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FEEDING BEHAVIOR OF *LEPOMIS MACROCHIRUS* IN AN ARTIFICIAL STREAM

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ABSTRACT

I tested the effects of habitat and food type on the feeding behavior of bluegills (*Lepomis macrochirus*) in an experimental stream (following Neff 2001). The bluegills more frequently ate sinking flake food than worms or floating flake food. They also appeared to prefer the wetland section over the fast flowing section of the stream. The results are discussed in the context of conservation.

Keywords: artificial stream, behavior, bluegill, conservation, Lepomis macrochirus

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INTRODUCTION

Bluegills, or bluegill sunfish (*Lepomis macrochirus*), are found throughout Pennsylvania and most of the eastern United States. They reach sexual maturity at the age of 1 year and can live to be 10 years old (Belk 1995). Average adult bluegills reach lengths of 6 inches (Anonymous 2001). In the wild they feed primarily on vegetation along shorelines and shallow areas. This vegetation doubles as a primary habitat for the bluegill. In order to avoid predation from birds and larger fish, bluegill fry particularly hide within the massive root systems of the vegetation (Trebitz et. al. 1997). Bluegills are good research tools because they are adaptable to many types of systems and conditions (Belk 1995).

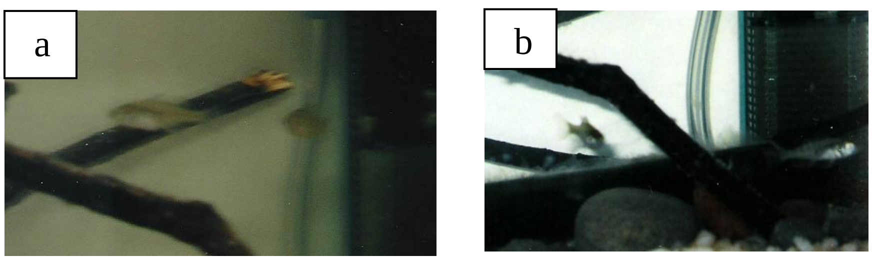
Artificial streams can be built either indoors or outdoors and can be of any size. The benefits of an artificial stream depend on the conditions in which it is used. In an experimental situation an artificial stream can be of great help because it allows you to have control over the variables while keeping the aquatic life in a realistic setting (Huntingford et. al. 1998). This allows the researcher freedom to add chemicals and other such variables without having to destroy large areas of natural habitat.

To ensure that data on aquatic life in artificial streams is comparable to natural situations it is important to supply proper feeding conditions. The goal of this study was to examine the feeding behavior of the bluegill in an artificial stream. Conservationists may then use this information in designing and sustaining a reserve for a rare or endangered species of similar fish (Hose et. al. 2002).

METHODS AND MATERIALS

The artificial stream consisted of three habitat types: a fast moving stream portion, a wetlands portion, and a third section that housed both the shoreline habitat and pump equipment (Figure 1). The bluegills were kept in the wetlands habitat for the first 6 days and the shoreline habitat for the last 6 days with the temperature remaining around 19^{o} C.

Figure 1. The stream, wetlands, and shoreline portions of the stream (clockwise from top left)



Figures 2a and b. Four of the bluegills used in the experiment

Figure 3. Test groups side 1 and side 2 in the shoreline habitat (from left to right)

For the first 6 days the bluegills were kept in one group of 8 like-sized bluegill fry collected from a small pond in McConnellstown, Pennsylvania (Figures 2 and 3). They were fed worms and standard flake food. The worms were full grown night crawlers that were cut into pieces about ¼" long. Feeding time and placement of food was random; and the type of food was rotated on a daily basis. The feeding was started on the first day with flake food and the next day was worm and so on for 6 days. Data collection was recorded in a table as illustrated in Table 1. The flake food was left to float on the water for one set of data and another set of data was taken when the flake food was pushed into the water (sinking).

Table 1: Example data from day 4. One of 8 bluegills was feeding on the floating flake food over a time period of 15 minutes.

Time (minutes)	Number of bluegill feeding	Type of food
0	0	flake food
5	0	flake food
10	1	flake food
15	0	flake food

During the last 6 days of data collection, 5 bluegills were placed in each of two sections of the shoreline habitat (Figure 3). They were fed and data was collected in the same fashion as the first 6 days. The type of food was rotated on a daily basis and was switched from side to side. The fish on the two sides were fed at the same time and were fed opposite types of food (i.e., Day 1 side 1 was given worm and side 2 was given flake, day 2 was the opposite and so on)

RESULTS

The bluegills fed more often fed on sinking flake food than worms or floating flake food (Figures 4-7). In addition, the bluegills that were fed worms showed different feeding behavior than those that were fed flake food. Worm-feeding elicited food protection behavior. The larger bluegills would float overtop of piece of worm and defend against other arriving bluegills that would display their fins and puff up their bodies. Shortly after these displays the bluegills would be chased away by the bluegill protecting the worm. During this time another bluegill would move into the spot over the worm and the process would repeat itself. Only the largest bluegills ate the worms.

The bluegills were reluctant to come to the surface for feeding or anything else. They were also reluctant to leave the root systems of the plants in which they hid. The only times they left the roots was to feed on sinking flake food or to protect worms. However, they were never outside of the roots for more than one minute, whether they were feeding or protecting or not.

Fish in side 1 of the shoreline section showed significant jerky and flashy movements. This occurred throughout the testing time, but it did not seem to affect the outcome of the feeding behaviors. The bluegills appeared to be most suited to the wetlands habitat.

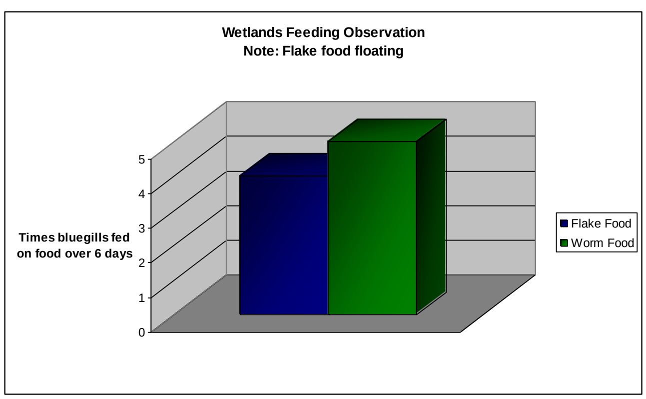


Figure 4. Feeding results for both flake and worm food wetland experiment. Flake food was left floating during feeding (Chi-sq. = 0.111, P > 0.05).

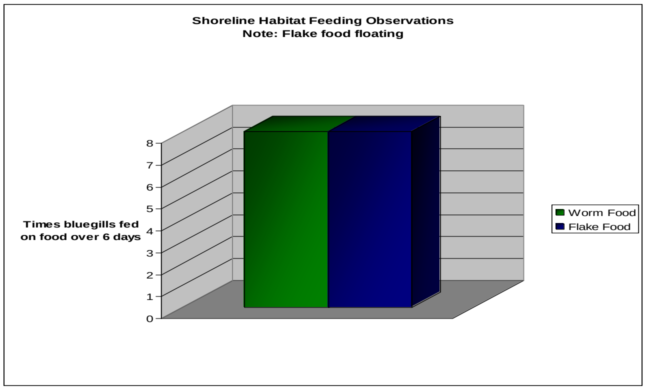


Figure 5: Feeding results for both flake and worm food for shoreline habitat experiment. Flake food was left floating during feeding time (Chi-sq. = 0.000, P > 0.05).

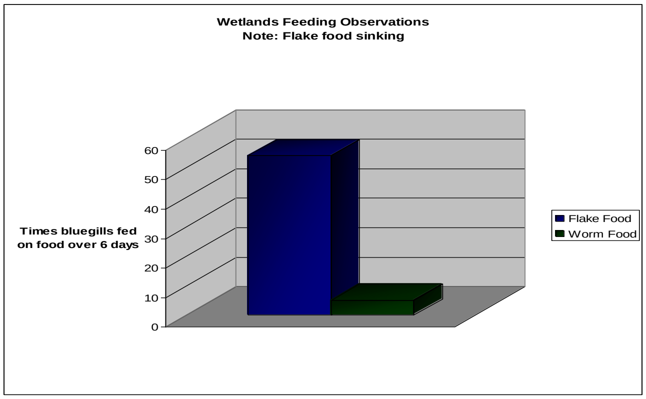


Figure 6. Feeding results for both flake and worm food for wetlands experiment. Flake food was pushed into water during feeding time (Chi-sq. = 40.694, P < 0.01).

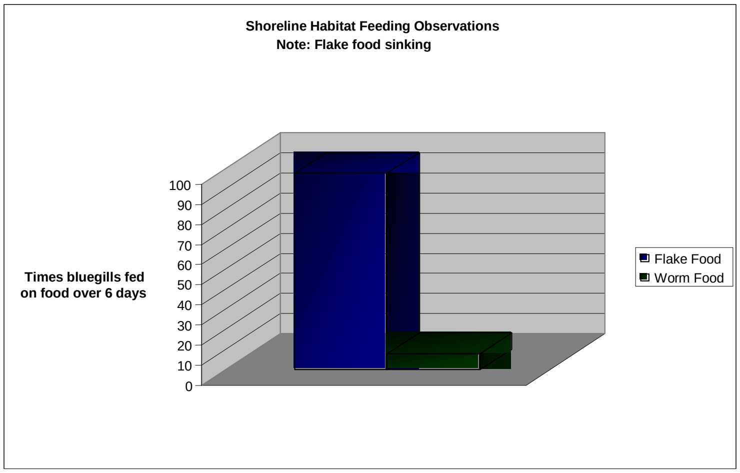


Figure 7. Feeding results for both flake and worm food for shoreline habitat experiment. Flake food was pushed into water during feeding time (Chi-sq. = 76.415, P < 0.01).

DISCUSSION

Since the bluegills appeared to prefer sinking flake food, it is recommended that this food should be used in further studies of behavior of these animals in artificial streams. They should also be placed in habitat with slow moving water, because fast moving water (due to the outflow pipe emptying into side 1 of the shoreline section) appeared to "stress" these fish, as indicated by their sporadic and shaky movements (Van Ham et. al. 2003). Bluegills are pond fish and are not accustomed to fast moving water (Wildhaber 2001).

The reluctance of small bluegill fry to go to the water surface for food may be adaptive for avoiding predators. This may be why they preferred to live near the bottom amongst plant roots that provide refuge from possible predators (Trebitz et. al. 1997).

Worm protection behavior is clearly related to body size. This behavior may also be gender-specific (Neff 2001), but this was not determined.

In conclusion, future work on bluegills in artificial streams should make use of sinking flake food, slow water velocity, and well vegetated substrates. These conditions may also be applicable to similar fish of concern to conservationists.

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