

Comparison of Population Densities of Queen Conch, *Strombus gigas*, from 2003 to 2011 in Cape Eleuthera Sound

Ellen Eberhardt, Claire Russell, Annie Bryan, Hallie Coon, Benjamin Beardsley, Charles Sandor
Advisors: Erin Cash and Julie Claussen

INTRODUCTION

Background

Queen conch, *Strombus gigas*, have been a crucial part of the Bahamian culture and economy for centuries. The Lucayan Indians used queen conch as a food source as well as for tools and jewelry as early as the 1400s. When the tourist boom began in the early 1970s, demand for conch steadily increased. The added fishing pressures have stressed local populations so that queen conch harvest is now greater than their ability to replenish their numbers. In addition, human interference and destruction of conch habitats, such as dredging, construction, and coastal erosion continue to stress queen conch populations throughout the Bahamas.

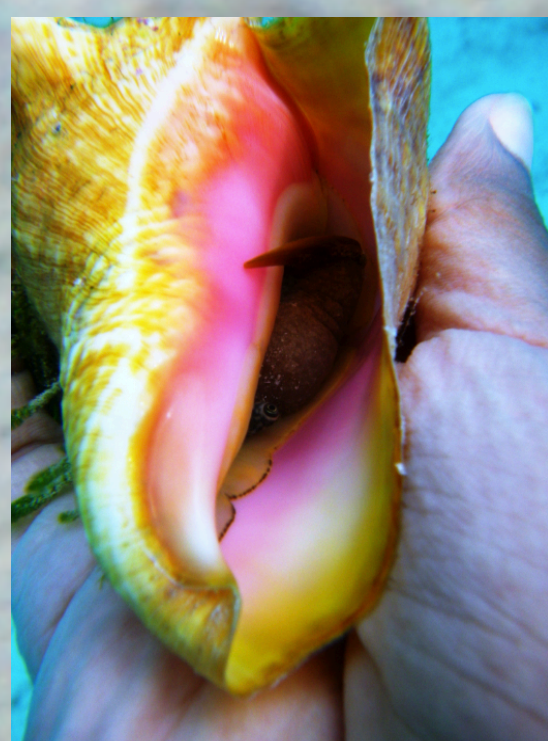
Due to the high demand of their meat, which is considered to be a prized delicacy throughout the Caribbean and Florida, Queen Conch play a key role in the local economies in the Bahamas. The conch fishing industry provides an abundance of jobs to local fishermen in the Bahamas. During times of economic downturn or in areas where there is little opportunity to for work, people often turn to the sea to harvest conch as a way to make money, as well as a source of protein. As the demand for conch has gradually increased, so have the fishing pressures. Fisheries regulations are not sufficient encouragement for fishers to find adult queen conch (Clark A. S. *et al.* 2009.). As adults become rare due to this increased pressure, they are being harvested faster than they can repopulate.

Previous Research

Much research has been conducted in order to investigate the changing population densities of queen conch. Archaeological studies show that humans first settled the Caribbean islands around 6,000–7,000 years ago, and evidence suggests these archaic fishermen were already having an impact on marine and coastal environments as early as roughly 6000–3000 B.P., with reported changes in landscape and species composition as a result of resource exploitation (Jackson *et al.* 2001; Wing and Wing 2001; Keegan *et al.* 2003; Fitzpatrick and Keegan 2007). In Venezuela, the appearance of younger and smaller specimens within middens has been considered a sign of heavy exploitation of local populations of queen conch during modern fisheries (Schapira D *et al.* 2009).

Current Research

This study is assessing if queen conch populations have decreased in recent years around Cape Eleuthera. The purpose of this project was to accomplish three goals: 1) to compare population surveys completed in 2003 to densities found today, 2) to determine whether the sites observed reflect a nursery habitat for queen conch, and 3) to assess a suitable conch habitat, and determine the ideal habitat for a conch to thrive.



Picture 1. Non- flared lip



Picture 2. Juvenile conch in algal plain



Picture 3. Juvenile conch in seagrass

METHODS

Research was conducted off the coast of south Eleuthera in the Cape Eleuthera Sound. Nine study sites were selected from the previous 2003 study (Clark *et al.* 2003) and located using a Global Positioning System. At each study site, three 30 meter transect lines were set (Picture 4 and 5) to encompass a 200 by 200 meter area. All live queen conch were collected within one meter on either side of the transect line (Picture 6). Each conch was then assessed to determine if it contained a live conch, the condition of the shell, and then measured using calipers for the shell length, and lip thickness. All conch were then placed back at the study site before proceeding to the next site.



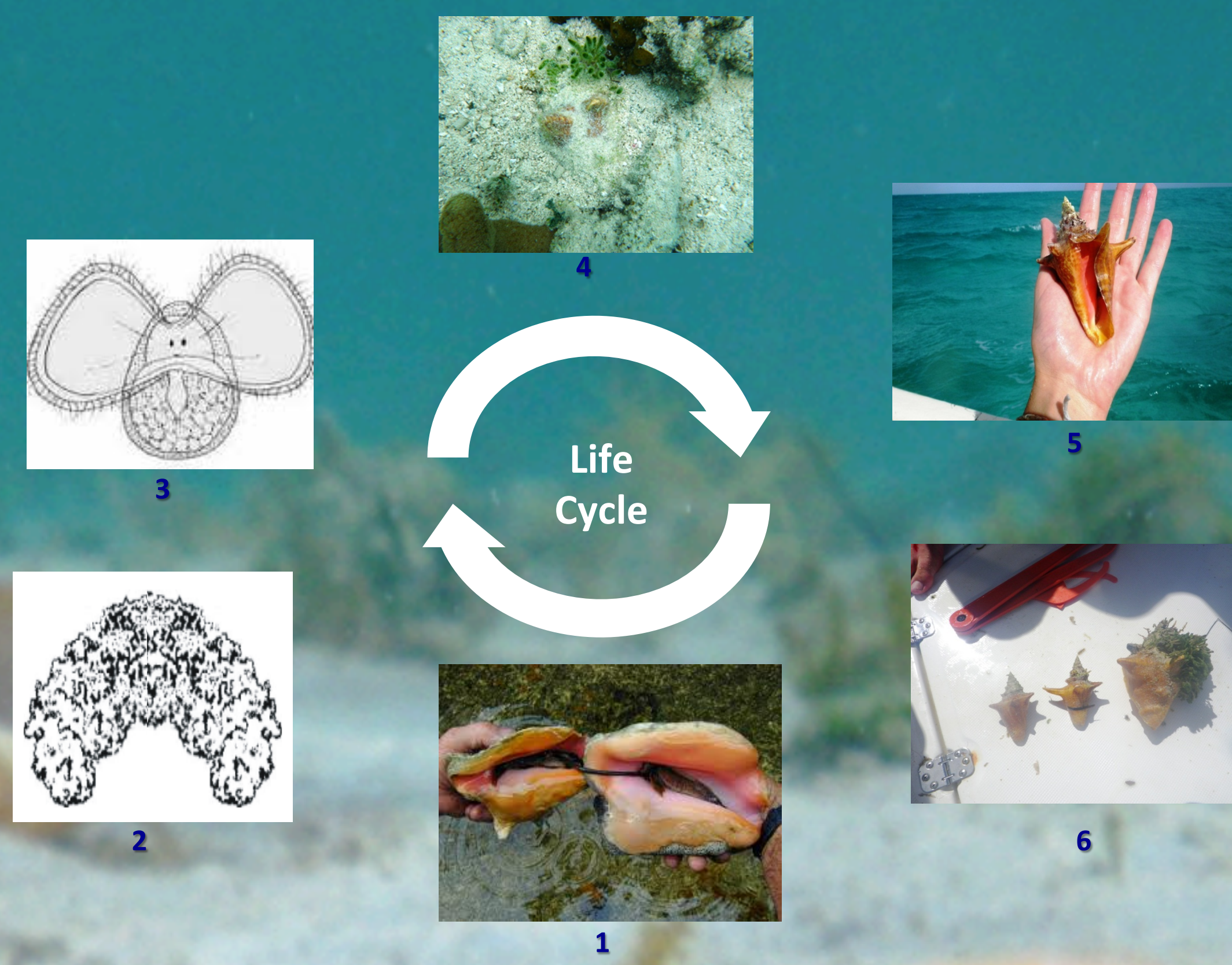
Picture 4. Laying out transect



Picture 5. Transect on seabed



Picture 6. Collecting conch along transect



RESULTS

There was a significant decrease in total number of queen conch per hectare collected in 2011 compared to what was collected in the 2003 study (Figure 4). An Analysis of Variance (ANOVA) determined that there were significant changes in the population density of queen conch from 2003 to 2011 among the nine study sites (p-value = < 0.008, Figure 2). The percentage of juveniles being harvested in comparison to the percent of adults increased by 2% and was therefore not statistically significant (Figure 1). There were declines in total conch collected within each size class between the years surveyed (Figure 3).

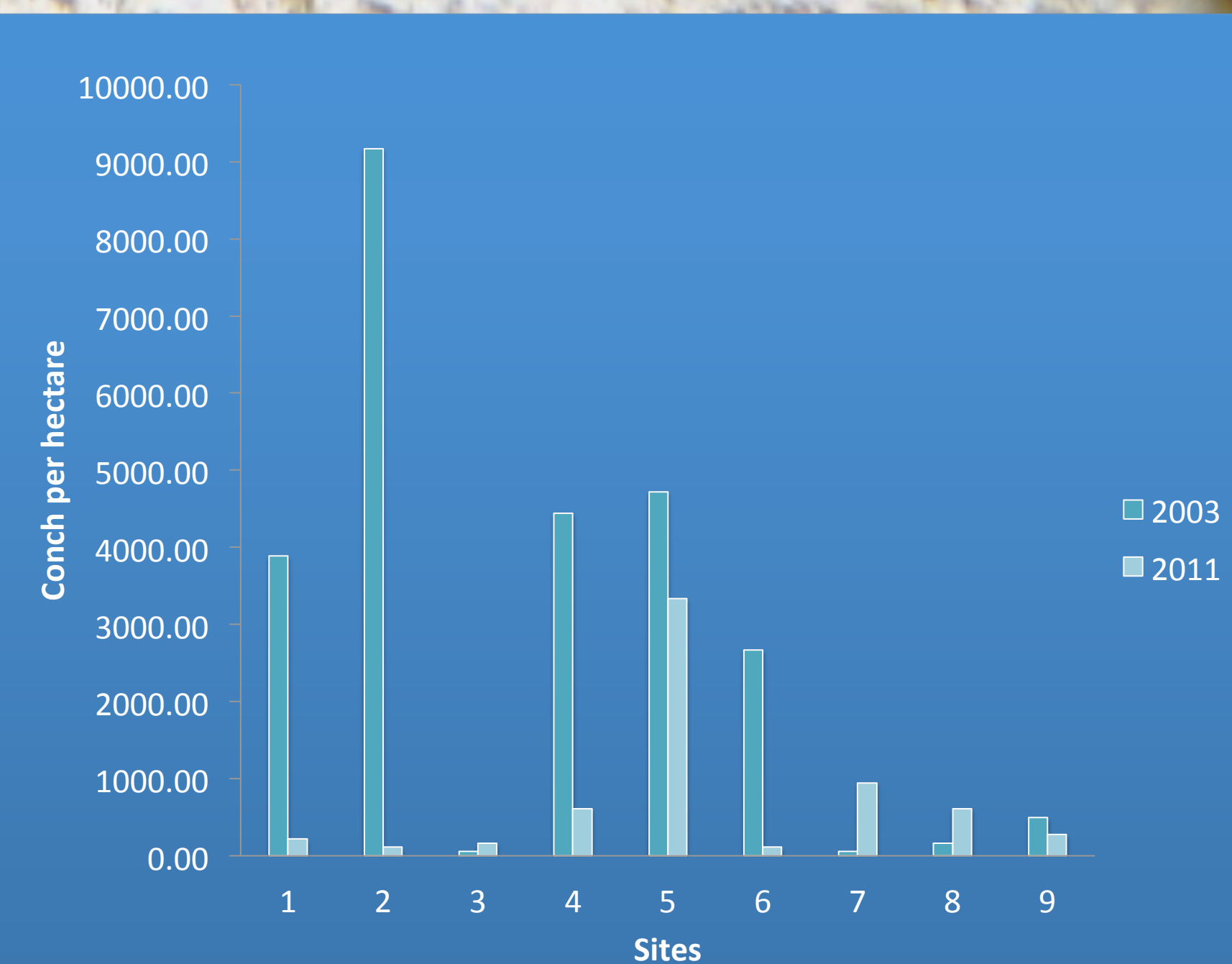
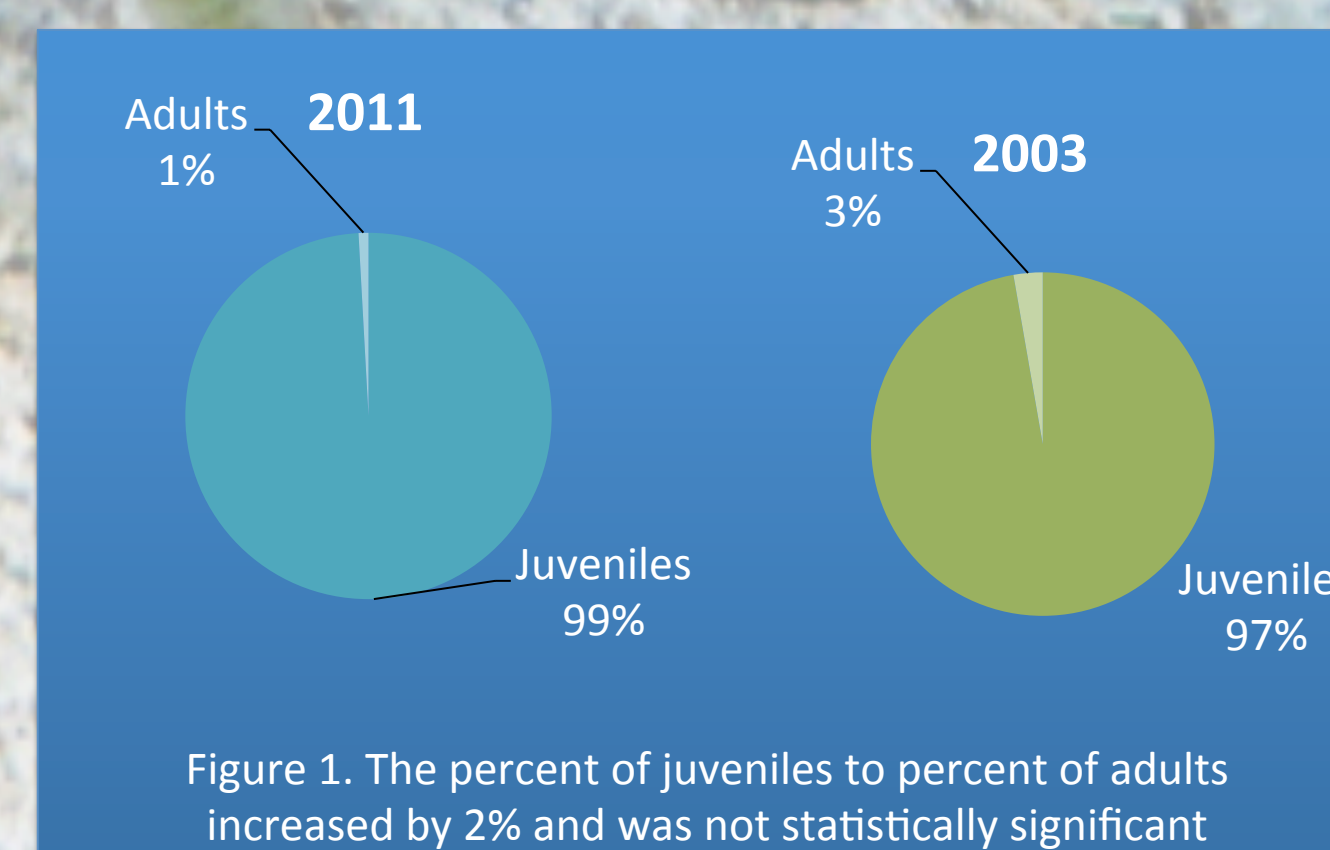


Figure 2. Results show that there is a significant decrease from 2003 to 2011 in the population density of queen conch within the sites studied pvalue <0.008

DISCUSSION

The objective of the research conducted was to compare data surveyed in 2003 to the collected data in 2011 on survey densities of queen conch in Cape Eleuthera Sound. The data supports the hypothesis that a decrease in densities of queen conch in the majority of the sites that were observed. We also determine that the number of juvenile conch found within the study area reflects a suitable nursery habitat for queen conch.

Factors that may contribute to these findings include overfishing (Clark *et al.* 2004), migration (Stoner *et al.* 1994), climatic variations, and predation (Jory *et al.* 1983). Overfishing can be in the form of the harvest of too many adults, or that illegal harvest of juveniles is occurring. Each would result in an unsustainable conch fishery.

In future studies it would be beneficial to repeat this research on a larger scale. Expanding the number of shallower water study sites around Cape Eleuthera would provide a clearer picture of the juvenile conch population structure. Expanding the study area to deeper water would provide better information on the entire size classes of queen conch. In addition, assessing active middens would allow for the evaluation of past and present fishing pressures in the area. This research would relate to middens surveyed in Los Roques Archipelago National Park in Venezuela, where conch population declines were evaluated (Schapira *et al.* 2009).

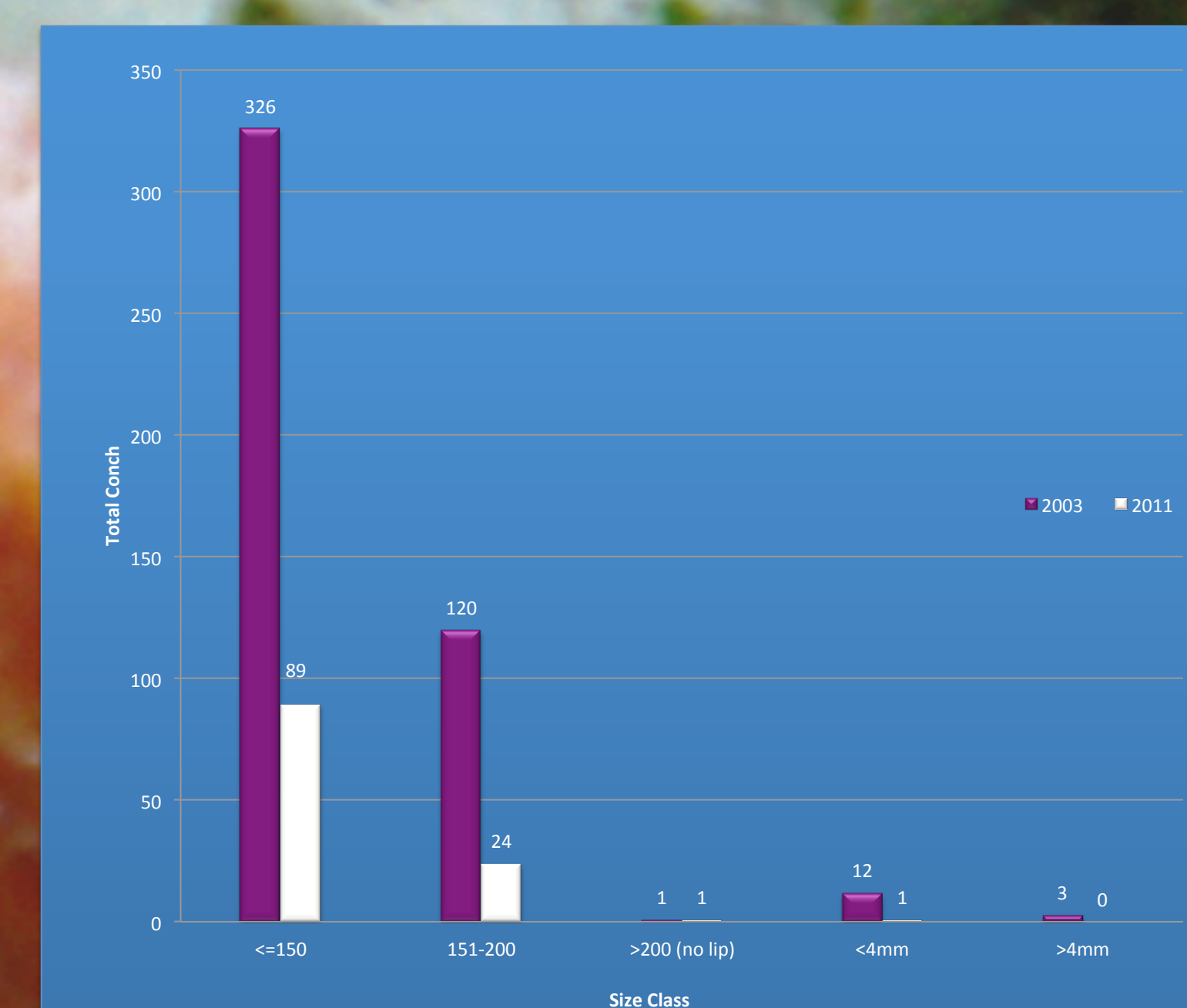


Figure 3. Size class data shows that there was a statistically significant decrease in total conch collected across size classes. These size classes are <=150 mm, small juveniles, 152-200, medium juvenile, >200 no lip, large juveniles, < 4 mm lip thickness, sub adult and > 4mm, adult.

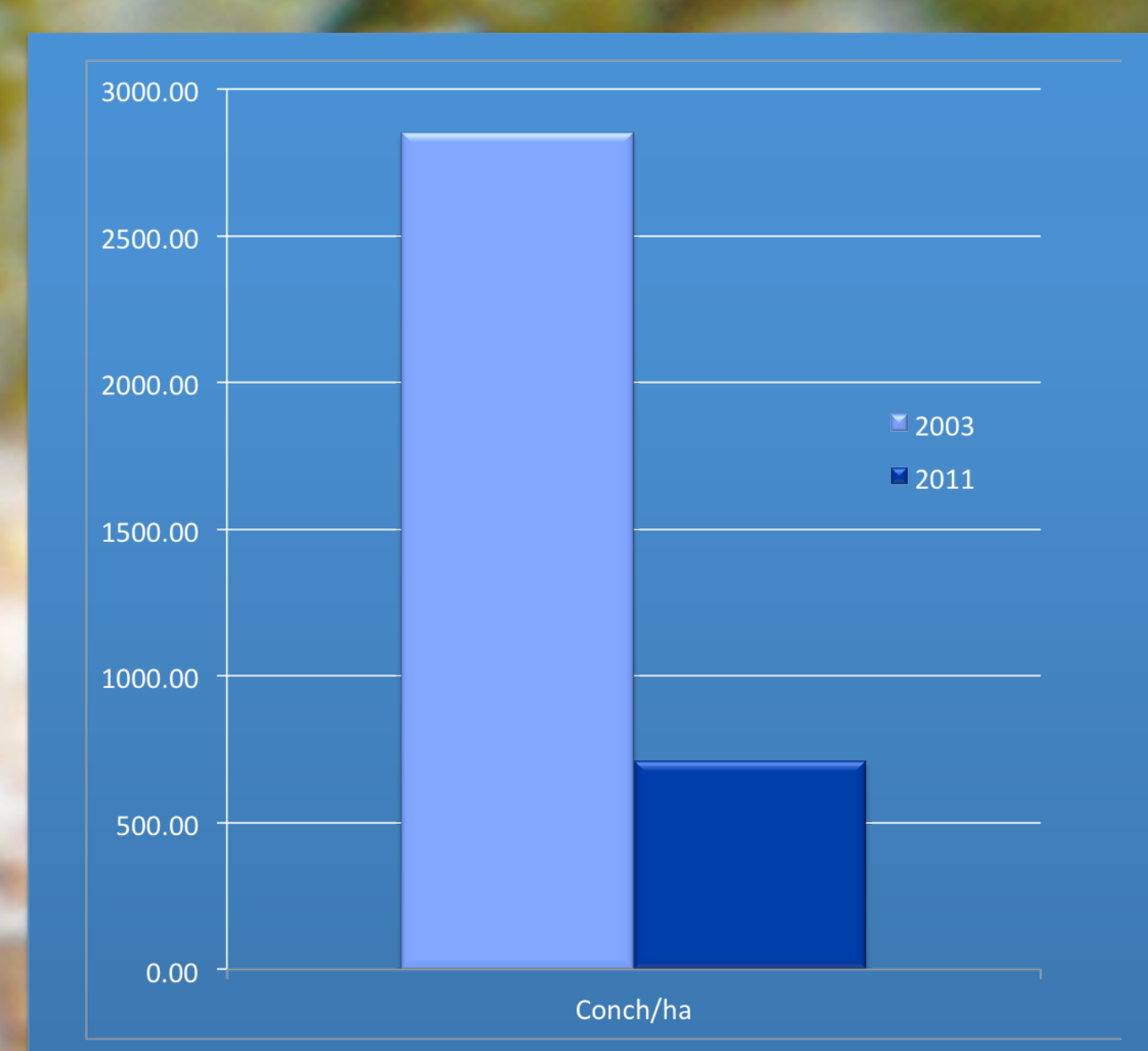


Figure 4. Data shows that there was a significant decrease of queen conch collected in 2011 compared to 2003

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WORKS CITED

- Charles, A., and Wilson, L. 2009. Human dimensions of Marine Protected Areas. – ICES Journal of Marine Science, 66: 6–15.
- Clark, A.S., Danylichuk, J.A., Freeman, T.B., 2004 The Harvest of Juvenile Queen Conch (*Strombus gigas*) off Cape Eleuthera, Bahamas: Implications for the Effectiveness of a Marine Reserve. GCFI 56: 705-713
- Danylichuk, J.A. Fisheries Management in South Eleuthera, Bahamas: Can a Marine Reserve Help Save the 'Holy Trinity'? Proceedings of the Gulf and Caribbean Fisheries Institute, Vol. 56 (in press)
- Davis, M.. 2005. Species Profile: Queen Conch, *Strombus gigas*. SRAC Publication No. 7203
- Schapira, D., Montano I.A., Antczak, A., Posada J.M.2009. Using shell middens to assess effects of fishing on queen conch (*Strombus gigas*) populations in Los Roques Archipelago National Park, Venezuela. Mar Biol 156: 787-795
- Shawl, A. Prada, M. Castro, E. Taylor, E. Davis, M 2007. Queen Conch Ranching and Educational Outreach as Part of the Seaflower Biosphere Reserve, Colombia GCFI 59: 79-83
- Stoner, Allan W. 2003. What constitutes essential nursery habitat for a marine species? A case study of habitat form and function for queen conch. Marine Ecology Progress Series 257: 275-289
- Stoner, Allan W., Ray, Melody. 1996. Queen Conch, *Strombus gigas*, in fished and unfished locations of The Bahamas: effects of a marine fishery reserve on adults, juveniles and larval production. Fishery Bulletin 94(3): 551-565