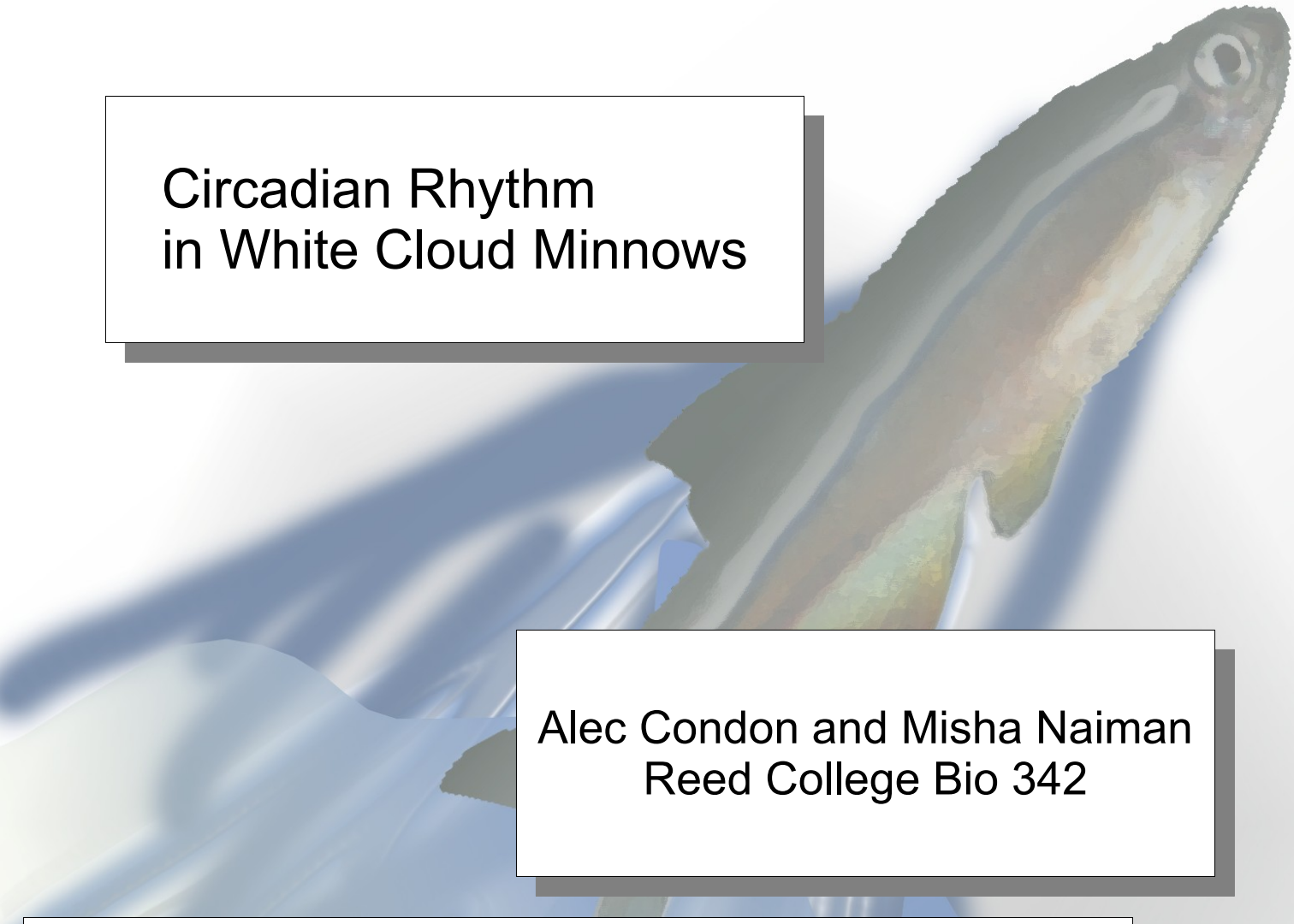
Circadian Rhythm in White Cloud Minnows



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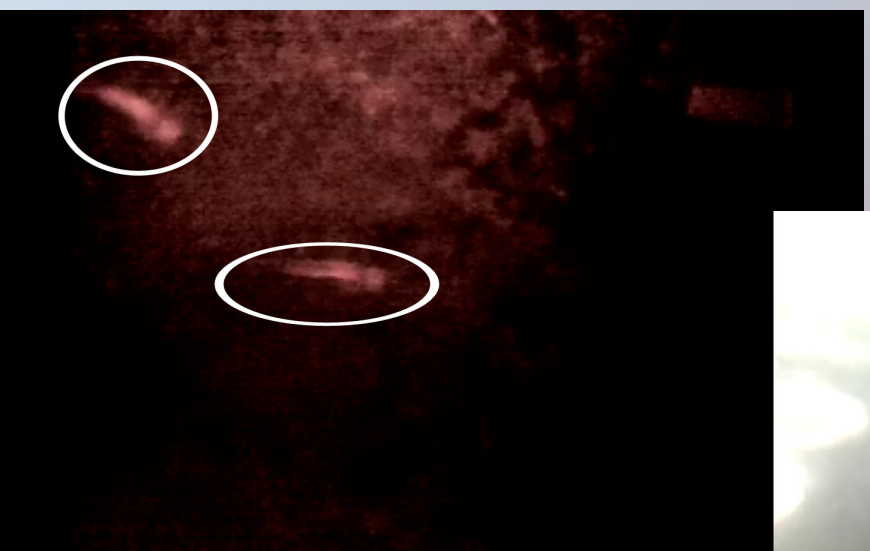
Prior literature has shown that circadian rhythm of an organism is directly involved in the prediction and recognition behaviors that that organism exhibits in response to repetitive events. This indicates that placing a fish on an extended light-dark cycle might interact negatively with the natural feeding cycle of the fish. However regulating the feeding of the fish acts as an exogenous cue to potentially override the effect of the extended circadian rhythm.

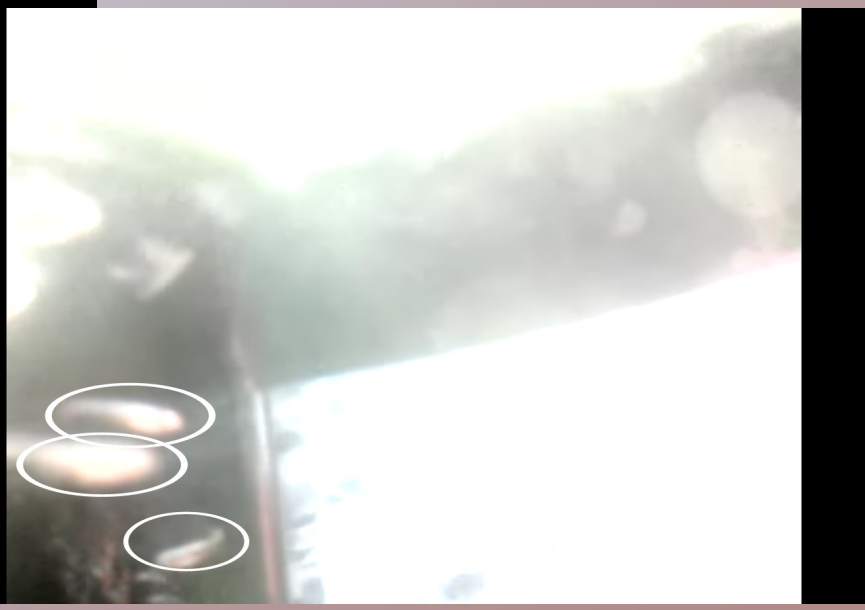
Hypothesis: fish will be able to entrain to the regular feeding cycle as indicated by a spike of activity prior to feeding

Materials/Methods

We had 60 white cloud fry (KGA Tropical Fish Wholesale), which we separated into three functional groups(n=20). Our testing paradigm had one control group on a 24 hour daily cycle, and our two sample groups were both on a 28 hour daily cycle.

We had three tanks that were placed on shelves of mobile apparatus that functioned as dark rooms (see figure 2 on last page for apparatus). All white clouds went through a 2 week acclimation period where they were placed on a 24 hour cycle and were fed at 5 pm everyday with lights on set to be 4 pm. The dark/light cycles were regulated through the timer controlled lamps on the shelves.





Example of dark and light activity

Results

After a ten day cycle of sample group fish getting acclimated to the extended schedule, an activity assay was done by recording the number of times fish swam past a pre-determined line in the middle of the tanks. Recordings were taken over a full light/dark cycle period per group (24 hours for control and 28 hours for each sample group). Prior literature shows that increase in pre-feeding activity starts to be noticeable four hours before regular feeding time, thus ten second from the two hours before feeding(five o'clock) were observed for each tank. The data did not support the hypothesis that the 28 h fish would be able to predict the feeding. Statistical analysis can be seen in figure 1.

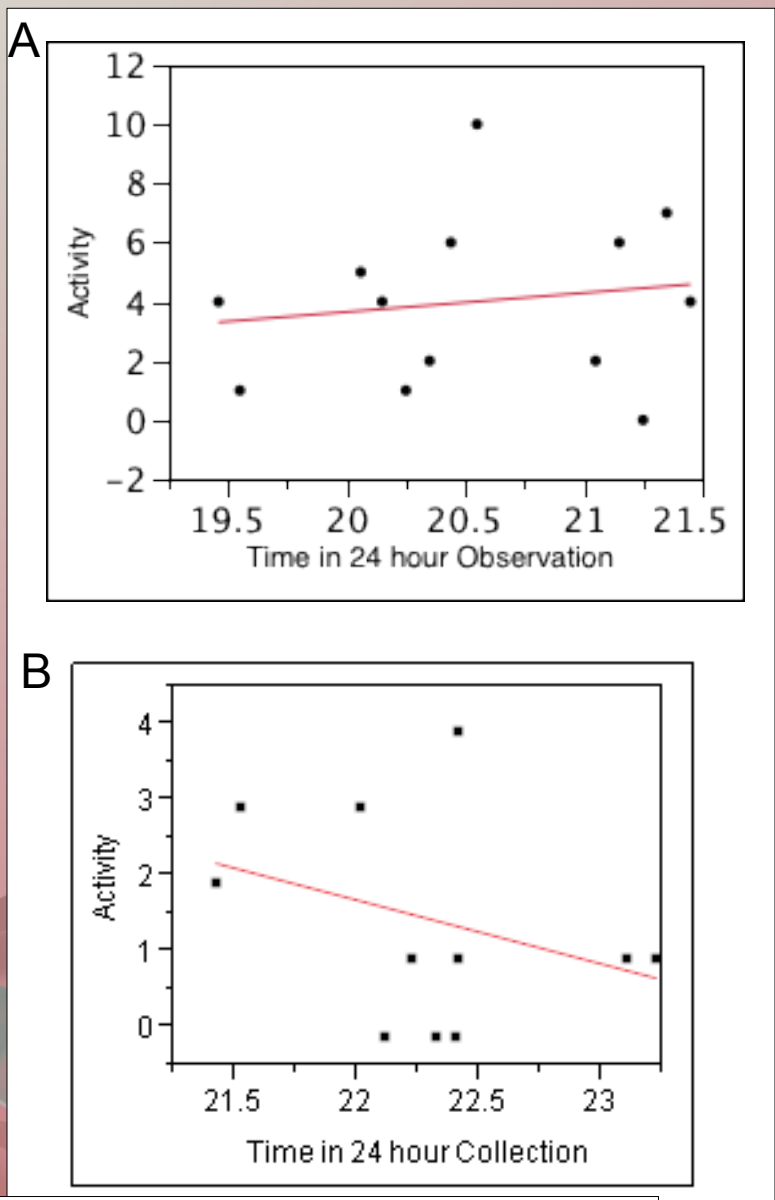


Figure 1. part a depicts control and general increase in activity as lights come on and the are fed. Part b (sample) shows a general decrease as time approaches feeding but with a spike at 22.5 during which the fish were actually feeding.

The possibilities for further research on this topic are numerous. This study is a preliminary exercise for determining effective apparatus set up and environmental know how. Future research should be done testing a variety of different circadian rhythms to see how they change behavioral patterns, as well as changing the apparatus in terms of brightness of light and visibility through the webcam equipment. Another interesting follow up study would be if fish could demonstrate behavioral patterns in response to other exogenous stimuli (eg: presence of mates, or rivals?)

We would like to thank Suzy Renn for her guidance throughout this project, Morgan for her time, Gene from the bio stock room for his help setting up apparatus, and Janis for letting us use her classroom.

Figure 2

References:
1) Boujard, Thierry, and John F. Leatherland. "Circadian Rhythms and Feeding Time in Fishes." Environmental Biology of Fishes 35.2 (1992): 109-31. Print.
2)Davis, R.e., and J.e. Bardach. "Time-co-ordinated Prefeeding Activity in Fish." Animal Behaviour 13.1 (1965): 154-62. Print.
3) Hurd, M., J. Debruyne, M. Straume, and G. Cahill. "Circadian Rhythms of Locomotor Activity in Zebrafish." Physiology & Behavior 65.3 (1998): 465-72. Print.