Habitat Impacts on Nesting Success of Buck Darters + Artificial Nests

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Introduction

The Buck Darter (*Etheostoma nebra*) has recently been identified as a new species of darter in the Cumberland River system in the tributaries of Buck Creek. Currently the Buck Darter distribution is in three streams in Shopville, Kentucky and has shown a decline in population and distribution throughout the tributaries of Buck Creek[3].

The Buck Darter is a part of the subgenus Catonotus in the barcheek clade. Catonotus has over 20 species of darters that all have the same reproductive strategy that is different from all other species of darters. Members of the subgenus Catonotus reproductive strategy lies primarily on parental care of the male darter. Male darters will establish a nest under a rock with a smooth underside in contact with the bottom of the stream. The males will then attract female darters to lay their eggs under the rock the males are guarding. Once successful the female will invert her body and deposit a cluster of eggs that will be attached to the rock. Once complete the male will invert this body and fertilize the eggs[4].

The male darter will continue to attract more females to the nest or start a new nest. The eggs of the darters take three weeks to reach maturity. During the three week time period the male darters will guard their nests until the eggs have matured. Afterwards the male will start over with a new nest under the same rock or a new rock[4].

Figure 1. Male Buck Darter (breeding colors)

This study evaluated possible factors that could impact Buck Darter reproductive success. Another aspect evaluated during the same time was the use of artificial nests as a possible solution to the decline of Buck Darters to promote increased nesting during the spawning season.

Methods

Habitat Impacts

Four stream reaches were established to conduct the study. Stewart Branch and Big Spring Branch were used, each containing two 50 meter reaches. In each stream, there was an upstream non shaded reach and a downstream shaded reach. Each reach was divided into 10 sections of five meters each and the surrounding habitat within each section was surveyed. The survey looked at the substrate in which possible nests could be established, along with a count of suitable rocks for nesting. Temperature loggers were placed to obtain average water temperature to be used in analysis.

Each week for a period of six weeks starting in mid June until late July a thorough search for Buck Darter nests in each reach was conducted. Once a nest was located, relative surface area of the rock was measured and a photograph of the eggs taken. The nest was marked for monitoring

until the end of the nest and the number of eggs contained was recorded.

Data analysis was conducted using IBM SPSS using a MANOVA and a Nonparametric ANCOVA using the habitat variable collected and number of nests.

Artificial Nest

96 clay roofing tiles were cut into thirds to be used as artificial nests. After each tile was cut to the length of 15 cm long with a diameter of 10 cm. A total of 288 artificial nests were sanded down and labeled. The tiles were bundled together in a set of three each to keep the same tile together.

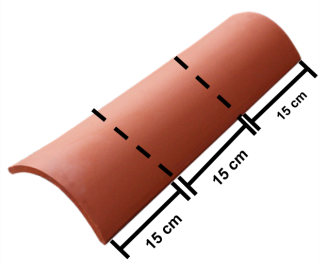

Figure 2. Roofing tile cutting dimensions

The tiles were then transported to each of the four reaches mentioned previously. In each of the reaches 24 1 x 1 meter plots were randomly selected and a bundle of tiles placed inside of each plot. Each week every tile was picked up and evaluated to see a Buck Darter nest. Once a nest was confirmed on a tile, a photograph and relative environmental data were collected. The nest was monitored each week and the amount of eggs recorded.

Results

Habitat Impacts

The results of the study indicated that water temperature(F= 56.759, P=2.793E-10) and location (stream reach; F=24.97, P=6.0E-6) both have a significant impact on Buck Darter nest abundance. Additionally, there was a significant impact on the duration of a Buck Darter nests when evaluating both location of the nest (F=8.55, P=0.0314) and the size of the rock (F=5.18, P=0.021).

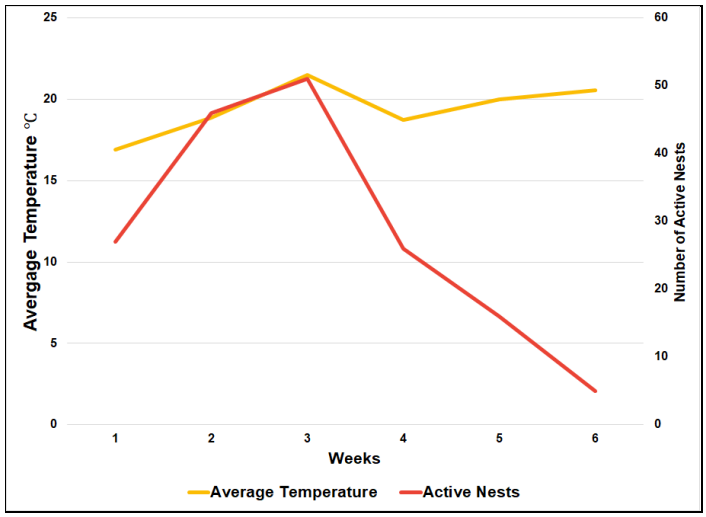

Figure 3. Water temperature compared to active nests of *Etheostoma nebra* for six weeks

Artificial Nests

There were a total of 8 artificial nests during the period of the study. Environmental variables were recorded for 7 of the 8 nests. The artificial nests had an average of (115 ± 68 eggs). All of the artificial nests were located in sediment substrate and were found in 3 of the 4 reaches. Stewart Branch non shaded reach contained 6 artificial nests accounting for 37% of nests in the reach.

Figure 4. Male Buck Darter guarding artificial nest

Conclusions

Habitat Impacts

The results support that habitat factors had an impact on Buck Darter reproductive success. Water temperature had a significant impact on the frequency of nests. The results also indicate that environmental factors like size of the rock, water temperature, and location have a significant impact on the duration of the nest[1]. The amount of time the nest is intact is important to ensure eggs reach maturity. The environmental factors have a significant impact on survivorship of eggs to

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maturity. Understanding the environmental factors could rise to a definitive answer as to the rapid decline in Buck Darters in Kentucky.

Artificial Nest

Although the artificial nests were not successful to yield substantial results it still has an application for Buck Darters and other species in the Catonotus subgenus. The use of artificial nests in a control setting yielded significant results and so can the of artificial nests in the wild as well[2]. More research and attention to location and substrate type for artificial nests can yield a significant amount of nest use. In the future the use of artificial nests where little habitat for nesting is available could be a viable solution to declining populations of Buck Darters.

References

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