

**Report for 2005MT59B: STUDENT FELLOWSHIP:
Movements of resident and non-resident anglers in
Montana: implications for transferring whirling disease
among drainages in the Greater Yellowstone
Ecosystem**

Publications

- There are no reported publications resulting from this project.

Report Follows

2005/2006 Water Center Fellowship Final Report

Movements of Resident and Non-Resident Anglers in Montana: Implications for Transferring Whirling Disease among Drainages in the Greater Yellowstone Ecosystem

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Abstract

Despite extensive research surrounding *Myxobolus cerebralis*, the causative agent of whirling disease, little is known about the parasite's transfer among drainages. Anglers represent a highly mobile group of individuals that travel among water access sites; however, it has not been established whether anglers are capable of transferring whirling disease. The myxospore phase of *M. cerebralis* is resistant to environmental stresses such as heat, cold, and desiccation. This makes it perceivable that spores could be transported on angling gear from one fishing site to another. To answer this question we plan to survey anglers and sample fishing equipment at popular fishing access sites on the, Beaverhead, Bighorn, Gallatin, Madison, Missouri, and Yellowstone rivers. The effectiveness of nested PCR testing at detecting small numbers of myxospores in water and sediment samples will also be evaluated. If PCR testing is successful, it will be used on samples collected from angling gear. Sediment and water samples will be cross-referenced with angler survey information to determine the origin of spores, if present, and the mobility of the angler carrying spores. In addition, survey data will document the movement of resident and non-resident anglers among basins within the Greater Yellowstone Ecosystem (GYE). Results from this study will be useful for developing management strategies aimed at reducing the spread of whirling disease and other invasive species.

Accomplishments

Goal 1: Assess the detectability of myxospores through PCR analyses in varying amounts of benthic sediment.

Test samples with known spore and sediment quantities were created in the Montana State University Trout Lab and sent to Biogenetics Laboratory in South Dakota for PCR analysis. The results were inconclusive; the lab was unable to detect even large numbers of spores when sediment was present in the sample. These results may have been caused by inhibitors present in the sediment. Another PCR lab (Pisces Molecular) was contacted and secondary test samples were sent to them in December of 2005. These samples also yielded inconclusive results possibly due to a fungal contaminant in the spore solution used to create the samples. Additional samples were sent with fresh myxospores and these yielded positive detection of myxospores in samples containing large quantities of myxospores (10,000 and 100,000) and small quantities of sediment (0.01g and 0.1g). Problems were encountered with inhibitors in the samples containing 1.0g of sediment that prevented PCR from detecting the presence of even large quantities of myxospores (100,000). Test samples with smaller quantities of myxospores (1,000 and 100) and the same quantities of sediment (less than 1.0g) are currently being prepared for PCR testing.

In addition to the PCR testing, in the fall of 2005 we developed a sediment texture centrifuge method for isolating spores from sediment by density separation. Although there is much information about the development of myxosporean spores, little is known about the movement of spores in water and their interactions with sediment. Varying quantities of sediment and stained myxospores were combined

with aqueous sodium hexametaphosphate ($[\text{NaPO}_3]_6$). We were able to extract myxospores from all of the sediment and myxospore samples using a sediment texture centrifuge technique to separate particles by density. The mean percent myxospore recovery declined as the quantity of sediment added to each sample increased. These results support previous research indicating that even small quantities of sediment in a sample can negatively affect myxospore extraction. The sediment texture centrifuge technique used with aqueous $[\text{NaPO}_3]_6$ effectively isolated *M. cerebralis* myxospores from water samples with no sediment. This technique could be used to assess whirling disease infection levels in water samples without sediment.

Goal 2: Identify movement patterns of resident and non-resident anglers.

Humans play an influential role in the transport of aquatic nuisance species (ANS) throughout the world. Understanding the movement patterns of anglers in Montana will provide information regarding the potential transport of aquatic nuisance species among drainages, states, and globally. We surveyed anglers at access sites on the Beaverhead, Bighorn, Gallatin, Madison, Missouri, and Yellowstone rivers in Montana from June through August of 2005. Anglers were asked questions regarding their most recent prior fishing trip, fishing trips in the past month, planned fishing trips in the coming week, and their state or country of residence. Of the anglers surveyed, 40% were Montana residents whereas 60% were non-residents. Non-residents represented 39 states and 2 foreign countries. Over half of all non-residents surveyed had fished in at least one other state than Montana in the past month. The average distance traveled by Montana residents from their home was 59 miles (± 67 , [95% CI], $n=112$). The average distance traveled by non-residents was 1,067 miles (± 769 , [95% CI], $n=162$). Our results indicate that anglers in Montana are highly mobile.

Goal 3: Determine the amount of benthic sediment on waders, boats, and boat trailers from anglers.

A study design was completed for angler equipment sampling and was conducted for four months on the Beaverhead, Madison, Gallatin, Missouri, Yellowstone, and Bighorn Rivers. Logistical problems arose with sampling boats and boat trailers (we were unable to take samples from entire boats or boat trailers due to sample size restrictions and water source availability). We were not able to develop a precise method for subsampling varying types of boats and boat trailers either. As a result, samples were only obtained from angling boots and waders. Half of each sample was frozen and stored for future spore analysis while the other half of each sample was dried to determine dry sediment quantity carried by anglers. Dry sediment samples were sifted through to look for other possible aquatic hitchhikers such as New Zealand mud snails and noxious weed seeds. A New Zealand mud snail was found in one of the boot rinses however, it was determined that the snail was already deceased at the time of sampling. The average angler in the Greater Yellowstone Ecosystem is carrying 22.10 g (± 8.6 , [95% CI], $n= 42$) of sediment on their boots and waders. Anglers in the Greater Yellowstone Ecosystem are capable of transporting detectable quantities of sediment between access sites. The potential for this sediment transport to move aquatic nuisance species that may be found in the sediment among drainages in Montana is of concern.

Goal 4: Test for the presence of myxospores in the benthic sediment from waders, boats, and boat trailers using polymerase chain reaction (PCR).

Awaiting results of Goal 1.

Goal 5: Experimentally test the accumulation of benthic sediment and the presence of myxospores on various wader and boot types.

Currently developing study design for spores adherence study to be conducted spring of 2006.

Conclusions

Polymerase Chain Reaction testing is not able to detect the presence of myxospores in samples containing greater than 1.0 g of sediment. Given the high average quantity of sediment carried by anglers on their boots and waders, we may need to sub-sample in order to keep the quantity of sediment below 1.0g when sending samples for PCR analysis this fall.

Preliminary results indicate that anglers in the Greater Yellowstone Ecosystem are moving between multiple drainages and multiple states within one-month periods. This coupled with the ability of anglers to transport significant quantities of sediment among sites on their boots and waders raises concern about the potential transport of nuisance species on angling equipment. Increased angler awareness campaigns and access site monitoring could be of value in preventing the spread of aquatic nuisance species among access sites. Providing angler wash stations at access sites may also be a way to encourage gear cleaning and raise awareness among anglers.