

**Genetic Changes Associated with In-basin Supplementation of Sockeye
Salmon (NOAA Component). Year 3 and 4
Final Report for 2011, 2012**

August 19, 2014

**Period covered: June, 2011 to Dec 31st, 2013 and
June, 2012 to Mar 31st, 2014**

**PSC Funds Received
2011 18,000
2012 36,000**

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Abstract/Executive Summary

This project will evaluate the long term fitness of hatchery and wild sockeye salmon within a small watershed in Southeast Alaska. Concern has been expressed in the case of both the Pacific Salmon Commission (PSC) Transboundary River enhancement on the Taku and Stikine Rivers and the PSC Northern Boundary Treaty Area of Southern Southeast Alaska (Hugh Smith and MacDonald Lakes) Measuring the fitness effects and potential impact of such enhancement projects (e.g. the lake stocking of fry or smolt using local or native stocks) is desirable to avoid long term undesirable effects on wild stocks. We will set out to evaluate the fitness of wild and hatchery progeny over multiple generations to understand and measure these impacts. Initial genetic sampling in 2008, 2009, and 2010 shows potential for utilizing microsatellite and single nucleotide polymorphism (SNP) markers to assess the parentage of Auke Lake sockeye and identify the progeny of wild and enhanced fish, so that we can evaluate the survival and introgression, if any, of the enhanced fish into the wild population. Additionally, we have demonstrated the ability to sample very close to 100% of the adult sockeye entering the system and provided a low impact design for sampling, capturing, maturing and spawning small numbers for use as brood stocking this study. During the summer of 2011/12/13, we captured and held adult sockeye in the Auke Creek Research hatchery. We conducted experimental matings in both years and have incubated, cultured and released approximately 50,000 sockeye salmon into Auke Lake in the spring of 2012 and 2013. Complete sampling of upstream migrating adult sockeye has occurred from 2008 thru 2013.

Introduction

The project will support both the Stikine River Enhancement Plan (SEP) and Taku River Enhancement Plan (TEP), the two enhancement plans governing enhancement and harvest shares of sockeye salmon on two important Transboundary rivers. It will also benefit the understanding of impacts to Alaska lakes that provide important sockeye harvest in the Northern Boundary Treaty Area of Southern Southeast Alaska. By utilizing technology and enhancement strategies currently in use for sockeye enhancement in Alaska, the project will help address and manage long term concerns about the impact of such enhancement on native populations. The work may also directly benefit the sockeye population at Auke Lake which has been noted in the Juneau Watershed Plan as declining in the face of increased watercraft use and upland development. We have an opportunity through ongoing collaboration between UAF and NOAA to conduct this important research at the NOAA Auke Creek Station hatchery and fish counting weir. This station affords the best experimental control and evaluation possible in Alaska. This is due to the presence of a small research hatchery and the two way counting weir which allows the capture, and observation of both juvenile and adult salmon migrating out and into Auke Lake. Prior work has demonstrated methodology to accomplish sampling, maturing and spawning of sockeye salmon at the facility and genetic results from UAF have been favorable.

NOAA, UAF, and ADF&G will partner to undertake this long term project. Each organization brings significant resources to the project. NOAA will provide the operational framework for the sampling, enhancement and evaluation that takes place at the Auke Creek Research Station and expertise in enhancement technology, experimental design and evaluation of long term enhancement impacts. UAF will provide expertise in the proper sampling, storage and analysis of genetic samples, particularly DNA microsatellite also in the experimental design, statistical analysis of genetic data and the evaluation of long term impacts. The ADF&G will provide permit support, advice in experimental design and sampling as well as genetic analysis.

Objectives

All Project objectives have been met and accomplished successfully in a timely manner, the specific objectives are listed below;

1. Operate the adult capture weir at Auke Creek on/about June 25th thru October 31 in order to capture all sockeye salmon returning to the system. Based on prior year molt escapement and average marine survival we expect approximately 2,000 adults and a few dozen jacks.
2. Sample all adult sockeye (axillary process) for DNA microsatellite and SNP analysis.
3. Capture and hold according to a stratified sampling plan – up to 30 males and 30 females to be held at Auke Creek, matured, and spawned to provide first generation hatchery fry for Auke Lake enhancement.
4. Incubate and culture juvenile sockeye salmon. Project goal is a release of up to 50,000 lightly fed or unfed fry (max wt .5 g) into Auke Lake and its major inlet stream, Lake Creek.

Results

During the summer of 2011/12, we captured and held adult sockeye in the Auke Creek Research hatchery. We conducted experimental matings in both years and have incubated, cultured and released 50,000 sockeye salmon into Auke Lake in the spring of 2011, 12. Detailed summary follows;

Results - 2011 Project Activity

The Auke Creek weir was converted to upstream capture mode on June 29, 2011. The first adult sockeye salmon were observed and captured on June 30. Between June 30 and Sept 4 all individual sockeye salmon were sampled by excision of an axillary process as they passed the weir enroute to Auke Lake. A total of 2,427 adult sockeye salmon samples were collected (1010 male, 1299 female and 118 jack) – fewer than five mortalities occurred during the capture and sampling process and fewer than three adults escaped sampling. On July 7th, the project review committee members met and developed an operational plan to capture and hold sockeye for maturation, spawning, incubation and eventual release of fry into Auke in the spring of 2012. The fish were captured and transferred from the weir into holding tanks in the Auke Creek Research Station on July 25th. A total of 30 females and 15 males were captured and held. The tanks were filled with Auke lake water collected from a 2.3 meter deep intake in Auke Lake which delivers water to the research station. The tanks were covered to prevent escape and minimize light and disturbance to the maturing fish. On September 6, 2011 eggs were collected from 30 females and fertilized with milt from 11 males. Four males died just prior to Sept 6. Crosses were performed according to the breeding design set forward by the committee; each male was crossed with at least two and sometimes three females. Viable eggs were obtained from all females. One female was believed to be slightly overripe; the rest appeared to have good quality eggs. Standard ADF&G procedures were followed during the spawning process including external disinfection and iodophore egg hardening to mitigate infectious hematopoietic necrosis virus (IHN) issues. Tissue samples were collected from kidneys and ovarian fluid to screen for bacterial kidney disease (BKD) and IHN. Incubating embryos have reached the eyed egg stage and fertilization rates appear good. Eyed egg fertilization rates should be available by 11/11/11. Intake water is being taken from the deep lake intake in Auke Lake and is mechanically filtered and ultraviolet (UV) light treated prior to introduction to the incubator trays. The committee will meet soon to finalize plans for incubation and release of the fry to Auke Lake this spring.

Results – 2012 Project Activity

Incubation, Culture and Release of Sockeye Fry

Approximately 75,000 sockeye fry were incubated in vertical flow incubators at Auke Creek. Water flow and temperature were monitored 24/7 and influent water was filtered and treated with a new UV treatment system in order to minimize risk to IHN and other infectious agents. Fry were transferred to ponding units on at an average size of . They were fed at manufactures recommended levels for approximately 4 weeks. At that time the average size was .25 g and 50,000 fry were transported in 5 gallon buckets the short distance to Auke Lake. The fish were planted along the Auke Lake Margin in three locations. The experimental development committee arrived at the 50,000 fry release as optimal to accomplish project goals.

Adult Capture, Sampling , Maturation and Spawning

The Auke Creek Weir was converted to upstream capture mode on June 19, 2012. The first adult sockeye salmon were observed and captured on June 20. Between June 20 and August 28 all individual sockeye salmon were sampled by excision of an axillary process as they passed the weir enroute to Auke Lake. A total of 1,569 adult sockeye salmon samples were collected (611 male, 905 female and 53 jack) –fewer than five mortalities occurred during the capture and sampling process and fewer than three adults escaped sampling. The fish were captured and transferred from the weir into holding tanks in the Auke Creek Research Station on July 17th and 18th. A total of 30 females and 20 males were captured and held. The tanks were filled with Auke lake water collected from a 2.3 meter deep intake in Auke Lake which delivers water to the research station. The tanks were covered to prevent escape and minimize light and disturbance to the maturing fish. On September 6, 2011 eggs were collected from 23 females and fertilized with milt from 11 males. Pre spawning mortality claimed the other males and females prior to Sept 6. Crosses were performed according to the breeding design set forward by the committee; each male was crossed with at least two and sometimes three females. Viable eggs were obtained from all females. One female was believed to be slightly overripe; the rest appeared to have good quality eggs. Standard ADF&G procedures were followed during the spawning process including external disinfection and iodophore egg hardening to mitigate infectious hematopoietic necrosis virus (IHN) issues. Tissue samples were collected from kidneys and ovarian fluid to screen for bacterial kidney disease (BKD) and IHN. Incubating embryos have reached the eyed egg stage and fertilization rates appear good. Eyed egg fertilization rates were collected from individual crosses and averaged 95.99 %. Fish should hatch in mid to late December and are incubating on Auke Lake water which is being filtered and sterilized with UV treatment prior to introduction to the incubator trays. Currently we have two stacks with approximately 30k fry in each, providing a buffer against loss to IHN. We will incubate, then culture, the fish for a short time, with light feeding -- 2-4 weeks at the most, this should produce fry in the .25-.g size according to the project goals. We will release them into Auke Lake after the ice has left. Specific culture and release plans will be made with the full committee input. The committee will meet soon to finalize plans for incubation and release of the fry to Auke Lake this spring.

Monitoring and Evaluation

Monitoring and Evaluation of this project is ongoing and is principally accomplished thru the annual operations of the NOAA Auke Creek Weir and Research Station. The weir traps, enumerates, and allows sampling of all juvenile and adult salmon migrating to and from the Auke Lake Watershed. PSC funding is critical for this important data set to move forward , principally by the monitoring of sockeye juveniles and adults in this system, the periodic collection of basic biological parameter data as well as DNA pedigree information and scales is the means by which the long term goals of this project can be accomplished.

Discussion/ Conclusion

Good planning and good fortune resulted in all project objectives being accomplished during 2011 and 2012. We were successful in sampling virtually every adult migrant, capturing and holding adults for the hatchery component, incubating and culturing fry, and eventually stocking goal numbers of fry into Auke Lake. We had some logistical challenges with floods and unplanned sampling issues but all challenges were met and the project goals for these time periods are complete. This is the first of three years of full cycle sampling, spawning and stocking.

Benefits

Benefits include increased knowledge of the fitness of hatchery and wild sockeye salmon reared in the same watershed. This will assist fisheries enhancement scientists and managers within the state and federal agencies that would increase their knowledge base of the potential and direct impacts of enhanced sockeye salmon on wild populations within the same basin. Direct knowledge of the genetic structure of this population will add to the general knowledge of sockeye salmon genetic variation in Southeast Alaska. Ultimately the knowledge gained from this study will help to provide direction to expanding the contribution and lowering the risk of sockeye enhancement projects in the US and US/Canada Transboundary rivers such as the Taku and Stikine. This could allow for the increased commercial, sport and subsistence catch and direct economic benefit while protecting wild salmon stocks

Budget Narrative

Budget summaries are attached. Spending was accomplished along budget plans and did not deviate in allocation, with primary spending going to contracted services and supplies. In both years the hold back was not requested and in year 2012, a little over 5000 dollars was left unspent due to fiscal year carryover and some administrative issues.