Movement Patterns and Growth Rates of Bonefish (*Albula vulpes*) in the Bahamian Archipelago

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Introduction

Bonefish (*Albula vulpes*) are critical to the tropical flats ecosystems of the Bahamas (Danylchuk et al.). Bonefish are both predators and prey in the shallow flats mangrove ecosystem they inhabit. They move in and out of creek systems with the tides to feed on benthic invertebrates (Danylchuk et al. 2006).

In addition, fly-fishing for bonefish is a major part of the Bahamian tourism industry, contributing an average of 141 million dollars annually (Danylchuk et al. 2006). Angling guidelines have been established to make fishing practices more humane and lower post-release mortality rates (Cooke and Sneddon 2011). Despite the ecological and economic importance of bonefish, relatively little is known about this species.

The purpose of this project was to determine the movement patterns and growth rates of bonefish in order to create effective fisheries management policies and marine protected areas. These areas are set up to protect the bonefish mangrove habitat from development. It has been documented that two fish tagged off the coast of Florida travelled across the Gulf of Mexico and were recaptured on Andros Island, in the Bahamas. **Therefore**, **it was hypothesized that bonefish travel between Florida and the Bahamian Archipelago.**

Figure 1. Seining bonefish at Broad Creek.

Figure 2. Fly-fishing for bonefish at Poison.

Methods

This research was conducted on the southern tip of Eleuthera in the Bahamas (24°50’05” N; 76°20’32” W) during the spring of 2011. Bonefish (*Albula vulpes)* were captured from a number of local tidal creeks using both seine nets and fly rods (Figure 5). Seine nets were used to block creek mouths in order to intercept fish as they left creek systems with the outgoing tides (Figure 1). Seines were left in place until low tide, at which time the fish were encircled by the net. Trapped fish were transferred into a flow-through holding pen using dip nets. Fish were then individually transferred into smaller coolers for measuring and tagging. The conventional anchor tag-and-recapture method was used to assess movements and growth rates (Ault et al. 2005). Fish were measured for total length and fork length to the nearest mm (Figure 4). Small plastic dart tags were inserted and anchored in between the dorsal musculature and bone structures using a tagging device (Figure 6) (Ault et al. 2005). Fish were also captured by fly-fishing during incoming tides (Figure 2). Responsible angling practices were used to minimize inflicting harm on the bonefish (Cooke and Philipp 2004).

Acknowledgements

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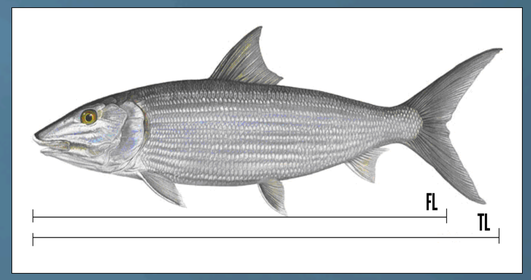

Figure 3 (top left). Flats and mangroves. Figure 4 (top right). Fork length (FL) and total length (TL) of a bonefish. Figure 5 (bottom left). The southern tip of Eleuthera with the creeks labeled and categorized as neighboring and far away creeks for recaptured fish. Figure 6 (bottom right). A tagged bonefish being measured for FL in the flats ecosystem.

Results

In this experiment 106 bonefish were tagged, out of which 21 were recaptured. The average fork length (FL) for the recaptured fish was 399.8 mm, and the average total length (TL) was 456.9 mm. In total 684 bonefish (average FL=430.44mm, average TL=480.1mm) have been tagged around the island of Eleuthera thus far.

By observing the movement patterns of bonefish, it was apparent that most of the recaptured fish were caught in the same creek as their first capture or in a neighboring creek (Figure 7). Additionally, fish that were recaptured in the same creek have faster rates of growth (Figure 8). Using an ANOVA test, it was determined that there was no statistical difference between the growth rates of fish recaptured in neighboring creeks and far away creeks (Figure 8, $p = 0.206$). However, there was a significant difference between the growth rates of fish recaptured in neighboring creeks and the same creek (Figure 8, $p = 0.003$) and between fish recaptured in the same creek and distant creeks (Figure 8, $p = 0.002$).

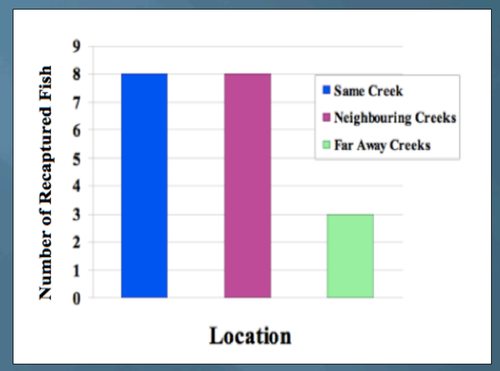

Figure 7. Number of fish that were recaptured in the same creek, a neighboring creek, or a far away creek in Eleuthera.

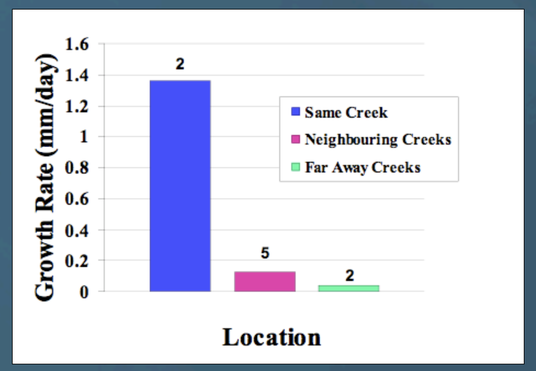

Figure 8. Growth rates of bonefish that were recaptured in the same creek, a neighboring creek, or a far away creek in Eleuthera. The numbers above each bar represent sample sizes. Fork length measurements were used to calculate growth rates.

Discussion

In conclusion, the results do not support the hypothesis that bonefish travel great distances within the island of Eleuthera. However, more data collection would need to be conducted to verify whether this conclusion also applies to the larger scale of bonefish movements, such as between Florida and the Bahamas. The results also indicate that bonefish recaptured in the same creeks have higher growth rates than fish that move between creeks. It is possible that fish which travel between creeks have less time to feed, and are also expending extra energy that could have been used for growth.

The growth rate data suggests that the average total length of bonefish in the Bahamas (480.1mm) is smaller than that of bonefish around Florida (592.2 mm) (Humston et al. 2005). Future studies might do DNA analyses to examine whether it is a different spices of bonefish in Florida. Additionally, studies might be conducted to determine what habitat factors affect the growth limits of bonefish.

This study was important because the Bahamian economy relies on angling for bonefish as a large part of their income. In order for bonefishing to persist, sustainable fishery policies and practices must be established. The results of this study suggest that establishing a marine protected area would be beneficial for bonefish populations. Future research could be conducted in the Bahamas to determine the population densities on different islands and in various creeks in order to facilitate management. It would also be beneficial to continue this study to collect more data to increase sample sizes.

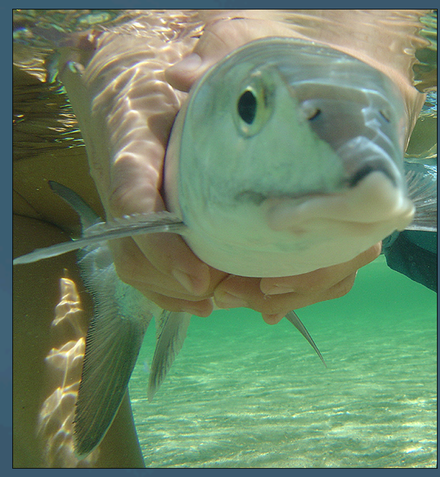

Figure 9. Bonefish being released after tagging event.

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