Status of the Queen Conch Resources in St. Thomas and St. John, U.S. Virgin Islands: Is There Hope for Recovery?

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ABSTRACT

This study reports on work in progress to determine the queen conch (*Strombus gigas*) population densities in waters around St. John and St. Thomas in the U.S. Virgin Islands. A ban on conch collecting was implemented by the Virgin Islands Government in February 1987. Resurveys of previous transects provided evidence that in spite of this restriction there appears to be little recovery of the population. Density of the population in Greater Lameshur Bay declined from 2,370 conch per hectare in November 1986 to 67 conch per hectare in July 1991. In the same area from November 1986 to March 1989, the mean length of conch increased from 14.2 to 21.8 cm.

A five year extension of the ban has been proposed. Doubts are expressed about the ability of the conch population to recover in an additional five year period and about its ability to sustain itself under fishing pressure. Restocking with juveniles greater than 9 cm is suggested.

INTRODUCTION

The decline in populations of the queen conch (*Strombus gigas*) around the islands of St. Thomas and St. John in the U.S. Virgin Islands was recognized in the late 1970s (Wood and Olsen, 1983). By 1987, conch catches had declined to such low levels that a five year moratorium on conch collecting was declared by the Virgin Island Government. In February 1992, the five year period will be completed and fishing will recommence although there is a proposal to extend the moratorium for another five years.

In this study we resurveyed several locations where conch populations were documented previously. The question we are asking is, has the ban on conch collection resulted in a population increase?

HISTORIC RECORD STUDIES vs. PRESENT DAY DENSITY ESTIMATES

In 1959, Randall (1964) began a study of queen conch on the island of St. John. He noted that the relative abundance of the species in waters around St. John, coupled with limited utilization of the species in the Virgin Islands were important factors in deciding to study the species. Randall did not quantify density, but notes that juvenile conch from about 80 mm in length to "subadult size" were very abundant on a coral rubble bottom in 9 - 13 m of water at Salt

Pond Bay (Figure 1). On one day in 1959 he tagged 104 conch. In August 1991, we found no live conch in a 1000 m^2 area in the Bay.

In 1981, Wood and Olsen (1983) conducted 22 one nautical mile transects surveying conch around St. John and St. Thomas Islands. They found conch densities ranging from 6.47 to 10.58 conch/hectare (standard deviation range 6.32 - 10.34) (Table 1). The 95% confidence level estimate for the highest density would be 41.2 conch/ha. The value suggests that no densities of conch were found in the aggregations observed by later studies.

Table 1. Queen conch densities.

LOCATION	DENSITIES CONCH/HA 1981*	DENSITIES CONCH/HA 1991	DEPTH (m)	COMMENTS	AREA SURVEYED
Coral Bay St. John	6.47	51.2	6 - 8	undisturbed sea grass bed	1.3
Leduck Island	-	0.0	3 - 10	healthy sea grass beds	1.5
Eagle Shoal	-	0.0	2 - 15	several dead conch shells	1.2
Flat Cay	-	47.2	4 - 25	aggregation of juveniles on sea grass	2.4
Little Hans Lollick Is.	-	0.0	3 - 10	healthy coral	2.2
St. James Islands	6.47	1.0	5 - 8	healthy sea grass	1.8
Sea Grass	6.47				4.3
Algal Plain	9.31				9.8
Coral	10.58				3.8
Sand	9.31				3.3

* Wood and Olsen

In 1985, Boulon (1987) attempted to duplicate nine of the conch counts made by Wood and Olsen (1983). Four of the nine transects in 1985 had fewer conch (25%, 54%, 64% and 70% less) than in 1981. All of these were within National Park boundaries. In 1985, two transects outside National Park boundaries had 36% and 112% more conch than in 1981. The remaining three transects had no conch in both years. Boulon (1987) used a Mann-Whitney U Test, pooling the transects, to conclude that there was no significant difference

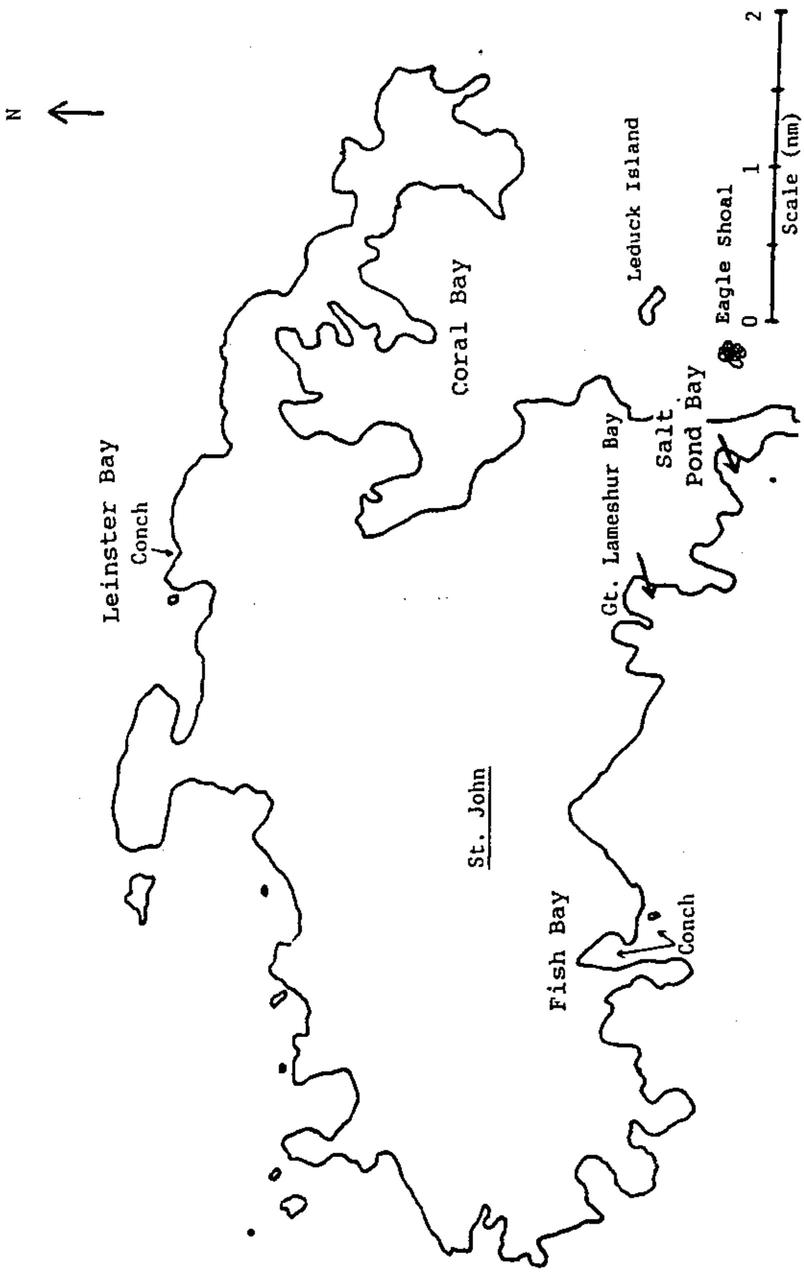

Figure 1. Map of St. John Island, U. S. Virgin Islands.

between the number of conch observed in 1985 and in 1981. Although Boulon (1987) advises caution in comparisons between the two years because of possible differences in relocation of transects, different observers, a small sample size and differential harvest rates between inshore and offshore sites, he concluded by predicting that "the continued harvest of subadult conch will lead to the gradual decline and eventual near extirpation of local populations.

In August 1991, we resurveyed several habitats in the region of the Wood and Olsen survey. Our estimate for Coral Bay, St. John Island was 51 conch/ha in 6 m deep sea grass meadows. A transect within the algal plain at 25 m depth off Flat Cay near St. Thomas recorded 470 juvenile conch per hectare.

While it is generally acknowledged that conch populations were low in the early 1980s, no other workers reported such low densities. Studies three years later in similar areas reported densities over 200 times those reported by Wood and Olsen. Without more details from each transect it is impossible to verify the accuracy of their calculations and make comparisons.

BASELINE STUDIES OF CONCH DENSITIES

Methods and Results

Leinster and Fish Bay. In 1984, Virgin Island Resource Management Cooperative (VIRMC, 1986) selected two locations for baseline data collection on conch populations in the waters around the island of St. John in the Virgin Islands National Park; Fish Bay on the south shore and a small sheltered cove east of Leinster Bay on the north shore (Figure 1). The north shore site is a small indentation of the coastline with a narrow fringing reef and is a popular anchorage for yachts.

A 61 m measuring tape was positioned on the bottom in the VIRMC study. All conch within 2 m of the tape were counted. In 1984, the north shore site was censused twice - once in April and again in June. In the first census covering 976 m^2 nearly 80 percent of the 209 conch measured were adults. One and one-half months later in a second census 99% of the population, 253 individuals, were juvenile conch. The range of the density was 2100 - 2600 conch/ha (x= 2377 conch/ha; N=2) (Table 2).

Table 2. Queen conch densities.

LOCATION	DENSITIES CONCH/M^2 1984*	1991	DEPTH	COMMENTS
Leinster Bay	0.235	0.000	3-7 m	habitat destruction
Inner Fish Bay	0.145	0.000	0.5-3 m	excellent condition
Outer Fish Bay	0.120	0.041	10-14 m	excellent condition

* VIRMC STUDY

In July 1985, Boulon (1987) surveyed an unquantified area seaward of the VIRMC study site and found 3 adult conch. One month later he surveyed 500 m^2 and observed a density of 400 conch/ha. Boulon acknowledges the instability of the conch population in this bay but does not offer any explanation.

In July 1991, we used a visual swimming transect method to estimate conch densities. The ends of a measuring tape were held by two divers swimming parallel to each other. The width of the swath depended upon the visability. After swimming 40 to 100 m the divers would turn around and measure the actual distance covered to the point of origin. Queen conch between each diver were counted and measured from the tip of the spire to the end of the groove on the ventral side of the shell. The length of the transect was measured and area covered calculated. In August 1991, no live queen conch were seen in a 850 m^2 area.

The south shore site, Fish Bay, is a deeply indented mangrove embayment. The inner portion of the shallow (0.5 to 3 m) bay is bordered by red mangrove. The 1984 survey (Boulon, 1987) did not record the condition of the sea grass meadow. The conch population was dominated by juvenile conch with a range of 900 to 2800 conch/ha (x=1453 conch/ha; N=2) (56 juveniles in an area of 688 m^2). A year later Boulon found no conch. Six years later in August 1991 we found no conch in a 700 m^2 area, and the sea grass meadow looked healthy and undisturbed.

In outer Fish Bay, a well developed *Syringodium* sea grass meadow 10 to 15 m deep, is juxtaposed to a fringing reef. Over a four month period in 1984, a total of 4,292 m^2 were surveyed, yielding a range of 800 to 1800 conch per ha (x = 1280; N=4). In August 1991, a survey of 1135 m^2 found that the density had declined by 1/3 to 410 conch/ha with a mean size of 22.2 cm (N=38) (Figure 2). Only one conch deposited eggs and none were copulating.

Lameshur Bay. The most detailed record of conch densities comes from Greater Lameshur Bay in studies by Conway and Morrow (1986), Beeh (1987), Graf (1987), Brickell (1987), Hicks (1988) and Harvey (1989). The density of the population in Greater Lameshur Bay has declined from 2370 conch per hectare in November 1986 to 67 conch per hectare in July 1991 (Figures 3 - 9). From November 1986 to March 1989, mean length of the conch increased progressively from 14.2 to 21.8 cm (Figure 10). In the context of the declining numbers of individuals, the increase in size from November 1986 to March 1989 (Figure 11) probably represents reduction in recruitment to the population rather than any real growth of individuals.

In July 1991, the adult population had apparently moved from the *Syringodium* grass baseline area to the algal plain at 20 m. The mean size of the conch was 21.5 cm (N=43) (Figure 12). This site was not included in previous baseline survey, so no comparison can be made. The density of this population

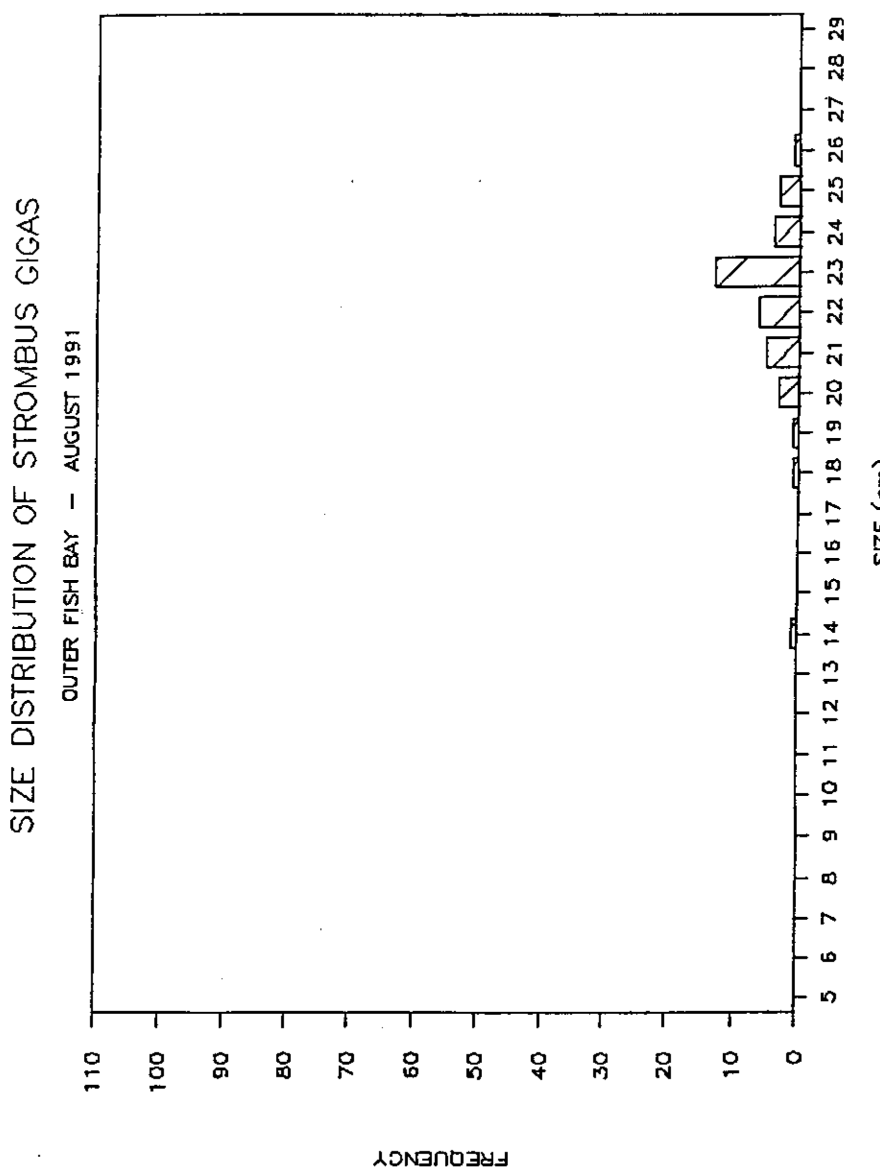

Figure 2. Size frequency distribution of *Strombus gigas* at Outer Fish Bay, July, 1991.

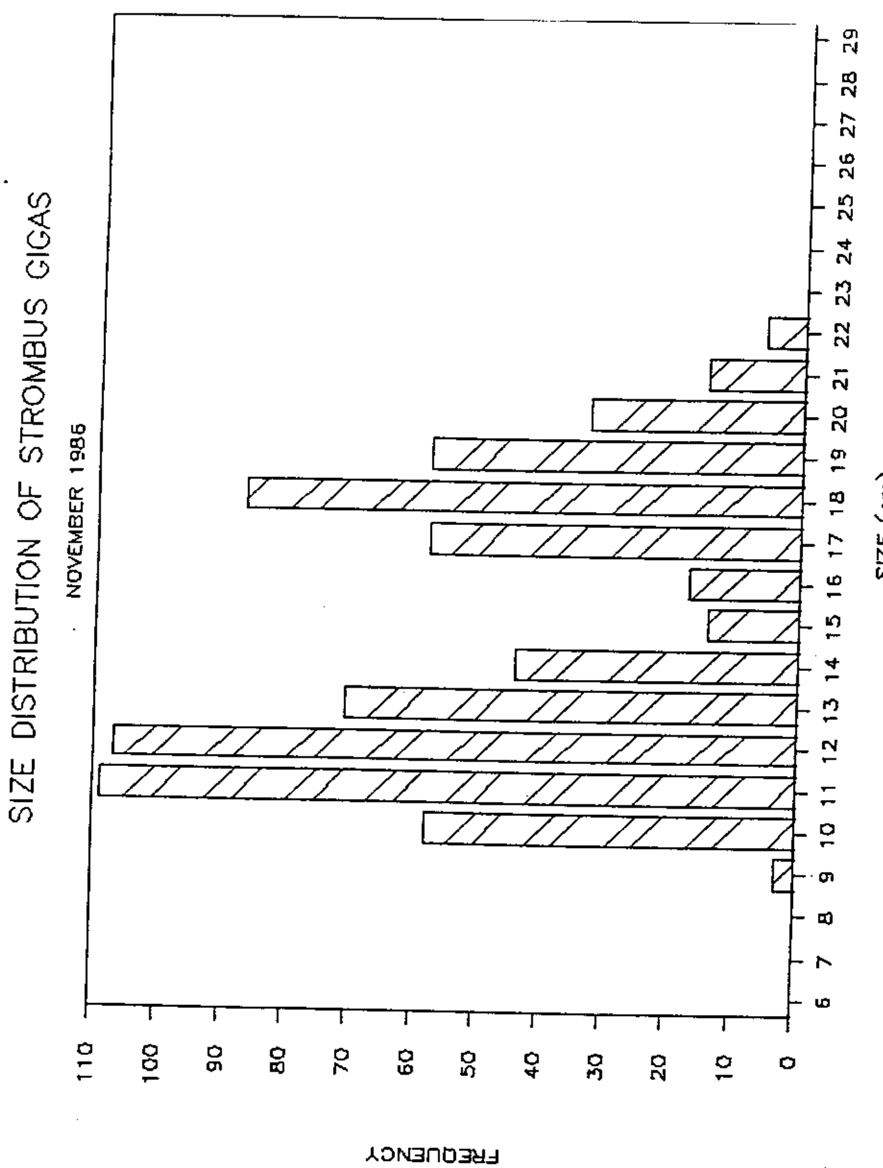

Figure 3. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, November, 1986 (after Conway & Marrow, 1986).

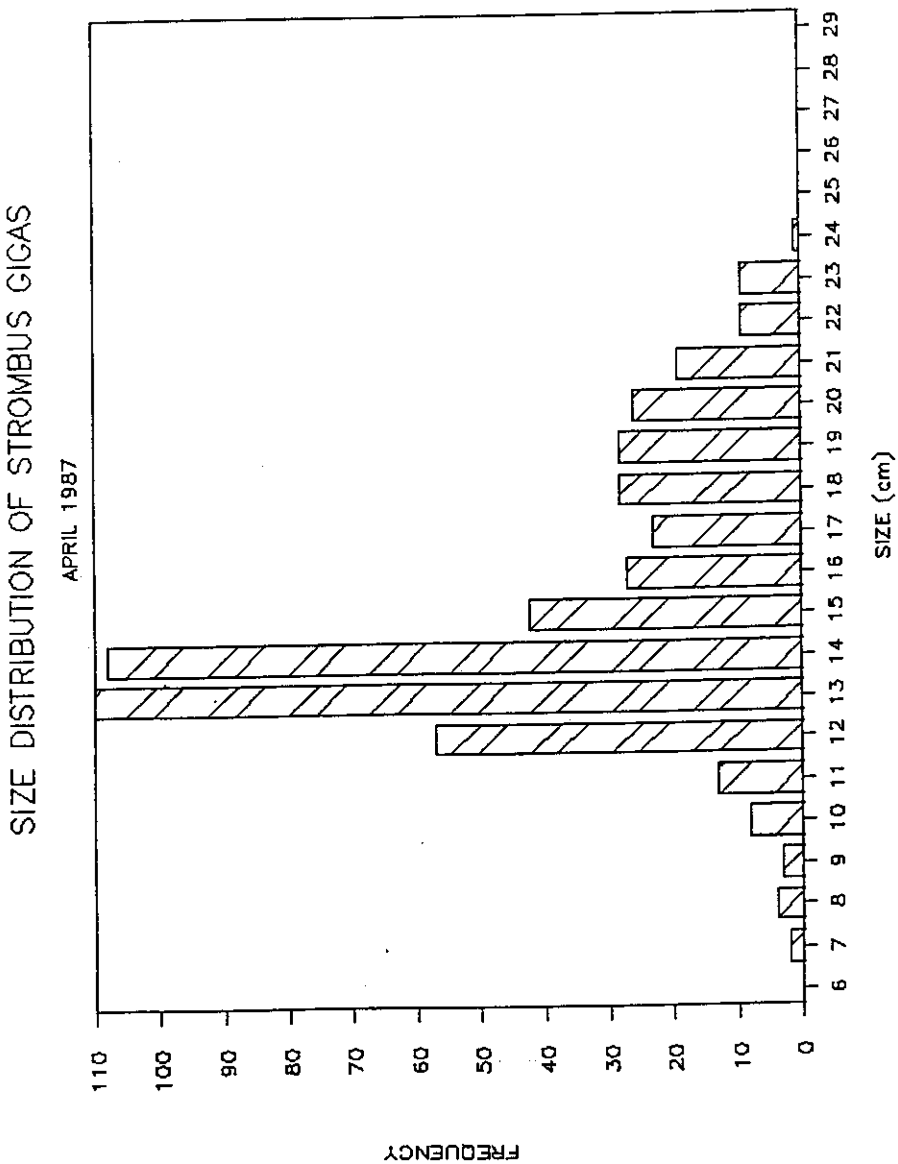

Figure 4. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, April, 1987 (after Beeh, 1987).

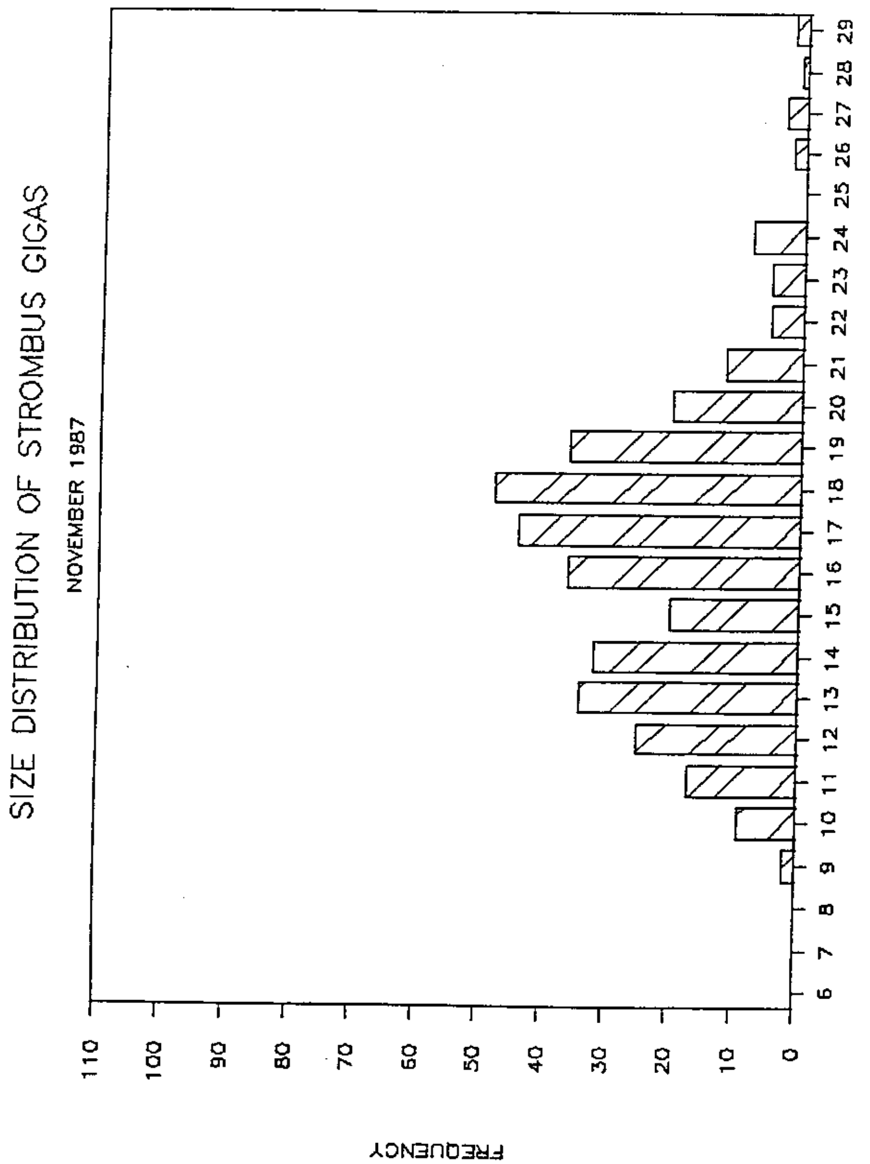

Figure 5. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, November, 1987 (after Brickell, 1987).

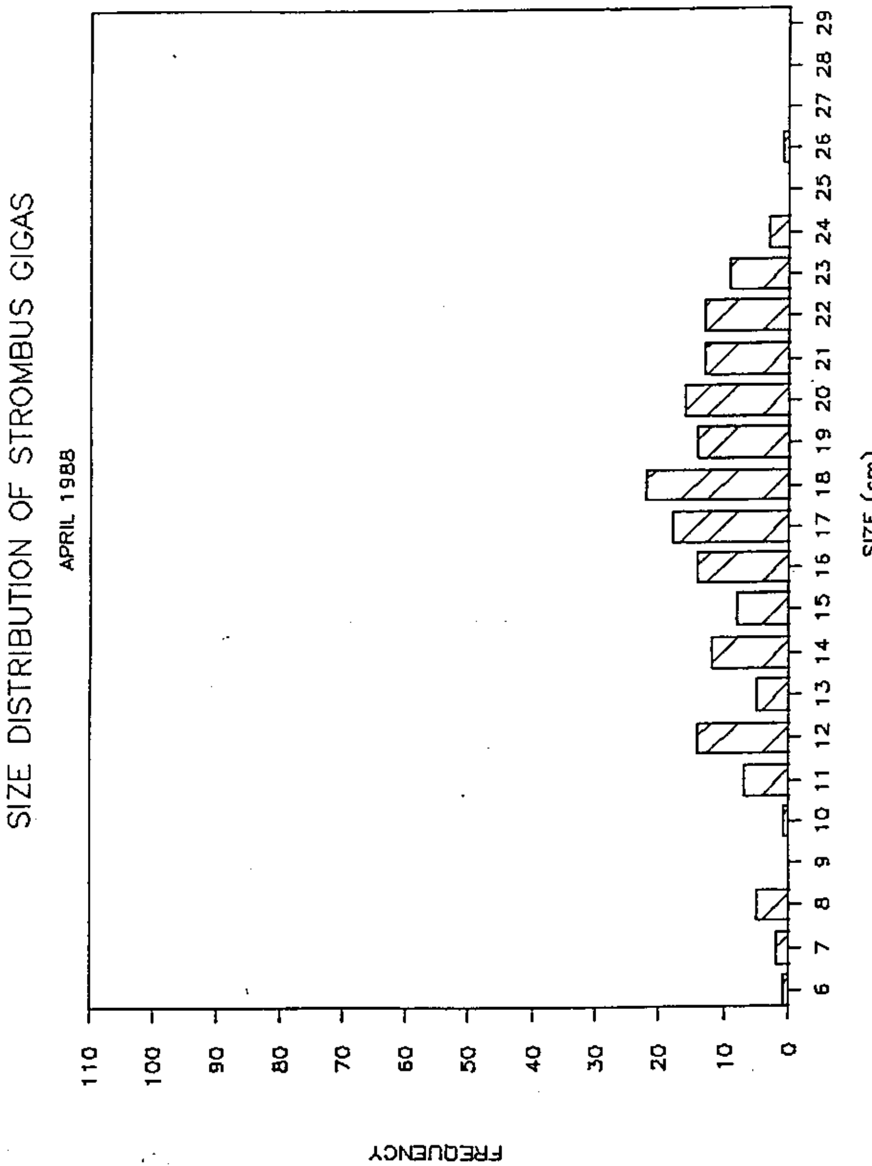

Figure 6. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, April, 1988 (after Hicks, 1988).

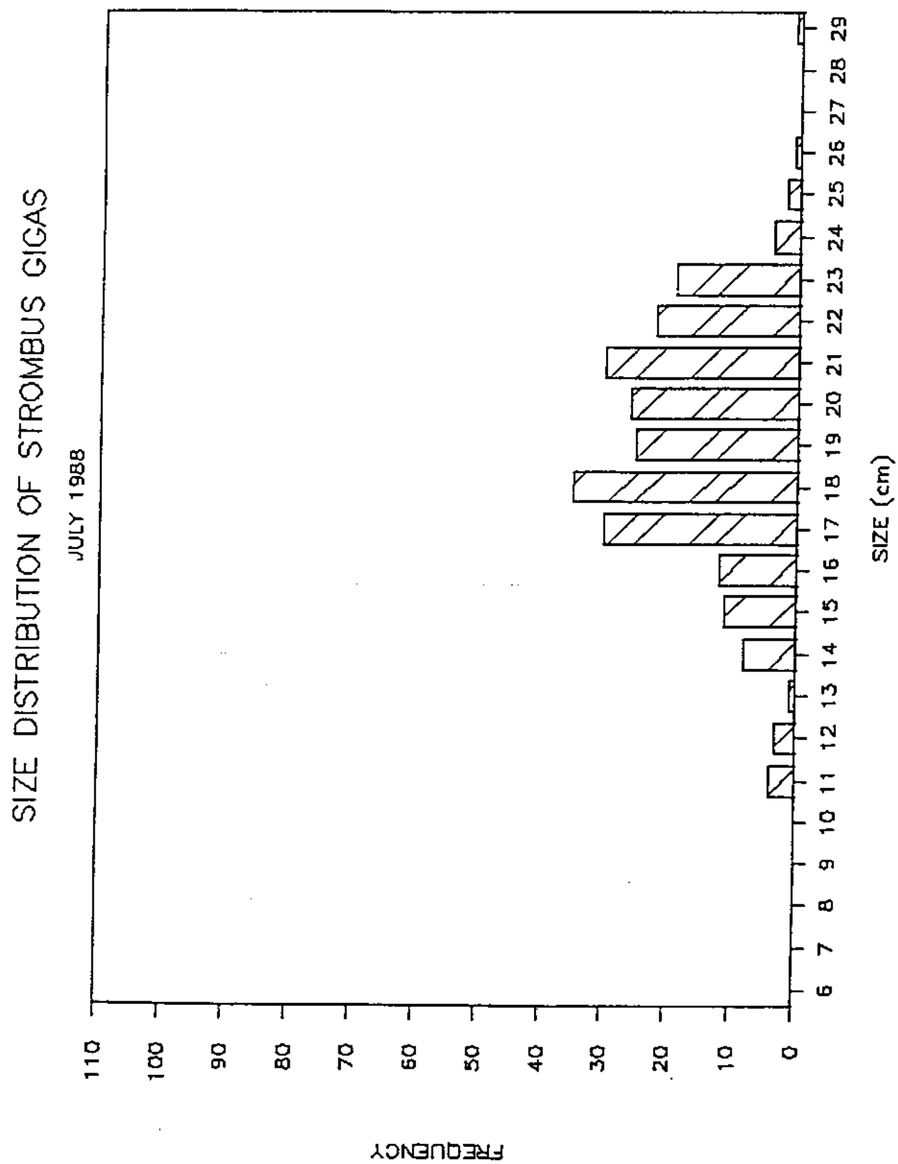

Figure 7. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, July, 1988 (after Hicks, 1988).

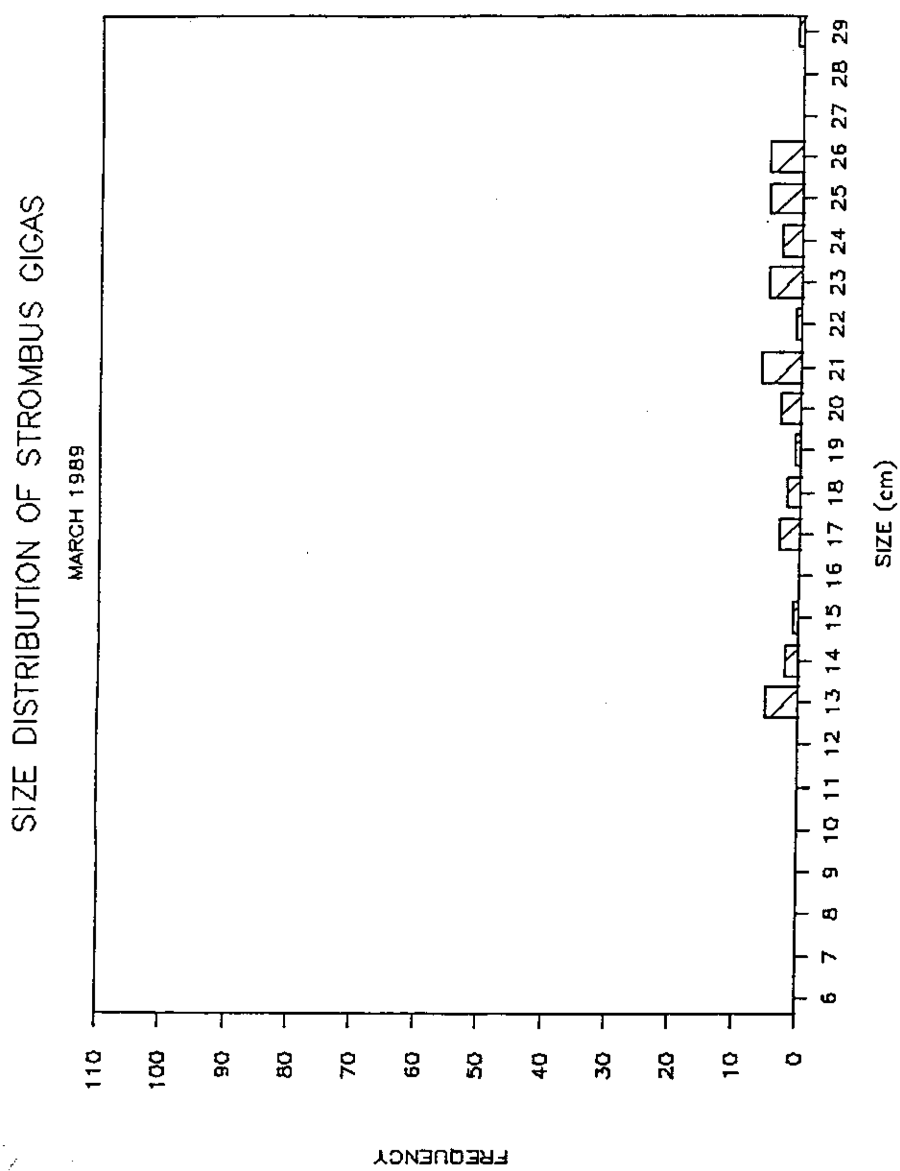

Figure 8. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, March, 1989 (after Harvey, 1988).

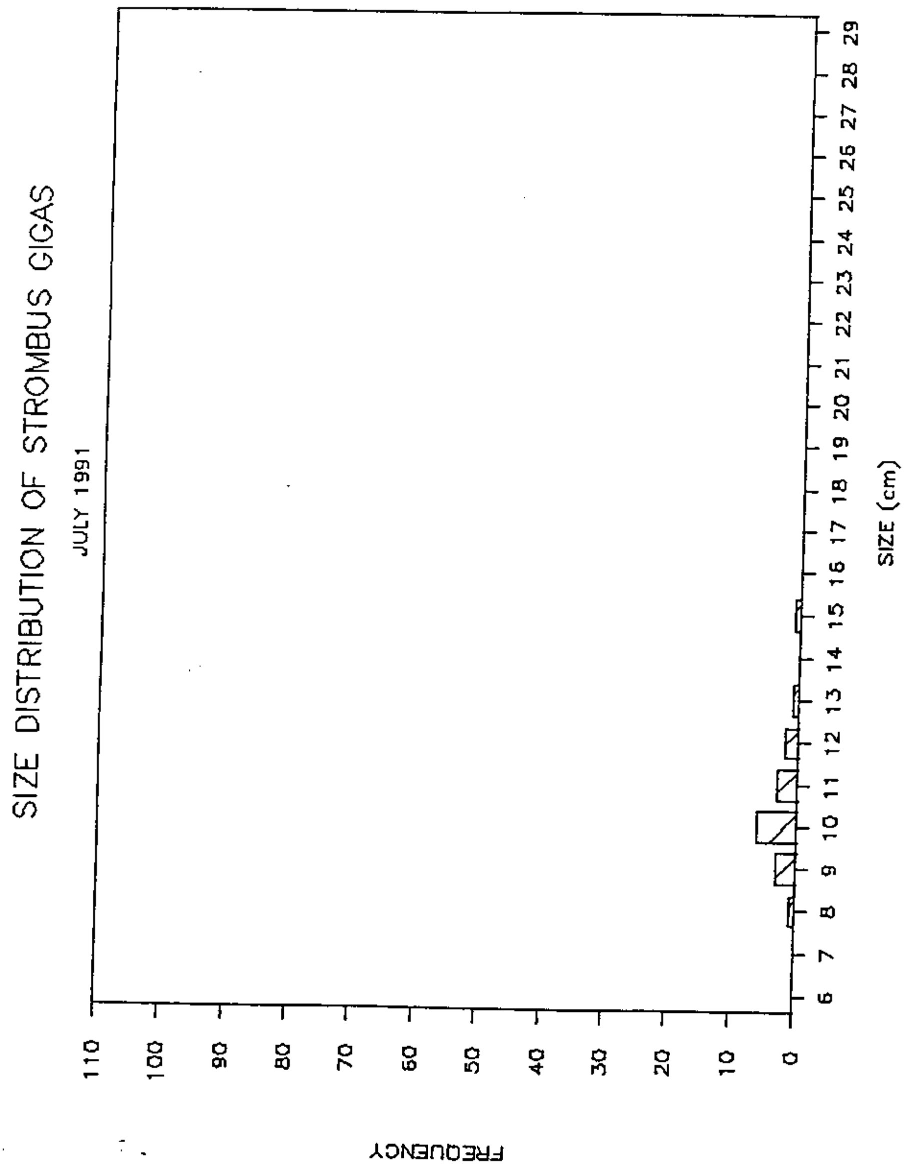

Figure 9. Size frequency distribution of *Strombus gigas* at Greater Lameshur Bay, July 1991.

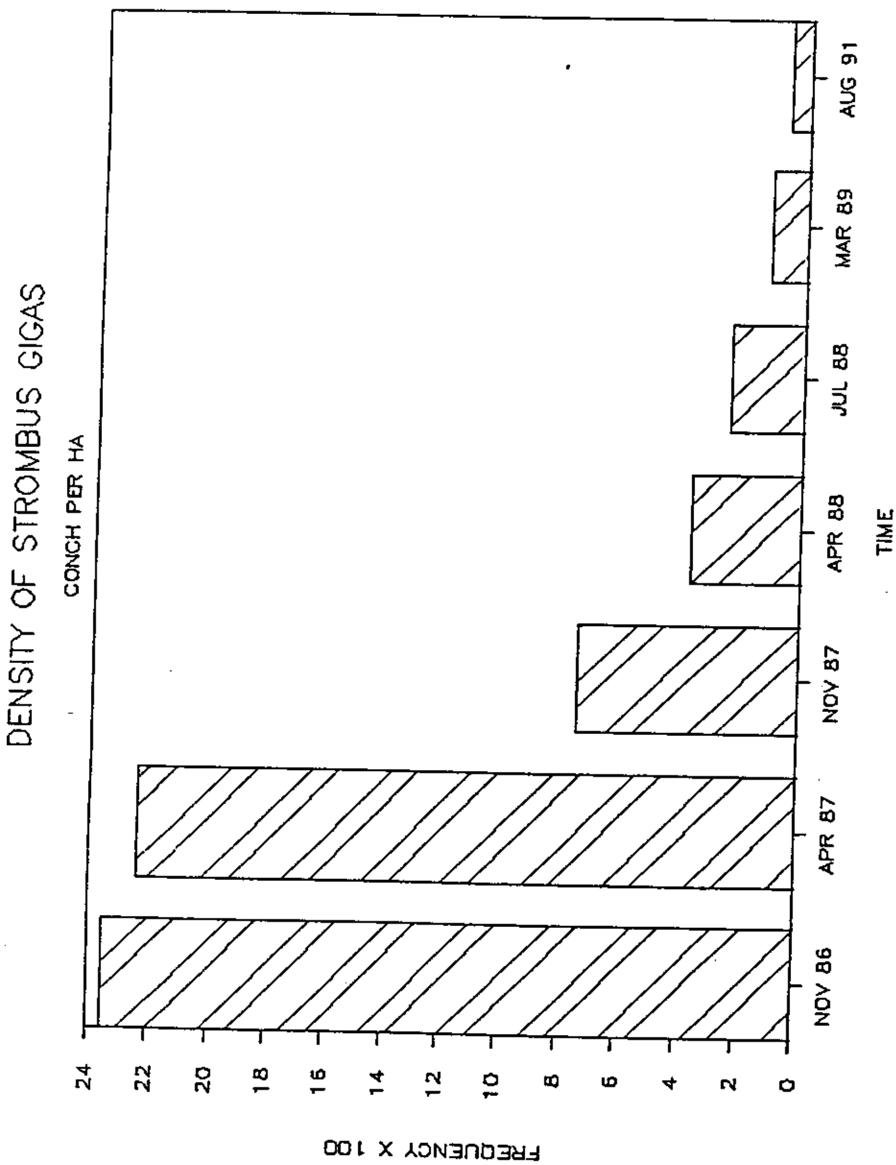

Figure 10. Density of *Strombus gigas* at Greater Lameshur Bay from November 1986 to August 1991.

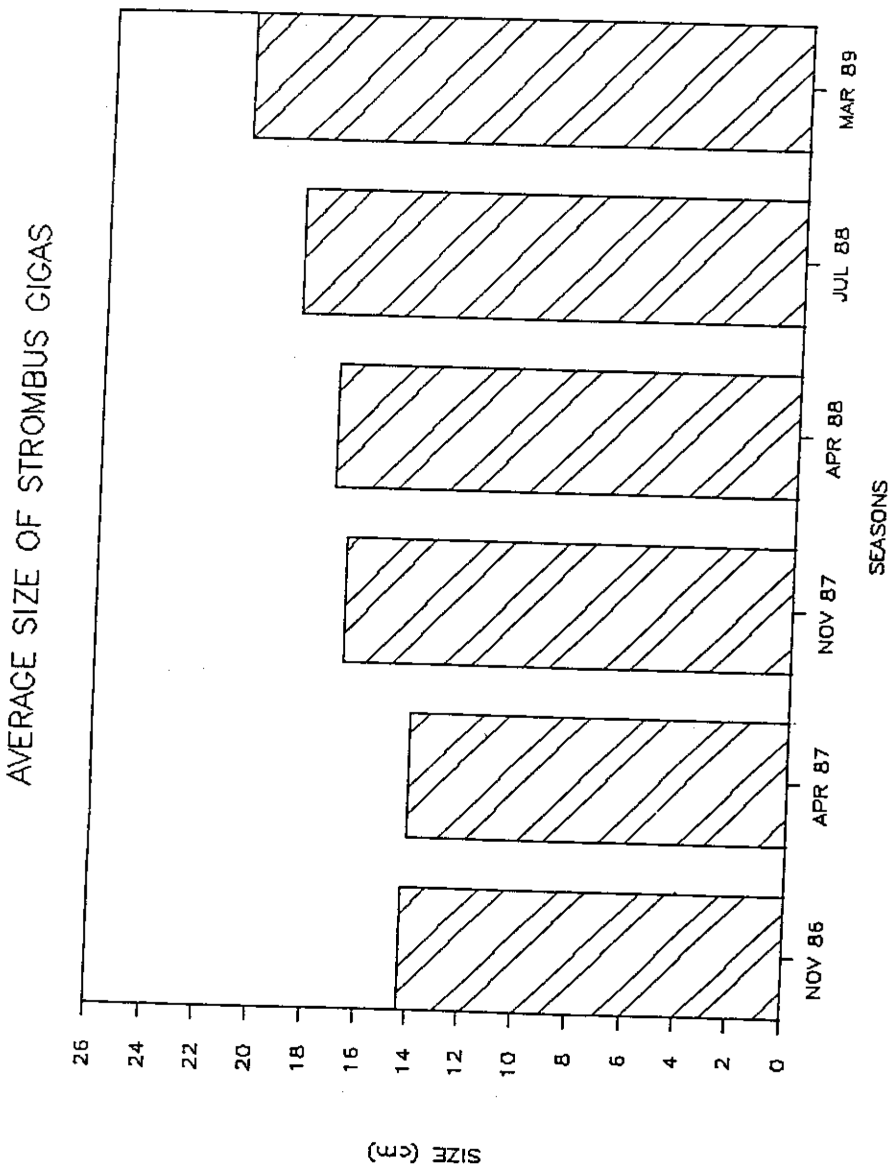

Figure 11. Average size of *Strombus gigas* at Greater Lameshur Bay from November 1986 to March 1981.

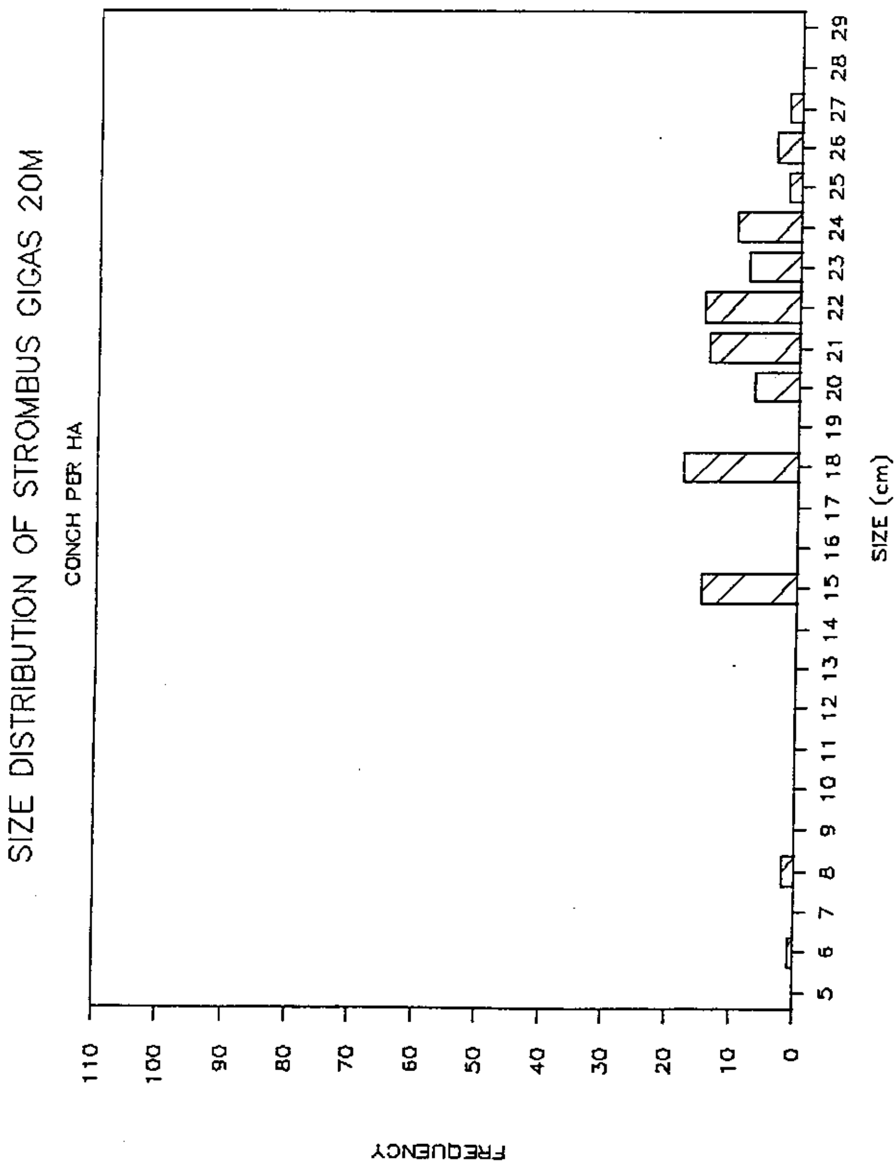

Figure 12. Average size of *Strombus gigas* at Greater Lameshur Bay from November 1986 to July 1991.

was 318 conch per hectare. We consider this a spawning aggregation as 30% of the animals were copulating or depositing eggs. In a resurvey of the area in September 1991 the density had declined to 82 conch per hectare. Out of 30 conch tagged in July 1991, only one was recaptured suggesting a migration from the bay. In summary, Greater Lameshur Bay has a healthy deep water adult population, but experienced a decline in recruitment compared with that in 1986 - 87, at the start of the moratorium.

DISCUSSION

After a closed season for queen conch fishing for five years there is little evidence to suggest a recovery of the populations. A five year extension of the ban has been proposed by the Division of Fish and Wildlife. Minimally, an extension of the fishing ban is necessary. However, considering the decline of the population during the past five years it is doubtful that the conch population could naturally recover in an additional five year period and sustain itself under fishing pressure during subsequent years.

In September 1989, Hurricane Hugo struck the Virgin Islands with winds gusting to 300 km per hour. It has been suggested that the effects of the hurricane retarded the conch population recovery. Population size in Greater Lameshur Bay in March 1989, before the hurricane was one-tenth that found two and one-half years before, at the start of the closed season. The hurricane certainly disturbed prime juvenile conch habitats and did not assist the recovery. We are doubtful whether the population would have shown signs of increase without the disturbance.

To increase the conch population during the fishing ban and to sustain it under fishery pressure when the ban is lifted, it appears that additional actions are required. The concept of using hatchery reared juveniles for restoration of depleted natural conch populations has been considered in other locations (Appeldoorn & Ballantine, 1983; Coulston, *et al.*, 1987). Its usefulness has been questioned for a number of reasons, and there is little evidence that hatchery production has ever had any measurable effect on natural fishery populations of any marine invertebrate (Hahn, 1990).

The theory is that hatchery rearing will avoid heavy predation and natural larval mortality, and the increase in survival will contribute to replenishing the natural population. Queen conch reaches commercial size after three and one-half years in the wild (Berg, 1976). At natural levels of predation, only about 0.1% (1 out of 1000) of seeded six month old juveniles (approximately 60 mm) will survive to the age of two and one-half years (Hahn, 1990).

Reseeding of queen conch less than 6 cm will not be effective unless the animals are protected from natural predation by crabs, octopus, turtles, rays and fish, released under special circumstances or unless they are in an area where they do not exist and are thereafter protected so the population can maintain itself by natural reproduction (Chanley, 1982). Jory and Iversen (1983) and Appeldoorn (1984) found that the number of conch predator species decreases with increasing conch shell length, suggesting that hatchery reared conch should be released when they are as large as possible. This is not, however, economically practical. They suggest an optimal size of release between 10 and 15 cm because there appears to a considerable decrease in predation mortality after this size range is reached.

Assuming a growth rate of 0.9 cm per month, would an additional half year of hatchery protection dramatically increase survival in the field? Studies by Jory & Iversen (1983) and Appeldoorn & Ballantine (1983) suggest that there is a 50% decrease in mortality rate in juveniles larger than 10 cm and that the number of possible predators decreases after the conch reaches a size range of 10 to 15 cm. Clearly the larger the released animal the greater chance for survival. More experimental studies should be done to investigate the relationship between size and predation for conch larger than 6 cm.

We believe that fishery management programs which have a realistic chance of restoring depleted conch populations can be developed. We suggest that experimental restocking of the St. Thomas & St. John conch habitats with juveniles greater than 9 cm should be attempted.

The long term restocking of small conch into the natural environment probably is not an economically feasible way to replenish and support the fishery. Restocking, even if it is cost effective, does not solve the problem.

The cause of the initial decline in the conch populations is not from recruitment failure, but from overfishing and/or destruction of habitat. Conch populations can only be restored by effective resource management and conservation. This can best be accomplished with the support of an environmentally aware human population.

ACKNOWLEDGEMENTS

We thank the staff of the Virgin Islands Ecological Station for their assistance. Ms. P. Moss assisted with the field work. Financial support was provided by the Caribbean Research Institute and the Eastern Caribbean Center at the University of the Virgin Islands. Dr. Barbara L. Kojis and Dr. David Booth kindly provided thoughtful comments on the manuscript. Mrs. J. King assisted with the typing and printing of the manuscript.

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