SIZE STRUCTURE AND DENSITY OF THE COMMON PURPLE SEA FAN *GORGONIA VENTALINA* IN BERMUDA'S TOBACCO BAY

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Abstract The spatial distribution and size structure of *Gorgonia ventalina* in Bermuda's Tobacco Bay were analyzed in order to further understand coral demographics and possible resource competition on the reef. A trend reflecting a negative association between population density of *G. ventalina* clusters and mean height of colonies within the clusters was found, however this association was not statistically significant. Although weak, the trend suggests that growth of *G. ventalina* is limited by population density. Understanding the growth and distribution patterns of important marine communities such as gorgonians is essential to developing a more complete framework of tropical coral reef dynamics.

Key Words: *gorgonian, spatial distribution, coral reef dynamics*

Introduction

Gorgonian corals are conspicuous members of reef communities throughout the Atlantic (Opresko 1973, Toledo-Hernández and Sabat 2007). These corals provide refuge and other resources for a wide variety of marine algae and animals, and thus play an important role in tropical reef ecosystems (Opresko 1973). Although gorgonians are not reef-building corals, evidence suggests that they modify the chemical composition of nearby sediment by providing a significant amount of calcium carbonate through the release of microscopic spicules (Opresko 1973). Insight into the growth and distribution patterns of these essential coral reef community members may help establish a broader understanding of tropical reef dynamics.

Clonal species follow significantly different distribution patterns from those of species that reproduce sexually. Taxa whose demographics depend on size may appear as vegetative propagules that favor fast growth and low mortality (Lasker 1990). These complex growth patterns determine the size pattern distribution of many gorgonian species. The demographics of the common purple sea fan *Gorgonia ventalina* are not well understood (Opresko 1973, Toledo-Hernández and Sabat 2007).

The purpose of this study is to survey the size structure and density of the soft coral *G. ventalina* throughout Bermuda's Tobacco Bay in order to find a possible association between sea fan size and proximity to other *G. ventalina* individuals or clusters. Additionally, proximity of *G. ventalina* to other soft coral species on the reef is investigated. Observed size and distribution patterns may lend insight to both intraspecific and interspecific resource competition on the reef.

Figure 1: A single *G. ventalina* colony, characterized by the presence of one mother branch (dark purple stem at inferior end) with many daughter branches that have grown outwards from the base. The dendritic networks observed in the body of the coral are polyp-containing branchlets. Sea fans were measured in height from the inferior end of the base to the branchlet most distal to the mother branch.

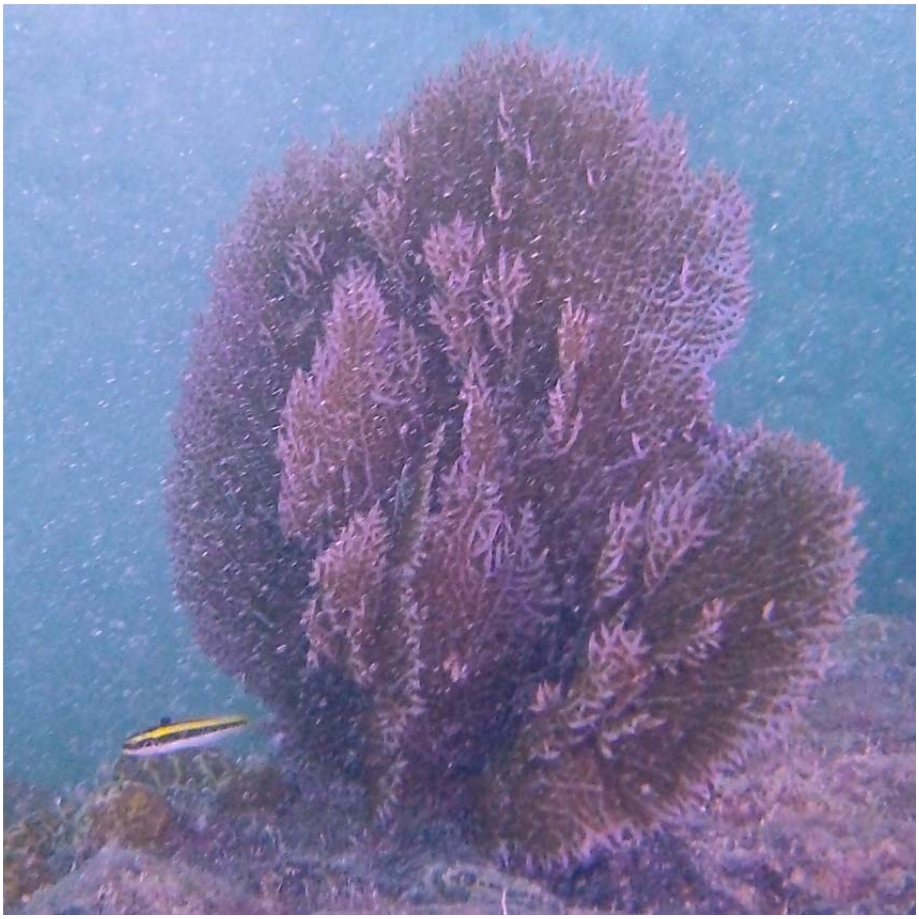

Figure 2: A cluster of G. ventalina colonies. Each individual colony shown has grown from its own mother branch. Every colony within a cluster was measured in height individually, and the number of colonies present in the cluster was counted.

Materials and Methods

The common purple sea fan is a prevalent soft coral of the gorgonian community (Toledo-Hernández and Sabat 2007). Morphologically, it is composed of branching structures that start with a mother branch from which daughter branches gradually grow, creating a colony (Sanchez 2004). On a microscopic level, the branchlets are composed of small structures called polyps (Sterrer 1992). Many gorgonians including *G. ventalina* form dense aggregates through fragmentation (Lasker 1990). These clusters are a tight collection of individual colonies, each with their own mother branch.

In October 2012, observations were made at Tobacco Bay (32.388315, -64.67926.), an inlet of the Atlantic Ocean located on the northern coast of Bermuda. Pictures were taken using a Kodak Playsport Video Camera, Zx5 (Eastman Kodak Company). A simple underwater transect line was used to measure the height of the sea fans in centimeters, and their distance from other corals, colonies, and clusters.

G. ventalina colonies were measured in height from the inferior end of the base, where it meets the reef, to the tip of the branchlet most distal to the mother branch (Figure 1). Each individual colony within a cluster was measured in the same way previously described, and the number of colonies present in the cluster was noted (Figure 2).

The small-scale spatial pattern was examined by measuring the distance in centimeters between two *G. ventalina* colonies, two *G. ventalina* clusters, or a colony and a cluster. Sea fans within 20cm of each other were recorded as proximal. Other soft coral species found less than 20cm away from a *G. ventalina* colony or cluster were identified, and their distance in centimeters from the sea fan was noted.

Results and Discussion

There was a negative association found between number of colonies in a cluster and mean height of branches in the cluster (Figure 3), however this trend was not statistically significant ($R^2 = 0.1773$). The association suggests that the presence of proximal *G. ventalina* mother branches in a cluster may limit growth. The error bars in Figure 3 show that in clusters containing one or two individual colonies, there was greater variation in length compared to the length variation in more densely populated clusters. It is imperative to use a larger study sample during future observations in order to find a numerically significant trend.

Two pairs of *G. ventalina* clusters were found less than 20cm away from each other. One pair consisted of a lone 24cm colony found 1cm away from a lone 9cm colony. The other pair was a cluster of two colonies (10cm and 2cm) found 10cm away from a cluster of four colonies (11cm, 13cm, 15cm and 6cm). It is possible that intraspecific competition causes one cluster to grow taller branches than a nearby cluster, but there is not enough data to draw an association.

In four cases there were *G. ventalina* clusters found less than 20cm away from other soft coral species such as *Pseudoplexaura porosa*. As previously noted regarding

intraspecific interactions, more data is needed to assess whether there is an interspesific competition influencing the growth patterns of soft corals on the reef.

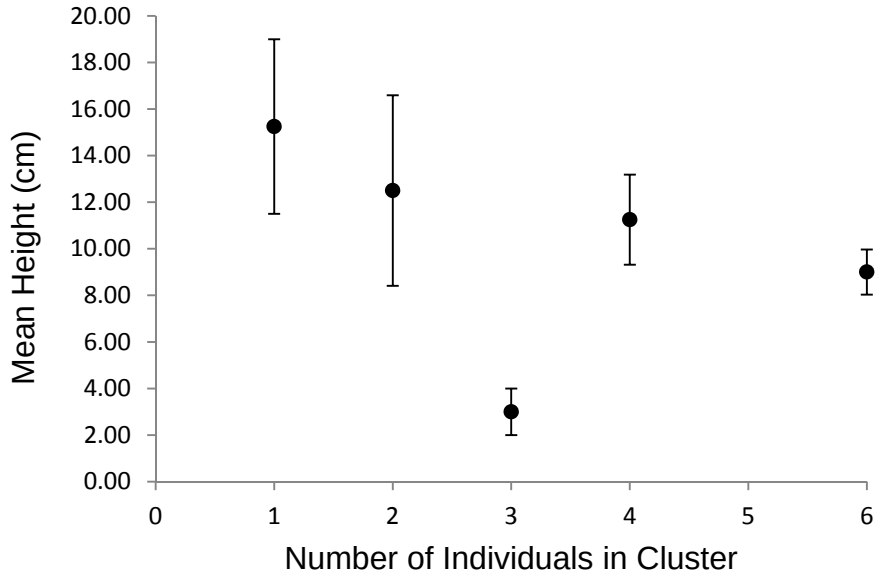

Figure 3: Mean height *Gorgonia ventalina* branches vs. number of individuals in cluster. Branches measured in centimeters. Error bars indicate standard error of length variations.

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