# Comparison of Reef Fish Populations at two sites off the Southwest Shore of the Commonwealth of Dominica

**by**

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**Abstract**

Champagne Reef and Scotts Head are located on the southwest tip of Dominica. Marine studies are frequently conducted in this area to study the condition of the fish population and its effect on the area. The purpose of this study is to compare the number of fish at each site by species and the factors in the surrounding areas that may influence their density and diversity. I conducted this survey using the protocols of AGRRA V5.4. The results showed both sites to have equal diversity but Scotts Head to have a higher density of fish. While both sites did not have the exact same species, they had a relatively equal number of different species. However, in comparing the density, Scotts Head had almost twice as many fish/m² compared to Champagne.

**Introduction**

Fluctuations in fish populations, especially certain indicator species cause both direct and indirect shifts in the structure of fish communities (Hughes, 1994). As tourist divers and fishers alike are dependent on healthy reefs, fish community structure provides a way to measure reef health over time. Dominica is a small, mountainous island in the Lesser Antilles of the West Indies and contains world renowned diving opportunities. The objective of this study was to evaluate the present fish community along the southwest shore of Dominica at Champagne Reef and Scotts Head.

The Atlantic and Gulf Rapid Reef Assessment (AGRRA) protocol has been used to measure fish density, abundance and diversity throughout the Caribbean Region. The technique has been used several times in the past to assess fish communities in Dominica, including the Champagne and Scott's Head area (Byrd, 2005; Klarman, 2005; Lowe 2005; Steiner 2005). The technique involves counting fishes in the water column above a total of twelve belt transects, 30 meters

long by two meters wide (Lang, 2010). I selected the AGGRA protocol for this study, as it provides a reef fish assessment that is consistent with previous studies.

Champagne Reef is a major tourist attraction with heavy human pressure from snorkeling tourists; fishing is legally restricted. Scott's Head has less influence from tourists and the fishing pressure is unclear. This study can be used as part of a growing set of reference points for future studies of reef fish in these areas. This survey recorded counts and density of reef fishes at the two sites. These data were in turn used to calculate the number and density of algae eating fish and predatory fish per site.

**Materials and Methods**

I used my own personal snorkeling gear and wetsuit to prevent sunburn and to allow me to be comfortable in the water. I used 50 meter long transect tapes with rocks tied to the end to anchor them down on the ocean floor, an underwater slate to count the fish, and a Garmin GPSmap 76 for plotting the start and end points of each transect. A Kestrel 3500 was used to record temperature, wind speed, relative humidity, dew point, and barometric pressure. A Hydrolab Quantra Water Quality Measuring System was used to collect the temperature, pH, depth, salinity, and dissolved oxygen percentage of the water at the site. HOBOs were used for collecting the water temperature every ten minutes.

Upon arrival at the site I found an open area, usually on a rock just off the shore, to gather weather data with a Kestrel and mark the point in the GPS. I recorded the wind speed, temperature, relative humidity, dew point, and barometric pressure for the site at the beginning of my survey for the day. An underwater slate was divided into a chart similar to a spreadsheet with the fish names down the side and the transect number across the top. I laid out three

transects tapes in accordance with the AGRRA V5.4 Fish Survey Protocol. Once the transects were in place I swam along them making tally marks on my slate for every fish observed within one meter on either side of the transect. I collected water quality data with the Hydrolab as close to the transect as possible to and mark the point in my GPS. To minimize human error I only conducted three transects per day. This process was repeated every two days for each site. I took a total of twelve transects, six at each site. Before deploying the transects I conducted a day of reconnaissance at each site for familiarization of the region and to find a practical location to place them. This process was repeated at Scotts Head except with one minor adjustment, due to a short reef two out of the final three transects were placed parallel to each other and perpendicular to the shore ten meters apart. The final transect was placed along a reef connected a rock wall fifteen meters to the west of transect two and perpendicular to the shore. The data were input to a Microsoft Excel spreadsheet to calculate the standard deviation by individual species.

**Results**

Both Scotts Head and Champagne had a similar number of species. Champagne had a species richness of 28 and Scotts Head having a species richness of 29. Several species were scared away at the Scott's Head site that is not expressed in the data below. Over the three day period of observations along the Champagne transects 28 different species were observed, *Pomacanthus paru* (French Angelfish) and *Ablennes hian* (Flat Needlefish) were observed in the area but not along the transects at Champagne. Over the three day period in Scotts Head 29 different species were observed along the six transects laid out. *Ablennes hian* (Flat Needlefish) and *Clepticus parrae* (Creole Wrasse) were observed at Scotts Head in areas away from the transects. Many of the same species were observed along the transects at both locations throughout the study. However, *Myripristis jacobus, Anisotremus virginicus, Haemulon chrysargyreum, Chaetodon*

*striatus, Aulostomis maculates,* and *Sparisoma aurofrenatum* were observed along the transects at Champagne Reef but not at Scotts Head, while *Scarus vetula, Epinephelus fulvus, Centropristis ocyurus, Caranx ruber, Ocyurus chrysurus, Halichoeres garnoti,* and *Syacium micrurum* were observed at Scotts Head, but not at Champagne Reef. Species evenness was calculated for each site using Simpsons Index; $D = \sum (n/N)^2$, where n represents the total number of fish of a particular species and N represents the total number of fish of all species. Champagne had an evenness of 0.1735 indicating a high amount of diversity. The species evenness at Scotts Head was 0.1936 which also indicates a high amount of diversity but less than that recorded at Champagne.

Figure 1 shows the average number and standard deviation of fish by species for each location. The three most abundant species at Champagne were *Stegastes partitus* (Bicolor damselfish) with an average of 22 $\pm$ 20.7, *Thalassoma bifasciatum* (Bluehead Wrasse) which had an average of 14.3 $\pm$ 17.7 fish per transect, and *Stegastes fuscus* (Dusky damselfish) with an average of 9.7 $\pm$ 1.5. At Scotts Head the top three species were *Stegastes partitus* (Bicolor damselfish) averaging 58.7 fish per transect with a standard deviation of 34.1*, Thalassoma bifasciatum* (Bluehead Wrasse) averaged 46 per transect and 12.4 standard deviation*,* and *Chromis cyanea* (Blue chromis) had an average of 36.8 per transect and a deviation of 22.9. The site at Scotts Head had a larger standard deviation due to the large schools of fish among the reefs causing a larger difference between transects depending on whether schools were present or absent. The averages are based on the total number of the species seen at the location being divided by the number of transects taken, in this case six at each site.

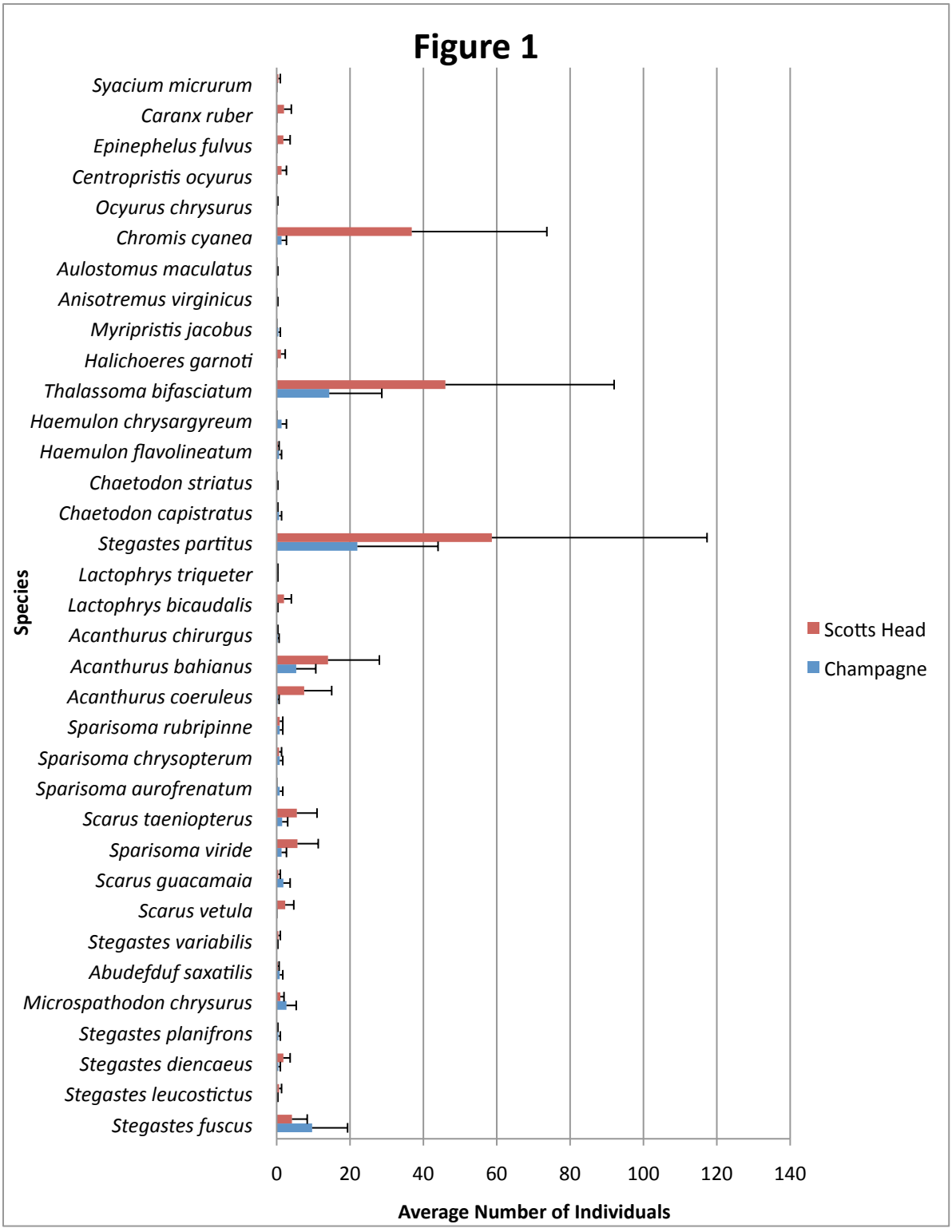
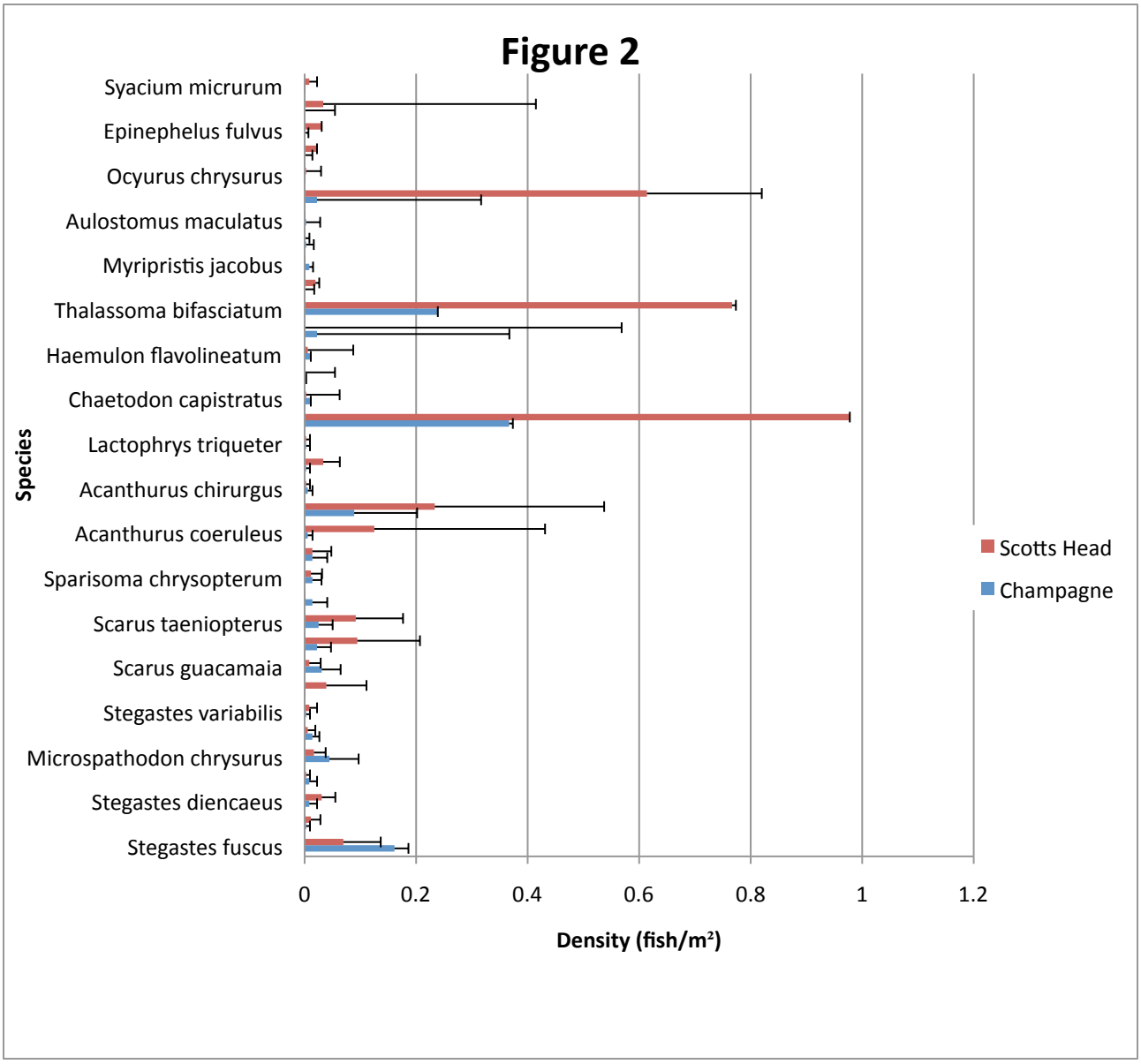


Figure 1
Syacium micrurum
Caranx ruber
Epinephelus fulvus
Centropristis ocyurus
Ocyurus chrysurus
Chromis cyanea
Aulostomus maculatus
Anisotremus virginicus
Myripristis jacobus
Halichoeres garnoti
Thalassoma bifasciatum
Haemulon chrysargyreum
Haemulon flavolineatum
Chaetodon striatus
Chaetodon capistratus
Stegastes partitus
Lactophrys triqueter
Lactophrys bicaudalis
Acanthurus chirurgus
Acanthurus bahianus
Acanthurus coeruleus
Sparisoma rubripinne
Sparisoma chrysopterum
Sparisoma aurofrenatum
Scarus taeniopterus
Sparisoma viride
Scarus guacamaia
Scarus vetula
Stegastes variabilis
Abudefduf saxatilis
Microspathodon chrysurus
Stegastes planifrons
Stegastes diencaeus
Stegastes leucostictus
Stegastes fuscus
Species
0
20
40
60
80
100
120
140
Average Number of Individuals
Scotts Head
Champagne

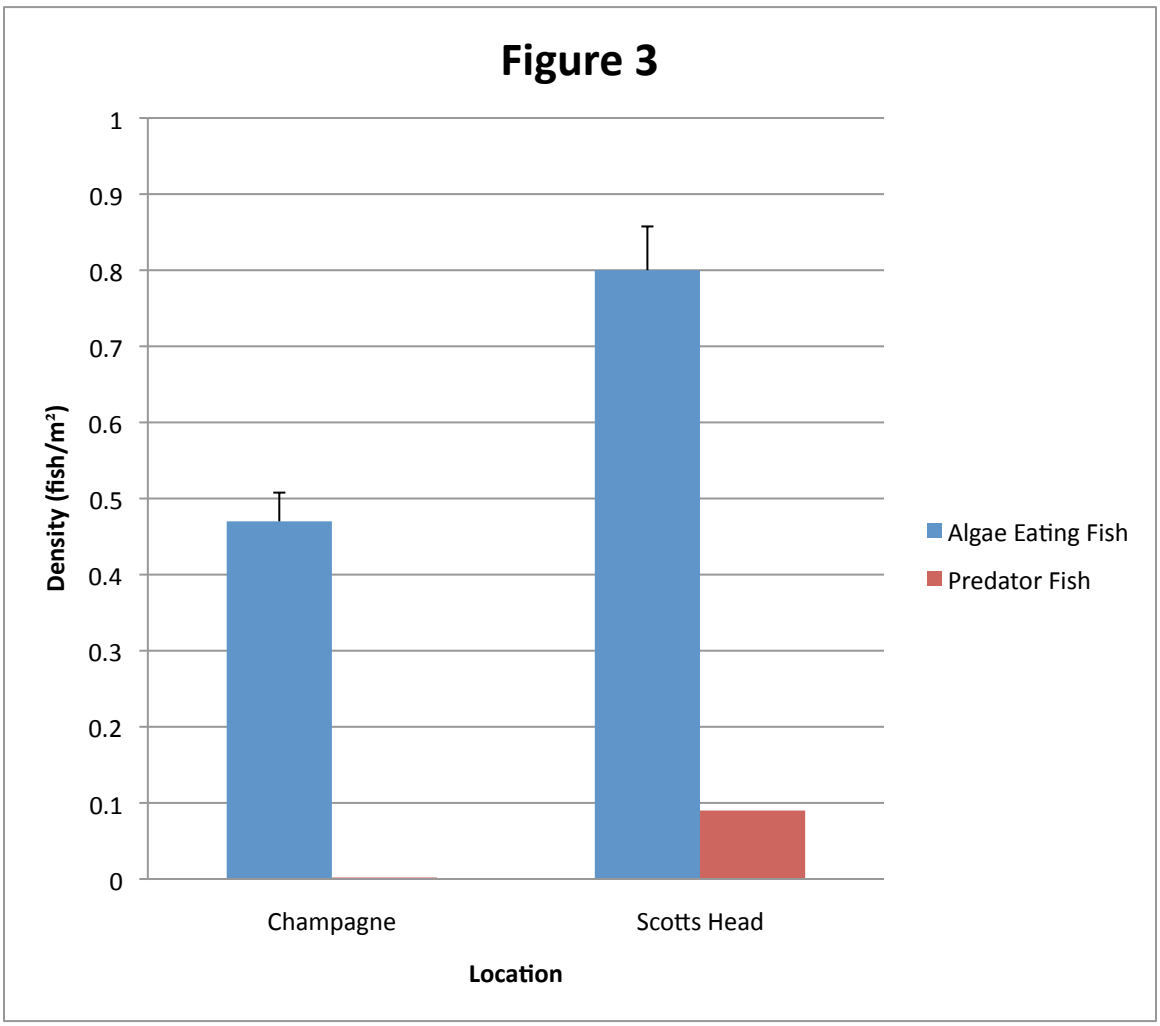
Figure 2 represents the density of each species (number of fish/$m^2$). This was calculated by taking the total number counted for each species and dividing by the area in meters covered by the transects. In this study each transect was sixty square meters with six taken at each site. Therefore, 360 square meters were covered at each site and was used as the denominator in our equation. Fish per $m^2$ = Total counted by species/360. The majority of the species had less than 0.2 fish/ $m^2$. The only two species with at Champagne with a higher density were *Stegastes partitus* with 0.37 ± 0.34 fish/ $m^2$ and *Thalassoma bifasciatum* with 0.24 ± 0.29 fish/ $m^2$ (Figure 2). Density for most species was higher at Scotts Head. The four species at Scotts Head with a density greater than .2 fish per meter squared were *Stegastes partitus* (0.98 ± 0.57), *Thalassoma bifasciatum* (0.77 ± 0.2), *Chromis cyanea* (0.61 ± 0.38), and *Acanthurus bahianus* (0.23 ± 0.3) (Figure 2).




The results shown in Figure 3 represent the number of algae eating fish observed compared to the number of fish observed that prey on other fish at each location. At Champagne Reef there was a smaller number of fish observed but the algae eating fish faced little threat since only one predatory fish was observed in the area. The numbers are significantly higher for both categories at Scotts Head; this was in part due to a larger number of fish present but also due to habitat. An increased number of fish will result in a larger number of predators as well as the surrounding

habitat. At Scotts Head a drop off approximately 200 meters deep at the edge of the barrier reef provided a habitat more suitable to predatory fish allowing them to lurk in the darker deep water and make occasional passes through the edge of the shallows to feed on the smaller fish.

Figure 3 shows the number of fish/m² based on algae eaters and predatory fish. Scotts Head had a little less than double the number of algae eating fish/m² than Champagne. However, Scotts Head had ten times as many predators/m² compared to Champagne. Champagne had 0.47 algae eaters/m² ± 0.04 and 0.002 predators/m² ± 0.0. Scotts Head had 0.8 algae eaters/m² ± 0.06 and 0.09 predators/m² ± 0.02 (Figure 3).



**Discussion**

The data show clear differences in the abundance and diversity of the two sites. Several observations however were not reflected in the data. This is because of the behaviors of the fish, in part as a response to me as an observer. At both locations during the survey I noticed the Blackbar Soldierfish (*Myripristis jacobus*) tend to stay in small groups and hide in the shadows or under rocks and openings in the coral along the reefs. The factor that seemed to escape the numbers shown in the results the most was the fish being more skittish at Scott's Head. Most noticeably was the Yellowtail Snapper (*Ocyurus chrysurus*), that swim in large schools but were startled while the transects were being placed and would swim off and not return. It was also noticed that Trumpetfish (*Aulostomus maculatus*) tend to be loners and were only seen individually, never in pairs or schools. The fish observed at Scotts Head were noticeably larger in size as they became adults. The bigger fish also tend to be more abundant in the deeper water than the smaller fish perhaps due to the threat of predators lurking in the darkness of the deeper waters near the drop off.

This survey uses only one method of counting, known as belt transects, as described by the current version of AGRRA (reference). For future studies it would be helpful to use two or more methods and counting simultaneously with extra people to assist in counting. Using multiple methods would allow for the fish that were slightly startled and retreated outside the coverage of the belt transect during preparation to be included and counted as well as covering a larger area of the reefs and surrounding areas. Having multiple people would also result in a more accurate count by being able to take the averages of a group count and having multiple observers to

identify fish others may overlook. If possible placing transects and leaving them for a short duration of time without affecting the habitat would allow for more accurate research by taking counts at a later time instead of shortly after the fish were startled.

Time was a limiting factor for this survey since it was only conducted over a period of two weeks. It would be more beneficial to observe the same transects over a longer period of time and compare the change in numbers over months rather than days. Another limiting factor in this study were the number of transects. Although the areas are not large it would still be advantageous to increase the length or number of transects per location. Considering multiple locations further north along the island would also help give the data more relevance.

The first implementation of the Atlantic and Gulf Rapid Reef Assessment v4.0 was conducted in the Commonwealth of Dominica from October through November 2005 (Steiner, 2005). The results of my survey show 0.47 herbivorous fish/$m^2$, an increase of 0.14 herbivorous fish/$m^2$ in Champagne compared to 0.33/$m^2$ in 2005. This could be the result of the decline of predator fish in the area from 0.05/$m^2$ in 2005 to 0.002/$m^2$ today (Klarman, 2005). This same assessment showed 0.13 herbivorous fish/$m^2$ and 0.05 predator fish/$m^2$ at Cachacrou (Klarman, 2005). My survey at Scotts Head, 100 meters south, showed 0.8 herbivorous fish/$m^2$ and 0.09 predatory fish/$m^2$. This suggests that the increase in predator fish was a result in the large increase of herbivorous fish for them to feed on.

Although there are several things that could be taken into consideration and improved for this study, it can be used as a snapshot for the status of the fish population at this point in time for the southwestern portion of Dominica's coast. This study will also provide a reference for the complete AGRRA study that is being conducted by our marine group and how the structure of

the fish population, *Diadema* population, and amount of algae present are affecting the status of living coral in the area.

**References**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