

Utilizing a Community Cichlid Fish Tank for Animal Behavior Studies

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A large fish tank on display at St. Francis College has served as a unique opportunity to study animal behavior using cichlids. The tank can be partitioned into three viewing regions and students can, using timers, view the movement of the fish, one fish at a time. They can record each time a fish moves into a different partition. They might find that some fish are more territorial than others. Separate smaller ten-gallon tanks can then be set up to house individual cichlids to be used for territorial behavior and color change studies.

Keywords: cichlid, fish tank, animal behavior, territorial behavior

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Introduction

Cichlids are fish that are found in the family *Cichlidae* in the order *Perciformes*. At least 1,600 species have been identified in Africa and South America, making this one of the largest families of chordates or vertebrates and new species are discovered annually. Some believe that the numbers of undiscovered fish species range from 1,300 to over 3,000. The fish in our tank were originally found in the lakes of Central Africa. Geological data show that Lake Victoria (one of the central African lakes) was completely dry during the most recent ice age, which was 12,000 years ago. Now the lake hosts over 500 cichlid species. Sexual selection could have been the driving force of this rapid speciation. The mate choices of females for differently-colored males maintain reproductive isolation between species of the same community (Galis and Metz, 1998), although these authors also acknowledge that a flexible jaw structure may have also lead to adaptive radiation.

Color morphing for some species such as the *A. burtoni* is a confirmed behavioral strategy. Territorial aggressive males have a bluish hue, while timid passive males are cryptically colored, and have repressed gonads. Males of that same species switch between these social states depending on their success in aggressive encounters (Korzán et al., 2008).

We decided to utilize a large 100 gallon tank that is placed at the entrance to the St. Francis College Cafeteria (no, they do not serve cichlids for lunch!) for animal behavior studies.

Glase (1992) presented an interesting ABLE workshop in which he studied schooling behavior using tetras and zebra fish as models. He placed one tetra fish and one zebrafish each in two jars, filled them with water, and placed them inside the tank on the left and right sides of the tank. The tank was divided vertically into thirds with markers on the outside glass. A fish of either species was placed into the middle of the tank at time zero and the amount of time the experimental fish spent in each third was recorded. It was found that the zebrafish spent more time around the jar containing the zebra fish than around the jar with the tetra. However, the tetra did not spend a significant amount of time around the jar with the tetra. This indicated that the zebrafish were stronger schoolers.

We wanted to use this same method to study behavior of cichlids in a community tank. We placed transparent tape as two vertical stripes to divide the tank into equivalent thirds. We used stopwatches and a simple pad and pencil to record changes of one fish from one part of the tank to another. It appeared that some species stayed in one area more than others. We then wanted to record territorial behavior with a single species of cichlid using specimen A and B, first housing them in separate, smaller tanks that they had become acclimated to, and then after putting them together in the same tank. The community tank then became the stepping stone for a myriad of inquiry-based activities that are on-going.

Student Outline

1. This experiment will be conducted in two parts. First, you will observe behavior of a single cichlid in a community tank with several species of cichlids. Note that this could be adapted to any community tank composed of various species.
2. Measure the tank and “divide” the tank equally into thirds with two vertical strips of transparent tape on the outside of the tank.
3. This part will be conducted in pairs (lab partners). One will observe the fish in question and call “1”, “2”, or “3” every time the fish moves from one of those thirds of the tank to another. Immediately after the movement, start the timer at zero, and stop it when a new number is called. This can be kind of tricky, as sometimes the fish only spend a second in each area.
4. Add up the time spent in each third to get the total amount of time spent in each third.
5. You may then test this with a Chi-square; your null hypothesis is that the fish will spend an equal amount of time in each third (indicating no territoriality).
6. The second part of the experiment involves videotaping territorial behavior, if indeed it exists. You may use your phone or a device such as a FLIP camera for this project.
7. Set up two ten-gallon fish tanks with gravel, a filter, and a heater. Check the supplier of your fish to get the proper temperature at which to adjust the tank water. Adjust it over a period of at least two days.
8. Place male A in tank A and male B in tank B. Let them become acclimated for a few days to a week.
9. Next, videotape and time the behavior when you place male B into tank A with male A. Try to not let the behavior, especially if it is aggressive, carry on for too long. Then remove male B, and place back into tank B. Note color changes.
10. Wait for a period of time from 10 min. to an hour, and re-introduce male B into tank A. You may repeat a third time.
11. Reverse the order of your experiment: now place male A into tank B with male B and record results.

Materials and Methods

- 50-100 gallon community tank of various cichlids or other freshwater fish species
- Transparent tape
- Thermometers
- Two ten-gallon aquaria
- Gravel
- Two filter set-ups
- Two heaters
- Stop watches or timers

Notes for Instructors

This experiment was designed based on using fish from a large community tank of cichlids. The experiments are extremely easy to conduct and they yield much data!

Selected Results

The community tank was divided into thirds with vertical stripes of tape. One male of each of three species was observed as described above. The fish definitely exhibited territorial behavior (see Figs. 1, 2, and 3).

Two ten-gallon tanks were set up and maintained at 23°C (75°F). We obtained two male Maulana peacock cichlids from the school aquarium and kept them in separate tanks. Each tank and cichlid was labeled A and B. The cichlids were left in their tanks for a few days to establish their territory. We observed that when the cichlids' territory is not under threat,

their facial coloring is about the same, their body is orange and stripes are not distinct and their dorsal fins are raised midway.

We introduced cichlid A into tank B and after a few minutes the subordinate male is taken out before being put back in again. The same procedure was conducted by introducing cichlid B into tank A. When the cichlid's territory is threatened, its stripes will become darker and more distinct. Both cichlids will begin to circle around each other and open their mouths wide so as to possibly to scare the other one off. Their dorsal fins will also be raised completely. When we introduced cichlid A into tank B, cichlid B successfully defended its territory and vice versa. During the second confrontation the dominant male will have a brighter coloration then the subordinate male and the subordinate male will then lower its dorsal fin and attempt to retreat.

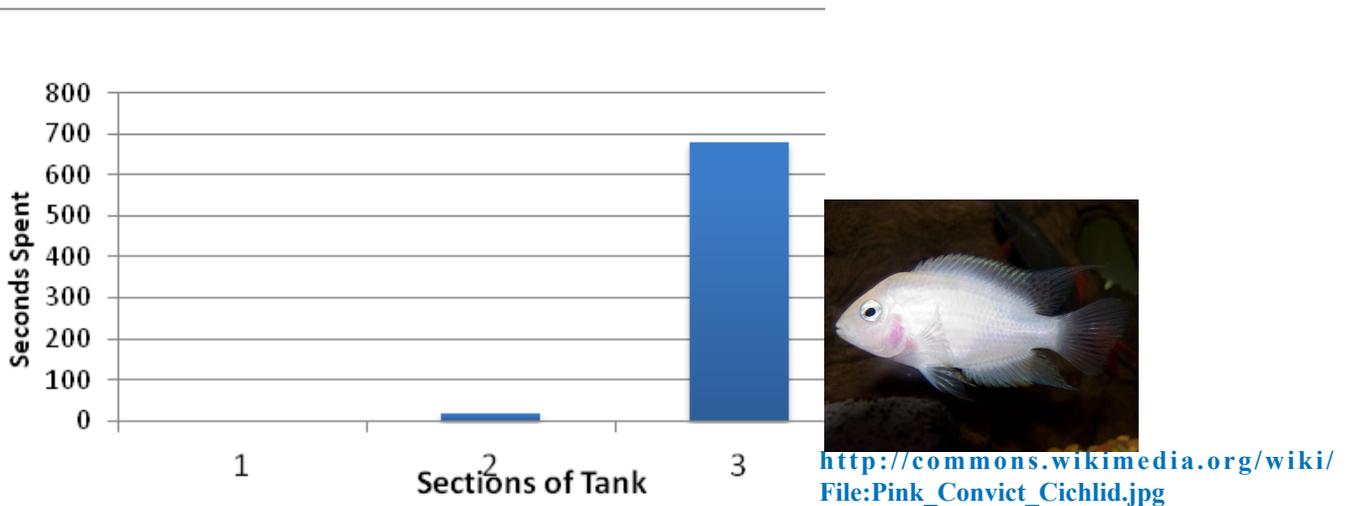


Figure 1. Time spent in territory section for a male albino brichardi cichlid (*Neolamprologus brichardi*) (10 cm in length)

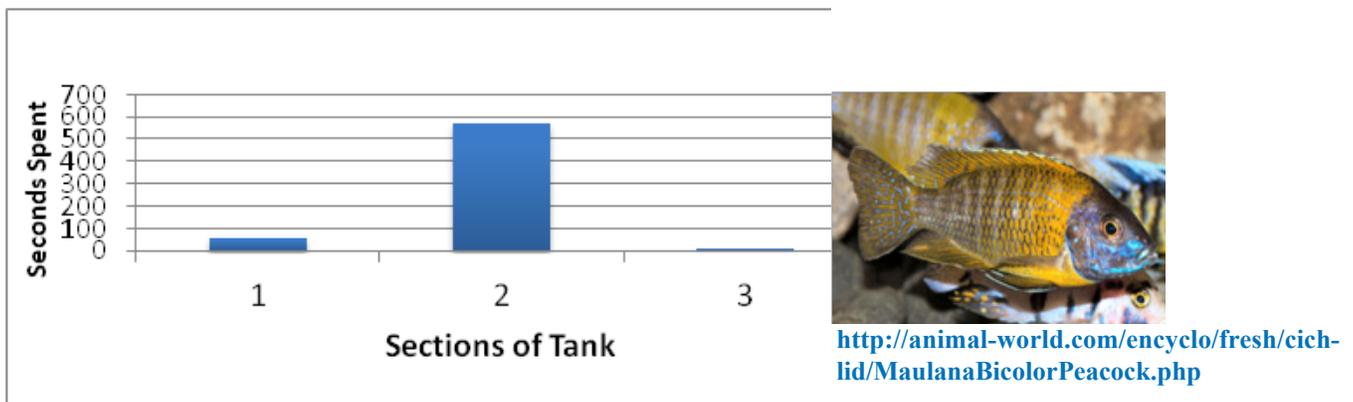


Figure 2. Time spent in territory section for a male Maulana peacock cichlid (*Aulonocara stuart-granti*) (6.5 cm in length)

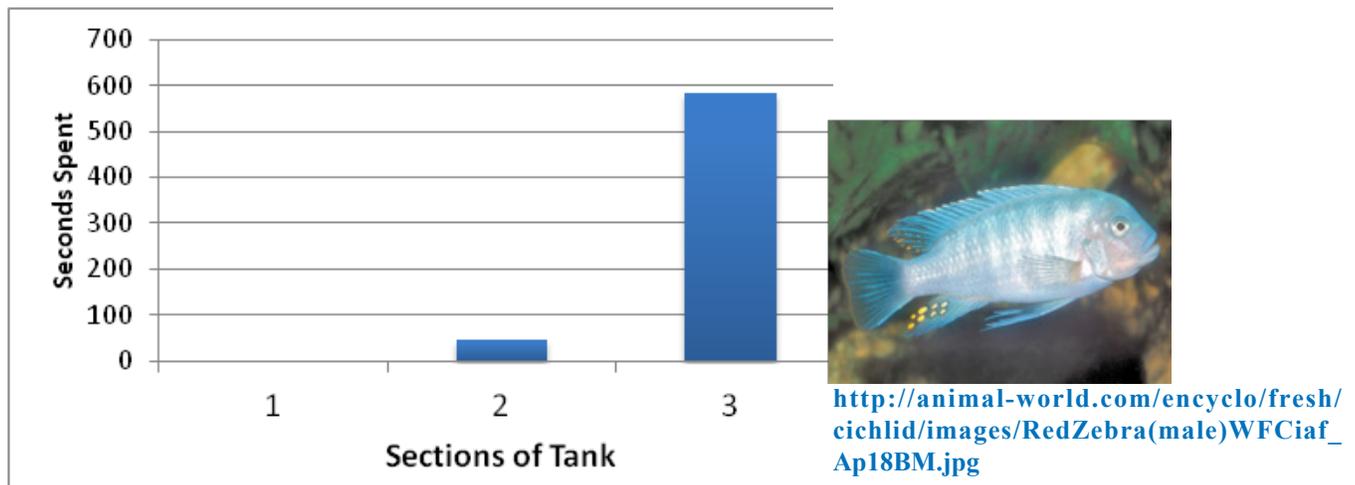


Figure 3. Time spent in territory section of a male red zebra cichlid (*Pseudotropheus estherae*) (12 cm in length)

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About the Authors

James Foo is a biology major and an honors student, and conceived of some of the ideas for the experiments.

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