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# NSEA Community Program Intern

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# COLLEGE OF THE ENVIRONMENT

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**Internship Title:** Community Program Intern

**Organization Worked For:** Nooksack Salmon Enhancement Association

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# COMMUNITY PROGRAM INTERN AT THE NOOKSACK SALMON ENHANCEMENT ASSOCIATION

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I was a Community Program Intern with the Nooksack Salmon Enhancement Association's (NSEA) Future Leaders of Whatcom County (FLOW) program for spring 2023. NSEA is a local, community-based organization within Whatcom County. It is a 501 c(3) organization meaning that NSEA is a charitable, nonprofit for the benefit of the community (IRS, 2023). Main funding comes from various grants. NSEA's major focus is on habitat restoration to help declining salmon populations:

> "We believe that salmon are an essential part of our environment, culture, and economy. We envision sustainable ecosystems with healthy watersheds and habitat conducive to producing abundant salmon that are protected and preserved by a caring and engaged community. The Nooksack Salmon Enhancement Association educates, inspires, and engages the community to take action to keep wild salmon here for future generations," (NSEA, 2023).

NSEA has a five-year plan from 2020 to 2025 that includes five strategies. The first states to support NSEA's roots in restoration, education, and stewardship. The second is to unite those fighting for salmon recovery by supporting and collaborating with other organizations and groups. The third strategy is to engage diverse communities in Whatcom County. Strategy four is to encourage interest and increase the ability of the community to help preserve salmon through opportunities and financial support. The final strategy is to grow NSEA to meet the needs for salmon recovery (Nooksack Salmon Enhancement Association, 2020).

The Nooksack Salmon Enhancement Association focuses on three major aspects of salmon recovery. These include restoration, stewardship, and education. Restoration focuses on removing invasive plants, planting native plants, and incorporating any additions to enhance the habitat. Although it takes multiple years to see the full effects of restoration, there are some sites

where we already see the positive changes to salmon habitat. For example, a restoration project on Kendall Creek worked to remove invasive species that were causing migration barriers to salmon. Large woody debris was added to make pools that salmon use for thermal, velocity, and predator refuge. Native plant diversity was increased and there are now many willow trees that help with bank stabilization, nutrient cycling, and much more. This creek is home to Coho Salmon, *Oncorhynchus kisutch,* that spend the first year of their lives in their natal streams. There is a hatchery located on this stream, so both wild and hatchery salmon use this creek during their life cycle (Figure 1). Another form of habitat restoration that NSEA partakes in is culvert removal or repair. These culverts are replaced with ones that salmon can pass through or, better yet, are replaced with a bridge. Bridges allow the natural habitat to be continued and undisturbed beneath it, unlike a culvert (NSEA *Restoration,* 2023).


*Figure 1.* This diagram depicts the changes to Kendall Creek through restoration work using pictures taken by the NSEA Restoration Team. This work began in 2003 to clear the grass and create a complex habitat that salmon can utilize. The "After" picture was taken five years later, in 2008, when native plants were fully flourishing within the riparian zone.

Stewardship is the next aspect of salmon recovery that NSEA focuses on. This organization creates opportunities for the community to get involved and take action in

salmon recovery. Many of these opportunities involve direct acts of service such as restoration, as well as educational opportunities to learn how to better coexist with salmon. Their Stream Stewards program provides work parties for volunteers to restore different sites each week in spring. The Nooksack River Stewards program helps educate those in the watershed about effective ways to reduce their impact when partaking in recreational activities. The Salmon Discovery program tracks salmon sightings in Whatcom County to raise awareness of salmon presence in our waterways and help track population and distribution (NSEA *Stewardship,* 2023).

The final aspect is education. Camp Keystone is a summer camp program with two age groups. For kids ages 4-6, there is Salmonberry Camp and for those 12-14, there is Fishing Camp. These camps are meant to connect campers to the environment around them through games, crafts, and activities. Another education program is Climetime Teacher Training. This is a grant-funded collaborative program that allows organizations, such as NSEA, to develop and share science-based teaching techniques. Currently, they have a program for teaching outside and on climate hope and resilience. The Future Leaders of Whatcom Waters Internship Program allows interns to run the programs such as Camp Keystone and Students for Salmon. Students for Salmon is a program for fourth-grade students to learn about salmon and their habitat. They get an in-class introductory visit, an opportunity for teacher-led curriculum, and an outdoor field trip. This is free for the schools to partake in (NSEA, *Education,* 2023). All of the programs at NSEA work in different ways to educate those of all ages on salmon habitat and recovery.

Salmon face many challenges during their lifecycle. From predators to smoltification to long migrations, there are many chances for fatality. On top of that, salmon face the challenges that humans place on their ecosystems (Helfield, *Salmon,* 2023). Here in Whatcom County,

Washington, the land was previously covered in trees such as Douglas Fir, Western Hemlock, Big Leaf Maple, and more. Although most creeks of Whatcom County have about 30-55% forested land cover in their watersheds, the rest is made up of urban development and agriculture (Kaminski, 2008). In the class ESCI 410: Habitat and Ecology of Pacific Salmon and Trout with Professor James Helfield at Western Washington University, the lecture on urbanization taught us that development and urbanization eradicates healthy salmon habitat characteristics from the stream ecosystem in many ways. One way is that increased impervious surfaces, such as compact soil and concrete, can increase the peak flows and worsen floods. This can lead to the removal of large woody debris, gravel, and stable banks, which all increase siltation. Another is the removal of plants from the riparian zone causes a loss of shade that would prevent the water from warming and the bank from eroding. Additionally, there is an increased input of nutrients and pollutants into the streams when fewer plants are present. Urban runoff, which can consist of pollutants, heavy metals, and organic contaminants, will increase in the streams with the combination of increased impervious surfaces for it to slide across and fewer plants to filter or trap that runoff. Urban runoff causes pre-spawn mortality in many species of salmon (Helfield, *Land,* 2023). For example, studies have shown that a specific chemical called 6PPD-quinone, an oxidation product in tires, is lethal to juvenile salmon (Lo, 2023).

Creating effective riparian buffers and restoring the habitat complexity within the stream is vital to salmon recovery. We have seen it in action with the completion of the removal of the Elwha Rivers dams in 2014. By unblocking 90% of salmon habitat and restoring the natural intricacies of a river with pools, riffles, and other characteristics (Pess, 2008), we have already seen salmon returning to previously unreachable areas (Myers, 2023). However, we do not yet know if these populations will hit the projected numbers due to ecosystem and population

recovery being on a timescale of many years, even reaching decades (Pess, 2008). Additionally, the ocean phase of salmon is where a large portion of salmon mortality lies and where our lack of knowledge on the salmon life cycle occurs (Helfield, *Salmon,* 2023). That should not stop us from taking action where we know it will be effective in the long run. That is why I chose to become an intern for the Nooksack Salmon Enhancement Association.

I grew up on the Snohomish River seeing salmon carcasses scattered along the edges of the streams during spawning season. I was fascinated by these creatures and the way they lived their lives. More often than I was on the river, I was boating on Puget Sound by Whidbey Island. We mainly did recreational crabbing and sometimes would cast out a line for flounders to use as bait for the crab pots. Through these experiences, I fell in love with the water. As a kid, I wanted to be a marine biologist and was intrigued with anything to do with the ocean. Any chance I could, I did school projects on the Southern Resident Killer Whale population to try to raise awareness for our local orcas, which always circled back to salmon recovery. At a young age, I learned how important environmental education was due to the reaction I got from adults who didn't know concepts such as what urban runoff was or that dog poop contributes to pollution. Things as a kid I thought adults would know since they know everything right? From then on I used as many opportunities as I could to partake in environmental education. I created a poster on the effects of dog poop in our waterways for my 4-H dog program and did multiple talks on our local orcas. I did a survey on plastic bag usage that called for a change to reusable bags in high school, and to this day some people still tell me they are sticking with the switch. My passion for all things marine led me to become one of 60 students in my class at the Ocean Research College Academy at Everett Community College. Here I finished the last two years of high school and got my Associate's Degree while doing marine-based research. It was also here

that I took my first marine biology class and found out that this was not my favorite subject. I realized I was much more interested in the physical sciences such as tides, oxygen, pH, etc. I then went on to Western Washington University to pursue Environmental Science with a Marine Emphasis. I took courses in oceanography, coastal seas, climate change, energy, forest ecology, and much more. It wasn't until my last few quarters that I took a Fisheries Science course, ESCI 412, and two courses about salmon habitat and ecology, ESCI 410 and 411. This is when I realized that I really enjoyed the management and freshwater aspect of environmental science. I was in awe with my salmon lecture and field classes and was ecstatic to see an internship based on environmental education on salmon habitat and recovery with perfect timing to meet my graduation requirements. Through this internship, I am able to do hands-on restoration work planting native species and removing invasive ones while teaching young kids about science and salmon. My fourth-grade experience at the salmon hatchery is a core memory for me and I feel honored to give dozens of classes the same chance at a path to science as I had.

This internship had two parts. During the week we led field trips through the Students for Salmon Program. On Saturdays, we led the spring stewardship work parties for volunteers to come help do restoration work at various sites around Whatcom County. Some interns were what we called, "Saturday only", meaning they worked just work parties. Those of us that were in the Students for Salmon program worked the assigned weekdays and every other work party. Work parties ran from 9 am to noon and we were there about two hours before for set up and two hours after for clean up. The day starts with a debrief of where we are going, what roles are assigned, and any other needed information. We then pack the outreach truck and the tools truck and head to the site. NSEA's restoration team preps the sites and places plants where they should be planted. When we arrive we unpack and get booths and tools set up. The roles for interns include

being at the sign-in table, shuttle drive (if needed), blue-tube makers, macroinvertebrates, and group leaders. Blue tubes are plastic cylinder-like wraps around the bottom of trees and shrubs to prevent animals from eating the plants after being planted. Often we have hundreds of plants to get in the ground at each work party and with dozens of volunteers this goes decently quickly. Group leaders are leading volunteers in an introduction, safety talk, and planting demonstration, then interacting with them and quality-checking their work. If we were on Starry Creek, for example, the introduction goes like this,

> "Hi, my name is Paige. I use she/her pronouns and I am a community program intern with NSEA. NSEA is the Nooksack Salmon Enhancement Association that works to educate, inspire, and engage the community to take action to keep wild salmon here for future generations. We would like to acknowledge that we gather today on the ancestral homelands of the Coast Salish Peoples, who have stewarded this land for time immemorial. Please join me in expressing our deepest respect and gratitude for our indigenous neighbors, the Lummi Nation and the Nooksack Tribe, for their enduring care and protection of our shared lands and waterways. Today we are on Starry Creek, a tributary of Tenmile Creek that is home to Coho Salmon. Today we will be planting native plants to enhance the riparian buffer and keep the water cold, clean, and clear for salmon".

We then emphasize tool safety and give a planting demo where we use a pre-dug hole that is about one foot deep and a width of three times the pot size (Figure 2a). We show how to loosen and splay the roots before filling and compacting the hole. Next is a quality check where you pull the base of the plant to ensure it is planted firmly, then add blue tubes and a donut ring of mulch around the plant. Mulch is important to help give nutrients to the topsoil and hold in

moisture around the plant (Figure 2b). Now volunteers are set free and restoration begins. The rest of the day consists of helping volunteers, quality checking, then clean up, and a debrief. As an intern who only does every other Saturday at work parties, I attended a total of 5 work parties at various locations (Appendix A).

a)  b) 

*Figure 2.* These are both images from the Starry Creek work party. A) Shows the planting demo hole prepared, with the needed tools and unconstructed blue-tube beside it. B) Shows a finished plant with the blue-tube placed over the plant and a donut ring of mulch around it.

For the Students for Salmon portion of the internship, based on our availability we get assigned up to three field trips a week. A few weeks before the field trip, each class gets an introductory visit where they learn about the salmon life cycle and what is important to their habitat. We emphasize “The Three C’s”, which means cold, clean, and clear water. They learn the terms riparian zone and watershed, along with the importance of native plants being in both of these areas to make sure the water has the three C’s. Students get taught the importance of salmon to jobs, culture, and environment. They also learn that for every redd of 3,000 salmon eggs, only two salmon return to spawn so salmon recovery is very important. After the introductory visit, the teacher has the choice to do five additional lessons before the field trip. On the field trip, there are three stations that include water quality, native plants, and

macroinvertebrates that are each led by one intern. Our supervisor leads any of the all-class talks like the introduction, conclusion, and restoration safety.

Students are given a scientific journal to write down their hypotheses, observations, experiments, and conclusions. Before they begin their first station, they do a salmon habitat assessment. This begins by writing the name of the location we are at and the creek name. They then have a list of habitat characteristics, such as garbage or large woody debris, that they see if they can find around the creek. Based on their observations, we make a hypothesis on whether the creek is excellent, fair, or poor for salmon. Then the students begin their first station.

The native plants station is a scavenger hunt that allows the fourth graders to identify and learn about a plant. We start by going over what a riparian zone is and why it is important. Then we go over native versus invasive plants. Native plants are ones that naturally occur in this ecosystem and provide the three C's, whereas invasive plants were brought by people, animals, or other ways into an ecosystem they aren't from. Invasive plants are unhealthy because they outcompete the native plants that have specific roles in the ecosystem. Finally, we go over how native plants provide the three C's. Shade keeps the water cold, while the roots help stop erosion to keep the water cold and clear. Next, they each get a card with a plant that is present within the area of this station. The first card has pictures and descriptions of the plant (Figure 3). Once they locate their species, they are given another card that tells them if it is native or invasive and some fun facts (Figure 3). Students then record the information in their journals and share their findings with their group. Finally, based on the amount of native versus invasive plants, students decide if the vegetation is excellent, fair, or poor for salmon.

a)

b)

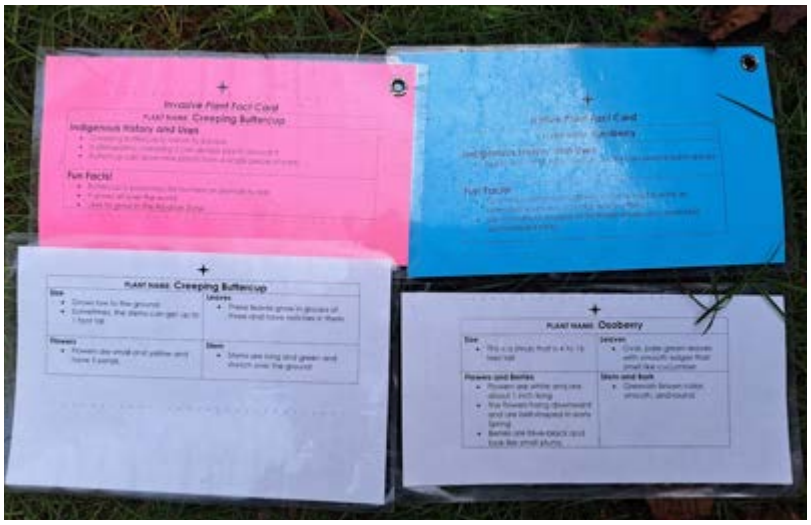



*Figure 3.* These images show the plant scavenger hunt cards. The white card on the bottom of each picture is the first card students get in order to find their plant, the colored cards have fun facts. A) This image shows the front of the cards. The pink one on the top left tells the student that creeping buttercup is an invasive plant and the white card below it is photos of creeping buttercup. The right one is a native plant card for osoberry with the card with photos of osoberry below it. B) This image is the backs of the same cards from a). This side has fun facts and descriptions about the creeping buttercup (left) and osoberry (right).

The macroinvertebrate station has students analyze a macroinvertebrate and find the pollution level of the stream. This station begins by explaining that a macroinvertebrate is an animal without a spine that you can see with your eyes. Then goes on to explain that macroinvertebrates are part of the food chain for salmon. Next, we explain that the species present in the creek can indicate the pollution level because of the tolerance levels of different species. Group one macroinvertebrates, like the caddisfly larvae and stonefly larvae, cannot

tolerate pollution and will not survive in areas without clean water. Therefore, if any group one species are present, the water is most likely low in pollution. Group two species, such as scuds and isopods, can tolerate some pollution, while group three species, such as leeches and tubifex worms, have a high pollution tolerance (Figure 4). Before the field trip, we use waders and a net to collect macroinvertebrates from the sediment in the stream and place them in trays for the students to find them. Each student is given a small box with a magnifying glass at the top and a scooper to collect a macroinvertebrate from the trays. They draw a picture, identify the species, and find what group their critter is in. Then each student shares what group they have and we make a conclusion based on the hypothesized pollution level.

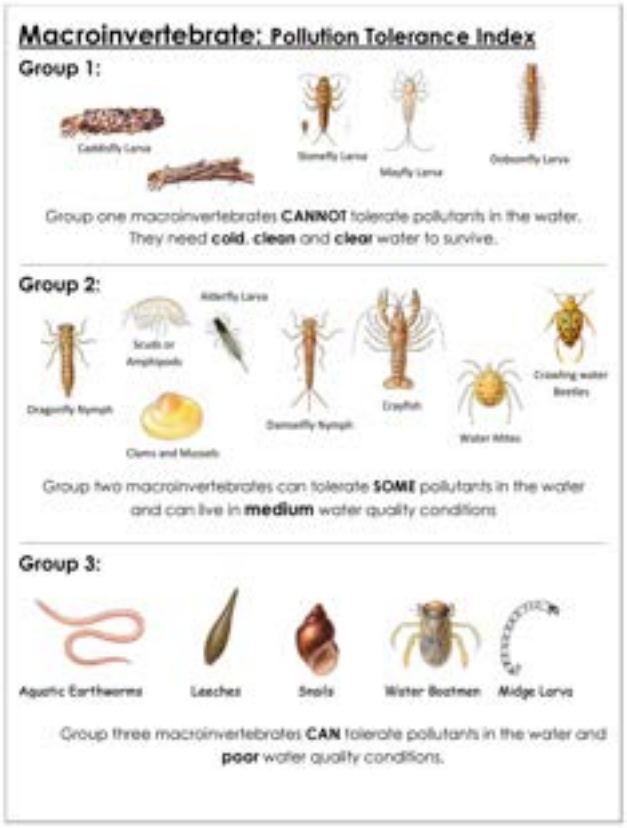



*Figure 4.* This poster is from NSEA's macroinvertebrate mission lesson. It depicts the pollution tolerance levels of commonly found species. Group one cannot tolerate pollution, Group two can tolerate some, while group three can tolerate a lot of pollution. Scuds and tubifex worms are the most common macroinvertebrates we find.

The water quality station has the students measure the temperature, dissolved oxygen, and turbidity of the stream water. First, we discuss the significance of water quality for salmon. Then move on to temperature and use a poster to show the optimal range is between five and thirteen degrees Celsius for salmon (Figure 5). We put a thermometer in a jar of stream water and wait for it to acclimate. In the meantime, we begin our dissolved oxygen experiment. This starts with going over what dissolved oxygen is, how much a salmon needs, and how to measure it. We use an analogy of one million red Skittles and a handful of green Skittles to explain parts per million (ppm). For the experiment, we have a small vial of stream water that we put two chemicals in. One chemical is for sterilizing the water, then the second bonds to the oxygen. We let that sit and return to the thermometer to mark down the temperature and see if it falls in the range that is optimal for salmon. Once that is done we go back to the dissolved oxygen experiment to put in the third chemical that also bonds to the oxygen, and then put it away again. Next, we begin to test turbidity. We have three jars with different turbidity levels that the students shake and hypothesize what turbidity is (Figure 5). When they have a good grasp, we discuss that salmon need clear water to see through and to breathe in. A turbidity tube gets passed around for them to record the turbidity level. Finally, back to the dissolved oxygen experiment where we finally get a measurement. With an even smaller vial, we measure out one ppm of water and add drops of the fourth chemical to the now golden stream water. Once it is clear, the students yell stop and however many drops are added is the amount of dissolved oxygen in ppm. Based on all three experiments, the students decide whether the water quality is excellent, fair, or poor for salmon.

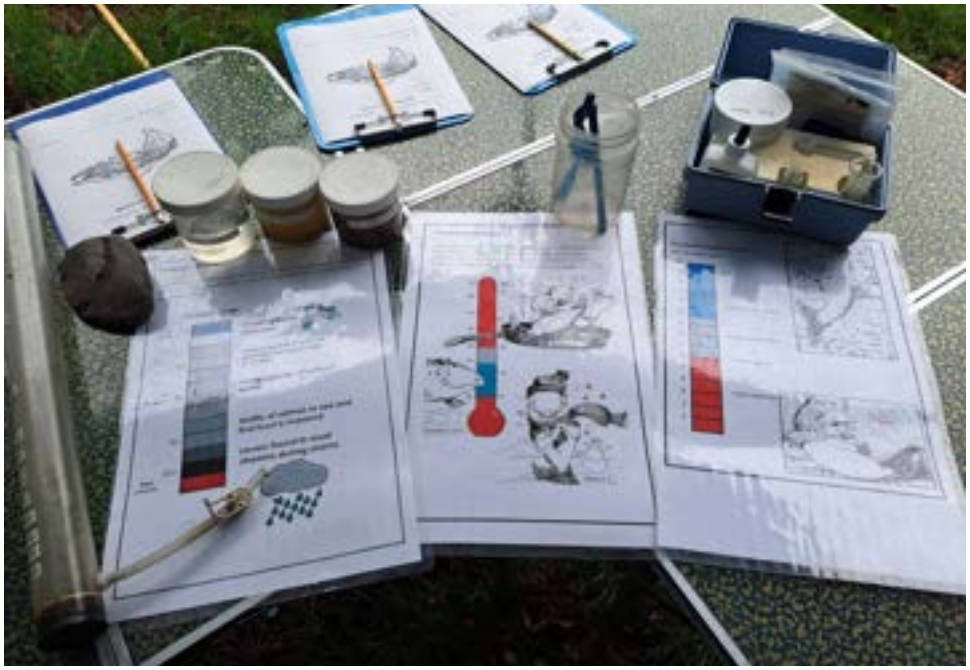


*Figure 5. This image depicts the posters and materials used for the water quality station. On the left is a turbidity tube and the three jars with various degrees of turbidity along with the poster explaining how salmon are affected by different turbidity levels. In the center is the jar and thermometer used to measure the stream temperature and the poster for optimal water temperature for salmon. On the right is the hatch kit with all the supplies to measure dissolved oxygen and the poster showing how much oxygen salmon need.*

After all three stations, a conclusion is drawn on the health of the habitat for salmon of this creek that is stated as such, “I conclude that (Creek Name) is an (excellent, fair, or poor) habitat for salmon because (State Reasoning)”. The last activity is salmon trivia which is given in the introductory visit as well and used to see how much the students learn. Finally, what all the students have been waiting for. It is lunchtime. After lunch is restoration where students are typically removing invasive species. Most commonly it is Himalayan blackberry, but also English ivy or buttercup. Rarely do we have a site where students plant like at work parties. We collect the invasive species the students remove and take them to the Recycling and Disposal Services as yard waste and get a weight measurement. The students love the competition of having to get more than the other classes. We have collected between 40 and 140 pounds for every class. Over the course of this internship, I attended 20 field trips at nine different sites on

six creeks within Whatcom County. Each was a completely different experience due to the area, creek, and class (Appendix B).

Some days it is a struggle to get students to pay attention and it feels like whatever you do, they just don't want to participate. Most days, there are kids who are so involved and excited to learn that it makes those hard days so worth it. One of my most heartwarming moments was when a student was very engaged in restoration and wanted to have his parents bring him back so he could do more. We told him about the work parties and he was there the next morning at the Earth Day work party with his family. He was so excited when he saw us there and showed his parents how to do everything. Creating positive experiences with the outdoors and science for these fourth graders is the most rewarding part for me. A handmade thank you card from one of the classes (Figure 6) is now one of my most prized possessions. I love hearing the students say things like, "This is the best field trip ever", or "I want to do this again". When that happens, you know they had a good time and made some memories.

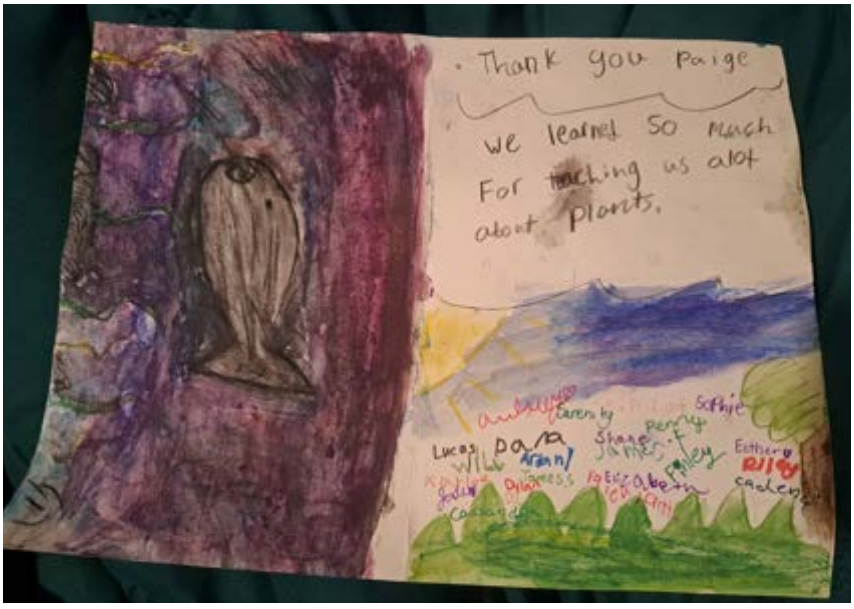



*Figure 6.* A hand-drawn card from a class that I had taught the native plants station to.

With those kids that seem like they don't want to participate, I find it is usually because they want to do or say something they aren't allowed to. When just told no, they get frustrated and shut down. The biggest thing to help them is acknowledging their feelings and working with them to get a balance between what you want and what they want. I had a student who really wanted to dig for worms when I was leading the native plant station. He was listening to me and answering all my questions as he dug for worms with his pencil in the dirt, so I did not ask him to stop. He was engaged although he was physically doing something else. The chaperone scolded him for not paying full attention and he shut down. He got mad and decided to stop participating. I went over and asked if he wanted to be my buddy for the scavenger hunt and he was thrilled, but upset because he no longer had a clean pencil and couldn't do his work. We made a deal that he had a digging pencil and a writing pencil and once he finished his work he could find worms. He ended up drawing an amazing picture and his written answers were exceptionally detailed. This student finished early so he got to dig for worms and all was well. He then spent the rest of the day with me and even left me the task of caring for his worms. Sometimes a little patience and understanding goes a long way. I try my best to do this same thing for as many students as possible. Understanding what they are feeling and as long as it is a safe activity, letting them partake in it when their work is done. It might be a bit of bribery, but the students feel seen and heard.

During my midterm evaluation, my supervisors stated that my kind, patient nature was one of the greatest strengths I bring to this internship. They said they can tell that I create a safe space for the kids where learning is fun and efficient. They enjoy that I do not stick 100% to the script and tailor my talks to the students I have at the moment and their responses, which are sometimes some of the wildest remarks. I feel that my empathetic nature and my own struggles

in learning help me understand that not everyone has the same learning style. I personally am a very visual learner and find information hard to remember from just verbal presentation. I also understand how hard paying attention to something can be even when it is something important or interesting. This helps me connect with the kids and do my best to find ways to engage each student in a way that works for them. My supervisors also said that I am very skilled at quick problem-solving and coming up with innovative solutions. This plays into how I work with the kids when I change up the games or learning styles for each group and for resolving issues that may arise. For example, on my first field trip, we forgot the turbidity tube. My supervisor said that was ok and to just compare the water to the three turbidity jars (Figure 6). I had some extra time so I decided to put a glove over the lid of an extra jar and draw the Secchi disk pattern on the glove for a makeshift turbidity tube. This way the students could still fill out the part of their paper that asks them for a drawing. I have also made a nametag out of an NSEA flier and a pin when I forgot my actual name tag and everyone was complimenting on the fact that I put effort into fixing a problem they would have just left alone. One time our D-net for collecting macroinvertebrates broke so I used a hair tie and a hair clip to temporarily hold it on. I feel that my innovative nature is one of my most helpful qualities because I can come up with rapid solutions to complications on the spot.

My main job may be teaching kids science, but I am learning a lot along the way as well. Due to the fact that I have focused so much on marine environments, I was not very confident in my plant identification and had never dealt with freshwater macroinvertebrates. I learned to confidently identify about a dozen different common plant species. These include osoberry, snowberry, sour cherry, paper birch, trailing blackberry, salal, Oregon grape, English holly, and more. Osoberry was the first that I learned to identify and learned that the leaves smell and taste

like cucumber. Having to find all the plants within the station area before the field trip with fourth-grade level descriptions honestly was a great way for me to learn to identify these plants. Most field trips had the same few plants so the repetition helped as well. This same process of having to identify the same species multiple times was how I also became confident in my macroinvertebrate identification. We typically collect the same ten or so species, so after a few field trips and some intense chart analysis, it is easy to identify them. I have also learned a lot of environmental education and general education techniques. My supervisors stressed that group management of students is not necessarily something you can practice unless you are actually working with a group of students. They told us that we would find the techniques that work best for us along the way and to be patient as we learn the ropes. My supervisors were completely correct. I am certainly less intimidated by rowdy groups and am better at redirection and being firm when needed. My group management technique is mainly tailoring to the needs of the current students. I had one student who really wanted to relate everything to Spongebob so I found a way to relate my native plants talk to Spongebob.

I have gained a lot of knowledge and experience from this internship and I felt most prepared by Professor James Helfield's *ESCI 410: Habitat and Ecology of Pacific Salmon and Trout* course and Professor Leo Bodensteiner's *ESCI 411: A Field Practicum in Fish Habitat Assessment* course at Western Washington University. I took both of these courses the quarter before this internship and they both focused on Pacific Northwest stream characteristics and salmon. They introduced me to the freshwater side of environmental science and led me to this internship. Although these courses were directly related to the content of this internship, I felt my background in interdisciplinary classes also helped me. The energy courses, *Energy 101: Energy and Society* and *Energy 380: Energy and the Environment*, put into perspective the needs of

society and made me aware of possible environmental issues and solutions that arise. *ESCI 407: Forest Ecology* taught me about how plant communities flourish, perish, and change with time and environmental changes. While *ESCI 412: Fisheries Science* opened my eyes to the economic reliance on fisheries and how to better manage them. These are examples of classes that have taught me to see the world from different points of view when it comes to environmental issues.

I have learned that I enjoy a wide range of disciplines under the environmental science umbrella. I plan to have a career that has something to do with water. I know how broad that sounds, but my entire college career I have worked to dip my toes in many different parts of science to see where I fit best. Through this, I have learned that freshwater and marine-based science is where I enjoy the work the most. My dream job would include some aspects of environmental education or research. To get there I first want to complete the Data Science Certificate through Western Washington University after completing my Bachelor's degree. After that I plan to either get my Master's degree at Western Washington University or find a job within my field. That will be decided based on where the stream of life takes me. Either way, this internship has provided me with the knowledge, skills, and confidence to move forward in environmental science.

# Appendix A

## Details of Each Work Party

The first was a potting party at the NSEA campus where we worked with volunteers to restock the nursery with potted plants that get used for restoration projects. This was a rainy Saturday morning with only about five volunteers and a group from the senior center. I worked with another intern and together we potted 138 twinberry plants (Figure A1a).

The next work party I went to was basically someone's front lawn that bordered Starry Creek, which is a tributary of Ten Mile Creek that flows into the Nooksack River. The plot was about an acre and we used the half closest to the road to plant over 100 native plants to enhance the riparian buffer (Figure A1b).

The third work party was on Earth Day! Every intern was at this work party to aid the 210 volunteers that showed up to plant 1044 trees and shrubs. We were right on the Nooksack River on a restoration site that had trees planted in 2019, but the flood in 2021 caused a lot of mortality. We planted shrubs in the gaps of the already-established trees and planted new trees in the open areas. We interns worked furiously to keep up with mulching and blue-tubing what was planted. Afterward the Blackhawk dancers from the Lummi Nation gave a performance and speech that was very moving. We then headed back to NSEA to count all 1044 pots, clean all 210 shovels, and put everything away (Figure A1c).

The next work party was partnered with the City of Bellingham at Happy Valley Park to remove Himalayan blackberry. This site was difficult to access by truck in order to haul out the blackberry trimmings, so we tried a new technique that consisted of

creating on-site compost piles. We did this by creating latices that were no bigger than 6x6 feet with sticks and logs in places with adequate sunlight. This is meant to allow airflow under the pile and heat from the sun to speed up the rotting process. We then placed all the live clippings and roots of the invasive species on the piles. These will get flipped when ready and eventually will become usable mulch. Altogether we filled 16 compost piles and used all available mulch on the site (Figure A1d).

The last work party I attended was at a site owned by BP and was the site of the first work party of the spring 2023 season. Unfortunately, the areas where volunteers planted are now overrun by reed canary grass and himalayan blackberry. This work party took place in a patch of the field where large Himalayan blackberry bushes were plowed. Now all that is left is a pile of dried stems and the roots in the ground. This work party aimed to remove as much of the root system as possible (Figure A1e).

a) 

b) 

c) 

d) 

e) 

f) 


*Figure A1.* This group of pictures shows an image from each NSEA work party I attended. A) At the NSEA potting party as we filled a cart with planted twinberry plants. B) At Starry Creek this was the half of the yard that was designated for planting. C) The Earth Day work party on the Nooksack River showing a portion of the blue-tubed and mulched plants behind a pile of pots and tools. D) A compost pile of blackberry pulled from Happy Valley Park. E) The patch of dried himalayan blackberry stems at a site owned by BP. F) The flier used for the Spring 2023 Community Work Party schedule.

# Appendix B

## Details of Field Trip Locations

I attended a total of 20 field trips between March 28, 2023, and June 1, 2023. Each site was unique due to the land-use patterns present and the creek that runs through it. I visited various locations on six different creeks in Whatcom County.

Cedar Creek is a small creek in Ferndale, Washington that runs through a residential area just west of the Nooksack River. We frequent this site at Cedar Creek Park due to its short distance from many Elementary schools. Compared to other creeks, this one is much smaller (Figure B1a). The advantage of revisiting a site often was watching the plants bloom from unidentifiable sticks into blossoming full vegetation. This made the native plant station have more scavenger hunt options as spring commenced. Additionally, with many classes removing invasive blackberry, there is an immense difference between the blackberry patch over the past few months. Soon this site will be ready to have native plants planted. Some classes released their classroom-raised Chum Salmon, *Oncorhynchus keta,* into this creek. Each student named a salmon and got to pour them down the salmon slide into the creek (Figure B1b).

a)  b) 

*Figure B1*. a) This photo of Cedar Creek depicts how narrow and shallow it is. b) This is a photo of the slide where students pour a Chum Salmon fry down to release them into the creek.

Fishtrap Creek runs from near the Canadian Border and south through Lynden, Washington until it runs into the Nooksack River. Land use around this creek consists mainly of dairy farms, agriculture, and residential. Due to the land use, water quality is a substantial issue on this creek (Erickson, 1995). We observed that Fishtrap Creek has an orange hue to its sediment and organisms growing in the benthic environment. We hypothesized this has something to do with the heavy influence of dairy farms, agricultural inputs, and sewage waste from the large area that makes up Fishtrap Creek's watershed. Despite possible water quality issues, at both sites on this stream, Bender Fields (Figure B3) and Dickinson Park (Figure B2), we saw Coho Salmon parr (Figure B2b/c, B3c). At Bender Fields I saw a flatworm from its natural environment for the first time.

a)

b)

c)

*Figure B2.* a) A photo of Fishtrap Creek at Dickinson Park depicting rocks and sediment with an orange hue. b) A close up photo of a Coho Salmon parr, which is identified by the orange tail and black and white stripes of the anal and dorsal fin. c) This photo shows a few Coho Salmon parr camouflaging in with the sediment, but can be spotted by their shadows at this angle.

a)

b)

c)

*Figure B3.* a) A photo of Fishtrap creek at Bender Fields shows a similar orange hue to other sites on Fishtrap Creek. b) A photo of the flatworm found at Bender Fields on the macroinvertebrate station. c) A photo of a Coho Salmon Parr in Fishtrap Creek.

Kendall Creek Hatchery on Kendall Creek was this field trip site. This was a very salmon oriented field trip because we could see them jumping in the hatchery pools and students here got to release their classroom-raised Chum Salmon. I also found salmon vertebrae and jaw bones when collecting macroinvertebrates from the creek.

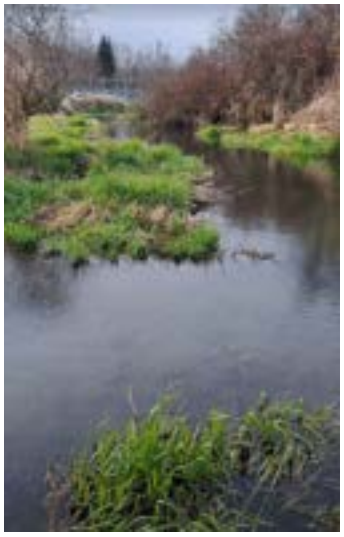
a)  b)  c) 

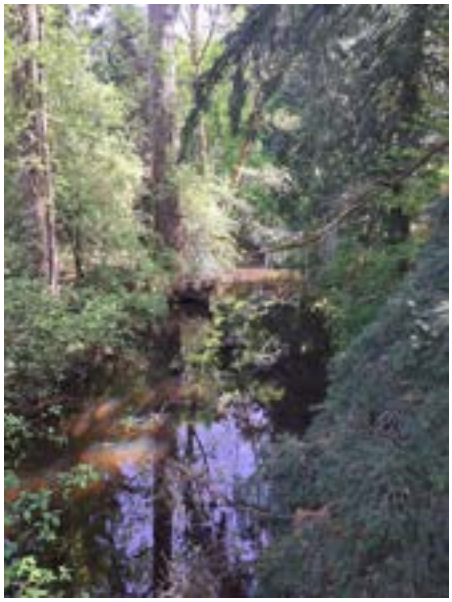
*Figure B4.* a) This photo depicts Kendall Creek with the Kendall Creek Hatchery in the distance at the top left corner. b) A photo of a cup of Chum Salmon fry raised by a fourth-grade class that are about to be released. c) A photo of salmon vertebrae and jaw bones in a dish that were found on the grassy banks of the creek.

This time we weren't at a creek, but at the mighty Nooksack River. The Nooksack river's forks begin in the North Cascades, until they all converge near Deming, WA. This river then flows through Lynden, then Ferndale, and finally into Bellingham Bay (Kleinknecht, 2019). The site on this river was called Riverside Park (Figure B5). Many of the plants here were native plants, but they were not species we had scavenger hunt cards (Figure 3) for. This site had insane amounts of knotweed, which is an invasive species that has bamboo-like green and red stems with large heart shaped leaves. These plants grow into large dense bushes that can cause erosion, foundation issues, and changed ecosystems. Like bamboo, this plant is hard to get rid of due to its substantial root systems and fast reproduction (King County, 2021). A field trip I was not on pulled over 300 pounds of knotweed, but if not completely eradicated it will grow back more intensely than before. So we decided to focus on the himalayan blackberry at this site for future field trips.

a)  b) 

*Figure B5.* Both photos, a and b, show the Nooksack River at Riverside Park from the rocky bank.

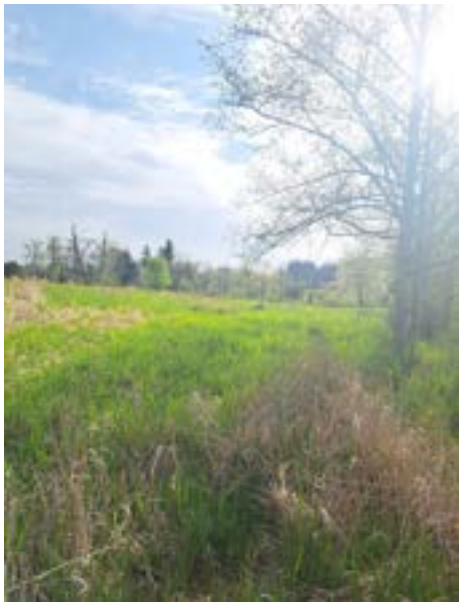
Squalicum Creek flows from Toad Lakes into Bellingham Bay and is one of the largest drainage basins in Whatcom County. This creek is home to Chum Salmon, Coho Salmon, and Chinook Salmon (NSEA, *Squalicum Creek,* 2023). Cornwall Park is owned by the City of Bellingham and is situated on Squalicum Creek (Figure B6a,b). Despite being in a residential area, this part of the creek seemed quite healthy with large woody debris, group two macroinvertebrate species (Figure 4), and lots of native plants. Restoration took place at a fence that was overgrown with himalayan blackberry. At macroinvertebrates we found a crawfish (Figure B6c), which I haven't found at other sites.

a)  b) 

c) 

*Figure B6.* a) This is a close up photo of the width of the Squalicum creek at Cornwall park stream showing the rocky bottom and vegetated banks. b) A photo of the length of the visible section of Squalicum Creek at Cornwall Park. c) The crawfish found in the creek at Cornwall Park.

Another site on Squalicum Creek is Ross Road. This is a dirt utility road situation just feet from the creek and is surrounded by various farms. The creek here was quite narrow with a steep bank that was covered in vegetation (Figure B7a). There was a large field where we planted native species as our restoration project (Figure B7b). Interesting macroinvertebrates at this site included a dobsonfly larva (Figure B7c) and a large stonefly larva that was missing one of its tails (Figure B7d).

a)  b) 

c)  d) 

*Figure B7. a) This photo shows the narrow part of Squalicum Creek at Ross Road with highly vegetated banks. b) A photo of the grassy field where restoration took place. c) Photo of a dobsonfly larva. d) A photo of a Stonefly larva missing its right tail.*

Terrell Creek begins at Lake Terrell and runs into Birch Bay. It is home to Chum Salmon, Coho Salmon, and many other species of wildlife (NSEA, *Terrell Creek,* 2023). The site we visited on this creek was Birch Bay State Park (Figure B8). Being so close to the bay itself, we were seeing estuarine species in our macroinvertebrate tows that we were unfamiliar with. Our best guess was lobster larvae due to the large front appendages (Figure B9a) and the estuary location. Upon further research, I discovered that they are a type of amphipod called mud scuds or more specifically, *Americorophium salmonis* (Figure B9a). These organisms live in the mud

flats of the puget sound and make U-shaped tubes in sediment like the other organisms in the family corophiidae. They are an important food source of juvenile salmon in estuaries (Hiebert, 2015). Also at the macroinvertebrate station, I caught two very small fish (Figure B9c) and a caddisfly larva (Figure B9b). The presence of the caddisfly larva, a group 1 species (Figure 4), indicates low pollution levels in the Terrell Creek. The water quality was fair, only because this stretch of creek was very shallow and slow moving so temperature and turbidity were slightly higher than the optimal ranges. There were more native plant species than invasive plant species, so it was a challenge for the students to correctly identify the himalayan blackberry we were removing.

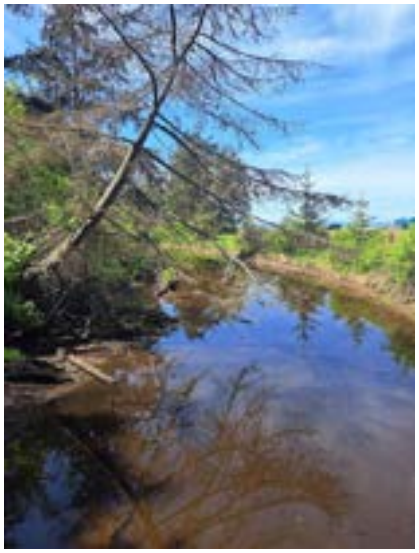
a)  b) 

*Figure B8.* Both pictures, a and b, were taken in Birch Bay State Park at Terrell Creek. a) This photo shows Birch bay. b) This photo shows Terrell Creek.

a)  b)  c) 

*Figure B9*. a) This photo shows the mud scud found in the estuarine environment. b) This photo shows a caddisfly larva in its shell that it makes from natural items it finds and binds it with a self-made glue. c) This photo shows one of the small fish that was caught in the macroinvertebrate tow.

Whatcom Creek flows from Lake Whatcom into Bellingham Bay and passes through Whatcom Falls park where we had our field trip site. Due to the size and inaccessibility to the creek itself, we remained in a grassy field to do our stations and observed the creek from above. We collected macroinvertebrates from Derby Pond.

a)  b) 

*Figure B10.* a) This photo depicts the d-net used for collecting macroinvertebrates in Derby Pond. b) This photo shows Whatcom Creek at Whatcom Falls Park.

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