

Assessment of queen conch (*Strombus gigas*) population density in Cape Eleuthera Sound

Shelby Ambargis, Robert Balloch, Maxwell Gordon, Amelia Patsalos-Fox, Shane Wetmore, Sterling Wright
Advisors: Steve Auscavitch and Kristal Ambrose



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Introduction

Queen conch have been a significant cultural and economic resource in the Bahamas since it was first used for food and decoration by the aboriginal inhabitants (Schaffer et al., 2012). As a major marine export in the Bahamas, conch bring millions of dollars to the Bahamian economy annually. The decline in tourism in the 1980s' and 90's in South Eleuthera caused a shift in the dependency on marine life as a source of income, resulting in further exploitation of marine species (Danylchuk, 2003). There is currently no closed season for conch and harvest regulation requires that conch must have a defined shell lip flare and can be not taken while using SCUBA. The flared lip has been suggested to be a sign they have reached sexual maturity, in hopes this will have allowed the conch a chance to reproduce before it is taken.

Recent Research

Conch are a population density dependent species; there needs to be a minimum density of conch in order for mating to occur (Allee effects). Stoner *et al* found this density value to be roughly 50 adults per hectare (2000). In the Berry Islands and Andros, historically important fishing grounds, the relationship between adult density and mating occurrence was observed. In these surveys no mating was observed in densities less than ~47 conch per hectare (Stoner et al, 2012). Also, several recent studies have concluded that the flared lip may not be an appropriate indicator of sexual maturity (Stoner et al., 2011; Stoner et al., 2012).

The lack of queen conch population data for South Eleuthera poses challenges for effective management and regulation of queen conch fishing in the Bahamas to ensure a lasting fishery for the future. The purpose of this research is to determine conch densities in the Cape Eleuthera Sound to establish a baseline census. These densities can then be compared to the density needed for a effective mating and population sustainability.

Methods

Study Area

The survey area for this study was located on the bank side of Eleuthera. The region has been found to support conch nurseries because of the shallow depths (<5m), seagrass beds, scattered patch reefs and coarse to fine grain sand beds. These types of habitats are similar to where conch have been observed to spawn in the summer months. (Clark et al., 2005; Stoner, 2003)



Figure 1: The Conch team collects data from a transect within the survey area.

Data Collection

Within the survey area, 42 GPS-guided transects approximately 6000 m² each in area, were conducted. One snorkeler was towed behind a boat taking note of live adult, sub-adult, and juvenile conch present. Adult conch were collected and measured, when present, to determine the total shell length and lip thickness. Depth measurements were also taken on each transect. Finally, dominant benthic cover was recorded at each site through underwater photos.

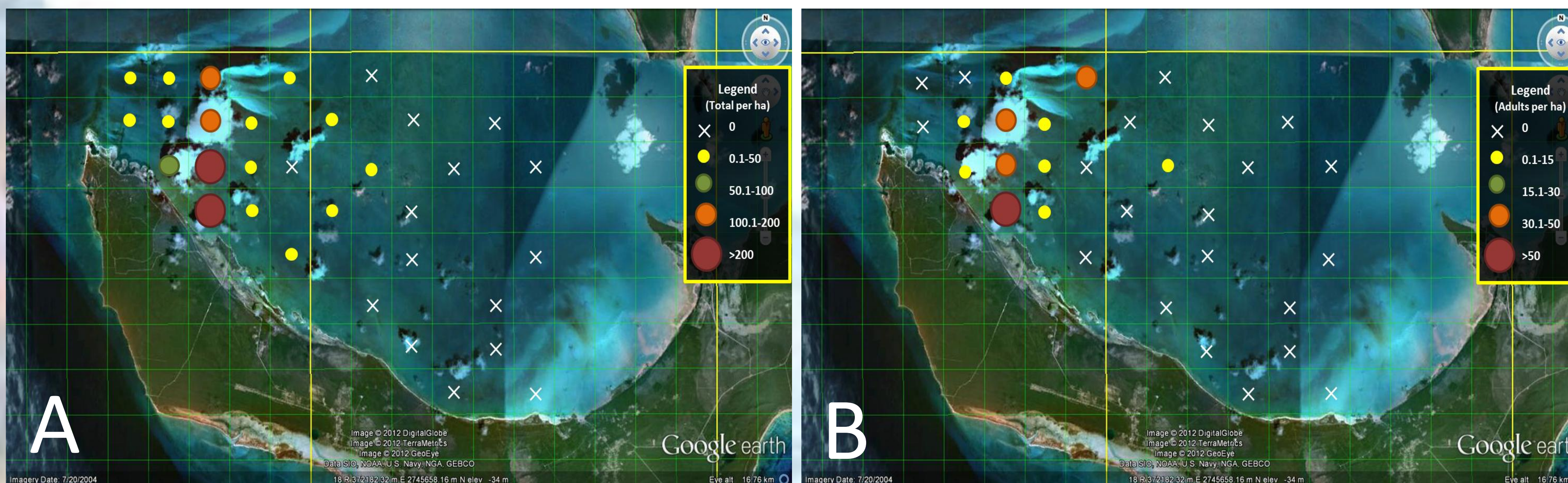


Figure 2: A) Total number of conch and B) Number of adult conch observed per hectare across the southern bight of Eleuthera. Larger circles denote a higher population density.

Results

Queen Conch densities ranged from 0 to 370 individuals ha⁻¹. The highest densities of total conch were found east of Powell Point, inside an area bounded by a sandbar to the north and Page Creek to the south (Figure 2A). Adult conch densities ranged from 0 to 70 individuals ha⁻¹. Maximum mean adult density values were found to be 54 ha⁻¹ in this area (Figure 2B). The mean adult densities for the areas southeast of Powell Point and west of Poison Point were 28 and 0.4 adults ha⁻¹, respectively. Adult conch make up approximately 12% of all individuals as compared to juveniles (82%) observed in this area. More than 10 areas were found to have no adult conch at all. In the macroalgae and seagrass dominated habitat types, mean conch densities were found to be 35.3 and 27.3, respectively (n=42). These were significantly higher than the sandy bottom habitats, with a mean density of 0.2 conch ha⁻¹ (Figure 3). A total of 19 adults shell lips were measured; thicknesses ranged from 3-24mm, the mean lip thickness value was 7.6 mm and a mean total shell length of adults was 185mm (Figure 4).

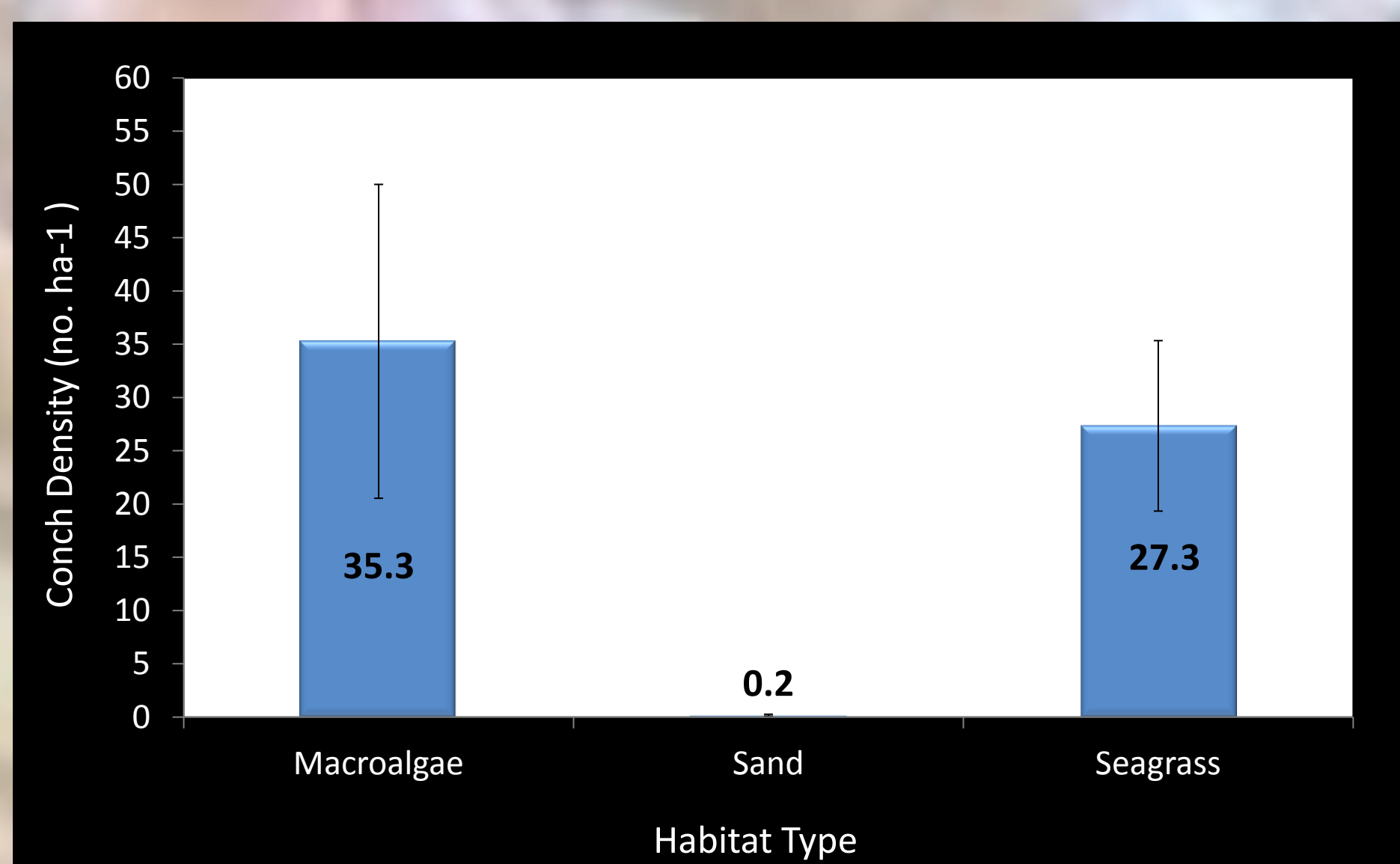


Figure 3: Densities of adult queen conch observed at three habitat types found in the survey area (n=42 transects, p<0.05).

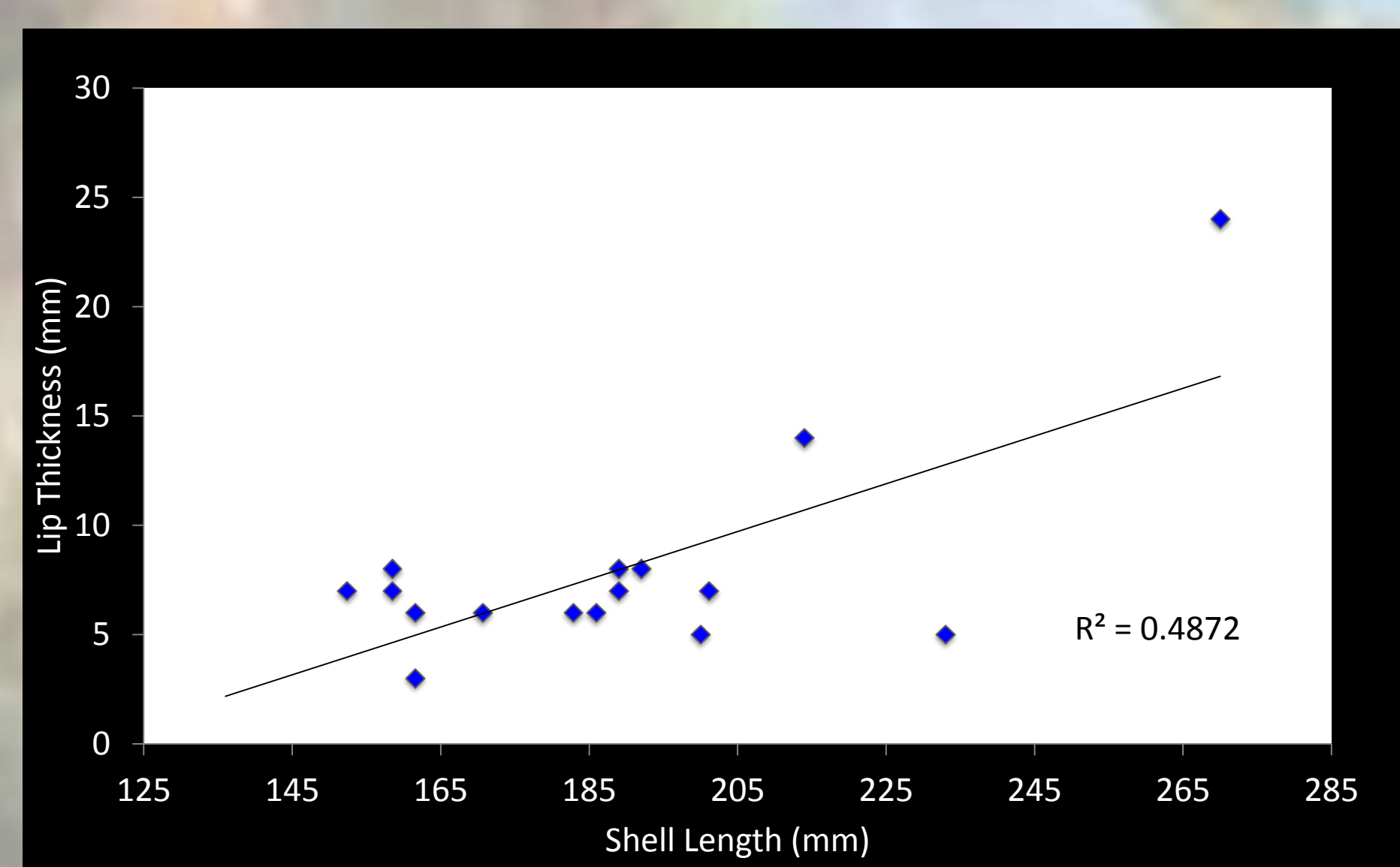


Figure 4: Shell lengths and lip thicknesses of adult conch (n=19) found on transects.



Figure 5 : A) Adult conch ≥ 150 mm, defined lip flare



B) Sub-adult conch ≥ 150 mm, no lip flare



C) Juvenile conch <150mm, no lip flare

Discussion

The density of adult queen conch in the Cape Eleuthera Sound, 14.2 adults ha⁻¹, were found to be lower than the average density necessary for observed mating, found by Stoner *et al* (2012). Such low observed densities suggest that the reproductive potential of this area is not sufficient to support the local population or populations down current with current fishing activity. Although we concluded these low adult conch densities may not sustain the population, we recognize adult conch densities are not the only indicator of the sustainability of a population. Many other factors play a role in this, such as benthic type, larval transport, seasonality and temperature. The previously mentioned factors in the area will also have a significant impact on annual queen conch recruitment.

A low mean lip thickness observed in this study suggest that queen conch in the area are part of a young population, many of which not reaching sexual maturity. This may be a result of fishing pressure continuing to remove many large thick-lipped adults, which generally yield larger amounts of meat. Having few sexually mature conch will likely have a negative effect on the reproductive capacity of the population, leaving densities too small for effective mating. The low conch densities found and the low mean lip thickness suggest this area may be overfished stock however annual recruitment data is necessary for further analysis of its suitability.

Future Research

To observe the occurrences of mating,, it would be beneficial to expand surveys into the warmer mating season (June-October). In order to quantify the population density of queen conch at deeper depths, surveys should extend to the shelf edge at depths up to 25m. These areas may act as a refuge from fishing activity for older adult conch. Also, identifying conch landings and catch per unit effort, indicators of fishing pressure, coupled with conch population data, would aid in determining the long-term sustainability of this stock..



Figure 6: Collecting data on lip thickness and shell length using calipers

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