

PRELIMINARY ANALYSIS OF GROWTH OF QUEEN CONCH, *STROMBUS GIGAS*, IN SAN PEDRO, BELIZE.

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ABSTRACT

Belize's fishing industry is the fourth largest foreign exchange earner from exported products. The queen conch fishery is third in economic importance. Queen conch fisheries has been studied by Blakesly, 1977 and Gibson et al., 1982. During the months of November and December 1992 a survey was carried to evaluate the conditions of conch populations at Hol Chan Marine Reserve and Tres Cocos near San Pedro Town, Belize.

In this study 2065 organisms were collected and their siphonal length were measured. Siphonal length measurements fluctuated between 7 and 27cm, with a mean of 14.23 cm at Tres Cocos and 14.59 cm at Hol Chan Marine Reserve. Juvenile queen conch were found to be predominant at both sites and sparse seagrass beds of primarily *Thalassia testudinum*, *Siringodium filiforme* and *Laurencia* Sp. was the habitat type where juvenile queen conch were most abundant. Length-frequency data were used to estimate growth parameters using ELEFAN (K 0.42, 0.40; L_∞ 31.5, 30.5; t₀ - 0.78, - 0.68 at Tres Cocos and Hol Chan Marine Reserve respectively).

Key words: Belize, Fisheries, Growth, Populations, Queen Conch.

INTRODUCTION

The queen conch, *Strombus gigas*, is the most important gastropod in the caribbean region. Belize started commercial exploitation of the resource in the early 1960's. Production reached its highest level in 1972 when over 562.5 tons of conch meat was exported to the U.S markets. The high demand for marine products attracted many people to start fishing not only for conch but also for the spiny lobster, *Panulirus argus*, and scale fish. Belize's queen conch population was being heavily exploited without any regulations to control the fishery. Therefore, based on the limited biological data available, the Government of Belize introduced its first fisheries laws in 1977. The regulations prohibit scuba gear for conch fishing and set

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a minimum size limit of 17.78 cm shell length, a minimum clean meat weight of 85.05 grams and a closed season which extends from July 1 to September 30 inclusive in any year (Fisheries Laws).

To date queen conch investigations which have been carried out in Belize include that of Howard L. Blakesly (1977) A contribution of the fisheries and biology of the queen conch, *Strombus gigas* L., in Belize and Janet Gibson (1982) The status of the Conch Industry in Belize and Janet Gibson (1983) A summary of conch fisheries in Belize. The average length of conch with a fully formed lip is 23.4 cm with a market clean weight of 110 g. (Gibson et al, 1982). A conch size of 22cm was found to be most economical in terms of maximum meat total weight (Blakesly, 1977). However, at this size conch may not be sexually mature. A large percentage of immature conch can be legally harvested at the current size limit if lipless conch are considered sexually immature (Gibson et al. 1982). Even though these two papers showed that conch in Belize were being harvested at an immature stage, the fisheries regulations of 1977 are still in effect today. This may be the major reason why conch population drastically decreased from 1972 to 1985. The objective of this study is to evaluate the condition of aggregations and to determine if there is any similarities in population parameters in two areas which support both adult and juvenile conch. Hol Chan Marine Reserve was formed in 1987 and is patrolled on a daily basis. However, conch fishing is allowed in certain areas within the reserve. Tres Cocos is a harvestable area and has been known to support very large populations of juvenile conch for many years. Both of these areas are located immediately at the north side of channels on the Belize Barrier Reef.

METHOD

Queen conch were collected from two sites near San Pedro Town. Tres Cocos is located 3.2 km. north of San Pedro and Hol Chan Marine Reserve with a total area of 8.0 square km. is located approximately 6.4 km. southeast of San Pedro Town, Ambergris Caye (Figure 1). These sites were selected to conduct the study because of their close proximity to the island as well as their relatively large populations of juvenile and adult conch. Ten transects were conducted in each site during the month of November and December 1992. Each transect consisted of a 150 m fiberglass tape baseline and 2 - 50 m lines perpendicular to the baseline. One 50 m line was placed on each side of the baseline and were on the 50 and 100 meters points. All conch found within a 2m swath on each side of the lines were counted and measured. Shell length was calculated as the distance from the apex to the end of the siphonal canal. In addition to measuring shell length, divers also recorded bottom coverage of the transect which provided valuable data on conch distribution and bottom habitat. Aluminum calipers were used to measure the conch

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to the nearest millimeter.

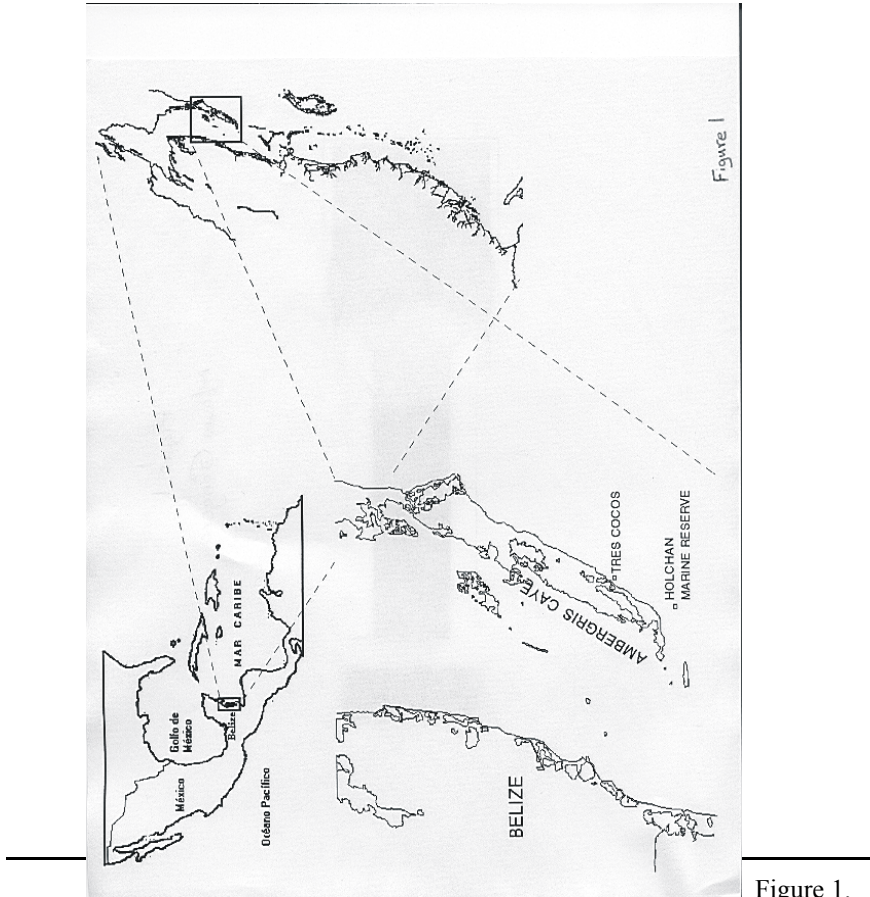


Figure 1.
Study

areas where sampling was carried out.

Having shell length data grouped into length-frequency, size structure of

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the populations was determined. Data obtained was processed to estimate growth rate by ELEFAN method (Gayanilo et al, 1988). Once age structured was estimated, cohort structure was determined. Natural mortality rates were estimated from the catch curve (Fig. 2 and Fig. 3).

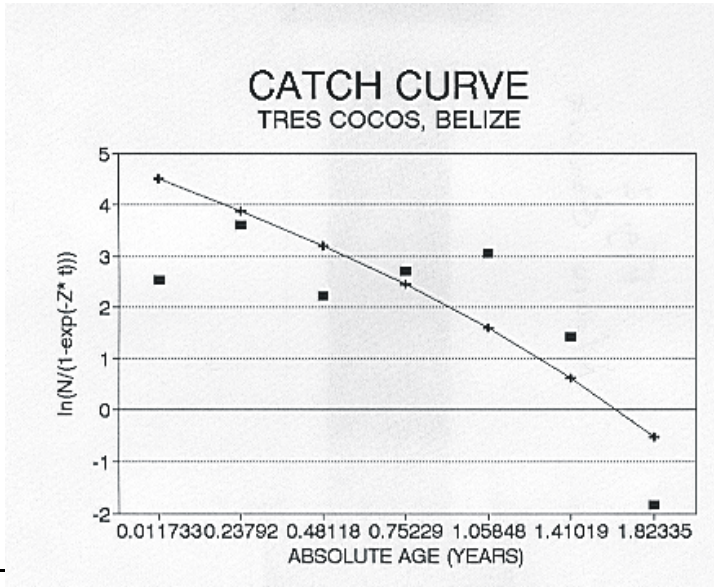


Figure 2. Catch Curve for Tres Cocos, Belize.

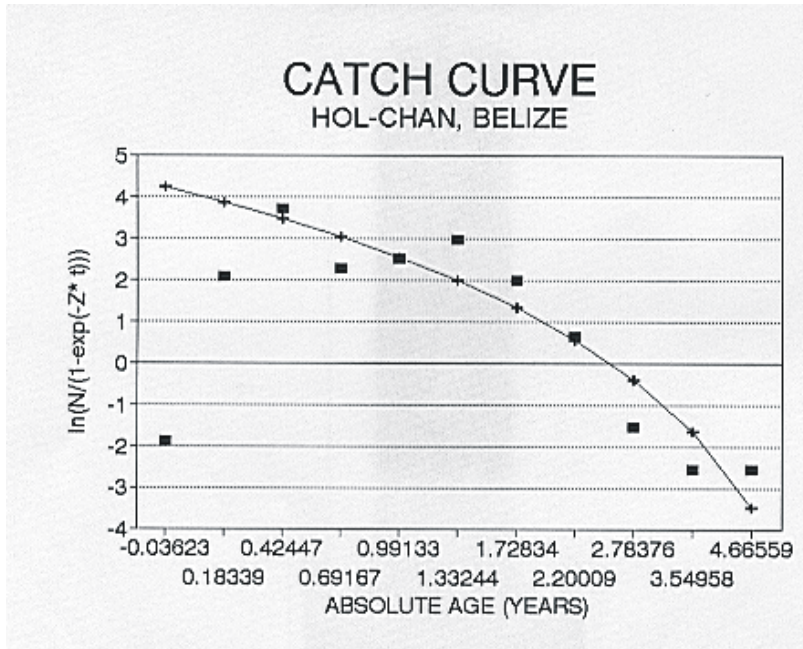
RESULTS

Table 1 shows abundance of organisms in the two areas sampled. Because conch data did not fulfill ANOVA basic requirements, especially on normal distribution of residues and therefore original data are presented. A total of 2065 queen conch, *Strombus gigas*, were counted and measured. Out of this total only 24 or 2.4% and 94 or 9.91 % in Tres Cocos and Hol Chan Marine Reserve respectively, were considered adults. Adult conch were classified as having a fully developed flared lip which is > 4mm in thickness. The mean lengths of year class

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conch is shown in Table 2 and Table 3. An average of 5.1% of total conch measured were considered adults.

Figure 3. Catch curve for Hol Chan Marine Reserve



Sparse grasses composed primarily of turtle grass, *Thalassia testudinum*, *Syringodium filiforme* and *Laurencia* Sp. was the most abundant habitat type encountered and constituted 68 % in Tres Cocos and 40.0 % in the Hol Chan Marine Reserve with an average of 53.75 % of total area covered (Table 5). The highest density 0.85 conch/m² was found in sparse grass at a depth of 3 - 5 m. The lowest density was found associated to areas with a high percentage of coral rubble, usually over sand or rock and dense turtle grass. The survey showed that conch were mostly found in the back reef and lagoon area. Transects were not carried out on the shallow foreereef because no conch were observed while snorkeling on this area. The conch population surveyed was found on the north side of channels or breaks on the barrier reef. High juvenile conch recruitment on north sides of channels has also been observed on other areas in Belize. Juvenile conch were most

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abundant at approximately 450-600 m north of the channels and 250-300 m westward from the reefcrest which suggests a high inflow of pre-metamorphosed larvae through these channels.

Table 1. *Strombus gigas* abundance (D =org/m²) in Tres cocos and Hol Chan marine reserve.

Tres Cocos, Belize: Average density 0.2059 conch/m²

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
#	339	218	291	29	36	3	150	13	6	21
area	400	1000	400	1000	1000	1000	1000	1000	1000	1000
Den.	0.85	0.22	0.73	0.03	0.04	0.003	0.15	0.01	0.006	0.02

Hol Chan Marine Reserve, Belize: Average density 0.101 conch/m²

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
#	84	6	36	23	58	175	127	136	139	175
area	800	1000	1000	1000	1000	1000	1000	1000	1000	1000
Den.	0.11	0.01	0.04	0.02	0.06	0.18	0.13	0.14	0.14	0.18

Lenght-frequency analysis (Figure 4) showed that the juvenile conch population in the Hol Chan Marine Reserve is composed of two distinct age classes and the adult class was faintly represented (Table 3). The population at Tres Cocos is composed of only two cohorts (Table 4). Juvenile conch in the first year class had a mean lenght of 16.63 cm and 15.05 cm in Tres Cocos and Hol Chan Marine Reserve, respectively. Using age structure data obtained (Fig.3), number of organisms in each age class was analyzed and mortality rates were estimated and are therefore used to provide a preliminary description of condition of conch resource in San Pedro, Belize. Using ELEFAN program values for von Bertalanffy prameters (Table 5) shows no significant difference between the two sites. The natural mortality in Tres Cocos was slightly higher than in Hol Chan Marine Reserve. The fishing mortality was almost double than in the reserve. The exploitation rates however, show that both sites are being overexploited.

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DISCUSSION

From results obtained it is clear that queen conch densities in Tres Cocos (0.2059 conch/m²) and Hol Chan marine Reserve (0.101 conch/m²) are similar to those reported for the region. In Venezuela, conch density in protected area was 0.4 conch/m² (Weil and Laughlin, 1984) and in Florida was 0.005 conch/m² (Stoner and Waite, 1990) and in southern Quintana Roo, Mexico density was 0.015 conch/m² (de Jesus et al, 1992). Siphonal length fluctuated between 7 and 27 cm. The survey

Table 2: Set of length-at-(relative)age data, pertaining to queen conch in Tres Cocos, Belize.

Age group (relative age, in years)	Mean length (cm)	Number
I	16.63	1100
II	21.75	4
III	25.10	0
IV	27.30	0

Table 3: Set of length-at-(relative)age data, pertaining to queen conch in Hol Chan Marine Reserve, Belize.

Age group (relative age, in years)	Mean length (cm)	Number
I	15.05	781
II	20.19	170

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III	23.62	7
IV	25.91	1

showed that the majority of the organisms measured (94.9%) were in their juvenile stage. This is no surprise, in Belize several areas such as Half Moon Caye in Lighthouse Atoll and in Turneffe Atoll have been identified with large populations of juvenile conch and may be an important nursery area which is subject to exploitation by Belizean and illegal fishermen from our neighbouring countries of Guatemala and Honduras. Tres Cocos and Hol Chan Marine Reserve support large populations of juvenile conch. Due to their close proximity to San Pedro and shallow depths much of first and second year class organisms are caught before they reach sexual maturity. This may be a reason for exploitation as shown in the results obtained from ELEFAN.

Growth parameters obtained by ELEFAN (Table 5) does not show any significant differences between the two areas and are within the range reported by other authors (Dominguez-Vivieros et al,1992). Total mortality was greater in Tres Cocos (2.430) than in Hol Chan Marine Reserve (1.380) as was expected because there was a greater number of juvenile conch in that area and therefore more predation. Fishing mortality was also greater in Tres Cocos. Both areas show slight over exploitation. The adult class in the Hol Chan Marine Reserve is faintly represented. It was expected that a larger portion of the population would be in their adult stage. Adult conch or those that are becoming sexually mature in the non-fishing area (1.6 Km²) can easily migrate to the fishing area for food, mating or to lay eggmasses because of its relatively small area. Conch fishermen will catch conch on the margin which delineate the fishing from the non-fishing area. The high natural mortality in the Tres Cocos area is as a result of the large number of juvenile conch in this area. Queen conch predators such hermit crab, *Petrochirus diogenes* and tulip shell, *Faciolaria tulipa* were frequently observed while conducting the transects. The high exploitation rates estimated by ELEFAN is as a result of very little adults and a high abundance of juveniles present in both areas.

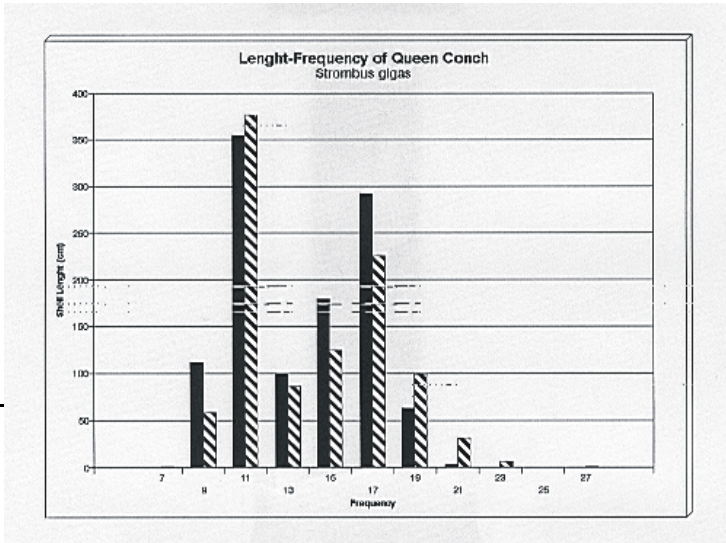


Figure 4. Length

h-Frequency of queen conch, *Strombus gigas*, in Tres Cocos and Hol Chan Marine Reserve, Belize

RECOMMENDATIONS

Since the majority of queen conch in Tres Cocos and Hol Chan Marine Reserve are juveniles and the adult population is very small it is important to protect the organisms until they become sexually mature. To do this it will be necessary to implement changes in the management of these areas. Hol Chan Marine Reserve should increase size of non-fishing area. No new fishermen should be issued licenses to conduct conch fishing activities in the fishing area of the reserve. Implement a quota system where fishermen are allowed to harvest a limited number of conch per season. Conduct annual evaluation of the resource and if exploitation rates continue to rise, conch fishing should be halted for a period not less than 2 to 3 years. The Tres Cocos area should be reserved and protected as a

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nursery area.

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Table 4. Length - Frequency Distribution of queen conch, *Strombus gigas*, in Tres Cocos and Hol Chan Marine Reserve.

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Shell length (cm)	Tres Cococ Frequency	Hol Chan Marine Reserve Frequency
7	0	1
9	111	58
11	355	377
13	99	86
15	179	124
17	292	226
19	63	99
21	3	1
23	0	6
25	0	0
27	0	1

Table5. Population parameters for Queen conch in Hol Cham Marine Reserve and Tres Cocos, Belize. SL= starting length sample

Area	L4	K	t_0	C	W.P.	SL	RN
Tres Cocos	31.5	0.42	0.78	0.00	0.00	16.0	0.446
Hol Chan	30.5	0.40	0.68	0.00	0.00	11.0	0.285