

FISH TALES

Volume 24, Issue 4 • Fall 2016

THE NEWSLETTER OF THE NOOKSACK SALMON ENHANCEMENT ASSOCIATION

A Huge Thank You! Capital Campaign Finish Line Crossed!

The Capital Campaign is complete (THANK YOU, SUPPORTERS!) and our facility is almost fully renovated. That means NSEA is more prepared than ever to accomplish our salmon recovery mission. The photos below were selected to give you a sense of how it has come together. Wow! Please come by NSEA's new home located at 3057 East Bakerview adjacent to the city limits of Bellingham, WA.



The Native Plant Restoration Garden, dedicated to former NSEA director Wendy Scherrer, was built at the new site to educate and inspire student groups, landowners and the general public. Inset: The entrance to NSEA's new digs at 3057 East Bakerview Road just outside Bellingham's city limits.



One of the final renovation projects is exterior painting. Mike McRory, NSEA Founding Board Member, volunteers his time to finish up the east wall of the Project Management office.



There's something about this pose from Elaine McRory that sums up the entire Capital Campaign journey. Here she is with the gate she designed and donated, just a few months before we reached the \$1.2M goal.

More photos on back page



Sid Nesbit, architect and dedicated volunteer, drills pilot holes for Adele's Potting Shed's beam installation.

 Nooksack Salmon Enhancement Association
3057 East Bakerview Road
Bellingham, WA 98226
www.n-sea.org

NONPROFIT ORG.
U.S. POSTAGE
PAID
LYNDEN, WA
PERMIT NO. 20

The Whatcom Conservation District, a Critical Community Partner!

By Rachel Vasak
Executive Director

Over the past 20 years, NSEA has partnered with the Whatcom Conservation District (WCD) on many programs and projects in and along Whatcom County waterways. The WCD's expertise in agricultural land management and

conservation has been a good match with NSEA's Salmon habitat education and restoration efforts. From leading outreach efforts in critical watersheds, to planting well over 1,000,000 native trees and shrubs in riparian buffers to leading efforts to fix fish passage barriers and instream

Please continue on [page 2](#)

Return Service Requested

FISH TALES

Fish Tales is the quarterly newsletter of the Nooksack Salmon Enhancement Association (NSEA).

Opinions expressed in *Fish Tales* are those of the authors and do not necessarily represent the official position of NSEA.

Original articles, unless specifically noted, may be reprinted without permission if appropriate credit is given to this publication. Please contact NSEA before reprinting any graphics.

NSEA welcomes articles, photos and artwork.

Please submit articles via email to ashulock@n-sea.org.

NSEA Contact Info:

Mail: 32594 East Bakerview Road Bellingham, WA 98226

Phone: (360) 715-0283

E-mail: ashulock@n-sea.org

On the Web: www.n-sea.org

NSEA Board of Directors:

Dave Beatty, *President*

Phelps McIlvaine, *Vice President*

Nicole Barrett, *Treasurer*

Analiese Burns, *Secretary*

Jeremy Brown, *RFEG Representative*

Dorie Belisle

Matthew Clark

Joe Dozal

Leif Embertson

Michael McRory

Shoshanna Paige

Tori Talkington

Erica Bleke (student)

NSEA Staff

Rachel Vasak, *Executive Director*

Darrell Gray, *Project Manager*

Kate Underwood, *Financial Manager*

Annitra Peck, *Program Director*

Kendra Krantz, *Program Assistant*

Adrian Shulock, *Development and Communications Manager*

Western Washington

University Work Study

Dana Eckert, *Bookkeeping Intern*

Alexa Jones, *Admin Assistant*

WSC AmeriCorps:

Joan Hong, Arianne Blatt, Khavan Tran Jessica Stanley

WCC Crew:

Crew Lead - James van der Voort; Josh Assink (Asst. Crew Supervisor), Joelle Blais, Lani Asman, Christopher Cabello, Hailey Reese

Fish Tales Production:

NSEA Staff, *Editors-in-Chief*

Theodore Parker-Renga, *Copy Editor*

Thom Barrie, *Layout*

Print date: October 2016



Letter from NSEA's Finance Manager

By Kate Underwood
Finance Manager

Sitting at NSEA's Schell Creek restoration site off Imhoff Rd. near Ferndale, WA, I am relaxing in the shade and watching birds flit about in the leaves. Twenty-two years ago there were few signs of the old stream bed; it was dry, overgrown with grass and there were no trees, and no fish. Instead, a ditch ran alongside the road, and when there were heavy rains the water spilled across the roadway. As a fledgling organization NSEA decided to restore this stream. It can now flow freely and has become a more vibrant ecosystem.

I first stumbled upon an NSEA work party in the fall of 1996 when my then five-year-old son and I were going for a walk. James was so excited to see people planting trees, something he was passionate about. I instilled in him, as I did with my two younger children, an ethic of stewardship from the time they took their first steps. Joining in NSEA's work parties was profound. It empowered us to make a measurable difference. We were able to plant trees that now cast shade on streams.

As NSEA's finance manager I support the work NSEA does every day. It's measurable, just like planting a tree. I enjoy the complexity of non-profit accounting. My job at NSEA is to take each receipt and enter it in a way that allows us to tell our story, each entry needs to show not only how much the purchase was, but also what type of item was purchased, what funding source was used, and the program or project it was used for. It's kind of like putting together a 3-dimensional puzzle, each piece on its own might not look like much, but put together correctly they



Holding hand-made card stock cubes that she used to teach NSEA staff about the three-dimensional nature of nonprofit accounting, Kate Underwood smiles big.

create a shape and a picture. I put together our financial puzzle pieces to show how much it cost to implement each program or project and how many different grant-

ors and donors came together to make it happen. We can then use that information to access what it would take to make an even bigger impact on salmon recovery.

The Whatcom Conservation District, a Critical Community Partner!

Continued from page 1

habitat conditions, to helping landowners implement best management practices for watershed health, the WCD accomplishes so much for local landowners and for salmon every year.

The WCD was established in 1946 and is one of 48 districts in Washington State. Conservation districts are all non-regulatory public entities that are governed by a local, five-member volunteer board of supervisors that are elected through local elections. George Boggs, the Executive Director, describes the WCD's purpose as "Our function is to make available, focus and coordinate technical, financial and educational resources, from whatever their source, so that they meet the needs of the local land manager in advancing the conservation of soil, water and related natural resources."

The WCD provides landowners with resources, management advice and technical assistance on natural resource issues ranging from nutrient management, riparian restoration, pollution control systems, pasture improvements, soil information and more. Programs offered vary by funding, but generally include: farm nutrient

management, agriculture preservation, the Conservation Reserve Enhancement Program (CREP) resource management, small farm assistance, GIS mapping, databases, community education and an annual plant sale. To best help landowners, all services are free, voluntary and confidential.

Whenever our project manager Darrell Gray meets with a new landowner to explore a restoration project, he is always asking two primary questions: what is best for the landowner, and what is best for the salmon in the creek? Often, as he learns more about the landowner's needs, he finds that the best fit is to refer them to one of the well-established programs at the WCD.

According to Darrell, "For many properties NSEA has been able to dovetail instream restoration with the WCD's Farm Service Agency's CREP program". This program not only covers the cost of all riparian planting and maintenance, but offers landowners lease payments for

land used for riparian restoration projects. Through the implementation of this successful program, the WCD has been responsible for the majority of riparian buffer plantings in Whatcom County.

In the past several years, Darrell has worked closely with WCD staff, particularly Frank Corey to remove Fish Passage barriers on agricultural lands through the NRCS Environmental Quality Incentive Program. Under their leadership, in 2015 NSEA and the WCD worked together to remove six barriers and currently have six more projects scheduled for 2017.

Currently the WCD is undergoing their comprehensive long-range program planning, which they do every five years. If you are interested in learning more, and contributing your perspective to this important work, please see their website for details: www.whatcomcd.org and search for long range program public comment!



Fall 2016 Community Saturday Work Party Schedule

Squalicum Creek - Parkway/Port site	October 15	9am to Noon	Port of Bellingham
Squalicum Creek - Make a Difference Day!	October 22	9am to Noon	City of Bellingham Parks, City of Bellingham Public Works
Terrell Creek - BP site	October 29	9am to Noon	BP Cherry Point, Chums of Terrell Creek
Whatcom Creek - Maritime Heritage Park	November 5	9am to Noon	City of Bellingham Parks
Landingstrip Creek - Maleng sitey	November 12	9am to Noon	Whatcom Land Trust
Squalicum Creek - Ross Rd. Site	November 19	9am to Noon	NSEA
Little Squalicum Creek/Park	December 3	9am to Noon	City of Bellingham Parks
Whiskey Creek - Portal Way Rd.	December 10	9am to Noon	City of Ferndale

For specific information, especially driving directions, please visit NSEA's website: www.n-sea.org/work-parties.

Salmon Science



Illness and Disease in Salmon

By Dave Beatty
NSEA Board President

Salmonids, similar to humans and other animals, are susceptible to a diversity of diseases and illnesses.

Illnesses include those caused by an unsuitable environment, inadequate nutrition or a genetic predisposition for illnesses. Additionally, there are the infectious or transmissible diseases caused by bacteria, viruses, fungi and parasites; the latter represented by helminths (flukes and tapeworms), myxozoa, protozoa and copepods.

The list of diseases affecting salmon is lengthy and newer technologies are identifying diseases across a wider geographical range and within a broader variety of species.

Salmon in natural (wild) conditions are exposed to diseases and may become sick and die. However, cultured fish (hatchery fish and farmed fish) are often more vulnerable to diseases than wild fish because they are usually in crowded surroundings, or the environmental conditions during culturing is quite different from their natural environment.

High Temperature

Stressful environmental conditions may exacerbate the effects of a disease in wild and cultured fish. As an example, certain bacterial, viral and parasitic diseases become more virulent with increasing water temperature because thermal stress on the fish lowers its resistance.

Moreover, higher temperature increases the rate of a pathogen's population growth and thereby increases the load of the pathogen within the host fish. Consequently, climate change and its affect on temperature will be an ongoing concern.

Certain conditions are necessary if a disease outbreak (the "perfect storm") occurs: 1) a large enough number of vulnerable fish, 2) enough of the virulent pathogen in infected fish, 3) spatial distribution of the fish supports transmission of the pathogen, and 4) the immune system of the fish to resist the disease is suppressed often due to environmental stressors, or the immune system is naive to the pathogen because previous exposure is lacking.

There is evidence that not all the individuals in a population of salmon are susceptible to an infectious disease. Salmon populations with a history of exposure to specific diseases tend to develop resistance to those diseases.

There can be generations of genetic selection resulting in disease-resistant individuals of a species. Whether genetically dependent (heritable) resilience to diseases in salmon will occur as temperature regimes change will be of ongoing interest and importance.

Open Water

The identification and extent of disease in a wild population of salmon in the open ocean are especially difficult to determine compared to when the species (either spawning adults or juveniles) is in

freshwater. Diseased fish in open water usually just die and disappear.

The identification of salmon diseases tends to receive greater attention for hatchery and farm fish where disease occurrence is often greater and sampling is easier because sick or dead fish are noticed. Dead or dying fish can be sent to a pathology lab for identification of the disease agent.

Prevention or control of a disease in hatchery fish is a major objective if disease transmission to wild fish is to be avoided when hatchery fish, after release, and wild fish come in contact.

Although farmed salmon in net pens, unless they escape or juvenile wild fish enter a net pen, do not come in direct contact with wild or hatchery produced fish, there is concern and an ongoing debate on whether farmed salmon with a disease are likely to infect open ocean fish.

Local Concern

There is accumulating evidence of significantly reduced survival of Pacific salmon and steelhead, especially of juveniles, in the Salish Sea since the early 1980s. The highest mortality likely occurs within the first few months in the ocean; however, there is non-harvest mortality throughout the period up to spawning for a number of reasons, including diseases.

In British Columbia (BC), the Pacific Salmon Foundation, Genome BC and Fisheries and Oceans Canada (DFO) have established the Strategic Salmon Health Initiative (SSHI). The initiative's goal is to determine the reasons for the high mortality in juvenile salmon during the early migration period in the ocean.

Many scientists believe infectious diseases are a major factor in the mortality. However, there is insufficient information from wild fish on the diseases that might be affecting juvenile salmon during their ocean migration. Almost all that is known is from studies of hatchery and aquaculture fish.



Furunculosis in salmon is shown with a large swollen area in the mid section.

The SSHI has the objective of discovering the pathogens that may be reducing the survival of BC's Pacific salmon. Additionally, the SSHI will attempt to determine whether the microbes in wild, hatchery and open net farmed salmon have a commonality, and whether there is the potential for microbe transfer between farmed salmon and migrating Pacific salmon as extensively proposed in an ongoing debate.

The SSHI is a four-phase program that includes: 1) taking tissue samples from wild, hatchery and aquaculture salmon in BC (has been completed), 2) the development of new technologies and molecular assays to identify pathogens and the exhaustive analyses on these samples and others taken in earlier research, 3) a focus on the identified microbes, especially those that have not been extensively researched previously but are considered as important disease causing agents, and laboratory studies to test the virulence and to understand disease processes in infected wild fish, and 4) reporting on the research and recommendations for future monitoring, likely by 2018.

Bacteria, Viruses

Bacteria are important pathogens for disease in wild and cultured Pacific salmon. Furunculosis, Bacterial Kidney Disease, Columnaris, Bacterial Cold Water Disease, Bacterial Gill Disease and Vibriosis are among the common diseases caused by bacteria.

In the Pacific Northwest, common viral pathogens infecting salmon are Infectious Hematopoietic Necrosis Virus (IHNV), Viral Hemorrhagic Septicemia Virus (VHSV) and Infectious Pancreatic Necrosis Virus (IPNV). Infectious Salmon Anaemia Virus (ISAV) has infected farmed Atlantic salmon in Norway and elsewhere in Europe, eastern Canada, Maine and Chile and can be quite lethal. It can transmit vertically (from eggs to offspring) or horizontally (from fish to fish).

There has been an ongoing controversy on whether ISAV occurs in farmed Atlantic salmon in BC. To date, there has been no verification of its presence in BC. Washington Department of Fish and Wildlife has an ISAV monitoring program and no sign of the virus or the disease has been found in wild, hatchery and farmed salmon in Washington.

During the SSHI study that began in 2013, a potential new disease, Heart and Skeletal Muscle Inflammation (HSMI), was found in samples of Atlantic salmon from one aquaculture facility in BC. HSMI was initially found in Atlantic salmon in Norway in 1999 and has become a widespread and economically important disease there and elsewhere.

It seems to be associated with a piscine reovirus that has been common in farmed and wild salmonids in BC since the 1980s, but the exact relationship to HSMI is not clear. As of May 2016, HSMI has not been found in wild Pacific salmon. It is a disease with no risk for human health. In general, fish diseases are not transmissible (not zoonotic) to humans.

Treating Infections

In salmon culture, especially in farmed salmon, antibiotics, either in medicated feed or medicated baths, are used to treat bacterial infections or are given to prevent bacterial diseases. Both types of delivery may pass the antibiotic into the environment where it may adversely affect other organisms or result in the development of antibiotic resistance in bacteria.

Vaccine inoculations are used to counteract bacteria and viruses in farmed salmon. Vaccines have tended to be more effective against bacteria than for viruses and are very important when antibiotic resistance has developed in a bacterial pathogen. Norway has a program to vaccinate all farmed salmon and this has reduced the use of antibiotics.

Please continue on page 8

DESIRE FISH COMPANY
Harvesting, Processing and Selling Wild Alaskan Salmon
Purchase Dockside, F/V Desire
Weekends, Squalicum Harbor
10 - 5, All Winter
King - Sockeye - Cobo - Chum - Pink
Whole + Fillets + Smoked + Lox
www.desirefish.com Sustainable • Nutritious (360) 676-0605

ROFMANN BUILDERS
Rofkar & Heitmann Company
Rofmann, Inc.
P.O. Box 5792, Bellingham, WA 98227
(360) 961-8963
www.rofmann.com
Additions Remodel
ROFMAI*018C3

Building Community One Book at a Time
VILLAGE BOOKS.com for more
1200 11th St. in historic Fairhaven • 671-2626

BELLEWOOD ACRES
FARM, BISTRO, BAKERY & DISTILLERY
CELEBRATE ALL THE SEASONS AT THE FARM!
6140 Guide Meridian (10 minutes North of Bellingham)
Open Tues. through Sun., 9:00 a.m. - 5:00 p.m.
www.bellewoodacres.com

Education and Stewardship

Stately Visit to the North Fork Nooksack River

By Connor Adams
Nooksack River Steward

On Aug. 10, Congresswoman Suzan DelBene of Washington's 1st District paid a visit to the North Fork Nooksack River.

The congresswoman represents parts of King, Snohomish, Skagit and Whatcom counties. The purpose of her visit was to explore and familiarize herself with the North Fork Nooksack River. The Nooksack River watershed is home to salmon, eagles, black bear, cougar, elk and many other species that rely on wild places to survive.

The daytrip was led and organized by Wendy McDermott of American Rivers, a group that works to protect wild, free-flowing rivers. The tour included a stop at the Horseshoe Bend trail to meet with NSEA River Stewards Danika Kraft and Connor Adams.

Salmon and S'mores

The Nooksack River Stewards program is a collaboration between the U.S. Forest Service and NSEA. The program provides salmon-focused education to recreational users of the Nooksack River. The River Stewards perform many tasks over the summer season, including removing trash and invasive plants and monitoring.

In addition, the River Stewards host an outreach booth every weekend during the summer at the Glacier Public Service Station, providing information on salmon,



Gesturing to the Nooksack River behind him, Connor Adams (center) stands with his River Steward teammate Danika Kraft (right) and Suzan DelBene, congresswoman of WA's 1st District.

the importance of native plants and good stewardship practices. Beyond the booth, they present at local libraries, campfires (with s'mores!), poetry readings and trivia nights and lead interpretive walks along the Horseshoe Bend trail every Saturday during the summer.

The guided walks are for people of all ages. There is something to learn for everyone. Discussions on the salmon life cycle and habitat requirements, as well as scientific surveys, are staples of the river walks. Water quality tests are done for turbidity, dissolved oxygen levels, pH and

temperature and sampling is done to find aquatic insects.

The North Fork Nooksack River originates from the Nooksack Cirque just north of Mount Shuksan. Glacial inputs into the north and middle forks provide cold water year-round, which salmon depend on for survival. Combined with the relatively untouched nature surrounding the river, fantastic habitat is created for migrating salmon. The cold, clean and clear water is the basis for the "three Cs," crucial to the success of salmon survival. This makes the North Fork a perfect place to visit to

see what type of ecosystem salmon need to persist.

Walk in the Woods

River Stewards Danika and Connor led Congresswoman DelBene and her group on a river walk along the Horseshoe Bend trail. As the group made its way along the river, everyone paused to talk amongst the trees about the native plants surrounding them and their critical role in helping to provide habitat for salmon.

The National Wild and Scenic Rivers System was created by Congress in 1968 to protect and preserve rivers with outstanding natural, cultural and recreational values in a free-flowing condition for the enjoyment of present and future generations. Currently, less than one half of one percent of American rivers have this protection.

In 2015, Congresswoman DelBene helped pass legislation that designated Illabot Creek, a 14-mile stretch of the Skagit River system, a Wild and Scenic River. Perhaps in the future the wild areas of the Nooksack River like the North Fork will also be protected; time will tell.

In the meantime, every summer River Stewards like Danika and Connor in their bright red NSEA mermaid shirts will be educating groups about Pacific salmon, removing garbage or hosting a raucous salmon poetry night at a restaurant in Glacier.

A Fishing Epiphany on the Upper Skagit



TQ fly-fishing the upper Skagit.

By Annitra Peck
Program Director

We set out our boats at dusk, just after 9 p.m. We had finished our dinner, feasting on salmon burgers and random Costco treats. Some had been casting off the docks, others reading, chatting in small groups and napping.

Once it was announced, "Come. We Fish!" we all scrambled to grab our rods and gear. It was raining and cold for July, but we were there – in the moment. There was no turning back now.

Three of us shared a boat. The beginning of the night sky framed the mountains surrounding us – big mountains in every direction. We passed through the international border by water.

Professor Leo Bodensteiner rowed our boat across the northern end of Ross Lake and into the Canadian waters of the upper Skagit River, where the river was allowed, once again, to be wild and untamed. We rowed past great blue herons, in their

prehistoric pose along the river's edge. The fog rolled through the river valley like a message.

We watched and waited in silence, looking for fish to surface, waiting like the herons on the shoreline: one, two, then more. We saw dozens of circles on the water's surface grow and then disappear. It was on. The fish were everywhere. The water was so clear that you could see large, amazing, gracious bull trout resting in quiet pools, free and magnificent.

We quickly tied on our green drakes, elk hair caddis and wooly buggers, each with our own interpretation of how to lure these fish from their resting spots. Our fly lines moved through the air, floating, unrolling, seemingly weightless. This is poetry. This is romance.

Catch and release were the rules. I looked over and saw the appreciation glowing off each of us – how lucky we were to be in this magical place.

Back at camp, we fought to tell our

stories: the ones that got away, the fly that made the best "recipe." Jazzed and drenched, we warmed ourselves by the fire, feeling alive, feeling connected to this place, each feeling the spirit of Liam Wood.

Life Changing

See, the thing about fishing is something I didn't understand until recently. I grew up fishing with my dad, my Mickey Mouse pole in tote with my sister, catching little trout up the Hood River. We would proudly stand holding these beautiful fish hanging from a chain.

I am surrounded by anglers at work, an obvious support group for NSEA's work to restore fish habitat, so we essentially have more fish. I get that it's fun to catch fish, that some depend on this catch to support their families and livelihoods.

And I understand that fish are incredible creatures. Some adapt to the ocean and swim thousands of miles to spawn in the very stream in which they were hatched.

I appreciate that fish feed the forests and other animals through the nutrient cycle. But what I didn't get was the connection, the true rapture of this art, how fishing changes and shapes people. There are infinite, often subtle lessons revealed along the way: how to cultivate a respect for fish, how to sustain fish and the natural world.

Liam's Legacy

My experience on the upper Skagit River was through the Liam Wood Flyfishers and River Guardians School, an education program with classes through Western Washington University, including the Art, Science and Ethics of Flyfishing, named after the late Liam Wood.

Liam was a boy killed while fly-fishing



Elkhair Caddisfly

along the banks of Whatcom Creek when a pipeline exploded in Bellingham in 1999. See, Liam learned to study the habitat and behaviors of these fish, to savor the moment when you set your hook and feel the pull, when you see their shiny scales, markings and colors up close, when you feel their body, their weight. Liam was just like us out there on the upper Skagit. We were learning from him. He knew.

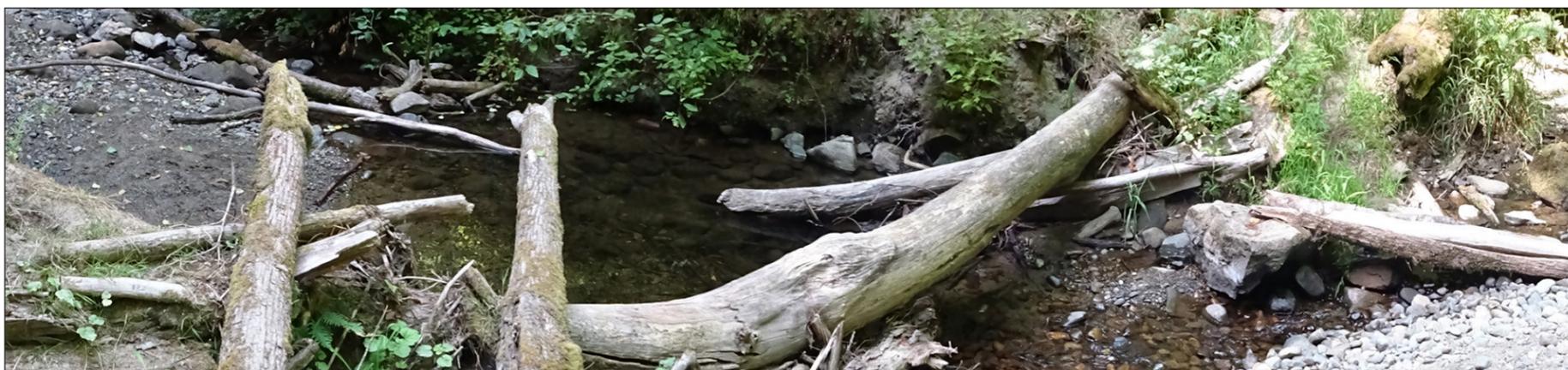
Fly-fishing is different than any fishing I have ever experienced. It requires intimacy with a place. It requires reading the river, finding out where fish live in the river and why, sometimes hours spent watching insects hatch, aiding in what fly to use.

It requires a connection. For me, it required connecting with the story of Liam Wood and the fortune of working for NSEA and taking a fly-fishing course through WWU.

Fishing is more than your trophy at the end of the day. The art of fly-casting is inherently a spiritual practice. There is a sense of satisfaction and wellbeing that comes from standing in a stream or in a boat at the water's level, rhythmically casting a fly line back and forth.

Liam Wood knew this. And now I do, too. If you can't find me at NSEA, I am probably out fly-fishing.

Volunteer and Stewardship



Quality habitat at Chuckanut Creek which flows into Bellingham Bay.

Investigating the Coho Life Strategy

By Rob Rich

Former NSEA Student Board Member

It's hard to forget the migration of salmon last fall.

For those who enjoyed NSEA's salmon viewing tours on Padden and Chuckanut creeks, do not fear – the fish and the tours will return! But in these sultry days of late summer as I write this, even as the blackberries rot, salmon can be seen in the creeks of Whatcom County.

I don't mean the ones you might like to catch on a hook. I mean their offspring, the ones the size of a hook. It was quite a feat for their parents to catapult themselves through a rushing November stream, and it was no small achievement for the young to hatch out from their pebbly redds last March. While the cold, oxygenated water of riffles is good for salmon eggs, the newborns need slower, safer places for juvenile development.

Each salmon species resolves this

need for a "rearing habitat" in its own way. Sockeye prefer lakes. Chum and pink like the estuaries. Some Chinook turn seaward, too, while others prefer streams. The wily coho, which won't taste salt for at least a year, rear in streams until they turn into silver-colored smolts that reach about the length of two house keys, end to end.

Exploring Creeks

To learn more about the life of a young coho, I revisited Padden and Chuckanut creeks in early August. During my visits, I discovered some of the perils – and the promises – behind the coho's adaptations for stream-based rearing.

For one, there needs to be a stream, ideally one where the temperature is below 60°F. In places where I remembered Padden as a continuous flow of water, I was stunned to find it a fragmented series of trickles and pools.

Fortunately, coho are opportunistic and perhaps the most tolerant of varied

conditions. They thrive in beaver ponds, side channels or shady tributaries where water collects behind rocks and wood. Looking at the root wads used during the City of Bellingham's Padden Creek restoration, I imagine future coho will have ideal holdouts until the fall rains remake the flowing stream.

Last year, City of Bellingham surveyors found two coho redds on Padden Creek. Coupled with all of Padden's recent habitat improvements, I wasn't too surprised that I didn't see any coho fry. Still, I couldn't help but wonder why coho evolved to endure the summer's droughty whims in a stream at all.

Chuckanut Creek was a good reminder why. The creek's plentiful aquatic insect larvae are choice fare for coho. I found plentiful water striders and even some caddisflies, which tend to indicate high-quality water. A mere 7 percent of chum, pink and sockeye live long enough

to become fry, but Chuckanut Creek's shade, structural complexity and abundant insects show why a whopping 19 percent of coho live through healthy juvenile growth.

Fry-Stalker Tips

By September, scientists estimate coho fry are hard at work defending a territory of about 8.5 square feet. It's thrilling to seek – and sometimes find – these quick-swimming adolescents.

Polarized sunglasses may help reduce glare, but to be an effective fry-stalker, you must first be patient. As you walk along the streambank, go slow and watch your shadow so you don't spook the fish. One misstep will set the fry frantic, so sometimes it's wise not to step at all.

It may be even more challenging to catch a coho fry on a camera than a big fish on a hook, but there's no better way to remember how salmon are always living in our local waterways.

No Gas Needed for NSEA's New Ride

By Ken Carrasco

Former NSEA Board Member

NSEA is now the proud owner of an all-electric car, a 2013 Nissan Leaf!

The Leaf, purchased in March, will be used for transportation by staff. It can hold five people and has plenty of storage space under the hatchback.

This purchase made sense for both financial and environmental reasons when NSEA's previous car, a donated Buick, had reached the end of its serviceable life.

Before buying the car, NSEA considered the two questions that face anybody mulling the purchase of an electric car: Does such a purchase make sense financially, and will it actually help the environment?

A member of NSEA's Board of Directors, Ken Carrasco, had the experience to help NSEA address these questions because he has accumulated more than 58,000 miles in an electric car since purchasing his own Leaf in 2011.

The initial purchase price of this used car was relatively inexpensive, mostly because the technology for electric cars is changing so rapidly. Still, ours works very well.

The second advantage to electric cars is the low maintenance costs because there is no oil to change and few moving

parts to deteriorate over time.

The third factor is the price of fuel, which is currently low but will certainly rise through time, relative to the cost of electricity.

Another concern about electric vehicles is the eventual degradation of the lithium-ion batteries that power the car.

However, Carrasco had the necessary device to determine that this particular car had only lost 3 percent of its energy storage capacity over its 2-and-a-half year life.

Environmentally, the car is also a distinct "win" for our local salmon streams. Storm water has been identified as a serious culprit to the water quality of streams

and can affect salmon health. Cars contribute much of the pollution to storm water, which flows off roads and into streams, because of the leakage of fuel, antifreeze and other fluids from cars. (It is true that a Leaf uses coolant in the battery, but it is a very small amount relative to petroleum cars and is situated where it is much less vulnerable to leakage.)

In the months since buying the Leaf, the car has proved to be a sensible purchase.

"I love NSEA's new Leaf! As I provide community outreach, I find myself driving to various events throughout the county, crossing the Nooksack River and its tributaries along the way. It makes me feel great knowing that by driving an electric car, I am keeping pollutants like motor oil and antifreeze from making their way onto the roads and consequently our streams and rivers. I'm sure the salmon appreciate it, too!"

– Lauren Murphy, former Stewardship Coordinator

"We encourage conservation and stewardship through our programs and projects and having an electric car enables NSEA to provide a tangible example of those values to our community."

– Annitra Peck, Program Director



Keep an eye out for NSEA's new all-electric Nissan Leaf as we visit school classrooms around Whatcom County and attend community events.

Porter Creek Alluvial Fan Restoration Project



Looking downstream at Porter Creek Berm

**By Darrell Gray
Project Manager**

In 2015, NSEA partnered with the Lummi Nation Natural Resources Department on a grant application to the Wildlife Conservation Society's Climate Adaptation Fund (CAF) Program. The focus of the grant application was to restore the Porter Creek Alluvial Fan downstream of the Mosquito Lake Rd crossing in order to create more cold water refugia for salmonids inhabiting the Middle Fork Nooksack.

As climate change puts more pressure on fish stocks in this region it is more critical than ever that this kind of habitat is available.

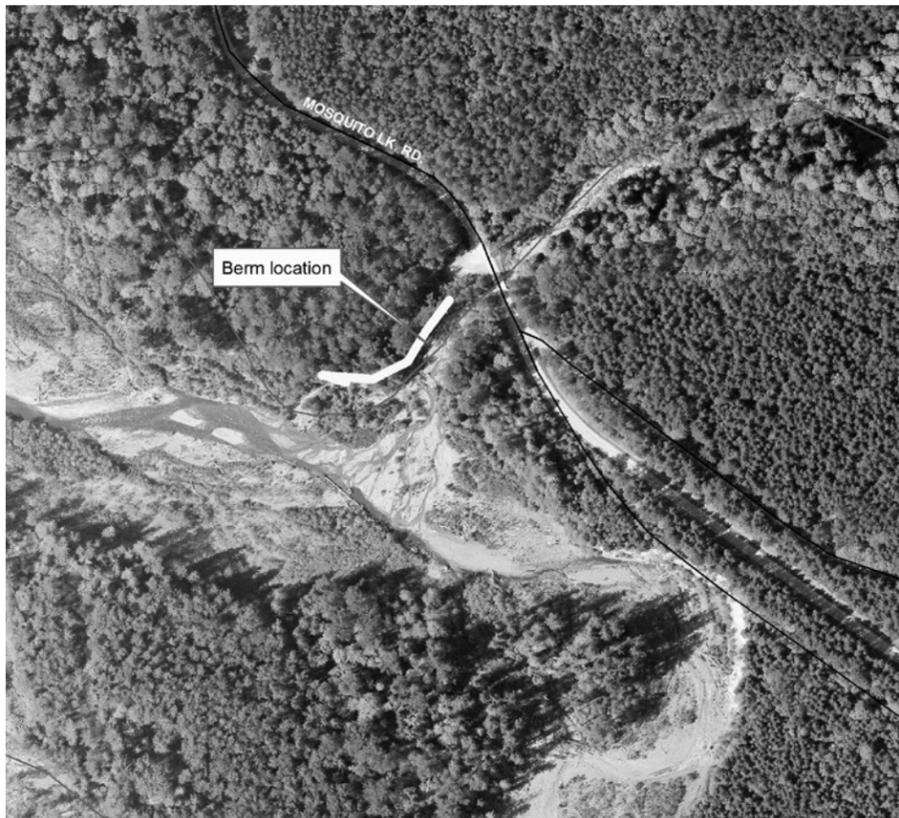
Below the Mosquito Lake Rd crossing, Porter Creek is confined by a large rock berm. This has limited deposition of fine sediments necessary for the development of the alluvial fan, vegetation, and water storage. The Lummi Nation has completed designs for habitat restoration

(large woody debris placement or LWD) in the Middle Fork Porter Creek Reach and is presently seeking funds to commence construction in 2017.

The CAF funds will be used to compliment those activities by removing the majority of the levee, placing LWD structures within the fan to trap and store sediment, and riparian planting to increase native vegetation on the fan.

Porter Creek historically supported one the largest Pink salmon runs in the Nooksack watershed. Endangered Species Act listed early Chinook and Steelhead also utilize lower Porter Creek. This project will ultimately benefit these salmonids by providing protected cold water refugia during warmer summer months for juvenile rearing, and more protected spawning and holding habitat for returning adults.

Base line monitoring of physical variables commenced in early 2016. Construction is scheduled for summer 2017.



Porter Creek alluvial fan project site.

CREW CORNER

The Inquisitive Beaver and the Restoration Technician



Emma Malpeso jokingly instructs Elle Harris (WCC crew members) on the best way to apply the beaver cage protector.

By Christine Cleghorn and Emma Malpeso, WCC Crewmembers

There is an ironic tension between the salmon restoration technician (*Homo sapien*) and the beaver (*Castor canadensis*).

While we, the restoration specialists, are working to replant streambanks with native plants to provide shade and control erosion, the beaver thinks we are doing it to fill her pantry.

Because a beaver's diet consists mainly of woody food, herbs and the roots, restoration workers must take extra measure to protect the young trees and shrubs they plant. With this in mind, it's no wonder that restoration work is viewed so differently through the eyes of a beaver.

Here, in two short episodes, is how we think it plays out.

The Beaver

Tired and hungry after a long day of constructing my fourth logjam this season, my mouth was salivating at the prospect of dinner. I had the perfect little cedar in mind: a nice sapling I'd been eying for the last week or so.

As I followed the familiar path, I came upon a perplexing site. My dinner was wrapped in a strange, metal grid. I tried to bite through it, but it was too hard and tasted terrible! I reached my paw through an opening and felt the bark I was longing to eat. It felt delicious.

"Why?" I sighed, "What kind of creature would want me to starve?"

In my moment of despair, I looked around to realize my intended dinner was not the only tree wrapped in the wire-like material. In fact, each and every sapling I could smell (beavers have poor eyesight) was also locked away from my sharp incisors.

I can't fathom why this would be happening. Had I said something brash to my cousin? Had I built my dam over the top of my older brother?

My stomach grumbled (and my head hurt from so much chomping) that I decided to move on from my quandary and look for dinner elsewhere.

Restoration Technician

My crew and I just returned from our lunch break and I noticed odd markings in the loose dirt around our trees. "Woah, beaver tracks!" I exclaimed, "We finished up just in time, it seems. Another day and the beaver would have gotten to 'em!"

Just last month, my crew planted 50 trees and 100 shrubs at this site, but we ran out of time to cage them against the busy beavers.

Don't get us wrong; we have an interest in the survival of beaver. It's just that we have a special calling to do what we can to build working habitat for salmon, too. That means we need to be choosy and, at least for now, even a little exclusionary.

As with many streambanks in the immediate area, the creek was overwhelmed with invasive plants, such as reed canary grass and Himalayan blackberry. Our native plantings will help to shade out the invasive plants and restore a natural, self-sustaining forest community.

Until that day, we will have to protect it from the beaver, which would otherwise quickly gobble up our restoration investment.

Article citation: A Linear Programming Model of Diet Choice of Free-Living Beavers. Nolet, Bart A. and Van Der Veer, Pieter J. and Evers, E.G.J. and Ottenheim, Mart M., Netherlands Journal of Zoology, 45, 315-337 (1994).



Rice Insurance, LLC
Ron Thorneycroft

NSEA Fish Tales Sponsor



harmony
MOTORWORKS
360.671.2420
1922 Grant Street, Bellingham

Introducing the 2016-17 AmeriCorps Team

The NSEA AmeriCorp Program matches talented and passionate young professionals with meaningful salmon recovery work full of significant responsibility. Each of the coordinators introduced below will hire and lead a team of interns to carry out programs and projects throughout Whatcom County that benefit students, volunteers, water quality and ultimately the salmonids that live in our shared watershed.

Joan Hong – Education Coordinator



I'm most excited about getting to do some fun community outreach with other salmon-loving volunteers. If I were a salmon, I would definitely be a Chinook because watching them spawn behind my dad's store when I was young is why I fell in love with salmon! Something unique about myself is that I can wiggle my ears.

Arianne Blatt – Monitoring Coordinator (Spawner Surveys and more)



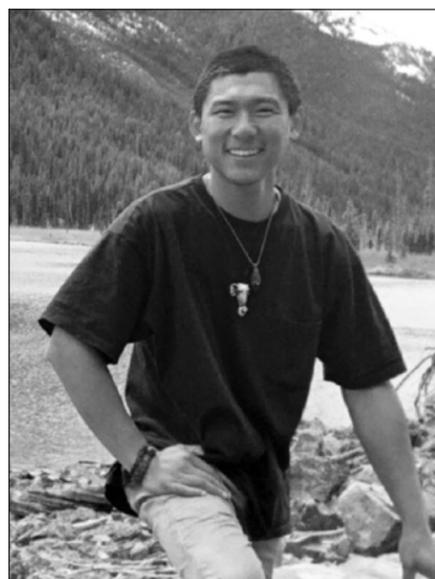
I am excited to get into some creeks and watch the salmon run! I'm also looking forward to being involved in the greater Bellingham and Whatcom County community than I was able to when I went to school here. If I were a salmon, I would be an estuary-rearing Chinook salmon: Chinook because they taste the best, and estuary rearing because estuaries connect waters from different places to create highly productive environments. Something unique about me is when I catch myself daydreaming it is most often about cabins and gardens.

Jessica Stanley – Education Coordinator



I am so eager to start working at NSEA! Honestly, I am really excited about having my first "adult," full-time job, and in a lot of ways I am not exactly sure what to expect. But I do know that I cannot wait to share my love and knowledge about our ecosystem with the students and people in our community! I would have to go with the sockeye salmon, because I think the bright red spawning coloration is amazing. I've been trapped (temporarily) on an island when I was traveling in Bali just as a volcano erupted, grounding all air travel.

Khavan Tran – Restoration Coordinator (Community Work Parties)



To be honest, I'm most excited about all of it. I've only heard positive things from those who have volunteered, interned and served for NSEA. To be here now is very special for me and I hope to be as helpful as I can in giving my time and energy into this place. I feel most connected to the Chinook. Growing up, I'd go fishing with my dad and it was mostly the king salmon we'd fish for on the Columbia River. Even today, when I travel home to visit, he gives me a few fillets every time. I like to write my dreams down. I have 100-plus dreams in my journal as of today. It's interesting to see how my dreams correlate to things happening in my waking life.

Haggen Chooses NSEA and Gives Beautifully



Amber Thunder Eagle, Haggen seafood buyer, offers a way for shoppers to enjoy a lunch while simultaneously supporting NSEA. Inset: Haggen customers were offered a chance to support NSEA's habitat restoration projects by purchasing a well designed paper salmon.

By Adrian Shulock Development and Communications Manager

For several weeks during the summer of 2016, Haggen generously raised money so that NSEA can accomplish critical on-the-ground habitat restoration projects that take place right here in Whatcom County.

How? Funds were raised at the checkstand by their super awesome store clerks by selling beautifully designed paper salmon that then adorned areas of the storefront. In addition, a BBQ was held at two of its stores (Sehome and Barkley) on a Saturday afternoon in August. Together, the two fundraising methods generated a gift of over \$5,000 toward habitat restoration projects. A huge THANK YOU! to the people at Haggen.

Why was NSEA Chosen by Haggen?

We were selected as a partner by Haggen because of their interest in being able to source and sell locally caught seafood for its customers. They recognize that the work NSEA does restoring salmon habitat helps make wild salmon runs more sustainable in the Pacific Northwest.

We were flattered to be chosen for such a great opportunity. Not only is the donation tremendous and substantial but we imagine the store clerks also introduced our organization to people who might not of ever heard of our work.

Again, a huge thank you to the incredible people at Haggen!





**Mountain
Veterinary
Hospital**

Michelle C. Schraeder, DVM, FAAVA
Edwin J. Stone, DVM, MEd

360 592-5113

www.mtnvet.com

3413 Mount Baker Highway, Bellingham, WA 98226

A Family Owned Veterinary Clinic Providing Personalized Pet Care Since 1986

- Offering a Full Range of Medical and Surgical Services including Acupuncture, Chinese Herbal Medicine and Massage Therapy
- Fellow of the American Academy of Veterinary Acupuncturists
- Boarding, Bathing and Pet Supplies
- Spays/Neuters at No Charge when your pet has the Complete Puppy/Kitten Vaccine Series at our hospital.



**KEEP OUR
COMMUNITY
STRONG**

**CHOOSE LOCAL,
INDEPENDENT
BUSINESSES**

www.SustainableConnections.org

**RECOGNIZED FOR OUR
ENVIRONMENTAL LEADERSHIP**

FULL SERVICE AND DO-IT-YOURELF FACILITY



**SEAVIEW NORTH
BOATYARD**
At Squalicum Harbor Marina
360-676-8282
north@seaviewboatyard.com

**SEAVIEW YACHT
SERVICE FAIRHAVEN**
In the Historic Fairhaven District
360-594-4314
fairhaven@seaviewboatyard.com

www.seaviewboatyard.com

3057 East Bakerview – NSEA’s New and Renovated Facility



NSEA's Equipment Shop (now complete) took about two solid months to build. The crew from Pioneer Post Frame did an outstanding job on the project.



A log and root wad is added to the Native Plant Restoration Garden to model how NSEA builds salmonid habitat throughout Whatcom County.



NSEA's new main office is awaiting good weather for a new coat of paint. Otherwise, staff are now working in a fully functional, modernized office space.



Campaign gifts came in from as far a way as Galveston, TX. In this case a trustee at the Kempner Fund loves to fish for salmon in the Salish Sea.



Donated by Architectural Elements of Bellingham, these steel salmon are both art and structural components of Adele's Potting Shed.



We drilled two new wells on the property - one to irrigate our inventory of native plants used in restoration projects and the other for potable water usage by staff and visitors.



Rebuilt largely with discount and reclaimed materials, this renovated chicken coop has become Mike's Place in honor Mike McRory's campaign leadership. It houses some of his favorite maintenance tools.



Commitment Creek is a recirculating feature of the Native Plant Garden. The creek was named by former NSEA Board President Phil Humphries to capture one of NSEA's core tenants, passing under a bridge built by campaign volunteers.

Salmon Science Continued from page 3

In BC, each license holder for farmed salmon must develop and implement a Health Management Plan (HMP) to cover all parts of the operation that can affect the salmon's health within the facility. HMP protocols include monitoring for signs and severity of disease or infection, treatments and euthanasia if necessary and reporting this information to DFO.

A common ectoparasite is the sea louse (copepod) (*Lepeophtheirus salmonis*), which attaches to the fins and skin of salmon in the ocean. Another ongoing controversy is whether sea lice on farmed Atlantic salmon in BC transmit the larval stage of the copepod to infest migrating juvenile pink and chum salmon, passing through or near net pens, to such an extent as to be lethal to these small fish. No study has definitively established that Atlantic salmon are responsible for the detrimental numbers of sea lice on these juvenile salmon.

Fatal to Dogs

The story of *Nanophyetus salmincola*, an endoparasitic flatworm (a digenean trematode or fluke) of the Pacific Northwest and its association with "salmon poisoning disease" in canids (aka nanophyiasis) should be of interest to anyone who has a dog because it can be fatal unless treated within a few days.

This fluke's life cycle requires more than one host (thus a digenean); there are two intermediate hosts and a definitive or final host. The first intermediate host is a specific freshwater snail (occurs only in Pacific Northwest streams); the second intermediate host is a salmonid fish, although other fish may substitute. The definitive (final) host is a canid (dog, coyote, fox), though other mammals, including humans, and birds can play this role.

Records of salmon poisoning disease (SPD) in dogs consuming raw salmon go back to the early 19th century. Investigators thought SPD was caused by the ingestion of poisonous fish blood. One hundred years passed before small white cysts (misidentified as amoebae) were seen in salmon muscle causing SPD after ingestion. Subsequently the cysts were identified as a larval stage of *N. salmonicola*.

After ingesting infected fish, small flukes were observed in dogs' intestines. The SPD is not caused by the larval or the adult flukes ingested from raw fish, but the fluke is the vector (host) for the disease causing rickettsia bacteria, *Neorickettsia helminthoeca*.

Adult flukes in a mammal or bird (definitive host) intestine lay eggs containing the rickettsia bacteria and the eggs pass out in the feces. The fluke's first larval stage develops within the eggs and the larvae (contain the bacteria) leave the eggs and swim away to infect a stream snail (the first intermediate host).

Within the snail, the larvae develop into the second and third larval stages and the third larval stage is shed by the snail and penetrates the skin of a salmonid (the second intermediate host), where the fourth larval stage becomes encysted within the salmonid's kidney and skeletal muscle. During the larval stages in the first intermediate host, more larvae are produced to amplify the parasite. If a canid (definitive host) ingests raw fish containing fourth larval stage cysts and their load of the rickettsia bacteria, nanophyiasis, or SPD, occurs.

The bacteria attack the dog's lymphatic system to cause hemorrhaging. The fourth larval stage becomes an adult fluke in the mammal's intestine and fluke eggs are passed in the feces to spread the fluke's first larval stage to the stream snail (first intermediate host) and the life cycle of the fluke and its load of rickettsia continues.

Keep dogs away from streams containing the second intermediate host (for example, salmon), ensure the dog does not consume raw or undercooked fish that may be infected, and ensure they defecate away from the stream snail's habitats.

For humans, consuming raw fish is discouraged, especially of fish from areas known to contain the intermediate host snail. There are effective antihelminthic drugs for treating infected humans. Studies on whether the fluke is harmful to salmonids are ongoing.

Milky Flesh

A parasite of culinary interest to humans is the myxosporean (*Henneguya salminicola*) embedded in white, fluid-

filled cysts in the flesh of salmon, one of its two hosts.

Spores are released from the cysts in decomposing, spawned out salmon. The spores enter the second (intermediate) host, a freshwater invertebrate, in the spawning stream. Juvenile salmon, before migrating to the ocean, are infected and the fish carries the encysted parasite through to the next spawning cycle.

Henneguya may occur in all species of Pacific salmon, although there is evidence that those juvenile salmon with a longer period in freshwater (for example, coho and sockeye) are more likely to become infected. The presence of the encysted parasite does not seem to harm salmon and, although unappealing for the marketing of infected salmon (referred to as "milky flesh or tapioca disease"), it is not harmful for humans.

The genus *Saprolegnia* is a common fungus (a water mold) found in freshwater throughout the world. It causes saprolegniasis (cotton wool disease) that is noticeable on skin, fins and gills or incubating eggs.

Infection often requires previous mechanical abrasions to expose the infection sites to the pathogen. Pacific salmon migrating to spawning sites have a weakened immune system and together with the skin and fins rubbing against rocks, cotton wool disease is obvious to anyone visiting spawning sites.

Crowded conditions in hatcheries during egg incubation and during juvenile salmon culture favor transmission from host to host. Infected eggs must be removed immediately and juveniles can be treated with formalin baths. If the infection is extensive, host death is likely.

The Bends

Gas bubble disease (GBD), or "the bends," in fish is not infective but can be lethal. It occurs when there is a supersaturated level of total dissolved gases in the water a fish breathes.

When water has more dissolved

gas than it normally would have for the temperature and atmospheric pressure, it is supersaturated. In nature, supersaturation occurs at the bottom of a waterfall's plunge pool, in water from springs and wells where water is under pressure at depth or when there is extensive aquatic photosynthesis and water becomes supersaturated with oxygen if the temperature warms.

Supersaturation can also occur in plunge pools at the base of dams and in hydro turbines. If cavitation occurs at a hatchery pump's propeller, forcing more of the gases into solution, supersaturation can occur.

Evidence of GBD includes gas embolisms in the vascular system, especially gill capillaries, fin rays and eyes. Supersaturation is more likely to cause death in juvenile salmonids than in older fish. Fish will swim to deeper or colder waters if accessible to reduce the effects of supersaturation. Modifications have been made to avoid GBD at hydro dams.

Barotrauma (decompression sickness due to a rapid change in barometric pressure) resulting from bringing fish rapidly from depths to the surface is not particularly a problem for salmon. Salmonids have a connection between the swim bladder (physostomous) and the esophagus and thus can expel swim bladder gas if decompression is not too rapid.

Many have observed barotrauma when rockfish (physoclistous and with no connection from the swim bladder to the esophagus to expel gas) are brought rapidly to the surface and the swim bladder proceeds out to the mouth and eyes bulge prominently.

A good general reference with an extensive list of common salmonid diseases and parasites is:

www.adfg.alaska.gov/static/species/disease/pdfs/fish_disease_book.pdf



Our brand new Mission Statement!

We strive to recover salmon by engaging our community in restoration, education and stewardship