Source and Significance of Deep-Water Conch in the Central Bahamas

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ABSTRACT

A survey of the queen conch populations near Lee Stocking Island, Exuma Cays, Bahamas, showed that over 80% of the adult conch were on the narrow island shelf adjacent to the Exuma Sound in 10-18 m depth. No conch were found deeper than 25 m. Adult: juvenile ratios and adult age increased with depth. Patterns of shell morphology suggest that adults that mature on the Exuma Bank rarely move off the Bank to deep water, and that the source for deep-water stocks are small inshore nurseries on the island shelf. The mostly unfished, deep-water populations are now probably the primary source of larvae for queen conch in the Exuma Cays. Because virtually all of the conch are within the limit of SCUBA, caution is advised in regulating the fishery.

INTRODUCTION

Strombus gigas (queen conch) is the second most important fishery species in the Caribbean region after *Panulirus argus* (spiny lobster) (Brownell and Stevely, 1981). The species has been fished to near extinction or to a level at which there is no longer a viable fishery for conch in many localities (Appeldoorn *et al.*, 1987). This particularly true in Caribbean nations where the fishery has been opened to SCUBA. In this report we present data on the depth distribution of queen conch in the Exuma Cays, Bahamas and discuss the importance of managing deep-water populations to prevent recruitment overfishing.

METHODS

An assessment of the adult conch populations was conducted during 1991 in a 12-km long section of the Exuma Cays adjacent to Lee Stocking Island (Figure 1). To the west and south of the Cays lies the Exuma Bank (part of the Great Bahama Bank), a shallow sand and seagrass-covered platform which extends to the Tongue of the Ocean. To the east and north is a narrow (1-2 km) island shelf and the deep Exuma Sound. The bank was divided into an inner section, from the Brigantine Cays to a line mid-way between the Brigantines and Lee Stocking Island, and an outer section, from the mid-line to the cays in the east. Approximately 90% of the bank area is less than 3.5 m deep. The island shelf was mapped for bathymetry using 540 points for depth and exact position. The

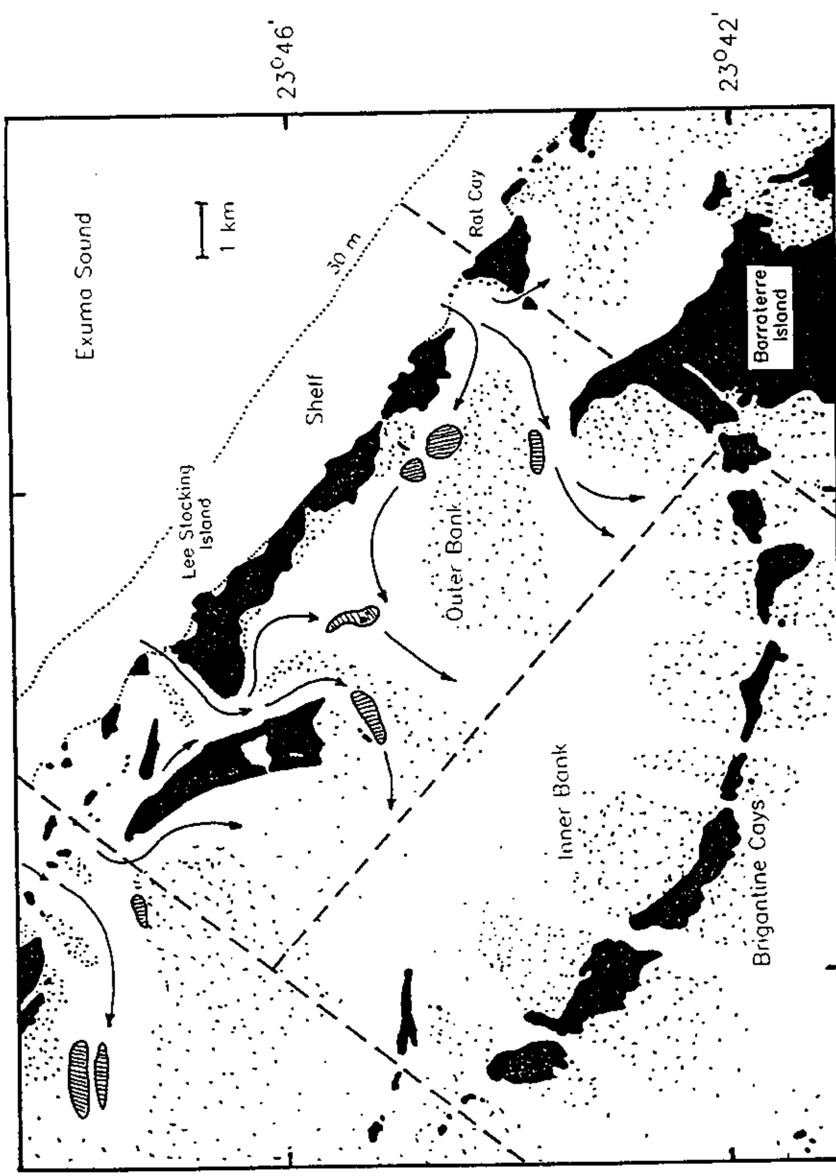

Figure 1. Map of the survey area near Lee Stocking Island, Exuma Cays, Bahamas. Sand bars (stippled), flood tidal currents (arrows), and the locations of Exuma Bank nursery habitats (cross-hatched) are shown.

bathymetric chart was then divided into regions of 0-2.5 m, 2.5-5.0 m, and 5-m increments down to 30 m depth.

The inner bank, outer bank, and the seven shelf regions were surveyed for adult conch. Bank sites were examined by divers towed behind a small boat over a total of 126 km distance in an organized grid of lines. Shelf sites were surveyed at each depth interval in nine transects extending perpendicular from the Cays into the Exuma Sound. At each station, measurements were made for conch length and shell lip-thickness. Except in the 0-2.5 m zone where adult conch were few, conch were counted over 8-m wide transects running parallel to the isobaths. Transect lengths were measured with a calibrated flow meter carried by scuba divers. Average transect length was 380 m, with a resultant surface area of just over 3000 m^2. Mean densities of conch in the bank areas and in each depth zone were extrapolated to total surface area for each of the regions. (For full details on the methods employed, the reader should refer to Stoner and Schwarte, in review).

RESULTS

Densities of adult conch in the survey area highest between 15 and 20 m depth on the island shelf (Table 1) with nearly 88 conch/ha. Density was also high between 10 and 15 m isobaths. No conch were found deeper than 25 m, and conch were very sparsely distributed in the inner sector of the Exuma Bank (0.19 conch/ha). Extrapolated for the total surface area of the Bank the total number of conch was estimated at 13,577, and despite the narrowness of the island shelf, 75,342 conch were estimated for that region. Nearly 66,000 conch were estimated for the region between 10 and 20 m depth (Table 1).

The shelf sites were characterized by large conch, primarily between 200 and 260 mm (mean = 227, S.D. = 23), while most adult conch on the Exuma Bank were between 170 and 210 mm shell length (mean = 187, S.D. = 16). Bank conch had thin shell lips (mean = 10, S.D. = 6), conch at inshore (2.5-5 m) regions of the shelf were intermediate in the shell lip thickness (mean = 18, S.D. = 5), and thicknesses were greatest in deeper regions of the shelf (mean = 30, S.D = 7). Discriminant functions analysis showed a highly significant separation of the small, thin-lipped bank morph from the large, thick-lipped shells of the shelf region (Hotelling-Lawley Trace, F= 1854, $p < 0.001$).

DISCUSSION AND CONCLUSIONS

In an unfished area of Islas Los Roques, Venezuela, Weill and Laughlin (1984) found maximum density of large conch in 4.0 m depth; density decreased with depth to 18 m. This may represent the natural distribution of queen conch. In Puerto Rico, Torres-Rosado (1987) found maximum density of adult queen conch between 10 and 20 m, similar to the findings reported here. She attributed the distribution to heavy fishing pressure in the nearshore areas, and we

Table 1. Estimated total number of adult queen conch in a 12 km long section of the Exuma Cays, Bahamas, between Adderley Rocks and Rat Cay.

REGION	TOTAL AREA (ha)	MEAN DENSITY (no. / ha)	TOTAL NUMBER OF CONCH
BANK			
Inner	4, 979	0.19	946
Outer	3, 997	3.16	12, 631
Bank Total	8, 976		13 ,577
SHELF			
0 - 2.5 m	161	Low - - Not Measured	
2.5 - 5 m	198	2.24	444
5 - 10 m	465	7.21	3, 353
10 - 15 m	429	60.14	25, 800
15 - 20 m	454	87.89	39, 902
20 - 25 m	320	18.26	5, 843
25 - 30 m	151	0	0
Shelf Total	3, 687		75, 342
GRAND TOTALS	12, 663		88, 919

conclude the same for the Lee Stocking Island survey area, where free-diving on the bank and in shallow shelf areas is the primary mode of fishing.

Although it is recognized that queen conch move to deeper depths with age (Randall, 1964; Weil and Laughlin, 1984), morphological analysis suggests that the number of conch that use bank sites as nurseries and reach the offshore spawning sites are very few. Given that mating and egg-laying are rare on the Exuma Bank, it is likely that recruitment to Bank nurseries is sustained by deep-water reproductive populations (Wicklund *et al.*, 1988; Stoner *et al.*, 1992; Stoner and Sandt, 1992). Furthermore, small aggregations of juveniles found immediately off the east (windward) side of the Cays on isolated seagrass beds (Stoner and Schwarte, in review) probably serve as the primary source for the offshore reproductive stocks. These juveniles have shell morphology close to that of the deep-water conch and are much unlike juveniles on the Exuma Bank. Tag recoveries have shown that juveniles from the windward beach areas move to deeper water with age and size.

Large deep-water reproductive stocks in the Exuma Cays may explain high productivity of queen conch in the area. However, virtually every conch in the Exuma Cays is within the routine range of scuba divers, and the species could be quickly decimated if the fishery was opened to SCUBA. The large number of juvenile conch on the Exuma Bank is now probably dependent upon small pockets of juveniles off windward beaches that recruit to deep-water reproductive populations. Analysis of larval transport and recruitment processes will be crucial to the sound management of the highly vulnerable conch fishery.

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