

# The Intake

WDFW Hatcheries Division

Photo: Ron Wong

## Hood Canal Steelhead Supplementation Project -Gary Marston, NRS3, HEAT Unit

The *Hood Canal Steelhead Supplementation Project* is a collaborative effort between NOAA Fisheries, WDFW, USFWS, the Skokomish Tribe, Long Live the Kings (LLTK) and the Hood Canal Salmon Enhancement Group. The program was developed to address sharp declines in natural-origin steelhead populations in the 1990s, which were particularly pronounced in the Hood Canal populations. Despite relatively intact freshwater habitat for many of the watersheds, the largest population, located in the Skokomish River, declined by approximately 71% from 1982-1989 to 1998-2005. Some populations such as the Hamma Hamma and Duckabush rivers had fallen to less than 10 fish prior to the start of the project. The purpose of the project was to evaluate experimental hatchery methods to improve the abundance of imperiled steelhead populations.

The project was designed as a “before and after” control experiment. Instead of traditional adult broodstock collection, fertilized eggs were collected via redd pumping. This method allowed natural mate selection to occur, and also ensured that some eggs from each redd remained in the gravel.

The fish were reared and released as either as age-1 or age-2 smolts, or held and released as four to six-year old adults directly on the spawning grounds. All the eggs for the project were incubated at **Quilcene NFH** and WDFW's **McKernan Hatchery**, and juveniles and adults were reared at McKernan, LLTK's **Lilliwaup Hatchery**, or the NOAA Fisheries' **Manchester Research Station**.

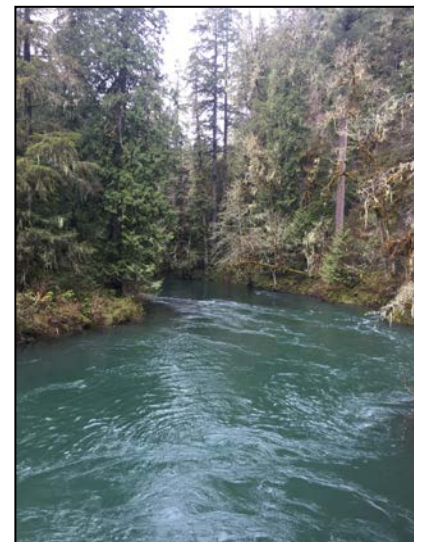
The first phase was pilot study on the Hamma Hamma River, which ran from 2002 to 2006. Next was an assessment on supplemented and non-supplemented control streams from 2006 to 2010.

The third phase of the project, which ran from 2011 to 2018, was to supplement three streams, the Duckabush, Dewatto, and South Fork Skokomish rivers, as well as to monitor non-supplemented streams in the Hood Canal watershed. The Project is currently in its final phase, which runs from 2019 to 2022, and includes post supplementation monitoring on all the streams.

Based on the results of the Hamma Hamma pilot study, in the generation after supplementation ended there was a 2.6-fold increase in redd abundance, while the control streams either remained the at the same levels or declined. Additionally, there was an increase in genetic diversity in the population. While there are still a couple of years of monitoring to go for the post-supplementation period on the other streams, the initial results also indicate an increase in redd abundance.



An adult return from the smolt release group.  
Photo courtesy of **Gary Marston**



Hamma Hamma River.  
Photo by **Gary Marston**

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## Fly Larvae as a Fishmeal Replacement -Laura Metcalf, Enterra Feed Corporation

Successful hatchery production requires a sustainable source of protein for their fish feed. Unfortunately, production of fishmeal can deplete ocean fish stocks and are subject to price fluctuations. Plant-based protein sources, such as soybean, requires significant agricultural inputs that could otherwise be used to grow food for people. Most fish diets include a wide variety of ingredients to meet nutritional needs. In the wild, insects are a natural source of digestible protein and fat for salmon and trout. So, can insects play a functional role in addition to a nutritional role in a hatchery system?



Photos of BSF adult and larvae from the Enterra website.

Insect-based feed ingredients can be produced using pre-consumer recycled food collected from farms, grocery stores and food producers; nutrient value that would be otherwise be lost or underutilized. Instead, the waste food is fed to black soldier fly (BST) larvae (*Hermetia illucens*), which grow rapidly under controlled conditions. Once mature, the larvae are processed into renewable feed ingredients, using dry mechanical extraction to produce protein and oil. Fat is pressed out of the larvae and processed into a meal approximately two-thirds meal and one third protein. The BSF larvae meal provides natural components that wild fish naturally consume during pre-migration: important nutrients, including calcium and iron, but also particular compounds that seem to be able to modulate animal microbiota and to optimize animal health.

**Chitin** is a polysaccharide found in the exoskeleton of insects. It has been attributed to both positive and negative response when insects are used in experimental diets. From a nutritional point of view, chitin has been viewed as a negative simply because fish can't use it as a source of protein or energy, and when flies are harvested too late, the chitin is high in nitrogen. However, chitin has been found to have some interesting effects on gut health, particularly the microbial communities along the length of the digestive tract: chitin can improve intestinal morphology resulting in a healthier epithelial lining, and appears to activate the immune system, either directly or indirectly through the gut microflora.

**Lauric acid (C12)** is a medium chain fatty acid found in various plant and animal fats and oils, including coconut and palm kernel oils, that is known to have antimicrobial activity, specially reducing gram+ bacteria. It is also associated with a reduction in excessive lipid deposition in the pyloric caeca, which leads to improved digestion, and with reduced liver fat.

With the purported benefits of insect-based feeds, it's "game on" to scale up this technology as an alternative feed ingredient for the aquaculture industry.

### North of Falcon 2020 Update -Mark Baltzell, NRS4, FM-Puget Sound

While COVID-19 has disrupted everyone's spring, and the North of Falcon process as well, WDFW continues to work on getting the 2020-21 salmon seasons in place. In accordance with Governor Inslee's social distancing orders, meetings are being held on the telephone or via Microsoft Teams, and through a number of other web-based platforms to get the job done.

**Chinook:** We have average forecasted returns for hatchery and natural-origin Chinook, and determined that the mid-Hood Canal and Stillaguamish natural Chinook stocks will be most constraining to recreational fisheries this year.

**Coho:** Low returns in 2019 are contributing to low forecasted returns in 2020. Forecasted hatchery and natural returns to the Columbia River are the second lowest in the last 20 years. Coastal stocks in Washington and Oregon are also well below average. Puget Sound coho returns are forecasted below average, but Snohomish natural coho are the constraining stock on fisheries this year. WDFW has already proposed closing the recreational fisheries in the river, except for a mark-selective fishery on the Wallace River, and limiting marine fisheries in Marine Areas 8-1, 8-2 and 9.

**Other species:** Overall, sockeye and chum salmon are also well below forecast for 2020 returns. 2020 saw some of the poorest returns for **chum** in the last 10 years, and the forecast also will likely limit a good deal of commercial fishing this year. Low returns of **sockeye** to Lake Washington and Baker Lake will also likely prohibit any directed fishing on those stocks this year.

**Ron Warren**, Director of Fish Policy, and Director **Kelly Susewind** have worked diligently to maintain communication with co-managers during this difficult time. Staff are hopeful that things can get settled on salmon seasons by the final day of the *Pacific Fishery Management Council* meeting on April 10.

## Staff Recognition-Above and Beyond: Winter Edition

**Colin Savage**, Fish Hatchery Technician at Ringold Springs, performed a wildlife rescue effort on an owl that was entangled in bird netting at the hatchery. Colin was prepared for this owl to fight back with all his safety equipment on, however the owl was very compliant with being freed from its predicament.

The owl was fine and flew away unharmed!

-Mike Erickson, FHS4 Ringold Springs



Winter weather in Washington was wet to say the least. No matter what weather you experienced this winter, we would like to say thank you to all the hatchery and regional staff that went above and beyond to keep facilities running and fish swimming. A special shout out was requested for all those that helped keep **Forks Creek Hatchery** up and running during the flood conditions in late-December. Thank you to everyone who worked through the night to ensure that the lights stayed on and the water kept flowing. So whether you helped place sandbags, keep a generator going, or run a pump to keep flood waters from overtaking buildings this very wet winter, many thanks!

### Staff Recipe: "Poke-chos" (Poke Nachos) -Jill Cady, Hatchery Evaluations Manager

The poke nachos were a bit hit at last year's Fish Program Holiday Potluck. Here is the recipe, by popular request.

#### Ingredients:

1 package wonton wrappers, cut into fourths (triangles)  
3 cups vegetable or canola oil for frying

1-1.5 lb sushi grade Ahi tuna, cut into small chunks  
2 large avocados, diced  
1/2 cup green onion, sliced 1/4 inch thick  
1-2 fresh jalapeño, sliced thin  
1 cup cilantro, diced  
2 tablespoons prepared wasabi paste  
1/2 cup mayo (Kewpie Japanese mayo is best)  
3/4 cup "Eel Sauce" (recipe included right)  
1 tablespoon sesame seeds, lightly toasted

#### Eel Sauce:

1/2 cup soy sauce  
1/2 cup sugar  
1/2 cup mirin

Heat all ingredients in a small saucepan over medium heat. Cook until liquid is reduced to about 3/4 cup.

#### Directions:

1. Heat oil in a saucepan or Dutch oven over medium heat. Test oil by dropping in one of the wonton wrappers: if the wrapper bubbles and floats to the top then the oil is ready. Deep fry wonton wrappers until light golden brown in batches, being careful not to overcrowd or burn. Drain chips on a paper towel-lined plate to absorb excess oil.
2. Combine mayo and wasabi paste, and stir until blended (consistency should be similar to honey). If too thick, add milk to thin out.
3. Assemble nachos:
  - a. On a large platter put down a 1/2 of the chips.
  - b. Spread out half of the tuna, onion, jalapeño, avocado and cilantro.
  - c. Drizzle 1/2 the wasabi mayo and eel sauce generously over the top (I use squeeze bottles).
  - d. Repeat second layer, then garnish with sesame seeds.



## Staff Migrations

With best regards, we wish the following employees success in their new positions:

**Dustin Sturgeon** - FHS3, McKernan Fish Hatchery

**Christopher Dean** - FHS3, Fallert Creek Hatchery

**Kirt Hughes** - Fish Management Division Manager

**Patrick Webster** - Bio2, Marking and Tagging

**Hailey Rosenthal** - Bio2, Marking and Tagging

## Interesting Reads

[Berejikian et al, 2018. Increased natural reproduction and genetic diversity one generation after cessation of a steelhead trout \(\*Oncorhynchus mykiss\*\) conservation hatchery program.](#)

[Fisher et al, 2020. Anderson Black soldier fly larvae meal as a protein source in low fish meal diets for Atlantic salmon \(\*Salmo Salar\*\).](#)

[Lock et al, 2016. Insect larvae meal as an alternative source of nutrients in the diet of Atlantic salmon \(\*Salmo salar\*\) postsmolt.](#)

[Rimoldi et al, 2019. The Effects of Dietary Insect Meal from \*Hermetia illucens\* Prepupae on Autochthonous Gut Microbiota of Rainbow Trout \(\*Oncorhynchus mykiss\*\).](#)

## Photo Contest!!

**Announcing this quarter's photo contest: "Show us your Smolts!"**

Share pictures of the awesome fish you are raising!



Photo by L. Kishimoto

Comments are always welcome and much appreciated. This newsletter is for you; to keep us connected, share information, and motivate us to new levels of scientific exchange and hatchery management. Be sure to share it with someone who isn't seeing it! Suggestions for future articles are always welcome...tell us what you want to read about! – Contact [Anja Huff](#)

