

Cichlid Size vs Flow Rate

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Objectives

Cichlids are a very diverse group of fish that vary greatly in size. Professor Ron Coleman has done extensive research on cichlids that has shown a correlation between egg size and fry size (baby fish). This research project is to explore the trade offs cichlids make in egg size and fry size by specifically testing the ability of varying sized cichlids to swim in different flow rates.

Testing Approach

The goal is to create a recirculating tank that had an area of steady flow that a fish could be placed into and kept in. Then the fish could be monitored swimming in different flow rates. Then the ability to swim in different flow rates and the time swimming could be compared over the different sizes of cichlids used.

Methods

Test Apparatus

The base was a 120x30 cm fish tank with a Box & Water TS3000 variable speed water pump. A plexiglass false bottom was designed to limit the space the fish could be in, aid in recirculating the water in the tank, and reduce turbulence (eddies). The false bottom was placed on bricks and the water pump intake was extended with PVC piping. In order to create a stronger flow and help with the recirculating a second, stronger, water pump was added (Box & Water TS8000).

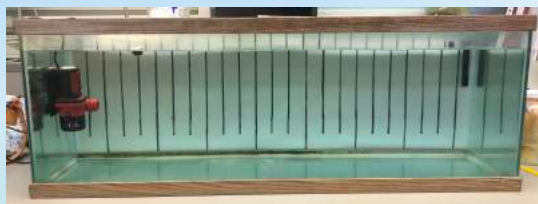


Figure 1. First Attempt at Recirculating Tank



Figure 2. Final Attempt at Recirculating Tank

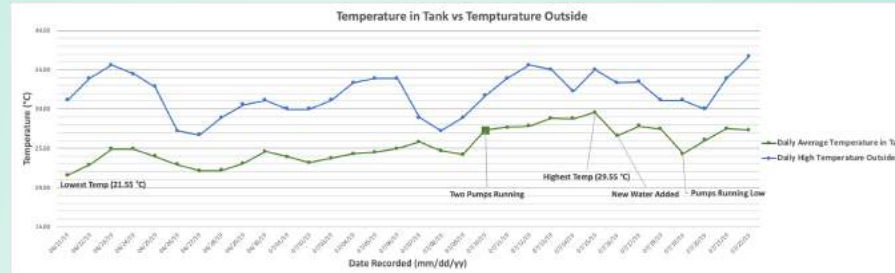


Figure 3. Actual and predicted masses.

Although creating the recirculating tank was the main focus of the experiment, creating a safe and suitable environment for the fish to be in was the second focus. In order to monitor the effects of the changes to the tank had on the water temperature a thermocouple was used. This thermocouple recorded the water temperature in the tank every minute. This data was then used to create Figure 5.

In an attempt to keep the water temperature more consistent, the pumps were adjusted to run at higher and lower speeds, particularly lower to counterbalance the influx of heat on the weekends when the air conditioning was not running.

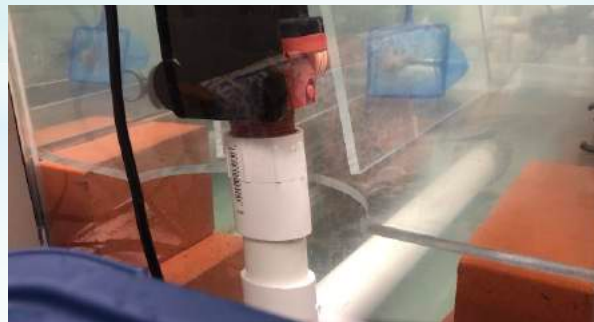


Figure 4. Test 1 with Plexiglass Guards and Net

When the final iteration of the tank was completed, as seen in Figure 2, testing with a small adult cichlid began. After a few trials a plexiglass A-frame was added, as seen in Figure 5. It was very difficult to keep the cichlid inside the area with the laminar flow. The following issues arose during the experiment:

- Cichlid could let itself go with flow out into back of tank
- Cichlid could swim out the sides of the flow
- Cichlid could use a burst of energy to swim out the front
- Cichlid could stay in net until removed from flow

Attempts at keeping the cichlid inside the floor were not a success. This included creating a screened in box to hold the fish in the flow area.



Figure 5. Tank with Plexiglass Guards

Discussion

This experiment needed more time to be completed. There are two pathways forward with this experiment. The first is to successfully create a screened in box that would minimally disrupt the flow and contain the fish in a specified area. This could be done with large netting that still holds the fish inside, but does little to disrupt the flow. The second is to redesign the water output which creates the flow in order to create a wider flow area to reduce the possibility of the fish being able to swim out of the flow. This could potentially be done using a PVC pipe connected to two pumps with a large slit in the side. This would create a large output and increase the area of the flowrate. The water pump should also be stronger, because the cichlids can live in very fast moving rivers and that needs to be replicated more accurately.

If the experiment can be completed, it could give insight and why cichlids have different size eggs and fries, particularly in relation to the environment they live in. It will also give us a better idea into cichlid evolution and the cost benefit analyses that is done through the natural selection process.

Acknowledgements

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