Queen Conch Density, Movement Patterns, and Size Distribution in a Tidal Flow Field Nursery

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ABSTRACT

Natural conch distribution and patterns of movement were examined along the longitudinal axis of a current flow field in densities in the southern Exuma Cays, Bahamas, over a fourteen-month period. Conch densities in nine zones along the axis were different from each other, and densities within four zones changed significantly over time. Tagged conch released in the population center and in the periphery zones tended to either stay where they were released or move towards the population center. In spite of similar seagrass, sediment and depth characteristics over the flow field, conch were concentrated within a portion of it. Historically-important nurseries appear to be unique habitats and warrant protection as primary sources of future reproductive stock.

INTRODUCTION

Juvenile queen conch, (*Strombus gigas*), inhabit discrete nursery areas in seagrass beds throughout the Exuma Cays, Bahamas. Virtually all of these nurseries are on the shallow Great Bahama Bank within 2 to 4 km of tidal inlets which connect the Bank to the Exuma Sound (Stoner *et al.*, in press). Although vast regions appear to offer suitable habitat in terms of seagrass and detritus characteristics, sediment, and depth, conch occupy only a small proportion of the Bank. This lack of juveniles in apparently suitable areas suggests that historically-important nursery grounds are somehow ecologically unique.

The purpose of this report is to examine conch distribution in one persistent nursery area by: (1) quantifying conch density in the resident population, and (2) monitoring growth, survivorship, and movement patterns in juvenile conch transplanted in the nursery.

METHODS

The Shark Rock nursery area is south of Norman's Pond Cay in the tidal flow field west of Lee Stocking Island in the southern Exumas (Figure 1). Highest seagrass (*Thalassia testudinum*) shoot density and biomass are mid-channel, grading to bare sand on both sides. Juveniles in this nursery were found to be associated with moderate density seagrass near mid-channel (Stoner and Waite, 1990), and few conch had been observed outside the seagrass before our study began. Therefore, we concentrated our investigation on the seagrass

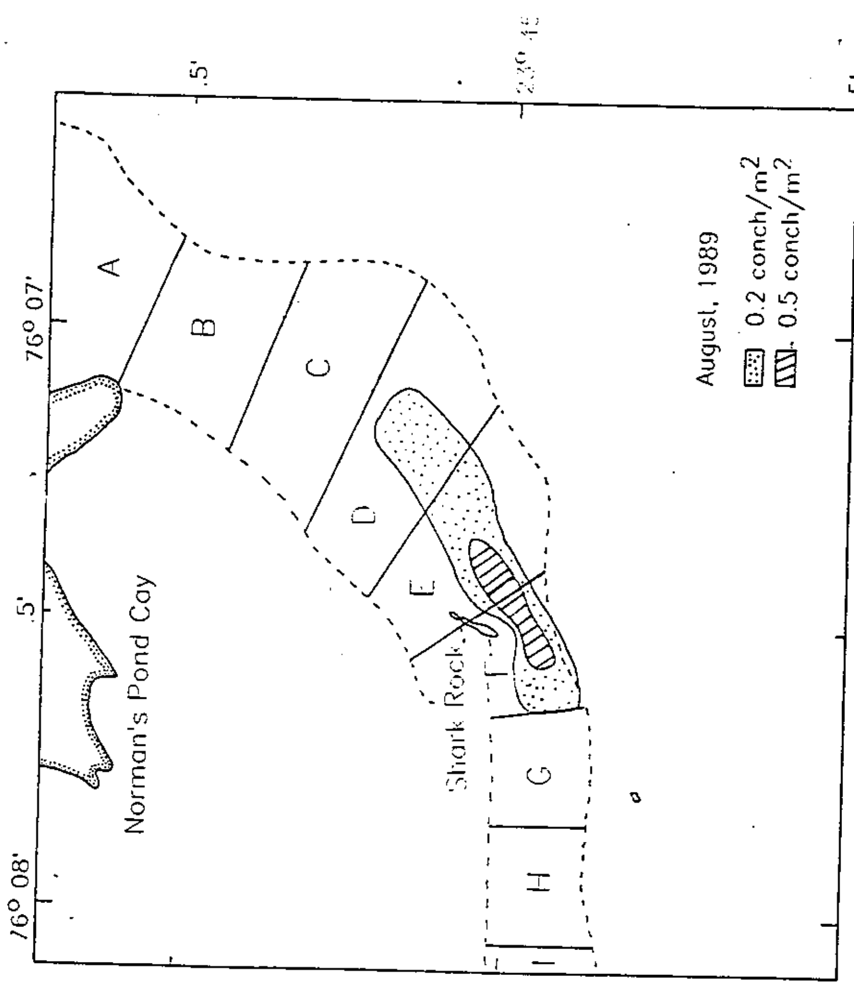

Figure 1. Location of the juvenile conch population at Shark Rock in the tidal flow field west of Lee Stocking Island, Bahamas, August, 1989. The stippled area represents the area with conch density greater than 0.2 / m^2, and the hatched area represents the area with density greater than 0.5 / m^2.

habitat of the tidal channel, dividing it into nine zones, each 300 m long and spanning the width of the flow field.

At the start of the study in August, 1989, snorkelers mapped the nursery to determine the overall population boundaries within which conch density was approximately 0.2 /m^2. Density surveys in each zone were conducted every two months from September, 1989 through September, 1990 for a total of seven surveys, and conch were measured to determine length frequency.

A tag release experiment was conducted to determine zonal differences in growth and survivorship as well as movement patterns within the population. In September, 1989, and May, 1990, two types (native and non-native) of tagged juvenile conch (total n = 4923) were released in each of three zones (Figure 1): the Sound end (zone B), the extreme Bank end (zones H-I), and the population center (zone F). During four recapture periods, recovered animals were measured, and their zone location was recorded. Winter growth was calculated for animals released during the first release and recovered in January, 1990. Summer growth was calculated for animals released during the second release and recovered in October, 1990.

RESULTS

At the beginning of this study, the Shark Rock juvenile conch population (0.2/m^2) extended from the upper portion of zone D through zone F and was concentrated within zones E and F (Figure 1). In each of the seven surveys, zonal differences in density were significant, and densities in zones C, D, E, and G changed significantly with time (Figure 2). In zone F, however, where conch were always most dense, there was no significant change over the year-long study period. Densities at the study area peripheries, zones A, G, H, and I, were consistently low.

Conch released in zones B and H-I tended to either stay in these zones or move towards the central population. Those released in zone F also tended to stay there and were rarely recovered beyond zones E and G. There were no marked differences between the movement patterns of native and non-native conch transplants.

Because tag recoveries over the flow field were thorough, the percentage of fall-released conch recovered during four recapture periods gave a reasonable estimate of survivorship over time and space. In all but the first recapture, survivorship was at least twice as high for conch released in zone F than for those released in zones B.

Winter growth rates in tagged conch (< 110 mm) were higher in periphery zones B and I than in zone F. Summer growth rates were highest in zone H.

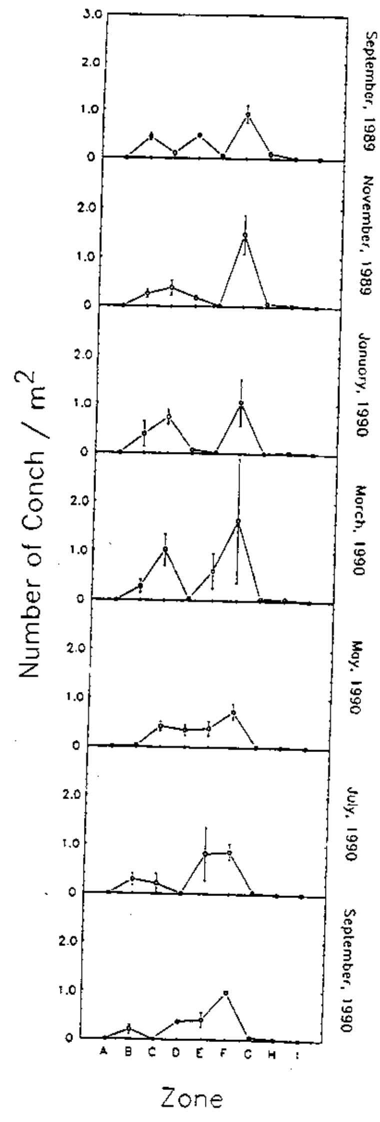

Figure 2. The number of conch / m^2 by zone at Shark Rock during seven surveys. Values are mean + standard error and are based on five samples, each 50 m^2.

DISCUSSION AND CONCLUSIONS

In spite of similarities in seagrass, sediment, and depth characteristics among the nine zones in the tidal flow field, juvenile conch were concentrated within a portion of the study area over the long term. Although juveniles are capable of discerning suitable seagrass habitat (Stoner and Waite, 1990), the presence of certain static features does not guarantee the presence of conch. Some transplants to areas with "optimal" seagrass biomass but without resident conch have resulted in low growth rates and high mortalities (Stoner and Sandt, 1991; Stoner *et al.*, in press). Although in this study growth rates of animals surviving transplant to the peripheries of the nursery population were high. There was a tendency among the survivors to move towards the population center. Dynamic factors such as predation, food productivity, and/or extent of tidal intrusion may have important influences on why juveniles occur where they do (Stoner *et al.*, in press).

It is well-known that queen conch populations are declining as a result of over-fishing in most regions where they occur (Brownell and Stevely, 1981; Appeldoorn *et al.*, 1987). Historic nurseries appear to be unique habitats and warrant protection as primary sources of future reproductive stock. In addition, the seeding of hatchery-reared juveniles will be most effective if selected transplant areas are characterized by features that are inherent in historically-important nursery areas. Further investigation of the features that make such areas suitable for juvenile conch should underlie management decisions concerning them.

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