2022

National Oceanographic and Atmospheric Adminstration (NOAA) Internship

Alexandra Studyvin
Western Washington University

COLLEGE OF THE ENVIRONMENT

WESTERN WASHINGTON UNIVERSITY
MAKE WAVES.

Internship Title: National Oceanic and Atmospheric Administration

Student Name: Alexandra Studyvin

Internship Dates: January 2022 to June 2022

STUDENT SIGNATURE Alexandra Studyvin

DATE: 3/27/2022

At the beginning of winter quarter 2022 I started my internship, and this internship was completed at the end of spring quarter of 2022. This internship was done with the National Oceanic and Atmospheric Administration (NOAA Fisheries). NOAA Fisheries are located across the United States, in areas such as Alaska and the Pacific Islands. My internship was done through the West Coast region, specifically working for the Northwest Fisheries Science Center. NOAA Fisheries goals include creating productive and sustainable fisheries, creating safe sources of seafood, recovering and conserving protected resources, and promoting healthy ecosystems. NOAA uses new sound science to support all these goals in order to have an "ecosystem-based approach to management". Specifically in the West Coast region (Northwest Fisheries Science Center and Southwest Fisheries Science Center) NOAAs goals are to apply new and improving science to manage the natural marine sources here in the Pacific NorthWest in a sustainable way.

For my internship with NOAA Fisheries I worked under Peter Kiffney, a research fish biologist who works for NOAA. The location I worked at for my internship was at Western Washington University using the school's lab rooms at the College of the Environment building. Dr. Kiffney works at the Northwest Fisheries Science Center for NOAA and has been a part of the Watershed Program since 1998. Dr. Kiffney's current research projects involve investigating the roles of tributary streams in relation to main stem rivers, riparian management of streams and rivers, and restoration of stream habitat. The project that I am helping work on for my internship is focused on the restoration of stream and river habitat.

The project that I am helping work on is the Cedar River salmon recolonization project. The project's goal is to assess changes within the river due to the implementation of the Landsburg Dam. In 1901 the Landsburg Dam was built on the Cedar River, preventing salmon

from migrating and accessing the rest of the river's reach. The addition of the dam removed approximately 43 km of habitat for salmon and steelhead trout. In 2003 a fish ladder was installed to the dam, allowing for fish to migrate. Since 2000 data has been collected on fish populations(salmon, trout, sculpin, invertebrates, e.) and other ecological factors (riparian vegetation, water chemistry, ect.). It has been noted that an increase of coho salmon population has occurred after the addition of the fish ladder and accounted for approximately 50% of the species biomass. The implementation of the fish ladder to the Landsburg Dam caused the coho salmon population to double, but the same is not true for sculpin and trout populations. Since the implementation of the fish ladder, there seems to have been no positive or negative effects on these two populations of fish (NOAA, n.d.).

Rock Creek tributary is a low gradient stream that provides great fish habitat where juvenile coho salmon primarily dominate in the creek. Although coho salmon have the largest population numbers in the creek, steelhead, cutthroat trout, rainbow trout (residential steelhead trout) and sculpin also reside in Rock Creek. Since 2004 Rock Creek has been observed to review restoration progress along with monitoring salmon and trout survival, growth and movement. The project's new focus is to assess other aspects for the restoration project, one new focus being monitoring fish diets. As water temperature of the streams, and river increases, fish's metabolism increases meaning they have an increased need for food. Water temperatures and the quantity of food affects the growth rate of juvenile salmon. Currently, research on fish diets is primarily done through laboratory experimentation; there is very little in-field research done. on this topic. NOAAs recent work for the recolonization of the Cedar River involves observing and attempting to better understand juvenile fish diets coming from invertebrate drift. The current goal of this project is to try to determine factors that affect invertebrate drift, in order to map out

scenarios involving climate change. More specifically, the study's focus is about how changes in invertebrate populations will affect fish diets. With the information obtained from this project, it can help guide other restoration projects.

For my internship I had to learn and memorize different invertebrate orders, classes, and the characteristics that define them. The orders I focused on were Diptera, caddisflies, mayflies, and stoneflies. For Diptera the common classes I was expected to see and recognize were Chironomidae, Simuliidae (black fly larvae), Blephariceridae, and Tipulidae. Diptera are identifiable by their false legs in their larvae stage and their halteres on the adults. Chironomids are best identified by their two pairs of prolegs. Simuliidae are best identified by their unique shape and mouth brushes (labral fans). Blephariceridae are best identified by their suctoral disks. Finally, Tipulidae are best identified by their reduced head capsule.

For Trichoptera (caddisflies) the common classes I was expected to see and recognize were Limnephilidae, Glossosomatidae, Rhyacophilidae, Hydropsychidae, and Brachycentridae. Caddisflies are best identified by their 3 pairs of segmented legs, prolegs with 1 claw, and casings built out of varying materials like pine needles or gravel. Limnephilidae are best identified by their first two hardened thoracic segments and their antennae between their eyes and mouth. Glossosomatidae are best identified by their unique saddle/tortoise shell shaped casing. Rhyacophilidae are best identified by their anal prolegs with claws and lack of casing. Hydropsychidae are best identified by their finely branched gills throughout their abdomen. Brachycentridae are best identified by their lack of humps on their abdomens, simple gills (sometimes lacking), and their finely lined casing (strips of material in an elongated casing). For Plecoptera (stoneflies) the common classes I was expected to see and recognize were Perlidae, Perlodidae, Chloroperlidae, and Nemouridae. Stoneflies are best identified by their long antenna,

three pairs of legs with two claws, and 2 tail filaments. Perlidae are best identified by their finely branched gills, white mark on head, and gold like color. Perlolidae are best identified by their similar appearance to the Perlidae but lack gills. Chloroperlidae are best identified by their elongated body, wide thorax, and short tail filaments. Nemouridae are best identified by their branched gills underneath their neck.

For Ephemeroptera (mayflies) the common classes I was expected to see and recognize were Baetidae, Heptageniidae, and Ephemerellidae. Mayflies are best identified by their gills that are on their abdomen and their number of tail filaments (2 to 3 depending on class). Baetidae and Ephemerellidae are extremely similar in looks, the best way to distinguish the different classes is if it has spiked segments of the abdomen they are in the Ephemerellidae class. Heptageniidae are best identified by their flat body structure. For each of these orders, I only needed to recognise aquatic invertebrates and group them by their order. Any other invertebrates, or other organisms found were sorted into a “other” category. So for example if a terrestrial Diptera was found it would go into the other category, and later be labeled (when measured) as terrestrial Diptera. Some of the “other” category invertebrates included mites, Collembola (springtails), wasps, spiders, adult beetles, beetle larvae, and Hemiptera.

My tasks for this internship included sorting through invertebrate drift samples, in order to pick out invertebrates and other organisms that I found. This involved sorting the organisms as described above. Once a sample is completely picked through for invertebrates, each order is taken out and sorted by class. They are then measured and the invertebrates head size is recorded. When going through samples and sorting out invertebrates, a dissecting microscope is used. One to three spoonfuls of the sample are put into a petri dish at a time (number of scoops depending on density of sample), to then comb through multiple times for invertebrates. After

each petri dish is combed through, found organisms are sorted into a small jar. They are then labeled by order, where the sample was from, and a sample date. The invertebrates were stored in 95% ethanol, in order to prevent decay. Some of the samples took up to 20 hours to complete, due to their high density of invertebrates. Once I was finished with the petri dish, leftover organic matter and ethanol were put into a waste jar. The petri dish was then rinsed with water and was ready to be used again. After the sample is completely gone through, each jar is separately emptied out into a petri dish and then each invertebrate/organism is sorted by class. Each organism is measured for its head size, using an attached scope with a micrometer on the microscope. If there were more than 25 of the invertebrates in a class, 25 are randomly sampled and measured while the rest is just counted for a total count. The sample site, sample date, invertebrate classes, head measurements, and total count are written on a printed spreadsheet. This data is later entered into a shared google sheet.

When first starting my internship under Dr. Kiffney, we went over my petri samples to ensure I did not miss any invertebrates. After one or two sessions of this practice, Dr. Kiffney was confident in my ability to comb through the drift samples alone without assistance. While I was still new to identifying invertebrates by their orders and classes, Dr. Kiffney would help me identify orders of invertebrates after I had finished combing through the samples. After a few sessions of Dr. Kiffney assisting me with samples, he felt confident letting me sort through the samples on my own. Dr. Kiffney allowed me to work in the lab on my own, while I was sorting through samples. Then we would meet once I had made significant progress, in order to review my work. He would also help me to identify some orders and classes I had trouble with. As time progressed during my internship, I became better at identifying different aquatic orders and

classes. I was also able to better identify some terrestrial invertebrates such as mites, wasps, hemiptera, spiders, beetles, and springtails.

As time progressed during my internship I better developed some new skills, as well as developed new ones. I developed skills such as identifying invertebrates, along with identifying fish. Additionally, I worked on fish dissection and measuring invertebrate sizes with micrometers. One skill I improved while in my internship is using microscopes. Before my internship I used microscopes in different lab classes, but they were briefly used. When doing my internship, I would be using a microscope for upwards of 4 hours at a time. My ability to focus and use a microscope for longer durations improved overtime, due to this internship. A skill I developed from my internship was learning about invertebrate taxonomy and being able to distinguish the different orders via their defining characteristics.Previously I only knew about one invertebrate order (Diptera) and didn't know what its key identifications/characteristics were. Working with Dr. Kiffney and his other intern also improved my communication skills while in the laboratory. Since I was unfamiliar with invertebrate taxonomy at the beginning of my internship, I was asking the other intern questions. Emma was more familiar with taxonomy and they would help clarify my questions when we were in the lab together. Being able to communicate with my peers is a crucial skill for me to have, and this internship has allowed me to strengthen my communication skills.

Like I mentioned previously, there was one other intern working under Dr. Kiffney at WWU. While working under Dr. Kiffney, Emma and I had separate projects. I worked on invertebrate drift samples, while Emma worked on dissecting and removing stomachs of sampled fish. Dr. Kiffney had me work on Emma's project, in order for me to develop my dissecting skills. For one session I assisted Emma with her work. When working with Emma we had to

create sample jars for each fish and label it with the site the fish was caught, sample date, total length of the fish (in mm), number of fish, and the type of fish (cutthroat trout, coho salmon, prickly sculpin, ect.). We made the labels right before each was dissected, right before dissection the fish were identified and measured. Since I was taking a field practicum fish habitat class at the same time as my internship, I was familiar with the fish we were working with. This allowed me to be able to identify the fish species without any assistance. After writing down the fish species and recording their total length, I would make an incision along the underside of the fish. This was done with a scalpel, then I would disconnect the stomach from the intestine and the esophagus. Once the stomach was disconnected, I would then put it into the prelabeled jar and fill it with 95% ethanol.

My original learning objectives were set at the beginning of my internship, specifically I set the learning goal of being able to identify and measure stream invertebrates collected via drift samples. Identification of invertebrates included identifying down to the family level for Plecoptera, Trichoptera and Ephemeroptera. With being able to identify the order level for Diptera, Hemiptera, and terrestrial invertebrates. My other learning goal was measuring, specifically learning how to measure invertebrates. Measuring invertebrates allowed me to collect data to use later for calculating biomass via body size-mass regression. Now I know how to identify different classes/families/orders for Diptera, Hemiptera, Plecoptera, Trichoptera and Ephemeroptera. Additionally, I learned how to measure invertebrates head sizes using an attached scope with a micrometer on my dissecting microscope. I believe that I have met the objectives that I set at the beginning of my internship.

The coursework for my major in Environmental Science, with an emphasis in freshwater and terrestrial ecology, allowed me to have a base knowledge on different subjects in the field.

With most of my classes having labs, I was able to apply what I've learned in my course work to my field work. Although some classes did contain labs/in field work, most of my major classes did not. Working under Dr. Kiffney not only provided me with more lab experience, it also provided me with work experience in a field I hope to work in one day. Being able to get more lab hours under my belt, as well as interning for a well known and established federal agency helped to provide me with experience. I was able to apply my knowledge that I had obtained from school to my internship. During my internship I took the opportunity to learn new things as well. With the courses I have taken through WWU and the internship I have done under Dr. Kiffney, I have gained knowledge, lab experience, field experience, and work experience all within the field I wish to pursue with my major. With these new skills I feel as though I would be successful in pursuing my career options, as well as continuing my education in this field.

I greatly appreciate the opportunity I was given to work under Dr. Kiffney, and I thoroughly enjoyed the work that I did. I feel like this internship has given me a step in the right direction, for both my future education and future career. I honestly wish that I could continue to intern for Dr. Kiffney and continue to work on this fascinating research project. I care deeply about the restoration of Cedar River and our scientific understanding about fish diets. Nonetheless, I greatly appreciate the knowledge and experience I gained from this internship and I hope to continue doing similar work in the future.

References

National Oceanic and Atmospheric Administration Fisheries. (n.d.). *Recolonization of the Cedar River, WA by Pacific salmon*. NOAA Fisheries science center public access to research results data inventory.

https://www.webapps.nwfsc.noaa.gov/apex/parrdata/inventory/projects/project/725