Research Applied to Conch Resource Management in St. Kitts/Nevis

R.M. WILKINS[1], M.H. GOODWIN[2] AND D.M. REID[1]

[1]Fisheries Division
Ministry of Agriculture
St. Kitts/Nevis
[2]South Carolina Sea Grant
287 Meeting Street
Charleston, South Carolina 29401

During the past decade, considerable interest has been shown in one of the Caribbean's economically important but rapidly diminishing resources - the queen conch (Strombus gigas). In 1981, the first attempt at pooling available information on the resource took place in Freeport, Bahamas, followed by a 1982 session at the 35th GCFI in Nassau. Both meetings evaluated the progress that had been made in conch mariculture and discussed the status of conch fisheries, but because of insufficient data on the general biology, mariculture, and fisheries management of the queen conch, it was recommended that efforts be made to achieve more factual understanding of the conch fishery in each country.

In St. Kitts/Nevis, the queen conch fishery is considered to be an important source of income for a relatively small number of fishermen. But though adequate information is not yet available, it seems likely that the fishery may be in serious danger of overexploitation. There are no statistical estimates of total landings, but export figures were constant at 100,000 lb until 1983, when increased use of SCUBA to penetrate deeper waters resulted in a 50% increase in conch exports.

There are no regulations on the fishery, but complaints from fishermen about difficulties in finding conch, coupled with the fact that some inshore areas around St. Kitts/Nevis have been fished out, prompted the Government to assess the state of the resource as a basis for management, conservation and rehabilitation of the fishery.

In 1984, a project was designed with financial support from the International Development Research Centre of Canada and the Jessie Smith Noyes Foundation in the United States. The objective of the project was to secure optimum sustained benefits to St. Kitts/Nevis from local use of indigenous conch resources. Five activity areas were identified:

1. Determine productive capacity of natural stocks
2. Investigate current fishery practices in terms of quantity harvested, size and markets
3. Investigate options for increasing natural production
4. Public information
5. Synthesis of information into a management plan

Juvenile and adult conch populations were located and animals

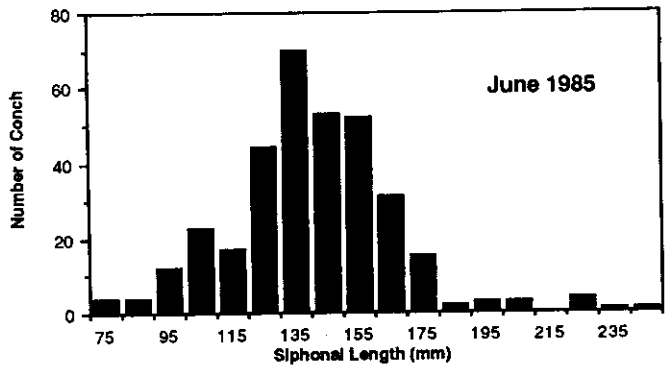
were tagged to provide information on growth and mortality rates which, combined with habitat surveys, is expected to provide information on total size and productive capacity of the resource. This program is still in progress, and analyses of existing data are not complete, but we are able to report some preliminary results.

Reproductive activity has been observed in a single cohort in Basseterre Bay. Nine percent of animals observed were copulating or laying eggs during July. In August the percentage increased to 12%, declined to 5% in September, and to zero in October. We do not know when the reproductive season begins, but it seems unlikely that significant spawning occurs after September. Egg-laying female conch had a mean shell length of 222 (standard deviation = 16.8) mm; the smallest egg-laying female seen had a shell length of 156 mm.

Length-frequency distributions of a single cohort studied in 1984 indicated a mean size between 150 and 160 mm. Nine months later, the mean size of the same cohort was between 200 and 220 mm, indicating a growth of about 6.1 mm per month. Length-frequency distributions of cohorts studied in 1985 show two or three modes, typically in the range of 90-110 mm, 150-160 mm and 220-230 mm. Between June and August, the two smaller modes advanced by roughly 10 mm, or about 5 mm per month (Figure 1). Tag-recapture data are highly variable. Data from 1984 indicate growth rates averaging 7.5 mm per month, while data from 1985 indicate an average of 4.5 mm/month. These growth rates are somewhat higher than those reported in the literature. Brownell and Stevely (1981) summarize growth rate estimates ranging from 1.3 mm/mo to 5.2 mm/mo. The variability in our data is similar to that reported by Alcolado (1976) who found that growth varied "considerably in regard to local ecological conditions," ranging from 3.3 mm to 6.7 mm per year.

Brownell (1977) and Ballantine and Appeldoorn (1983) report growth rates of about 9 mm/mo in hatchery-reared juvenile S. gigas during the first 7 to 9 months following metamorphosis. On this basis we assume that the smallest size class found in our study is composed of animals approximately one year old. Considering length-frequency and tag-recapture data, our best estimate of growth in the second and third years is 5-7 mm/mo or 60-84 mm/yr.

If reproductive activity is maximum during August, at 60 mm per year conchs would reach a shell length of 220 mm after 2.3-2.8 years, between January and June. Most conchs of this size have a flared shell "lip," the formation of which has been assumed to signal reproductive maturity (Berg, 1981). But we have found indications that actual reproductive maturity may occur considerably later. Earlier this year, Barbara Buckland, a visiting graduate student, obtained preliminary data which suggested that two weight classes could be distinguished among flared-lip conchs in the 220 mm size class. We have investigated this further, and collected approximately fifty flared lip conch from the cohort observed for reproductive seasonality, and an additional fifty from another cohort in which reproductive activity has not been observed. Measurements were made of shell



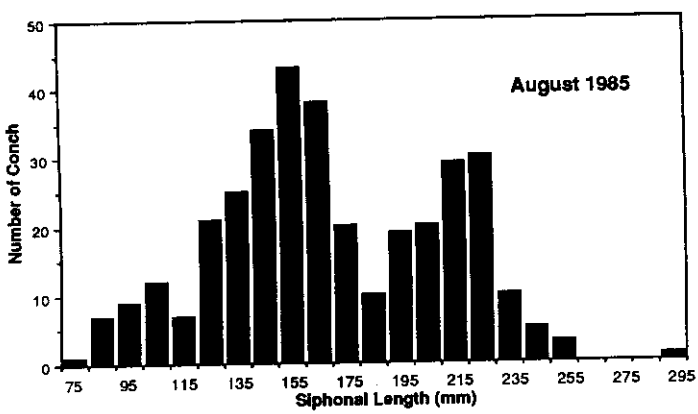


Figure 1. Siphonal length-frequency histograms of S. gigas illustrating progression of class modes between June and August 1985.

length, shell weight and total soft tissue wet weight. No statistically significant differences were found in shell length between the two cohorts. However, highly significant differences were found in both shell weight and soft tissue weight (Table 1). These differences were apparent in comparisons of females, males and both sexes combined (Figure 2).

Table 1. Summary of Analysis of Variance Comparing Siphonal Length, Shell Weight and Body Weight of Flared Lip Conch in Reproductively Active (BT) and Inactive (TH) Cohorts

Comparison	F (d.f.)
Shell Length:	
BT Males : BT Females	5.04 (1,43)*
TH Males : TH Females	4.94 (1,35)*
BT Females : TH Females	0.67 (1,37)
BT Males : TH Males	0.36 (1,41)
BT All : TH All	1.76 (1.80)
Shell Weight:	
BT Males : BT Females	2.59 (1,43)
TH Males : TH Females	0.0003 (1,35)
BT Females : TH Females	73.79 (1,37)**
BT Males : TH Males	30.78 (1,41)**
BT All : TH All	94.41 (1,80)**
Body Weight:	
BT Males : BT Females	2.36 (1,43)
TH Males : TH Females	0.007 (1,35)
BT Females : TH Females	16.16 (1,37)**
BT Males : TH Males	12.14 (1,41)**
BT All : TH All	30.10 (1,80)**

* - significant at 95% probability level
** - significant at 99% probability level

These observations raise the possibility that conch may not be reproductively competent for some time after the flared lip is formed, and clearly indicate that soft tissue growth continues after linear shell growth ceases. Conch from the cohort in which reproductive activity had been observed were 35% heavier than the smaller cohort. If our growth rate estimates are reasonable, this 35% weight increase would require at least one additional year after reaching a shell length of 220 mm.

This has important implications for management of St. Kitts/Nevis conch resources. Fisheries regulations drafted by the FAO/OECS Workshops on the Harmonization of Fisheries Legislation specify a minimum shell length of 180 mm and use the flared lip condition as a criterion of maturity. These

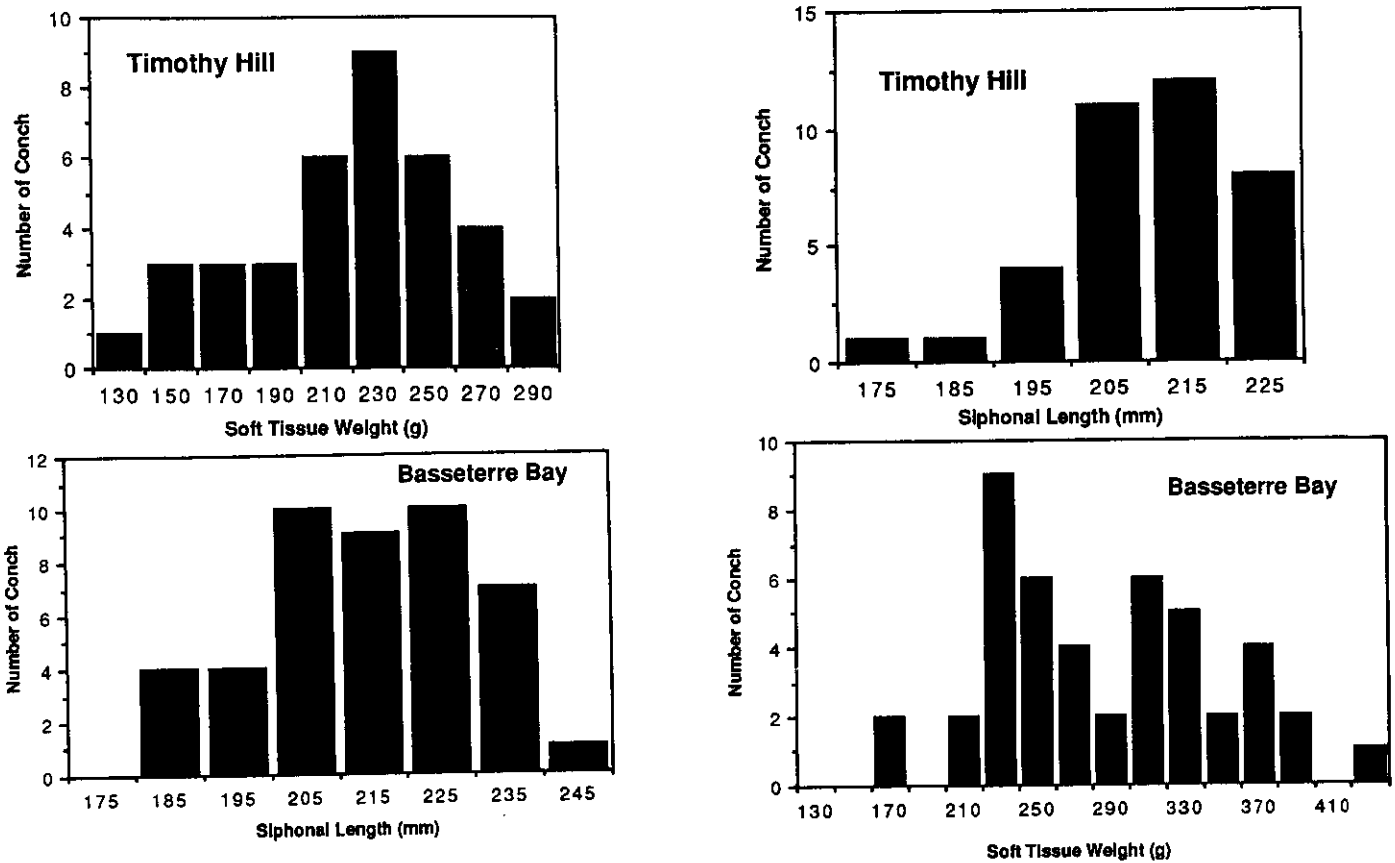


Figure 2. Histograms comparing siphonal length and soft tissue weight frequencies of flared-lip conch; reproductive activity has been observed in one cohort (Basseterre Bay), but not in the other (Timothy Hill).

regulations were prepared with expert consultation and are based upon assumptions commonly reported in the technical literature. The results of our study, however, suggest that these regulations may not be appropriate for St. Kitts, and illustrate the need for site-specific information when developing management strategies.

If the flared lip is not an accurate indication of maturity, there is danger that immature but "legal" animals may be harvested. In addition, because these animals are often found in shallower water than reproductively active cohorts, the immature conchs may be subjected to heavier fishing pressure. Data from St. Kitts also indicate that the mean shell length of the third year class is greater than that reported for other locations (e.g., 180 mm-209 mm in Puerto Rico, U.S. Virgin Islands, Caicos Island and Venezuela; Berg, 1981). This may be because a long history of intensive harvest in other locales has created a selection pressure which favors survival of animals which mature at a smaller size. Alternatively, this difference may indicate genetic differences which cause basic growth parameters to vary between conch populations of St. Kitts and those of other locales.

Based upon our site-specific data, we are recommending that the minimum shell length be raised to 220 mm, and that areas containing large numbers of newly-flared conch be designated as reserves which will be closed to fishing. We expect to identify these areas with the aid of information obtained through the IDRC habitat survey project.

In order to improve our information base for managing conch resources on a long-term basis, we intend to continue periodic observations of selected cohorts for reproductive activity and growth. Our next priority will be to obtain a better estimate of domestic catch and effort, to provide an indication of development and management measures needed to approach the goal of optimum sustained use.

LITERATURE CITED

Alcolado, P.M. 1976. Crecimiento, variaciones morfologicas de la conch y algunas datos biologicos del cobo Strombus gigas L. (Mollusca, Mesogastropoda). Acad. Cienc. Cuba, Ser. Oceanol. 34: 36 pp.

Ballantine, D.L. and R.S. Appeldoorn. 1983. Queen conch culture and future prospects in Puerto Rico. Proc. Gulf Caribb. Fish. Inst. 35: 57-63.

Berg, C.J. (ed.) 1981. Proceedings. Queen Conch Fisheries and Aquaculture Meeting. Wallace Groves Aquaculture Foundation, Freeport, Bahamas.

Brownell, W.N. 1977. Reproduction, laboratory culture, and growth of Strombus gigas, S. costatus and S. pugilus in Los Roques, Venezuela. Bull. Mar. Sci. 27: 668-680.

_____ and J.M. Stevely. 1981. The biology, fisheries, and management of the queen conch, Strombus gigas. Mar. Fish. Rev. 43: 1-12.