Introduction

Ecological systems contain multiple predators and prey but few studies have examined the complex interactions, especially with non-native predators. Predation may be evolutionary naïve with such predators and thus exhibit ineffective or inappropriate defense behaviors when faced with a novel threat. Introduced-predator effects may be attenuated or exacerbated depending on interactions with native predators or with previously established non-native predators.

More than 30 non-indigenous fish species are currently established in Everglades National Park (ENP), a large number relative to the small 35-species native fish fauna. A recent biological invasion of ENP (ca. 2002) is that of the African jewelfish, Hemichromis formosa. Among the most abundant and well-established non-native fishes is the Mayan cichlid, Cichlasoma letourneuxi. We used a field enclosure experiment to assess and compare predation effects of these two non-native cichlids and an aquarium experiment to examine predator tactics and anti-predator behavioral responses.

Research Questions

- Are these two predation effects fundamentally redundant (i.e., are predation rates and performance similar)?
- How do these predators interact (including a function of size, since Mayan cichlids are larger)?
- How do native prey respond to these non-native predators?
- How does anti-predator behavior relate to the vulnerability to predation of prey?

Field Enclosure Experiment

We conducted an in situ replacement series experiment (Schnittker, 2007) in a randomized-block design at the peak of the wet season (October 2007; mean water level 33.4 cm) to compare mortality rates among treatments of Mayan cichlids, African jewelfish, and African jewelfish-Mayan cichlid combinations.

Laboratory Behavior Experiment

Timed trials were conducted in aquaria with similar randomized-block design to record behavioral interactions. Six hourly spot-check observations were taken.

Conclusions

Our results showed that the well-established invader had a larger predation effect than the recent invader. Mayan cichlids have a higher predation rate than African jewelfish, Jordanella floridae, and Palaemonetes paludosus. The recolonization of ENP (ca. 2002) is that of the African jewelfish, Hemichromis formosa. This study provides insight into the nature of interactions between African jewelfish and the native Everglades aquatic-animal community.

Implications

This study provides insight into the nature of interactions between African jewelfish and the native Everglades aquatic-animal community. It is important to determine if predation by the non-native cichlids poses a formidable threat to the native community, and if range expansion by African jewelfish will result in negative impacts to areas of the Everglades presently unpolluted. Invasive species are a major conservation concern in the restoration of the Everglades and may be affected indirectly by CERP actions. For instance, the pro-project envision 36 km of canals and levees will remove canal habitat that is home to a number of non-native fish species, and that seem to be cold-temperature refugees, allowing reoxidation of marshes after severe winters. However, new structures and canals are also planned to move water in CERP projects, and transformations of invasive species should be considered in that planning. Overall, restoration should enhance Everglades habitats and the functional quality of the ecosystem, which has been shown by research to benefit native species to the detriment of non-native taxa.

Literature Cited


Acknowledgments

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Fig. 1. Native prey; 6 individuals used for the field study and 2 individuals used for the aquaria study, per species.