Current Research on Queen Conch (*Strombus gigas*) in Florida Waters

CARL J. BERG & ROBERT A. GLAZER
Florida Department of Natural Resources
Bureau of Marine Research
13365 Overseas Highway
Marathon, Florida U.S.A. 33050

ABSTRACT

Florida stocks of queen conch, *Strombus gigas*, have declined markedly in the past decade, and a moratorium on all harvest has been in effect for two years. A major research effort has been initiated to measure stock size, population dynamics, and reproductive activity of Florida conch. Stock rehabilitation will be attempted through hatchery rearing and release of tagged juvenile conch. Population genetics of the Florida stock will be compared with those of other conch populations throughout the Caribbean and will be analyzed with respect to models of effects of ocean/island interactions upon larval retention and dispersal.

Although it never constituted a major fishery, the queen conch has come to represent a way of life to the Florida Keys. The Keys are known as the "Conch Republic" and the conch shell is its symbol. Local people have long been known as "conch." However, overfishing and habitat degradation during recent years have brought about a decline in abundance and altered the distribution of conch in Florida waters. In response to widespread local reactions to the depletion of conch, Florida's Marine Fisheries Commission in June 1985 imposed a total ban on the taking, harvesting, sale, or harming of conch within state waters. The ban was extended to contiguous United States federal waters in December 1986. In March 1987 a major program of stock assessment, population ecology, and stock rehabilitation research was begun with the goal of making recommendations to the Marine Fisheries Commission on how to best manage the resource. Progress to date and future plans are discussed here.

Queen conch in Florida occur predominantly in shallow marine areas from Miami to the Dry Tortugas. Our survey is limited to the area from Virginia Key to Boca Grande Key west of Key West. This area constitutes approximately 225,000 hectares. An ecological study by Marszalek (1984) produced 10 maps loosely identifying seven major benthic marine communities from Miami to Key West. These maps were digitized by our laboratory in St. Petersburg and the percent cover of each marine community was determined. Maps were updated using current high altitude airplane and satellite photographs, and corrected with ground truthing. One additional map, covering Key West to Boca Grande Key, has been added. Because the entire area cannot be surveyed, a random stratified

sampling program has been devised. The communities on each map are being surveyed during each of four seasons by making 10 strip transects using scuba divers towed behind boats. The number of transects made in each community is proportional to its relative coverage on that map, but each community will be surveyed at least once. Through the first two seasons, strip transects averaged 1.2 hectares; a mean of 11.8 hectares were surveyed on each map.

A mean value of 4.82 conch per map was found during the spring surveys and a mean value of 9.36 per map was found during summer. Most animals were located off the lower keys during spring, whereas greatest numbers were off Key Biscayne during summer. Highest mean densities were found in the "limestone bedrock" community (1.09 conch/ha) during spring and in the reef community (2.98 conch/ha) during summer. Data must be collected for every map during every season before total abundance values can be extrapolated. In future years, changes in conch abundance will be monitored by concentrating efforts on areas of greatest numbers and least variance.

Because changes in overall population structure might be most evident in numbers of animals breeding each year, areas of conch breeding activity are being monitored. Conch are particular about where they breed; areas with clean flowing water and a coarse sand bottom seem preferred. Three areas have been located where conch are breeding and have been known to aggregate in the past. Two of these areas lie within U.S. National Marine Sanctuaries, where conch are relatively well protected. Numbers of animals, reproductive behavior, and numbers of egg masses are being recorded on a weekly basis throughout the year. Egg mass production has been recorded from early March until Hurricane Floyd passed over the Keys on October 12. No egg masses were found after the hurricane.

Population dynamics are being studied concurrent with the stock assessment. Estimates of growth rates and mortality are derived from shell length frequency distributions using probit analysis and the ELEFAN programs of Brey and Pauly (1986). Preliminary analyses indicate growth rates differing among subpopulations in the Florida Keys, but the values fall within the range reported for Cuban conch (Alcolado, 1976).

In addition, a tag/recapture study is being conducted in several areas of the Keys. To decrease the bias associated with tag loss, several tagging methods are being employed. In one method, a numbered piece of plastic tubing is slipped over stainless steel rigging wire and the wire twisted tightly around the spire of the shell. In a second method, a hole is drilled near the edge of the shell and a clip tag with numbers identical to those on the wire tag is fastened through the shell. Two hundred double-tagged conch have been placed in raceways, and tag loss is being monitored on a monthly basis. After six months, 8.6% of wire tags and 25% of clip tags were lost; 7.7% of the conch lost both tags. A third tagging

method using cold branding was also tried. Fifty conch were branded and there has been no mortality after three months. This appears to be a suitable method for tagging large numbers of individuals.

The above studies assume that there is a single conch population in the Florida Keys. To test this hypothesis, a biochemical-genetic study of allele frequencies has been initiated. Results will be compared with earlier work in the Caribbean (Berg *et al.*, 1986), in which genetic differentiation among populations separated by relatively short distances was noted. For example, populations at the north and south ends of the island of St. Lucia, in the eastern Caribbean, are separated by only 20 km, yet those populations exhibit significantly different allele frequencies. This difference may be explained by geographic barriers and ocean currents that keep the two populations separate. A series of models of ocean/island interactions that may help to explain these genetic observations has been developed and will be further refined with additional data, using the island of Bermuda as a model. We hope to begin an extensive study of larval dispersion and retention around the Florida Keys and islands of the Caribbean. We are also studying effects of hatchery rearing on allele frequencies.

Because conch appear to be heavily depleted around Florida, and there is no assurance that the population will be restored by larval recruitment from conch breeding in Florida or the Caribbean, the State of Florida has also begun to test the feasibility of stock rehabilitation through aquaculture. Conch egg masses were collected from naturally breeding wild conch and larval rearing was attempted in the laboratory at St. Petersburg. No animals survived to metamorphosis, and indications are that a water quality/toxicity problem is present. After that problem has been corrected, post-metamorphic conch will be reared in tanks and raceways until they are approximately 5 cm in length. These conch will then be tagged and released onto experimental plots in their natural environment. After studying subsequent growth and survival, recommendations concerning the value of further experimental or large-scale re-seeding programs will be made.

In conclusion, the State of Florida has initiated a large scale, long-term study of its conch resource. We look forward to sharing our findings with the scientific community of the Caribbean and joining in collaborative efforts.

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