**INTRODUCTION**

Preservation of natural resources within some natural range of variation is a core mandate of National Parks in Alaska and elsewhere. Both ANILCA and the NPS Management Policies of 2006 have language that requires parks to manage resources “...at levels they would occur absent human domination over the landscape” and in their ‘natural’ condition. While concern over ‘unnatural’ abundances of park resources often focus on rare or depleted resources (endangered wildlife, rare fish, soundscape, wilderness), it is equally important to manage overabundant resources, even if they are a natural component of park ecosystems.

Sitka National Historical Park currently faces a question regarding recent abundance of pink salmon in the Ḵaasda Héen or Indian River. The river is the predominant aquatic resource in the park and supports diverse biological and riparian communities typical of a small coastal river ecosystem. As such, is the duty of park managers to maintain “natural” levels of salmon abundance.

Evidence today suggests that populations of pink salmon returning to spawn in the Indian River have grown tremendously in the past forty years. In the 1980s, peak abundance estimates, conducted by the Alaska Department of Fish and Game (ADF&G) varied between several hundred and 20,000 fish. In the mid-1990s, however, peak spawner abundances regularly exceeded 100,000 and have regularly exceeded 400,000 pink salmon, three orders of magnitude higher than peak runs in the 1970s.

The question faced by park managers is to what extent the increase in abundance of pink salmon is unique to the Indian River (and therefore driven by some potentially “unnatural” cause). If the increase in abundance observed is reflected in other similar streams hosting pink salmon populations on Baranof Island and elsewhere in the region, then it can be argued that salmon populations are within their natural range of variation. If the Indian River’s populations of pink salmon are indeed regional outliers, the question then becomes what factors might contribute to this abundance, including natural geomorphic features such as length, area, and gradient, and the hatchery at the mouth of the river.

To address these questions, a team from the University of Washington visited Sitka in August of 2023 to interview interested parties and begin the process of gathering relevant information, perspectives, and data. The team consisted of Professor Thomas Quinn, Professor Mark Scheuerell, PhD student Brian McGreal, and they were joined by National Park Service Senior Science Advisor Scott Gende. Over the course of three days, the group met with representatives from Sitka National Historical Park, the Alaska Department of Fish and Game, the Sitka Tribe of Alaska, the Sitka Sound Science Center, and the Northern Southeast Regional Aquaculture Association, among others. Communications with these parties, specifically focused on questions of interest and data availability, are detailed in this report.

**COMMUNICATIONS**

Between the 21st and 23rd of August 2023 the team from the University of Washington conducted informational interviews with parties from various state and federal agencies as well as private non-profits associated with salmon monitoring and aquaculture in Sitka. In addition to these interviews, Thomas Quinn presented a public talk on the changing shape of salmon conservation efforts over the course of his 45-year career. These communications are detailed below.

**Alaska Department of Fish and Game (ADF&G)**

21 August, 2023

ADF&G fishery biologists discussed many facets of the department’s monitoring of salmon abundance, prespawn mortality rates, and hatchery stray rates in northern Southeast Alaska. Salmon abundance is most often recorded via aerial surveys, given the vast and largely road-less area. While aerial surveys are not a precise method of assessing salmon abundance, they are the only practicable means by which many remote streams in the region can be surveyed. Prespawn mortality rates cannot be surveyed aerially, as direct sampling is required to determine what proportion of female fish in a given stream have died before or after laying their eggs. As such, there is less data on this topic readily available, although some such monitoring does occur.

Otoliths take on distinctive markings when embryos or young fish are exposed to rapid temperature fluctuations or other stressors. In this way hatcheries can distinctly mark fish prior to release. These mass-marking programs allow fisheries scientists to collect many forms of data, including the proportions of naturally- and hatchery-produced adult salmon on spawning grounds and in hatcheries. Otoliths are collected in different places and for different purposes, and are processed by ADF&G and other entities, so obtaining and organizing relevant data will be an important component of this project. For example, ADF&G and other biologists have noted that the proportion of strays from hatcheries in a given stream may vary with proximity to the hatchery and other site-specific factors, and the sampling date within the spawning season. Commonly, greater numbers of hatchery fish are purported to be observed earlier in the season, though this pattern cannot be assumed.

**Sitka National Historical Park (SNHP)**

22 August, 2023

SNHP Superintendent Mary Miller and park staff discussed the National Park Service mandate to conserve the scenic, natural, and cultural resources within the park. Park management is specifically focused on maintaining healthy salmon habitat in the Indian River, due to its ecological importance and cultural significance as an historic fishing ground of the Sitka Tribe of Alaska. In particular, SNHP staff expressed interest in what effect, if any, straying hatchery fish released from the nearby Sheldon Jackson Hatchery are having on the proportion of wild fish in the river, as well as any impact on the reproductive fitness of both Pink and Chum salmon.

During the spawning season, the park collects data on salmon abundance, body size, prevalence of prespawn mortality, and salmon origin (wild or hatchery). Data is also available on habitat conditions in the Indian River, including (but not limited to) water temperature, turbidity, and levels of dissolved oxygen.

After meeting with Superintendent Miller and staff, park biologists led a hike up the length of the Indian River within SNHP boundaries (accounting for about a mile). Being a late August day with mild weather, stream flows were gentle and thousands of salmon, mostly pink and some chum, were present in the river’s lower reaches. Salmon carcasses provided ample evidence that this healthy abundance supported the subsistence of various wildlife (bears, eagles, ravens, seagulls).

**Northern Southeast Regional Aquaculture Association (NSRAA)**

22 August, 2023

Technicians provided an overview of NSRAA’s otolith laboratory, the only facility in Sitka where otoliths from salmon are processed. Observing otolith markings from salmon sampled at various sites allows NSRAA to assess the extent to which hatchery origin fish contribute to salmon abundance. NSRAA’s otolith laboratory is currently only involved in processing otoliths collected from NSRAA hatchery monitoring efforts. Otolith samples collected from other monitoring efforts are typically sent to be analyzed at ADFG’s otolith lab in Juneau, and coordinated with otolith marking conducted elsewhere.

**Sitka Sound Science Center**

22 August, 2023

Aquaculturists at the Sitka Sound Science Center led a tour of the Sheldon Jackson Hatchery (SJH), the center’s associated educational hatchery. Located on Crescent Bay, the SJH rears and releases on site 3 million pink salmon, 3 million chum salmon, and 250,000 coho salmon per year. As an educational hatchery, the SJH partners with local high schools and the University of Alaska to provide students with immersive training in aquaculture.

SJH technicians expose salmon embryos to a series of timed de-watering events to distinctly mark the otoliths of the fish. SJH aquaculturists described this method of dry marking as equally effective to traditional thermal marking and coming at a much lower cost because it does not require large amounts of water to be heated or cooled. After being marked, the SJH raises fry before releasing them into the bay. Upon the return of adult fish, the hatchery retains enough broodstock to guarantee the necessary number of eggs for next season. Any further returning spawners are harvested for cost recovery via contracts with local seafood companies.

SJH aquaculturists were particularly interested in this project as they share an academic and professional interest in the extent to which hatchery released fish are spawning in the Indian River. Additionally, aquaculturists are interested to determine what percentage of their cost recovery and broodstock may be wild born salmon.

**Thomas Quinn, University of Washington**

22 August, 2023

On the evening of 22 August, Tom Quinn of the University of Washington team gave a lecture detailing changes in salmon conservation over the course of his 45-year career. The talk provided a personal view of the changing research themes and social perspectives regarding salmon and trout that he has experienced over more than four decades of studying them. Topics such as logging, commercial and recreational fisheries, hydroelectric dams, hatcheries, invasive species, diseases, contaminants, aquaculture, marine mammals, and other threats, have changed in their real or perceived importance. The social setting and laws related to salmon and trout, and natural systems in general, have also changed greatly since the 1970s. Tom presented his perspective on some of these changes in order to spur conversations about present and future conservation efforts for salmon and trout, their ecosystems, and the people who care about them.

**Trout Unlimited**

22 August, 2023

Trout Unlimited (TU) offered to assist this project through the provision of salmon habitat data for many streams in northern Southeast Alaska. Trout Unlimited is a major national organization that seeks to conserve and restore freshwater habitat for salmon and trout throughout the United States, and so is engaged in extensive habitat monitoring efforts, outreach, and related activities. Thomas Quinn is a Life Member of TU and will follow up on this contact.

**Sitka Tribe of Alaska (STA)**

23 August, 2023

Members of the University of Washington team had the opportunity to meet with Chairman Lawrence Widmark of the Sitka Tribe of Alaska. Chairman Widmark shared his perspective on the historical and cultural importance of the Indian River and surrounding area. The team briefed Chairman Widmark on the goals of the project and asked for his insights and concerns. Both he and Superintendent Miller highlighted the importance of the long-term working relationship the Tribe and the Park have enjoyed, and that they expected our research to mutually benefit both parties.

The University of Washington team was also put in touch with STA biologists who are involved in ensuring robust subsistence salmon harvests. Although their work mostly concerns Sockeye salmon largely absent from the Indian River, STA biologists are also interested in other issues affecting the Tribe’s customary and traditional area, such as hatchery stray rates. The STA’s deep understanding of northern Southeast Alaska ecosystems will provide valuable support for this project.

**NEXT STEPS**

The meetings described in this report did much to lend form and dimension to the research questions regarding salmon abundance in the Indian River. All parties involved seemed eager to see what information could be gleaned from an in-depth and careful analysis of salmon abundance and stray rates in the Indian River.

Next steps on the part of the University of Washington team will include continued contact with the agencies described above in order to receive and parse available data. As is often the case when multiple data streams are involved in some analysis, careful integration will be necessary to develop an accurate and useful dataset. From that point analysis of the data available will proceed.

Looking further, there is the potential to develop, in cooperation with Sitka National Historical Park, a fine-grained data set of salmon abundance and otolith marks over the entirety of the Indian River spawning run in 2024. Such a project would ideally serve to reinforce results derived from analysis of the integrated dataset described in the above paragraph, as well as provide the park with highly detailed information on this keystone species.