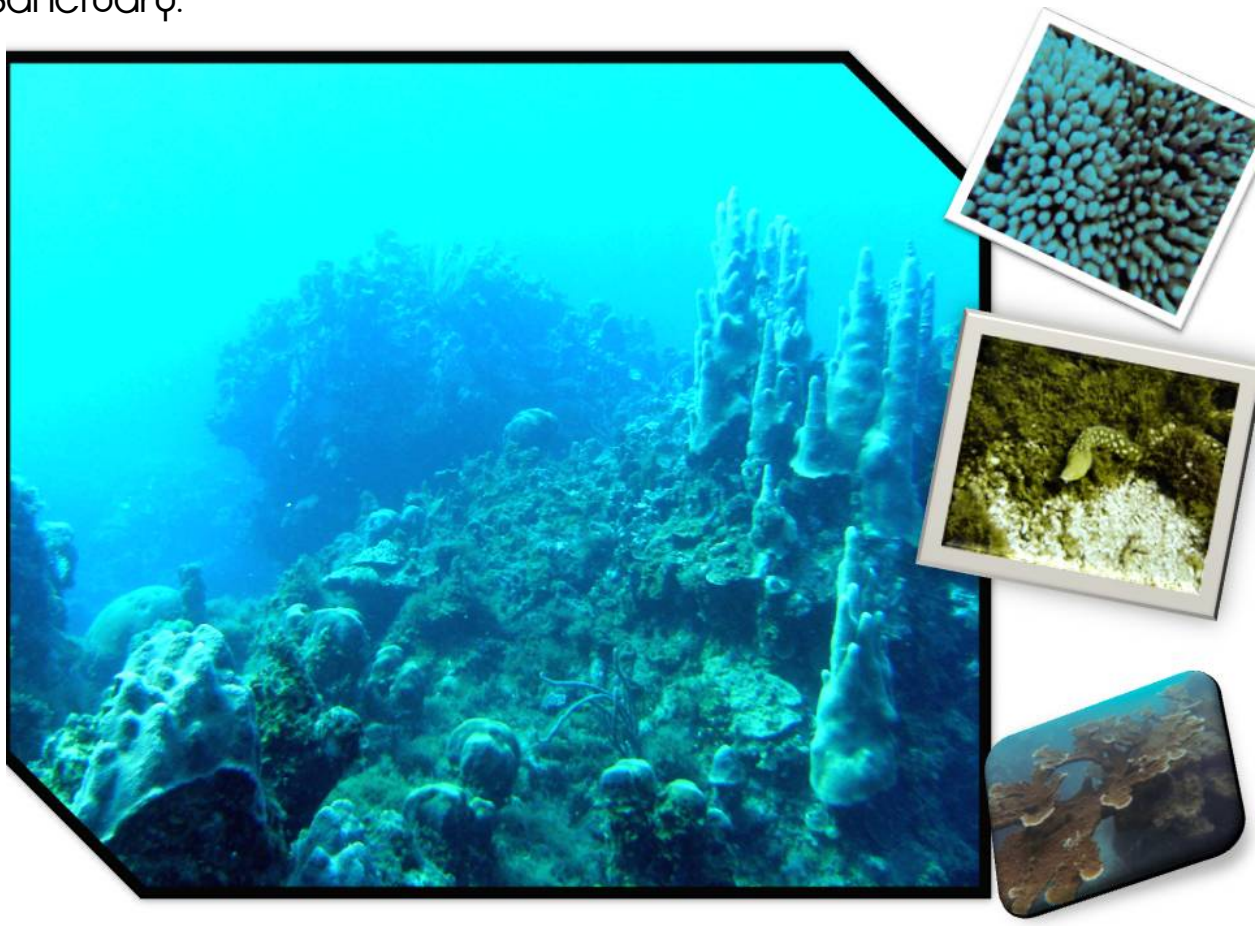
ORACEBESSA FISH SANCTUARY

BASELINE SURVEY ASSESSMENT

A Rapid Assessment of the Reefs of the Oracabessa Bay Fish Sanctuary.



October 2011

Table of Contents

Executive Summary

The Oracabessa Fish Sanctuary is one of nine newly established Fish Sanctuaries in Jamaica. This approximately 96.1 hectare sanctuary is managed by the Oracabessa Foundation in partnership with the St. Mary Fisherman's Cooperative. There is a paucity of baseline information readily available on the reef biota and fish populations in this marine space and in order to measure the efficacy of the goals, objectives and management systems that are to be implemented in the sanctuary then it necessary that sound baseline data is collected to inform the evaluation process

In September 2010 and May 2011 rapid ecological assessments of the reefs within and immediately adjacent to Oracabessa Bay Fish sanctuary was conducted to determine current reefs health and the status fish populations. The goal of the assessments was to collect data on the following indicators of reef health: (a) coral cover, (b) algal cover, (c) reef relief (rugosity), and (d) fish families. The assessment conducted at seven (7) reef areas using a modified Atlantic & Gulf Rapid Reef Assessment (AGRRA) methodology- this utilized a combination of photo-transects and AGRRA fish assessment methods.

In general, all the reef systems assessed were algal dominated and the fish population although diverse is comprised of mainly juvenile individuals. The topography of the reefs assessed were medium to low relief and the mean hard coral cover of the entire survey site was determined to be 7.09% ± 2.3SE and

macro algae a mean cover was 75.58% ± 3.8SE. With the exception of Morantie Reef, (20.1% ± 3.8SE), there was no noticeable difference in hard coral cover between those reefs located with the boundary of the sanctuary and those found just outside the boundary. Fleshy algal cover was always in excess of 50% cover at all sites which is indicative of an algal dominated reef system.

Sixty-nine (69) different fish species were recorded in the Oracabessa Fish Sanctuary during assessments conducted in 2010 and 2011. Forty percent (40 %) of fish species recorded during the assessments were often observed in low densities. These species include blue tangs, bar jacks, graysby and coney. Commercially important species such as snappers and grunts were rarely observed and were usually observed in low densities.

Parrotfish were recorded in high densities at all sites investigated. However based on the assessment of the biomass and size class of the fish populations observed it was determined that populations observed was predominantly comprised of the juvenile to sub-adult fishes. Also of importance and concern is the fact that 2-10 lionfish individuals were recorded at each site.

Background

The Oracabessa Fish Sanctuary is one of nine newly established Fish Sanctuaries declared by the Minister of Agriculture in May 2010. This approximately 96.1 hectare sanctuary is managed by the Oracabessa Foundation in partnership with the St. Mary Fisherman's Cooperative. The primary objective of the sanctuary is to create a no-fishing zone that will ultimately protect the breeding grounds and fish habitats in the bay and gradually increase the fish population in the adjacent fishing areas.

The partnership between the Oracabessa Foundation and the local fishers is still in its infancy however, there is a high level of enthusiasm by all involved in the management of this marine protected area. In order to measure the efficacy of the goals, objectives and management systems implemented in the sanctuary then it necessary that sound baseline data is collected to inform the evaluation process.

In September 2010 and May 2011 rapid ecological assessments of the reef at seven (7) sites within and immediately adjacent to Oracabessa Bay Fish sanctuary was conducted to determine current reefs health and the status fish populations. The goal of the assessments was to collect data on the following indicators of reef health: (a) coral cover, (b) algal cover, (c) reef relief (rugosity), and (d) fish families. This report presents the findings of the ecological surveys conducted.

Methodology

The assessment conducted at seven (7) reef areas using a modified Atlantic & Gulf Rapid Reef Assessment (AGRRA) methodology- this utilized a combination of photo-transects and AGRRA fish assessment methods. The assessment was conducted on September 22 and 23, 2010 (3 sites) and May 11 - 13, 2011 (4 sites) with the assistance of the local fishermen who were instrumentally in the site selections for assessments (Figure1 & Table 1). Rock was the only site that was assessed on both occasions.

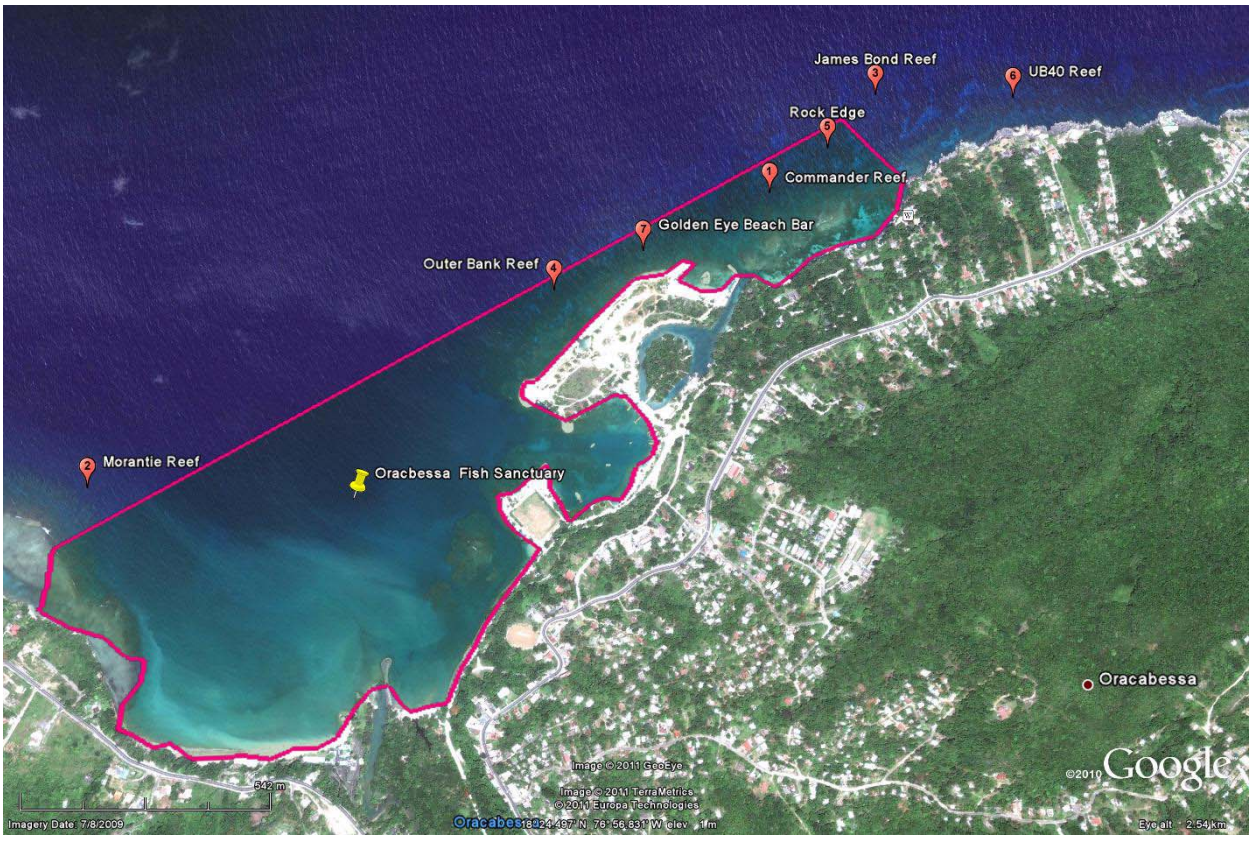


Figure 1: Oracabessa Bay Fish Sanctuary Assessment Sites

Table 1: Location of Assessment Sites

Site	Latitude	Longitude	Depth
Commander Reef	18° 24.784'N	76° 56.641'W	14m
Morantie Reef	18° 24.411'N	76° 57.551'W	8m
James Bond Reef	18° 24.908'N	76° 56.500'W	12.8m
Outer Bank Reef	18° 24.661'N	76° 56.929'W	8m
Rock Edge*	18° 24.841'N	76° 56.564'W	14m
UB 40 Reef	18° 24.904'N	76° 56.317'W	10.6m
Golden Eye Beach Bar	18° 24.711'N	76°56.8098'W	10m

** Repeat Site*

Benthic Assessments

At each site five 20m transects were deployed. The lines were photographed at 0.5m intervals with the camera placed at a fixed distance of 0.5m above the substrate to determine the composition present. The data collected using the photographic survey was then analyzed using a visual basic programme "Coral Point Count with Excel extensions" (CPCe) version 3.6. This programme is used to provide an estimate of the substrate composition from still images or frame-grabbed video (Kohler and Gill, 2006). The programme utilizes the random point count method in which random points are generated and distributed on a still image and the species or substrates underlying these points are then identified.

Reef Complexity

Reef rugosity, a measure of the structural architecture or three-dimensional nature of the site was determined using the chain length method. At each site five 10m chains were draped over the substrate directly beside the transect line. The reef rugosity is expressed as an index of the ratio of the chain length to the actual length of the transect line by the following formula: Rugosity = 1 – (CL/TL); where CL = chain length and TL = transect length. The closer the resulting value is to zero the flatter the reef.

Fish

Along the same lines used for the substrate assessment, 2m wide by 20m long belts were assessed using a modification of the AGRRA methodology for assessing fish. In this modification, five 20m transects were assessed instead of a minimum of six 2m wide by 30m long belt transects. During this assessment fish density and size classes of key fish species that play an important role in reef ecology and commercially important fishes were measured. The estimation of total biomass of individual fish groups was also determined from this assessment.

Roving diver surveys, a feature of AGRRA fish assessments, were also conducted. Two parameters were used to assess the fish population, species density and percentage sighting frequency (%SF). These parameters provide a measure of the relative density of species and the frequency with which these

species were observed. These surveys recorded the species seen and an abundance category for each species thus allowing for density calculations for each site. The fish observed where categorized based on the estimates of the number of individuals sighted during each survey: **S**ingle = 1, **F**ew = 2-10, **M**any = 11-100, and **A**bundant = over 100. This data was further translated to an abundance scale of 1- 4 with 4 representing the highest abundance (Abundant) and 1 representing the lowest abundance (Single). The information gleaned from the species density and the sighting frequency data was then used to determine the overall abundance of the recorded fish species found in the sanctuary.

Table 2: Interpretation of Findings for Roving Diver Census (REEF, 2010)

Category	Den	%SF	Explanation
A	HIGH Den >3.0	HIGH %SF >50	Species is often observed and observed at high densities. Species is seen > 50% of the time and when it is seen the abundance category most often recorded is M or A.
B	HIGH Den >3.0	LOW %SF <50	Species is not often seen, but when it is seen, it is observed at high densities. Species is seen < 50% of the time and when it is seen the abundance category most often recorded is M or A.
C	LOW Den <3.0	HIGH %SF >50	Species is often observed, but always at low densities. Species is seen > 50% of the time and when it is seen the abundance category most often recorded is F or S.
D	LOW Den <3.0	LOW %SF <50	Species is not often observed and when it is observed, it is at very low densities. Species is seen < 50% of the time and when it is seen the abundance category most often recorded is F or S.

Findings

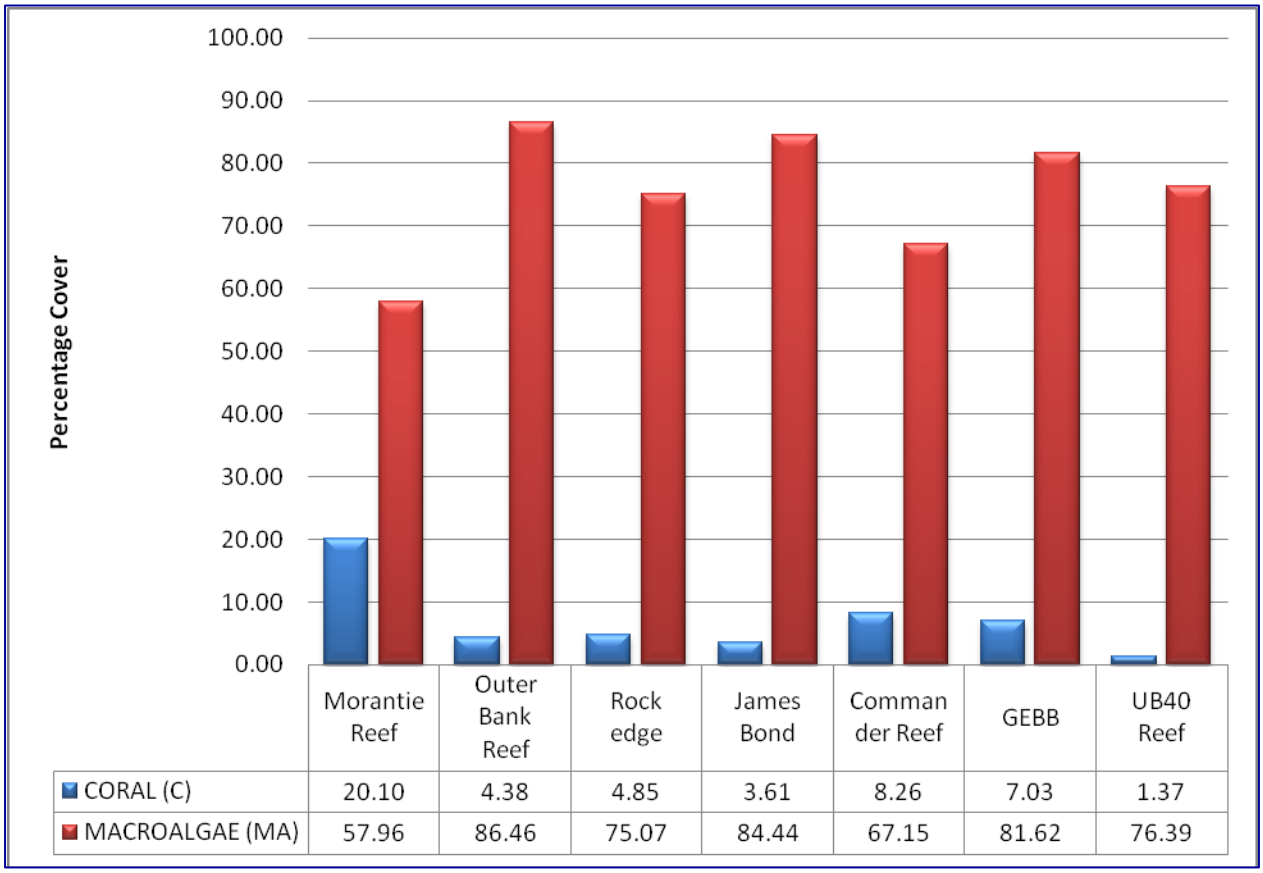
The general observations of the rapid ecological assessment of the reefs of the sanctuary indicate that there is some room for improvement of existing health status of this ecosystem. Reef systems are algal dominated and the fish population although diverse is comprised of mainly juvenile individuals. The analysis of the baseline data collected for each reef health indicator is presented in the following paragraphs.

Benthic Cover

The benthic cover of the reef provides a comparison of the functional groups that comprise a reef such as coral, algae, sponges and other sessile invertebrates. Benthic cover provides a good indicator of the process of reef competition among reef organism. The availability of space is a reef is essential to reef organism for growth and development and as a result there is often competition between reef biota. The competition between live coral cover and fleshy algal cover is of concern to because the loss of live coral cover will result in shift from coral dominated reefs to algal dominated reefs. The loss of live coral cover will ultimately lead to a loss of reef framework. Coral cover is an excellent indicator of reef health and is normally a proxy for net coral growth.

The results from the baseline assessment indicate that the reefs within the area assessed had a mean hard coral cover of 7.09% ± 2.3SE and macro algae a mean cover of 75.58% ± 3.8SE. With the exception of Morantie Reef, with a

coral cover of 20.1% ± 3.8SE, there was no noticeable difference in benthic cover between those reefs located with the boundary of the sanctuary and those found just outside the boundary. Fleshy algal cover was always in excess of 50% cover at all sites which is indicative of an algal dominated reef system (Figure 2).



	Morantie Reef	Outer Bank Reef	Rock edge	James Bond	Commander Reef	GEBB	UB40 Reef
CORAL (C)	20.10	4.38	4.85	3.61	8.26	7.03	1.37
MACROALGAE (MA)	57.96	86.46	75.07	84.44	67.15	81.62	76.39

Figure 2: Benthic Cover at Survey Sites

Reef Complexity (Rugosity)

A reef's architecture and structural complexity will determine the availability of habitats for reef organism to shelter. The relief of a reef also aids in the protection of shorelines. The higher the reef rugosity then more habitat is available to provide shelter to reef fish and other organism. At the sites assessed the reefs were relatively low to medium relief and of similar species richness. In Figure 3 which shows a plot of species richness compared with the reef rugosity, there is a noticeable (approximately two-fold) increase in the species richness at the Golden Eye Beach Bar and the UB 40 site in comparison to the other sites. This discrepancy is attributable to differences in observer expertise.

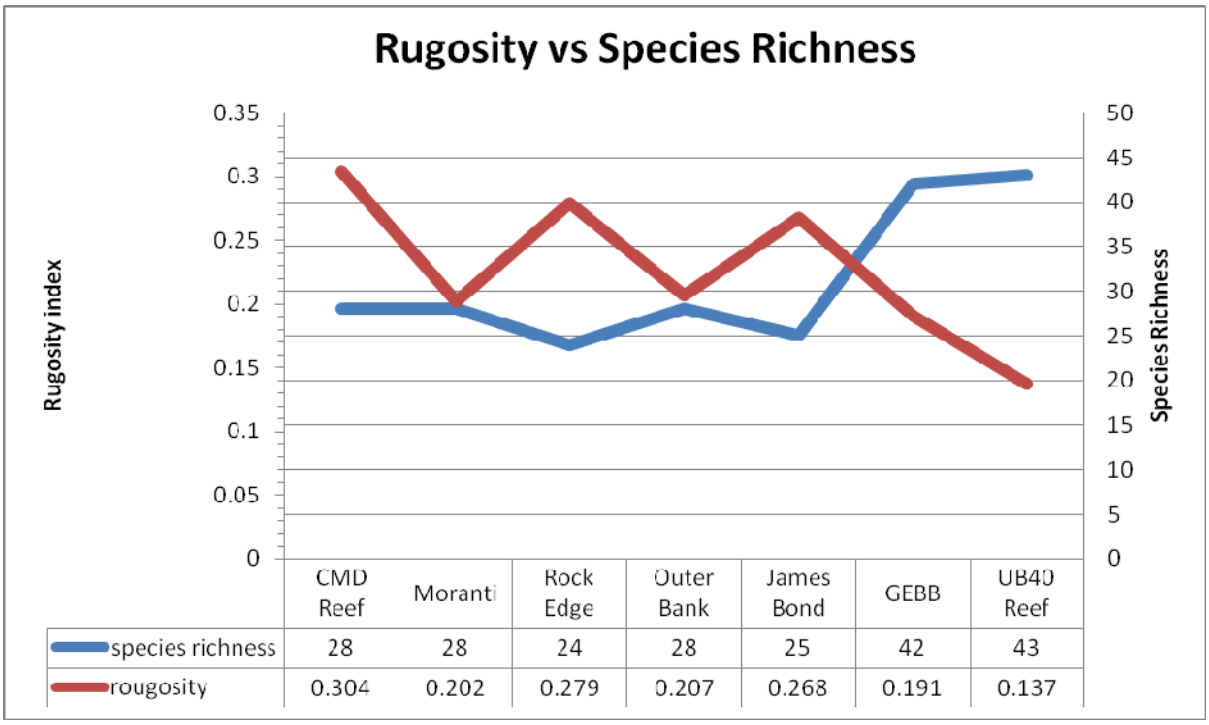


Figure 3: Reef Rugosity and Species Richness

Fish Community

The assessment of fish populations provides an indication of fish community dynamics and an indication of anthropogenic influences such as over-fishing. The examination of commercially fish density, size and biomass will provide an indication of the status of the fish stocks and by extension fishing pressure in the area.

In addition the overall assemblage of fish species on the reef gives a general indication of the community dynamics on the reef. The relative abundance of one trophic group to another will dictate species interactions; the types of predators on the reef are determined by the relative availability of prey food items. Similarly, the amount of fleshy algae on a reef is determined to a significant extent on the abundance of herbivorous fish on the reef.

Four indicators of fish health were assessed using data collected on key reef fish species and commercially important groups; (a) the total biomass of key fish groups (b) the observed size classes of the fish groups (c) the relative abundance key fish species and (d) a sighting frequency of all fish species observed during the surveys.

Fish Biomass

Fish biomass gives and overall indication of the reef fish community health status. The biomass of reef fish is calculated based on estimates of length to weight relationships of the individual groups. Fish biomass estimation is also a good indicator of the reproductive health of the fish population. Larger fish will in general produce greater numbers of offspring.

The data collected indicates that parrot fish biomass (159g/100m^2) was the highest on the reef however this total biomass was still low in comparison to other Caribbean reefs. All other families were well below 100g/100m^2 (Figure 4).

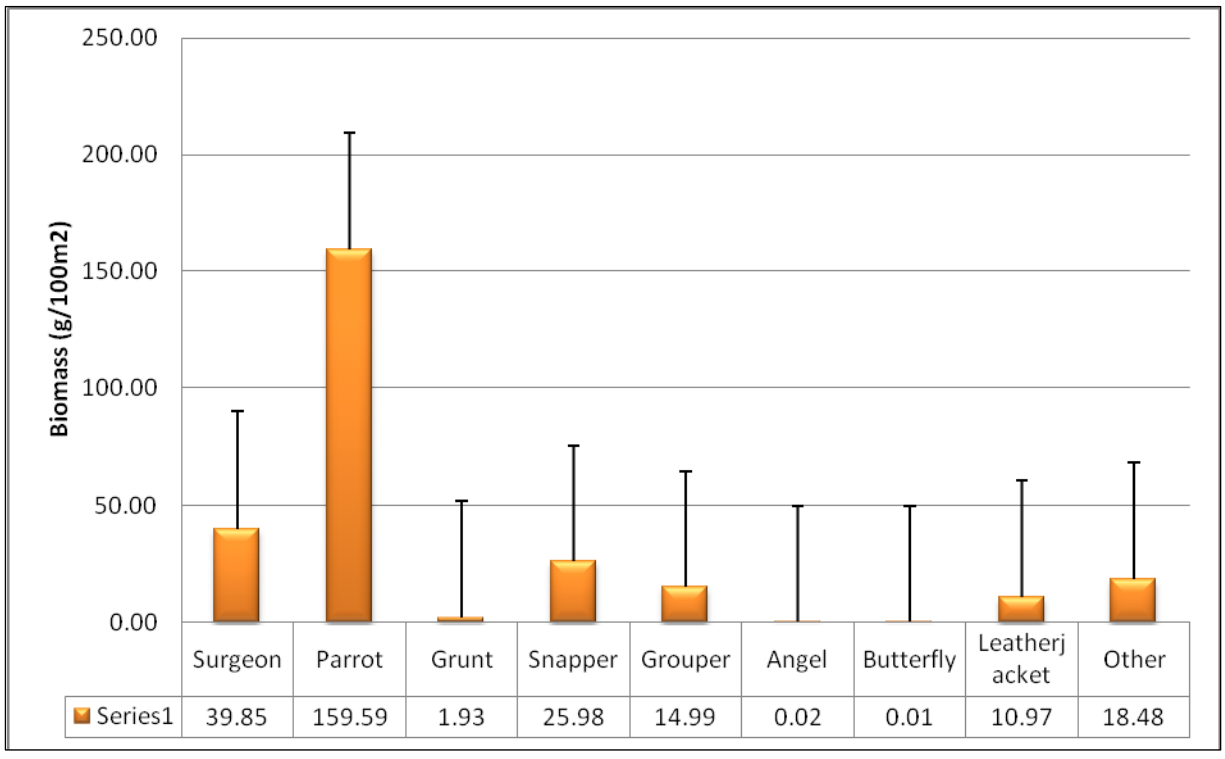


Figure 4: Mean Biomass of Fish Families

Fish Size

An examination of the size classes of the fish population is generally a good indication of the resilience of the fish population. The mean of the size class observed within each fish family gives an indication of relative age of the cohort of the population. The average size of fish species recorded was below the expected size class range of adults (Table 3).

Table 3: Expected Size Adult Size Class for Commercially Important Fish Families

Group	Surgeonfish	Parrotfish	Grunt	Snapper	Grouper
Adult size range (cm)	15 -30	15 - 25	15 - 25	17 - 45	15 - 25

For all species recorded the highest distribution of individuals were recorded in the 6-10 cm size class. In the case of the commercially important species such as the parrotfish, grunts and groupers high number of individuals were also recorded in the 11-20 cm size class. No species had individuals >21 cm in size (Figure 5). This indicates that the fish population within the study area is mostly comprised of the juvenile to sub-adult class ranges.

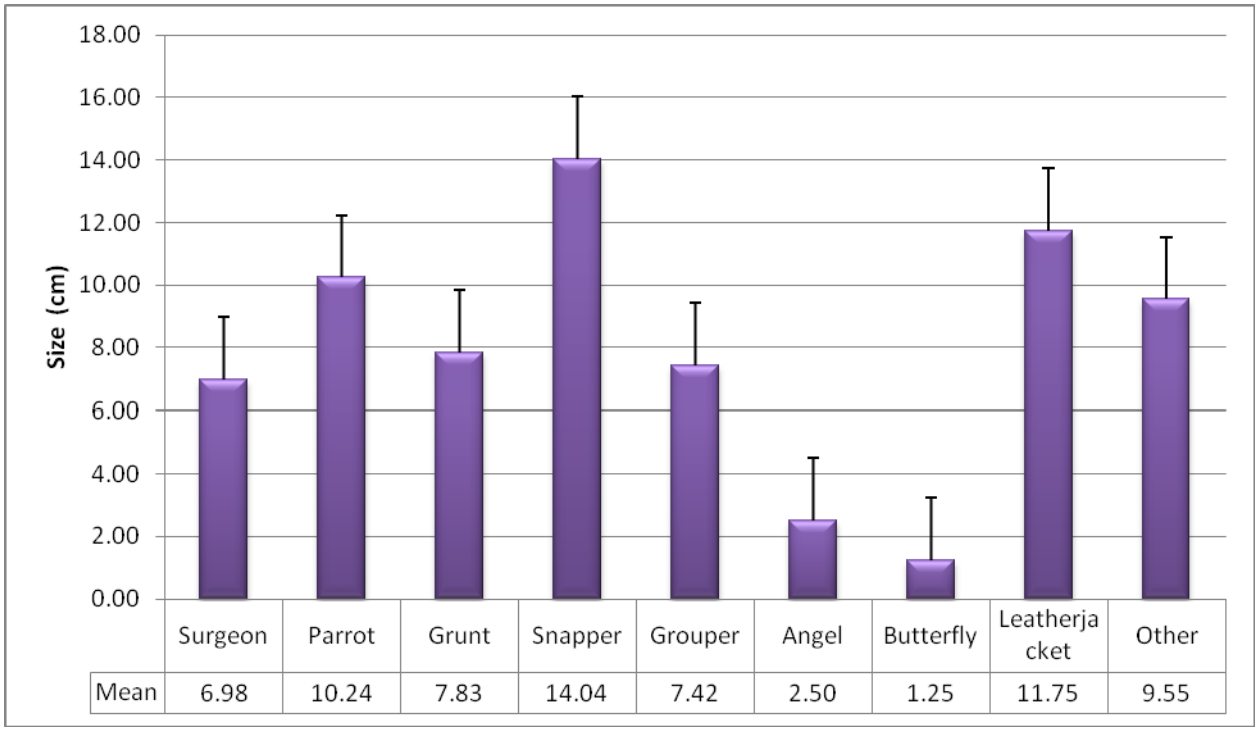


Figure 5: Mean Size Class of Fish Families

Fish Density

Healthy reef fish communities will have high numbers of fish on a reef. Fish density was relatively low when compared to other reef with the Caribbean. Of the main families parrotfishes and surgeon were the most abundant on the reef surveyed all other species were observed in relatively low densities. (Figure 6).

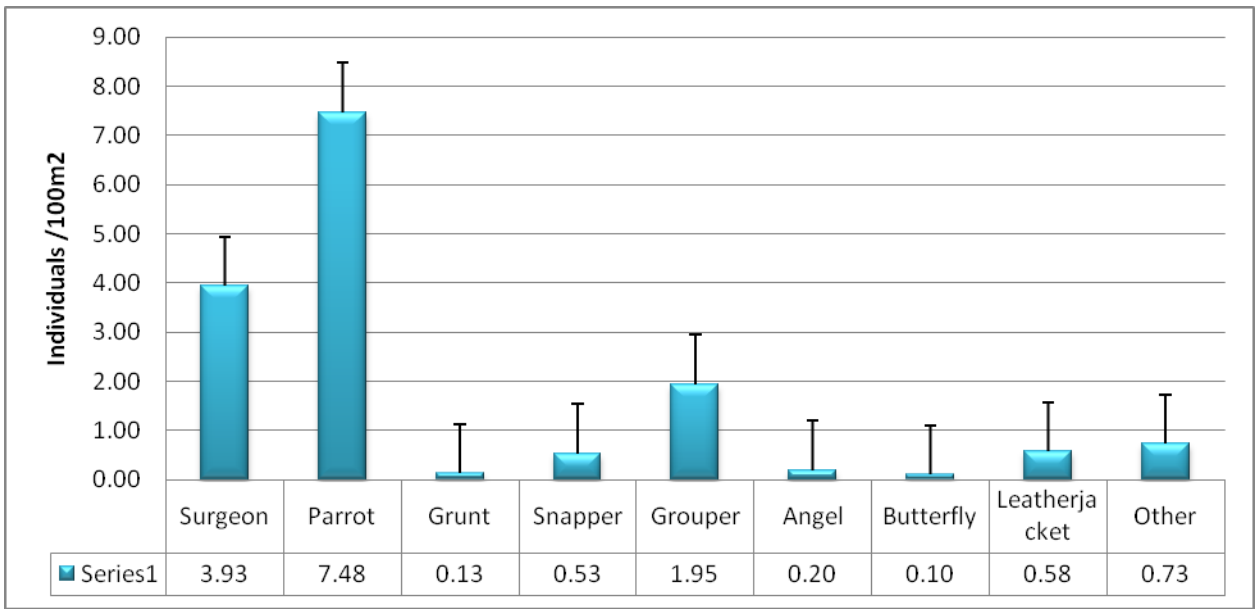


Figure 6: Mean Density of Fish Families

Fish Sighting Frequency & Distribution

An analysis of the density and the sighting frequency data can be used to determine the overall abundance of the recorded fish species from the study area. Using the roving Diver methodology, sixty-nine (69) different fish species were recorded in the Oracabessa Fish Sanctuary during assessments conducted in 2010 and 2011. The species list is provided in Appendix I

Data collected in 2010 and 2011 indicate that over 40 % of fish species recorded during the assessments are often observed but usually in low densities (Category C) {Figure 7}. These species include blue tangs, bar jacks, graysby and coney. Species that were often observed in high densities (Category A) for both years include the commercially important ocean surgeonfish as well as the blue chromis and yellowhead wrasse. Commercially important species

such as snappers and grunts were rarely observed and were usually observed in low densities. The indicator species banded butterfly and foureye butterfly were spotted however they occurred in low densities. The striped and spotted parrotfish were recorded in high densities at all sites investigated (Category A). They were however recorded in the AGRRA fish assessment as predominantly within the juvenile to sub-adult size class range. Also of importance and concern is the fact that 2-10 lionfish individuals were recorded at each site investigated.

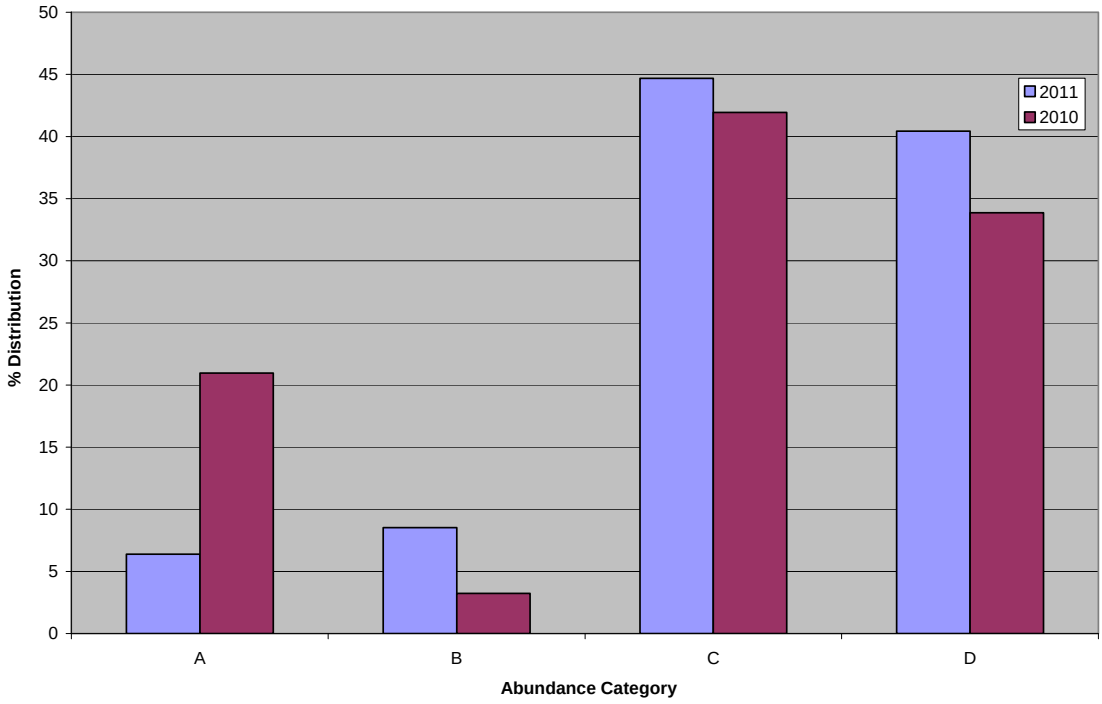


Figure 7: Fish Abundance determined by Sighting Frequency and Density

Author's Statement

This baseline assessment was conducted to provide a snapshot of the current conditions of the reefs within the sanctuary and also of the fish stocks. The data collected represents a starting point for further investigations and may be used a benchmark to measure management interventions to enhance fish populations and overall reef health.

Appendix 1 : Fish Sighting Data

		2011					2010		
Fish Species	**Common Name**	**Commander Reef**	**Outer Bank Reef**	**James Bond Reef**	**Morantie Reef**	**Rock Edge**	**Rock Edge**	**UB40 Reef**	**Goldeneye Beach Bar**
Abudefduf saxatilis	Sergeant Major				m		f	f	s
Acanthurus bahianus	Ocean Surgeonfish	m	m	m	m	m	a	a	a
Acanthurus coeruleus	Blue Tang	m	m	f	f		f	m	m
Aluterus scriptus	Scrawled Filefish						s		
Amblycirhitus pinos	Redspotted hawkfish							s	f
Aulostomus maculatus	Trumpetfish	f					f		f
Bodianus rufus	Spanish Hogfish			f				f	f
Canthidermis sufflamen	Ocean Triggerfish			m					
Canthigaster rostrata	Sharpnose Puffer	f					f		f
Caranx latus	Horse-eye Jack		f						
Caranx ruber	Bar Jack	s	s	f	f	f	f	f	f
Chaetodon capistratus	Foureye Butterflyfish	f	f			f	s	S	s
Chaetodon striatus	Banded Butterflyfish	f	f	f	f		s	f	
Chromis cyanea	Blue Chromis		m		a	m	m	a	a
Chromis multilineata	Brown Chromis	m				m		m	m
Clepticus parrai	Creole Wrasse	m	m	f	f		m		a
Epinephelus cruentatus	Graysby	f	f	f	f	f	f	m	s
Epinephelus fulvus	Coney			f	s	f	s	m	f
Epinephelus guttatus	Red Hind							f	
Equetus punctatus	Tobaccofish							s	f
Equetus punctatus	Spotted Drum							f	
Gobiosoma evelynae	Sharknose Goby						f		
Gramma loreto	Fairy Basslet		f		f		f	f	m
Haemulon flavolineatum	French Grunt	f	f				f	s	f
Haemulon parrai	Sailors Choice						s		
Halichoeres garnoti	Yellowhead Wrasse	a	m	m	f	m	a		a
Halichoeres maculipinna	Clown Wrasse		f				m		
Holocanthus tricolor	Rock Beauty								s
Holocentrus marianus	Longjaw Squirrelfish	m	m	f	f	m	f	m	f
Holocentrus rufus	Longspine	f	f	m	m	f	f	m	f

		2011					2010		
Fish Species	**Common Name**	**Commander Reef**	**Outer Bank Reef**	**James Bond Reef**	**Morantie Reef**	**Rock Edge**	**Rock Edge**	**UB40 Reef**	**Goldeneye Beach Bar**
	Squirrelfish								
Hypoplectrus gummigutta	Blue Hamlet							f	
Hypoplectrus guttavarius	Shy Hamlet							f	f
Hypoplectrus indigo	Indigo Hamlet			f			s	f	f
Hypoplectrus puella	Barred Hamlet			m			f	f	s
Hypoplectrus unicolor	Butter Hamlet	s						f	f
Inermia vittata	Boga							f	
Lactophrys triqueter	Smooth Trunkfish								s
Lutjanus analis	Mutton Snapper					f	m	s	
Lutjanus mahogoni	Mahogany Snapper		s		f				f
Malacanthus plumieri	Sand Tilefish	s					f		s
Melichthys niger	Black Durgon				f			m	s
Microspathodon chrysurus	Yellowtail Damselfish	f		f	f	f	m	m	m
Mulloidichthys martinicus	Yellow Goatfish		m		f		f	f	m
Myrichthys breviceps	Sharptail Eel		s						
Myrichthys ocellatus	Goldspoted Eel							s	
Myripristis jacobus	Blackbar Soldierfish	f					m	m	m
Ocyurus chrysurus	Yellowtail Snapper	f	m	f	f	m			
Pempheris schomburgki	Glassy Sweeper								m
Priacanthus cruentatus	Glasseye Snapper						f		
Pseudopeneus maculatus	Spotted Goatfish	f	m	f	m	f	f	s	s
Pterois sp.	Lionfish	f	f	f	f		f	f	f
Rypticus saponaceus	Greater Soapfish						f		
Scarus croicensis	Striped Parrotfish	f	f	f		m	m	a	a
Scarus taeniopterus	Princess Parrotfish		m	f	f	f			
Scarus vetula	Queen Parrotfish						f		
Scomberomorus regalis	Cero Mackerel					f			
Serranus tigrinus	Harlequin Bass	f	f	f	f	f		f	f
Sparisoma atomarium	Greenblotch							m	m

		2011					2010		
Fish Species	**Common Name**	**Commander Reef**	**Outer Bank Reef**	**James Bond Reef**	**Morantie Reef**	**Rock Edge**	**Rock Edge**	**UB40 Reef**	**Goldeneye Beach Bar**
	Parrotfish								
Sparisoma aurofrenatum	Redband Parrotfish	f		f	f	m	f	f	f
Sparisoma rubripinne	Redfin Parrotfish				f		f		
Sparisoma viride	Stoplight Parrotfish	f	m	m	f	m	m	a	m
Sphyraena barracuda	Great Barracuda							s	
Stegastes dorsopunicans (formerly fuscus)	Dusky Damselfish						f		
Stegastes partitus	Bicolor Damselfish	f	f		f	m	m	a	a
Stegastes planifrons	Threespot Damselfish	f	f	m	m	m		f	
Stegastes variabilis	Cocoa Damselfish							f	
Thalassoma bifasciatum	Bluehead Wrasse		f	m	f	f	m		m
Urolophus jamaicensis	Yellow Stingray	s				f			
	Yellowbelly hamlet							s	
	TOTAL	**28**	**28**	**25**	**28**	**24**	**40**	**43**	**42**

KEY	
s	Single
f	Few
m	Many
a	Abundant

Fish Species	Common Name	Category	
		2011	2010
Abudefduf saxatilis	Sergeant Major	B	D
Acanthurus bahianus	Ocean Surgeonfish	A	A
Acanthurus coeruleus	Blue Tang	C	C
Aluterus scriptus	Scrawled Filefish	-	D
Amblycirhitus pinos	Redspotted hawkfish	-	C
Aulostomus maculatus	Trumpetfish	D	C
Bodianus rufus	Spanish Hogfish	D	C
Canthidermis sufflamen	Ocean Triggerfish	B	-
Canthigaster rostrata	Sharpnose Puffer	D	C
Caranx latus	Horse-eye Jack	D	-
Caranx ruber	Bar Jack	C	C
Chaetodon capistratus	Foureye Butterflyfish	C	C
Chaetodon striatus	Banded Butterflyfish	C	A
Chromis cyanea	Blue Chromis	A	A
Chromis multilineata	Brown Chromis	B	A
Clepticus parrai	Creole Wrasse	C	A
Epinephelus cruentatus	Graysby	C	C
Epinephelus fulvus	Coney	C	C
Epinephelus guttatus	Red Hind	-	D
Equetus punctatus	Spotted Drum	-	D
Gobiosoma evelynae	Sharknose Goby	-	D
Gramma loreto	Fairy Basslet	D	C
Haemulon flavolineatum	French Grunt	D	C
Haemulon parrai	Sailors Choice	-	D
Halichoeres garnoti	Yellowhead Wrasse	A	A
Halichoeres maculipinna	Clown Wrasse	D	B
Holocanthus tricolor	Rock Beauty	-	D
Holocentrus marianus	Longjaw Squirrelfish	C	C
Holocentrus rufus	Longspine Squirrelfish	C	C
Hypoplectrus gummigutta	Blue Hamlet	-	D
Hypoplectrus guttavarius	Shy Hamlet	-	C
Hypoplectrus indigo	Indigo Hamlet	D	C
Hypoplectrus puella	Barred Hamlet	B	C
Hypoplectrus unicolor	Butter Hamlet	D	C

Inermia vittata	Boga	-	D
Lactophrys triqueter	Smooth Trunkfish	-	D
Lutjanus analis	Mutton Snapper	D	C
Lutjanus mahogoni	Mahogany Snapper	D	D
Malacanthus plumieri	Sand Tilefish	D	C
Melichthys niger	Black Durgon	D	C
Microspathodon chrysurus	Yellowtail Damselfish	C	A
Mulloidichthys martinicus	Yellow Goatfish	D	C
Myrichthys breviceps	Sharptail Eel	D	-
Myrichthys ocellatus	Goldspoted Eel	-	D
Myripristis jacobus	Blackbar Soldierfish	D	A
Ocyurus chrysurus	Yellowtail Snapper	C	-
Pempheris schomburgki	Glassy Sweeper	-	B
Priacanthus cruentatus	Glasseye Snapper	-	D
Pseudopeneus maculatus	Spotted Goatfish	C	C
Pterois sp.	Lionfish	C	C
Rypticus saponaceus	Greater Soapfish	-	D
Scarus croicensis	Striped Parrotfish	C	A
Scarus taeniopterus	Princess Parrotfish	C	-
Scarus vetula	Queen Parrotfish	-	D
Scomberomorus regalis	Cero Mackerel	D	-
Serranus tabacarius	Tobaccofish	-	C
Serranus tigrinus	Harlequin Bass	C	C
Sparisoma atomarium	Greenblotch Parrotfish	-	A
Sparisoma aurofrenatum	Redband Parrotfish	C	C
Sparisoma rubripinne	Redfin Parrotfish	D	D
Sparisoma viride	Stoplight Parrotfish	C	A
Sphyraena barracuda	Great Barracuda	-	D
Stegastes dorsopunicans (formerly fuscus)	Dusky Damselfish	-	D
Stegastes partitus	Bicolor Damselfish	C	A
Stegastes planifrons	Threespot Damselfish	C	D
Stegastes variabilis	Cocoa Damselfish	-	D
Thalassoma bifasciatum	Bluehead Wrasse	C	A
Urolophus jamaicensis	Yellow Stingray	D	-
	Yellowbelly hamlet	-	D