# A Study of Fish Abundance South of Rodney's Rock

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## ABSTRACT

The objective of this experiment was to survey fish off the west coast of Dominica, south of Rodney's Rock, and determine if weather, water clarity, or both affected the mean abundance of observed species. Results indicated that visibility may play a key role in species present each day. Water clarity was the main focus of this experiment as it seemed to affect the ability of the diver to see the fish.

## INTRODUCTION

Rodney's Rock is a rocky point along the west coast of Dominica. It is composed of fractured volcanic lava from the Trois Pitons volcano (Honychurch, 2003). South of Rodney's Rock the coast is decorated in smooth volcanic rocks that adorn the ocean floor for about twenty meters off shore until replaced by rippling sand. The objective of this experiment was to survey fish along the sand/boulder interface, and then determine if weather, water clarity, or both affected the mean abundance of fish species observed. A survey of fishes at Rodney's Rock was completed by Hoffman et al. (2001), but did not consider the effects of weather or water clarity on species abundance.

## MATERIALS AND METHODS

Fish species abundances were estimated along the coast on the south side of Rodney's Rock using transect lines. Three transect lines, each 5m long, were marked by red flagging tape on trees along the shore. Weather and water conditions were recorded as observed, but no instruments were used in the process.

A wetsuit was worn at times of high jellyfish concentrations to avoid stings, and proper snorkeling techniques were reviewed. When surveying along a transect, one person would swim the transect line while a second person would tread water at the far end of the transect to mark the end of the line. All fish along the transect within the surveyor's field of vision were tallied on an underwater writing slate. One transect consisted of a single pass down and back along the line. Data were recorded for all three transects on four separate days: 1 June, 2 June, 3 June, and 8 June 2005. A list of the ten most abundant species was compiled from the first three days and analyzed. Data collected on the fourth day were used solely to provide an estimate of sample variance. For the purpose of this experiment, feeding and habitat preference of each species observed was considered and analyzed in an effect to link them to changes in weather, water clarity, or both.

**RESULTS**

Table 1 displays a list of the ten most abundant fish observed on the transects as well as the relative abundance. Bicolor Damselfish, *Stegastes partitus*, were clearly the most abundant on the south side of Rodney's Rock. With the exception of the Slippery dick, *Halichoeres bivattatus*, there were more individuals of each species on the first day of the survey than on the subsequent days (Refer to Table 1). Table 2 gives the mean (plus sample standard deviation) number of individuals counted during the fourth survey. These figures provide an estimation of sample variance to facilitate the comparison of the means given in Table 1.

Figure 1 is a graph of the mean abundances of the ten most abundant fish observed along the transect. Bicolor Damselfish were so numerous (> 100 individuals) that they sometimes required estimation, rather than actual counts.

In reference to weather, the first day of the survey was partly cloudy with slightly rough water. The second day was sunny and windy with rougher water, and rain from the morning prior to our arrival at the site had created some runoff that resulted in poor visability. The third day was overcast with scattered showers. The runoff was still apparent, and the water remained murky (although not as bad as on day two).

## DISCUSSION

Weather was the first variable considered, however no pattern could be deciphered from available data. Overall, more fish were seen on the first day, which was partly cloudy but with no wind, and fewer fish were observed the second day (Table 1), which was sunny but windy. It rained throughout the entire survey on the third day, yet more surgeonfish, *Acanthurus bahianus*, were seen on that day than on the second day. Moreover, as shown in Figure 1, many fish abundances changed very little between the second and third days, despite the contrasting weather conditions.

No pattern was observed relating food or habitat preference to weather. *Stegastes partitus* is very territorial and feeds on crustaceans and plankton. Plankton is generally found near algae or with organic debris. The rocks in the area were covered with algae. Although rough waters would be expected to stir up more organic debris and nutrients, there were fewer *Stegastes partitius* along the transect on rough days than on calm days.

The results for the Dusky Damselfish, *Stegastes fuscus,* were similar. This species feeds on algae and detritus and prefers shores exposed to wave action. The second day produced greater wave action due to increased winds, yet fewer Dusky Damselfish were seen on that day than on the first day that wasn't as rough. The rocks were covered in algae, but the mean abundance of *Stegastes fuscus* observed decreased each day.

Water clarity seemed to provide the best explanation for the observations. Bicolor Damselfish, Dusky Damselfish, and Ocean Surgeonfish were most abundant and were therefore easiest to compare. Figure 1 suggests that mean abundance decreased from day one as water clarity worsened. The water appeared less murky on the third day, yet still more than the first, which could explain the increase in Surgeonfish abundance from day two to day three. Dusky Damselfish abundance was essentially equivalent on days two and three. Bicolor Damselfish exhibited a dramatic decrease from 41 on day one to 27 on day two, with day two and three roughly equivalent. Although Bicolor Damselfish abundance had to be estimated because of the large numbers present, this does not affect the conclusion that the numbers observed on day one were significantly different than the numbers observed on day two. The most feasible explanation for the outcome of this experiment was that changes in water clarity affected the diver's ability to survey and calculate precise fish abundances.

When assessing the above results, sample variance (Table 2) should be considered. For example, changes in Bicolor Damselfish abundances displayed in Figure 1 were most likely not as dramatic as indicated in Figure 1 because data collected on the fourth day (high water clarity) demonstrated that the variance about the mean was relatively high.

**ACKNOWLEDGEMENTS**

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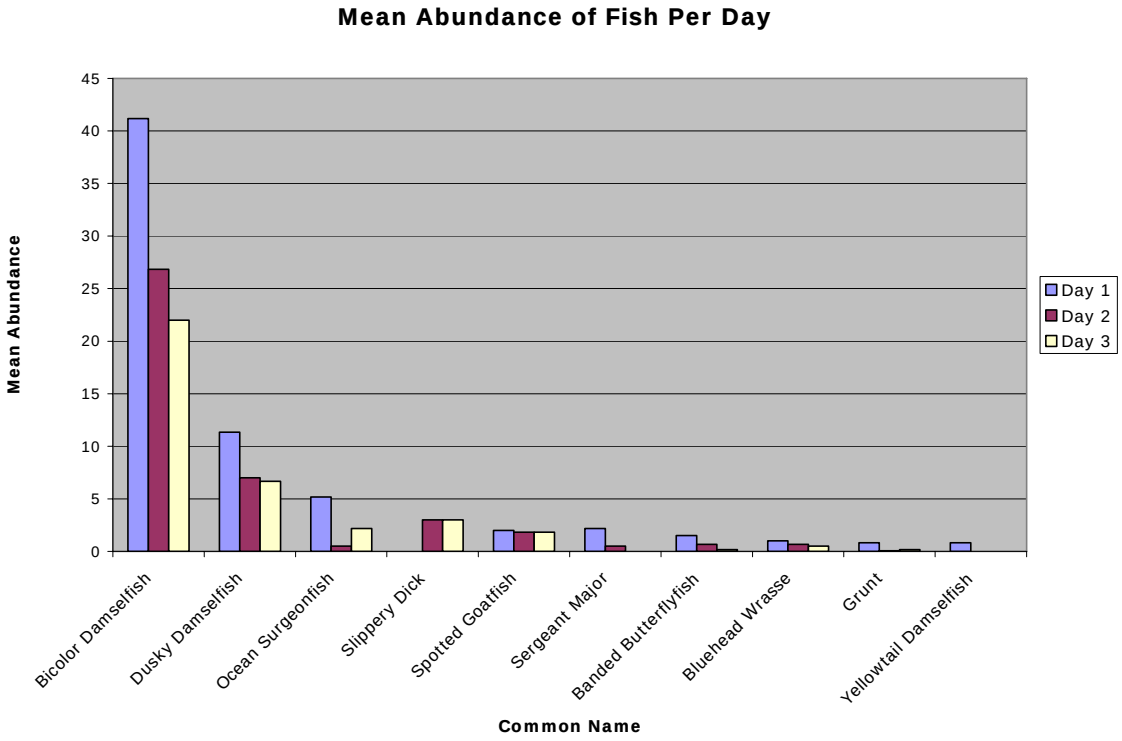
**Table 1 Ten Most Abundant Species and Mean Abundance by Day**

| Common Name | Scientific Name | Day 1 | Day 2 | Day 3 | Mean Abundance |
|---|---|---|---|---|---|
| **Bicolor Damselfish** | *Stegastes partitus* | 41 | 27 | 22 | 30 |
| **Dusky Damselfish** | *Stegastes fuscus* | 11 | 7.00 | 6.7 | 8.3 |
| **Ocean Surgeonfish** | *Acanthurus bahianus* | 5.2 | 0.50 | 2.2 | 2.6 |
| **Slippery Dick** | *Halichoeres bivattatus* | 0.0 | 3.0 | 3.0 | 2.0 |
| **Spotted Goatfish** | *Pseudupeneus maculatus* | 2.0 | 1.8 | 1.8 | 1.9 |
| **Sergeant Major** | *Abudefduf saxatilis* | 2.2 | 0.50 | 0.00 | 0.89 |
| **Banded Butterflyfish** | *Chaetodon striatus* | 1.5 | 0.67 | 0.17 | 0.78 |
| **Bluehead Wrasse** | *Thalassoma bifasciatum* | 1.0 | 0.67 | 0.50 | 0.72 |
| **Grunt** | *Haemulon spp.* | 0.83 | 0.05 | 0.17 | 0.35 |
| **Yellowtail Damselfish** | *Microspathodon chrysurus* | 0.83 | 0.00 | 0.00 | 0.28 |

**Table 2 Standard Deviations Calculated from Day 4**

| Common Name | Transect 1 | Transect 2 | Transect 3 | Std. Dev. |
|---|---|---|---|---|
| Bicolor Damselfish | 60 | 80 | 40 | 20 |
| Slippery Dick | 6 | 0 | 0 | 3.5 |
| Dusky Damselfish | 11 | 29 | 4 | 12.9 |
| Ocean Surgeonfish | 0 | 0 | 29 | 16.7 |
| Spotted Goatfish | 5 | 0 | 2 | 2.5 |
| Bluehead Wrasse | 2 | 0 | 3 | 1.5 |
| Stoplight Parrotfish | 0 | 0 | 2 | 1.2 |
| Grunt | 0 | 0 | 0 | 0 |
| Yellowtail Damselfish | 0 | 0 | 0 | 0 |
| Banded Butterflyfish | 0 | 0 | 0 | 0 |

## Figure 1


Mean Abundance of Fish Per Day
Mean Abundance
45
40
35
30
25
20
15
10
5
0
Day 1
Day 2
Day 3
Bicolor Damselfish
Dusky Damselfish
Ocean Surgeonfish
Slippery Dick
Spotted Goatfish
Sergeant Major
Banded Butterflyfish
Bluehead Wrasse
Grunt
Yellowtail Damselfish
Common Name