

Two Interns Leap into Student Board Seats

Salmon recovery requires broad, accessible community participation.

Thus, along with things like making sure its restoration tools are sized for people of all ages, NSEA reserves three board seats for students.

Two students with a similar genesis recently joined the NSEA Board of Directors, leaping from their internship experiences during the fall of 2015 into 2016 board seats. Thank you to Mitchell Anderson and Alexa Jones for your participation in making salmon recovery vibrant!

Mitchell Anderson

On Leaping to the Board after an Internship

I “took a leap” to the NSEA board to serve my community and the salmon of Whatcom County in a position not typically offered to young people. After hearing about the board seat, I had to do some fact checking, making sure it really was the opportunity I envisioned. After talking it out with a few peers, I was hooked.

Board Surprises

Serving on the board has allowed me to understand the technical side of nonprofits, the inner-workings that allow great people to do the work they do.



Mitchell and Alexa take the leap from NSEA internships to NSEA Student Board Members.

Salmon recovery, I’m finding out, is no simple task. Fortunately, we have some very motivated and enabled folks on the board to help facilitate the complex path.

In Addition to NSEA

Personally, I enjoy being outdoors but am also an avid reader and budding design-enthusiast. My significant other is a graphic designer attending Western

Washington University. Her work has influenced my attitude and ethics moving forward in my career as an environmental professional. Other than enjoying student life and spending time doing anything and everything intellectually engaging, one could find me drinking a spot of coffee with my cat, Luna, close at hand.

Career Aspirations

My career aspiration has been considerably altered, now that I’ve spent so much time at NSEA. My father, sister and brother all work for nonprofits in Washington and I’m realizing working within my community to make a difference is possible through nonprofits like NSEA. After I graduate from WWU in March with a Bachelor of Arts in Environmental Education, my goal is to obtain employment with the Washington Conservation Corps working to restore wildlife habitat around King County.

Favorite Creek

My favorite creek in Whatcom County has to be Squalicum Creek, near Sunset Pond, where NSEA and the City of Bellingham held the Make A Difference Day work party last fall. I’m excited for the Bay to Baker trail to be complete, so the site is more easily accessible to everyone in the area.

Alexa Jones

On Leaping to the Board after an Internship

The involvement of the community at NSEA restoration work parties inspired me to “make the leap” to the board. It

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NSEA’s New Home - A Sweet Work In Progress



Elaine McRory leans against NSEA’s entrance gate that she designed. Thanks Elaine!

By Darrell Gray, Project Manager

In July 2015, NSEA purchased the old Fourth Corner Nursery site at 3057 E. Bakerview Rd. It was a tremendous

moment in NSEA’s efforts to build its commitment and interest in building a foundation of strength and stability for salmon recovery.

Since then, with the dedication of NSEA’s board and generosity of community donors, we have made great strides in developing the property.

Below is list of accomplishments to date:

- Expanded the entrance and line of sight off Bakerview Road to improve access and safety entering and exiting the property
- Installed a new entrance gate designed and supported by contributions from Elaine McRory
- Improved parking for NSEA visitors, volunteers and staff
- Installed an amazing five-salmon sculpture carved by Mike McRory from a single Western red cedar tree
- Installed a new irrigation well and pump for the nursery
- Installed a new well and water treatment system for offices and outbuildings
- Installed a fire sprinkler system in office buildings
- Remodeled the existing house for office use and completed required ADA improvements
- Made necessary electrical and plumbing improvements to offices and outbuildings

We are presently in the process of:

- Replacing roofs on the office buildings
- Installing a ductless heating and cooling system through the Community Energy Challenge program
- Weatherizing and increasing insulation in the main office through the CEC program
- Obtaining permits for NSEA’s new equipment shop

- Designing and permitting for converting an outbuilding into a community meeting room
- Constructing a new open air native plant potting shed
- Installing a native plant demonstration and education garden
- Developing and permitting a new septic system

Future projects include:

- Constructing NSEA’s new equipment shop
- Constructing the new community meeting room
- Installing the new septic system
- Reconfiguring the nursery and irrigation system

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A new metal roof was installed on NSEA’s main office in February and March.



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An NSEA AmeriCorps Member Navigates the Stream of Life



Cameron conducting a salmon spawner survey in Macaulay Creek (tributary of the Nooksack River)

Walking through a stream is a good metaphor for life. Sometimes the water is clear and calm. You can walk through it with ease, seeing everything. Other times it's turbid and rough, and you wonder where your next step will take you.

This thought came to me one day when trudging through a stream; after a few hours of walking a stream, your mind starts to wander. But first, let me set the context.

I am currently serving as NSEA's Monitoring Coordinator. I have spent the past three months conducting salmon spawning ground surveys in search of the salmon born in these streams that have returned to complete their lifecycle.

While walking the streams, I imagine how incredible the journey must have been for these salmon to make it back all this way. It often makes me wonder about my own journey in life. Where will my journey take me? What obstacles will I have to jump and where will I eventually wind up?

I have enjoyed these times of reflection. I'm sure many recent college graduates like myself ponder similar questions. What do I do now? Where will my life and career take me? How do I find a job and support myself in an ever-more competitive workforce? I've learned in my short time since graduating that sometimes you go with the flow, and other times you jump barriers or take a side channel to reach

your goal.

After graduating from Western Washington University with an environmental science degree in the spring of 2014, I landed an AmeriCorps position in Fresno, CA, with the Watershed Stewards Program, part of the California Conservation Corps. I was ecstatic to be working in fisheries. My drive down to California was like a walk in a turbid stream. I knew the general direction I was going but had no clue what lay before me.

Some days, the going was easy and the waters were clear. Other days, my life was like a stream following a big rain event: It got chaotic, unclear and hard to press forward.

I struggled from time to time with living two states away from the people who love and support me. But with time came growth. I learned to be more outgoing, meet new people and do new things. I learned to budget my small monthly stipend to pay bills and feed the dog. I learned that however turbid and rough the waters of life may be, you will eventually find resting pools with calm waters and clear vision.

After my 10-month AmeriCorps term at the Watershed Stewards Program ended, the time came to search for new waters. I heard about NSEA's need for a new group of AmeriCorps members. Having interned for NSEA during college, I was thrilled

about the opportunity to work there.

I did, however, have hesitations about doing a second AmeriCorps term. After some time spent sorting my options, the waters calmed. It became clear NSEA was the right step in my journey. I knew the skills, knowledge and relationships gained at NSEA would be entirely worth living the AmeriCorps lifestyle again.

Today, the waters of my life still fluctuate. Just like a returning spawner, I continue to press forward. I have reached the halfway point of this AmeriCorps term and am starting to look to the future. My time with NSEA has been more rewarding than I could have imagined. I have grown in so many ways.

Being an AmeriCorps member puts you in an interesting position. You get placed with organizations that do amazing work, yet your tenure is short. It is stressful at times but also exciting, and you won't find me complaining. I continue to learn and grow as I overcome barriers in my life that make me stronger.

In the words of the great karate master Bruce Lee, "Be like water making its way through cracks. Do not be assertive, but adjust to the object, and you shall find a way through it. Be water, my friend."

**- Cameron Coronado
WSC AmeriCorps Member**

Student Board Seats *continued from page 1*

has been a joy to watch people so hard at work planting native species or removing invasive species to improve salmon habitat. I was also inspired by how rewarding and satisfying a day's work was out there, working alongside so many people with a similar goal. I am grateful to be in Whatcom County, where you don't have to pull teeth to get volunteers.

Board Surprises

The board has influenced my perspective on salmon recovery by showing me people from all disciplines can work together toward one common goal. The

board has also helped me to further my knowledge in policy regarding stream restoration, aiding me in one of my goals.

In Addition to NSEA

I love to hike, visit our local bodies of water, volunteer and study. I am a passionate student and enjoy learning, so I end up spending much of my time studying indoors and out. Currently, my favorite class that I am taking is Watershed & Water Quality Studies. My career aspiration is to become an executive director of a Regional Fisheries Enhancement Group like NSEA. That's pretty specific, I real-

ize, so more generally I'd be happy working for any nonprofit, community-based organization whose goal is to restore and preserve natural habitat.

Favorite Creek

It's hard to say; there are so many to visit and enjoy. I visit Whatcom Creek the most often because I live very close to Whatcom Falls. It also interests me because of the Olympic Pipeline explosion of 1999 that devastated the creek. Chuckanut Creek is also one of my favorite creeks because of the amazing salmon runs there.

NSEA Calendar of Events April through June 2016

Lower Landingstrip Creek Work Party	April 2	9am to Noon	Near Acme
Black Slough Work Party	April 9	9am to Noon	Near Acme
NSEA Potting Party	April 16	9am to Noon	Near Bellingham
Earth Day Work Party - Terrell Creek	April 23	9am to Noon	Near Birch Bay
Whatcom Creek Work Party	June 4	9am to Noon	Bellingham



The Story of a Transgenic Salmon (Genetically Modified Organism)

Salmon Science

The much larger AquaAdvantage Salmon vs non-transgenic Atlantic Salmon shown here at the same age

By Dave Beatty
NSEA Board President

Consumers in the US can expect to find transgenic Atlantic salmon for sale in the market within a few years. Here is an abridged story about how it all happened.

The Basics

A transgenic organism, or genetically modified organism (GMO), is produced when the biotechnology (recombinant DNA or rDNA technology) of genetic engineering is used to insert and stably integrate a gene or DNA sequence (a transgene) into the genome of a host organism (transgenic organism).

The transgene can occur in the host's offspring. The biotechnology for producing a transgenic organism can rapidly alter its genome compared to the slow process of genetic selection achieved through crossbreeding or hybridizing in matings of closely related organisms.

In a transgenic, the transgene is often from an organism distantly related to the host or even totally unrelated taxonomically. Very often, transgenic organisms are produced in laboratories for research purposes. However, the production of transgenics is often for commercial purposes.

Chinook + Pout

In 1989, a group of scientists in Newfoundland, Canada, did the initial research to develop a two species rDNA construct (a transgene) by linking the growth hormone gene of Chinook salmon with the antifreeze protein gene from a species of ocean pout (an eelpout of the cold Northwest Atlantic Ocean).

When the transgene construct was microinjected into fertilized eggs of Atlantic salmon (AS), it integrated into the Atlantic salmon's genome and transgenic Atlantic salmon (TAS) were produced. This founder TAS was backcrossed with wild-type Atlantic salmon and the progeny had the identical transgene construct demonstrating that the transgene is reproductively stable.

The ocean pout has antifreeze proteins in its body fluids to survive in subzero Celsius seawater. The ocean pout antifreeze gene acts as a promoter to stimulate Chinook growth hormone (CGH) production and release throughout the year in the TAS, even in very cold water. Many of the TAS had growth rates 2 to 6 times the growth rate of wild type AS controls.

In Chinook salmon, its natural promoter for CGH is active seasonally in response to specific environmental cues (e.g., day length and water temperature and growth rate responds accordingly). Likewise in normal AS, GH production is reduced in colder water as is the growth rate.

Three Concerns

AquaBounty Technology, a biotechnology company in Massachusetts involved in research and development directed at increasing productivity in aquaculture, recognized the opportunity of developing TAS for commercial aquaculture. Compared to conventional farm raised AS in Norway, North America, Great Britain and Chile, the TAS would have at least twice the growth rate, reach market size at a younger age and might



have a higher efficiency of food converted into body mass.

AquaBounty continued to develop the technology to create its TAS as the AquaAdvantage Salmon (AAS) and acquired the license for the technology. Salmon aquaculture companies in Norway and Chile spurned the production of TAS fearing consumer reaction, regulatory concerns and loss of market share. AquaBounty believes AAS produced in aquaculture has the potential to provide protein faster for an increasing world demand than can conventional aquaculture of AS.

Immediately, concerns were raised: 1) if AAS escaped and became established in the natural environment, would they interbreed with wild, native Atlantic salmon or otherwise adversely affect their ecosystems; 2) would AAS have significantly altered phenotypes (e.g., body shape and malformations, swimming ability and behavior in the confines of the aquaculture system); and 3) would the transgene construct have an effect during the AAS's growth and development affecting human health if AAS are consumed?

AquaBounty, as it sought approval during the mid-1990s from the United States Food and Drug Administration's Center for Veterinary Medicine to market AAS, submitted documentation addressing these concerns. The TAS broodstock and its transgenic progeny, the

AAS, would have biological, physical and environmental constraints to prevent the escape of AAS into the environment and if escape occurred, to eliminate interbreeding with wild type AS and thereby prevent transmission of the transgene into wild populations.

1) Biological Containment

In the production of AAS, fertilized eggs are treated with high pressure within an hour after fertilization to produce triploid eggs (AquaBounty claims no more than 1.1% remain diploid). Wild salmon are diploids (two complete sets of chromosomes or 2N, one set from each parent), whereas triploids have three complete sets of chromosomes or 3N (two from the female parent and one from the male) resulting from the high pressure treatment of eggs.

Triploid females are sterile and do not produce eggs. However, some triploid males do produce sperm and thus may be fertile. Also, any diploid eggs (triploidy is not 100%) could produce diploid AAS of both sexes. If any of the triploid AAS males capable of producing sperm (not all are sterile) or of the diploid AAS escaped into the environment, they could mate with wild type AS and thereby introduce the transgene ("the alleged Trojan gene effect") into a wild population of AS. Consequently, an additional method for reproductive isolation of the transgene was required to prevent the possibility of AAS

matings with wild salmon if AAS escape and survive.

All TAS used to produce sperm for fertilizing Atlantic salmon eggs are neomales (reproductive males that are genetically female). To produce neomales, female TAS homozygous for the Chinook salmon growth hormone/sea pout GH promoter transgene construct (it is present on both chromosomes of a homologous pair) are treated with 17-methyltestosterone to create genetic females with testes to produce sperm and all sperm carry the transgene construct because of homozygosity for the transgene. Female salmon are XX (sex chromosome pair for sex determination) and the neomales (by sex reversal of females) are also XX for sex chromosomes whereas normal males are XY for the pair.

All progeny resulting from high pressure treatment of wild type Atlantic salmon eggs fertilized with sperm from transgenic neomales (sex reversed TAS females) produce nearly all triploid and a relatively small number of diploid female progeny, each having one copy of the transgene construct provided by sperm from the transgenic neomale. No males will be produced because there are no XY (the pair of sex chromosome for becoming male) males.

Consequently, the sex reversal of a female TAS homozygous for the transgene

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Education and Stewardship

Students for Salmon: Still Growing After All These Years



By Cori Schleich
Education Coordinator

This spring will be the busiest season ever for NSEA's Students for Salmon program.

Forty-eight classes from 19 different schools in Whatcom County have signed up for this spring season's exciting, field-based program.

Students for Salmon has undergone quite a few changes over the last 17 years. The fundamental elements of the program – field trip activities where students collect macroinvertebrates, test water quality and examine native plants – have remained. However, its organization has been polished each year to become more efficient so we can reach as many students as possible.

In the past, NSEA's Education Coordinator has been in charge of running the entire program, including both field trips. This year, a collaborative approach allows us to reach more students, with NSEA's Restoration Coordinator orchestrating the restoration field trips – 25 this spring!

NSEA also has three other superb AmeriCorps members to help when activities overlap, such as April 26, an auspicious day with seven different classes on the schedule. All hands on deck!

Revamped Curriculum

In order for students to be optimally prepared for these field trips, NSEA provides teachers with the *Students for Salmon* curriculum. This 185-page document is full of hands-on lesson plans, educational and creative activities, and other tools and resources to help teachers succeed in their efforts to teach kids about salmon.

There has always been a curriculum, but it has undergone improvements as the program has evolved. Last fall, then Education Manager Maggie Long reformatted and reorganized the *Students for Salmon* curriculum to modernize its usability.

Most importantly, the revamped curriculum supports the Next Generation Science Standards, which are being implemented in all K-12 classrooms in Washington starting in the 2016-2017 school year. NSEA has explicitly geared the curriculum toward problem-solving and systems concepts in line with the new standards, so it assists teachers with this challenging transition.

Of course, to truly modernize any document these days, you put it online



Having just studied erosional processes in the classroom, students from Alderwood Elementary apply their knowledge by planting native snowberry to stabilize the streambank of Squalicum Creek.

– and we have! Check out the revamped curriculum, along with a calendar to schedule classes, at www.n-sea.org/students-for-salmon. Download the entire curriculum as a pdf, or click around on the blue bubbles to find specific lessons. Let us know what you think!

We are hoping that classroom teachers, parents, other nonprofits and informal educators will use this teaching tool for years to come. Or at least until the next update.

New Parent Handout

Through work in the classroom, NSEA has recognized a need for more communication with families, both English speaking and multilingual. NSEA has developed a parent flyer that will be sent home to engage parents and guardians in their child's activities with Students for Salmon.

NSEA worked with the team at the Bellingham School District's Interpretation and Translation Services to develop Spanish translations of this flyer and a student

release form. Hopefully, more families can keep up with what their child is doing with NSEA and learn how to get involved!

Opportunity: NSEA is actively

recruiting community members to join its Education Committee. If interested, please contact Program Director Annitra Peck at [apeck@n-sea.org](mailto:apeek@n-sea.org).

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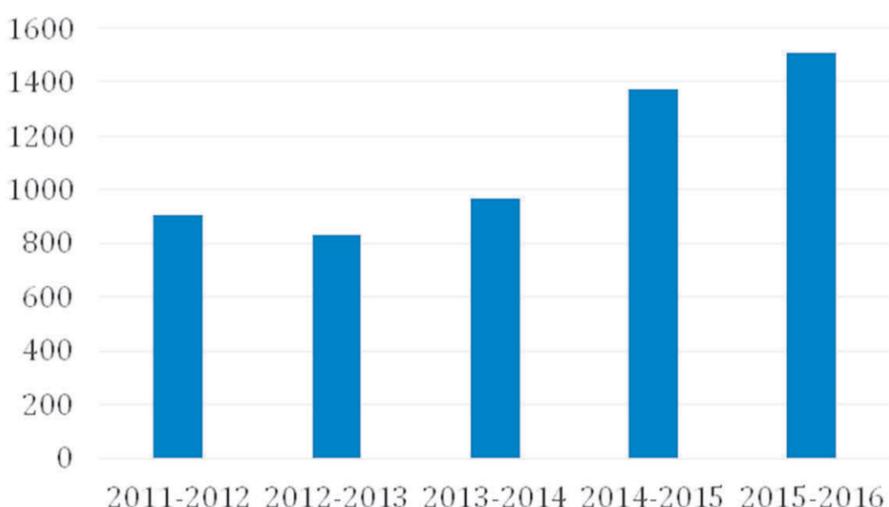


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For more information, visit www.n-sea.org/internship-program or email stewardship@n-sea.org

SFS Students in Recent Years



MARTIN LUTHER KING JR DAY OF SERVICE 2016



Lending Hands!



MLK Day 2016 was a huge success thanks to each and every volunteer who made it, from the first time volunteers to those working behind the scenes. Over 180 people joined together to improve streamside salmon habitat on Padden Creek. In just a few short hours volunteers cleared invasive English ivy from over a half acre of streamside forest. Talk about hard work!



Work Parties aren't all mud, thanks to Tony's Coffee there's always something to help warm up!

Uh oh, English ivy is heading up this tree! Thank goodness our volunteers are here to help out.

English ivy wreaks havoc in our forests by strangling tree seedlings and climbing high into trees. A tree in the Olympic National Park was once found to have 2,100 pounds of ivy on it! During wind storms ivy infested trees are much more likely to be blown over. Along the creek that means less shade and warmer waters for salmon.



For AmeriCorps members, MLK day is a day on, not a day off! AmeriCorps from throughout Skagit and Whatcom County joined in to help improve Padden Creek.

If you spend much time with NSEA, you'll find out we don't take kindly to English ivy along our creeks. This is just some of the ivy pulled out by volunteers!



Left: NSEA AmeriCorps members Cameron Coronado and Lauren Murphy and City of Bellingham AmeriCorps member Alexandra Doumas pose with Bellingham Mayor Kelli Linville, new Bellingham Parks Director Leslie Bryson, and City of Bellingham Council Member Michael Lilliquist.

Right: Congressman Rick Larsen joined in on the fun as well!

Adjacent to the restoration site was the City of Bellingham Public Works Padden Creek Daylighting Project. Project Engineer Craig Mueller is seen below giving a tour of the new creek!

CREW CORNER

Seven Characterizations of a WCC Crewmember



From left to right - Zach Shirk, Andrew Budihaus, Emma Malpeso, Dayna Stuart, Chistine Cleghorn, Elle Harris

**By Emma Malpeso
WCC Crewmember**

Dig, plant, cut, rip, rebuild and restore. When actions like these describe life on the job, you certainly can't say that your work is dull.

As a Washington Conservation Corps crewmember, these words describe the core of what you do. However, it is only once you fully immerse yourself in WCC life that you understand some of the peculiarities that arise within the program.

1. You're smelly and you know it.

And you really don't care if you show it, because it is unavoidable. You can try to mask the smells with deodorant or clean work clothes throughout the work week, but unless your body produces only rose-scented sweat droplets, you stink – and that's a fact.

2. Going into stores looking like you rolled in the mud is a pretty common occurrence.

Frequently, people come up to you

and ask, "Have you been playing in the mud?" Or they simply roll their eyes as you walk in onto freshly mopped floors. You feel bad, but no matter how much you dust, scrape or stomp your boots, the dirt will still stick in all the crevices of your boots and leave a telltale trail everywhere you go. Once you finally pry it off, it is just in time to get to work again!

3. Barely recognizing your crewmates when you see them in anything other than work clothes.

We've all experienced it. Every day, it's dirty and/or ripped Carharts, an array of WCC sweatshirts, T-shirts and long-sleeve shirts, and hair tied up in the easiest and most practical way possible. So when you finally meet up with your crewmates in a non-work setting, you can barely tell they're the same person. It's really amazing how nice jeans and a T-shirt change how a person looks entirely.

4. The feeling of being cramped in the truck.

It happens on those days when raindrops keep falling on your head, or Washington pulls a fast one and brings on the snow. Everybody hightails to the truck. Who would have thought the truck could fit everybody and their backpacks? Also, does everybody always breathe this much (yes, I am referring to the condensation covering the truck windows at the 15-minute mark of lunch).

Aromas of distinct dishes combine together to produce something you'd never before imagined. You start wondering, why on earth would anyone think to bring curry, or egg salad? And let's not forget the scent of six hardworking individuals often faced with rain or excessive layers, bringing the smell of mildew and sweat to the forefront.

5. You can only find gloves for one hand.

New gloves: can you think of anything nicer? They're so fresh and clean and perfectly paired, but nothing lasts forever.

As all things do, these gloves grow apart over time until they are separated completely. It starts innocently enough. You set one here and you set one there, always remembering where they are, of course, until you don't! One morning, you wake up for work and BAM! You look through your pack pulling out left glove after left glove and you wonder, why am I only seeing the left one?! Until you realize, with only five minutes before you depart to a site, you're working with two left hands today.

6. Sanitary eating habits are defined differently when you're at work.

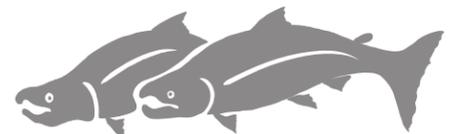
When you're home, dishes are washed scrupulously. For instance, if there's something crusty on your spoon or you drop it on a dirty floor, you wash it again or grab a different spoon. When you're at work, however, any spoon (or fork or knife) will do. Is it cool to eat with yesterday's spoon with a little bit of yesterday's lunch crusted on it? Just wipe it off with the corner of your shirt! If you find a fork that's been in the bottom of your (or your crewmate's) backpack for who knows how long, covered in mysterious dust, just pour a little water on it and rub it off with your sweatshirt sleeve. It's totally sanitary! And don't forget about the communal truck silverware. We don't know for sure how it got there, but it sure comes in handy in a pinch.

7. Knowing you're a part of something bigger.

At the end of the day, no matter how hard, stinky, cramped or muddy your work is, you know you're a part of something bigger than just your crew. You are just a small part of the greater WCC community, full of hundreds of people dedicated to making our world a better place for future generations to live. And that is the true beauty of being WCC.

NATIVE PLANT CORNER

Bull Kelp Provide Shelter for Salmon



Bull Kelp - Photo Credit Steve Tuckerman

**By Rachel Benbrook
Program Manager**

Honestly, we are cheating a bit because our native plant for this issue is not technically a plant. But let's bend the rules. It's a cool part of the marine environment and provides important habitat for salmon. We are talking about bull kelp, the long whip-like seaweed that is a hallmark of local marine shorelines.

While it looks and feels like a plant, bull kelp and other similar species of submerged aquatic vegetation are classified as algae, not plants. This distinction arises because they lack the cellular complexity present in plant cells, but have nonetheless adapted to thrive in conditions that would be much too harsh for

true plants to survive.

Bull kelp (*Nereocystis luetkeana*) is an annual seaweed that is the dominant kelp species from northern California to

Alaska. As an annual, bull kelp colonies, or beds, die off each year.

Striving to reach the sun in waters up to 100 feet deep, bull kelp "seedlings" grow in the spring at an astonishing rate of 2-3 feet per day to reach the surface, making them one of the fastest-growing organisms in the world.

The round bulbs on the kelp are filled with a gas mixture that keeps the long, photosynthetic blades floating at the surface in the sun. And, just for fun, here's your random nature fact of the day: Bull kelp bulbs contain enough carbon monoxide to kill a chicken! While there is no record of native peoples making use of this toxic gas, bull kelp bulbs were used as storage containers by the Salish people, while the whip-like stipes were dried and used for fishing nets.

Bull kelp beds form excellent habitat for ocean dwellers, sheltering juvenile

rockfish and schools of salmon. The kelp dies back in the winter months, when decomposing kelp whips are a frequent site throughout the fall and winter on Whatcom County beaches. Once deposited on the beach, kelp is incorporated into the "wrack line," piles of decomposing seaweed and other debris that form along the high tide line. These piles become a buffet for marine insects that are important prey for juvenile salmon.

Bull kelp has inspired many a mermaid tale in the waters of the Salish Sea, fronds ebbing and flowing with the tides like so many ponytails waving in the currents. Bull kelp beds are a favorite habitat of salmon, herons and harbor seals – and also are a cool destination for a kayak trip. Bull kelp beds are prevalent on rocky shorelines and can be found locally around Lummi Island and alongside northern Whatcom County beaches.

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M O T O R W O R K S

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1922 Grant Street, Bellingham

NSEA Quarterly Awards

Intern of the Quarter: Katie Johnson



Kneeling on the bank of Macauly Creek, Katie Johnson extracts the otolith bone (used to determine age among other things) from a wild coho salmon carcass.

Each year, a group of dedicated interns conducts salmon spawning ground surveys with NSEA. Katie Johnson was one of those interns during the 2015-16 season. Katie and her family moved to Bellingham a year ago. Before then, Katie bounced around a lot. She worked with the National Park Service in California, instructed ski lessons in Vermont, did sea turtle monitoring in Texas and moved to Miami to work at Biscayne National Park.

How do you like Bellingham?

The trail systems throughout Bellingham are great. Bellingham is a good size. It has good food and good beer – really good beer. Bellingham has it all, from scuba diving to skiing. It's an endless recreational playground.

What are some of the biggest

differences you have noticed moving coast to coast?

I was surprised how clean the streams and rivers are here. This area is full of environmentally friendly and conscious people. They love the outdoors and they work to protect it.

How has your time at NSEA been?

It's been great. I have learned a lot about salmon species. I have also learned about the Bellingham area and met some really cool, likeminded people. I knew very little about salmon and freshwater ecology before interning with NSEA. Being marine based, it is a whole different world. I was happy to expand my knowledge base.

Thank you, Katie, for all of your hard work this season!

NSEA Alum Continues Pursuit of Conservation Education



NSEA intern alum Ashley Allan stands in front of Seattle's Pike Place Market's famous gum wall.

By Ashley Allan Former NSEA Intern

In 2012, I graduated from Huxley College of the Environment at Western Washington University with a Bachelor of Science in Environmental Science.

During my senior year, I attended an internship fair where I first learned about NSEA. Of all the conversations I had with people that day, my interaction with the NSEA representative was the most memorable. It was clear from our conversation NSEA was an organization with a positive outlook and a deep commitment to salmon and local communities. Not long after, I became a spring stream restoration intern.

Prior to starting my internship, I knew that I would gain valuable knowledge and skills in habitat restoration. However, I had not anticipated how rewarding and fun the work would be.

I remember coming home after my first restoration work party and feeling extremely tired but equally excited about what I was doing. It was great getting to witness firsthand how the seemingly small efforts of community members working together led to drastic transformations and positive outcomes. Besides gaining technical and leadership skills from my internship, this belief in the potential of small efforts combining to create real change has stuck with me since leaving NSEA and

encouraged me to continue volunteering for issues important to me.

The best advice that I could give to an incoming NSEA intern is to actively seek out ways in which you can assist outside of your specific internship duties. Near the end of my time as a stream restoration intern, an opportunity to join the environmental education team arose.

Choosing to help out with the *Students for Salmon* program was a pivotal decision that helped me discover my interest in environmental education, a pursuit I had not considered prior to my internship. Currently, I continue to educate students about the environment by volunteering as an outing leader with Seattle Inspiring Connections Outdoors, a Sierra Club program that provides opportunities for Seattle youth to explore and learn about the natural world.

The skills that I acquired at NSEA have enabled me to better translate information to younger students using language they understand and fun activities. For example, during an outing to Wallace Falls, I was able to use a little trick I learned at NSEA to help the students remember the five species of Pacific salmon.

The students caught on quickly and used their newfound knowledge to test fellow hikers on the way to the falls, thereby spreading NSEA's lessons far beyond Whatcom County.

Business of the Quarter: Green Frog Nursery

Tell us about Green Frog Nursery and your connection to the community here in Whatcom County?

Wendy Roberts and I (John Roberts) started Green Frog Nursery in 2001 with the goal of having an income when I retired from commercial fishing. The plan worked out and I retired in 2003. Our business is located at our home, near Marietta, Wash., and our specialty is hanging flower baskets. You may have seen some of our baskets hanging on the streets of Bellingham and Ferndale, or decorating the grounds at Rosario Resort. We also sell our baskets retail for a short period each spring, out of our greenhouses.

Beyond growing beautiful hanging baskets, what are your other passions?

Wendy has a love of gardening and has designed and maintains an impressive landscape around our home. I play guitar and have a love of country music, especially duet singing. But if a short-term local fishing opportunity arises, I will jump back on a boat without much persuading!

Why do you feel it is important to be a business that is philanthropic?

It seems most businesses rely directly or indirectly on taking something from the earth. A farmer harvests crops grown from the earth. All the lumber-related industries utilize trees. And the electricity that every business relies on comes from the earth in one form or another. In my case, for 30-plus years, I harvested fish from the ocean for our family's livelihood, so it seems important that I find a way to give something back.

What is your connection to NSEA?

We first got involved with NSEA



John and Wendy Roberts of Green Frog Nursery gearing up for a great year of growing hanging flower baskets.

because we wanted to see fish come back to the creek that runs through our property and so we invited their team to evaluate our creek. As it turned out, our creek is not a good candidate for restoration, but we were affected by this ambitious group of concerned, fish-loving people.

Getting involved with NSEA seemed like the ideal way for my family to give back. Being around some of the NSEA projects has shown me that it gets more accomplished per dollar spent than most other charitable organizations.



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Salmon Science Continued from page 3

construct to produce neomales producing sperm containing the transgene and the pressure treatment of fertilized eggs to produce nearly all triploids results in sterile, triploid female AAS that will not produce eggs, or if eggs are produced they lack the genetic framework for fertilization.

This is the final biological containment. However, a small percentage (no more than 1.1% according to AquaBounty) of AAS can be diploids because the pressure treatment of fertilized eggs is not 100% for triploidy. If the diploid AAS females (no males exist) escaped, they could mate with wild salmon. Therefore, physical containment of AAS is necessary.

2) Physical Containment

Closed containment with no possibility of escape or accidental release of eggs or AAS is essential even if the capability of these transgenics to survive in natural ecosystems and to interbreed with wild salmon is very small. Currently, all fertilized AAS eggs are produced from broodstock held in tightly controlled, closed containment facilities in Prince Edward Island, Canada. When the AAS eggs develop to the eyed stage and can survive transport, they are air shipped to a land-based rearing facility in a mountainous region of Panama. In November 2013, Canada approved the production of AAS eggs for commercial use.

3) Environmental Containment

The Panama facility is close to a river draining to the Pacific Ocean and thus there is the potential for introducing AAS into the Pacific Ocean. Although a developing embryo, juvenile or adult might escape and survive in the river, a juvenile or adult would likely not survive when it reached the warmer river water as it moved downstream. Likewise, any AAS reaching the ocean would meet lethal temperatures.

AquaBounty believes it has built in a redundancy of protections to avoid AAS's introduction into wild AS ecosystems and thereby eliminate mating with wild fish.

Transgenic vs. Wild Studies

Biological and ecological risk assessments must be done in closed containment facilities and should be done under as wide a range of conditions as feasible.

Intense studies to compare transgenic salmon to wild salmon have been done at the Fisheries and Oceans Canada Laboratory in West Vancouver. The studies used growth enhanced transgenic coho salmon (TCS) whose genome contains the transgene construct of a promoter driving the expression of a sockeye salmon growth hormone gene. The TCS are then compared to hatchery coho (HC) at different life stages under a variety of experimental conditions.

As an example, in a study on the reproductive performance of TCS in a simulated natural environment, the TCS show courtship behavior, can spawn together or with HC and produce viable TCS progeny.

Because wild type TCS are not available, it is not possible to fully determine the TCS's reproductive fitness. However, these studies demonstrate the capability of transgenic salmon to mate with wild salmon. Also, the research provides evidence for the transmission of a transgene to wild populations if mature transgenic salmon are in contact with mature wild salmon of the same species.

Consumption Concerns

AquaBounty received mounting criticism from numerous consumer advocacy groups once it was known of the

intent to market the AAS. Allergenicity and possible adverse changes in the nature of the edible flesh, including increased levels of specific hormones of potential human consequence, have been major concerns.

Specific to AAS is the transgene construct derived from integrating Chinook salmon GH and the sea pout promoter and triploidy. Certain individuals are known to be allergic to wild type AS and thus are likely to have an allergic reaction to AAS. However, would the allergenicity be more intense or even expand to more individuals?

Using high pressure treatment of fertilized eggs, hatcheries produce and release triploid rainbow trout (not transgenic) for recreational fishing and possible consumption. There is no evidence indicating triploid trout are more allergenic than wild type diploid trout.

FDA Approval

When FDA's Center for Veterinary Medicine began the process to determine whether AAS is safe for human consumption, the guidelines for such a determination were not fully developed. Why was FDA involved? The AAS transgene construct is considered a drug for use in an animal and thus AquaBounty had submitted a New Animal Drug Application (NADA).

In 2010, FDA determined that AquaBounty had provided sufficient information to make its decision. The critics' opposition mounted over several shortcomings in the fundamental information AquaBounty provided, especially for the allergenicity and the amount of a specific hormone in the flesh.

Furthermore, in the FDA's process for determining the safety of AAS, FDA had not consulted NOAA's National Marine Fisheries Service and the U.S. Fish & Wildlife Service regarding the potential biological and environmental effects of the AAS on endangered Atlantic salmon. In 2001, NMFS and USFWS issued a Biological Opinion to the U.S. Environmental Protection Agency to ban all transgenic salmon on ocean-based salmon farms, a ban that FDA seemed to ignore in 2010 while AquaBounty continued to consider this option for rearing AAS. Consequently, a full Environmental Impact Statement was required. In 2010, several members of Congress requested the FDA to reject the approval of AquaBounty's application.

For another five years, the FDA approval process continued. In December 2012, FDA published a draft Environmental Assessment for AAS and also published a "Finding of No Significant Impact." In May 2013, the public comment officially ended and FDA could proceed to complete its assessment.

On Nov. 19, 2015, FDA gave approval to AquaBounty's NADA for the production and marketing of AAS with conditions and restrictions including 1) all AAS eggs shipped for rearing must be triploid eyed eggs produced at the Prince Edward Island facility and are to be used only by AquaBounty at its Panama rearing facility and 2) any purchase or use of AAS eggs by a third party or any rearing of AAS at other than the Panama facility would require a new application.

For a comprehensive review, see Alain Goubau's "The AquAdvantage Salmon Controversy - A Tale of Aquaculture, Genetically Engineered Fish and Regulatory Uncertainty" (May 2011) at <https://dash.harvard.edu/handle/1/8789564>.

For FDA's AquAdvantage Salmon Approval Letter and Appendix for the extensive restrictions and conditions, see <http://tinyurl.com/j6at2yz>.

NSEA's New Home Continued from page 1

- Repainting the older, original building exteriors
- Installing solar panels on the equipment shop

At NSEA, we feel flattered and fortunate for all the support we've received for our new home. Since we started the Capital Campaign almost two years ago, many generous people, businesses and foundations have contributed gifts both big and small. Thank you! Together, we have made significant progress on our ultimate goal

to build the ideal home for our salmon recovery efforts.

The third and final phase is upon us. We are working to raise the rest of the money needed to complete mission critical projects that remain undone. Please feel free to come by our new home on Bakerview Road and see all of the amazing improvements for yourself (this is your home, too!), or consider making a gift to the Capital Campaign at www.n-sea.org.



The new Equipment Shop will go here after the site is properly graded.

Please Help Us Cross the Campaign Finish Line!

NSEA's Capital Campaign to Sustain Our Impact

The NSEA Capital Campaign is in the third and final phase – to make three necessary improvements to a 6.3 acre property that we purchased in July of 2015 and brought up to county code shortly after.

What are the three main projects that will unlock the full potential of NSEA's new home?

Build an Equipment Shop (pole building construction)

- An 2,000 square foot shop will allow NSEA to securely store and maintain all of its restoration equipment, including hand tools, machinery and tractors.
- This will increase security, reduce crew prep time, and support their field work restoring salmon habitat.

Renovate an existing building into a Community Meeting Room

- With partial funding from the Norcliffe Foundation, we are converting the storage building into a meeting, training and educational space for 20-25 people.
- The Community Meeting Room will serve as a hub in Whatcom County to drive collaborative efforts among all our partners involved in salmon recovery.

Construct a Demonstration Garden for Native Plant Landscaping

- NSEA has long needed a location to teach landowners and students how to landscape with native plants, particularly near a stream.
- We are dedicating about a ¼ of an acre to this demonstration project.



Generous donors have propelled our campaign to 87.5% of the \$1,200,000 goal. If you haven't given yet, please help us finish by making a gift to the campaign so you can be a major part of NSEA's improved ability to achieve the mission of restoring sustainable wild salmon runs in Whatcom County.

Make a Gift! The best way to make a campaign gift is to visit NSEA online at www.n-sea.org/take-action.

For more information call or email
Development Manager Adrian Shulock.

360-715-0283 x103
ashulock@n-sea.org

Mission Statement

The Nooksack Salmon Enhancement Association is a community-based nonprofit organization dedicated to restoring sustainable wild salmon runs in Whatcom County.