Minnows Essay, Research Paper

Low Temperature Effects on Minnows (Phoxinus phoxinus) and juvenile Atlantic Salmon (Salmo salar)

Studies have shown that freshwater minnows and juvenile Atlantic Salmon become nocturnal with increased low temperature. To determine if these species are nocturnal at low temperatures, counts of individual fishes would be taken by how many fishes are observed during the daytime taking refuge underneath rocks. Also, by observing how many individuals are active at nighttime. At a warmer day time temperature of 13.2 o C, minnows were taking refuge only 20% of the time. On the other hand, at cooler daytime temperature of 6.6 o C, minnows were found taking refuge 75% of the time. Similar results were found for the juvenile salmon. In both instances, it is suggested that this behavior is an adaptation to avoid predators during daytime hours.

INTRODUCTION

Phoxinus phoxinus, commonly known as minnows, are a group of freshwater fish that live in mid- to high-latitude streams and rivers. Recently, strange behavioral patterns of the minnows foraging strategies have been observed. It has been seen that the minnows, in low temperatures in the winter, would seek refuge during the day, but emerge to feed at night (Greenwood & Metcalfe, 1998). This behavior has been well documented in the species Salmo salar, the Atlantic Salmon. Field observations by Francis, Gries, Juanes, Parrish & Whalen (1997) showed that juvenile salmon would emerge at night in low temperatures to feed. This was found in post-young-of the year (PYOY) salmon only. This study will look at both the minnow and the juvenile salmon to see if there is a correlation between the two species foraging habits.

METHODS

The minnows to be studied were captured from the River Endrick in west Scotland in early November of 1995. The fish were caught using hand netting and were transferred to Glasgow University. The minnows were placed into glass holding tanks. Then tanks were prepared for the experiment. Tanks measuring 60 long x 30 x 30 cm and the water depth was 15 cm were divided into four equal compartments, each containing gravel substrate and dark-gray pipes for refuge. Each tank was surrounded by black polythene sheeting and was illuminated by a 90-cm long fluorescent lamp. These lights were placed on timers that turn on at noon and off at midnight.

Two of these tanks were put in each of three constant temperature rooms (6.6, 8.9, and 13.2 o C). This was done so activity could be compared across different temperatures. There are six tanks and twenty-four compartments, and a single fish is placed in each compartment allowing measurements of twenty-four fish total, eight in each temperature-controlled room. The activity of the fish were then recorded twice a day, one between 8:30 a.m. and noon, and the other between noon and 5:00 p.m. in the dark. The data recorded was whether the fish was taking refuge or actively feeding. The fish were fed on larvae each day after the observations. Observations were made for 10 days per fish, then the fish were replaced with new ones and the observations took place again. This was repeated until 24 fish had been tested at each temperature. A total sample size of 72 fish has been used.

In an experiment by Fraser, Heggenes, Metcalfe, and Thorpe (1995), data was collected from the Aurland River on the coast of Norway and from the Stjordal River in central Norway. Underwater observation was used to collect data. Divers wore a dry suit, mask, and snorkel. Conditions were clear, about 7-8 meters visibility. Daytime observations occurred from 11: 00 a.m. to 4:00 a.m. and at night from 11:00 p.m. and 1:30 a.m. Once divers spotted a fish, they would observe the fish for five minutes and record the data.

RESULTS

For the minnows, observations on whether or not the fish was taking refuge were used to calculate three parameters: the percentage of the daytime observations and the percentage of the nighttime observations spent out of refuge, and an estimate of the percentage of the fish’s activity that was nocturnal. [% nocturnal = 100 N (N + D) -1, where N = % night observations spent out and D = % day observations spent out (Fraser et al., 1993, 1995)].

The effect a size of a fish would have on the experiment was tested using covariance analyses and it was found that body size did not influence activity patterns.

Temperature did have an effect on the activity of the minnows and these effects were tested using one-way analysis of variances (ANOVA). The percentage of the daytime observations in which fish were out of the refuge was dependent on temperature (F 2.69 = 26.82, P

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