DOMINICA REEF FISH STATUS 2002:
An Assessment of the Abundance and Species Composition of Dominican Reef Fishes.

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An Assessment of the Abundance and Species Composition of Dominican Reef Fishes

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Abstract Reef fishes were surveyed at eight sites along the western coast of Dominica using a combination of two different roving diver techniques. The purpose of the study was to establish a list of marine fish species found in Dominican waters as well as to rank those species according to abundance. The top five species most abundant species, from highest to lowest, were Brown Chromis (*Chromis multilineata*), Bicolor Damselfish (*Pomacentrus partitus*), Ocean Surgeonfish (*Acanthurus bahianus*), Sergeant Major (*Abudefduf saxatilis*), and Yellow Goatfish (*Mulloidichthys martinicus*). The top five most abundant families, from highest to lowest, were Pomacentridae, Acanthuridae, Mullidae, Haemulidae, and Aulostomidae. Species richness was also estimated at each of the eight survey sites.

Introduction

Reef fishes, as predators or grazers, play an important role in the community dynamics of coral reefs through their interactions with corals, algae, and other herbivores (AGRRA 1999). Fluctuations in fish populations, especially certain indicator species and guilds cause both direct and indirect shifts in the structures of fish communities as well as other components of coral communities (Hughes 1994). Disruption in the balance of reef fish assemblages can also decrease coral cover and increase algal abundances (Roberts 1995). Because of this importance, fishes are often a focus of monitoring and management programs to evaluate the condition of reef communities (Hatcher *et al.* 1989). The purpose of this study was to establish some baseline data on the abundance and species richness of reef fishes along the west coast of Dominica, a relatively young volcanic island in the Lesser Antilles chain. Dominica's underwater topography is characterized by a narrow, rocky, steeply sloping shelf upon which a variety of coral assemblages, and some true reef formations, are found. These coral communities attract a variety of fish species that are a mainstay of the local diet and economy. Thus, baseline data on Dominica's reef fish populations can be useful for fisheries management decisions as well as future scientific studies.

Materials and Methods

Fish surveys were conducted at eight study sites along the west coast of Dominica during the months of October and November 2002. Listing from the northernmost to the southernmost, these sites were Tabby Bay, Salisbury West, Salisbury East, Macoucherie, Tarou Point, Canefield, Champagne, and Scott's Head. Descriptions of each site can be found in the introduction of Smith *et al* (2002). A total of ten one-hour-long surveys were completed using both SCUBA and snorkeling equipment, with SCUBA being used at Salisbury East and Macoucherie and snorkeling at all others. Champagne and Macoucherie were both surveyed twice, while all other sites were only surveyed once. Surveys were carried out by utilizing two different roving diver techniques that were conducted simultaneously during each hour-long survey. The use of these two techniques resulted in two distinct measures of species abundance: timed scoring and visual scoring. During the surveys, species with visibly different life stages, such as some parrotfishes, wrasses, and angelifishes, were separated according to those stages. In addition, a separate

"species only" list was compiled in order to begin to establish a complete species list of Dominican reef fishes. This list was independent of the abundance data being taken and included any and all marine fish species that I was able identify in Dominican waters since September 2002. All fishes, with respect to both abundance and species only data, were identified *in situ* based upon Humann and Deloach (2002). Only those fishes that could be positively identified were included in the results.

Timed Scoring

Timed scoring was based upon the Random Swim Technique outlined in Rogers *et al* (1994). Roving surveys of reef fish were conducted for periods of 60 minutes at a time. Estimates of species abundance were determined based upon when in the survey each species was sighted, the theory being that the most abundant species would be seen sooner in the survey. Thus, the 60-minute surveys were split up into 10-minute periods. Species identified in each survey were then given a score between 0 and 6 based on what 10-minute period they were sighted in, with 6 being those sighted in the first 10 minutes and 1 being those in the last. Zero scores were given to fish that had been sighted in previous surveys but were not sighted in the specific survey being conducted. Thus, the timed scoring was as follows:

6 = seen within the first 10 minutes of the survey.
5 = seen between 11 and 20 minutes into the survey.
4 = seen between 21 and 30 minutes into the survey.
3 = seen between 31 and 40 minutes into the survey.
2 = seen between 41 and 50 minutes into the survey.
1 = seen between 51 and 60 minutes into the survey.
0 = not seen on that specific survey.

A mean timed score and its standard deviation was obtained for each species by averaging the scores of that species from all ten surveys. A sighting frequency (%) was obtained for each species by taking the number of surveys in which that species was sighted and dividing it by the total number of surveys.

Visual Scoring

In addition to the timed scoring system mentioned above, species abundance was also estimated using a visual scoring system. The visual scoring system is based upon the Roving Diver Technique (Schmitt and Sullivan 1996) used by the Reef Environmental Education Foundation (www.reef.org). Visual scores were determined using the same roving surveys mentioned before, but visual abundance estimates were independent of the 10-minute time intervals. Directly after each survey, while the species that had just been seen were still relatively fresh in mind, each species was assigned a visual abundance score between 0 and 4 based on how many of each species were seen during the whole of the one-hour survey. The logarithmic-based categories of the visual scoring system were as follows:

4 = Abundant = >100 individuals seen
3 = Many = Between 11 and 100 individuals seen
2 = Few = Between 2 and 10 individuals seen
1 = Single = Only one individual seen
0 = None = No individuals of this species were seen during that survey.

A mean visual score and its standard deviation was obtained for each species by averaging the scores of that species from all ten surveys. A sighting frequency (%) was obtained for each species by taking the number of surveys in which that species was sighted and dividing it by the total number of surveys.

Data Analysis

All survey data was input into Microsoft Excel spreadsheets for data analysis. In order to establish a rank-order list of species abundance, each species needed to be assigned an abundance score. Two different formulas were used to do this. One abundance score was the raw total score. This score was the sum of the timed scoring mean and visual scoring mean for each species. This total score was on a 10-point scale, six points for timed scoring and four points

for visual scoring, with a score of 10 being the highest abundance and a score of 0 being the lowest. A second abundance score took into account the sighting frequencies as well. In this case, the mean of each species, both timed and visual, was multiplied by that species' sighting frequency. Thus, each species received two "Mean*SF" scores, one for timed and one for visual. These two scores were added together to obtain a total abundance score that was on a 10-point scale, with 10 being the highest and 0 the lowest. Since this second scoring system took into account sighting frequencies as well, it resulted in a better delineation among species than did the raw total score. Thus, the only way a species could receive a perfect 10 in total abundance was if it appeared in every survey and received maximum timed and visual scores of 6 and 4 respectively in each one. This total abundance score was used to make a list of Dominican reef fishes that were ranked from greatest abundance to least. In order to rank abundance data on the various families, both the mean and max of all samples from each family was taken. Thus, the families could be ranked in four different ways: Raw Mean Total, Raw Max Total, Mean Total Abundance, and Max Total Abundance. Ranking differences between mean and max totals was based on the number of samples in each family. However, it appeared that the Max Total Abundance ranking best reflected the actual conditions (pers. obs.). Finally, the total number of species sighted during each survey was added to get an estimate of species richness from each site.

Results

Tables presenting all the data and abundance rankings are at the end of this document. The species only list included 115 fish species comprising 46 different families. Of the fishes on which abundance data was obtained, there were 87 different species comprising 35 families and 59 genuses. The top five species according to total abundance score, ranging from highest to lowest, were Brown Chromis, Bicolor Damselfish, Ocean Surgeonfish, Sergeant Major, and Yellow Goatfish. The top five families, from highest to lowest, according to max total abundance scoring were Pomacentridae, Acanthuridae, Mullidae, Haemulidae, and Aulostomidae. Species richness, according to the number of species sighted during each survey, was found to be highest at Champagne and lowest at Tabby Bay.

Discussion

The results presented in this paper are only intended to serve as a general baseline of data on Dominican reef fish populations. The species list presented represents many of the most commonly sighted fish species but should not be considered comprehensive as more surveys and different survey techniques might reveal even more species. This study was limited by the fact that only one person was conducting the surveys. Future studies could be improved through a combination of more surveys and multiple surveyors. While the abundance data does seem to provide a good picture of the actual populations (pers. obs.), it is important to note that the roving diver techniques used in this study have known advantages and disadvantages when compared to other survey techniques such as belt transects. Random swim/roving diver techniques are more likely to record rare and cryptic species, and thus provide a more complete species list, than belt transects. However, random swim/roving diver techniques cannot be used in density estimates since the surveys are conducted over a large area of undetermined size. Furthermore, these types of surveys provide less quantitative data by not including size and numbers of individuals, which could be used in determining biomass (Rogers *et al.* 1994; Schmitt *et al.* 2002). Schmitt *et al.* (2002) have shown that a combination of belt transect and roving diver techniques provides a more complete overall species assessment of reef fishes than does either method in isolation as a result of specific biases and limitations inherent to each individual method. Thus, the data presented here could be used as a starting point for conducting future studies that employ both methods.

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