Distribution & Abundance of *Strombus gigas* in the British Virgin Islands

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ABSTRACT

Throughout the Caribbean region, populations of queen conch (*Strombus gigas*) are declining. In the British Virgin Islands, the conch fishery has been historically valuable and is presently a valued resource in hotel and restaurant trades as well as for local consumption.

Continual fishing pressure without proper stock assessment and management could pose an imminent threat to the future of this commercial fishery. To address concerns regarding possible declining conch stocks in the BVI, Fisheries Regulations passed in 2003 specify size limits and seasonal fishery closure. However, the status of current populations is unknown, and only one study (1993) assessing size distribution and abundance exists.

This study expands on the previous investigation to evaluate temporal changes in habitats and in population densities since 1993. Current population densities and size distribution in eight popular conch-fishing grounds are also evaluated.

Replicating the 1993 study, 2,500 meter^2 quadrats previously established at four sites were studied. Additional quadrats were set up at four different sites to evaluate the fishery on a broader spatial scale. The number and lengths, of conch were measured. Densities and sizes were calculated and measurements were coupled with 1991 results.

Preliminary results suggest there is an overall decline in the abundance and size of conch on a temporal and spatial scale. This paper discusses probable causes of decline as well as possible management strategies to regenerate this vital fishery.

KEY WORDS: British Virgin Islands, stock assessment, *Strombus gigas*

¿Distribución? Abundancia de *Strombus gigas* en las Islas Británicas Vírgenes

En todas partes de la región caribeña, las poblaciones de la Concha de Reina (*Strombus gigas*) han estado disminuyendo. En las Islas Británicas Vírgenes, el piscifactoría de concha ha sido históricamente valioso y es en este momento un recurso valorado en hotel y comercios de restaurante así como para el consumo local.

La presión continua de pesca sin evaluación de reserva apropiada y dirección podría plantear una amenaza inminente para el futuro de este piscifactoría comercial. Para dirigirse a preocupaciones en cuanto a reservas de concha posibles que disminuyen en el BVI, las Regulaciones de Piscifactoría pasadas en 2003 especifican límites de tamaño y cierre de piscifactoría estacional. Sin embargo, el estado de poblaciones corrientes es desconocido y sólo un (1991) el estudio que tasa la distribución de tamaño y la abundancia existe.

Este estudio amplía la investigación anterior para evaluar cambios temporales de hábitats y de densidades de población desde 1991. Las densidades de población corrientes y la distribución de tamaño en seis tierras populares de pesca de concha son también evaluadas.

Reproduciendo el estudio 1991, 2,500 meter^2 quadrats antes establecido en cuatro sitios fueron estudiados. Quadrats adicionales fueron establecidos en dos sitios diferentes para evaluar el piscifactoría por una escala más amplia espacial. El número, las longitudes, y el grosor de labio de la concha fueron medidos. Las densidades y los tamaños fueron calculados y las medidas fueron conectadas con 1991 resultados.

PALABRAS CLAVES: Islas Británicas Vírgenes, evaluación de reserva, *Strombus gigas*

INTRODUCTION

The Caribbean Queen Conch, *Strombus gigas,* is second to the spiny lobster, *Panulirus argus,* as the most valuable demersal resource in the Caribbean (Brownell and Stevely 1981, Appeldoorn 1994a). Since they are slow moving and inhibit shallow waters, collection is relatively easy and consequently has been a staple food throughout the region for hundreds of years (Brownell and Stevely 1981, Stager and Chen 1996). An increased demand for conch caused the development of commercial fisheries in many Caribbean regions during the early to mid-1900s (Ninnes 1994). As a result, the fishing pressure on queen conch stocks quickly intensified bringing some stocks, such as those off Bermuda, to the point of commercial extinction (Brownell and Stevely 1981, Mulliken 1996). The majority of the queen conch stocks in the Caribbean are now in decline (Theile 2001). The close proximity the British Virgin Islands (BVI) has to the US Virgin Islands (USVI) should raise concern for immediate action especially since research shows overexploitation, local depletion and potential recruitment failure has occurred in the USVI (Theile 2001).

BACKGROUND

The BVI Conch Fishery

In the BVI, ancient conch mounds reveal Arawak Indians used conch as an important source of protein 500 years ago (Blok 1993). Traditionally, conch was harvested in near shore areas with a looking glass and scoop bag, but with

the invention of SCUBA gear in the 1960s fishermen were able to fish more intensely throughout the conch's range. In June of 1990, SCUBA equipment was banned for use to harvest any marine product (Fisheries Regulations 1979). Discussions with fishermen as well as studying the ancient conch mounds indicated that these more progressive methods of harvesting conch lead to mean size and population levels of the queen conch to drop in the BVI (Blok 1993). However, no studies have been made to determine if the mean size has increased over the past thirteen years since this order came into effect.

Fishing is an important recreational and cultural activity in the BVI. Most locals have been exposed to fishing activities at one time or another (Delaney 2000). Some of the main cultural food dishes reflect the BVI's interaction with the sea and items such as conch are present on most local menus. Not only is the fishery important for local consumption, but most fishers sell their fish to customers near their landing site or to local restaurants and hotels (Alimoso and Davies 1991

The conch fishery in the BVI has had little focus for comprehensive analysis for its sustainability. It is reasonable to believe stocks have been exploited, particularly since an anonymous article stated fishermen took an average of 1,000 kg of conch per week during the mid-1980s (Blok 1993) and monthly catches were averaging less than 1,000 kg a month in 2002 (BVI Fishing Complex 2002). Fishing pressure may also be exacerbated by the close proximity several fishing grounds are to shore that allows easy access.

Other problems causing decline may include conch habitat loss due to anthropogenic factors such as construction or heavy sedimentation from coastal erosion.

Management of the BVI Conch Fishery

Political platforms have suggested the emergence of a "third pillar" of the economy to diversify and enhance the territories long-term stability (BVI Government 2003). The primary economic engines are financial services and tourism but this third tier in the economy could possibly come from the marine and fishing industries (BVI Government 2003). It is generally accepted that the fishing industry has and continues to contribute to the economy. However, measurements of existing or potential contributions to the economy are nonexistent. This is because there is an absence of mechanisms to collect relevant information on a regular basis. There are no formal or consistent records of persons involved in the fishery whether it's commercial, sport, or recreational. There is little regularly collected information on the inputs into the fishing industry and little to no information on the patterns of consumption of fish imports and exports. Illegal fishing occurs and there is no estimate as to the amount of fish taken from BVI waters. These information gaps make it difficult to estimate the economic contributions of the fishing industry in general, not just the conch fishery.

As a strategy to help manage the fishery in the BVI, the Fisheries Regulations passed in 2003 specify a closed season from 1 June to 30 September. All conch must be landed in the shell with a minimum size of 7 inches (17.78 cm), have a flared lip, and meat must not weigh less than 8 oz. (Fisheries Regulations 2003). Several Fisheries (Marine) Protected Areas (MPAs) and Fishery

Priority Areas (FPAs) have been established. Anchoring, snorkeling or diving is not allowed in either type of area however, local fishermen are allowed to fish in FPAs.

There are some problems with the establishment of these regulations. Most MPAs are "paper parks" which lack agreement of the resource users as well as monitoring or enforcement from the management agencies. Thus, a high proportion of MPAs fail to meet their objectives (Jameson et al 2002). The success of MPAs is determined by the level of community and institutional capacity (Rudd et al 2001).

The current fishery management strategy in the BVI is centralized, top-down and has a nonparticipatory orientation. However, management of the conch fishery in the USVI has recognized a bottom up approach would be beneficial (Beets et al. 1994). This type of "co-management" shares responsibilities and authority between the government and the community to manage a resource (Pomeroy and Williams 1994). This idea of co-management allows the community the policy and legislative support as well as enforcement and conflict resolution from the government (Pomeroy et al. 1996). With the existence of a co-management plan, the protected areas may also have better success. The future outcome of this preliminary study is hoped to replicate the management strategy the USVI has established.

METHODS AND MATERIALS

The methodology used for this study replicates four 1993 study sites (Figure 1). Sites were selected on suitability as permanent study sites, benthic habitat characteristics where high incidences of conch would be found, relatively shallow areas to allow unnecessary risk to divers and large distances between the four study areas to allow unbiased analysis of the resource (Blok 1993). The four new sites were chosen on the recommendation of local fishermen (Pemberton, personal communication).

Within each site, three 100 m belt surveys were established, each 50 meters apart and demarcated by rebar. All transects were in less than 5m of water except for Fallen Jerusalem (30 m). Divers collected information on the total number of conch as well as shell length within 2 m of the transect. The 2003 surveys took place once a month from August to October 2003. Visual surveys described habitat types as sea grass, algal plain, sand, or coral. Information gathered from the 1993 study was then compared with the 2003 study.

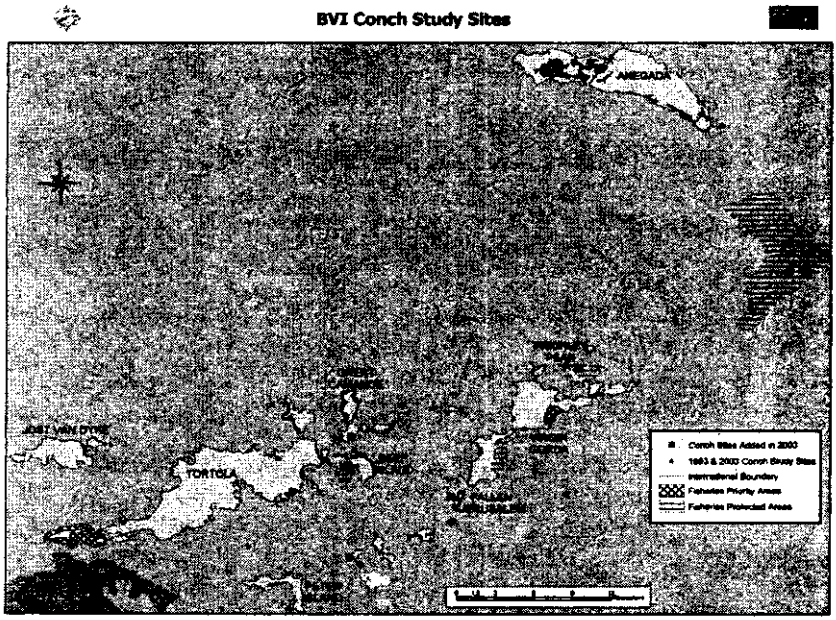

Figure 1. Map of the British Virgin Islands with 2003/1993 conch study sites as well as Fishing Priority Areas (FPAs) and Fishing (Marine) Protected Areas (MPAs)

RESULTS

A total of 40,000 m^2 was surveyed and 341 conch were surveyed in the 2003 study (not including the new sites), 11 more than the 1993 study. All sites were close to shore (< .25 km). However, Prickly Pear is an uninhabited island and the Peter Island (PI) site is in a remote area. Both Beef Island (Bird Rock) (BIBR) and North Prickly Pear (NPP) showed dramatic declines in population size, 41 and 27 respectively, to zero. The NPP site had an abundance of "knocked" or empty shells. This was the only site over reef and sandy substrate, the rest were over seagrass (*Thalassia testudinum and Syringodium filiforme)*, algal plain, or a mixture of the two. The BIBR site was < .5km from reclaimed land for the extension of the airport. All mean lengths were < 20.1 cm (juveniles). All densities were < .03/ha. Results are in Table 1.

The four new sites covered 40,000 m^2 and 857 conch were surveyed. All new sites were close to shore (< .25km). Fallen Jerusalem was the deepest site (30 m) and primarily algal plain. All other sites were seagrasses (*Thallasia tesudinum and Syringodium filliforme*). FJ had the largest mean length (20.09), the other sites contained juveniles. Results are in Table 2.

Table 1. Descriptive statistics for 2003 / 1993 conch study sites

Site	Mean Length	Total # counted	Densities (conch/ha)
Peter Island 1993	14.22	257	0.0257
Peter Island 2003	15.42	208	0.0208
Anegada 1993	22.23	7	0.0007
Anegada 2003	20.11	133	0.0133
Beef Island (Bird Rock) 1993	21.36	41	0.0041
Beef Island (Bird Rock) 2003	0.00	0	0
Prickly Pear North 1993	20.51	27	0.0027
Prickly Pear North 2003	0.00	0	0

Table 2. Descriptive statistics for new 2003 conch study sites

Site	Mean Length	Total # counted	Densities (Conch/ha)
Prickly Pear East 2003	12.84	89	0.0089
Bluff Bay 2003	12.40	656	0.0656
Great Camanoe 2003	18.28	96	0.0096
Fallen Jeruselem 2003	20.09	16	0.0016

DISCUSSION

Given data limitations, preliminary observations provide generalizations of the BVI conch fishery. Results suggest a slight decline in the fishery. The change in abundance at North Prickly Pear and Beef Island (Bird Rock) contrasts with the increase of conch at Anegada and Peter Island, thus implying spatial variation of abundance over time. Due to the lack of data, it is difficult to establish if the mean length of conch has declined.

The methodology used for this study was simplistic and easy to replicate, however, there are several problems with how the study was performed. First, both studies were performed in different months of the year. Because conch move inshore during spring to spawn and return to deeper waters during the fall (Hesse 1979), the times of year will make a difference in determining the population abundance and distribution. This could have had an effect on all results of this study.

Fallen Jerusalem had the highest mean average (20.09 cm) and was the only deep water site. Deeper sites should be studied to avoid bias in counting primarily juveniles, as they are important in stock recruitment and a critical spawning stock refuge (Appeldoorn 1997). Including deeper sites would have given a more accurate distribution of conch in the BVI, especially since all but one site contained primarily juveniles (< 2.5cm).

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