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Effects of turbidity on Interfish Distance in Sand Shiners (Notropis stramineus) and Red Shiners (Cyprinella lutrensis) from the Canadian River.

Sabrina Michael

ENMU

NM WRRI Report

NM WRRI Student Water Research Grant Progress Report Form
Draft Final Report Due June 1, 2015

1: **Student Researcher:** Sabrina Michael
Faculty Advisor: Dr. Marv Lutnesky

2. **Project title:** Effects of turbidity on interfish distance in Sand Shiners (*Notropis stramineus*) and Red Shiners (*Cyprinella lutrensis*) from the Canadian River.

3. **Description of research problem and research objectives**. I did this research project to see if there are any differences in fishes' group behavior, depending on the turbidity of the environment. I have 100 red shiners and 100 sand shiners from the Canadian River, NM that I am used in my project. I separated the fish into 20 groups of five fish of the same species and approximate size. There are three treatment groups, .34g/L, .68g/L, and 1.36g/L, and a control (no clay added) that each group of fishes will go through randomly. My objectives were to design an experiment and test for behavioral changes with different levels of turbidity. I aimed to find out how long it takes fish to find each other and how close they can remain together in turbid waters. I also wanted to find out how fishes of different species behave when placed together in turbid environments. Overall, I wanted to add to the little information there is on group cohesion and fish behavior in turbid waters.

4. **Description of methodology employed**. A 1.5m galvanized-steel tank, painted white with food-grade epoxy paint was used for all studies. A remotely-operated digital camera was suspended 2m above the tank, which allows a complete view of the tank. The water depth in the tank was ~1.5 cm so that fishes may be seen from above, even in turbid water, while allowing sufficient depth for swimming. After a five minute acclimation period recording would begin and then cease after 10 minutes. Turbidity was sampled 1 minute before recording and immediately after the 10 minute experimental recording time. The camera was connected to a tablet computer, which used a custom designed (specifically for this research project) tracking program, BioSense®. This program uses the camera feed to track and record the distance between fish. The program records up to 30 frames per second, therefore for this experiment, it was able to capture up to 18,000 frames per ten minutes.

For the statistical analysis, I tested the influence of species (Red Shiners *Cyprinella lutrensis*, and Sand Shiners *Notropis stramineus*), and turbidity (four levels; clear water [control], .34g/L, .68g/L, 1.36g/L), and their interactions, on average inter-fish distances using a two-factor ANOVA with one factor being group identity due to the use of repeated measures (Zar 2010). Post-hoc questions will be answered, however this step has not been completed yet.

5. **Description of results; include findings, conclusions, and recommendations for further research.** So far, data has been collected on 10 groups of red shiners and 10 groups of sand shiners from the Canadian River drainage, NM. This is one half of the data that will be collected on this question (10 more groups of each species have not yet been tested). So far, 80 trials have been completed and we have found significant differences in both red shiners and sand shiners and their behavioral changes in turbid waters. Red shiners' and sand shiners' interfish distance significantly increases ($p<.001$) in turbid water. We did not find any significant differences

between sand shiners and red shiners (p>.05). However, this may be misleading and we need to run more analyses and collect more data before failing to reject the null hypothesis.

6. **Provide a paragraph on who will benefit from your research results. Include any water agency that could use your results**. I will publish my thesis as well as several papers based on this current research project. I will be the primary author on two papers, which will most likely be published in an ecology or ichthyology journal and a co-author on a third, which will be published in an engineering journal. A major part of this research involved an engineering/computer science student designing a fish tracking program, therefore engineers and computer scientist will be able to benefit from this research. There is not much known about fish behavior in turbid waters, therefore I am adding to the little that is known about fish behavior in turbidity. It is significant that this research is on New Mexican fishes, because fishes of NM are also understudied, so hopefully fish biologists of NM can benefit from this research. Water quality is important to water agencies, mostly because people need clean water, however it is also important to know how water quality can affect the behavior of the organisms living there, as it can indirectly be related to people.

7. **Describe how you have spent your grant funds**. Also provide your budget balance and how you will use any remaining funds. If you anticipate any funds remaining after June 15, 2015, please contact Carolina Mijares immediately. (575-646-7991; mijares@nmsu.edu). Most of all my supplies and materials for this research were funded by the NM WRRI grant. I was able to purchase all of the clay, materials, and tablet to collect all of my data on. I have a complete list of my expenditures, currently in the process of being updated from the last few purchases. I will send it separately. (This will be completed after July 1, due to issues with the business office).

8. **List presentations you have made related to the project.** NM WRRI Conference 2014; Biology Faculty Lectureship with Dr. Marv Lutnesky (April 2015); Graduate Education Day in Santa Fe (January 2015).

9. **List publications or reports, if any, that you are preparing**. Remember to acknowledge the NM WRRI funding in any presentation or report that you prepare. I am currently in the process writing my thesis; there should be between 2-3 publications from this research as well.

10. List any other students or faculty members who have assisted you with your project. Dr. M. Lutnesky, J. Patman, Dr. T. Brown, and S. Syers.

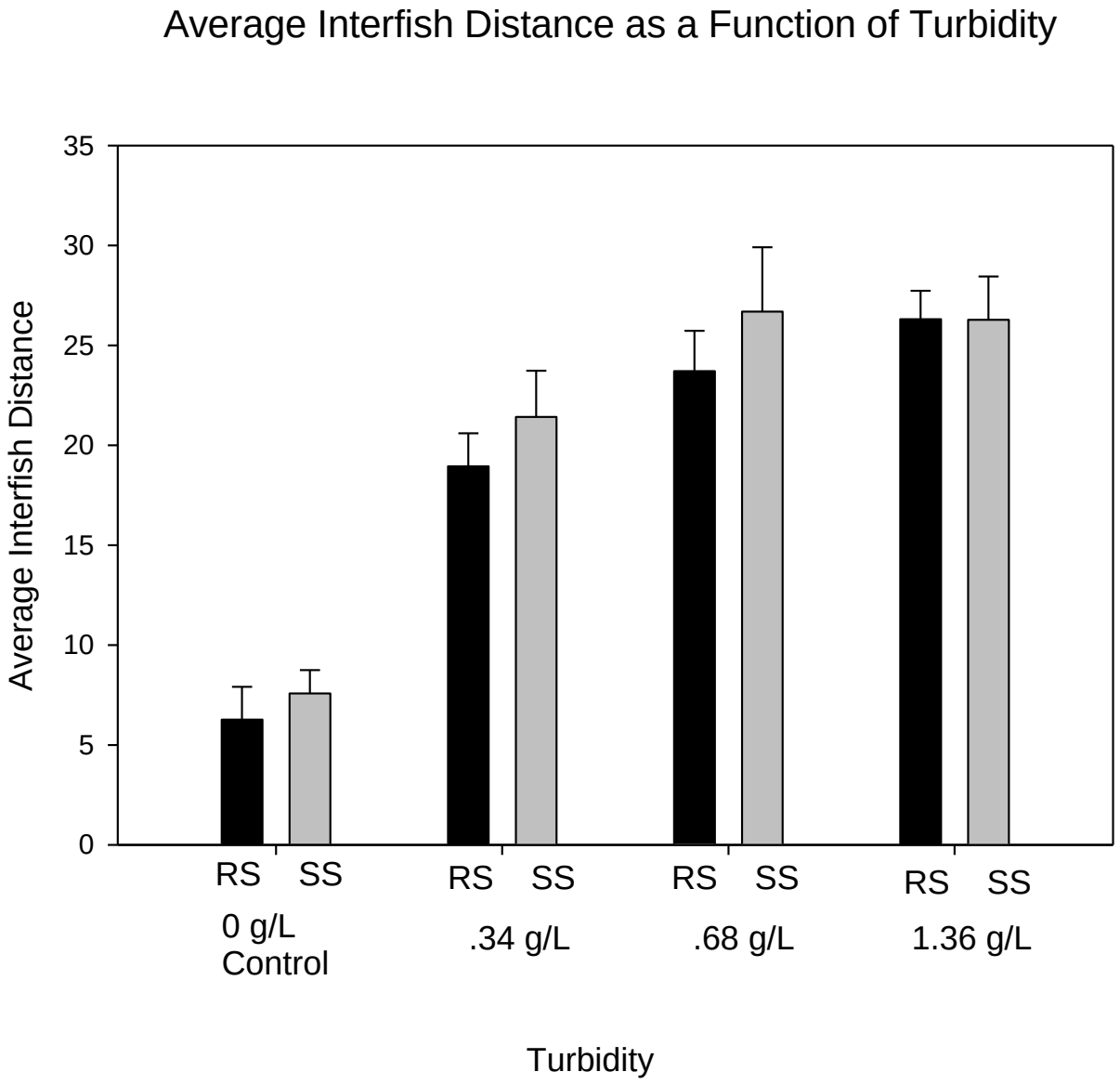

Figure 1. Average (± 1 SE) interfish distances as influenced by turbidity and species. Turbidity caused a significant increase in average interfish distances, but there was no significant difference between species. RS= Red Shiner, *Cprinella lutrensis*; SS= Sand Shiner, *Notropis stramineus*.

Image 1: Graduate student researcher, Sabrina Michael, stands next to her experimental observation room. The 1.5m galvanized steel tank, painted with white epoxy paint, is centered underneath the camera for tracking.

Image 2: Tanks set up for housing fishes in the behavioral ecology lab at ENMU.

Image 3: Researcher, Sabrina Michael, measures out a fish before placing into a randomly assigned group.

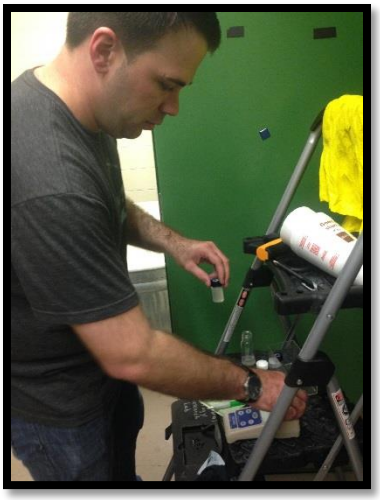

Image 4: Undergraduate researcher and program designer, Jon Patman, assists in a trial during the experiment by measuring the turbidity of the water.