Introduction
Lionfish are a venomous, predatory species endemic to the Indo-Pacific. In their natural habitat, lionfish are found between 0 – 50 meters (Fishelson 1975), which means they feed at dawn and dusk. Lionfish were introduced to the Atlantic Ocean in 1992 during Hurricane Andrew by the aquarium trade as an ornamental reef fish (Whitfield et al. 2002). Lionfish abundance has increased from their introduction to the Atlantic due to lack of natural predators and an exponential reproduction rate. As an invasive species, lionfish pose the potential threats of reducing biodiversity and recruitment of ecosystems (Albins and Hixon 2008). The Bahamas relies greatly on a fishing based economy (Danylchuk 2003) and lionfish reduce species composition and diversity that may result in negative ecological and economical impacts.

Methods

Study Site and Collection
Thirty-two lionfish (11 juveniles, 15 sub-adults, and 6 adults) were collected from shallow and deep water patch reefs in the Cape Eleuthera area, ranging in depth from 5 ft to 85 ft. Lionfish were collected between the months of February and May, 2009 using a hand-held aquarium net. Specimens were introduced to the testing container where the water temperature was raised by 0.2°C per minute until loss of equilibrium (Fig. 2). The water temperature, behavior, and color changes were recorded every minute and dissolved O2 levels were recorded every 5 minutes.

Dissection

The wet weight (g), total length (mm), and standard length (mm) were recorded. Stomach contents and sex were also observed. Two tissue samples were taken from the dorsal musculature for stable isotope analysis and genetic testing.

Statistical Analysis

Linear regression analysis was used to determine the relationship between body size (length and weight) and CTMax of lionfish. Analysis of variance (ANOVA) and the Tukey’s test were used to assess significant differences between CTMax and life stage.

Results

The total length of lionfish ranged between 120 mm and 360 mm ±56.33 mm. The results indicate that there was no correlation between CTMax and total length (r² = 0.15799, p-value = 0.101, Fig. 5). The CTMax ranged from 33.8 °C to 38.8 °C ±1.1 °C. The relationship between CTMax and wet weight was significant (r² = 0.05378, p-value = 0.024, Fig. 5) as indicated by the p-value, which was <0.05. The weight ranged from 16 to 976 g (±174.1 g). Sub-adults had the highest mean CTMax, which was 37.1 °C (±1.0 °C) and adults had the lowest mean CTMax of 36.2 °C (±1.1 °C). Overall, there was no significant difference between CTMax and life stages (p-value = 0.101, Fig. 6). The mean CTMax of all lionfish sampled was 36.9 °C (±1.1 °C).

Discussion

The purpose of this study was to find and compare the CTMax of lionfish to their body size, and to support the initial hypothesis that body size has a significant relationship with CTMax. Wet weight had a significant relationship with CTMax, but overall body size did not. Previous studies have shown variable relationships between CTMax and body size (Mora and May 2006; Ospina and Mora 2004). Lionfish are medium bodied fish, which could affect the amount of time it takes for heat to diffuse through their body (Ospina and Mora 2004).

The information gathered will help to inform the Bahamian government about the distribution and habitat use of lionfish. Today, a network of five Marine Protected Areas (MPAs) has been proposed in the Bahamas (http://www.bfref.org). 90% of the lionfish tested in our study were collected from reefs in one of the proposed MPAs (Fig. 8). This research will assist the Bahamian government to determine which habitats should be included in the MPAs. Knowing the lionfish CTMax will also allow future research to predict which habitats lionfish can live in according to their upper thermal limits.

The lionfish tested throughout this study were all collected from patch reefs. Future research should test lionfish from different habitats including creeks, flats, and mangroves to determine if habitat correlates with CTMax. Mora and May 2006 discovered that there is a direct relationship between acclimation temperature and CTMax. The acclimation temperature is derived from the ocean and varies significantly depending on the season. Additional research should examine the seasonal affects of acclimation temperature on the CTMax of lionfish. Continued research on lionfish ecology and biology is required to adequately assess potential impacts to the ecosystem.

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Literature Cited


