Trout, Salmon, and Shrimp:
Research Experiences with the Fish Wildlife and Parks in Montana

Ashlin Stahlberg

Marine Science Department
University of Hawai‘i at Hilo

MOP Advisor
Professor Lisa Parr
Marine Science Department University of Hawai‘i at Hilo

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Trout, Salmon and Shrimp: Research Experiences with the Fish Wildlife and Parks in Montana

Abstract:
The ecosystem of Northwest Montana is under threat from human interaction. To understand the negative effects humans have had on the unique ecosystem, the Fish, Wildlife, and Parks monitors the land and water resources. The internship I participated with the Montana state Fish, Wildlife, and Parks was located in the Flathead Valley, Montana. Fish, Wildlife, and Parks has many different responsibilities within the state, overseeing hunting, fishing, and recreational use of state land. I worked with the Fisheries department, where the main responsibilities of my internship involved analysis of substrate samples, using electrofishing to conduct population surveys, checking fish traps, and working with the Sekokini Fish Hatchery. Plankton tows were also conducted to check the population of the invasive Mysis shrimp. Substrate samples from streams were analyzed to gauge the health of those streams for fish eggs because the percentage of small grains to larger gravel determined the likelihood of fish eggs to survive to emergence. The majority of streams surveyed were good habitat for fish spawning and egg survival. Electrofishing surveys were used to observe the population of the native and endangered Bull Trout (Salvinius confluentus). Fish live traps also helped track the movements of native species such as Bull Trout and Westslope Cutthroat Trout, as well as the spread of invasive species. Fyke traps were set in Lake Mary Ronan to investigate the population of illegally introduced Northern Pike (Esox lucius). No pike were captured in these traps, so their numbers and distribution throughout the lake are still uncertain. With Sekokini Fish hatchery I assisted in spawning native Westslope Cutthroat trout (Oncorhynchus clarki lewisi) and monitored the condition of the maturing eggs. Through this work I learned about management techniques and methods to control invasive species.

Introduction:
The ecosystem of lakes in the Northwest United States is threatened by man-made interference. Dams and the introduction of non-native species have negative effects on fish and other wildlife in the area, from bears to eagles (Muhlfeld et al. 2012, Spencer 1991). Throughout the Northwest United States the populations of native species such as cutthroat trout (Oncorhynchus clarkia lewisi) and the endangered bull trout (Salvelinus confluentus) are threatened by non-native species including lake trout (Salvelinus namaycush) and rainbow trout (Oncorhynchus mykiss) (Muhlfeld Giersch and Marotz 2012, Peterson 2004, Wiegel 2003). Native bull trout can be negatively affected by human building and development in an area (Dunham 1999).

Human manipulation of the food chain has created problems for other native species in the Northwest area also. The arrival of Opossum shrimp, Mysis, which was introduced with the intent of boosting salmon populations in Flathead Lake, Montana, ended up destroying the population of salmon. The shrimp were intended to be a food source for the salmon, but, despite the best motives, the introduction resulted in the Mysis shrimp consuming the zooplankton and
removing the salmon’s food sources. The disappearance of the salmon disrupted the population of bears and resulted in the mass movement of the eagle population, which previously had fed on the salmon (Spencer 1991). A further threat to native species in the Flathead area is the hydroelectric dam on the Flathead River. This dam changes normal seasonal flooding patterns of the river, which can have negative effects on the trout populations (Muhlfeld et. al. 2012).

While humans have had a mostly negative impact on the ecosystem, it is possible to prevent and mitigate those effects. As part of understanding populations of fish, especially endangered species, it is necessary to investigate the quality of spawning habitats. Taking substrate samples is one way to determine the quality of spawning streams for trout. The percentage of fine sediment to coarser gravel determines the amount of oxygen that will reach the developing eggs in the gravel and therefore the amount of eggs that will survive to emergence.

Because of the significant effects humans have had on the ecosystem it is important to monitor the populations of both native and non-native species and their ecosystem. This information will be used to write fishing regulations and inform future policies of land use. As a summer intern with Fish, Wildlife, and Parks in Kalispell, Montana, I helped monitor these populations and conduct research about their habitats.

Objectives:
My goals through this internship were to gain experience in analyzing substrate samples, in electrofishing, tagging, and other population survey techniques, as well as learn about monitoring and the control of invasive species.

Methods and Materials:
Study site:
I worked with the Fisheries department of the state Fish, Wildlife, and Parks, (FWP) in the Flathead Valley of Kalispell, Montana. The goal of FWP is to preserve the ecosystem for future generations to enjoy and to manage responsibly the wildlife and natural resources. There are several major branches of the FWP, which are Wildlife, Fisheries, and Enforcement. The physical location includes a large office where the public can come to learn about the ecosystem, get information on hunting and fishing permits; as well as a large garage area where the boats, vehicles, nets, live traps, and other equipment were stored. The facility also included a small lab equipped with several types of microscopes, scales, vials, water equipment, and other instruments. The responsibilities of the whole organization include writing hunting regulations, fishing regulations, public education, research, and enforcing regulations. The state is divided into seven regions and I worked in Region 1. The management area includes Flathead Lake, all forks of the Flathead River, and the Hungry Horse reservoir on the South Fork, Jewel Basin, and
Swan Lake drainage. The terrain is mountainous covered in pine forest with high alpine lakes.

![Map of Montana with FWP regions](image)

Fig. 1 Map of the state of Montana with different FWP regions labelled. Region 1 is the Flathead region.

My responsibilities at Fish, Wildlife, and Parks involved many different projects with multiple persons within the Fisheries department. I was an intern with Tom Weaver, research specialist. I also worked with Jon Cavigli, Scott Hawxhurst, Leo Rosenthal, and Amber Steed as part of the Fisheries Department. Analysis of substrate samples, checking fish and fry traps, setting gill nets, working with Sekokini Fish Hatchery, mounting fish scales, conducting surveys for Mysis shrimp, bathymetric surveying, posting signs to educate the public, electrofishing, and data entry were all part of my experience. During the internship I documented the work done with photographs and journal entries. I have a record of the lakes and methods used to sample them, as well as photographs of the sites.

Substrate Analysis:

As part of the effort to monitor the quality of spawning streams, substrate samples taken needed to be analyzed by sorting the samples by grain size by drying each sample. I did all of this by removing the samples from their plastic bags, spreading them on broad trays and placing them in the oven to dry overnight, then putting each sample through a series of progressively smaller sieves. The gravel samples would be swept into stacks of gradually smaller sieves to sort the samples by size. The sieves would be shaken by machine for 12 minutes to make sure the gravel was settled into the correct size. Each size of gravel was weighed and recorded. The percent composition of fine grains (under 6.35 mm) to coarser sediment provides the ability to predict the survival-to-emergence percentage of fish eggs.

Population surveys:

Population estimates and surveys were an important part of my internship. The three different types of population surveys: electrofishing, fish traps, and gill nets. Population estimates of fish were conducted in several areas around the Flathead Valley by electrofishing. The east side of Hungry Horse Reservoir and the Jewel Basin/ Swan Lake area were places where I assisted in taking population estimates using backpack electroshockers. An area of the stream 150 yards was measured off and a block net was placed at the downstream end of the area. Then we proceeded downstream and collect all
the fish stunned by the shock. My supervisor would carry the backpack electrofisher. The backpack had a long rod attached, which the person would hold and run through the water to send out the electric shock. I would walk in front to catch the stunned fish and carried them in a bucket of water. After we shocked the entire section we weighed the fish, and I recorded the length, mass, and species of each fish we caught.

Another kind of electrofishing was done with a boat. This kind of electrofishing was used in rivers for similar purposes, to monitor species population and diversity. The electric current was sent into the water through long wires off the front of the boat. This method was also used in Lake Mary Ronan to attempt to find a population of illegally introduced Northern Pike.

Fish traps were set on several streams to monitor fish migration and hybridization. The traps were essentially mesh cones spanning the width of the stream that led into mesh boxes. The boxes were about 3-4 feet across and the fish would swim in and be unable to escape. Westslope Cutthroat Trout and Rainbow trout caught in these traps in the streams of the North Fork Flathead River drainage were tagged and a DNA sample was taken. The DNA was sent to a lab to determine if the fish was a Cutthroat/Rainbow hybrid. I assisted in checking the fish traps and periodically cleaning them of debris. Fyke traps are another type of fish trap that was used on Lake Mary Ronan to catch invasive Northern Pike. I assisted in setting, retrieving, and repairing these traps, as well as recording the fish caught in them.

Gill nets were set in lakes, such as Beaver Lake, to monitor the population of Rainbow trout and Kokanee salmon. I assisted in setting these nets and then pulling them out again after a set amount of time, usually overnight. Then we untangled the fish from the nets so they could be counted, weighed, and recorded.

Populations of some plankton species are also monitored. Mysis shrimp are a problem species in Northwest Montana. Since Mysis are firmly established, FWP checks their population by conducting plankton tows. On Swan Lake I helped take the survey by pulling the plankton nets and counting the Mysis collected.

Fish Hatchery:

Sekokini Fish Hatchery is part of Fish, Wildlife, and Parks, so I also spent time there helping with the spring spawning of Westslope Cutthroat trout. Part of my job was making sure the eggs were clean and healthy by rinsing them with an iodine solution and picking out bad eggs. I also fertilized the eggs by mixing the roe from the adult females with seed from the males. This was done with different parents in each set of eggs to ensure genetic variability.

Mounting Fish Scales:
I mounted fish scales, which involves making an impression of the scale on a plastic sheet. This was done for several different species including Kokanee Salmon and Large Mouth Bass taken from several different locations. First I would take the scales from the sample envelope and place them on an acetate sheet, then put that sheet between two metal sheets and compressed at high temperatures in a press for 20 seconds. Then I would remove the scales, replace them in the envelope, and check the impression left under a microfilm reader.

Bathymetry:

In Meadow Lake a bathymetric survey was conducted to create a topographical map of the bottom of the lake. We used a canoe and a line pattern to take depth readings of most of the bottom of the lake. We used a small depth finder, about the size of a flashlight. This information was sent to a cartography center in Helena, which took the raw data and generated a bathymetric map.

Results and Discussion:

I was the most heavily involved with the substrate analysis project. Understanding the substrate component of spawning streams is important because too much fine sediment hinders water flow, essentially suffocating the eggs. In total, 14 different streams were surveyed and each stream had 12 samples taken from different areas along its length. We found most streams had a percentage under 40% by weight of fine grains under 6.35 mm. The substrate sample analysis produced encouraging results. Almost all of the streams surveyed in and around the Flathead drainage system had good percentages of gravel composition to allow water flow and fish eggs to survive.

Fig. 2: Substrate Sample analysis equipment. Left: mechanical shaking apparatus. Middle: Sieves with a sample. Right: Stack of graduated sieves.
Fig. 3: A chart of mass of all sizes of grains within the 12 different samples from Big Creek. It also includes the total percentages of each grain size. The median highlighted is the mean percent by mass of all the grains less than 6.35 mm in the streams.
Electrofishing population surveys were intended to monitor the population of first and second year fry living in the stream. These population surveys were encouraging in that they demonstrated that the population had not significantly changed since the last year’s surveys. The population of cutthroat and bull trout young remained stable. The different population survey methods each had different advantages. With backpack electrofishing, we were surveying small streams and recording the small first and second year fry. When fish traps were set we were monitoring the movement of fish up and down specific streams and the spread of hybridization. Gill nets were only used sparingly in specific lakes because this is a method lethal to the fish. Gill nets were used in areas where it was known to have high numbers of invasive fish species and were used to get a wide cross section of the different species within a lake.

Fig. 4: A backpack electroshocker and a block net, used to stop the fish from escaping downstream.

The other methods used to measure population spread and fish migration were fish traps. There were several different kinds of traps used. One kind was set in streams to catch migrating Westslope cutthroat trout and bull trout. While working with the Fish, Wildlife, and Parks I learned certain areas of Montana still had pure Cutthroat Trout, while other areas had Westslope Cutthroat and Rainbow hybrids. Initial research possibly indicated that hybridized species were less hardy than the pure species. However, further research is in progress and these traps helped us measure the spread of hybridization.
A problem in Northwestern Montana is the introduction of new species by people, usually intentionally. Some sport fishermen wish to catch a favored species in their local lake and will catch and transport live fish to start in that lake. Unfortunately, this kind of “bucket biology” can devastate the existing ecosystem of that lake. The fyke traps were set for several weeks, but no Northern Pike were found. It is a possibility that these traps were set in poor pike habitat, but it is more likely that the hunting strategy of pike does not lend itself well to capture in fyke traps. Pike are ambush predators and will rarely venture out of hiding without some kind of prey within reach. The fyke traps are designed to catch mobile fish that are more active swimmers. Electrofishing using a boat was also tried to catch pike, however, the large area of Lake Mary Ronan made this unsuccessful.

Fig. 5: Lake Mary Ronan

As part of Fish, Wildlife, and Parks, I also worked with the Sekokini Fish hatchery. While there I helped monitor the condition of the eggs. Sekokini raises genetically pure Westslope Cutthroat Trout for release back into the wild in an effort to reverse hybridization. Taking care of the incubating fish eggs involves periodically rinsing them in an iodine solution to prevent the growth of mold. If the mold gets prevalent enough it will kill all the eggs within a batch, so cleaning the eggs is important. The iodine solution toughens the outside of the eggs so they will be able to stand handling when being cleaned.
Mounting fish scales on an acetate sheet makes a clear impression of the scale. Fish scales grow in rings, much like a tree, and the age of the fish can be determined from viewing these magnified scales. I did this for several different species of fish that were caught at differing locations to see what the average age was for that species. This combined with the size of the fish when it was caught gives a good estimate of how large a fish can grow in a year in a given area.

Fig. 6: Eggs in an iodine bath

Fig. 7: Eggs ready to hatch in an incubator

Fig. 8: An acetate sheet with scale impressions on it from a Kokanee Salmon.

Fig. 9: A magnified version of the scale impression.
Mysis Shrimp were introduced to the Northwest Montana lakes to improve salmon populations, but ended up having the opposite effect. Now that the Mysis are firmly established, the Fish Wildlife and Parks conducts plankton tows to measure their population numbers and spread. On Swan Lake we conducted six tows, three each at two specific locations. I counted the number of shrimp found, which would be compared to the number of shrimp found during other years.

Fig. 10: Mysis Shrimp from Swan Lake

Several small lakes around Flathead Lake have not been surveyed for habitat suitability. A population survey of cutthroat trout in Meadow Lake had been conducted earlier in the year. The depth of the lake and its other features would complement the information on the trout population found in the lake. (See Fig. 10)
The work that I did in this freshwater environment will be applicable to the marine environment in several ways. The experience in conducting scientific surveys, which can later be applied to marine science, was invaluable. The different ways of monitoring and controlling invasive species can be directly applied to the marine environment. Understanding how populations are affected by different factors such as fishing, human pollution, and invasive species is a huge part of responsible use of our oceans. Learning about a freshwater environment was helpful to making contemporary issues in marine science applicable.

The best part of this research was working outside and being in the field. It was physically challenging at times because many of the locations we surveyed were fairly remote and there was a lot of hiking involved. It was a great experience and I gained a deeper understanding of the Montana ecosystem than I thought possible in just a few months. The most important thing I learned was how much there is still to learn.
References:


