlet was removed to create a siphoning action to flush out the accumulated detritus at the end of the trough. Care was taken to minimize disturbance of the fry. Separate cleaning apparatus was used for each pen and disinfected in 100 ppm iodine solution after every use.

Fry transfer and net pen rearing

Two net pens measuring 5m x 5m x 5m deep, of 3/8-inch mesh were suspended in the lake from wood and aluminum frame structures constructed on site (Figure 6). The wood structures consisted of SM Styrofoam sandwiched between 2 x 8 lumber arranged to form a 5m square. Plywood gussets were placed in the corners to provide structural rigidity. Two pens were constructed using 2 x 6 lumber and two were of 2 x 8 lumber. Holes were drilled through the frames to allow for the insertion of two-inch diameter upright aluminum pipes (stanchions) 1 m in length. A 5m square frame of aluminum pipe was attached to all the stanchions at a height of 50 cm above the floating pen frame. A net pen was then suspended from the aluminum frame to hang approximately 4.2 m into the lake. Weights were attached to the outside corners of the net pens in order to maintain shape and volume.

Each pen was individually anchored at a site located 3 km from the cap trough rearing site (Figure 7). The two pens were anchored about 30 meters distant from each other. A lightweight 2-inch mesh cover net was suspended over the pen enclosures from the aluminum frame to prevent access by avian predators.

The fry were transferred from the cap troughs to the net pens using a 5m open skiff with a 220 liter holding tank. The fry were netted out of the troughs, placed in 20 liter pails and transferred to the tank in the boat. Approximately 5000 fry were transferred in each tank load. Supplementary oxygen was supplied to the water in the tank at a rate of approximately 2 liters/min. The water in the tank was changed with each load. Typically it would take 8 hours to transfer the fry from two cap troughs to the two net pens.

After the net pen rearing was completed the fry were released in mid-lake. This was accomplished by towing each pen offshore with a boat to the release site. In order to ensure the release was as stress free as possible the margin of the net pen was detached from the frame on two sides and the pen was allowed to settle into the water. The fry were allowed to passively swim out of the pen into the lake.

Smolt Sampling and Population Estimates

From 1998 through 2011 a sockeye smolt sampling and mark/recapture population estimate project has been conducted at Tatsamenie Lake under the aegis of a DFO Whitehorse contract. This was an ongoing annual project with the objective of providing data on the growth and survival of out-planted enhanced sockeye fry as well as stock assessment information on the total wild and enhanced smolt production in the system. The methodology and results of the project are detailed in annual reports (unpublished reports, DFO Whitehorse) and in the TTC annual reports (PSC TTC reports). Using stratified population estimates and representative smolt sampling it is possible to quantify the smolt production of each identifiable cohort based on age and origin (wild or enhanced). Using these methods it is possible to track the survivals and growth of the wild, reared, and directly out planted enhanced fry.

In 2011 the smolt sampling and mark recapture project was extended through to September 13 because the personnel were able to continue the project under the aegis of the DFO funded Tatsamenie adult weir and egg take project. This allowed for the tracking of fed fry after their release.

3. Results

Water temperatures

Water temperatures in the Cap troughs ranged from 4.0 to 10.0 Cº over the course of the project (Figure 8). As expected, higher ambient air temperatures increased the daily maximum temperatures as well as the diurnal temperature spread. Lake temperatures averaged approximately 4° higher than mean trough temperatures and did not display the typical diurnal fluctuation.

Growth and Food Conversion

Growth and food conversion rates are presented in Figure 9 and Appendix 1. The growth and conversion rates observed were within the range predicted in published fish culture indices (Fisheries and Oceans Canada) and the Ewos™ food manufacture charts.

During the period from June 07 through August 14 the mean weight of the fry reared in troughs 3 and 4 increased from an average of 0.70 gm to 4.0 gm, representing a mean increase of 3.3 gm over 68 days. The mean food conversion rate was 0.72 over this period. The growth rate within the in-lake rearing pens was higher than the troughs likely due to the higher lake temperatures.

Net pen rearing and fry releases

The first group of 99,000 fry were removed from troughs 1 and 2 and transferred to the 2 in-lake net pens on July 21 at a mean weight of 2.08 gm. This group was reared in the net pens for 10 days and released into the lake on July 31 at a mean weight of 2.63 gm. Total rearing mortality in the first group totaled 451 fish resulting in the release of 98,900 fry.

After removal of the fry from troughs 1 and 2 on July 21 the fry from troughs 3 and 4 were evenly distributed into the empty troughs. This resulted in a rearing density of approximately 25,000 fry per trough for the final 10 days of trough rearing for the second group of fry. These fry were transferred to two in-lake rearing pens on August 2 at a mean weight of 2.84 gm.

Smolt Sampling and Smolt Population Estimates

The 2011 smolt sampling results are presented in Appendix 3 and in Figures 10 and 11. There are 7 separate cohorts based on age classes and fry origin that were identified from the 2011 smolt sampling. The total smolt population estimate was 159,800[2] (S.E. 11,790). The calculated age structure of the population was 90,000 wild ages 0+, 1+ and 2+, 31,000 directly planted age 0+ and 1+, and 38,000 age 0+ and 1+ reared fry.

As occurred in 2009 and 2010, reared age 0+ fish were observed in the out-migrating smolt population within the first week after the first group was released into the lake (Figures 11 and 12). Unlike in 2009 when 90% of the released reared fry out-migrated as 0+ smolts within 3 weeks of their release (Mercer 2010), only 13% of the 2011 reared fish out-migrated as 0+ fish. This is comparable to 2010 when 5% out-migrated as 0+ smolts.

Wild and directly planted age 0+ smolts were also observed in 2011. These 0+ fish were first detected in the smolt samples on August 2, coincidently the same day the first marked smolts were observed and 2 days after the fry were out-planted in the lake. The age 0+ fish continued to out-migrate along with the other smolts for the remaining six weeks the smolt project was in operation. The 0+ out-migration appeared to peak approximately 4 days after each group was planted in the lake (Figure 12).

Smolt osmo-regulatory evaluation

The results of the smolt osmo-regulatory competence trials are presented in Table 1. As occurred in 2010 a sample of age 1+ wild and age 0+ reared smolts were placed in a salt solution of 15,000 ppm. The 1+ wild and age 0+ reared smolts in this solution survived for a period of 6 hours after which they were released. Beach seine caught sockeye fry with an average weight of approximately 1 gm survived less than one hour in the 15,000

[2] Pooled Petersen mark/recapture estimate generated by SPAS model.

ppm solution. While not conclusive, these results are the same as observed in 2010 and suggest that the age 0+ smolts may possess a osmo-regulatory capability similar to that of the age 1+ wild smolts.

4. DISCUSSION

The fry rearing component of the 2011 Tatsamenie project was conducted successfully. Rearing mortalities were minimal, fry growth rates were as expected, and the fry releases occurred on schedule

The 2011 smolt population estimate and sampling results provided the first evaluation of the smolt production from the combined age 0+ and over wintering age 1+ fed fry from BY 2009. The smolt production results indicate the combined age 0+ and 1+ egg to smolt survival of BY 2009 fed fry was only 10.1%. Although significantly greater than wild survivals this rate is only marginally higher[3] than the un-fed BY 2009 egg to smolt survival of 7.9% (Figure 13a). The BY 2009 fed fry survivals are less than expected and considerably lower than egg to smolt survivals (approximately 40%) experienced with other sockeye fed fry projects (Zadina and Haddix 1990; Piston et al., 2006) . The 2011 results suggest there was no perceivable survival/production benefit associated with the BY 2009 Tatsamenie fry rearing experiment. One year of observation is not a complete evaluation of the project but the BY 2009 results are not encouraging. Moreover, the results imply a higher attrition rate of the fed fry than either the wild or the directly planted fry over the same period. Past research at Tatsamenie Lake indicates a fall fry to spring smolt survival rate of approximately 70% (Riffe and Mercer 2006). This is similar to that observed in other systems (Piston et al., 2006; Unpublished data, Enhancement Sub-committee of the TTC). The BY 2009 fed fry were out planted in late July and mid-August at a mean weight of 2.8 gm. The expectation was that with a larger average size than the wild or un-fed fry and isolation from attrition associated with predation, the fed fry would have exhibited a significantly higher survival rate. Definitive evaluation of the project will require quantification of adult returns by origin and age class from BY 2009. The Enhancement Sub-committee of the TTC has recommended one more year of fry rearing to occur in 2012 with a possible change of fry release strategy. In addition, in-lake monitoring of the 2012 released fed-fry through hydro-acoustics, trawling, and beach seining may be conducted to obtain information which could help to explain the lower than expected survivals.

The combined egg to smolt survival of the age 0+ and age 1+ reared fish from the BY 2008 rearing project was 82% (Figure 13b). While it appears the BY 2008 on-shore fry rearing strategy conferred a significant increase in the egg to smolt survival of the enhanced fish, these high survivals were likely due to the short term in-lake residency. The smolt sampling data over the past three years suggest there may be a short out-migration window from late July through to mid-August when the wild and enhanced 0+ smolts out-migrate. The 0+ age class was not detected in the previous 18 years of smolt

[3] Due to the size of the standard error of the total 2011 smolt population estimate and the absence of measurable variance within temporal population strata the difference between the BY 2009 fed and un-fed egg to smolt survivals are statistically insignificant.

sampling because the sampling program always ended by June 30 when it was thought at least 90% of the population had out-migrated. It is possible the large proportion of fed 0+ smolt out-migrants observed in 2009 was due to the earlier (early-mid July) out-plant timing. The 2010 and 2011 fed fry releases were in the mid to latter period of the 0+ out-migration window (early – mid-August) which may be the reason approximately 95% and 90% respectively of the released fry from those years appear to have stayed in the lake.

The age 0+ freshwater age class has not been observed in sampled Tatsamenie Lake origin adults[4] (Kathleen Jensen ADF&G Juneau per. Comm.). However, with the extension of smolt sampling into July and August beginning in 2009 the evidence suggests 0+ wild fish are a natural component of the out-migrating smolt population. In 2011 age 0+ wild smolts comprised 12% of the total smolt population. It has been postulated that the absence of 0+ freshwater age classes in adult age data may be due either to misidentification of the age class (as a result of the high growth rates of the 0+ wild fry) or the 0+ smolts remain in the Taku system (downstream of Tatsamenie Lake) over the winter and begin their marine residency as typical age 1+ smolts.

It is not known if the smolt to adult survival of the BY 2008 0+ smolts will be comparable to that observed in the directly out-planted and wild fish. Tatsamenie sockeye wild and enhanced aggregate smolt to adult survival averages approximately 7% (Unpublished stock assessment data, DFO Whitehorse). Evaluation of the smolt to adult survival of the fed 0+ smolts will be made when the principal age class of returning adults from the BY 2008 reared fry (3 year ocean) occurs in 2012 for the age 0+ smolt and/or 2013 for age 1+smolts.

The age 1+ component of the wild smolt age structure has averaged approximately 85% of the population over the past 20 years (TTC Enhancement Sub-committee, unpublished data). Notwithstanding the issue of age 0+ smolt to adult survival, the early fed fry out planting in 2009 appeared to confer a significant egg to smolt survival (82%). However, in keeping with the policy of a "semi-natural" TBR sockeye enhancement program it is the opinion of some on the TTC that efforts should be made to maintain an enhanced fish population structure similar to that of the wild fish.

The mean weight of the 0+ wild smolts continues to be an inexplicable anomaly. The mean weight of 0+ wild smolt sampled in 2011 was 5.5 gm (n=47). This is 0.8 gm larger on average than the wild 1+ smolt (Figure 14) and is congruent with the large age 0+ wild smolts weights observed in 2009 and 2010. Further monitoring and research on the sockeye smolt age class structure at Tatsamenie Lake may shed some light on this enigma.

[4] 750 adult sockeye are sampled annually as part of an adult weir project at Tatsamenie Lake that has been ongoing since 1984. In addition, 400 adults from the egg take broodstock are sampled for scales and otoliths.

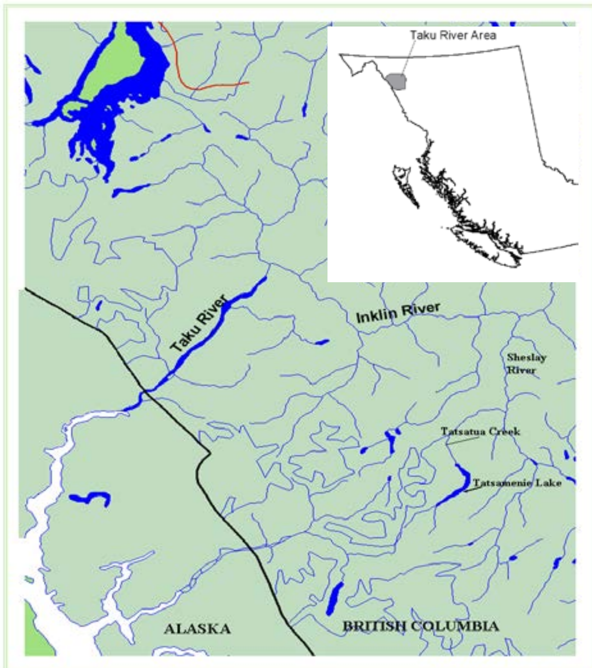

Figure 1. Location of Tatsamenie Lake within Taku River drainage.

Figure 2. Dam and water impoundment structure.

Figure 3. Dam and water impoundment structure after flood event.

Figure 4. Troughs ready to receive fry.

Figure 5. Transferring fish from transport aircraft to rearing troughs.

Figure 6. Assembled net pen.

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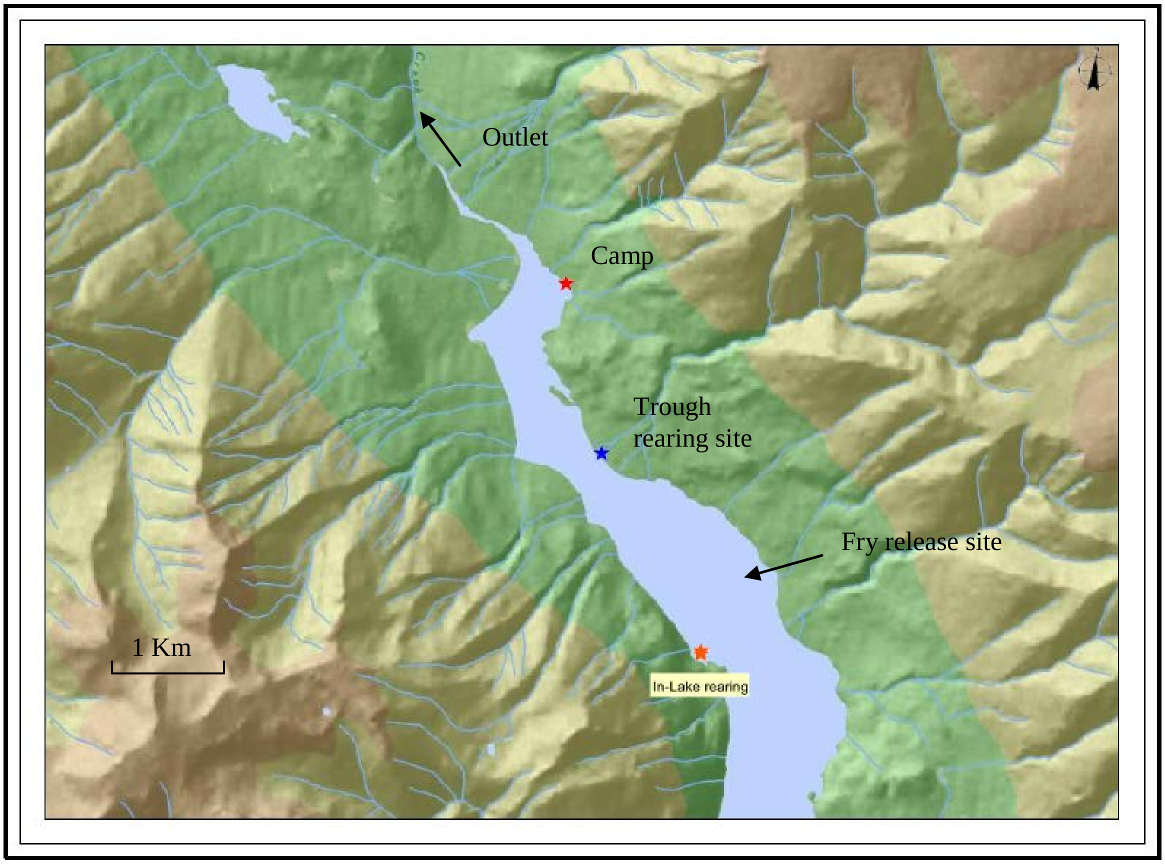

Figure 7. Location of trough and net pen rearing site at north end of Tatsamenie Lake.

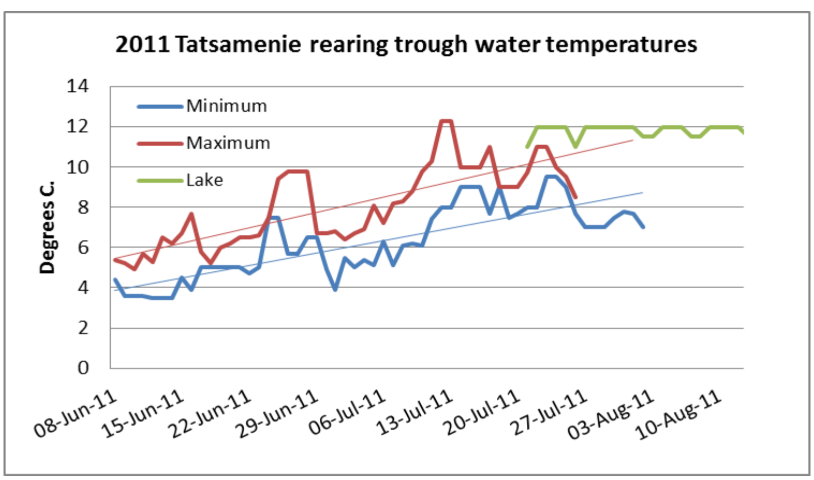

Figure 8. Diurnal temperatures (07:00 and 18:00) in trough #1 and in-lake temperature. at Tatsamenie Lake 2011.

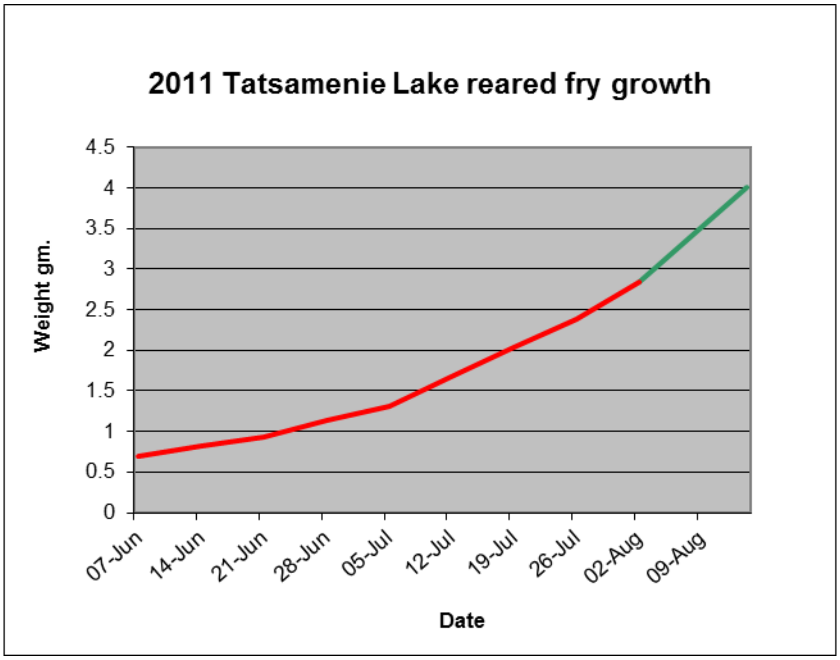

Figure 9. Growth of fry in troughs #3 and #4, Tatsamenie Lake 2011.
Note: Green line denotes growth in lake net pen.

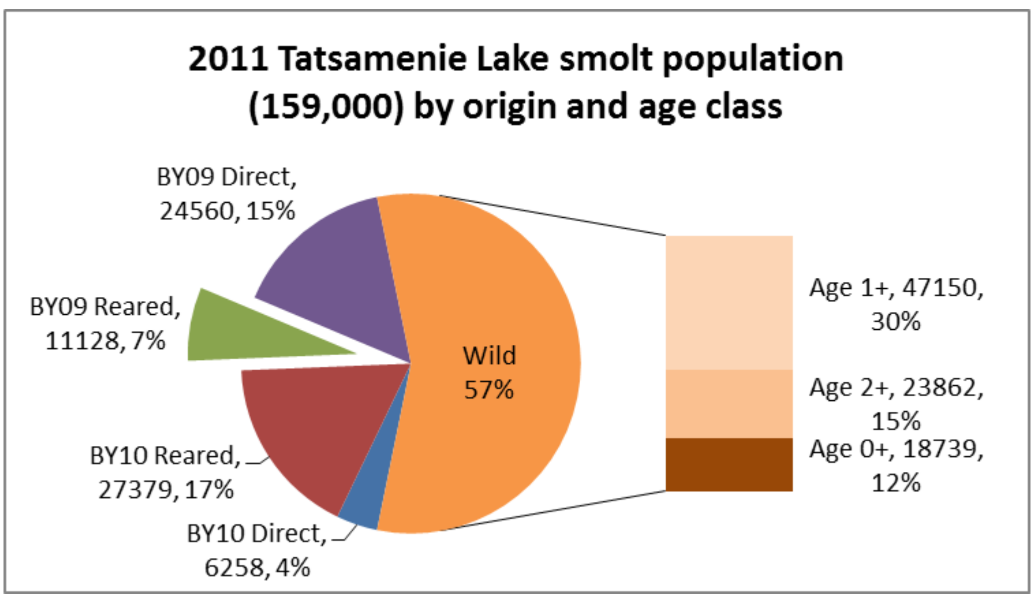

Figure 10. Population and age structure of sockeye smolts out-migrating from Tatsamenie Lake 2011.

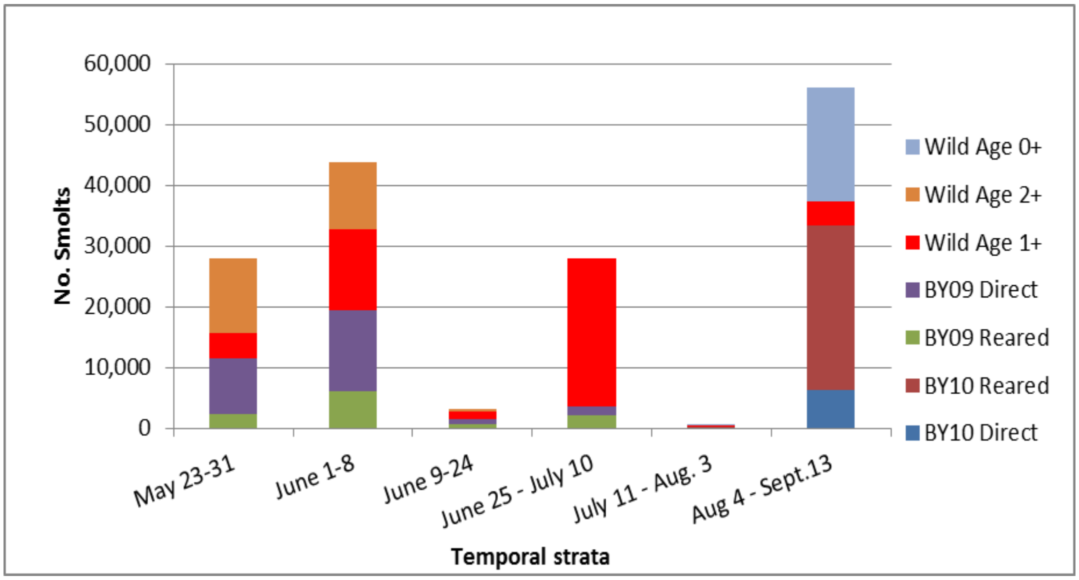

Figure 11. Population and age structure of sockeye smolts out-migrating from Tatsamenie Lake by temporal strata in 2011.

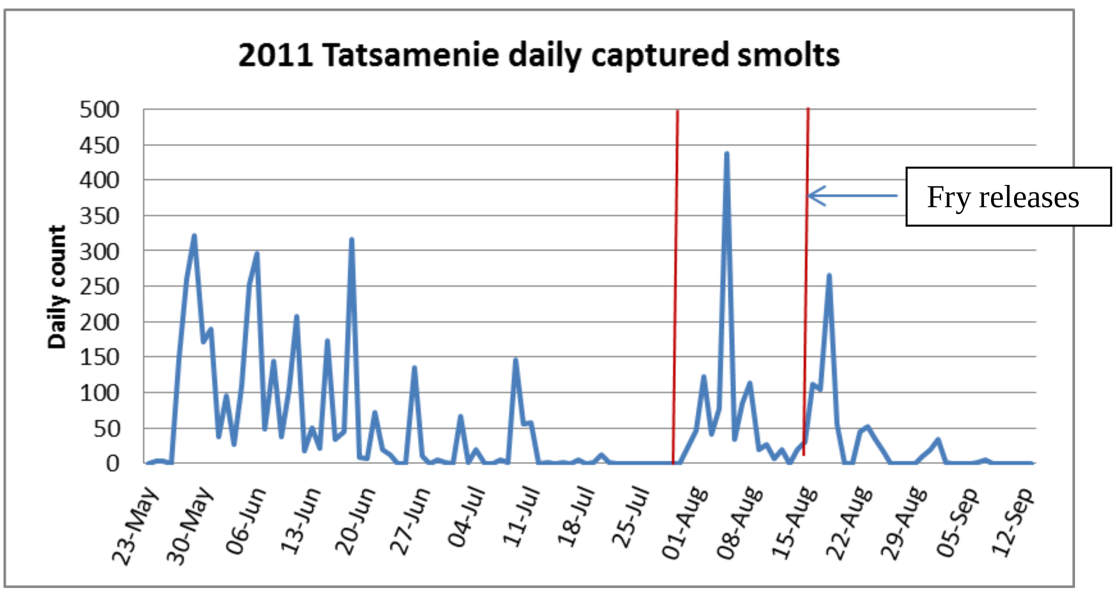

Figure 12. 2011 Tatsamenie Lake daily smolt capture.

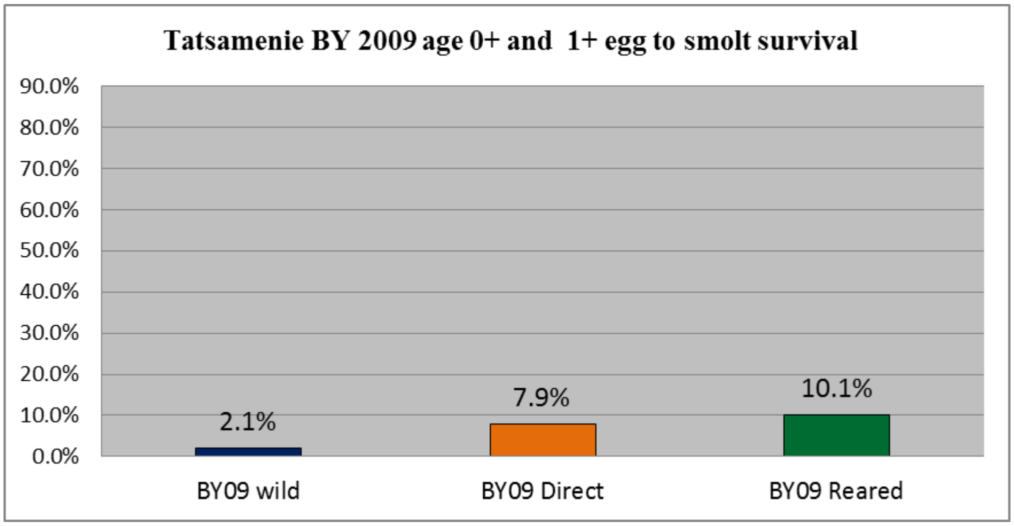

Figure 13(a). Tatsamenie Lake BY 2009 egg to smolt survival for age 1+ wild, age 1+ directly planted fry, and age 0+ and age 1+ reared fry.

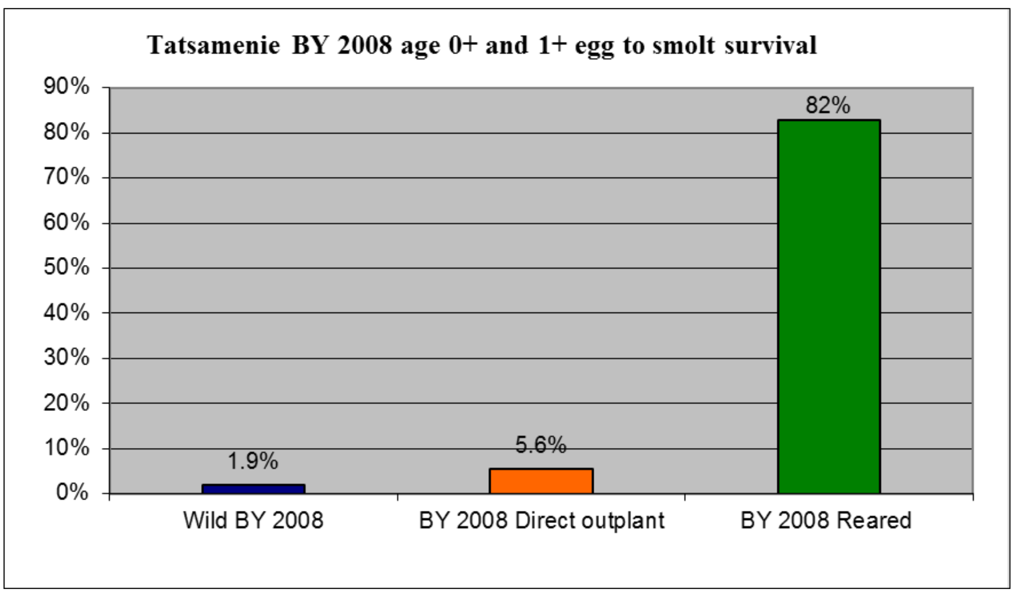

Figure 13(b). Tatsamenie Lake BY 2008 egg to smolt survival for age 1+ wild, age 1+ directly planted fry, and age 0+ and age 1+ reared fry.

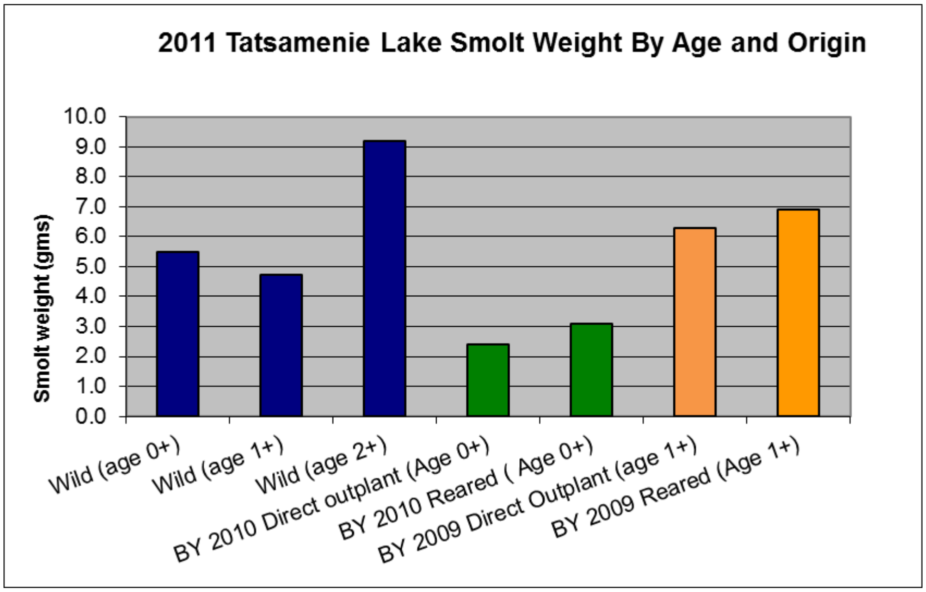

Figure 14. 2011 Tatsamenie Lake smolt weights by age class and origin.

Table 1. Results of Tatsamenie Lake 2011 smolt osmo-regulatory competence evaluation.

Treatment Group	n	Salt solution (PPM)	Soak time	Results
Age 1+Wild smolt	6	30,000	1 hour	Mortality in less than 60 minutes
Age 0+ reared	6	30,000	1 hour	Mortality in less than 60 minutes
Age 1+Wild smolt	6	15,000	6 hours	Alive after 6 hours
Age 0+ reared smolt	6	15,000	6 hours	Alive after 6 hours
Beach seine caught fry	6	15,000	6 hours	Mortality in 30 minutes

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Appendix 1(a). 2011 daily feeding rate, % BWD fed, and conversion for Troughs 1 and 2.

Date	# of Fish	Morts	Mean wt/fish (gm)	Biomass (kg)	Kg Fed	% BWD FED	Net Gain/fish (gm)	Conversion
07-Jun-11	100000	63	0.7	70.00	0.454	0.65		
08-Jun-11	99937	16	0.7	69.96	1.4	2.00		
09-Jun-11	99921	7	0.7	69.94	1.4	2.00		
10-Jun-11	99914	3	0.7	69.94	1.2	1.72		
11-Jun-11	99911	2	0.7	69.94	1.2	1.72		
12-Jun-11	99909	3	0.7	69.94	1.2	1.72		
13-Jun-11	99906	2	0.7	69.93	1.2	1.72		
14-Jun-11	99904	23	0.82	81.92	1.2	1.46	0.12	0.68
15-Jun-11	99881	0	0.82	81.90	1.4	1.71		
16-Jun-11	99881	0	0.82	81.90	1.5	1.83		
17-Jun-11	99881	4	0.82	81.90	1.4	1.71		
18-Jun-11	99877	1	0.82	81.90	1.4	1.71		
19-Jun-11	99876	0	0.82	81.90	1.4	1.71		
20-Jun-11	99876	2	0.82	81.90	1.6	1.95		
21-Jun-11	99874	24	0.93	92.88	1.6	1.72	0.11	0.9
22-Jun-11	99850	1	0.93	92.86	1.6	1.72		
23-Jun-11	99849	0	0.93	92.86	1.6	1.72		
24-Jun-11	99849	0	0.93	92.86	1.7	1.83		
25-Jun-11	99849	3	0.93	92.86	1.8	1.94		
26-Jun-11	99846	0	0.93	92.86	1.8	1.94		
27-Jun-11	99846	3	0.93	92.86	1.8	1.94		
28-Jun-11	99843	26	1.13	112.82	2.1	1.86	0.2	0.6
29-Jun-11	99817	0	1.13	112.79	2.2	1.95		
30-Jun-11	99817	1	1.13	112.79	2.2	1.95		
01-Jul-11	99816	0	1.13	112.79	2.2	1.95		
02-Jul-11	99816	0	1.13	112.79	2.2	1.95		
03-Jul-11	99816	1	1.13	112.79	2.2	1.95		
04-Jul-11	99815	1	1.13	112.79	2.2	1.95		
05-Jul-11	99814	29	1.24	123.77	2.5	2.02	0.11	1.1
06-Jul-11	99785	0	1.24	123.73	2.5	2.02		
07-Jul-11	99785	1	1.24	123.73	2.5	2.02		
08-Jul-11	99784	3	1.24	123.73	2.5	2.02		
09-Jul-11	99781	2	1.24	123.73	2.6	2.10		
10-Jul-11	99779	3	1.24	123.73	2.7	2.18		
11-Jul-11	99776	2	1.24	123.72	2.7	2.18		
12-Jul-11	99774	29	1.6	159.64	3.3	2.07	0.36	0.5
13-Jul-11	99745	5	1.6	159.59	3.3	2.07		
14-Jul-11	99740	2	1.6	159.58	3.3	2.07		
15-Jul-11	99738	8	1.6	159.58	3.3	2.07		
16-Jul-11	99730	11	1.6	159.57	3.5	2.19		
17-Jul-11	99719	16	1.6	159.55	3.5	2.19		
18-Jul-11	99703	13	1.6	159.52	3.8	2.38		
19-Jul-11	99690	46	2.08	207.36	4.2	2.03	0.48	0.5
20-Jul-11	99644	25	2.08	207.26	4.2	2.03		
21-Jul-11	99619	56	2.08	207.21	2.1	1.01		
22-Jul-11	99563	47	2.08	207.09	2.1	1.01		
23-Jul-11	99516	5	2.08	206.99	4.5	2.17		
24-Jul-11	99511	10	2.08	206.98	4.5	2.17		
25-Jul-11	99501	8	2.08	206.96	4.7	2.27		
26-Jul-11	99493	27	2.33	231.82	4.7	2.03	0.25	1.06
27-Jul-11	99466	1	2.33	231.76	4.7	2.03		
28-Jul-11	99465	2	2.33	231.75	4.7	2.03		
29-Jul-11	99463	1	2.33	231.75	4.9	2.11		
30-Jul-11	99462	2	2.33	231.75	5	2.16		
31-Jul-11	99460	44	2.63	261.58	0	0.00	0.3	0.8

Appendix 1(b). 2011 daily feeding rate, % BWD fed, and conversion rate for Trough 3 and 4.

Date	# of Fish	Morts	Mean wt/fish (gm)	Biomass (kg)	Kg Fed	% BWD FED	Net Gain/fish (gm)	Conversion
07-Jun-11	100000	65	0.7	70.00	0.2	0.29		
08-Jun-11	99935	18	0.7	69.95	1.4	2.00		
09-Jun-11	99917	10	0.7	69.94	1.4	2.00		
10-Jun-11	99907	3	0.7	69.93	1.2	1.72		
11-Jun-11	99904	2	0.7	69.93	1.2	1.72		
12-Jun-11	99902	4	0.7	69.93	1.2	1.72		
13-Jun-11	99898	147	0.7	69.93	1.2	1.72		
14-Jun-11	99751	111	0.82	81.80	1.2	1.47	0.12	0.66
15-Jun-11	99640	9	0.82	81.70	1.4	1.71		
16-Jun-11	99631	13	0.82	81.70	1.5	1.84		
17-Jun-11	99618	7	0.82	81.69	1.4	1.71		
18-Jun-11	99611	2	0.82	81.68	1.4	1.71		
19-Jun-11	99609	0	0.82	81.68	1.4	1.71		
20-Jun-11	99609	1	0.82	81.68	1.6	1.96		
21-Jun-11	99608	24	0.93	92.64	1.6	1.73	0.11	0.91
22-Jun-11	99584	3	0.93	92.61	1.6	1.73		
23-Jun-11	99581	2	0.93	92.61	1.6	1.73		
24-Jun-11	99579	1	0.93	92.61	1.7	1.84		
25-Jun-11	99578	0	0.93	92.61	1.8	1.94		
26-Jun-11	99578	3	0.93	92.61	1.8	1.94		
27-Jun-11	99575	1	0.93	92.60	1.8	1.94		
28-Jun-11	99574	25	1.13	112.52	2.1	1.87	0.2	0.6
29-Jun-11	99549	2	1.13	112.49	2.2	1.96		
30-Jun-11	99547	1	1.13	112.49	2.2	1.96		
01-Jul-11	99546	1	1.13	112.49	2.2	1.96		
02-Jul-11	99545	1	1.13	112.49	2.2	1.96		
03-Jul-11	99544	0	1.13	112.48	2.2	1.96		
04-Jul-11	99544	2	1.13	112.48	2.2	1.96		
05-Jul-11	99542	25	1.31	130.40	2.5	1.92	0.18	1.1
06-Jul-11	99517	1	1.31	130.37	2.5	1.92		
07-Jul-11	99516	0	1.31	130.37	2.5	1.92		
08-Jul-11	99516	0	1.31	130.37	2.5	1.92		
09-Jul-11	99516	0	1.31	130.37	2.6	1.99		
10-Jul-11	99516	1	1.31	130.37	2.7	2.07		
11-Jul-11	99515	1	1.31	130.36	2.7	2.07		
12-Jul-11	99514	26	1.67	166.19	3.3	1.99	0.36	0.5
13-Jul-11	99488	3	1.67	166.14	3.3	1.99		
14-Jul-11	99485	5	1.67	166.14	3.3	1.99		
15-Jul-11	99480	8	1.67	166.13	3.3	1.99		
16-Jul-11	99472	13	1.67	166.12	3.5	2.11		
17-Jul-11	99459	5	1.67	166.10	3.5	2.11		
18-Jul-11	99454	6	1.67	166.09	3.8	2.29		
19-Jul-11	99448	32	2.03	201.88	4.2	2.08	0.36	0.67
20-Jul-11	99416	18	2.03	201.81	4.2	2.08		
21-Jul-11	99398	3	2.03	201.78	4.2	2.08		
22-Jul-11	99395	5	2.03	201.77	4.2	2.08		
23-Jul-11	99390	16	2.03	201.76	4.5	2.23		
24-Jul-11	99374	18	2.03	201.73	4.5	2.23		
25-Jul-11	99356	15	2.03	201.69	4.7	2.33		
26-Jul-11	99341	34	2.38	236.43	4.7	1.99	0.35	0.88
27-Jul-11	99307	5	2.38	236.35	4.7	1.99		
28-Jul-11	99302	2	2.38	236.34	4.7	1.99		
29-Jul-11	99300	4	2.38	236.33	4.9	2.07		
30-Jul-11	99296	2	2.38	236.32	5	2.12		
31-Jul-11	99294	0	2.38	236.32	2.5	1.06		
01-Aug-11	99294	12	2.38	236.32	2.5	1.06		
02-Aug-11	99282	40	2.84	281.96	5.2	1.84	0.46	0.64
03-Aug-11	99242	0	2.84	281.85	5.8	2.06		
04-Aug-11	99242	6	2.84	281.85	5.8	2.06		
05-Aug-11	99236	0	2.84	281.83	5.8	2.06		
06-Aug-11	99236	5	2.84	281.83	6	2.13		
07-Aug-11	99231	0	2.84	281.82	6	2.13		
08-Aug-11	99231	4	2.84	281.82	6.1	2.16		
14-Aug-11	99227	28	4	396.91	6.8	1.71	0.56	0.73
10-Aug-11	99199	1	3.4	337.28	6.8	2.02		
11-Aug-11	99198	0	3.4	337.27	6.8	2.02		
12-Aug-11	99198	0	3.4	337.27	7.1	2.11		
13-Aug-11	99198	0	3.4	337.27	7.1	2.11		
14-Aug-11	99198	60	4	396.79	6.4	1.61	0.6	0.58

Appendix 2(a). Weight and length sampling data of trough and pen reared fry at Tatsamenie Lake in 2011.

Tatsamenie Lake Extended Rearing Sockeye Fry Individual Length Weight Sampling 2011								
Date	Trough 1		Trough 2		Trough 3		Trough 4	
	weight gms	length mm	weight gms	length mm	weight gms	length mm	weight gms	length mm
Jun-14	0.8	46	0.8	44	0.82	45	0.86	47
	0.72	44	0.91	43	0.81	44	0.8	46
	0.65	42	0.78	45	0.81	46	0.87	46
	0.65	41	0.76	46	0.8	44	0.76	45
	0.92	45	0.79	46	0.79	44	0.88	47
	0.81	44	0.97	48	0.84	47	0.98	48
	0.89	46	0.96	46	0.95	48	0.73	46
	0.79	45	0.94	47	0.7	44	0.61	43
	0.6	42	0.93	47	0.7	44	0.85	45
	0.78	44	1.02	48	0.92	46	0.87	47
	0.9	45			0.8	46		
					0.82	46		
Average	0.77	44.00	0.89	46.00	0.81	45.33	0.82	46.00
Jun-21	0.76	44	1.03	47	1.2	50	0.98	48
	1	48	0.93	46	0.94	46	0.88	46
	0.87	45	1.12	49	1.07	49	1	48
	0.58	41	0.73	44	1.06	47	0.95	48
	1.06	48	1.08	49	0.74	43	0.98	46
	0.89	45	1.09	48	0.8	45	0.95	46
	0.86	46	0.91	45	0.96	47	0.85	45
	1.32	52	1.09	49	0.77	45	1.16	51
	0.92	46	0.81	44	0.93	46	0.92	46
	1.07	48	0.7	44	0.78	45	0.84	46
	1.08	46	0.82	45	0.94	47	0.81	46
	0.8	45	0.98	47			0.87	46
Average	0.93	46	0.94	46	0.93	46	0.93	47
Jun-28	1.26	51	1.2	50	0.94	47	1.48	54
	1.08	47	1.35	52	0.96	48	1.27	51
	1.15	49	1.12	50	1.07	48	1.32	50
	1.36	52	1.27	50	1.4	52	1.02	48
	1.1	49	1.39	52	1.03	49	1.29	52
	0.95	46	1.6	55	0.97	49	1.15	49
	1.1	49	0.83	45	0.96	48	0.85	46
	1.13	49	1.32	50	1.09	48	1.14	49
	0.97	47	0.94	47	0.99	49	1.13	48
	1.21	50	1.25	51	1.23	50	1.01	
	0.87	47	1.16	50	1.3	52	0.76	46
	0.93	48	0.92	47	1.01	48	1.21	50

Tatsamenie Lake Extended Rearing Sockeye Fry Individual Length Weight Sampling 2011								
Date	Trough 1		Trough 2		Trough 3		Trough 4	
	weight gms	length mm	weight gms	length mm	weight gms	length mm	weight gms	length mm
Average	1.09	48.7	1.2	49.9	1.08	49	1.14	49.4
Jul-05	51	1.32	53	1.38	54	1.63	49	1.17
	47	1.12	50	1.25	52	1.44	49	1.05
	50	1.24	47	0.95	50	1.26	53	1.44
	53	1.48	48	1.12	51	1.3	54	1.63
	51	1.35	49	1.02	34	0.33	51	1.36
	48	1.08	52	1.35	54	1.59	48	1.08
	51	1.27	48	1.06	53	1.46	55	1.64
	52	1.3	51	1.31	53	1.38	51	1.35
	50	1.2	51	1.2	43	0.77	57	1.82
	46	0.92	49	1.1	50	1.11	51	1.24
	49	1.16	50	1.16	53	1.41	50	1.2
	50	1.25	51	1.23	50	1.22	49	1.2
			54	1.61	53	1.44		
			58	1.87				
Average	49.83	1.22	50.79	1.26	50.00	1.26	51.42	1.35
Jul-12	51	1.24	52	1.37	61	2.03	60	2.01
	52	1.32	57	1.82	56	1.68	55	1.62
	57	1.9	57	1.84	57	1.75	55	1.6
	56	1.68	60	2.22	56	1.51	50	1.22
	51	1.38	55	1.61	53	1.45	55	1.66
	54	1.37	53	1.48	46	0.96	56	1.73
	55	1.71	55	1.6	54	1.47	43	0.71
	52	1.42	56	1.66	61	2.27	55	1.49
	54	1.56	54	1.55	59	2.05	55	1.51
	53	1.3	55	1.61	58	1.9	53	1.38
	53	1.56	55	1.58	63	2.56	60	1.98
	51	1.22	62	2.26	59	1.98	55	1.59
Average	53.25	1.47	55.92	1.72	56.92	1.80	54.33	1.54
Jul-19	60	2	59	1.91	57	1.84	61	2.29
	58	1.81	61	2.18	58	1.92	64	2.44
	61	2.3	65	2.7	64	2.56	57	1.64
	62	2.48	59	1.99	61	2.03	60	1.99
	57	2.05	61	2.24	62	2.28	61	2.28
	63	2.36	59	2.05	61	2.16	59	2.15
	62	2.32	61	2.23	60	1.94	61	2.03
	56	1.86	55	1.49	54	1.5	60	2.01
	62	2.31	60	1.99	58	1.78	59	1.94

Tatsamenie Lake Extended Rearing Sockeye Fry Individual Length Weight Sampling 2011								
Date	Trough 1		Trough 2		Trough 3		Trough 4	
	weight gms	length mm	weight gms	length mm	weight gms	length mm	weight gms	length mm
	60	2.22	55	1.64	60	2.31	57	1.78
	59	2.1	58	1.97	60	1.95	60	2.16
	58	2	58	1.85	60	1.96	62	2.23
	58	1.77			54	1.53		
	59	2.18						
Average	59.64	2.13	59.25	2.02	59.15	1.98	60.08	2.08
Jul-26	60	2.3	63	2.38	64	2.55	55	1.72
	64	2.65	63	2.44	63	2.51	64	2.77
	64	2.82	65	2.85	62	2.38	63	2.47
	60	1.87	61	2.37	57	1.8	62	2.17
	63	2.51	60	1.96	62	2.47	59	1.93
	63	2.37	62	2.42	59	1.98	65	2.65
	60	2.13	60	2.18	61	2.33	65	2.43
	62	2.16	63	2.66	64	2.63	64	2.44
	64	2.4	65	2.64	61	2.4	62	2.41
	62	2.41	58	2.07	64	2.53	65	2.5
	58	1.96	58	1.89	65	2.91	60	2.13
	61	2.12	62	2.46	62	2.55	62	2.4
	60	2.04					61	2.38
Average	61.62	2.29	61.67	2.36	62.00	2.42	62.08	2.34
Jul-31	65	2.78	63	2.51	n /a	n/a	n/a	n/a
	65	2.51	57	1.9				
	67	2.88	69	2.9				
	67	3.09	65	2.81				
	63	2.35	66	2.92				
	62	2.18	71	3.19				
	68	2.81	63	2.52				
	65	2.56	62	2.44				
	67	2.98	68	3.05				
	64	2.45	60	2.31				
	61	2.08	63	2.56				
	61	2.3	65	2.51				
	60	2.3	62	2.43				
	64	2.48	70	3.14				
	65	2.62	61	2.26				
	68	3.02	65	2.55				
	66	2.67	67	2.8				

Tatsamenie Lake Extended Rearing Sockeye Fry Individual Length Weight Sampling 2011								
Date	Trough 1		Trough 2		Trough 3		Trough 4	
	weight gms	length mm	weight gms	length mm	weight gms	length mm	weight gms	length mm
	65	2.85	69	3.3				
	60	2.06	65	2.72				
	68	2.84	63	2.35				
Average	64.55	2.59	64.70	2.66				
Aug-02	n/a	n/a	n/a	n/a	65	2.59	67	3.09
					75	4.15	63	2.47
					65	2.8	66	2.76
					63	2.36	70	3.3
					65	2.89	68	3.09
					68	3.07	68	3.04
					66	2.88	62	2.13
					67	2.59	67	2.81
					70	3.25	66	2.58
					67	2.78	67	2.96
					67	3.03	66	2.66
					65	2.76	65	2.61
					64	2.45		
Average					66.69	2.89	66.25	2.79
Aug-09	n/a	n/a	n/a	n/a	66	3.03	63	2.65
					70	3.4	68	3.19
					75	4.32	69	3.35
					74	4.49	73	3.98
					70	3.73	70	3.38
					70	3.42	66	2.86
					71	3.8	70	3.36
					73	3.88	70	3.33
					69	3.38	65	2.93
					73	3.84	71	3.52
					66	2.77	66	3
					71	3.66	69	3.35
					65	2.89	75	4.02
					68	3.04		
					66	2.76		
Average					69.80	3.49	68.85	3.30
Aug-14	n/a	n/a	n/a	n/a	75	4.12	73	4.17
					77	4.99	67	3.13

Tatsamenie Lake Extended Rearing Sockeye Fry Individual Length Weight Sampling 2011								
Date	Trough 1		Trough 2		Trough 3		Trough 4	
	weight gms	length mm	weight gms	length mm	weight gms	length mm	weight gms	length mm
					77	4.85	71	3.63
					76	4.61	70	3.51
					75	4.66	70	3.54
					75	4.74	65	3.22
					72	3.75	66	3.04
					75	4.46	73	4.18
					74	4.27	71	4.09
					78	4.74	65	2.85
					75	4.41	71	3.73
					75	4.39	75	4.13
					73	3.94	68	3.21
					76	4.86	70	3.64
					74	4.67	71	3.47
					75	4.46	71	3.4
					75	4.46	73	3.83
					70	3.66	72	3.71
					72	3.77	72	4.01
					72	3.97	72	3.75
					75	4.63	68	3.39
Average					74.57	4.40	70.19	3.60

Appendix 2(b). Bulk weight (gms) sampling data of trough and pen reared fry at Tatsamenie Lake in 2011.

Tatsamenie Sockeye Fry rearing 2011 bulk Sampling					
Date	TR 1	TR 2	TR 3	TR 4	Mean
Jun-07	0.70	0.70	0.70	0.70	0.70
Jun-14	0.77	0.89	0.81	0.87	0.84
Jun-21	0.93	0.94	0.93	0.93	0.93
Jun-28	1.09	1.20	1.08	1.14	1.13
Jul-05	1.22	1.26	1.26	1.35	1.27
Jul-12	1.22	2.26	1.98	1.59	1.76
Jul-19	2.13	2.02	1.98	2.08	2.05
Jul-26	2.29	2.36	2.42	2.34	2.35
Jul-31	2.59	2.66			2.62
Aug. 2			2.89	2.79	2.84
Aug-09			3.49	3.30	3.40
Aug-14			4.40	3.60	4.00

Appendix 3. Tatsamenie Lake 2011 smolt sampling results and population estimates.

2011 Tatsamenie smolt mark/recapture results	
Total sampled	504
Total captured	5625
Total tagged	4858
Total examined	5618
No. Tags Recaptured	180
Total Smolt Population Estmate	**159,800 (Std. error 11,790)**
(Pooled Petersen Estimate)	

2011 Tatsamenie Lake smolt population estimate by thermal mark			
Otolith mark	Cohort	Population Estimate	Total population %
2,1,2H	BY10 Direct	6258	4%
2,2,3H	BY10 Reared	27379	17%
3n,2H	BY09 Reared	11128	7%
6,2H	BY09 Direct	24560	15%
Wild	Age 1+	47150	30%
Wild	Age 2+	23862	15%
Wild	Age 0+	18739	12%
Total		**159,076**	100%

2011 Tatsamenie smolt length and weight by cohort		
Cohort	**weight (gm)**	**Length (mm)**
Wild (age 0+)	5.8	83
Wild (age 1+)	4.9	83
Wild (age 2+)	9.2	108
BY 2010 Direct outplant (Age 0+)	2.5	64
BY 2010 Reared (Age 0+)	3.1	69
BY 2009 Direct Outplant (age 1+)	6.5	97
BY 2009 Reared (Age 1+)	7.0	99

Appendix 4. Tatsamenie Lake 2011 fry rearing statement of expenditures.

Name of Project:	Tatsamenie Lake extended fry rearing project - 2011						
							PSC
ELIGIBLE COSTS					**TOTAL**	**OTHER**	**N. FUND**
					PROJECT	**FUNDING**	**GRANT**
Labour					**BUDGET**		**AMOUNT**
Wages & Salaries							
Position	# of crew	# of work days	hrs per day	rate per hour	**Total (In-kind & cash + PSC Amount)**	**In-Kind & Cash**	**PSC Amount**
Project fish culturist/biologist	1	62	8	27.5	15,400	1,760	13,640
Field Technician	1	46	8	22.5	9,792	1,512	8,280
					-		
					-		
					-		
					-		
					-		
Person Days (# of crew x work days)		108		**sub total**	25,192	3,272	21,920
Labour - Employer Costs (percent of wages subtotal amount)							
	rate	20%		**sub total**	5,038	654	4,384
		# of work		rate per			
Subcontractors & Consultants	# of crew	days	hrs per day	hour			
Project facilitator/contract biologist	1	10.5	8	37.5	3,150		3,150
Insurance if applicable	rate	0%					
				sub total	3,000		3,150
		# of work					
Volunteer Labour	# of crew	days	hrs per day				
Skilled							
Un-skilled							
Insurance if applicable	rate	0%					
				sub total			
			Total Labour Costs		33,230	3,926	29,454

Appendix 4 continued.

Site / Project Costs	Provide details in the space below (use an additional page if needed)			
Travel (do not include to & from work)		6,235		6,235
Small Tools & Equipment		-		
Site Supplies & Materials		3,395	675	2,720
Equipment Rental		35		35
Work & Safety Gear		240		240
Fish Food		1,393		1,393
Permits		300		300
Technical Monitoring		-		
Other site costs	Freight for fish food	580		580
	Total Site / Project Costs	12,178	675	11,503

ELIGIBLE COSTS				BUDGET	OTHER FUNDING	CONTRIBUTION FUNDING
Training (e.g Swiftwater, bear aware, electrofishing, etc).				**Total (PSC + In-kind + cash)**	**In-Kind & Cash**	**PSC Amount**
Name of course	# of crew	# of days				
			Total Training Costs			

Overhead / Indirect Costs				
Office space; including utilities, etc.				
Insurance		400		400
Office supplies				
Telephone & long Distance	Satellite phone	500		500
Photocopies & printing		48		48
Indirect/overhead 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).				
Other overhead costs				
	Total Overhead Costs	948		948
		Total (PSC + In-kind + cash)	**In-Kind & Cash**	**PSC Amount**

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.				
Rearing tank				-
	Total Capital Costs	-		-
	Project Total Costs	46,356	4,601	**41,905**