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Michael Bangs

S.E. Subsistence Regional Advisory Council

**RE: Kanalku Sockeye Enhancement Opportunities**

Dear Mr. Bangs:

Thank you for the letter dated December 1, 2014. As you know I did not receive the letter until January 22, 2015 at the FSB meeting in Anchorage.

The first thing to understand about a sockeye lake is its carrying capacity or the balance of food abundance (zooplankton) with fry production. In the case of Kanalku Lake the scientific community does not know what the maximum or optimum number of sockeye fry the lake's zooplankton can sustain on an annual basis. Some sockeye lakes have an abundance of zooplankton but are limited by spawning area or the fry production from spawning adults; and therefore, a portion of the carrying capacity is underutilized. Alternatively, Kanalku might be limited by food resources compared to natural fry production, in which case putting more fry in the lake by any means would tax or even crash the system. A 1995 study of Kanalku Lake by Barto et.al. states the lake produces about 80,000 sockeye smolt which is below carrying capacity based on zooplankton sampling. However, the Koenings model, upon which these predictions are based, has been shown to inaccurately predict lake carrying capacities.

I provide this background simply to show that sockeye lakes are difficult to assess and hence a cautious approach should be exercised when considering enhancement. There are several enhancement options to consider but it is important to understand the goals and expectations. In light of your request for "ecologically sound and proven strategies" you might consider the following:

**Net pen rearing of sockeye fry in Kanalku Lake** – this would entail taking eggs from wild sockeye at Kanalku Lake during spawning. Eggs would be transported to Snettisham via plane, incubated in isolation, and flown back to Kanalku in the spring or early summer. Fry would be placed in net pens and reared until late fall or held through the winter and released in the spring during normal smolt emigration from the lake.

This sounds simple but has many complexities and risks. Sockeye carry a naturally occurring virus Infectious Hematopoietic Necrosis Virus (IHNV). The virus can manifest itself at any time but most often in incubation. In the hatchery setting the eggs are constantly monitored for the virus and if found the eggs are destroyed. If IHNV is found in rearing fish, a less likely occurance, the fry must also be destroyed.

This type of enhancement is expensive as it requires a crew to capture adults, spawn adults over a month period, feed and monitor fry, and actively release the fish to the system. The State of Alaska would likely require operating a smolt weir, conducting limnological studies, and operating an adult weir for the duration of the project. In essence there would need to be a staffed field camp on the lake from March/April through most of December.

**Fertilization of Kanalku Lake** – Lake Fertilization (nitrogen & phosphorus additions) boosts the primary producers (Chlorophyll a) that the zooplankters consume. This can be done via liquid application or pellets similar to Redoubt Lake sockeye fertilization program near Sitka. This is a more passive type of enhancement. In the Barto et.al. paper autumn smolt size is reported to be 2 to 3 grams, which is a relatively small smolt and similar in size to smolt in Chilkoot Lake, primarily an Age I producer. Contrast this with Chilkat Lake where smolt are 15 to 20 grams with much of the smolt production as Age II smolt. Generally systems with very small size Age I sockeye smolt are driven by limited prey and therefore the smolt evolve to an Age I emigration strategy, likely due more productive ocean resources yielding higher marine survivals.

Passive fertilization such as dissolvable pellets placed on beaches is a lower cost option and doesn't require a crew stationed at the lake. However, as mentioned earlier we don't truly know if nutrients are a limiting factor to Kanalku smolt growth and production.

**Steep pass ladder at barrier falls on Kanalku outlet stream** – The least invasive strategy to get more adults in the lake and greater fry production would be to construct a steep pass for sockeye. The steep pass could be designed to allow only sockeye escapement. I expect there are some coho getting into Kanalku Lake although the Anadromous Stream Catalog does not list coho above the barrier.

The contention with Kanalku sockeye has revolved around interception of sockeye. Implicit in this argument is that there are not enough sockeye for subsistence or insufficient sockeye entering the lake. In either scenario the ~50% that die at the base of the falls are a waste vis-à-vis subsistence use and/or lake spawner recruitment. It is well known that adult salmon deliver marine derived nitrogen to fresh water systems. Nitrogen is often the limiting productivity factor in oligotrophic lakes, so at a minimum getting most of the sockeye into Kanalku would be a benefit. Nowhere are marine derived nutrients in terms of quality and quantity more important than in sockeye lakes.

**Net pen rearing of coho fry in Kanalku** – If the primary goal is to produce high quality salmon with a proven strategy and high benefit to cost ratio, coho net pen rearing is the answer. Similar to the sockeye net pen rearing strategy described above, coho fry from a hatchery are reared in

net pens and released to the lake in December or held in pens through the winter for release during late May smoltification. If the Hidden Falls stock of coho could be used at Kanalku 200,000 one gram fry could be produced annually for net pen rearing at Kanalku. Coho do not carry IHNV and are easy to raise and highly cost effective. This number of smolt would likely result in 16,000 adults, 30% to 40% of which would be caught in troll fisheries and the remainder ending up in the Kanalku estuary and at the base of the falls. Because the program would be perpetuated from a hatchery all the fish could and should be harvested. Additionally, this strategy could be developed to a much larger program over time. For example, NSRAA's program at Deer Lake in lower Chatham employs this strategy and produces from 100,000 to 200,000 adults annually.

I would be happy to make a presentation at your next meeting if you would like to investigate enhancement options and have further discussion.

Sincerely,
Steve Reifenstuhl,

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