Habitat Choice and the Distribution of Juvenile Conch

Progress Report

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INTRODUCTION

Seagrass meadows are known to be important sources of food and shelter for numerous fishes and invertebrates from high to low latitudes (Ogden, 1980). Juvenile queen conch are primarily found in the seagrass, *Thalassia testudinum* (Randall, 1964). We have recently documented (Stoner and Waite, in review) the habitat characteristics within *Thalassia* with which juvenile queen conch are associated. We also reported on the ability of different size classes to choose between different seagrass characteristics. Successful management of the fishery and/or outplanted populations will depend upon detailed information on the relationships of conch and environmental variables.

SITE DESCRIPTION

The Study was conducted in the Exuma Cays, Bahamas, at two sites with known juvenile conch populations. The first site is located 1.5 km west of Children's Bay Cay (CBC) (23° 44.3'N, 76° 04.5'W), and the second site just southwest of Shark Rock (SR) (23° 45.0'N, 76° 07.5'W), a rock outcrop off the southern end of Norman's Pond Cay.

METHODS

Field Measurements

At each site three transects were run from bare sand to dense seagrass, in both July 1988 and February 1989. Stations marked by stakes were placed along each transect (5 at CBC and 7 at SR). Habitat characteristics were measured in a 2 and 1/2 m circle around each station. These included *Thalassia* shoot density, *Thalassia* and detritus biomass (gathered in 1/4 m quadrats), depth, and sediment grain size and organic content. Conch were counted and measured at each station, and conch biomass was calculated from their lengths.

Habitat Choice Experiment

Experimental manipulations of plots of seagrass were made at the Shark Rock site to test for habitat preference in conch of various size classes. Cages were built and *Thalassia* shoot densities were manipulated to present two habitat types to conch of three different size classes. Runs were made presenting these habitat combinations: low shoot density and sand, moderate shoot density and sand, moderate and low shoot density, and high and moderate shoot density. Ten conch were placed in each enclosure on the border of the two habitats. After three days, the number of conch found within each habitat was recorded.

RESULTS

Distribution Patterns

At all sites and dates, habitat characteristics had similar patterns across stations. *Thalassia* shoot density, *Thalassia* and detritus biomass, and depth all increased with increasing station number. Sediment grain size decreased slightly, and organic content increased slightly along transects. Correlations were strong between macrophyte variables and depth.

At Children's Bay Cay, conch density also increased along transects from station 1 to 5 (except for a small decrease at station 5 in February). At Shark Rock, numbers of conch and biomass again increased to station 5, but then in July decreased at stations 6 and 7, and in February, decreased at station 7. A multi-way analysis of variance on log-transformed data showed no interaction terms between date, site, and station ($p < 0.05$). There were also no transect differences within a site and date, and so transects were used as blocks. A One-way ANOVA on combined data (using stations 1 – 5 only) showed a significant difference in the log of conch density between stations ($F = 22.02$, $p < 0.0001$). Log transformations of conch biomass showed similar results, increasing along transects (Stations 1 – 5) with significant differences between stations ($F = 21.17$, $p < 0.0001$).

Highly significant correlations were found between conch density and biomass, and the depth and macrophyte variables (using only Stations 1 through 5 at SR). At each site and date separately, these four habitat characteristic always showed a strong correlation with conch density. When sites and dates were combined, correlations were still significant ($p < 0.01$). Regression analysis showed that conch density increased with shoot density, up to an optimum level.

A stepwise multiple regression for conch density using all of the data for stations 1 through 5 showed shoot density to be the best predictor of conch density, followed by detritus biomass and yielded a multiple correlation coefficient of 0.664 ($p < 0.001$). An analysis of conch length frequency across stations showed that smaller conch are more abundant at stations 3 – 5, with larger conch found at stations 6 – 7 (at SR).

Habitat Preferences

Conch were proficient in detecting and choosing habitats with different macrophyte characteristics. Ninety percent of conch in all size classes associated with moderate density seagrass as opposed to sand. Selectivity was less strong in other habitat pairs, though it was still clear that plots with seagrass present were selected over bare plots and that moderate seagrass shoot density plots were selected over high or low density seagrass. G tests showed that all size classes and treatment pairs resulted in highly significant differences with $p < 0.01$, except for two cases. Adults in the low/sand and high/moderate treatments showed no significant habitat preference.

DISCUSSION

Queen conch show an association with a specific range of seagrass shoot density. Conch numbers and biomass increase from low to moderate shoot density, where, at an optimal shoot density, they are found in greatest numbers. Beyond this shoot density, only larger animals tend to be associated. Proximal mechanisms responsible for this distribution may be:

- simple habitat choice for certain seagrass cover,
- limited mobility of smaller animals through heavy seagrass, and/or
- differential survival.

The cage experiments showed that juvenile conch are capable of habitat choice. They may choose habitats with preferred foods, such as macrodetritus and algal ephiphytes (Stoner and Waite, in review). Both of these food items increase with seagrass density. Also, conch may avoid bare sand or low density seagrass because food is limited (Stoner, 1989) or because of high predation rates in these habitats (L.S. Marshall, unpubl data). Beyond the optimal level, small conch may be unable to move efficiently through the dense seagrass and detritus. Randall (1964) speculated that thick stands of seagrass obstruct the movements of small conch. The greater ability of small conch to choose between habitats suggests they may have stronger evolutionary pressure to choose, possibly to avoid predation.

The relationship between juvenile conch and easily measured characteristics of the macrophyte community should prove useful in predicting conch distributions and in planning stock enhancement programs involving the seeding of hatchery-reared conch. This study demonstrates that there is a strong relationship between conch density and biomass and the amount of seagrass structure in the habitat; however, general seagrass characteristics can not be used as predictors of conch distribution independent of other variables such as food quality, presence of predators, hydrographic considerations, and recruitment processes.

LITERATURE CITED

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