

The Effect of Barometric Pressure on Feeding Activity of Yellow Perch

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This is the first study to our knowledge that has attempted to relate feeding activity of fish to barometric pressure. This study was conducted with the expectation that a difference in food ingestion would occur in a game fish species at different barometric pressures. The overall objective of this study is to determine if barometric pressure influences the feeding activity of a popular game fish. Yellow perch (*Perca flavescens*) were collected by seine and trap net from Lake Bemidji 12 September through 24 October 2013. The range in size and weight of yellow perch used for this study were between 75 – 125 mm and 4 – 20 g. Over the course of 3 months 12 trials were conducted; 5 at rising pressure, 5 at falling pressure, and 2 at a constant or steady pressure. Barometric pressure did not have a significant influence on how much yellow perch ate ($R^2 = 0.38$, $P = 0.55$). However, a gradual increase in fish consumption was found throughout the duration of the study indicating that acclimation to laboratory conditions was influencing fish consumption rates ($R^2 = 0.50$, $P = 0.01$). Future studies attempting to relate barometric pressure to feeding activity should keep acclimation length constant.

Faculty sponsor: Dr. Andrew W. Hafs

Introduction

Many factors such as moon phase, past fishing pressure, water temperature, and wind speed have been shown to affect the feeding activity of fish (Kuparinen et al. 2010). Additionally, Stoner (2004) reported that a rapid change in temperature can inhibit feeding activity of fishes. These studies demonstrate the environmental variables often affect the feeding activity of fish.

Barometric pressure is another variable that many fishermen speculate influences fish feeding activity. However, few publications can be found on the relationship between barometric pressure and fish behavior. Barometric pressure has been used to predict the migration time of rainbow trout (Peterson, 1972), and Jeffrey and Edds (1999) reported that the depth and distribution of sauger (*Sander canadense*) is influenced by barometric pressure. Guy et al. (1992) reported an increase in the movement rate of black crappies (*Pomoxis nigromaculatus*) with a rise in barometric pressure.

The lack of information available on barometric pressure as a variable affecting feeding activity was the reason for conducting this experiment. This study was conducted with the expectation that differences in food ingestion would occur in a game fish species at different barometric pressures. The overall objective of this study is to determine the level of influence barometric pressure has on the feeding activity of a popular game fish.

Materials and Methods

Yellow perch (*Perca flavescens*) were collected each week by seine and trap net from Lake Bemidji 12 September through 24 October 2013. At the time of collection they were held in a 38 L bag of lake water submersed in the collection tank for 45 minutes to allow them to acclimate to lab conditions before being released into the collection tank. The collection tank was 530 L and measured 213 x 61 x 56 cm. Additionally, three

test tanks were used that measured 62 x 32 x 43 cm (76 L).

After fish were acclimated for 24 hours in the collection tank they were fed 20 wax worms on a daily basis. Temperature (16 – 20 C°), pH (8.23 – 8.81), and dissolved oxygen concentration (4.00 – 8.69 mg/L) were held constant throughout the study following the recommendations of Conte (2004).

Each 76 L test tank had a divider put in place to split the tank in half, and an aeration tube was split into each compartment. For each trial, three fish were randomly selected from the collection tank and placed in each side of the three test tanks. Length (mm) and weight (g) of each fish was measured before each trial. Fish were starved for at least 1 d before each trial. Rough handling and moving fish to new aquatic enclosures provides a great deal of stress (Conte, 2004). Therefore, fish were handled with care at all times. Fish were reused for several consecutive trials due to the lack of individuals collected for the study. The range in size and weight of yellow perch used for this study were between 75 – 125 mm and 4 – 20 g. Conte (2004) provided evidence to suggest that it takes 6 h for a fish to recover from a disturbance therefore, each compartment was covered by cardboard to avoid human disturbance.

Wax worms were weighted before the trial periods, and the amount eaten was calculated after each 6 h trial period had ended. The average weight of wax worms was divided by the total weight of fish used in that session to calculate food consumption for each tank. Consumption rate for each of the three tanks were then averaged.

To analyze the daily trend, barometric pressure was recorded at start and end of each trial using a Professional Plus YSI meter. Barometric pressure was recorded from the Bemidji airport from weather underground online (Weather Underground Inc., 2013). Pressure was recorded from two different sources to compare and verify that pressure in the building did change as pressure changed outside the building. Pressure readings were also recorded at 6 and 12 hours prior to each trial to determine the trend in pressure change. Other readings such as pH, dissolved oxygen (mg/L), and temperature (°C) were recorded at the time of feeding. The trend of pressure was determined based on if it rose by or fell by at least 1.52 mmHg, and was considered holding steady when the change was less than 0.76 mmHg during the trial period. After each trial, the water was changed to eliminate the build-up of waste products.

Data was analyzed by graphing pressure verses average consumption. Linear regression was used to determine if pressure was having a significant influence on consumption rates. Regression analysis was also used to determine if the date the trial was conducted influenced consumption rate.

Results

Over the course of 3 months 12 trials were conducted; 5 at rising pressure, 5 at falling pressure, and 2 at a constant or steady pressure. Barometric pressure did not have a significant influence on how much yellow perch ate (Figure 1, $R^2 = 0.38$, $P = 0.55$).

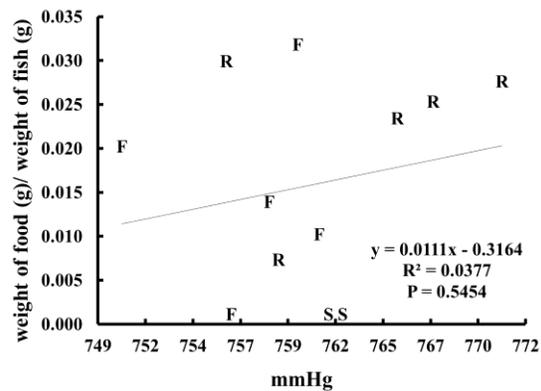


Figure 1. – Shows the weight of food eaten during each test session per gram of fish, plotted against the mean pressure in mmHg during the trial. R stands for rising pressure, F for falling pressure, and S for pressure holding steady.

Linear regression analysis indicated there was not a significant relationship between how much the perch ate and barometric pressure at either of the pressure trends tested (Falling, $P = 0.98$ Rising, $P = 0.63$). There was, however, evidence to suggest consumption rates of yellow perch increased throughout the duration of the study ($R^2 = 0.50$, $P = 0.01$, Figure 2).

Discussion

The findings of this study do not support the hypothesis that pressure affects a fish's feeding activity. This is the first study to our knowledge that has attempted to directly relate feeding activity to barometric pressure. Barometric pressure has been shown to influence vertical migration and movement rates of black crappie (Guy et al. 1992). Fish movement occurs to reduce the amount of energy required to be suspended in the water column (Neighbors and Nafpaktitis, 1982). Guy et al. (1992) suggested these movements were related to feeding activity.

In this study it was hypothesized that pressure would influence the size of the swim bladder, altering the amount of pressure on the fish's stomach. It is suspected that fish would move up and down in the water column to account for the change in pressure. Therefore, influence the amount of food intake.

Other species that do not live near the bottom, such as top predators like bass or large schooling fish such as crappies, could react differently to pressure changes than smaller more bottom dwelling fish like perch. Predatory fish feeding rates are more spread out over time than smaller fish such as perch which feed at a more frequent rate, which seems to be related to stomach size, activity level, and how digestible their food is (Bromley, 2004). Additionally, species dependent variables such as morphology or anatomy are present and need further investigation.

Another aspect that occurred and was very important to the outcome of this study was that as the days went by, the perch acclimated to the laboratory conditions. In the future, similar studies could be improved by collecting a sufficient number each week to fill the three test tanks with three fish in each half. Therefore, fish would not have to be reused for several feeding sessions reducing the influence of acclimation on the results. Setting a specific acclimation period would limit the fish's time in the tanks. This would possibly make conducting test sessions harder at a precise pressure change. Due to the amount of time needed to acclimate before the desired pressure arrives. Overall, this would hopefully reduce the variation in consumption of the fish.

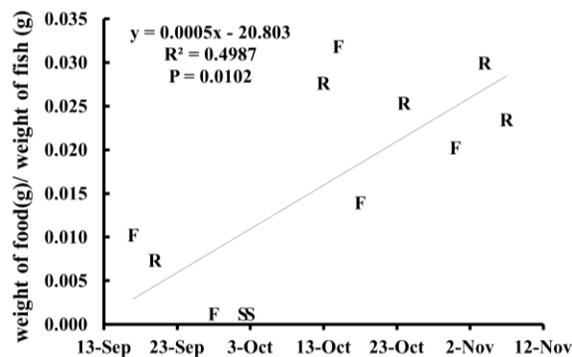


Figure 2. – Shows the date each trial was conducted and the amount of food consumed in grams in 2013. R standing for rising pressure, F standing for falling pressure, and S standing for pressure holding steady.

Another improvement that could be made is making the three test tanks into a flow through style just like the collection tank setup. This would eliminate the need to change and add water and ultimately result in more controlled pH, dissolved oxygen, and temperature levels. It would also reduce the amount of mortality during acclimation.

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