2022

Skagit Fisheries Enhancement Group (SFEG) Spawning Survey Internship

Tana Smallwood
Western Washington University

COLLEGE OF THE ENVIRONMENT

WESTERN WASHINGTON UNIVERSITY
MAKE WAVES.

Internship Title: Spawner Surveys - SFEG

Student Name: Tana Smallwood

Internship Dates: Oct. 2, 2021 – Jan. 31, 2022

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STUDENT SIGNATURE Tana Smallwood

DATE: February 24, 2022

Internship/Learning Agreement

Section 1 – Student Identification			
Last Name, First Name:	Smallwood, Tana	Western ID:	W01416468
Email Address	smallwt@wwu.edu	Major/PreMajor	Environmental Science, Freshwater and Terrestrial Ecology

Section 2 – Registration Information			
Total Credits:	5	Faculty Advisor:	Leo Bodensteiner
Internship Start Date:	September 02, 2021	Internship End Date:	December 2021
Number Credits Per Quarter (F/W/S/Sum)		5F	

*Note: You must be registered for credits during quarters you perform **any part** of the internship work (Including Summer Session) to include writing of reports…this can be spread over multiple quarters. You are expected to register an appropriate number of credits based on anticipated hours worked BY Quarter (Example: Working 120 hours during Summer = 4 Credits Summer Enrollment)*

Section 3 – Organization for Internship	
Organization Name:	Skagit Fisheries Enhancement Group
Intern Supervisor Name:	Erin Matthews
Mailing Address:	PO Box 2497 Mount Vernon, WA 98273
Email Address:	ematthews@skagitfisheries.org
Phone Number:	360-336-0172

Description of Duties (Or Attach Job Description):

Spawner Surveyors monitor past, present, and potential project sites–places where SFEG has done or wants to do habitat restoration of some kind.

Tasks include:
- Counting salmon (dead and alive)
- Identifying salmon species seen
- Marking redd locations
- Determining spawning status of dead salmon

Section 4 – Learning Objectives

What do I intend to learn from this experience:

I will be able to observe an array of stream conditions and report my findings to Skagit Fisheries. I intend to learn how to properly identify different salmon species both in the water and in varying stages of decomposition on the bank. I will be able to identify and properly mark redds. I will assess whether a fish has spawned successfully, and collect this data to compare this year's spawn with previous years.

How does this experience contribute to my educational goals:

My goal is to gain hands-on experience while learning about salmon biology, habitat, and spawning patterns. This experience can help to build my knowledge in stream ecology, familiarizing me with multiple methods to assess stream conditions. I can make connections between both past courses and future work to understand the dynamics of these interactions.

If Faculty require any additional Learning Objectives, they should be listed here:

Section 5 - Deadlines, Evaluation, and Assessment (Completed by faculty advisor)

Meet with Advisor: 11-20

First Draft Due: 11-22

Final Draft Due: 12-6

	Yes	No
Additional Learning Objectives (as assigned by faculty)	○	◉
Oral Presentation Required	○	◉
Daily/Weekly Log Require	○	◉

Section 6 – Students Certification

I certify that I have read the University Policy on Risk Management Considerations for Student Internships and I will report any injuries suffered while performing internship promptly to WWU.
http://www.wwu.edu/bfa/Risk_Mgmt/documents/Internship%20Considerations%20(14).pdf

I will endeavor to represent myself and my college well and will abide by the relevant policies, procedures and ethical standards of the university and the internship organization.

I understand that 30-hours of work per credit earned is expected for an internship. I understand that I am expected to enroll in a number of credits commensurate with hours worked each quarter.

Student's Signature/Date	Tara Smallwood October 20, 2021

Section 7 – Internship Site Supervisor Certification

I have reviewed the student's indicated learning objectives and on behalf of my organization agree:

- To enrich the Student's knowledge by orienting him/her to the occupation, the work setting, and the responsibilities relating to the assignment
- To regularly evaluate/provide feedback to student on progress, projects and areas of growth
- At or near the completion of the assignment to provide an evaluation of the student's performance
- To review and approve the Student's Learning Plan and communicate with Huxley College if areas are not going to be met.
- To supply the student with, and abide by the organization's policy against discrimination and/or harassment in the workplace
- To contact the instructor or the Huxley Internship Coordinator (360) 650-3646, ed.weber@wwu.edu should any problems arise

Internship Site Supervisor Signature/Date	

Section 8 – Faculty Advisor Certification

I certify that the student intern and I have reached agreement on the learning objectives and academic expectations for this experience. These objectives are challenging and enriching to the student's academic and/or career goals. I will award grades after satisfactory completion of all learning objectives/tasks/reports assigned and load final internship report onto the Huxley Server. *P:\Huxley\PUBLIC_folders\COLLEGE_OFFICE\Intern_Reports*

Faculty Advisor's Signature/Date	

Section 9 – Huxley College Internship Coordinator

Actions:

1. Review Agreement
2. Update Course Override
3. File Agreement in Student Records
4. Communicate with Employers as necessary during internship

Registering and Completing ENVS/ESCI 498B Credits

YOU MUST BE REGISTERED FOR INTERNSHIP CREDITS WHENEVER YOU ARE PERFORMING WORK RELATED TO THE INTERNSHIP TO RECEIVE ACADEMIC CREDIT

- This **INCLUDES** Summer Sessions

REQUEST FACULTY MEMBER TO OVERSEE 498B CREDITS

- The CRNs for ENVS/ESCI 498B credits are linked to Huxley faculty members
- Students need to speak with the faculty member for these credits
    - If possible, students should have a draft of an Internship/Learning Agreement completed before they approach a faculty member to supervise the internship.
    - Most students use their faculty academic advisor as their faculty internship supervisor
        - During Summer Sessions, your faculty advisor may not be available. If not, then register for internship credits with Ed Weber, Huxley Internship Coordinator
- Environmental Science students register for ESCI 498b and all others for ENVS 498b
- Registration for 498B (Internship Credits) requires an override, which is normally given by Huxley College Internship Coordinator (Ed Weber, ES545)
    - You should have a completed/signed Huxley Learning/Internship Agreement signed before the override will be input

CRNS FOR ENVS/ESCI 498B

- See Classfinder for the CRNs for ENVS/ESCI 498B Internship credits
    - During Summer Sessions, if you faculty advisor is not listed, please register for credits with Ed Weber, Huxley College Internship Coordinator

VARIABLE CREDIT REGISTRATION ON WEB

- Initially you can only register for one credit.
- Return to the registration menu after registering. Then go to Change Variable Credits to change the 1 credit to the number of credits desired. (Instructions for Changing Variable Credits are included on the Add/Drop page for registering.)

RESOLVING K GRADES

- To graduate, you must receive a passing grade for any credits listed on your major evaluation.
- (For Internship, students must receive a Satisfactory (S) for S/U grading. **Incomplete grades not completed and graded after a year from the quarter of registration automatically become a U (Unsatisfactory) or a Z (equivalent to an F). Incompletes can impact financial aid standing.**

REPORT SUBMISSION

- Always consult with the faculty advisor **in advance** about how much time he/she will need to read and grade the report by the end of the graduation quarter.
    - The most difficult time to get a grade on a report is for summer quarter graduation because faculty are generally not available during this time.
    - Spring graduation is a close second in difficulty because many faculty leave campus for extended periods after their last final.

- Students with incomplete K grades on 498B credits should provide a list of quarters with K grades to the faculty advisor with the submitted report to ensure proper grading credit. Information to provide: Student Name, Student Number, Name of Course (i.e., ESCI 498B), Quarter(s) of K grade, Number of credits of K grade per quarter.

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Student's Signature/Date	Tara Smallwood October 20, 2021

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Internship Site Supervisor Signature/Date	Eli Matthews October 27th 2021

Section 8 – Faculty Advisor Certification

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Faculty Advisor's Signature/Date	Leo Bodensteiner	Digitally signed by Leo Bodensteiner Date: 2021.10.25 09:52:29 -07'00'

Section 9 – Huxley College Internship Coordinator

Actions:

1. Review Agreement
2. Update Course Override
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4. Communicate with Employers as necessary during internship

Tana Smallwood

Skagit Fisheries Enhancement Group

1202 S 2nd Street

Unit C

Mount Vernon, WA 98273

Habitat Restoration Coordinator: Erin Matthews

Salmon Spawner Surveys with

Skagit Fisheries Enhancement Group

Western Washington University's Environmental Science department works toward getting students involved early on, requiring work such as research projects and internship programs. Many students, I know, appreciate the push to get involved before they graduate from the Environmental Science Program. However, searching for an internship amid the impacts of the COVID-19 was often frustrating for many students. Planning on interning the summer of 2021 may have been hopeful. Many positions were cancelled for the summer, and the ones that were not were quickly filled due to the fraction of openings per internship seeker. By the end of the summer, I was still searching for an internship program, finding that I would graduate one quarter earlier than planned- in winter of 2022. I found a program, Skagit Fisheries Enhancement Group, or SFEG, that works with the Washington Department of Fish and Wildlife, tracking data trends on salmon in Skagit River tributaries as well as other streams in Skagit County.

Skagit Fisheries Enhancement Group

I had never heard of SFEG; reading into their site, I found that this program had values that align with my personal ideas. Skagit Fisheries Enhancement Group states their main objective: "We envision a healthy watershed ecosystem with abundant and self-sustaining wild salmonid populations in our region enjoyed by present and future generations" (About SFEG, 2021). The simple yet straightforward vision stood out to me. It seemed broad, yet goal-oriented. Salmon are integral in maintaining the function of our river systems as well as the function of our local Salish Sea. I searched their site for an internship opportunity and found that SFEG, in fact, had a paid internship starting at the beginning of October, less than a month later. I applied for the Spawner Survey Internship, soon to find out by SFEG's Habitat Restoration Coordinator, Erin Matthews, that the internship

opposed my school schedule for fall quarter of 2021. The good news, coming from the same application rejection email, was that anyone is welcome to volunteer for Spawner Surveys.

Spawner surveys are common where watersheds need to be monitored for salmonid or other fish activity over time. Changes in abundance of spawning salmon may be due to human activity as well as may develop naturally. Often, streams and rivers are monitored as projects occur to determine the effects that watershed enhancements have on the success of the salmon. When surveying a stream, teams work together to keep watch for salmon, redds, and carcasses. Recording this data for the Skagit and Samish River tributaries can help the Washington Department of Fish and Wildlife to determine both short- and long-term changes in salmon population and spawning success. SFEG is active when it comes to maintaining healthy watersheds. Not only do they survey for salmon activity, but they also often hold events such as community education outreach workshops and work parties for planting native vegetation and removing invasive vegetation near rivers and streams (*Volunteer Opportunities* 2021). A plant nursery, containing native species of vegetation is monitored and maintained in Burlington, Washington for use during vegetation planting parties. Finding that SFEG had action-oriented values similar to mine, I was thrilled to have the opportunity to learn more about our area's five species of pacific salmon and their local habitats, and to be able to do most of this learning in the field. I signed up to volunteer for the spawner surveying season, recruiting Janelle Vu, a friend that is also in Western's Environmental Science program with a similar interest in fish ecology. I was anxious to begin my work with this program, seeking new experiences that apply to my field of education.

Internship Goals

Beginning my volunteer work, my goals were not only to learn more about the salmon, but how the ecosystem relies on the success of the spawning season. I wanted hands-on experience that enabled me to guide my learning through my own curiosity. Knowing little about my stream, I planned on actively observing the functions of the stream system, paying close attention to flora and fauna as well as changes in the system through the season. More specifically than stream and salmon function in their ecosystem, one goal was to be able to correctly identify salmon species and salmon redds in an array of stream conditions including muddy, turbid, or even flooded streams. I intended to learn how to properly execute a carcass dissection in order to determine sex and spawning status. I was also curious if I would be able to recognize spawning patterns and fish behavior by the end of the season. I intended to use my knowledge from previous courses that I have taken at Western Washington University such as Stream Ecology and Biology of Fishes, and apply what I have learned in a classroom setting to the field.

Stream Assignment

SFEG held a training session that allowed for new surveyors to learn about the identification of salmon species and redds, dissection to determine spawning status, data collection, and field safety. I received training and immediately signed up to get assigned to a stream for the season. Originally, I was assigned to Carpenter and English Creek- located in Mount Vernon, Washington- surveying a stretch of each creek near the point where they intersect. Carpenter and English Creek were projected to support major increases in salmon abundance and success due to recent projects. In 2019, a small culvert was removed from Carpenter Creek and replaced with a large bridge in efforts to making the entirety of both creeks accessible to salmon (Degrace, 2021). Shortly after surveys began, I was asked to adopt Parson Creek alongside the Mount Vernon creeks. I quickly accepted, learning from Erin Matthews that Parson Creek tends to support a large population of spawning salmon. Parson Creek is located south of Alger, Washington, and flows into the Samish River. A stretch of each of the three creeks was to be monitored weekly. Surveys began October 9th of 2021 and were to run until two surveys had been completed without sight of any live salmon or carcasses.

In order to execute a successful survey, all team members must keep watch on the water and on the banks. Depending on the creek, it may be easier to walk in the water rather than on the bank. When walking in the stream, extra caution must be taken to avoid stepping on redds, nests where the salmon have laid and buried their eggs. At both of my creek assignments, it was often a mix between both. When the bank is steep and the brush is thick, walking in the stream was the only option. It was vital that I watched my step while I was in the water. My team looked down near our feet for resting salmon and redds. Looking ahead at the stream, I searched for fins at the water line as well as redds. Keeping an eye on the bank seemed unnatural at first, but it is extremely important that salmon carcasses are found and investigated. Stretches of these creeks are always walked from downstream to upstream; the silt that surveyors' boots kick up can make the water downstream cloudy. It is generally easier to spot and identify fish and redds in clear, slow, shallow streams. When salmon are moving, it is easier to keep count and identify the species when everything is visible rather than clouded.

Species Identification

When surveys first began, I was inexperienced in identifying salmon, let alone fish that I could hardly see through the water. Seeing not a single salmon in the first week or two was discouraging, and I started to doubt that many salmon would show in my creeks. I quickly learned to never doubt salmon again. Soon enough, my team was counting up to 85 salmon on a stretch less than one mile long. On both assigned creeks, the majority of the fish recorded were coho (*Oncorhynchus kisutch*). Rarely, the team would spot chum (*Oncorhynchus keta*) and chinook (*Oncorhynchus tshawytscha*). Filling in for another team surveying Cumberland Creek near Hamilton, Washington, I got to identify quite a few pinks (*Oncorhynchus gorbuscha*). I did not get the chance to see a sockeye salmon (*Oncorhynchus nerka*) during my assignments with SFEG.

Identifying these five species can be difficult especially when the water is not clear, or the fish are hidden or moving. The spawning adults of each species have distinguishing markings that became much easier to identify with practice as the season went on. I found that a few easy rules worked for my team and I, keeping in mind that coho were the most present in our streams.

*Coho (*Oncorhynchus kisutch*)*

Seeing hundreds of spawning coho through this season, I learned that they are easiest identifiable by their white nostrils. Along with their darker heads and dorsal sides, coho can have silvery or maroon to deep red bodies with spots down their back and on the top half of their tails only.

*Chinook (*Oncorhynchus tshawytscha*)*

The chinook salmon that my group identified were often greener than the coho, with spots on the entire tail. It was surprisingly easy to sneak up on a live salmon and check their tail by bringing it closer to the water's surface if not completely out of the water. Chinook have dark nostrils and one main identifier is their black gums, contrary to the white gums of a coho.

*Chum (*Oncorhynchus keta*)*

The chum were a rare sight, only seen one week at Parson Creek. The four of them were easily distinguishable by the vertical stripes; they were in such a shallow part of the creek that a majority of their body was out of the water.

*Pink (*Oncorhynchus gorbuscha*)*

On and near the banks of Cumberland Creek, I found quite a few carcasses that I identified as pink salmon. Although these carcasses were fairly decomposed and covered in fungus, the prominent hump of a spawning pink salmon was highly visible. Pinks are the most common salmon in this creek as well.

*Sockeye (*Oncorhynchus nerka*)*

Although I did not see any sockeye this season, spawning sockeye are identifiable by their dark green head and deep red body. There is a distinct change in color beginning at the operculum, the gill cover.

Behavior

There are certain features in a stream that salmon often prefer. If they are running, or moving upstream, they will likely be close to the water's surface and moving. Other times, they will be resting in pooled, slower-moving water close to the bank, often under a tree or log. Salmon become very weak from swimming upstream to spawn, and almost always die soon after spawning. This can make salmon somewhat docile and weak in their final days, allowing the previously mentioned handling of the tail. It is common to see a mating pair over or near a potential redd. Spawning males will fight over a female to be the first one to fertilize her eggs, pushing the other male away from the female. A single female could be seen guarding a redd with eggs in it if it still has the energy.

Identifying Redds

(Coho redd, 2020) This photo depicts a completed redd with rocks and gravel turned over by a spawning female coho.

Redds, nests for salmon eggs, are built by female salmon. With its tail, a female salmon will dig up a small bowl into the gravel at the bottom of a river. During spawning, female salmon tails are often extremely damaged, turning white or tan with little to no markings or color. Once the nest is dug out, the female salmon then lays its eggs in the depression and the eggs are fertilized with milt, the sperm from a male salmon. The female salmon will then cover the eggs with just enough gravel. Too much will not allow for enough oxygen, and too little would expose the eggs to predators as well as allow eggs to get washed out. Redds are often in moderately shallow locations near the middle of a stream; slower moving water in pools, for example, does not contain enough oxygen. Water near the banks can be too shallow and low in oxygen. Immediately identifying a redd can be a difficult task. I look for an oblong group of rocks that have been turned over just downstream from a depression in the gravel. This depression was left behind by a female covering her eggs.

Mortality

This photo depicts a male coho carcass measuring nearly 70 centimeters.

When a carcass is found during a survey, there are steps to follow in order to record the correct data successfully. The first thing to do is move the fish to the bank if it is not already and lay it out so that you can get an accurate measurement. The fork length for SFEG is taken in centimeters from the tip of the nose

to the fork in the tail at the lowest point of the caudal fin. Once measurements are taken, the sex of the fish must be determined. A prominent kype or hooked jaw is often telling that the salmon is male, but the fish must be cut open to confirm sex and spawning status. Starting from the vent, a slit must be cut into the fish's underside, exposing the abdominal cavity. Here, there are a number of things that can present. If the salmon is male and has successfully spawned, you will see empty tubes, testes, that were full of milt at one time. If they are full, the salmon did not successfully spawn before mortality. If the salmon is female and has spawned successfully, there may be an empty cavity with no eggs. However, seeing just a few eggs left would count as a successful spawn.

This photo depicts the abdominal cavity of a male coho carcass that has successfully spawned.

This photo depicts the carcass of a female coho that still has a bulging abdomen full of eggs.

You may come across a female carcass that is still full of eggs. This fish died before it spawned. Unsuccessful spawning for both male and female salmon is called pre-spawn mortality or PSM. Only one PSM was identified this season at my assigned creeks. PSM is rare in many places and is thought to be caused by water temperature or stormwater runoff (Baldwin et al., 2014). However, PSM was very rare in the creeks I visited, making the one case an exciting find. After the cavity has been examined, and data has been taken, the tail must be cut off at the caudal peduncle. This practice was put in place so that salmon are not counted again if found a week later downstream. My team did our best to put the carcass back where we found it. Salmon carcasses can provide large amounts of nutrients for the stream and the surrounding area, so we did not want to alter the natural course of the nutrients.

Seasonal Changes

Through the season, I noticed so many changes in the streams, and the vegetation surrounding them. During the flood events in November, so many changes took place at each of the streams. For a couple of weeks, the water was so clouded with clay that we could not see into the first inch of it. Erosion upstream had spiked due to the great amounts of runoff and landslides. The next time we surveyed, it was difficult for my team to recognize where we were. There were portions of the creek that had changed course. Piles of rocks were pushed where they were not present before. Many trees had fallen across the stream and our path. We spent a great amount of

time clearing a new trail and did even more climbing and crawling than we did before. Redds that we had marked seemed completely washed away. It seemed that salmon had slowed their run waiting for the water to clear up and slow down; after the flood events, our numbers declined, even with the reestablishment of clear water in the weeks following.

Application to Long-Term Goals

I, personally, believe that I went beyond achieving my goals for this work. Achieving my goals during my time with SFEG set me up for success in my future goals. My interest in freshwater and terrestrial ecology partially stems from my background. My father is a fisherman and has always included my family in his hobby. With a lifelong interest in fish and wildlife, I decided to see where a path in environmental science could take me. I am interested in the ways in which human needs can coincide with that of nature. This experience has increased my confidence in my work both in school and in my career. Before this work, I did not feel knowledgeable enough to even believe that I qualified for environmental jobs. My time at WWU has provided me with enough tools to straighten the learning curve that may come with future opportunities. I have learned that catching on can be one of the most rewarding parts about an experience like this rather than the intimidating part.

Citations

About SFEG. Skagit Fisheries Enhancement Group. (2021, November 3). Retrieved March 17, 2022, from https://www.skagitfisheries.org/about-2/

Baldwin, D. H., Spromberg, J., Davis, J. W., Damm, S., McIntyre, J. K., & Scholz, N. L. (2014). Symptoms of adult coho salmon pre-spawn mortality are not produced by exposures to artificial mixtures of metals and PAHs.

Coho redd. (2020). [Photograph]. National Park Service. https://www.nps.gov/articles/slow-start-to-2019-2020-coho-spawning-season.htm

Degrace, L. (2021, June 24). *A Collaborative Effort to Restore Fish Passage in Carpenter Creek*. Skagit Fisheries Enhancement Group. Retrieved March 17, 2022, from http://www.skagitfisheries.org/wp-content/uploads/2019/10/SFEGnewsFallWinter_2019.pdf

Volunteer Opportunities. Skagit Fisheries Enhancement Group. (2021, November 24). Retrieved March 17, 2022, from https://www.skagitfisheries.org/volunteer/