

# GLOVER'S REEF MARINE RESERVE

## ANNUAL REPORT

**JANUARY - DECEMBER 2008**



*Collecting Turtle data at GRMR, photograph courtesy of Roberto Carballo*

**Submitted To:  
Belize Fisheries Department**

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## 1.0 INTRODUCTION

### *1.1 Glover's Reef*

Glover's Reef is uniquely positioned deep within Belize's territorial waters, and it is recognized by many to be a spectacle of the Caribbean. In fact, Glover's as it is frequently referred to, according to Dahl et al. (1974), is said to be, "the prototypic atoll of the Caribbean, which is not only the best developed biologically, but also possesses the greatest diversity of reef types."

Formed almost seven million years ago by faulting offshore resulting in submarine escarpments, Glover's Reef is Belize's best formed coral atoll structure, with an approximate area of 260 km<sup>2</sup> and dimensions of 32 km long and 12 km wide. In addition, it is the southernmost of Belize's three offshore atolls and is about 75 km southeast of Belize City, and 45 km east, from the mainland.

Historically, because of its geographical location, Glover's Reef was once an important trading post for the indigenous Mayas of Meso-America, more than 900 years ago.

However, in more recent times, the atoll once served as a refuge for British buccaneers.

As a matter of fact, the name Glover's is derived from the famous British pirate, John Grovers. Nowadays, Glover's Reef is renowned, and acclaims international recognition, for its majestic cayes, vibrant marine flora & fauna, and of course, its unique reef structure, which is rugged, and resembles a mountain like precipice, of "spectacular walls and coral canyons." But above all else, the area is treasured for its geological & scientific attributes.

It was a result of the latter, that in 1993, Glover's Reef was officially designated as a marine reserve. According to (Munnings et al. 2002), the reserve was established by the government to maintain the ecological process, to preserve the genetic diversity, to maintain natural areas for educational and research, to provide social and economic benefits through ecologically sensitive recreation and tourism, and to achieve sustainable use of its resources through wise management of the species and their habitats. To date, Glover's Reef is the third largest marine protected area in Belize and is managed by the Belize Fisheries Department.

### *1.2 Reserve boundaries and zones.*

The atoll is divided into four zones.

1. The General Use Zone is approximately 261 km<sup>2</sup>, and allows for extractive activities. These include commercial fishing within the context of Belize Fisheries Regulations, however, no traps, long line, or nets are permitted.
2. The Conservation Zone is about 70 km<sup>2</sup> encompassing all cayes of the atoll. This area is designated as a non extractive activity zone, with the intention to protect a representative sample of the atoll's habitats. To provide an area for recreational activities, and provide a relatively undisturbed area for applied research.

3. The Wilderness Zone is located at the southern tip of Middle Caye and only scientific activity is permitted.
4. The Special Protected Zone is a bank located at the northern point of the atoll where the spawning aggregation of Nassau grouper is monitored. The bank is closed all year to fishing.

Visitors can differentiate the different zones by large cylindrical buoys deployed around the Conservation Zone.

### *1.3 Rules & regulations*

The reserve staff has a mandate to enforce all fisheries regulations including those of all marine reserve.

The Fisheries regulations states that all persons engaged in commercial fishing must be in possession of a valid fisher folk license, and all fishing vessel must also be licensed. Reserve officers also checked for the possession of marine products in closed season and compliance with size limits.

In addition, reserve staff has the power to arrest anyone found in violation of these regulations, and such persons shall be charged and prosecuted in a court of law.

The rules of the reserve are as follows:

1. All visitors must check in with the reserve staff upon entering the reserve.
2. There is a park fee set in place for foreign visitors. The fee is \$10.00 per person/day, and \$30.00 per person/week.
3. The sport fishing fee is \$25.00 per person/week and only catch and release sport fishing is allowed.
4. Boat should avoid anchoring by using mooring buoys where they are available.
5. All boat operators must display the “diver’s down” flag when diving.

## **2.0 ENFORCEMENT**

All marine reserve tries to educate people especially fishermen on the importance of the sustainable use of our marine resources. Marine Reserves have no take zone which they use as a tool to try and ensure the development of several species to adulthood. Therefore allowing them to reproduce and contribute to the longitivity of the species. It has been seen that enforcement is one of the most important aspects of marine conservation. This is because no matter what there will be people who at times will try to break the rules due to personal greed and other issues. Enforcement creates somewhat of a fear in someone to break certain regulations and this is known because there are less illegal activities occurring in areas where there is constant and strict enforcement.

## 2.1 Patrols

Regular patrols and checks of fishermen catch helps reduce illegal fishing and preserve the livelihood of our marine resources at Glovers. Glovers as we know is a relatively large reserve and with the given tools it is impossible to patrol the entire area on a daily basis. Thus more effort is placed on the conservation zone. Daily patrols are done in this area and boats within the immediate surroundings are checked.

Most of the fishermen that fish within Glovers are sailboat fishermen who are engaged in spare fishing and diving for conch and lobsters. Most of these fishermen come from Sarteneja, Belize City, Cayo and Orange Walk. We also get fishermen from Dangriga and Hopkins these guys don't use sailboat they use skiff. Those fishermen from Hopkins are mostly engaged in hand line fishing for fish and those from Dangriga do both handline and diving. The fishermen from the sailboats usually stay out at sea for 8 days before they go back into the mainland to deliver their products and those from Hopkins and Dangriga usually spend 3 days.

Patrols of the reserve led to the discovery of fifty one fishing vessels fishing within the waters of Glovers Reef Marine Reserve; two were wooden dories, eighteen were sailboats and thirty two were skiffs.

Table 1. Fishing Vessels found at Glover's Atoll for 2008.

Boat Name	Captain Name	Number of Crew	Type of Vessel
Marce	Pablo Castillo	2	Wooden Dory
Diara	Anastacio Castillo	5	Wooden Dory
Ginie	Oscar Mena	7	Sailboat
Gissell	*	10	Sailboat
Sandynoe	Francisco Garcia	4	Sailboat
Sandynoe 1	Elmer Cruz	8	Sailboat
Briseidi	Valdomar Milendez	6	Sailboat
Tormento	Francisco Lopez	11	Sailboat
Marisol	Higinio Tzul	7	Sailboat
Julia	Aron Kunil	9	Sailboat
Bella	Alberto Patt	5	Sailboat
Rosa	Luciano Rivero	11	Sailboat
La Bonita	Taulfo Rivero	10	Sailboat
Princess	Leobihildo Tamai	10	Sailboat
Adinely	Fidel Villamil	9	Sailboat
Ubafu	Juan Munoz	13	Sailboat
Nixa	Meridaldo Allen	4	Sailboat
Inri	Jorge Garbut	6	Sailboat
Bien Amigo	Andrew Usher	5	Sailboat
Diara	Anastacio Castillo	5	Sailboat
Mi Nina	Estanis Villamil	4	Skiff

Darling	Nelson Ortega	3	Skiff
Lady OG	John Thomas	4	Skiff
Jonathan 2	Duran	3	Skiff
Lennox	Lennox Maximo	2	Skiff
Nikaela	Micheal Jackson	4	Skiff
Soon Come	Ismael Usher	3	Skiff
Fully Loaded	Fermin Nunez	3	Skiff
Chico	Luke Nunez	5	Skiff
Twins	Anthony Nunez	3	Skiff
Ibzan	Hernando Rivero	6	Skiff
Black Chiney	Francis Ramirez	3	Skiff
Wayabia		4	Skiff
Baby J	Steven Ledlan	3	Skiff
Seagul	Rodney Castillo	2	Skiff
Queen Ann	Conseption Castillo	2	Skiff
Yeseri	Emilio G. Rivero	2	Skiff
Mary	Darrel Castillo	5	Skiff
Slickrock	Luke Nunez	6	Skiff
Miksha	Dennis O'Brien	2	Skiff
Beluga	*	2	Skiff
Ginie	Oscar Mena	6	Skiff
50 cents	*	2	Skiff
Elegance	*	3	Skiff
Vanina cc75	Paul Mark	4	Skiff
Ellen	Aaron E. Nasario	3	Skiff
Edimar	Herminio G Perez Jr.	4	Skiff
Janna Mia	Moses F. Cruz	4	Skiff
Biscuit	*	3	Skiff
Marisol	Rene R. Chub	3	Skiff
Crystal	Breeze Williams	4	Skiff

## 2.2 Warnings and Arrests

In all there were a total of thirty six arrests made of these fifteen were warnings, eleven did not show up to answer to their charge, eight were charged in court, and one case was dropped.

Table 2. Arrests made at Glover's Atoll and outcome.

Date	Person Name	Offense	Action taken by reserve staff	Outcome from Fisheries Department
17/01/08	Jose F. Aragon	Fishing without a valid fisher folk license	Arrested	Warned
17/01/08	Hernando	Employing of	Arrested	Warning issued by

	Rivero	fisherman without a valid fisher folk license		Julio Maz
17/01/08	Jose Luis Ortega	Fishing without a valid fisher folk license	Arrested	Warned
21/01/08	Higinio Rivero	Fishing without a valid fisher folk license	Arrested	Charged in court
21/01/08	Meridaldo Allen	Employing of a fisherman without a valid fisher folk license	Arrested	Warning given by Julio Maz
21/01/08	Meridaldo Allen	Using of a commercial fishing vessel without a valid vessel license	Arrested	Charged in court
27/01/08	Moises Eliazar Jimenez	Fishing without a valid fisher folk license and harvesting of undersized conch	Arrested and taken to Dangriga where he was locked up.	Case dropped
27/01/08	Leroy S. Ruiz	Harvesting of Nassau Grouper out of season	Arrested	Warning
27/01/08	Jorge G. May	Harvesting of a lobster with a tar spot	Arrested	Warning
27/01/08	Juan Munoz	Employing of a fisher folk without a valid fisher folk license	Arrested	Warning
30/01/08	Rosario Jones	Fishing within the conservation zone	Arrested	Did not show up in Belize City.
10/02/08	Ernando Rivero	Possession of undersized conch.	Arrested	Warned
11/02/08	Mauricio J. Cordoba	Fishing without a valid fisher	Arrested	Did not show up

		folk license.		
11/02/08	Hernando Rivero	Employing of a fisherman without a valid fisher folk license.	Arrested	Warning
14/02/08	Miguel A. Garcia	Possession of undersized conch.	Arrested	Warned
15/03/08	Giovanni Cruz	Fishing in the conservation zone.	Arrested	Warned

Table 3. Arrests made in April at Glovers Reef Marine Reserve.

Name	License #	Date	Process time	Offense	amount	Comment	Outcome
Alberto Palmero	000065	27/04/08	2:01pm	Undersize conch	69	Resisted arrest	Charged
Edibrto J. Rivero	001825	27/04/08	2:13pm	Undersize conch	25		Charged
Ardulfo Rivero	002901	27/04/08	2:18pm	Undersize conch	20	Resisted arrest	Didn't show up
Eddie Garcia	001436	27/04/08	2:23pm	Undersize conch	14	Resisted arrest	Charged
Julius I. Forman	001343	27/04/08	2:30pm	Undersize conch	25	Resisted arrest	Didn't show up
Francisco Garcia	000428	27/04/08	12:35pm	Undersize conch	20	Resisted arrest	Charged
Victor Reed		27/04/08	2:40pm	Undersize conch	8	Resisted arrest	Warned by court
Joselito Biasas	004189	27/04/08	2:45pm	Undersize conch and Expired fisher folk license	11	Resisted arrest	Warned by court
John T. Montero		29/04/08	5:30 am	Undersize conch and fishing in the conservation zone	6 undersize and 8 large conch		Did not show up

Table 4. Arrests made in May

Accused Name	Purpose of arrest	Quantity	Outcome
Ediberto Rivero	Harvesting of undersized conch	17	Charged

Ardulfo Rivero	Harvesting of undersized conch	64	Did not show up
Francisco J. Garcia	Harvesting of undersized conch	3	Charged
Julius Forman	Harvesting of undersized conch	15	Did not show up

On August 26<sup>th</sup> two arrests were made but when the guys showed up in Dangriga one Troy Nunez was able to show that he possessed a valid fisher folk license. As a result Troy Nunez and Anthony Nunez (Captain) charges were dropped and they were told that they must be able to present their licenses at all times when conducting commercial fishing.

Table 5. Arrests made at GRMR for the month of October

Accused Name	Purpose of arrest	Quantity	Outcome
Juan A. Cedillo	Harvesting of undersized conch	122	Did not show up
Anastacio M. Rivero	Harvesting of undersized conch	131	Warned
Martin Villamil	Harvesting of undersized conch	118	Did not show up
Sebastian Sho	Harvesting of undersized conch	59	Did not show up
Francisco Garcia	Fishing within the conservation zone	18 live conchs	Did not show up

### 3.0 Monitorings

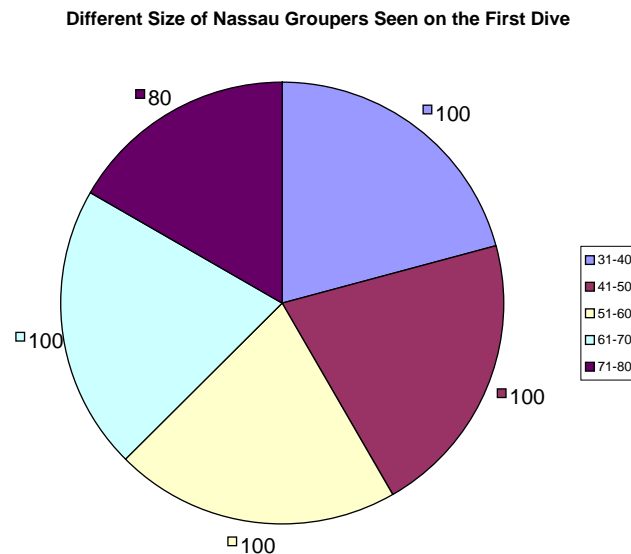
#### 3.1 Nassau Grouper Spawning Aggregation

The Spawning Aggregation monitoring program for this year should have been conducted from the 29<sup>th</sup> of December 2007, to the 3<sup>rd</sup> of January 2008; together with WCS scientist and fisheries reserve staff. However that did not take place with the full team due to some circumstances, fortunately fisheries reserve staff was all on duty at the time and decided to go forth and proceed to the site on the 29<sup>th</sup> evening and conduct one dive at 4:00pm. On this dive three individuals participated, Mr. Cantun, Mr. Carballo, Mr. Novelo and Mr. Martinez as the boat captain. A total estimation of 350 Nassau Groupers (*Epinephelus striatus*) was observed at this site all congregating at the bottom of the sea all around and between the corals all getting ready for the year's mating season. The groupers showed signs that they were getting ready to spawn because of the fat white bellies they showed which means that their gonads were already full. The area the monitoring took place was at the northern point of the atoll, a channel also called the Grouper Bank. The SPAG dive began five days after the full moon and most of the dives took place around 12:00pm and at 5:30pm. Unfortunately this year was not so successful

after all, due to a storm that approached us unexpectedly. Because of this we were unable to make it out to the site again for the rest of the surveys, and also due to fact that the reserve vessel is too small to reach there.

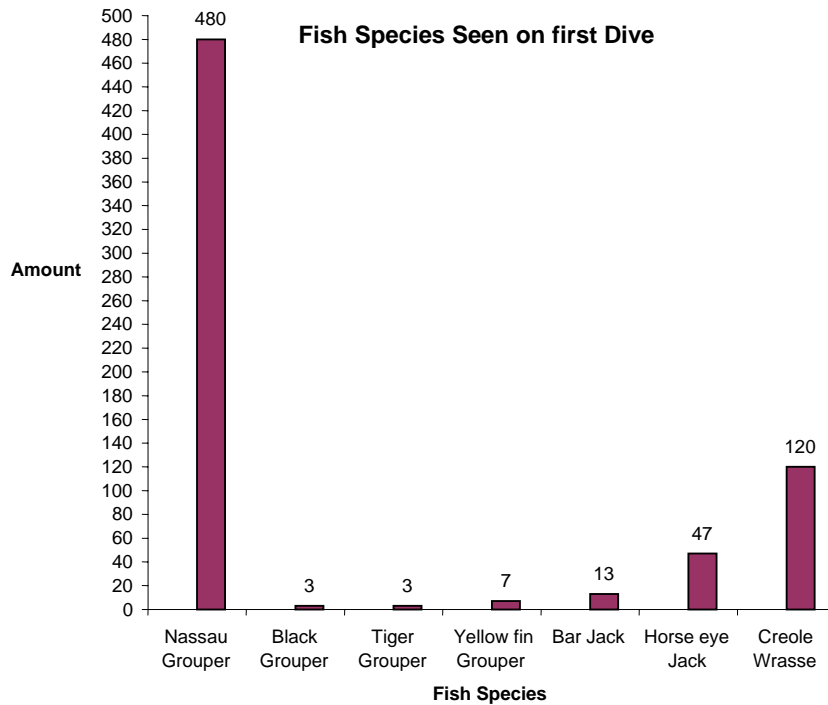
The second part of the spawning aggregation monitoring of the Nassau Groupers (*Epinephelus striatus*) took place from the 25<sup>th</sup> to the 29<sup>th</sup> of January 2008, at the same Northern channel of the Glover’s reef atoll called the Grouper bank. This time the team consisted of two researchers from WCS, three fisheries reserve staff and Linda Garcia from Friends of Nature who headed the survey. This type of survey usually takes place five days after the full moon and mostly last for five days as well. The depth range is between 90 to 100 feet sometimes a little deeper at certain time of the day. During this spawning aggregation survey a total number of two dives were conducted per day, one in the earlier part of the forenoon and the other at the later part of the evening, just before the sunsets. The method use to cover a large area is by hovering in a horizontal line all together, also depending on the amount of individuals participating in the survey. Everyone spreads out at about 20 feet from each other and conduct estimation of sizes and amount as well as any other spawning behavior seen and other different fish species observed while conducting the survey.

**Chart1. Shows the amount and the different sizes of Nassau Groupers studied while conducting the aggregation on the first dive.**



**Chart 1. Also illustrates that five different sizes and amount was studied. Eighty ranged from (71-80cm), one hundred ranged from (31-40cm), one hundred ranged from (41-50cm) another ranged from (51-60cm) and another one hundred ranging from (61-70cm).**

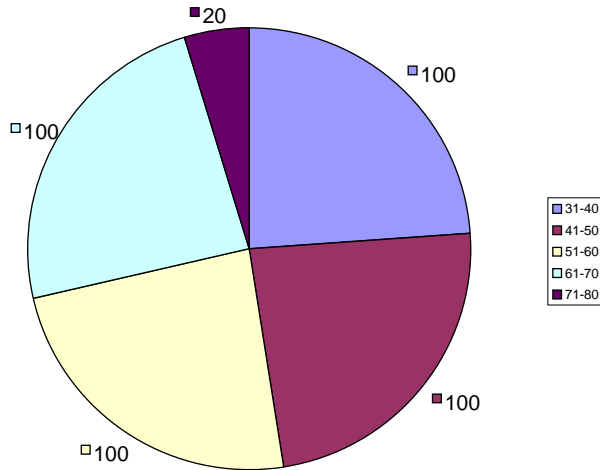
**Graph 1. Shows that seven different fish species was observed while conducting the first dive**



**Graph 1.** The Graph above illustrates that seven different fish species was seen in this first dive. An estimated amount of six hundred seventy three different fish. Of which four hundred eighty were Nassau Groupers, three Black Grouper, three Tiger Grouper, seven Yellow fin Grouper, thirteen Bar Jacks, forty seven Horse Eye Jacks and one hundred and twenty Creole Wrasses.

**Chart 2. Shows the different size and amount of Nassau Groupers studied while conducting the survey on the second dive.**

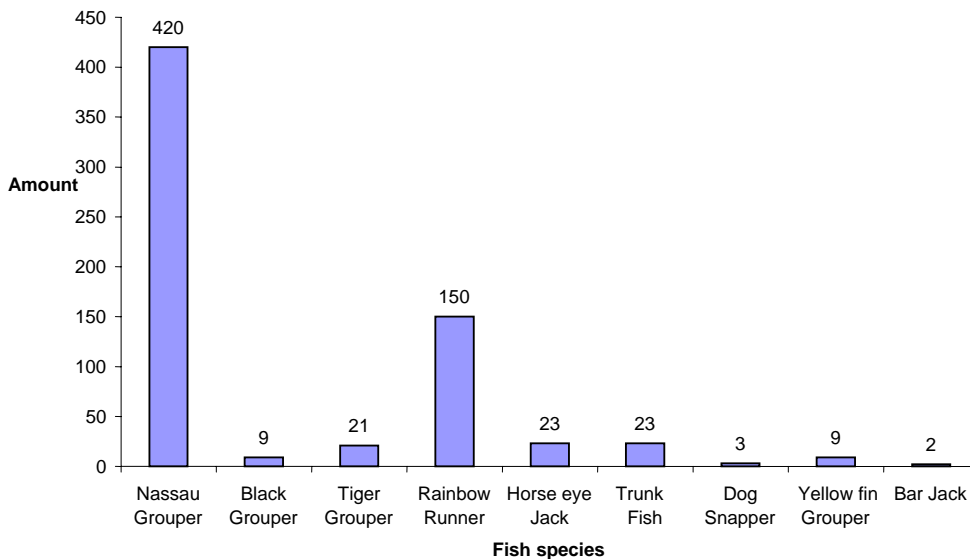
Different Size of Nassau Grouper Seen on Second Dive



**Chart 2. Illustrates that one hundred estimated amount of the different sizes remain the same only for the Nassau groupers ranging from (71-80cm) which has a number of twenty fish. For Nassau’s from (31-40cm) one hundred was observed. An amount of one hundred again for fish from (41-50cm), one hundred from (51-60cm), and one hundred from (61-70cm).**

**Graph 2. Shows the sizes and amount of fish species seen while conducting the survey on the second dives.**

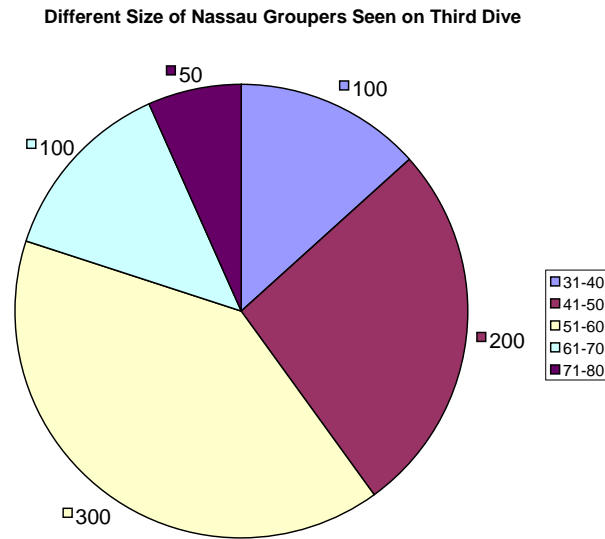
Fish Species seen on Second Dive



**Graph 2. The Graph above illustrates that nine different fish species was seen on the second dive. An estimated amount of six hundred and sixty fish total. Of this estimated amount, four hundred and twenty were Nassau Grouper, nine Black Grouper, twenty**

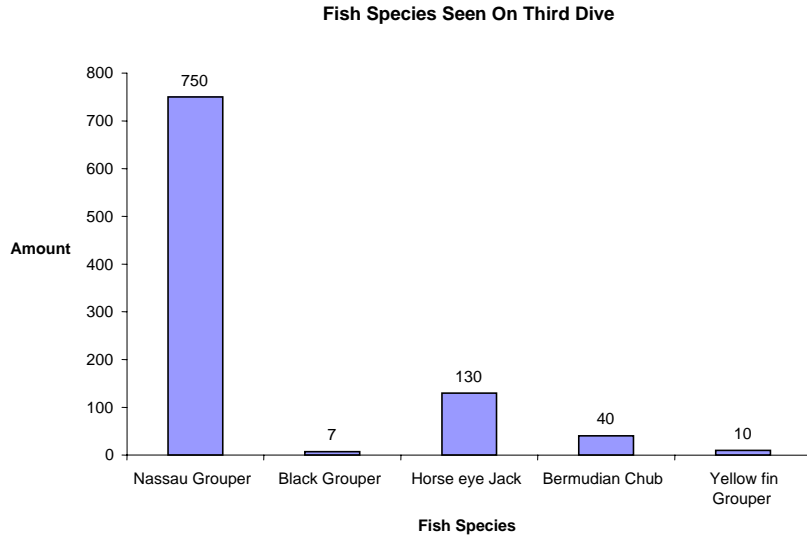
Tiger Grouper, one hundred and fifty Rainbow Runner, twenty three Horse Eye Jack, twenty three Trunk Fish, three Dog Snapper, nine Yellow fin Grouper, and two Bar Jack.

**Graph 3. shows the sizes and amount of Nassau Groupers studied while conducting the survey on the third dives.**



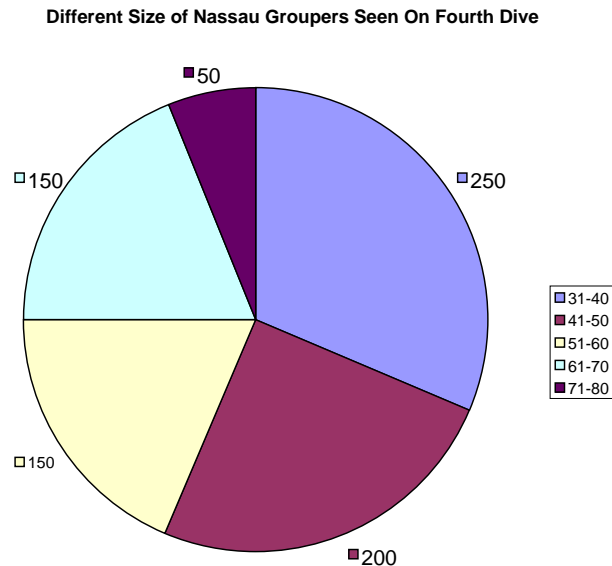
**Chart 3. Also Illustrates that five different sizes of Nassau groupers were observed and count on this survey. One hundred ranged from (61-70cm), fifty ranged from (71-80cm), one hundred ranged from (31-40cm), two hundred ranged from ( 41-50cm) and the largest amount of three hundred ranged from (51-60cm).**

**Graph 3. Shows five different fish species seen also while conducting the survey on the third dives.**



**Graph 3.** The Graph above shows that five different fish species was also seen on the third dive conducted. With a total amount of nine hundred and thirty seven fish all together. Of this amount seven hundred and fifty were Nassau Grouper, seven Black Grouper, one hundred and thirty Horse Eye Jack, forty Bermudian Chub and ten Yellow fin grouper.

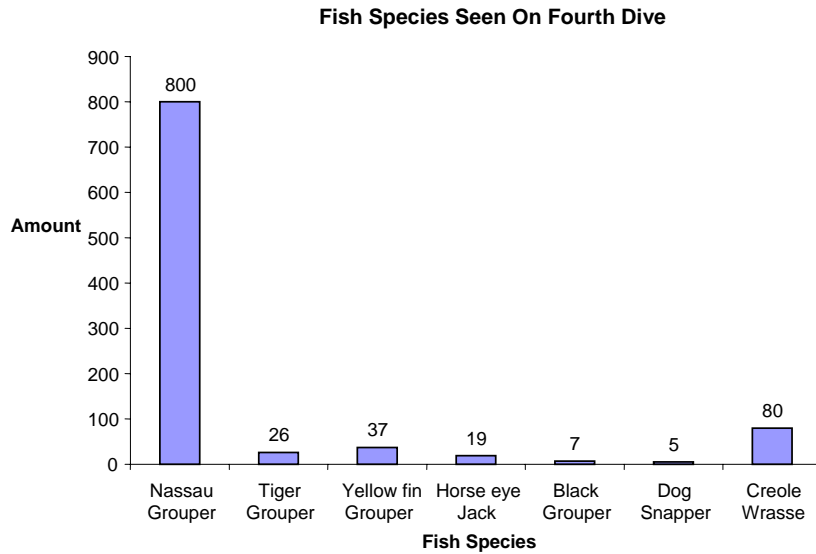
**Chart 4.** Shows the sizes and amount of Nassau Groupers studied while conducting the survey on the fourth dive.



**Chart 4.** Illustrates that five different sizes of Nassau groupers were counted during the survey. Fifty range from (71-80cm), two hundred and fifty ranged from (31-

40cm), two hundred ranged from (41-50cm), one hundred and fifty ranged from (51-60cm), and one hundred and fifty from (61-70cm).

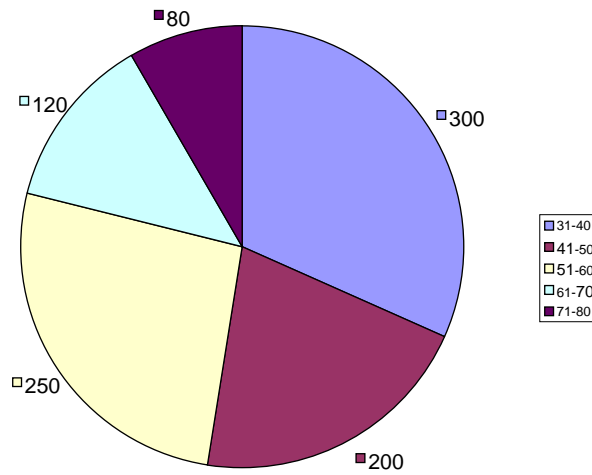
**Graph 4.** Shows the amount different fish species observed while conducting the survey on the fourth dive.



**Graph 4.** The graph above shows that seven different fish species was observed on the fourth dive. A total amount of nine hundred and seventy four fish was observed. Of the nine hundred and seventy four, eight hundred were Nassau Grouper, twenty six Tiger Grouper, Thirty seven Yellow fin Grouper, nineteen Horse Eye Jack, seven Black Grouper, five Dog Snapper, eighty Creole Wrasse.

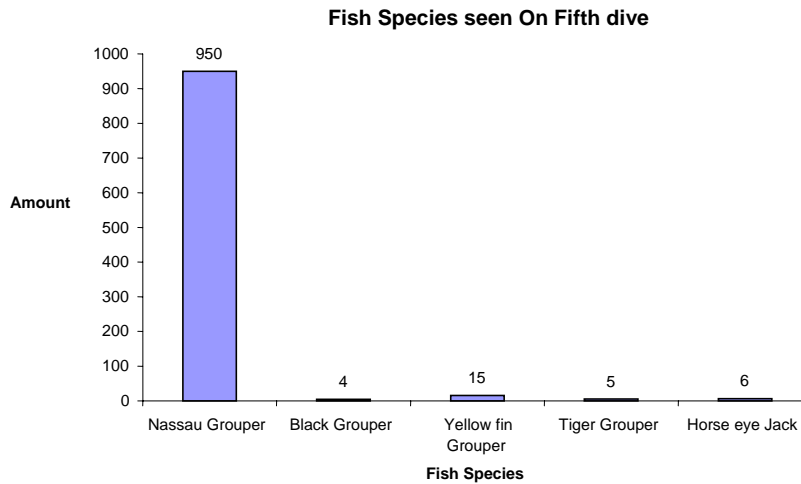
**Chart 5.** Shows the amount and sizes of Nassau Groupers studied while conducting the survey on the fifth dive.

Different Size of Nassau Groupers seen on Fifth Dive



**Chart 5.** Also shows that of the five different sizes of Nassau groupers, one hundred and twenty ranged from (61-70cm), eighty ranged from (71-80cm), three hundred ranged from (31-40cm), two hundred ranged from (41-50cm), and lastly two hundred and fifty ranged from 51-60cm).

**Graph 5.** Shows the different amount of fish species observed on the fifth dive while conducting the survey.



**Graph 5.**The Graph above Illustrates the different type of fish species observed while conducting the Nassau Grouper aggregation. The total amount of fish came up to nine hundred eighty of which nine hundred and fifty were Nassau Grouper, four Black grouper, fifteen Yellow fin Grouper, five Tiger Grouper, and six Horse Eye Jacks.

**Chart 6.** Shows the size and the amount of Nassau Groupers studied while conducting the survey on the sixth dive.

Different size of Nassau Groupers seen on sixth dive.

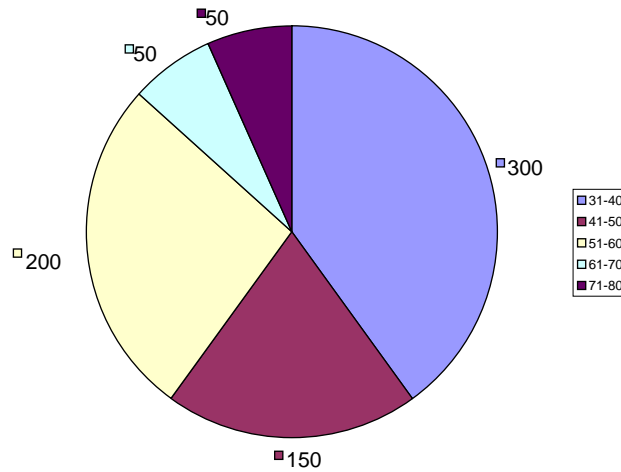
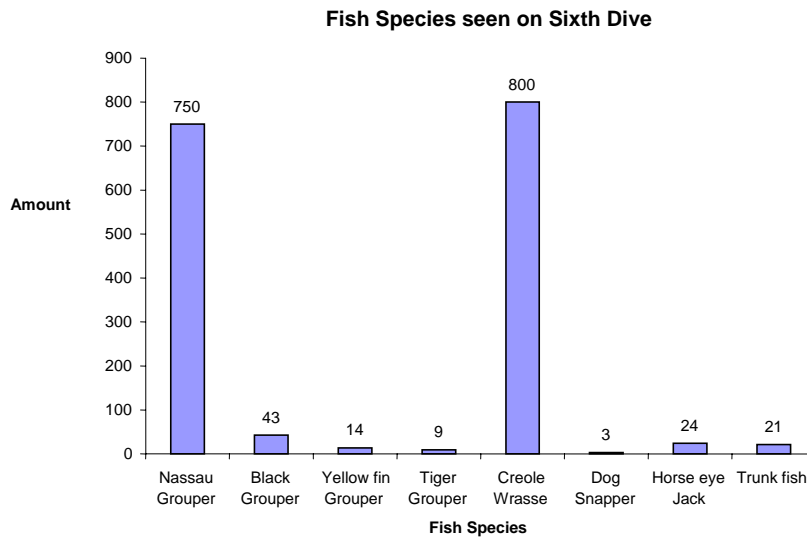


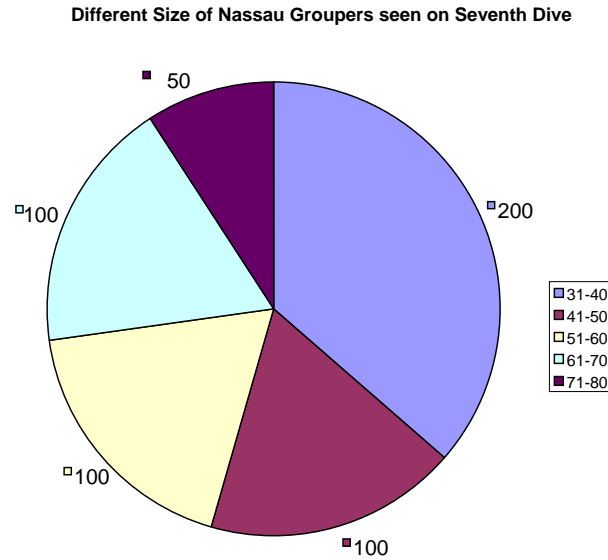
Chart 6. Illustrates that five different Nassau groupers was studied. Fifty ranged from (61-80cm), fifty ranged from (71-80cm), three hundred ranged from (31-40cm), one hundred and fifty ranged from (41-50cm), and two hundred ranged from (51-60cm).

Graph 6. Shows the amount of the different fish species seen while conducting the survey on the sixth dive.

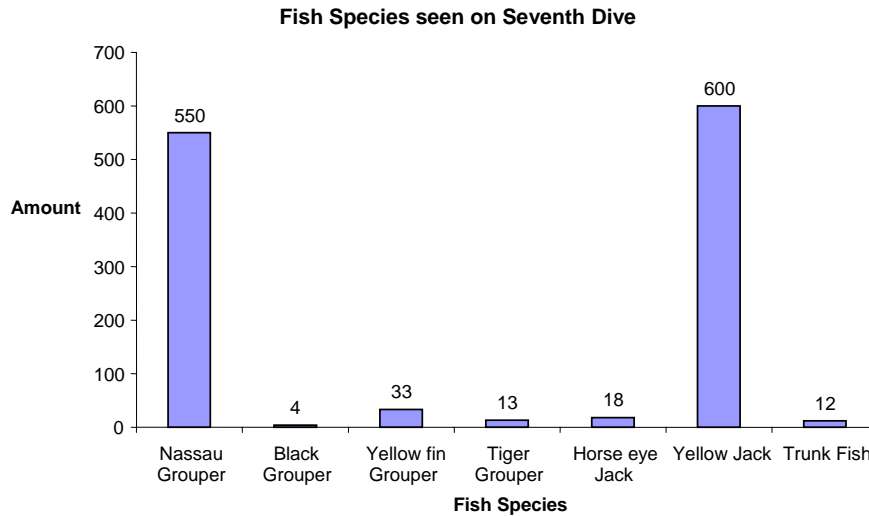


Graph 6. The graph above shows that a total of eight different fish species was seen while conducting the spawning aggregation survey. A total of one thousand six hundred and sixty four fish was observed in the survey of which seven hundred and fifty were Nassau Groupers, forty three Black Grouper, fourteen Yellow fin Grouper, nine Tiger Grouper, eight hundred Creole Wrasse, three Dog Snapper, twenty four Horse Eye Jacks, twenty one Trunk Fish.

**Chart 7. Shows the amount and sizes of Nassau Groupers studied while conducting the survey on the seventh dive.**



**Chart 7. Also shows that five different sizes and amount of Nassau Groupers were studied. Fifty ranged from (71-80cm), two hundred ranged from (31-40cm), one hundred ranged from 41-50cm), one hundred ranged from (51-60cm), and One hundred from (61-70cm).**

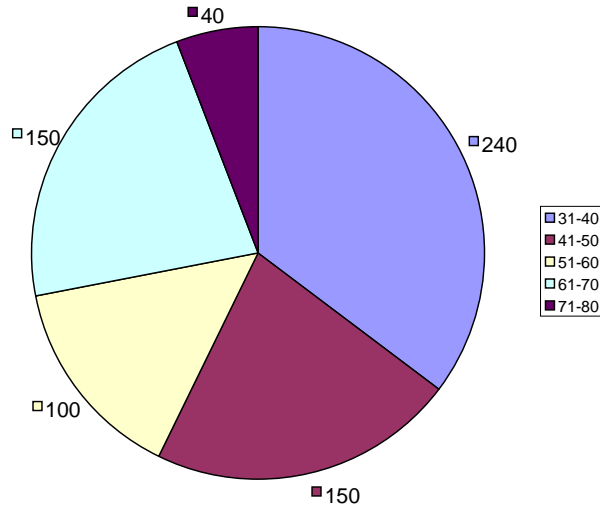


**Graph 7.** The graph above shows that seven different types of fish species were seen in the survey. A total amount of one thousand two hundred and thirty put together. For the Nassau Groupers five hundred and fifty was observed, for Black Grouper only four, thirty

three Yellow fin Grouper, thirteen Tiger Grouper, eighteen Horse Eye Jack, eight hundred Yellow Jack and twelve Trunk Fish were also seen on this dive.

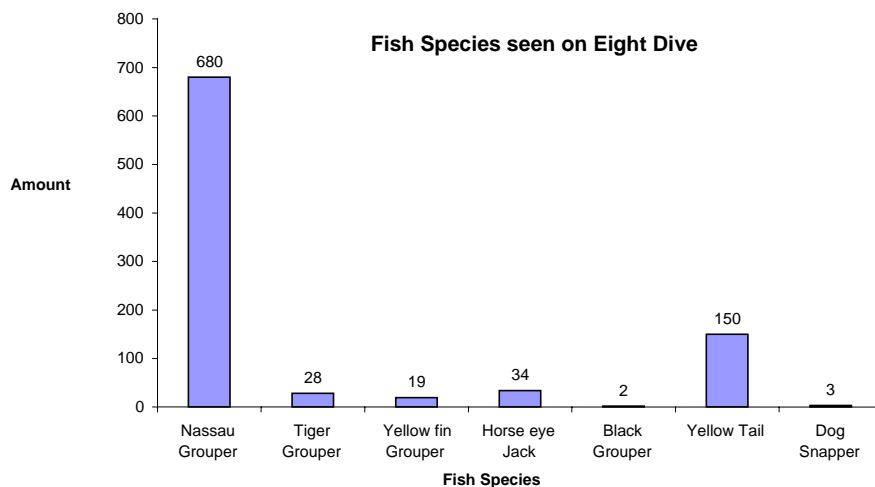
**Chart 8. Shows the different sizes and amount of Nassau Groupers studied while conducting the survey on the eight dives.**

Different Size of Nassau Groupers seen on Eight Dive

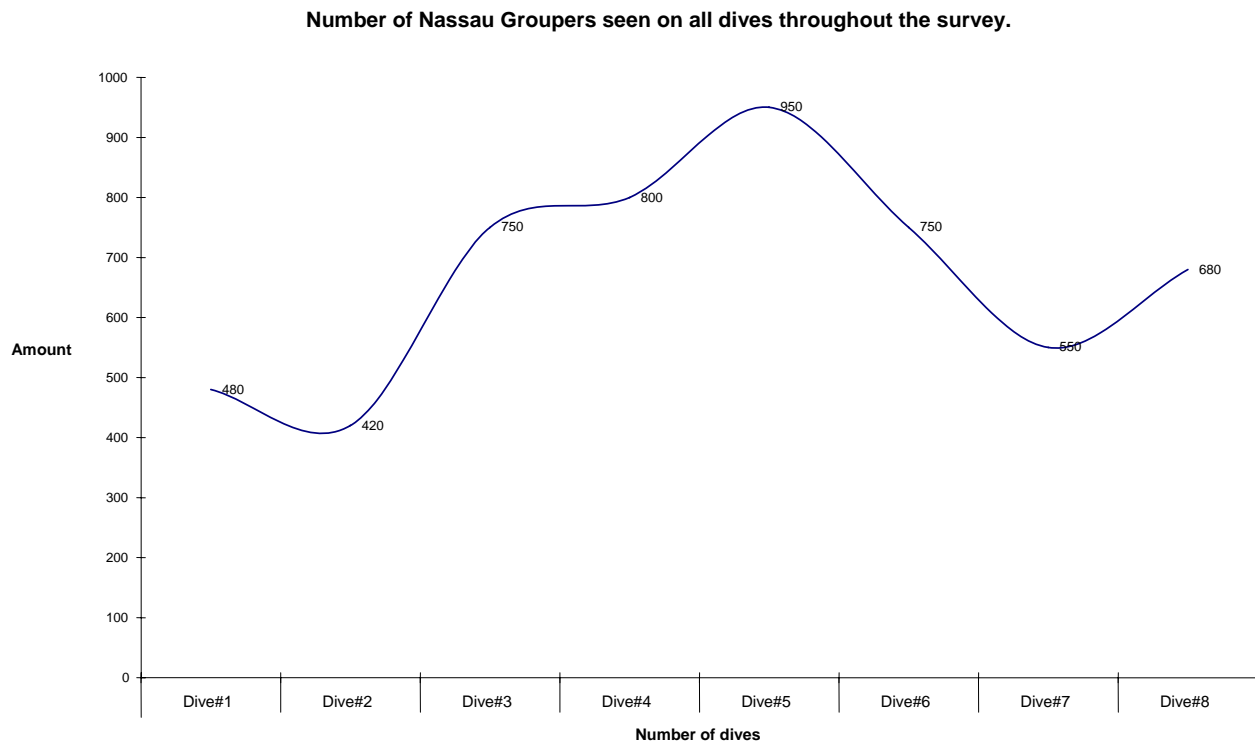


**Chart 8. Also Illustrates that forty ranged from (71-80cm), two hundred and forty ranged from (31-40cm), one hundred fifty ranged from (41-50cm), one hundred ranged from (51-60cm), and one fifty ranged from (61-70cm).**

**Graph 8. Shows the amount of the different fish species observed while conducting the survey on the eight dives.**



**Graph 8.** The graph above illustrates that seven different fish species was seen while conducting the survey. A total of nine hundred and sixteen fish was estimated; of this six hundred and eighty were Nassau Groupers, twenty eight Tiger Groupers, nineteen Yellow fin groupers, thirty four Horse Eye Jack, two Black Grouper, one hundred and fifty Yellow Tail Snappers, and three Dog Snapper.



**Graph 9. Number of Nassau Groupers seen throughout the survey.**

The Graph above illustrates that during the entire Spawning Aggregation survey it was observed that the highest numbers of Nassau groupers (*Epinephelus striatus*) was observed on the fourth and fifth dive conducted. During the first two days the quantity was in the four hundreds then start rising with a number of seven hundred and fifty. A peak of nine hundred and fifty was observed at which point the numbers of Nassau Groupers started to decrease slowly.

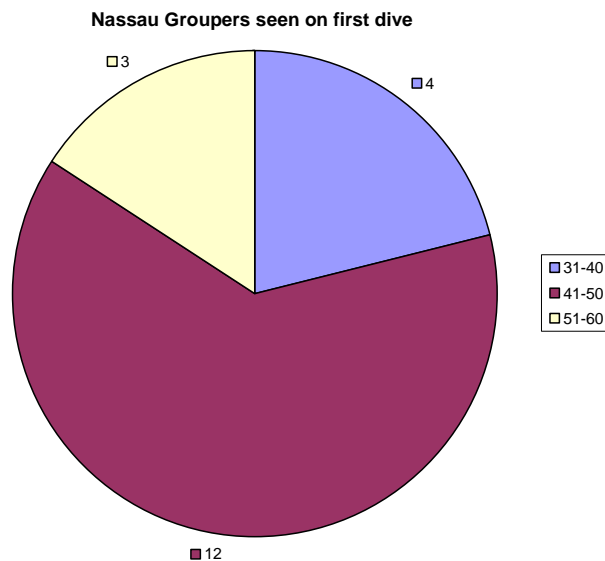
It was observed that at the beginning and for most of the early forenoon dives the Nassau Groupers were all scattered over the sea bed along and between corals. These Groupers also showed different spawning behaviors. One was color changes whereby some demonstrated the bicolor phase (black and white), others had fat white bellies, while others were dark in color. In addition a few of the Groupers had signs of bite marks, and some were gravid. Other behaviors seen were groupings, fighting, courtship and spawning. Spawning however was only seen on the third dive in the late forenoon.

### 3.2 Nassau Grouper Spawning Aggregation

The Spawning Aggregation monitoring program of the Nassau Groupers (*Epinephelus striatus*) for the month of February 2008 was conducted from the 24<sup>th</sup> to the 28<sup>th</sup>. The number of individuals that participated in this survey was consisted of one group leader from WCS named Mr. Valentine from San Pedro town as well as two of their staff, Tyron and Randolph (Buck). Also the reserve staff from Fisheries Department participated in this survey. The area that this monitoring took place was at the north point of the atoll, also call the Grouper Bank. The SPAG dives began three days after the full moon and usually took place around 2:00pm and 5:30pm. During this survey the sea state was rough but the team still didn't hesitate and proceeded to the site.

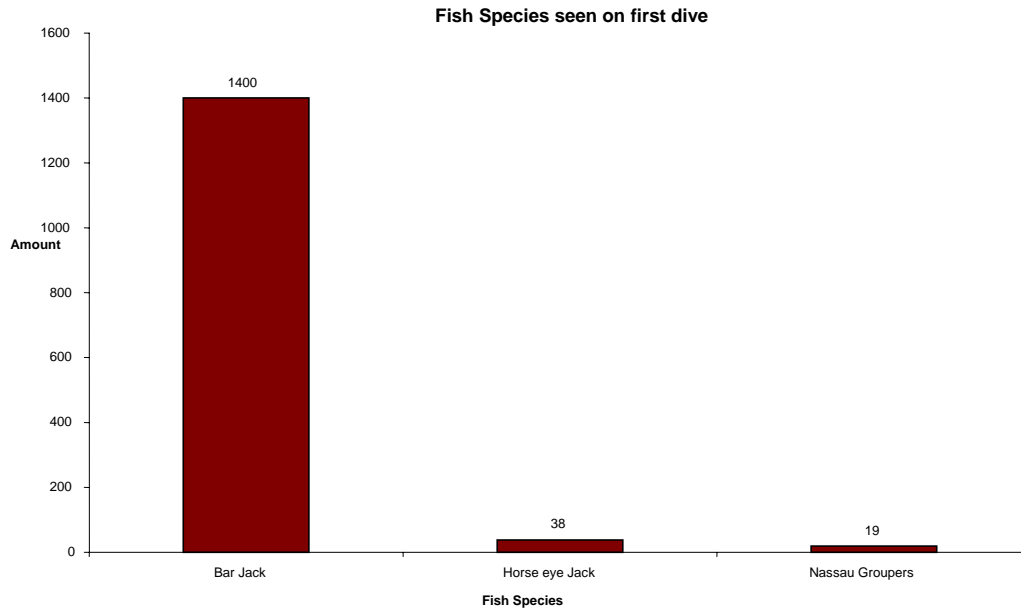
The depth range that these surveys are conducted is mostly between 90 to 150 feet sometimes a little deeper at certain time of the day. For the spawning aggregation survey a number of two dives were conducted per day, The dive that are most expected to see more spawning activities is usually during the later part of the evening just before the sunsets. The method use to cover a larger area is by hovering in a horizontal line all together; this depends on the amount of individuals participating in the survey. Everyone spreads out more or less at a distance of about fifty feet away from each other and conduct estimation of sizes and amount as well as any other spawning behavior seen and any other type of fish species as well as any other unnatural behaviors seen.

**Chart 1. Shows the amount and size of Nassau Groupers seen on first dive.**



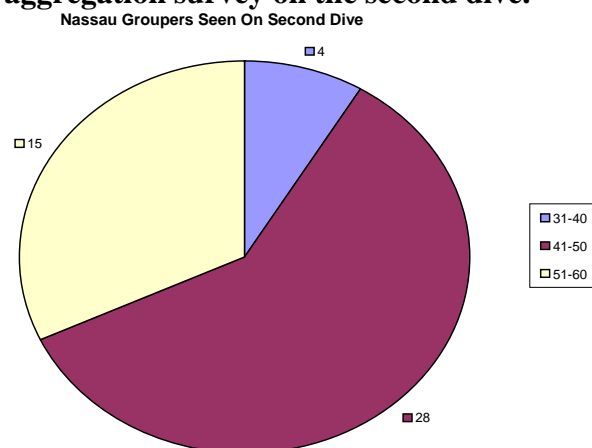
**Chart 1. Illustrates that on the first dive three different sizes of Nassau Groupers was seen while conducting the spawning aggregation survey. Three were (51-60cm), four (31-40cm), and twelve was (42-50cm) in sizes.**

**Graph 1. Shows the different species of fishes studied on the first dive while conducting the same Nassau Grouper Survey.**



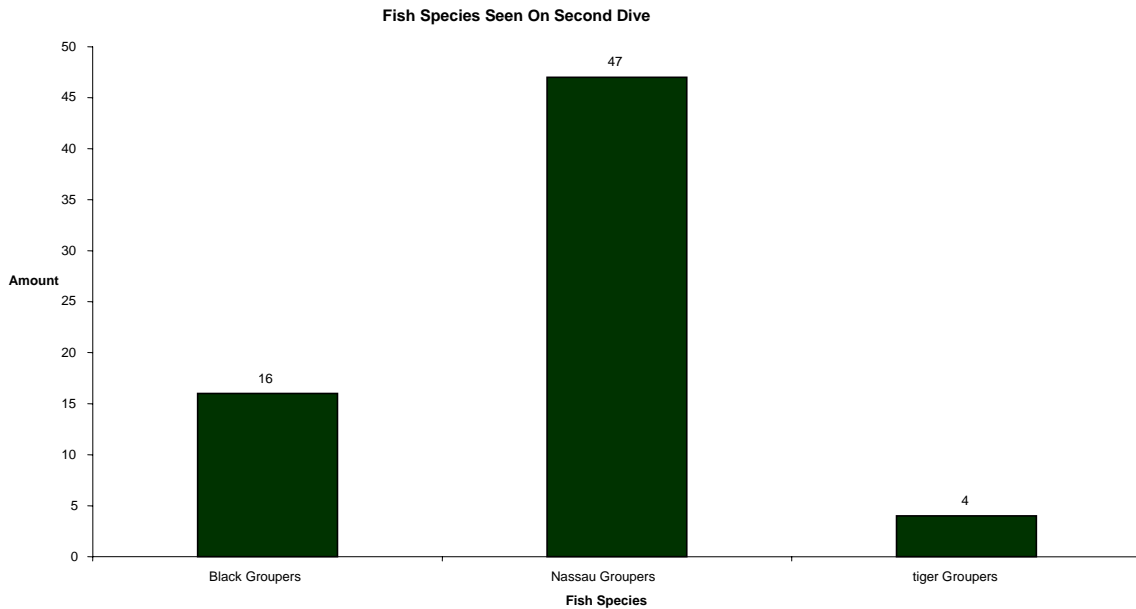
**Graph 1.** Illustrates that three other different fish species was seen in the area while conducting the survey. It was estimated that one thousand four hundred and fifty seven fish was seen, which of these amount of one thousand four hundred were of the Bar Jacks species, thirty eight Horse eye jacks, and a small amount of nineteen was of the fish species of the Nassau Groupers.

**Chart 2. Shows the different amount and sizes of Nassau Groupers seen while conducting the spawning aggregation survey on the second dive.**



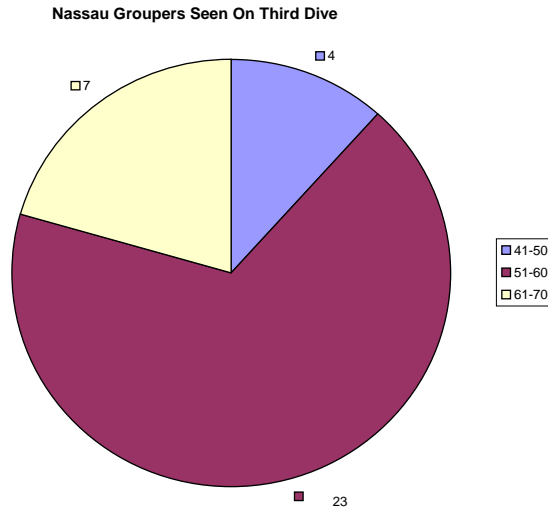
**Chart 2.** Also shows that fifteen Nassau groupers were in the size range of (51-60cm) while twenty eight were (41-50cm) and four were (31-40cm).

**Graph 2.** Shows the different fish species seen while conducting the survey on the second dive.



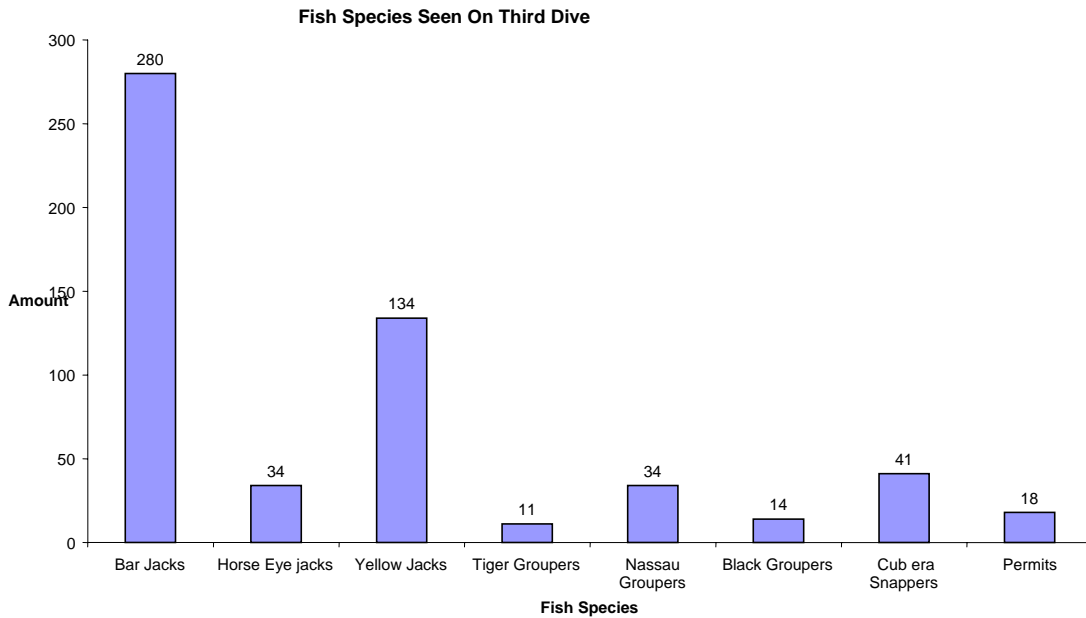
**Graph 2.** The Graph above illustrates that three different fish species was seen on the second dive while conducting the survey. The total estimated amount was sixty seven fish. Of these sixty seven fish, sixteen were Black Grouper, forty seven were Nassau Grouper, and four was Tiger Grouper.

**Chart 3.** Shows the amount and sizes of Nassau Groupers studied while conducting the survey on the third dive.



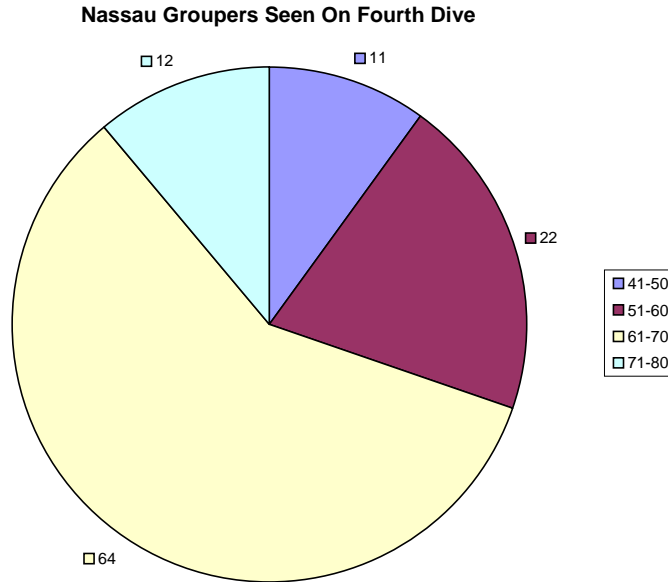
**Chart 3.** Illustrates that seven of this species sizes were (61-70cm), while twenty three which was the largest amount ranged from (51-60cm) and only four Nassau were seen ranging from (41-50cm) in size.

**Graph 3.** Shows the different fish species also studied while conducting the survey on the third dive.



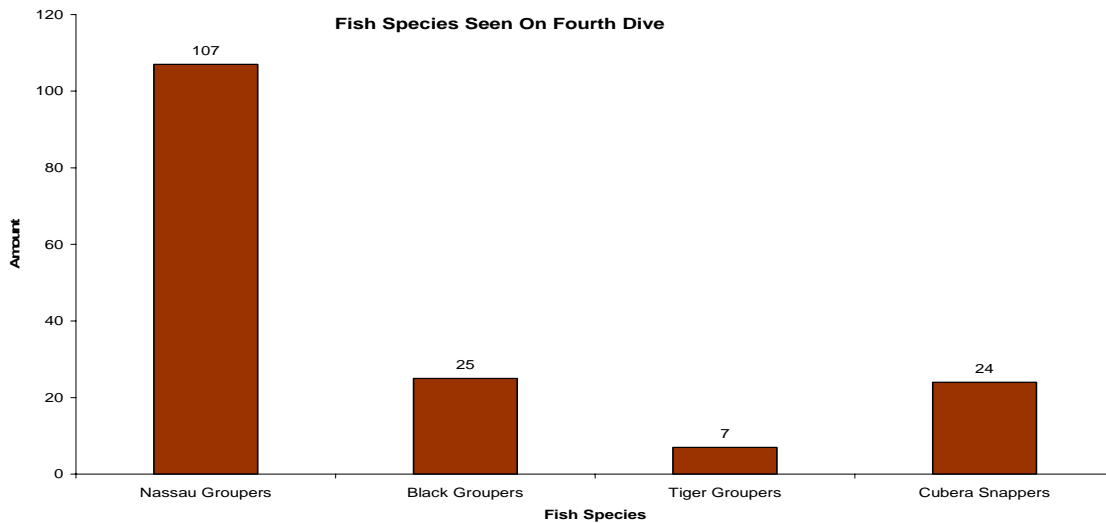
**Graph 3.** Also illustrates that eight different fish species was also seen on the third dive. It was estimated of a total of five hundred and sixty six all together. Of this amount two hundred and eighty were Bar Jacks, thirty four Horse eye Jacks, one hundred and thirty four yellow Jack, eleven Tiger Groupers, thirty four Nassau Groupers, fourteen Black Groupers, forty one Cub era snappers, and eighteen Permits.

**Chart 4. Shows the amount and sizes of Nassau Groupers studied on the fourth dive of the survey.**



**Chart 4. Also Illustrates that twelve of the Nassau groupers sizes were ranged between (71-80cm), eleven ranged between (41-50cm), twenty two ranged between (51-60cm) while the largest amount of Nassau studied ranged from (61-70cm) with a total estimated amount of sixty four.**

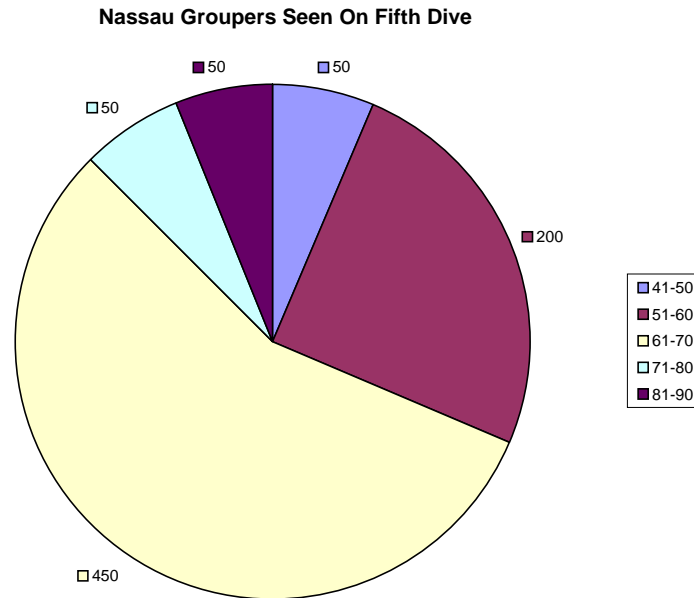
**Graph 4. Shows the amount and type of fish species seen while conducting the survey on the fourth dive**



**Graph 4.** The graph above illustrates that four different fish species was observed while conducting the survey on the fourth dive. It amounted of an estimate of one hundred and

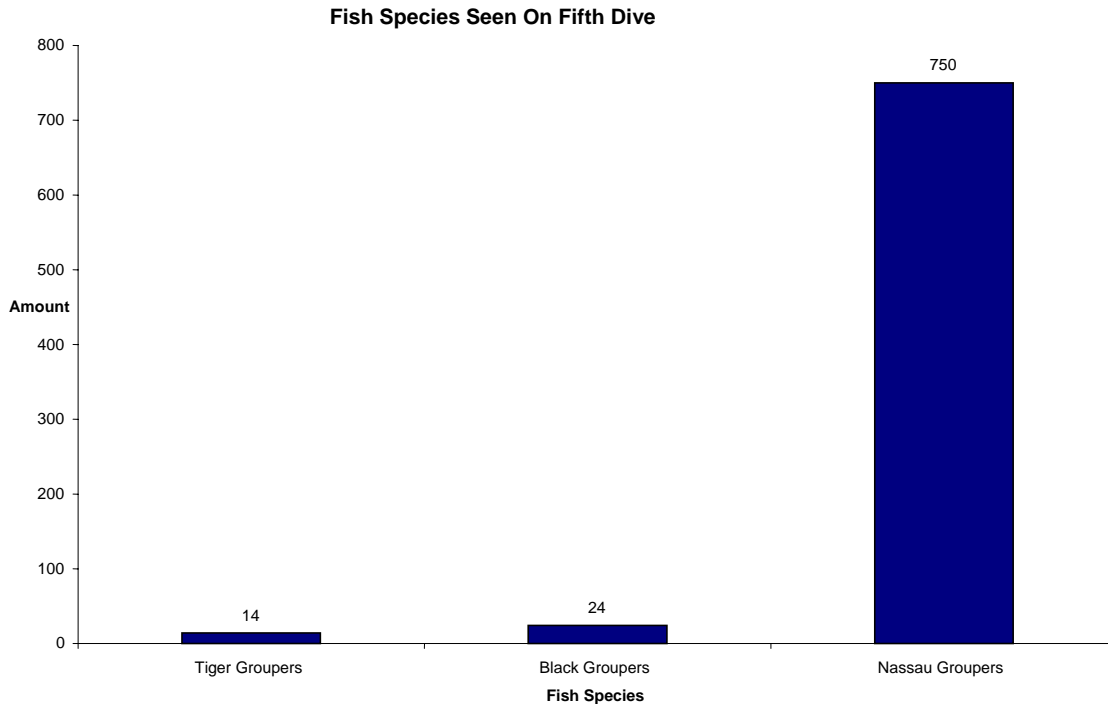
sixty three fish. Of this amount, one hundred seven were Nassau Groupers, twenty five Black Groupers, seven Tiger Groupers, and twenty four Cub era snappers.

**Chart 5. Shows the amount and sizes of Nassau Groupers studied while conducting the survey on the fifth dive.**



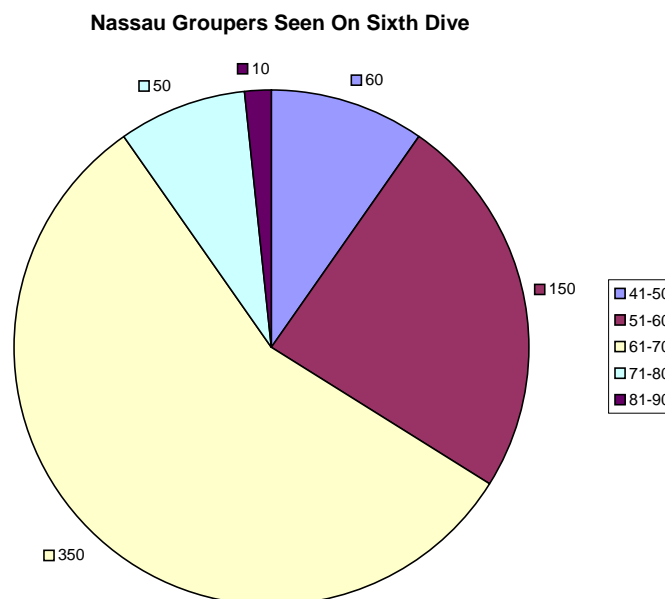
**Chart 5. Also illustrates that five different sizes of the Nassau groupers were seen, which were (71-80cm) with fifty fish, (81-90cm) with fifty as well, (41-50cm) with fifty again (51-60cm) with two hundred fish, and the largest amount of Nassau range from between (61-70cm) with an amount of four hundred and fifty fish.**

**Graph 5. Shows the three other fish species observed while conducting the survey on the fifth dive.**



**Graph 5.** The Graph above Illustrates the three different fish species observed while conducting the Nassau Grouper aggregation. All totaling to an amount of seven hundred and eighty eight fish all together. Of the amount fourteen was Tiger Grouper, twenty four Black groupers, and seven hundred and fifty was Nassau Groupers.

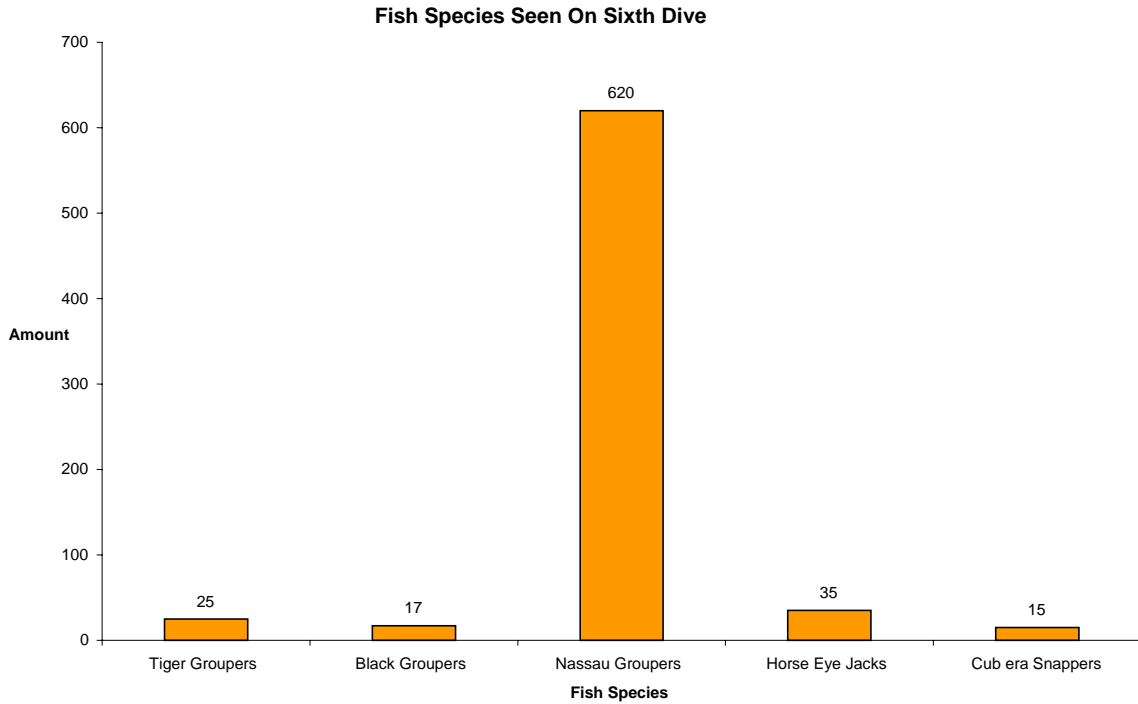
**Chart 6.** Shows the amount and sizes of Nassau Groupers seen while conducting the aggregation survey on the sixth dive.



**Chart 6.** Illustrates that five different sizes of Nassau groupers was studied, which the largest amount had three hundred and fifty with size range between (61-70cm), one hundred and fifty range from sizes between (51-60cm), sixty fish range between

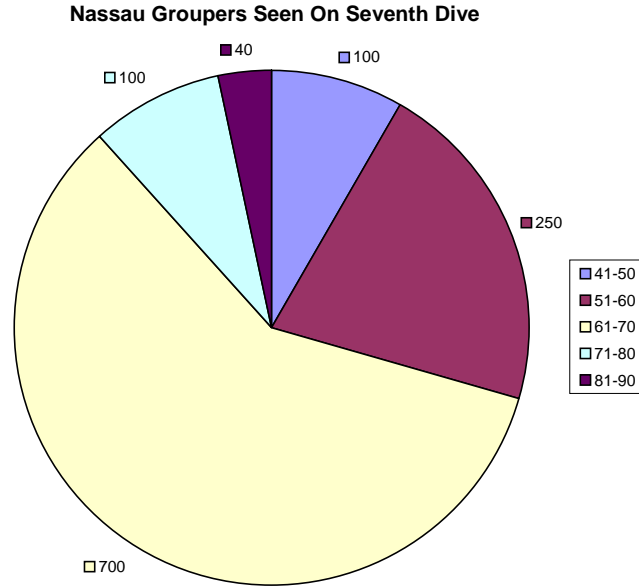
(41-50cm), fifty ranged between (71-80cm), and the smallest amount ranged from between (81-90cm).

**Graph 6.** Shows the amount and the different fish species also observed while conducting the survey on the sixth dive.



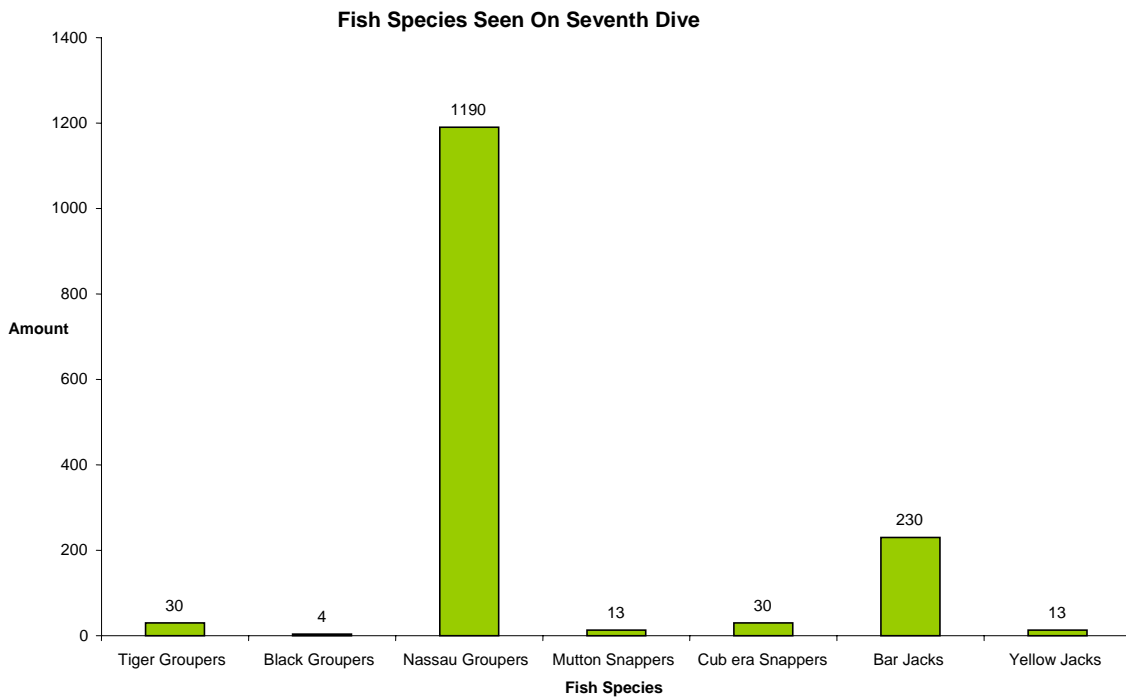
**Graph 6.** The graph above illustrates a total of seven hundred and twelve fish were observed on the sixth dive. Of that amount twenty five was Tiger Groupers, seventeen Black Groupers, six hundred and twenty was Nassau Groupers, thirty five Horse eye jack and fifteen Cub era Snappers

**Chart 7.** Shows the amount and sizes of Nassau Groupers Studied while conducting the aggregation survey on the seventh dive.



**Chart 7.** Also illustrates that five different sizes the species were estimated on the survey. One hundred ranged between (71-80cm), forty ranged between (81-90cm), one hundred between (41-50cm), two hundred fifty ranged between (51-60cm) and the largest amounted to seven hundred which ranged between (61-70cm).

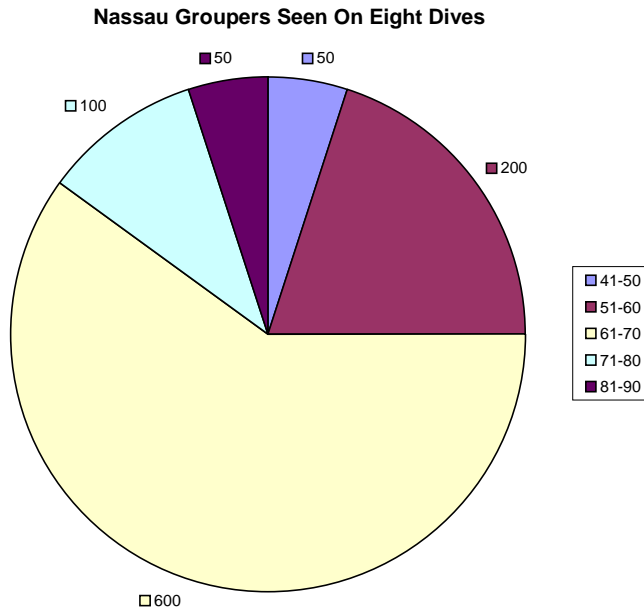
**Graph 7.** Shows the amount and the different fish species seen while conducting the aggregation survey on the seventh dive.



**Graph 7.** The graph above shows seven different types of fish species was seen in the survey totaling to an amount of one thousand five hundred and ten. Thirty Tiger Groupers was seen while only four were Black Grouper. One thousand one hundred and ninety

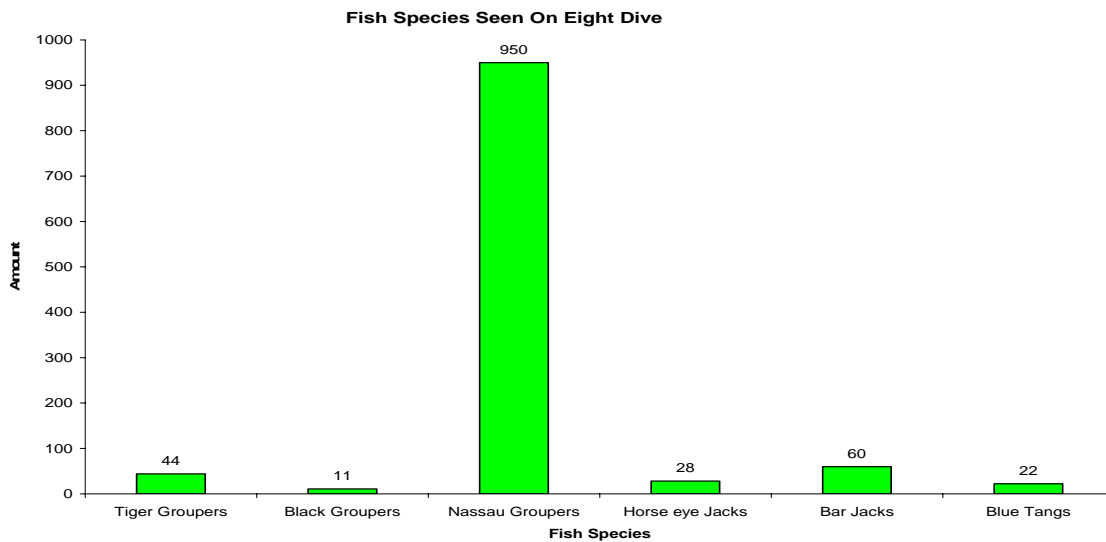
Nassau Groupers was seen also, thirteen Mutton snappers, thirty Cub era Snappers, two hundred and thirty Bar Jacks and thirteen Yellow Jacks.

**Chart 8. Shows the amount and sizes of Nassau Groupers studied while conducting the survey on the eight dives.**



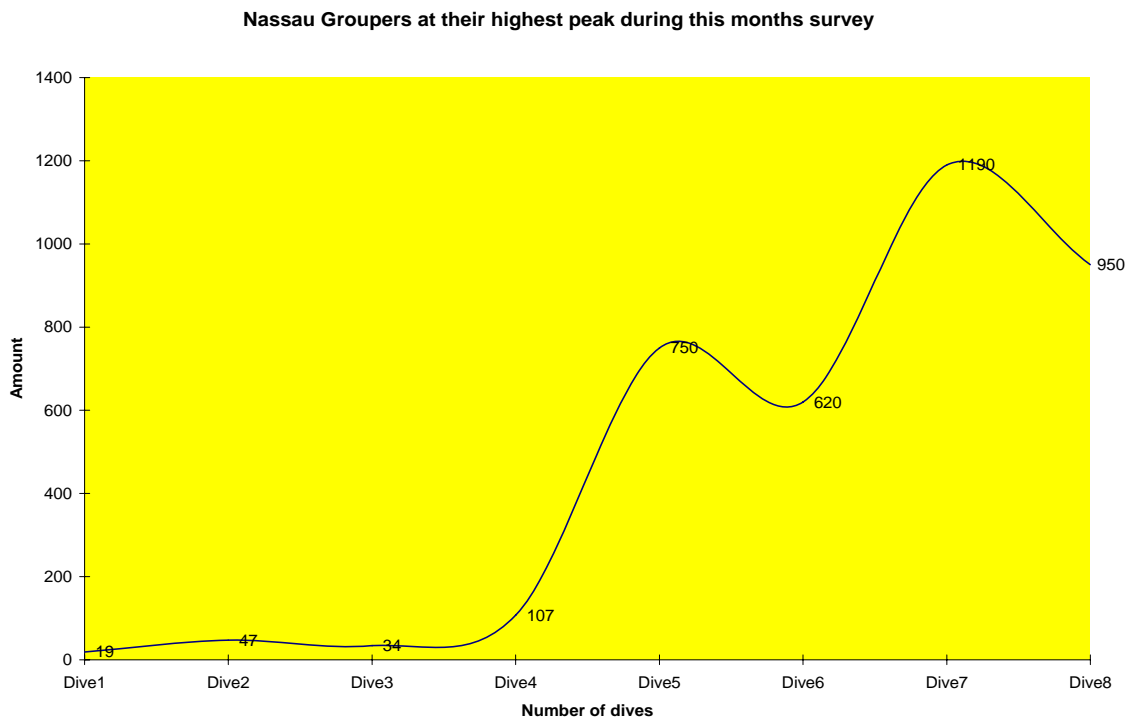
**Chart 8. Illustrates a total of five different sizes of Nassau Groupers were estimated their size range. They were one hundred ranging between (71-80cm), fifty were ranging between (81-90cm), another fifty were ranging between (41-50cm), two hundred ranged between (51-60cm) and the largest amount ranging between (61-70cm) amounted to six hundred.**

**Graph 8. The Graph Shows amount of the six fish species seen while conducting the aggregation survey on the eight dives.**



**Graph 8.** The graph above illustrates that six different fish species was seen while conducting the eight surveys. A total of one thousand one hundred and fifteen different fishes were estimated; of this forty four was Tiger Groupers, eleven Black Groupers, nine hundred and fifty Nassau Groupers, twenty eight Horse eye Jacks, sixty Bar Jacks, and twenty two Blue Tangs.

**Graph 9.** Illustrates the number of dives and the highest peak of the Nassau Groupers observed throughout the entire Spawning aggregation survey for the month of February 2008.



The Graph above illustrates that during the SPAG survey's for the month of February, it was observed that the highest numbers of Nassau groupers (*Epinephelus striatus*) studied was on the seventh dive. The first three days the amount was low being below the fifties, then start rising on the fourth dive conducted with an amount of one hundred and seven right up to a number of approximately seven hundred and fifty on the fifth dive and decreases a little to six hundred and twenty on the six dive. The seventh dive which had the highest peak of the Nassau Groupers was up to an amount of one thousand one hundred and ninety at which point the numbers of Nassau Groupers started to decrease slowly again on the eight dive which was the last day of the survey, still with an amount nine hundred and fifty which is still higher than the beginning of the survey.

It was also observe that at the beginning of the first three dives in the early part of forenoon that this fish species (*Epinephelus striatus*) were all scattered over the sea bed of a habitat of spur and grooves as well along and between corals and rock crevices. Some of these Groupers showed few signs of spawning behaviors; such as color changes whereby some demonstrated a little bicolor phase (black and white), others had fat white bellies, while others were dark in color this activity was observed on the fourth and fifth dives. In addition a few of these species had signs of bite marks, and some also had low occurrence of gravid except for the Tiger Groupers. Other behaviors observed were some groupings, a couple fighting's between them, and some few courtship as well these were signs seen on the fifth and sixth dives, while no spawning behaviors was seen during the surveys conducted, but could be possible that on the twenty seventh, late in the evening some spawning activities was performed, due to fact that on that particular day when the seventh dive was conducted in the later part of the evening there was a larger amount of the Nassau Groupers in a big group above the sea bed. The last dive the other showed a reduction in the species studied and this meant that they have started to move on.

### ***3.3 Lobster Survey***

The survey for the closing of the lobster (*Panulirus argus*) season was carried out on the 23<sup>rd</sup> to the 26th of February 2008 by Elias Cantun reserve biologist, Mr. Carballo, Mr. Martinez and Mr. Novelo. A total of fourteen patch reefs were covered following the Field Protocol for Monitoring Coral Reef Fisheries Resources in Belize 2003 edition. The survey covered seven sites; seven in the conservation zone and seven within the general use zone.

An average of one hour was spent at each lobster site depending on the amount of individuals participating in the survey. One hundred twenty seven lobster samples was surveyed of which eighty eight was found in the sites that were in the conservation zone and the other thirty nine was found on the sites in the general use zone.

#### *Method*

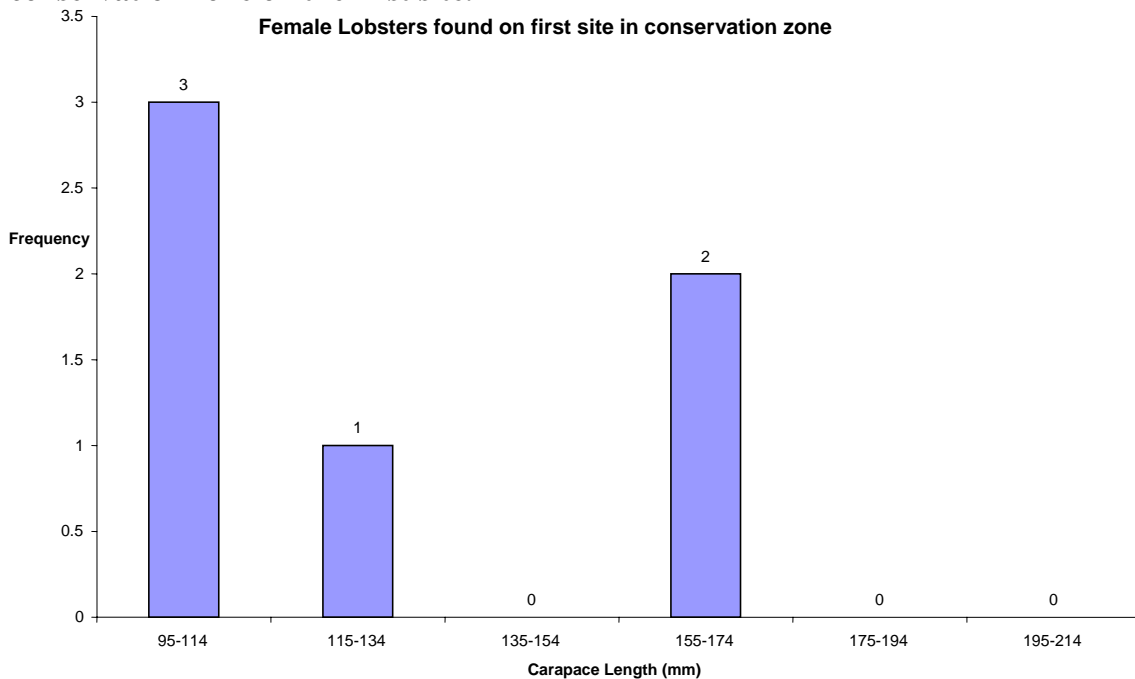
The survey was done following the Field Protocol for Monitoring Coral Reef Fisheries Resources in Belize 2003 edition. While carrying out this survey different parameters

where collected. The average temperature at each site was about 30<sup>0</sup> C. The average conductivity was around 54ms, the average salinity at the different sites was around 35ppt, the average visibility at the different sites was 25 meters (m), and the depths at the different sites varied but most were shallow patch reefs some of which were deeper on the edges. The time that the survey was carried out was usually between 9:30 am to around 5:30pm in the evening.

The survey was carried out by snorkeling in cross patterns across the whole reef structure and all rock crevices were searched trying to find lobsters (*Panulerus argus*). Each patch reefs took approximately an hour to search depending, like was said before on the amount of individuals assisting in the survey. When any lobsters were found they were checked for sex and search for egg masses without capturing the animal if possible. The size length was also measured by placing a marked tickle stick over the dorsal surface of the carapace and it was estimated to the nearest mm. The sex was determine by, the adult male having a third pair of walking leg that is much longer than all other legs, while the adult female lobsters have swimmerets with frilly tips under the ventral side of the abdomen use sometimes in holding egg mass that are sometimes visible.

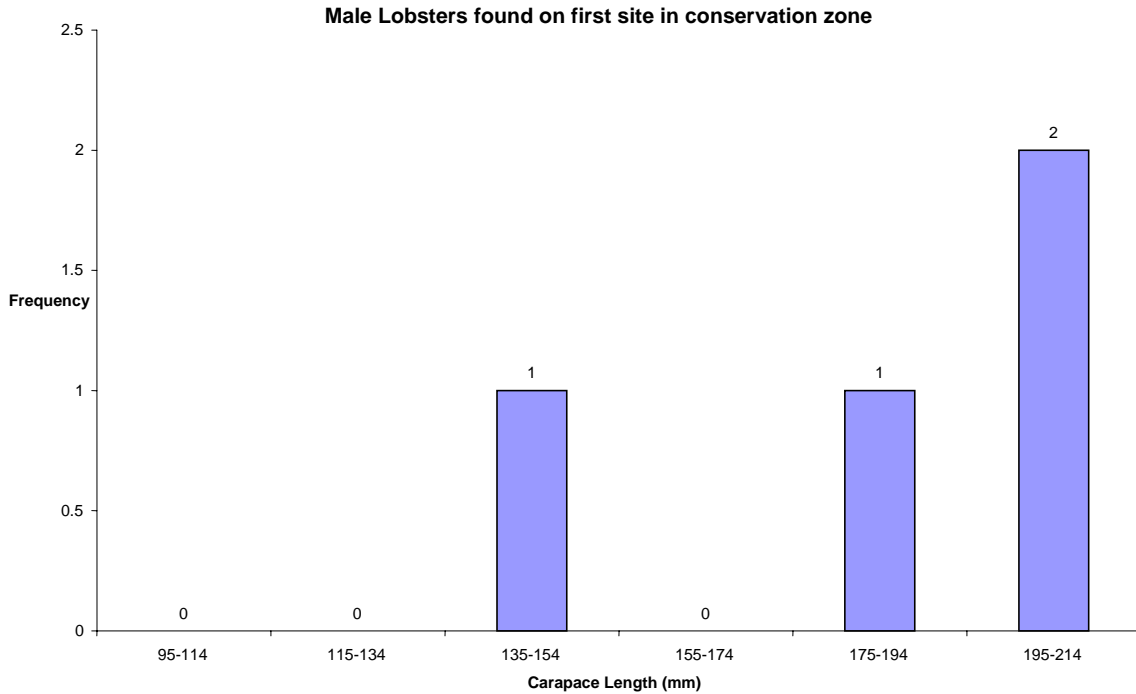
On each lobster site that was surveyed a thorough observation on some particular fish species recorded to keep track of their status on these patch reefs that we classified as lobster site. These fish species are the Nassau groupers, Black groupers, Hog fish, and Mutton snappers. The data were collected on the amount seen and included are graphs below showing the amount seen on each site that are surveyed.

**Graph 1. Illustrates the frequency and the sizes of female lobsters found within the conservation zone on the first site.**



**Graph 1.** The graph above also shows that three different sizes of lobsters were observed which three of their carapace length ranged from (95-114mm), one carapace length ranged from (115-134mm), and two ranges from (155-174mm).

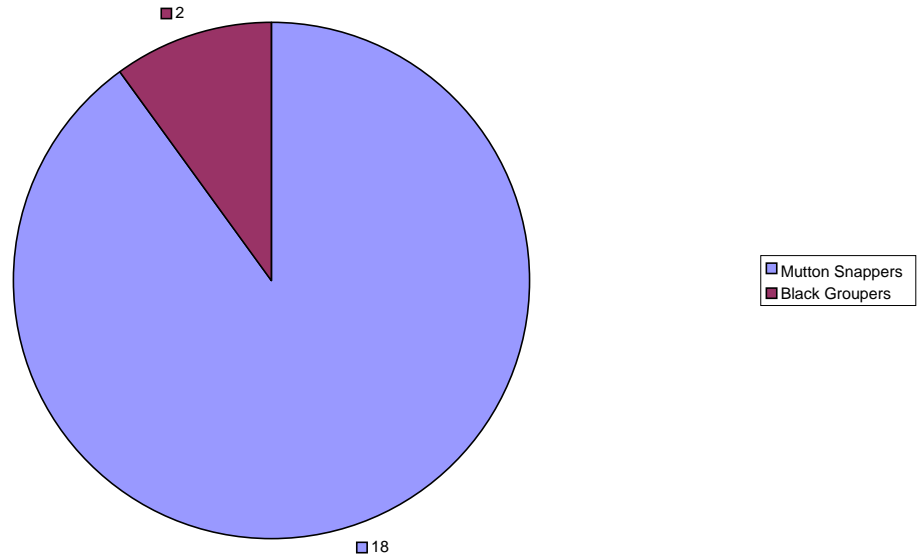
**Graph 2.** Illustrates the amount and sizes of male lobsters found within the conservation zone on the first site.



**Graph 2.** Also shows that of the three different sizes of lobsters studied one carapace length ranged from (235-154mm), One from (175-194mm), and two ranged from (195-214mm).

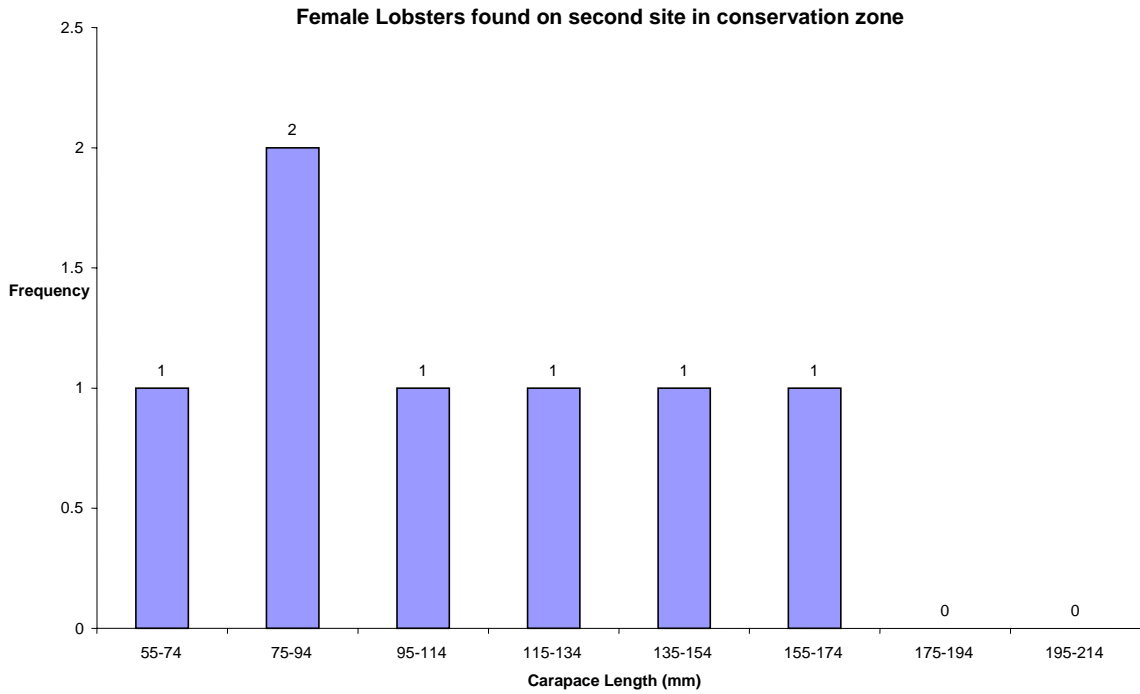
**Chart 1.** Shows the amount and the different fish species seen while conducting the lobster survey on the first site.

**Fish Species Seen On First Site in Conservation Zone**



The chart above illustrates that two different fish species were seen in this lobster survey at the first site. An amount of twenty fish total, which eighteen were Mutton Snappers, and two were Black Grouper.

**Graph 3. Illustrates the amount and sizes of the carapace length of female lobsters studied on the second site of the conservation zone.**

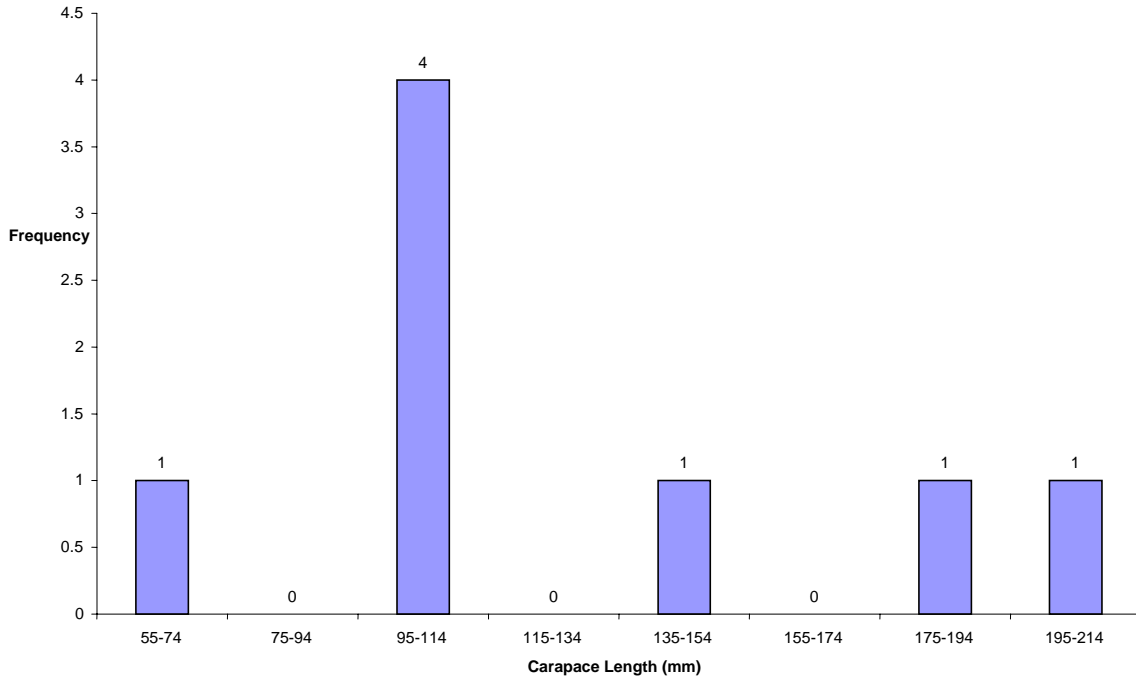


The graph also shows six different sizes of carapace lengths of the lobsters found within the conservation zone of the second sites were ranged in different sizes which are one

from (55-74mm), two range from (75-94mm), one from (95-114mm), one from (115-134mm), one from (135-154mm), and the last ranged from (155-174mm)in carapace length.

**Graph 4. Illustrates the frequency and sizes of male lobsters found within conservation zone on the second site of the survey conducted..**

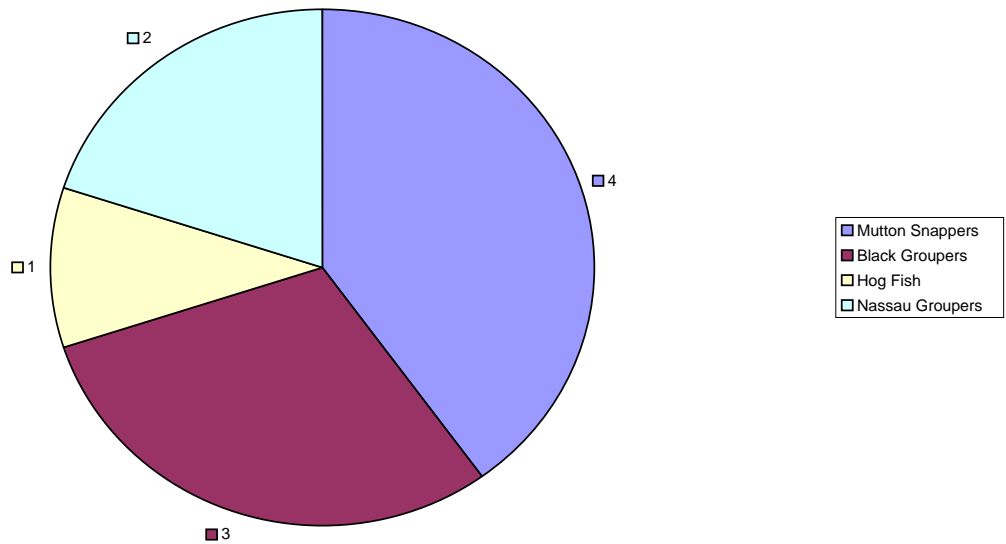
**Male lobsters found on second site in conservation zone**



The graph also shows that five different carapace lengths of lobsters were found within the conservation zone in the second site. One range from (55-74mm), four ranges from (95-114mm), one range from (135-154mm), one from (175-194mm), and the last one ranged from (195-214mm).

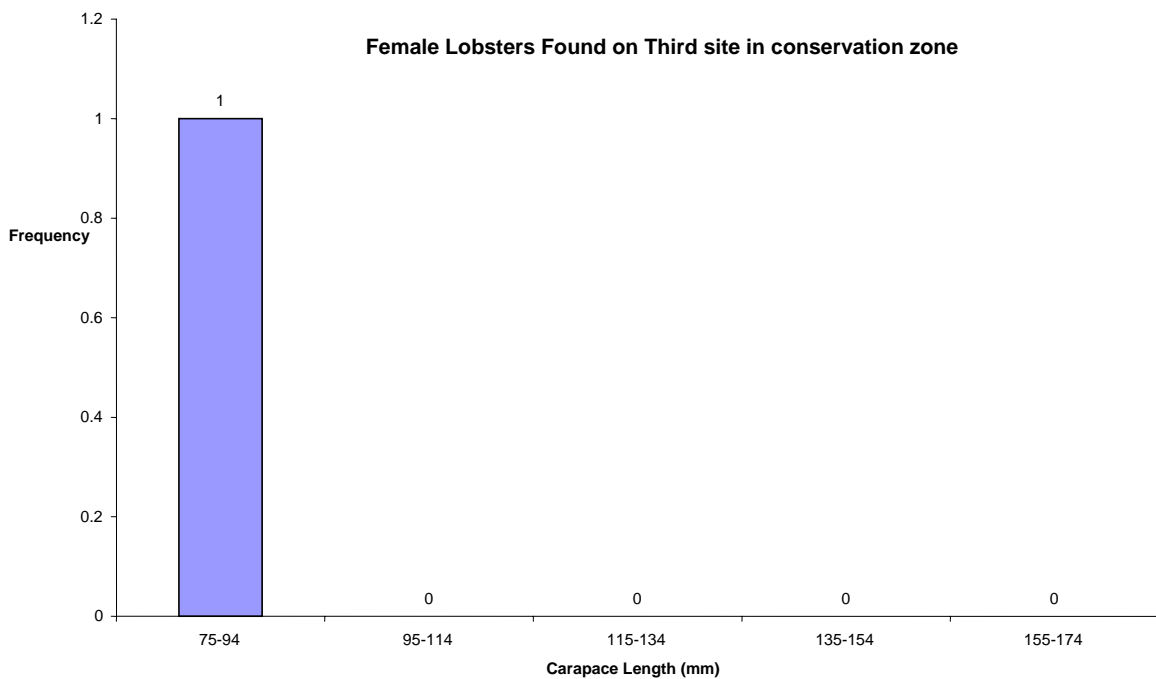
**Chart 2. Illustrates the amount of the different fish species seen while conducting the lobster survey on the second site.**

**Fish Species seen on second site in conservation**



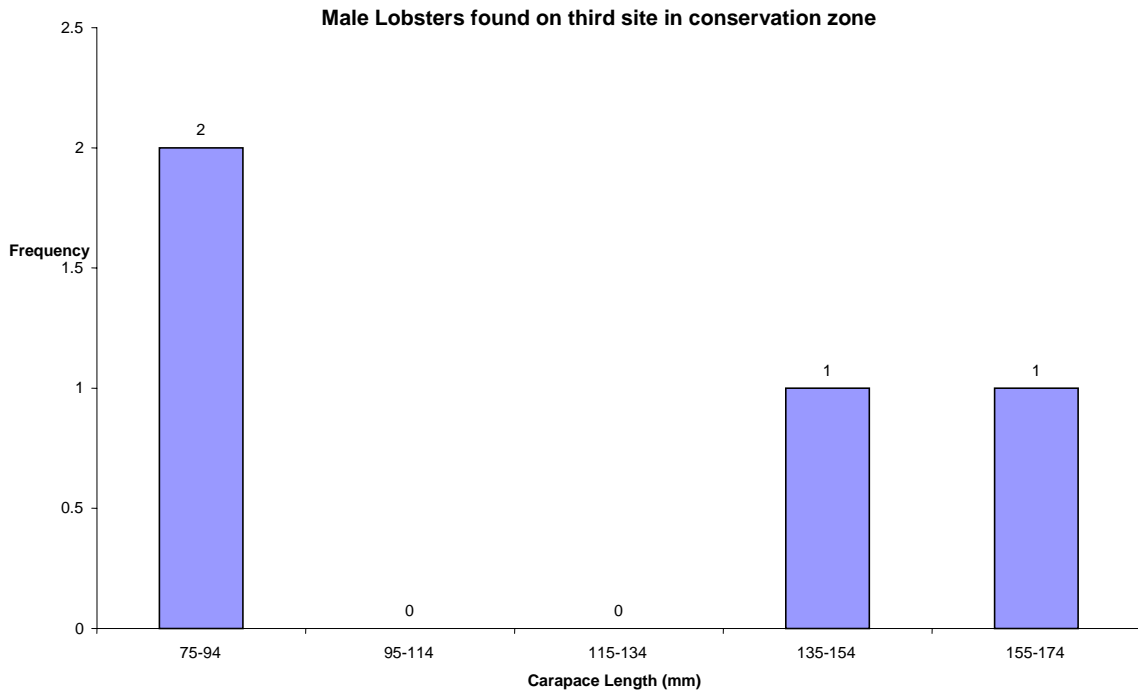
The chart above also shows that four different fish species was seen while conducting the survey. Four Mutton snappers was seen, three Black groupers, one Hog fish, and two Nassau groupers.

**Graph 5. Illustrates the amount and size range of the female lobster found within the conservation zone on the third site.**



Graph 5 also shows that only one lobster was found in the third site with a carapace length ranging from (75-94mm).

**Graph 6. Illustrates the amount and sizes of male lobsters found within conservation zone of the third site.**



The graph also shows that three different sizes of lobsters were studied. Two ranged from (75-94mm), one ranged from (135-154mm), one from (155-174).

**Chart 3. Illustrates the amount and sizes of the different fish species seen while conducting the lobster survey on the third dive in the conservation zone.**

**Fish Species Seen On Third Site in Conservation Zone**

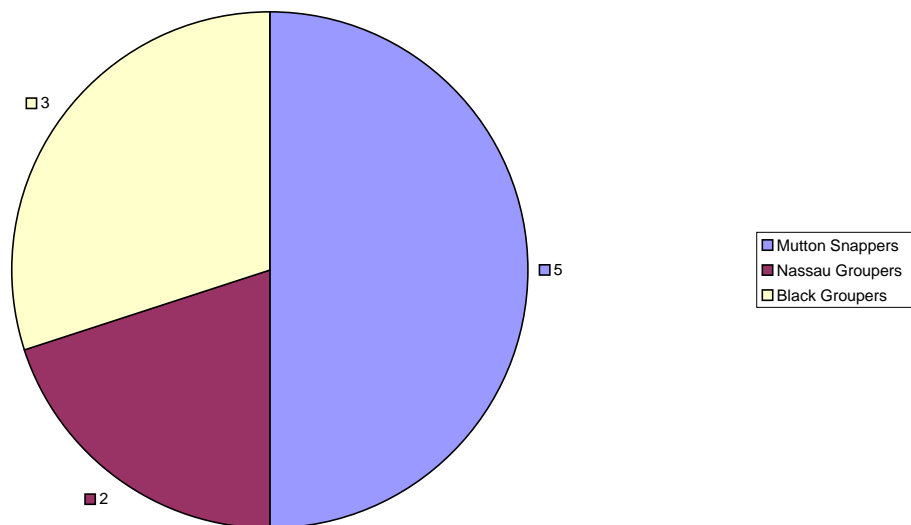
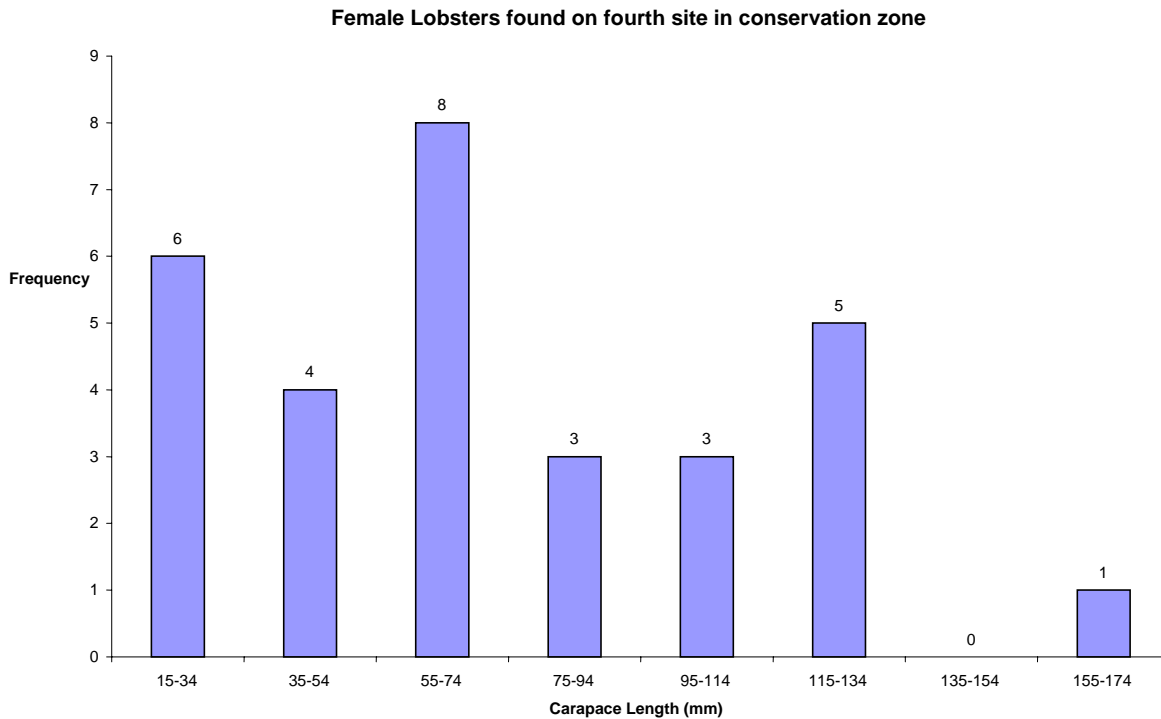


Chart 3 also show three different fish species seen while conducting the lobster survey. The first was the Black groupers which three of them were seen, then five mutton snappers and two Nassau groupers were the last to be seen.

**Graph 7. Illustrates the amount and size range of the carapace length of the lobsters found within the conservation zone of the fourth site.**



Graph 7 also shows that seven different sizes of lobsters were studied during the survey. Six ranged from (15-34mm), four range from (35-54mm), eight range from (55-74mm), three from (75-94mm), three from (95-114mm), five from (115-134mm), and one from (155-174mm).

**Graph 8. Illustrates the amount and sizes of male lobsters found within the conservation zone in the fourth site.**



Graph shows that six different sizes of lobsters were surveyed. Three ranged from (55-74mm), five ranged from (75-94mm), three from (95-114mm), one from (115-134mm), two from (145-154mm), and one from (155-174mm).

**Chart 4. Illustrates the different fish species seen while conducting the lobster survey on the fourth site.**

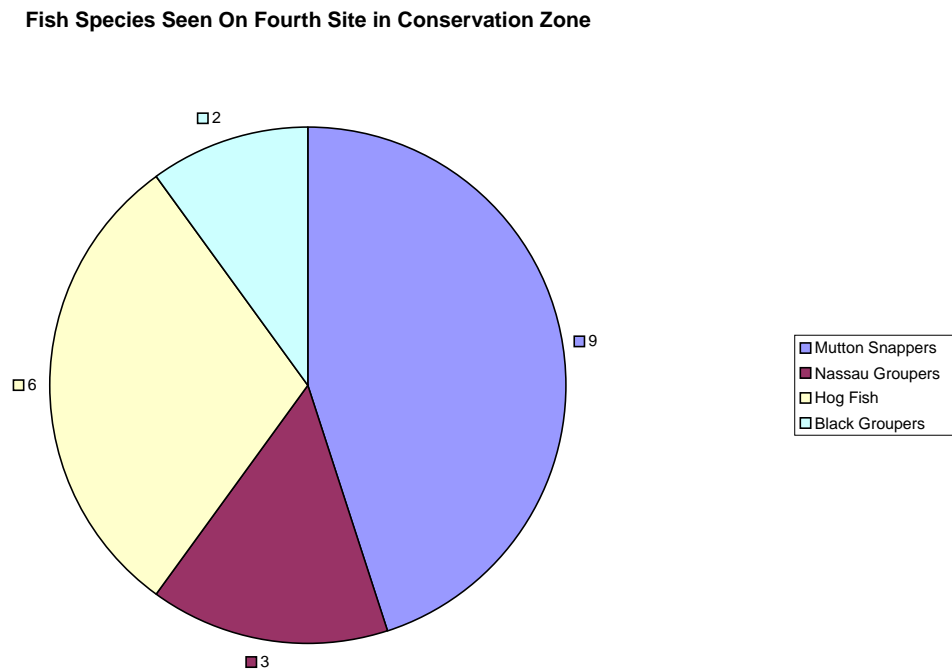
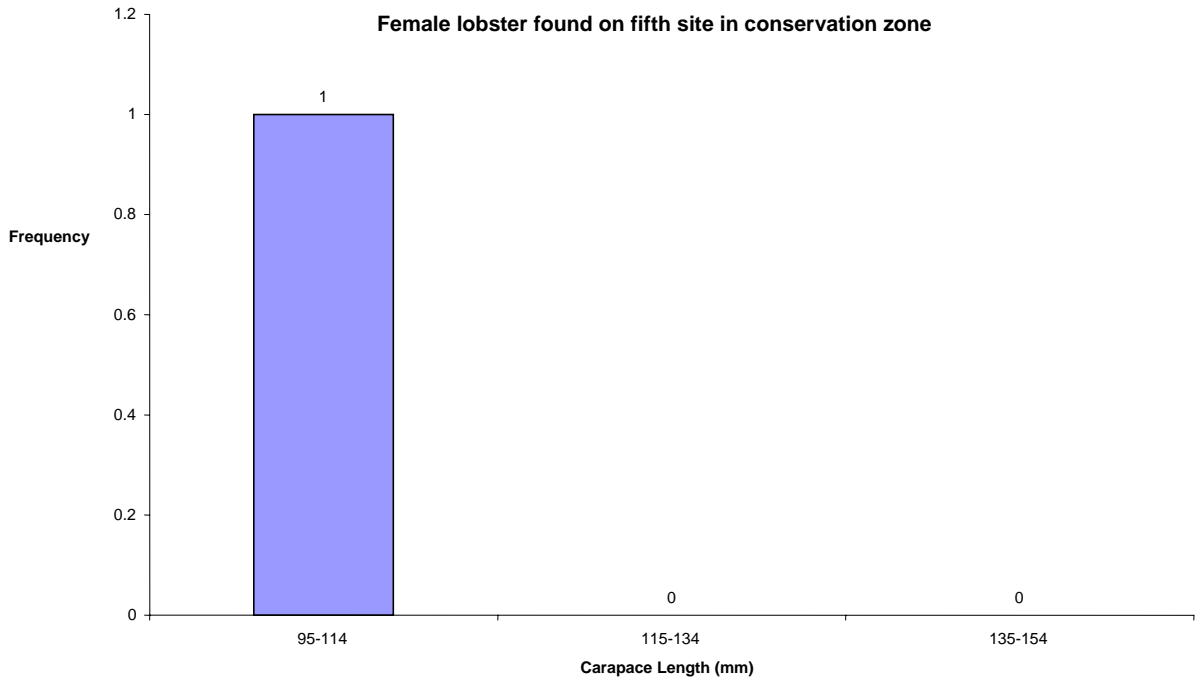


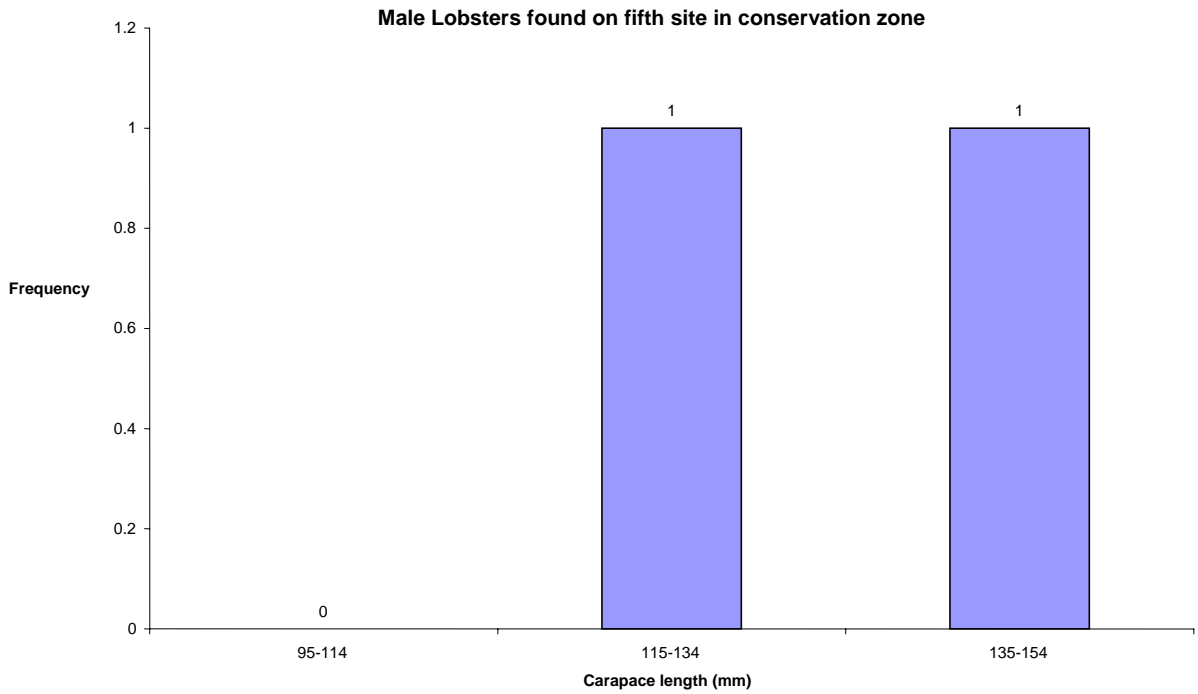
Chart 4 also shows that four different fish species was seen conducting the lobster survey. Two was Black grouper; nine was Mutton snapper, three Nassau grouper, and six hog fish.

**Graph 9. Illustrates the amount and sizes of female lobsters found within the conservation zone on the fifth site.**



Graph 5 also shows that only one female lobster was observed on the fifth site in the conservation zone. This lobster carapace length measurement ranged from (95-114mm).

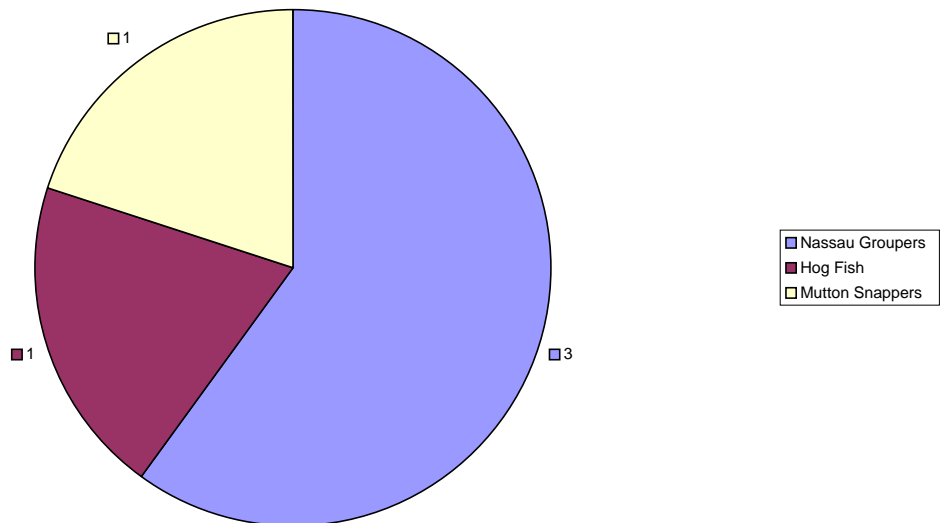
**Graph 10. Illustrates the amount and sizes of male lobsters found in conservation zone of the fifth site.**



Graph 10 also shows that two lobsters were studied as well one ranging from (115-134mm), and one ranging from (135-154mm).

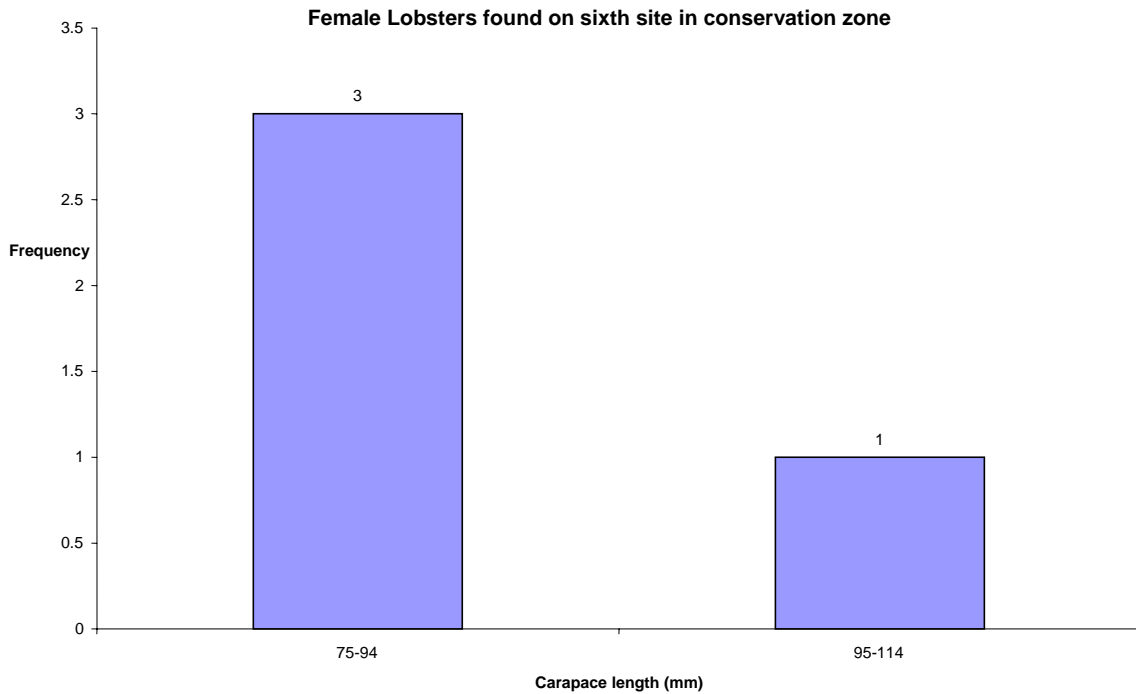
**Chart 5. Shows fish species seen on fifth site in conservation zone.**

**Fish Species Seen On Fifth Site in the Conservation zone**



Graph above shows three fish species seen at fifth site while conducting lobster survey. Three was Nassau groupers, one Hog fish, and one Mutton snapper.

**Graph 11. Illustrates the amount and sizes of female lobsters found in the conservation zone of the sixth site.**



Graph 11 also shows that only four female lobsters were studied in the sixth site. Three which ranged from (75-94mm) and One which range from (95-114mm), no male lobster was observed.

**Chart 6. Illustrates the amount of different fish species seen while conducting the lobster survey on the sixth site.**

**Fish Species Seen On Sixth Site in Conservation zone**

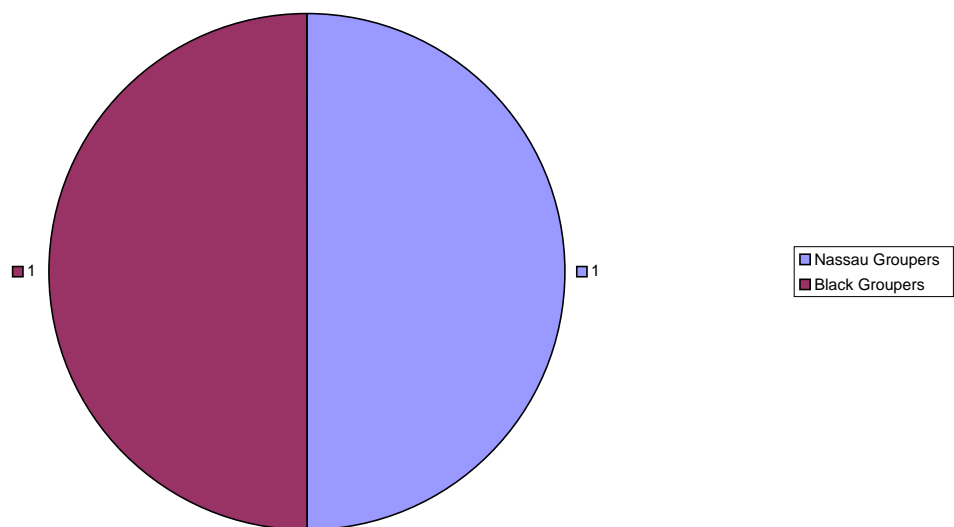
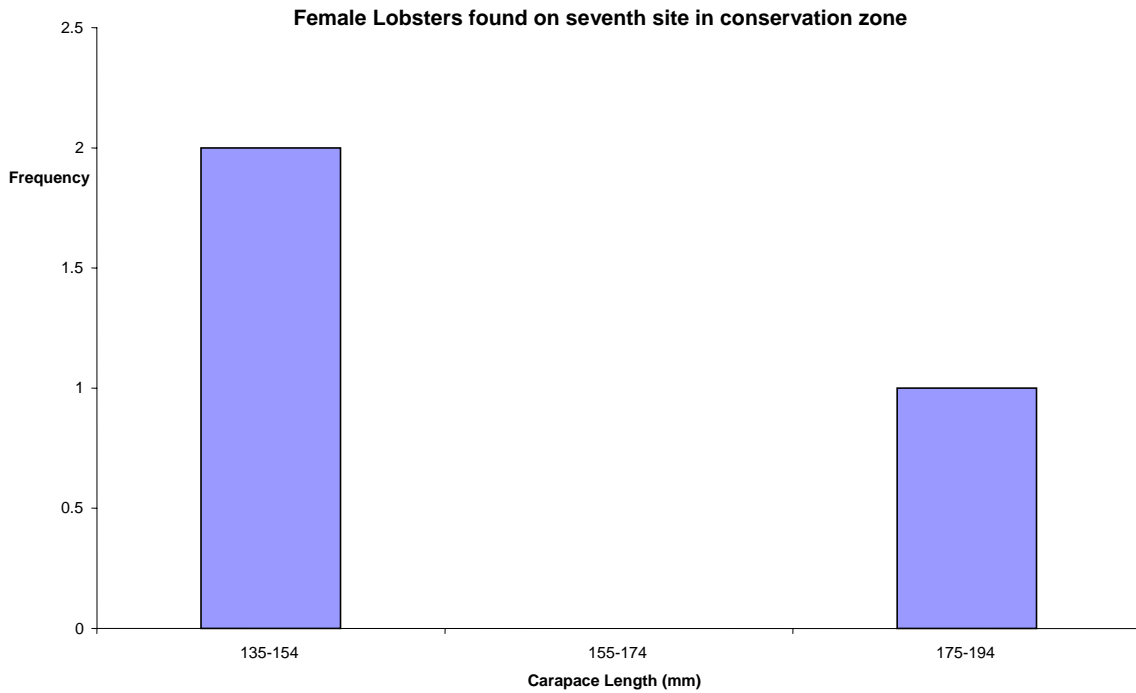


Chart 6 above also shows that two fish species was seen on sixth site while conducting lobster survey. Of this amount one was Nassau Grouper and one was Black Grouper.

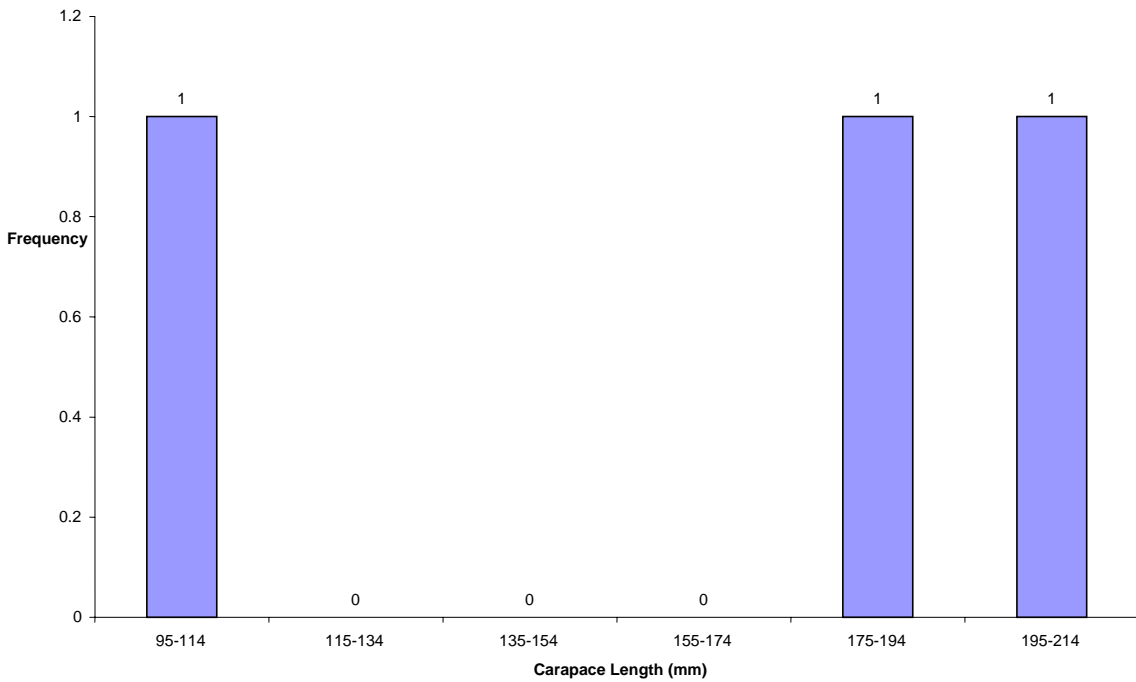
**Graph 12. Illustrates the amount and size range of female lobsters found on seventh site of the conservation zone.**



Graph 12 also shows that two different sizes of lobsters were studied. Two ranging from (135-154mm), and one from (175-194mm).

**Graph 13. Illustrates the amount and size range of lobsters studied while conducting the lobster survey in the seventh sit of the conservation zone.**

**Male Lobsters found on seventh site in conservation zone**



Graph 13 also shows that three lobsters were studied. One ranging from (95-114mm), one from (175-194, and one from (195-214mm).

**Chart 7. Shows fish species seen on seventh site in conservation zone.**

**Fish Species Seen on seventh site in Conservation Zone**

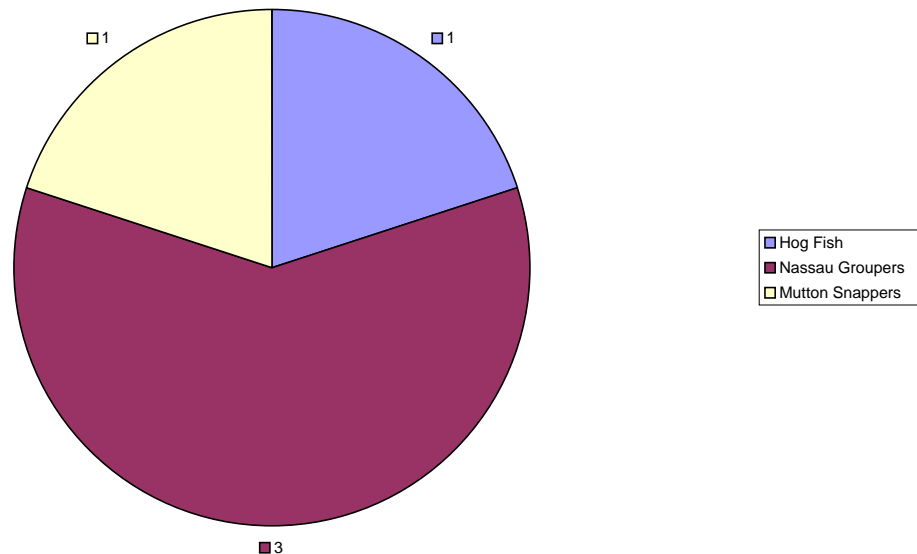
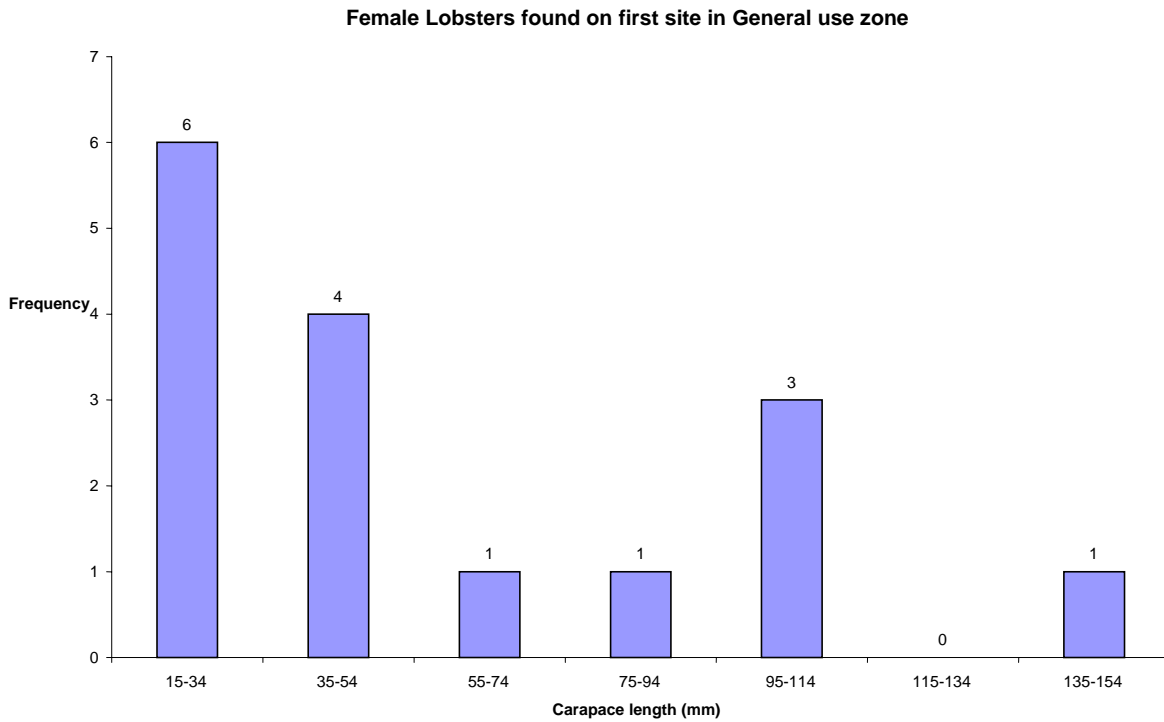


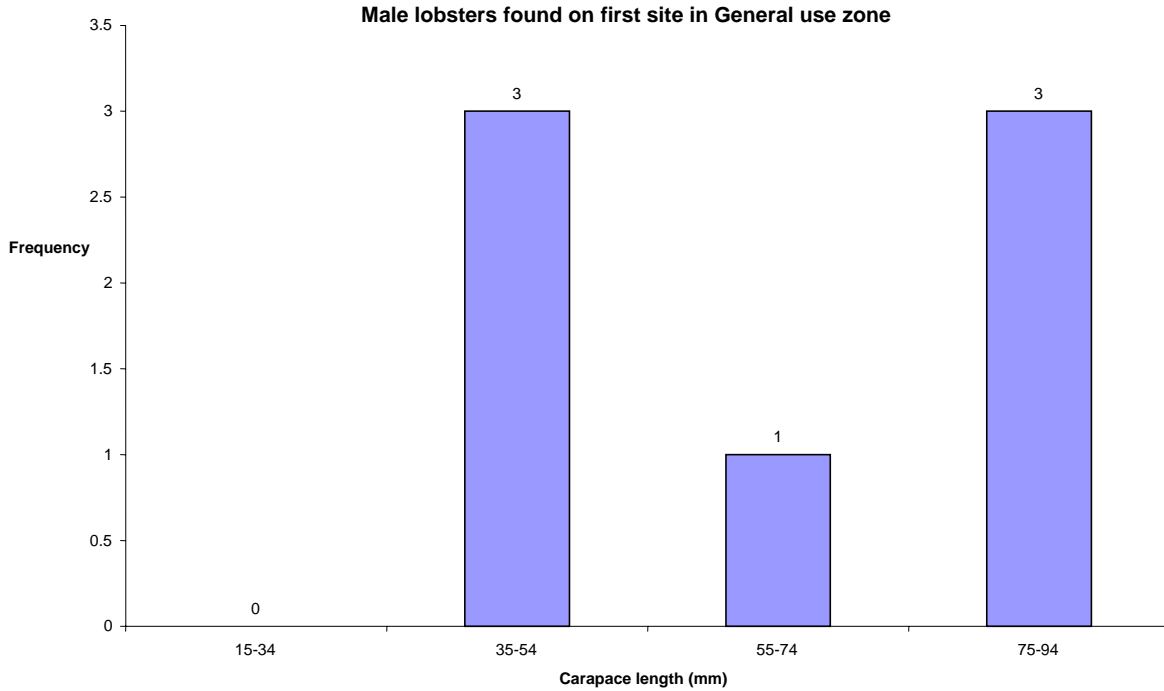
Chart above also shows three fish species was seen while conducting lobster survey on the seventh site. Of this amount one was Hog fish, three was Nassau Groupers and one Mutton Snapper.

**Graph 14. Illustrates the amount and size range of lobsters studied in the general use zone on the first site.**



Graph 14 also shows that six different size ranges of lobsters were seen while conducting the survey. Six ranged from (15-34mm), four from (35-54mm), one from (55-74mm), one from (75-94mm), three from (95-114mm), and one from (135-154mm).

**Graph 15. Illustrates amount and sizes of male lobsters found within the General use zone of the first site.**



Graph 15 also shows that three different sizes of lobsters were studied. Three which range from (35-54mm), one from (55-74), and three from (75-94mm).

**Chart 8. Shows fish species seen on first site in General use zone.**  
Fish species seen on first site in general use zone.

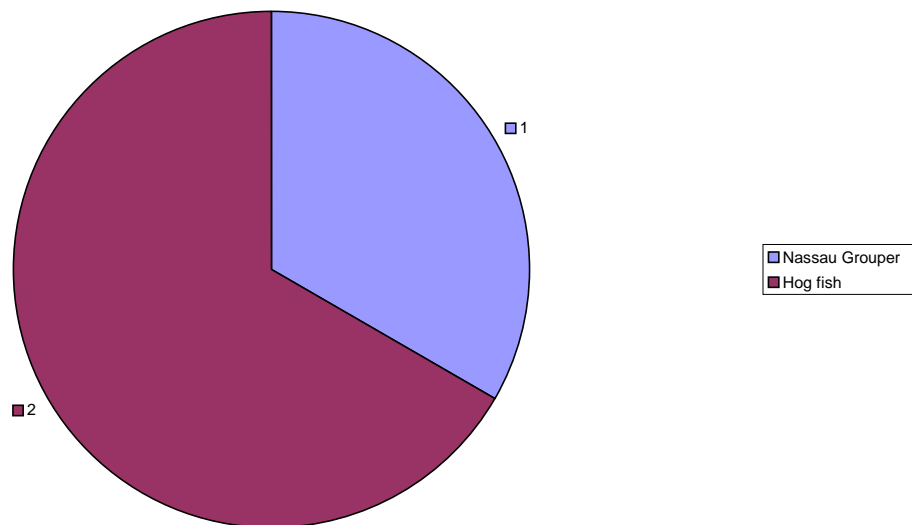


Chart above also shows two fish species seen on first site in the General use zone. Of this amount one was Nassau Grouper and the other fish seen was two Hog fish.

**Graph 16. illustrates the amount and sizes of female lobsters found within the general use zone on the second site.**



Graph 16 also shows that only three female lobsters were studied during the survey on the first site in the general use zone. One range from (35-54mm), one from (55-74mm), and one from (115-134mm).

**Chart 9. Shows fish species seen on second site in general use zone.**

Fish species seen while conducting the survey on the second site in the general use zone.

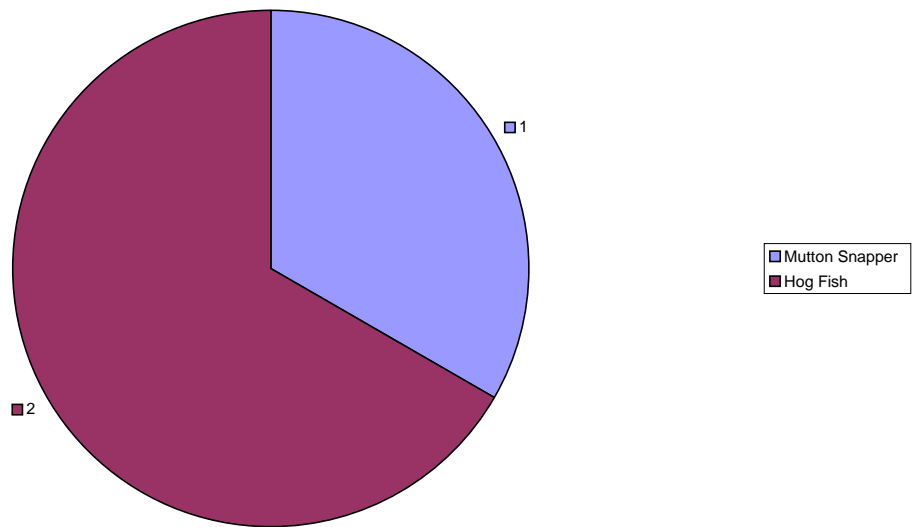
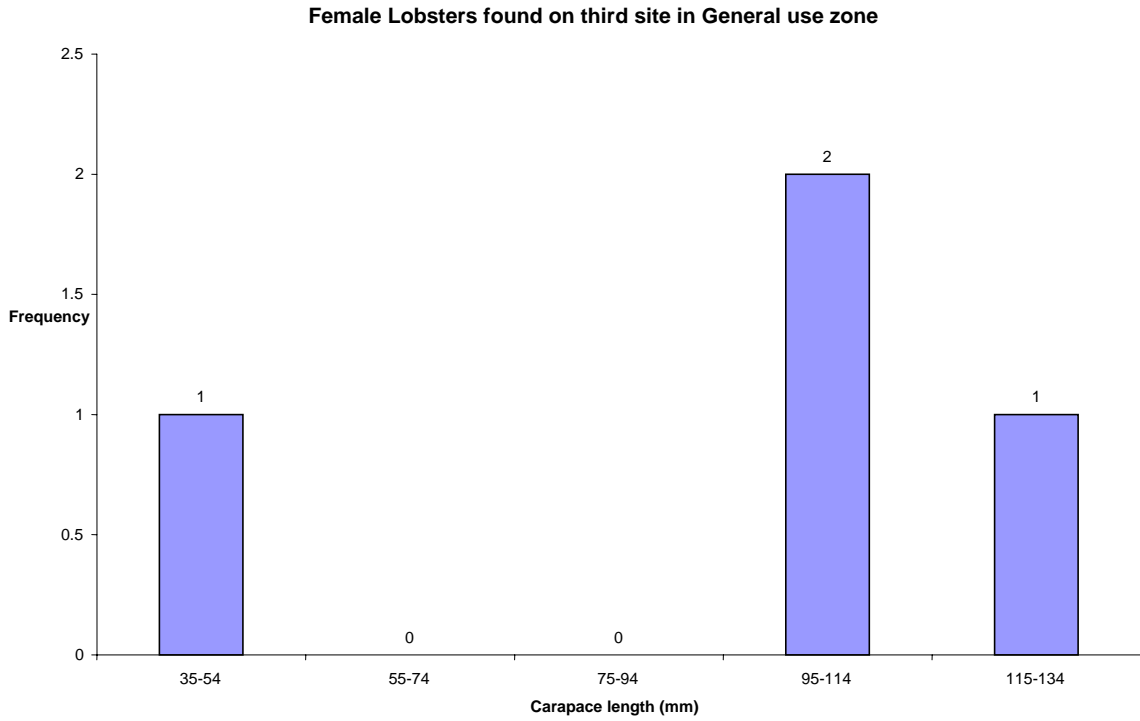


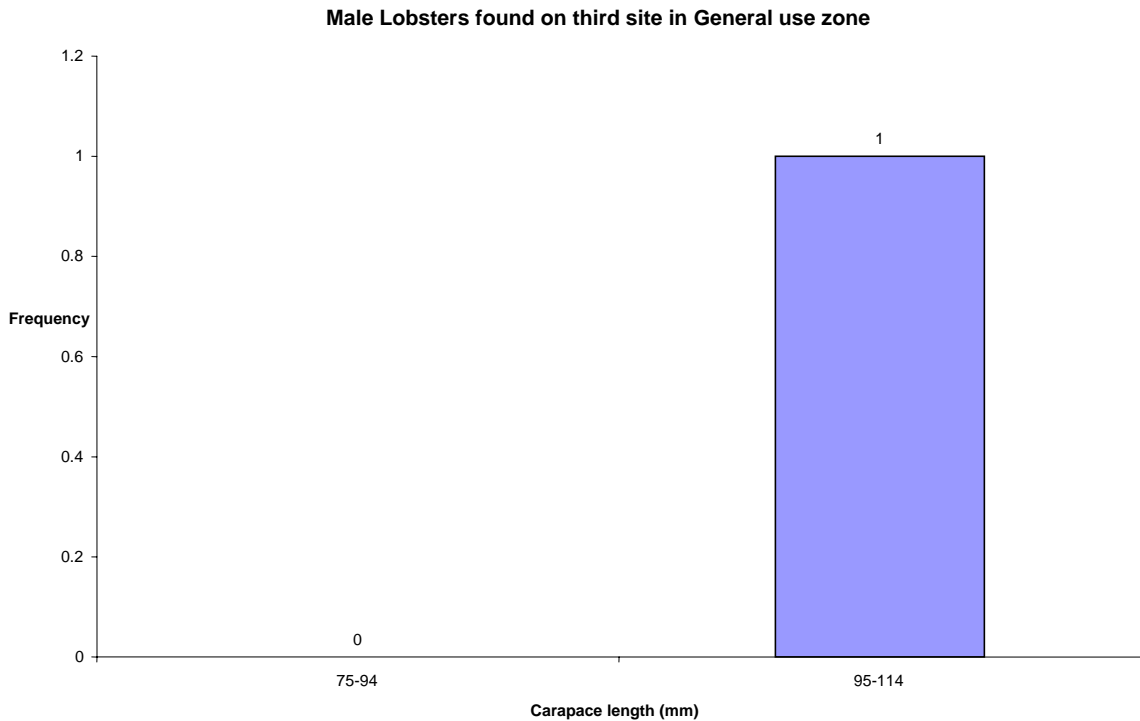
Chart above shows two fish species were seen at the second site while conducting lobster survey, at a total of three fish. One was Mutton snapper and the other was two Hog Fish.

**Graph 17. Illustrates the amount and size range of lobsters in the general use zone on the third site.**



Graph 17 also shows that three different sizes of lobsters were studied. One that ranged from (35-54mm), two from (95-114mm), and one from (115-134mm).

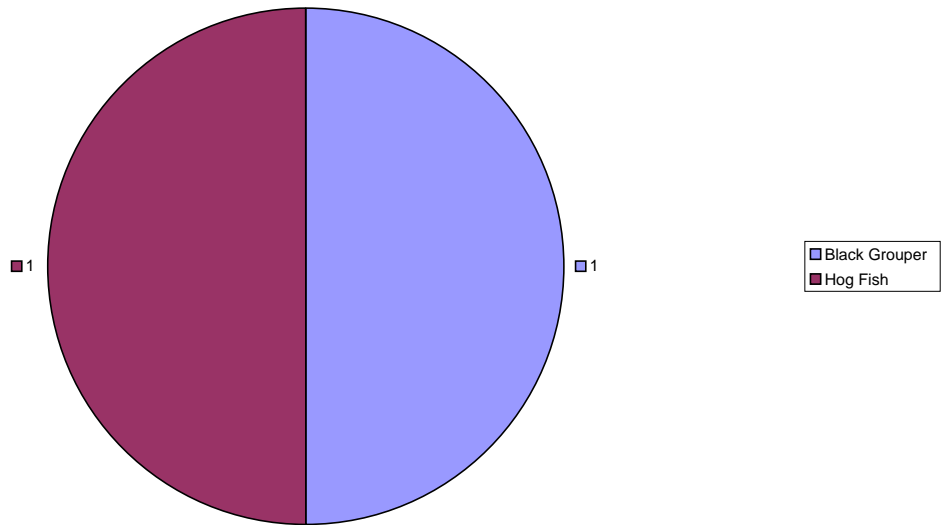
**Graph 18. Illustrates amount and sizes of male lobsters found within general use zone on the third site.**



Graph 18 also shows that only one male lobster was seen and measured on the third site, ranging from (95-114mm).

**Chart 10. Illustrates the fish species seen while conducting the lobster survey on the third site of the general use zone.**

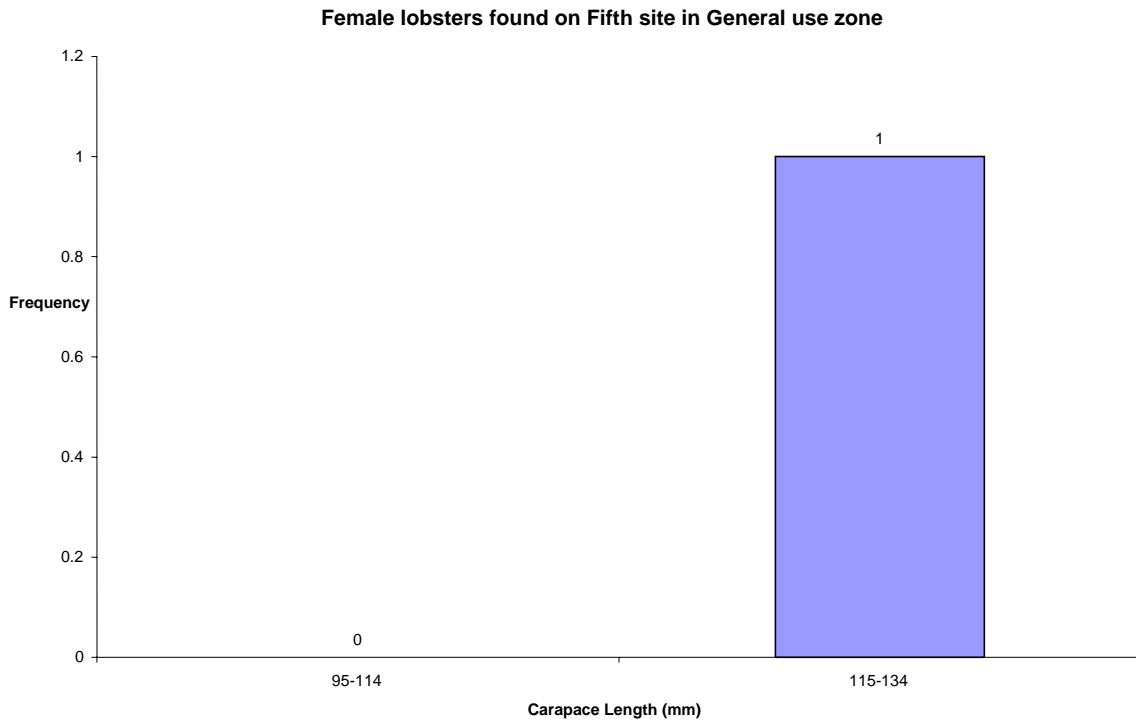
Fish species seen on third site of the general use zone



The chart above shows that two fish species were seen while conducting lobster survey. Of this amount one was Black Grouper, and the other was a Hog fish.

**N.B. On fourth site in General use zone only one Mutton Snappers was observed. No lobsters was seen in this site as well, so the survey continued on the fifth site.**

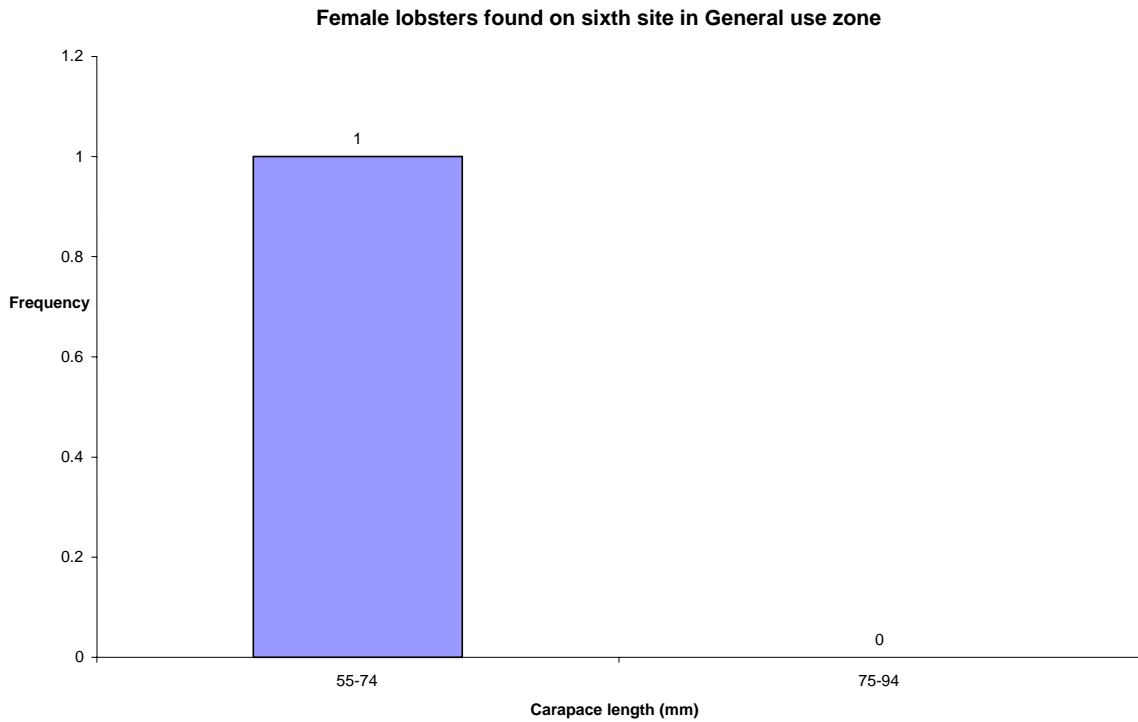
**Graph 19. Illustrates the amount and size of female lobster found in the general use zone on the fifth site.**



Graph 19 also shows that only one lobster was observed on the survey of the fifth site, which carapace length size ranged from (115-134mm).

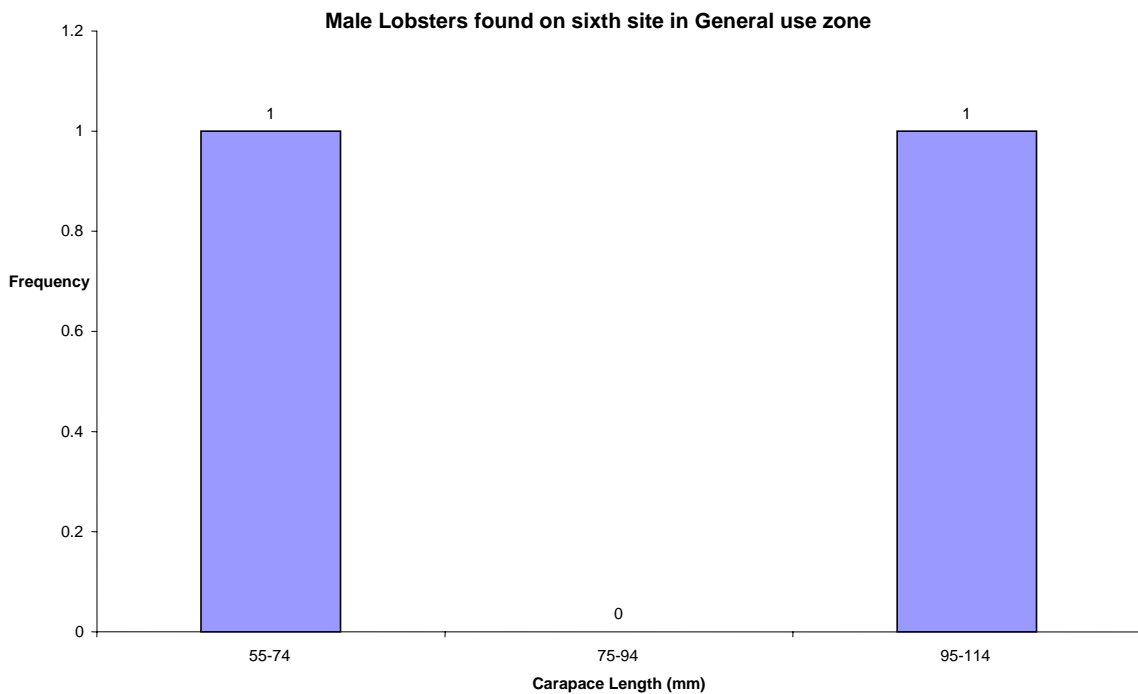
**N.B. On this fifth site no male lobsters seen. For fish species only two Mutton Snappers was observed.**

**Graph 20. Illustrates the amount and size range of the carapace length of female lobster found on the sixth site of the general use zone.**



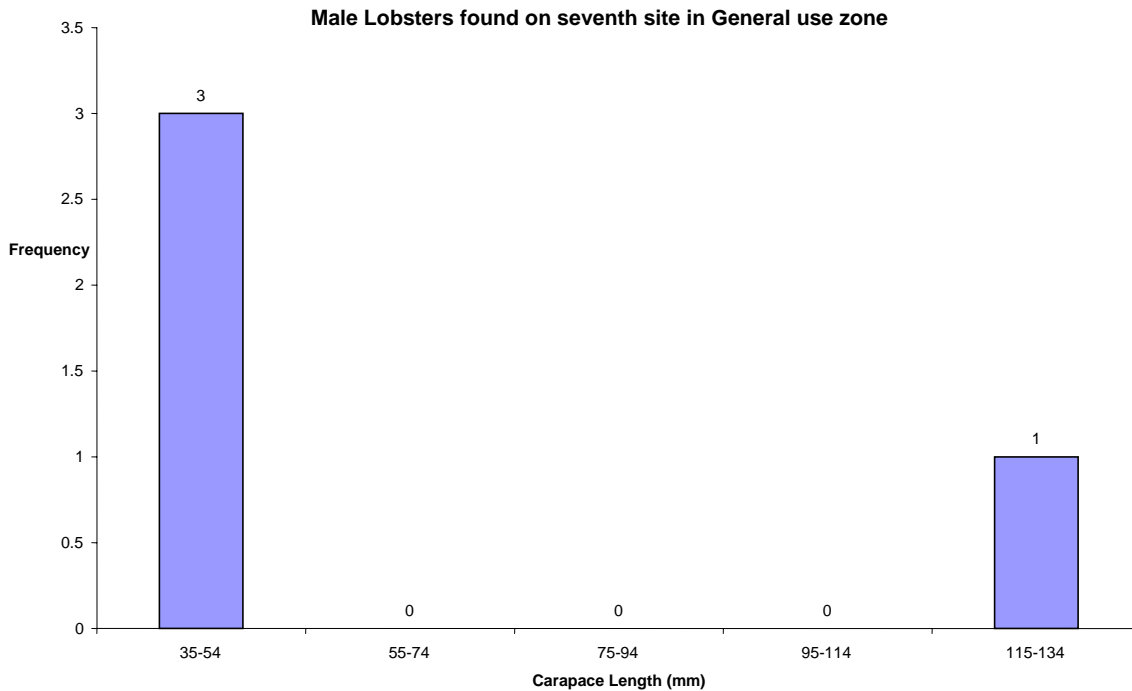
Graph 20 also shows that only one female lobster was studied. Its carapace length ranged from (55-74mm).

**Graph 21. Illustrates the amount and size of male lobsters found on the sixth site of the general use zone.**



Graph 21 also shows that two lobsters were studied. One ranging from (55-74mm) and the ranging from (95-114mm).

**Graph 22. Illustrates the amount and sizes of lobsters found on the seventh site of the general use zone.**



Graph 22 also shows that two lobsters were studied three ranged from (35-54), and one from (115-134mm).

**N.B. On the seventh site of the general use zone it also shows that no female lobster was observed and that only one fish species was seen which is the mutton snapper.**

### *Results*

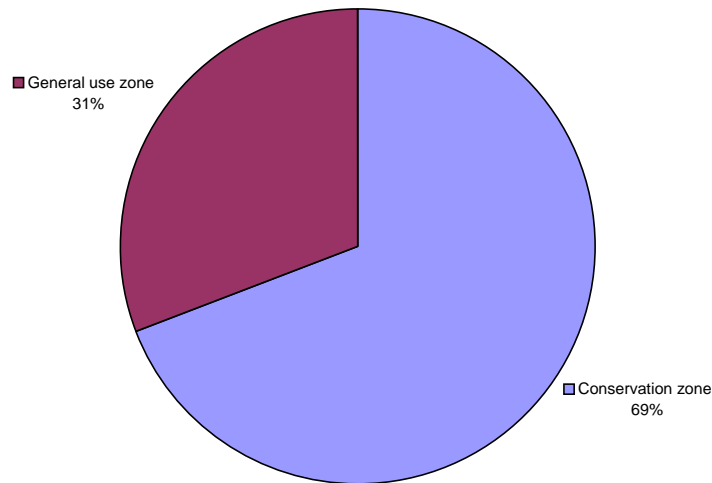
A total of one hundred and twenty seven lobsters were found on this survey. Fourteen sites which are patches reefs are studied. Of the fourteen sites seven are in conservation zone and seven in the general use zone. A total amount of eighty eight lobsters were found and studied in the conservation zone while in the general use zone thirty nine was observed.

In the conservation zone a total of fifty two female lobsters were found where its size range from 15mm to 214mm. Of these females four was found with eggs. On the other hand there were thirty six male lobsters sampled ranging from 55mm to 214mm.

Within the general use zone a total of twenty five female lobsters were sampled, these females ranged from 15mm to 134mm. Then fourteen male lobsters was found in the general use zone that range from 35mm to 134mm.

### *Conclusion*

Percentage of lobsters found in conservation zone and in the general use zone



The survey showed that of the one hundred and twenty seven lobster samples found, forty two were of illegal size and eighty five of legal size. In addition this survey observes almost the same amount of the illegal size lobsters in the general use zone and conservation zone. Hence there is more mature, reproductive lobster protected in the conservation zone that could add to the population, which amounted to sixty eight than in the general use zone that had only sixteen mature lobsters. The chart above illustrates that sixty nine percent of the lobsters were found in the conservation zone and thirty one percent was found in the general use zone. Therefore the conservation zone is contributing in a big way to the livelihood of the lobster population out at Glover's Reef especially with the great effort of enforcement place to stop a lot of intruders into the conservation zone even at night.

### 3.4 MBRS- Synoptic Monitoring Program

On May the 14<sup>th</sup> to the 16<sup>th</sup> the mbrs coral and adult fish survey were carried out at specific sites in the marine reserve. The team included Glover's reef staff, Mr. Cantun, Mr. Carballo, Mr. Novelo, and Mr. Martinez as well as some assistance from the biologist from South water caye reserve.

A total of four sites were studied; two fore reef and two back reef sites. In regards to the adult fish survey, at each site two thirty meters transect tapes was used to eight transect lines parallel to the reef crest and were laid approximately five meters apart from each other along the corals and from the list of fish species their abundance and size was noted.

In addition for the corals survey both point intercept and benthic data were collected using thirty meters transect lines. The point intercept data include marking the transect tape at every twenty five centimeter point. A total of five transect were laid out and the substrate under each twenty five centimeter was recorded. Using the same transect lines the benthic data was collected by recording each hard coral found that were less than ten centimeter in diameter. For this a total of fifty different species of corals is to be collected

per site for the benthic data and once this number is met no more is documented. All data recorded is been entered in the mbrs programming system.

### **3.5 Turtle Monitoring**

Up to date concerning the nesting of turtles in the nesting beaches of the reserves cayes one hawksbill turtle have nested so far at the manta beach. It was noted strange to some port authority workers who witness the laying of the eggs that this particular turtle have chosen a very bizarre place to lay its eggs. When the staff arrives at the spot the individual took us and showed us the site which was in the sand and gravel used for infrastructure of the resort.

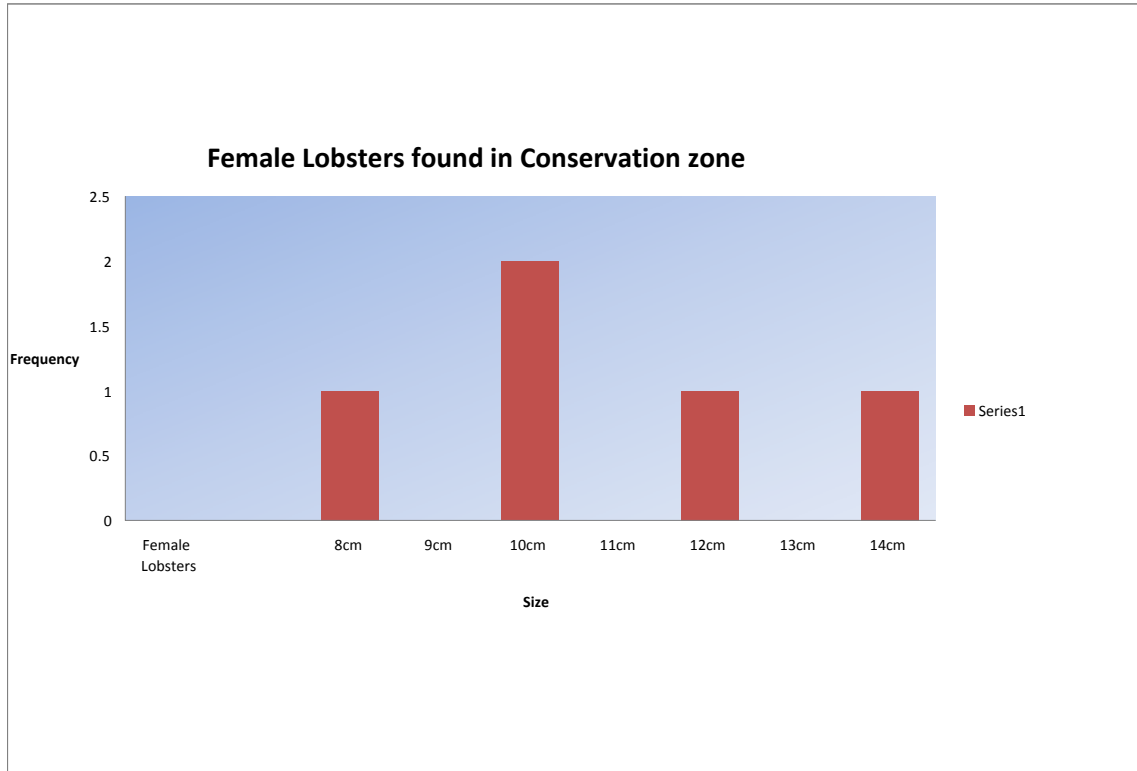
To prove that the eggs were laid at the site it was dogged up until observation of eggs was seen then the site was marked off so it can be easy to locate afterwards. The date that the hatching took place was taken down which was on the 17<sup>th</sup> of May. Further monitoring of the site will continue until around due date of hatching which should be around the 13<sup>th</sup> to the 22<sup>nd</sup> of July 2008.

### **3.6 Lamp Survey**

LAMP survey for the month of May 2008 was conducted from the 9<sup>th</sup> to the 15<sup>th</sup>. The team was consisted of six individuals who were Virginia, Robin, Elias, Tyron, Marvin and Samuel from SWCMR who was here assisting the reserve staff on the MBRS survey. The protocol used in this survey involved two different methods, one which is by having transect lines laid both on sea grass and sand flats areas and record the number of conch found within a two meter range span which should be done on either side of the line transect. The other method involves pure snorkeling, which the individuals swim around the patch reefs and record data of specific marine species such as conch, lobsters, and some commercial fish species as well.

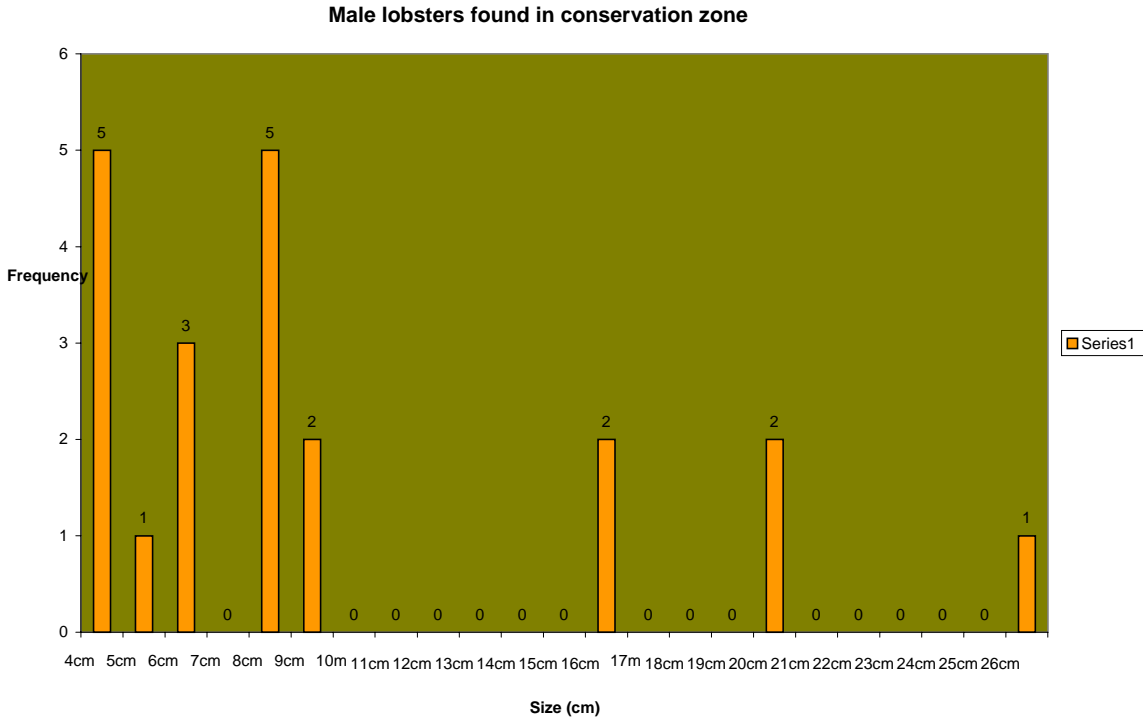
For all lobster data collected a tickle stick is used to get a more accurate measurement on their carapace length. As for fish and estimate on their sizes is noted in centimeter. For conch it should be observed carefully for the presence of any eggs. The measurements collected on conch are their shell length, shell width and lip thickness. For this survey a total of thirty three sites is surveyed, fourteen in the conservation zone and nineteen in the general use zone. The data collected is showed in the graphs below.

#### **Graph 1. Illustrates female lobsters found in Conservation zone**



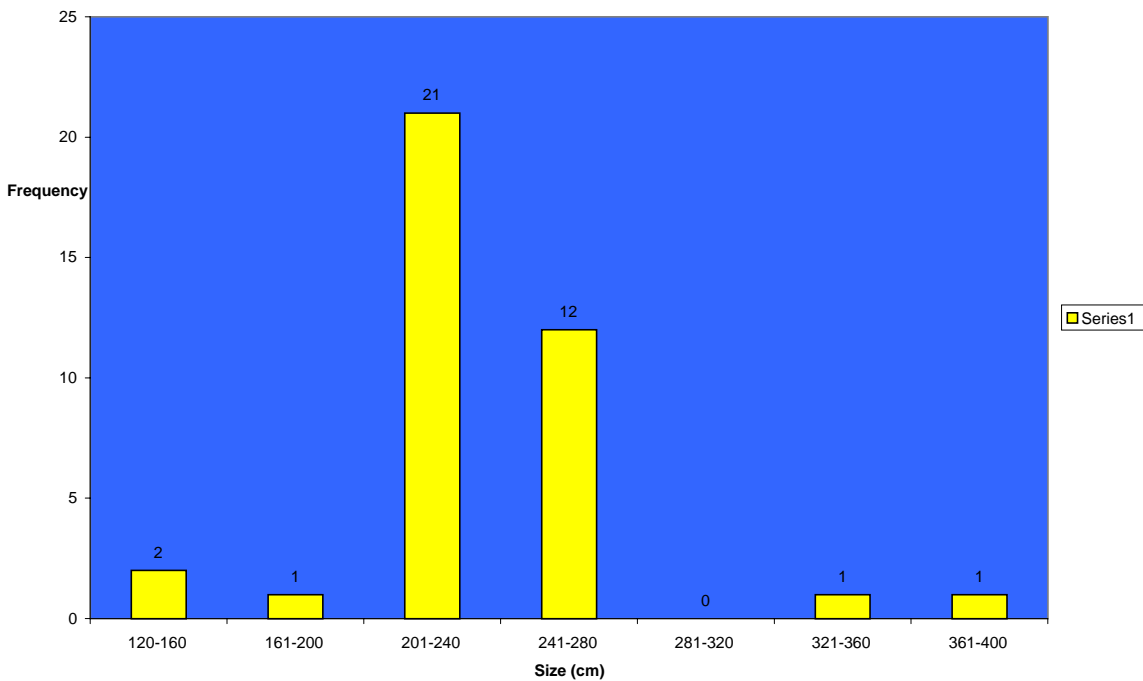
The Graph above shows the amount of female lobsters that were found while conducting the LAMP survey. It also illustrates the frequency of the lobsters which range from zero to two point five centimeters. At the bottom of the graph the size is shown which eight (cm) was the smallest lobster found and fourteen (cm) which was the largest lobster found all of legal size.

**Graph 2. Illustrates male lobsters found in Conservation zone.**



The graph above shows the amount and size of male lobsters observed while conducting the LAMP survey. It shows that eight different sizes of lobsters were studied.

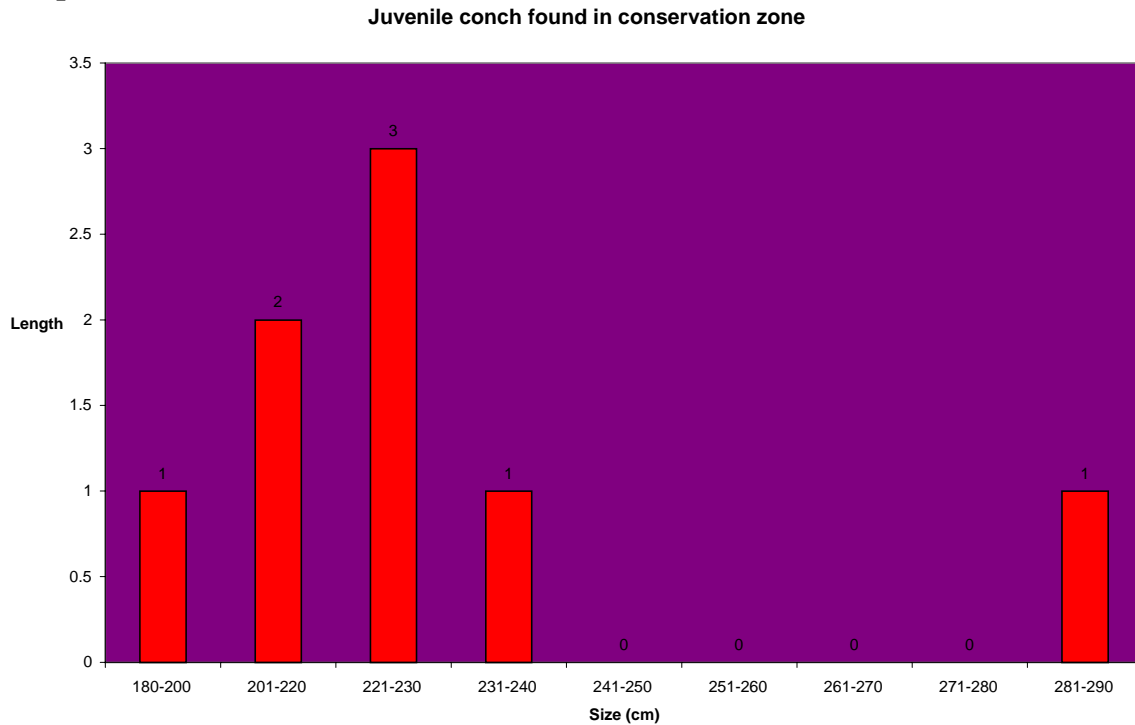
**Graph 3. Illustrates adult conch found in conservation zone.**  
**Adult conch found in conservation zone**



The graph above shows the size and amount of adult conch that was seen during the LAMP survey. The highest amount that was seen was twenty one and the lowest amount

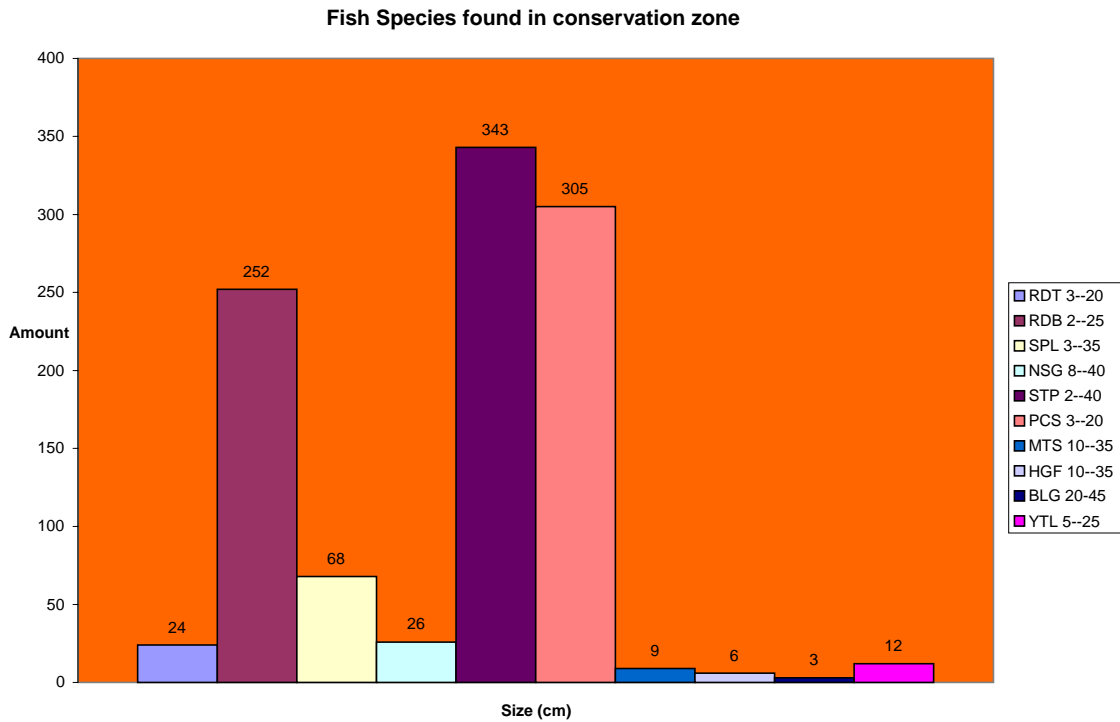
was one and they ranged from one hundred and twenty (cm) to four hundred (cm) in shell length.

**Graph 4. Illustrates Juvenile conchs found in the conservation zone.**



The graph above shows the amount and different sizes of juvenile conch that was observed while conducting the LAMP survey. For this survey eight juvenile conchs was seen in the conservation zone and they range from one hundred and eighty to two ninety in shell length.

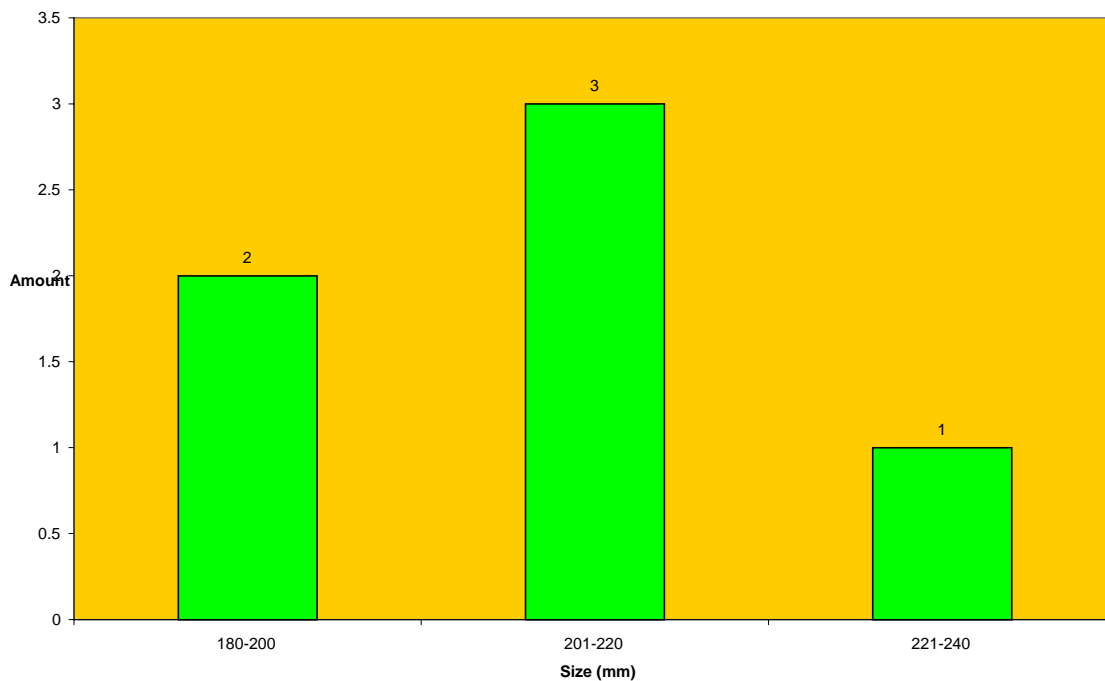
**Graph 5. Shows the fish species seen in the conservation zone.**



The graph also illustrates the different fish species seen while conducting the LAMP survey. Ten different species was studied which was Red tail parrots fish, Red band parrotfish, Stoplight parrotfish, Nassau groupers, Stripe parrotfish, Princess parrotfish, Hog fish, Mutton snappers, Black groupers and Yellowtail parrotfish.

**Graph 6. Illustrates Adult conch found in general use zone.**

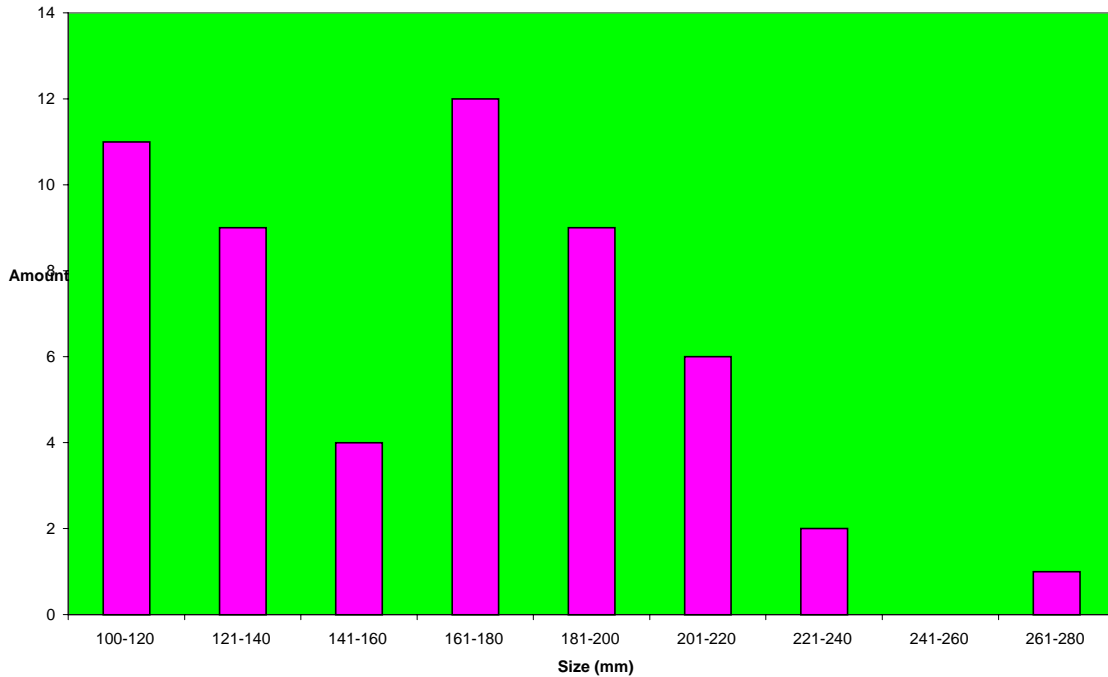
**Adult conch found in general use zone**



The graph above shows the amount and sizes of adult conch found while conducting the LAMP survey. Two conch range in between (180-200mm), three from (201-220mm), and one from (221-240mm).

**Graph 7. Illustrates Juvenile conch found in general use zone.**

Juvenile conch found in general use zone



The graph above shows that eight different sizes of conch were studied. Eleven that range from (100-120mm)

### 3.7 Mutton Snappers Aggregation

For the mutton snappers survey the first dive was conducted the first day the rest of the team arrived who were Mito Paz and Marciano the ones that were going to head the reef check training for some fishermen and assisting in trying to locate the aggregation site as well. Unfortunately the site was not located again and this time a full team was form who was the full reserve staff as well as couple staff and some fishermen as well were participating in this survey. On the first dive one of the guys from San Pedro said he saw about two hundred mutton snappers but we search for them again and no snappers were seen.

The search for the mutton snappers lasted from the 19<sup>th</sup> to the 22<sup>nd</sup> of the month and the dives depth range from about 80ft to about 120ft. During this survey other fish species were observed grouping as well but no signs of spawning. These species were about eighty Horse eye jacks, eight Black groupers, and some chubs and triggerfish but not in big groups. All dives were conducted in the latter part of the evening.

### 3.8 Lobster Survey

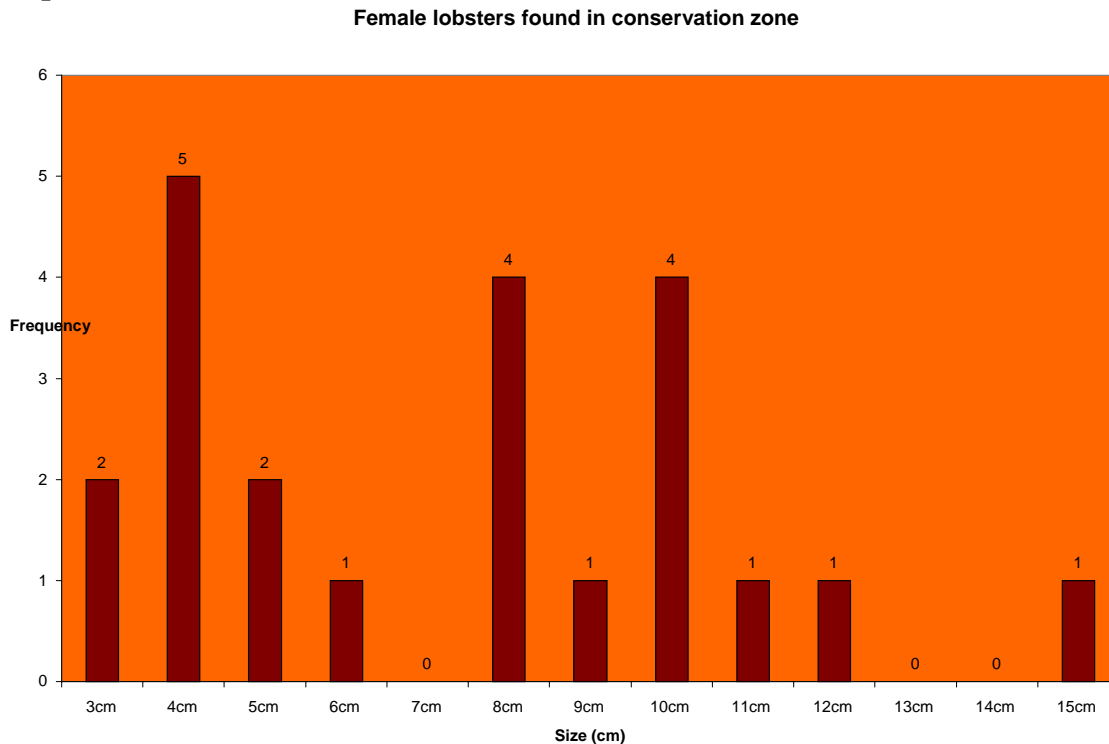
The lobster survey was conducted from the 21<sup>st</sup> to the 23 of June 2008 by Mr. Cantun, Mr. Carballo, Mr. Novelo and Mr. Martinez. In this survey a total of fourteen patch reefs site were studied. Of the fourteen patches seven were situated in the conservation zone where there is no extraction by law and another seven more sites in the general use zone which has been designated for commercial use.

At each patch reef sites an average time of one hour was spent conducting these surveys. A total amount of ninety eight lobsters were studied. Also in this survey some commercial fish species such as the Black groupers, Nassau groupers, Hog fish, and Mutton snappers were studied and their sizes were estimated as well.

### Method

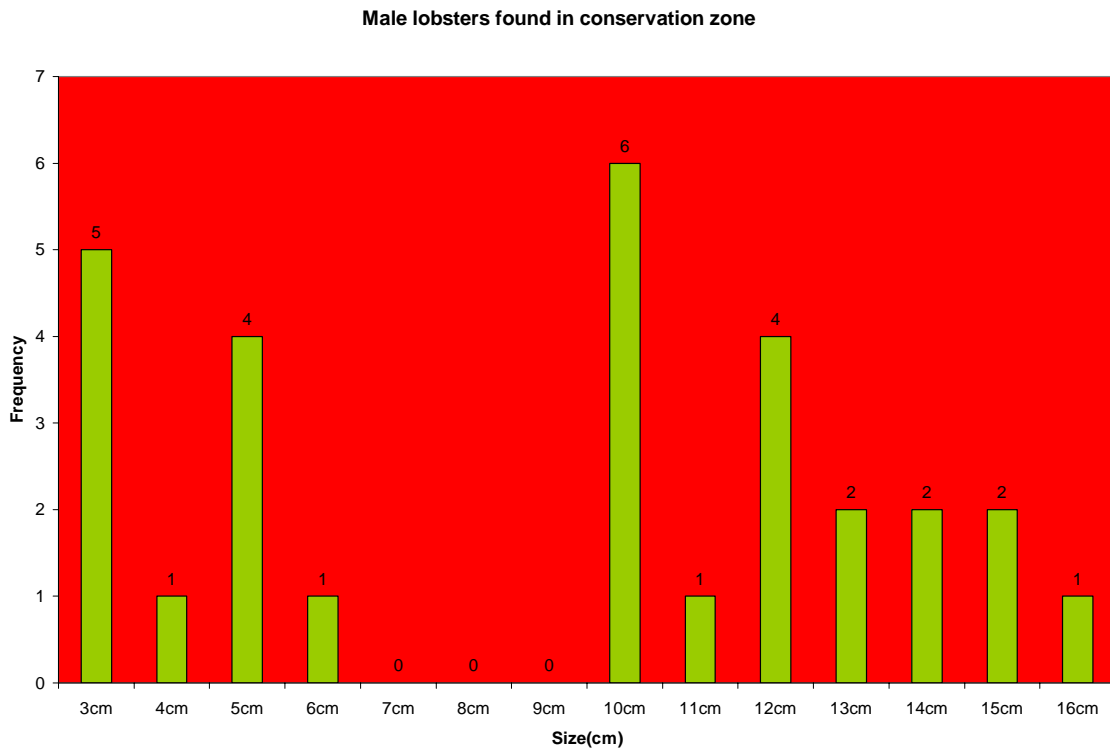
The survey was done following the Field Protocol for Monitoring Coral Reef Fisheries Resources in Belize 2003 edition. While carrying out this survey some parameters were conducted. The temperature at each site was about 26.5 degrees celsius. And the visibility was about 50 meters. The survey was carried out by swimming in a cross pattern across the whole reef structure (2003 edition), and all rock crevices were searched to find the lobsters. An average of one hour was spent at each site; this depended on the amount of lobsters found. When found all lobsters were measures for their size, sex, and checked for egg masses, without capturing the animal if possible. The size length was measured by placing a marked tickle stick over the dorsal surface of the carapace and it was measured to the nearest (cm). The sex was determined by, the adult male having their third pair of walking legs much longer than all the other legs, while the female have some frilly swimmerets under their abdomen, which under the ventral side they sometimes carry an egg mass that are sometimes visible.

**Graph 1. Female lobsters found in conservation zone.**



The graph above illustrates the amount and size of twenty two female lobsters, of which two was measured at 3cm five was measured at 4cm, two measured 5cm, one measured 6cm, four measured 8cm, one measured 9cm, four measured 10cm, one at 11cm, one at 12cm, and one 15cm.

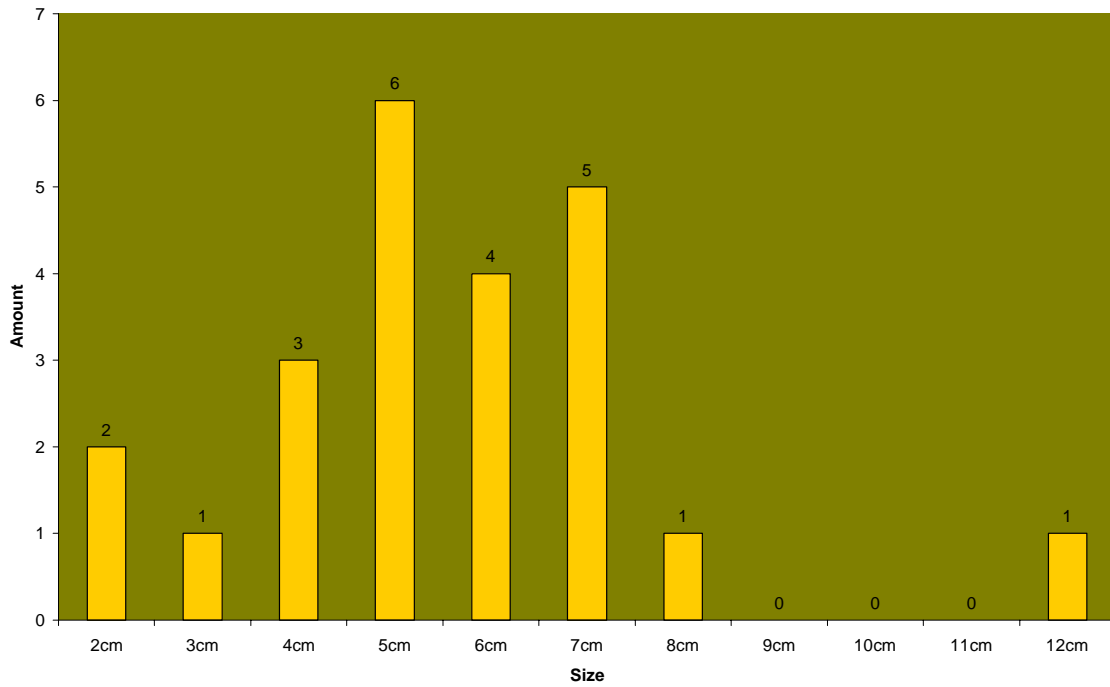
**Graph 2. Male lobster found in conservation zone.**



The graph above Shows the amount and sizes of twenty nine male lobsters found in conservation zone during the survey on the first site. Five lobsters measured 3cm, one measured 4cm, four measured 5cm, one measured 6cm, six at 10cm, one at 11cm, four at 12cm, two at 13cm, two at 14cm, two at 15cm, and one at 16cm.

**Graph 3. Male lobsters found in General use zone.**

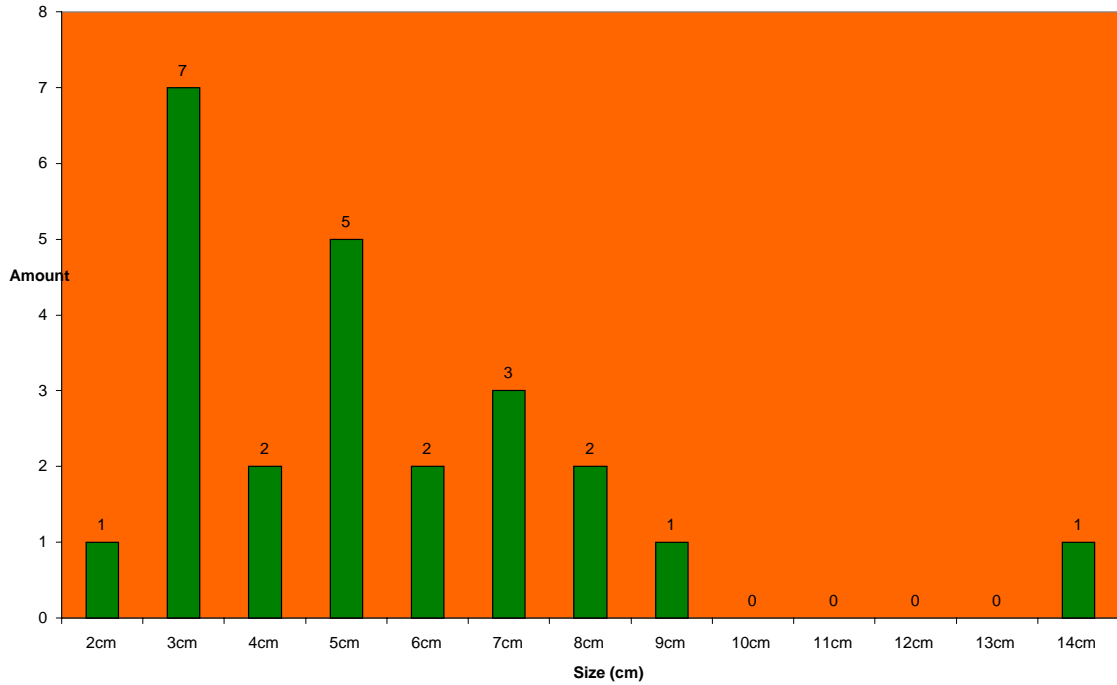
**Male lobsters found in General use zone**



The graph above illustrates the amount of eight different sizes of male lobsters found in general use zone of which two measured at 2cm, one measured at 3cm, three from 4cm, six measured at 5cm, four at 6cm, five at 7cm, one 8cm, and another one at 12cm.

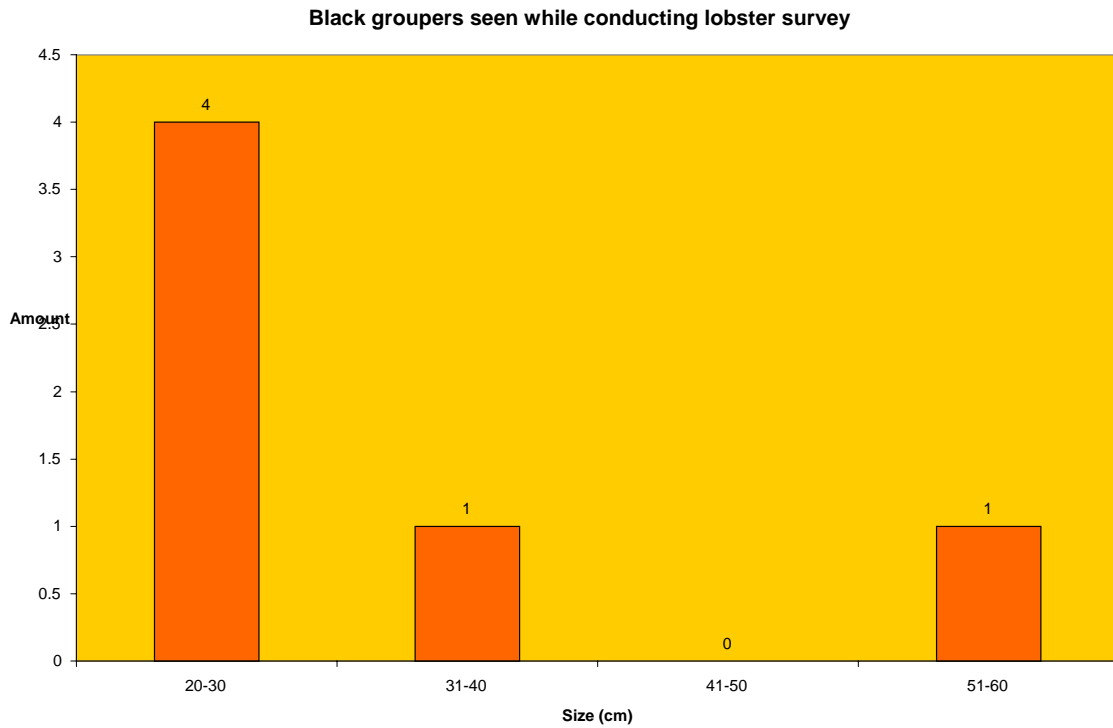
**Graph 4. Illustrates female lobsters found in the general use zone.**

**Female lobsters found in General use zone**



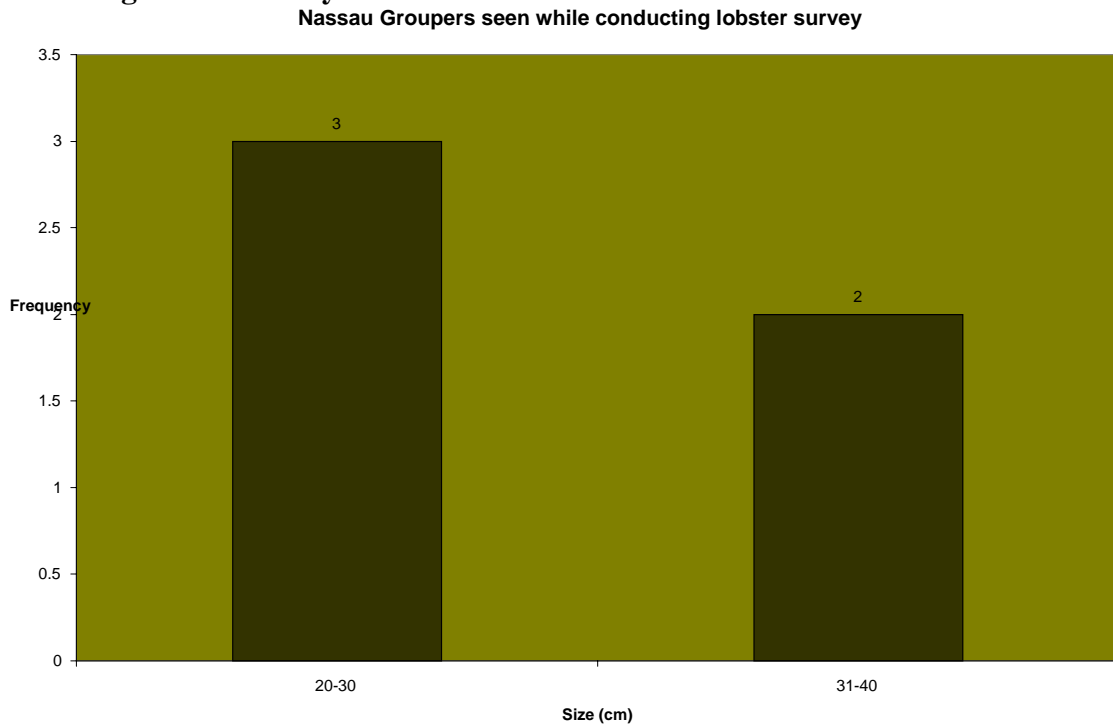
The graph above illustrates the amount and size of nine female lobsters found while conducting the survey in the general use zone. One measured 2cm, seven measured 3cm, two measured 4cm, five measured 5cm, two measured 6cm, three measured 7cm, two measured 8cm, one measured 9cm, and one 14cm.

**Graph 5. Fish species seen while conducting lobster survey.**



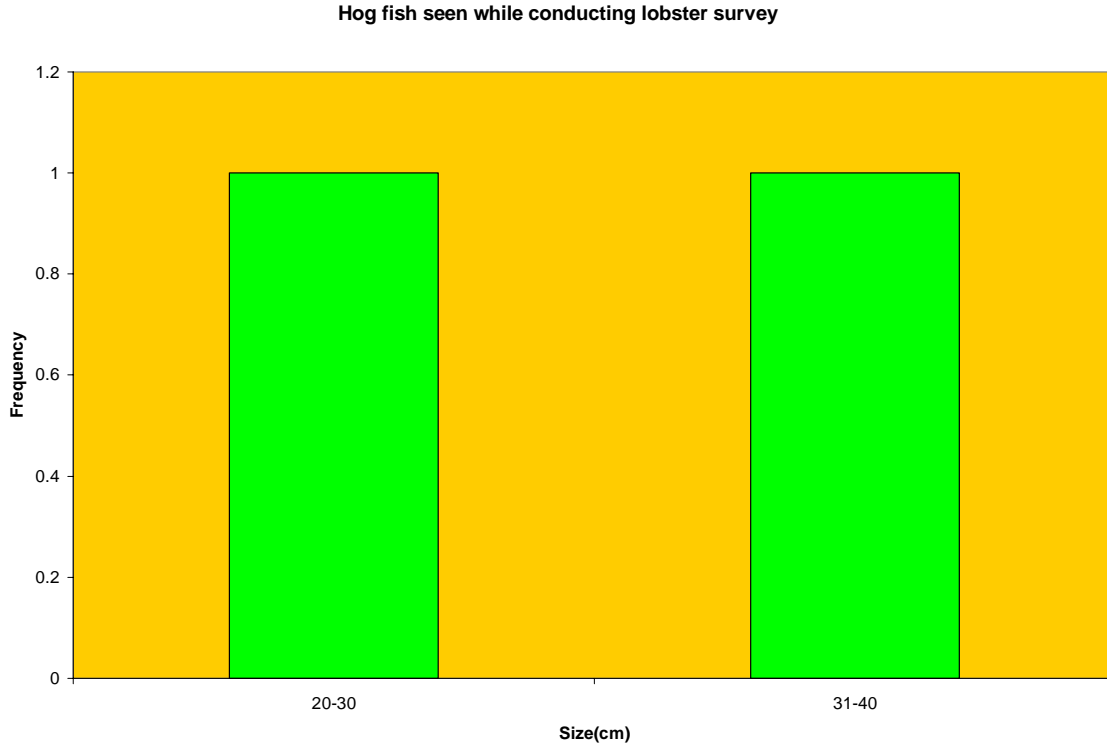
The graph above also illustrates the amount and size range of six Black groupers seen in conservation zone. Four ranged from (20-30cm), one from (31-40cm), and one from (51-60cm).

**Graph 6. Illustrates the amount and size of Nassau groupers found while conducting lobster survey.**



The graph above shows that five Nassau grouper was studied in the survey. Three range from (29-30cm), two from (31-40cm).

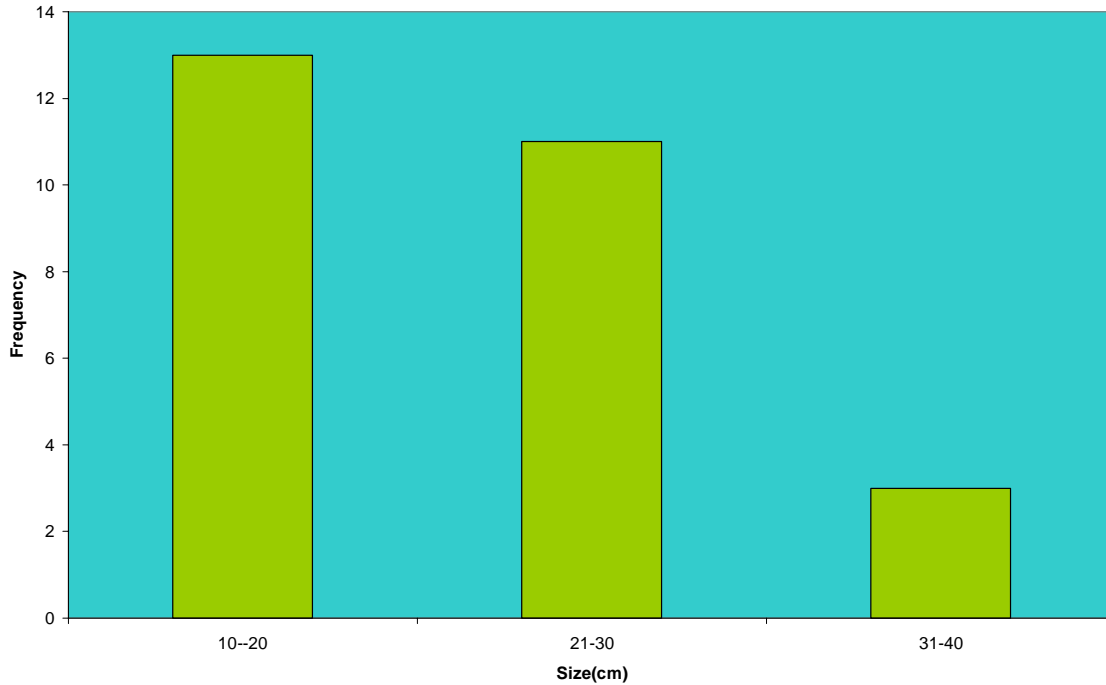
**Graph 7. Illustrates the amount and sizes of Hog fish observed in the survey.**



The graph above also shows that two hog fish was studied. One size range from (20-30cm), one from (31-40cm).

**Graph 8. Fish species seen while conducting lobster survey.**

Mutton snappers seen while conducting lobster survey



The graph above illustrates the amount and size of twenty seven Mutton snappers, found during the entire survey. Thirteen ranged from (10-20cm), eleven ranged from (21-30cm), and three from (31-40cm).

### *Result*

A total amount of ninety eight lobsters were studied while conducting the lobster survey for the month of June 2008 before the opening of the lobster season. Fourteen patch reefs was the site designated for this survey. Of the fourteen sites seven were in the conservation zone and seven in the general use zone. Graph one illustrates the amount and size of female lobsters found in conservation zone totaling to twenty two ranging from 3cm to 15cm in size. Graph two shows male lobsters found in the conservation zone. Their sizes and amount were twenty nine and their sizes ranged from 3cm to 16cm. In the general use zone a total amount of forty seven lobsters were studied. In graph three it shows that twenty three were male and their size range from 2cm to 12cm while graph four shows that twenty four were female and their size range from 2cm to 14cm.

### *Conclusion*

The survey shows that of the ninety eight lobsters studied. Fifty four were of illegal size and forty four were had their legal size limits. The laws of Belize states that the undersize range should be under seven (cm) in carapace length. Most of the undersize lobsters are in the general use zone. So it shows that more of the mature lobsters are based in the conservation zone which is protected.

### 3.9 Conch survey ( *Strum bus gig as* )

The conch (*Strumbus gigas*) survey was conducted from the 8<sup>th</sup> to the 10<sup>th</sup> of July after the closing of the season. The team consisted of three individuals from the reserve staffs; Mr.Cantun, Mr. Novelo, and Mr. Martinez.

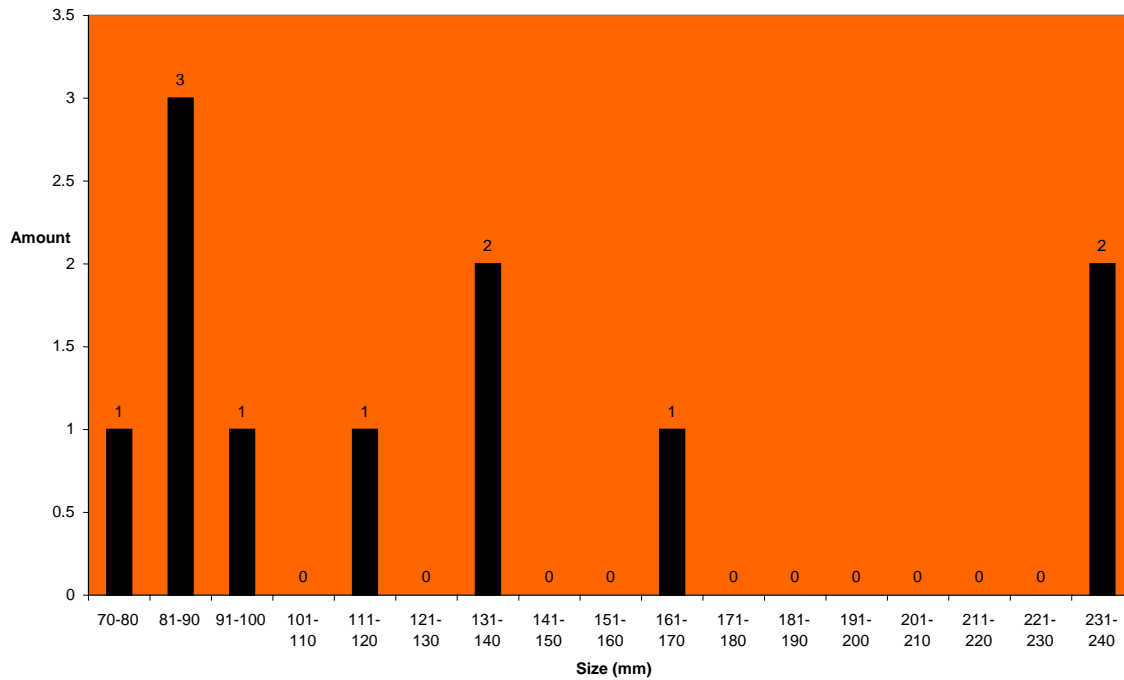
The survey includes collecting data from fourteen different designated sites. Seven of these sites are in the conservation zone and the other seven in the general use zone. The habitat type where these surveys took place were in the sand flats of the back reef of the marine reserve.

#### Method

For each survey conducted at these sites five 30 meter transect tapes were deploy five meters apart from each other perpendicular to the reef crest in the sand flat. These transect begin behind the reef crest and runs up to the 15m depth contour towards the main land. The quantity of conch that are observed in the transect swims are retrieved and their lip thickness, shell length and shell width data are collected except for copulating and spawning adults. Upon completion of the measurements all animal will be return to sea and in most cases to the area of capture. Below are graphs showing the frequencies and sizes of adult and juvenile conch collected during the surveys.

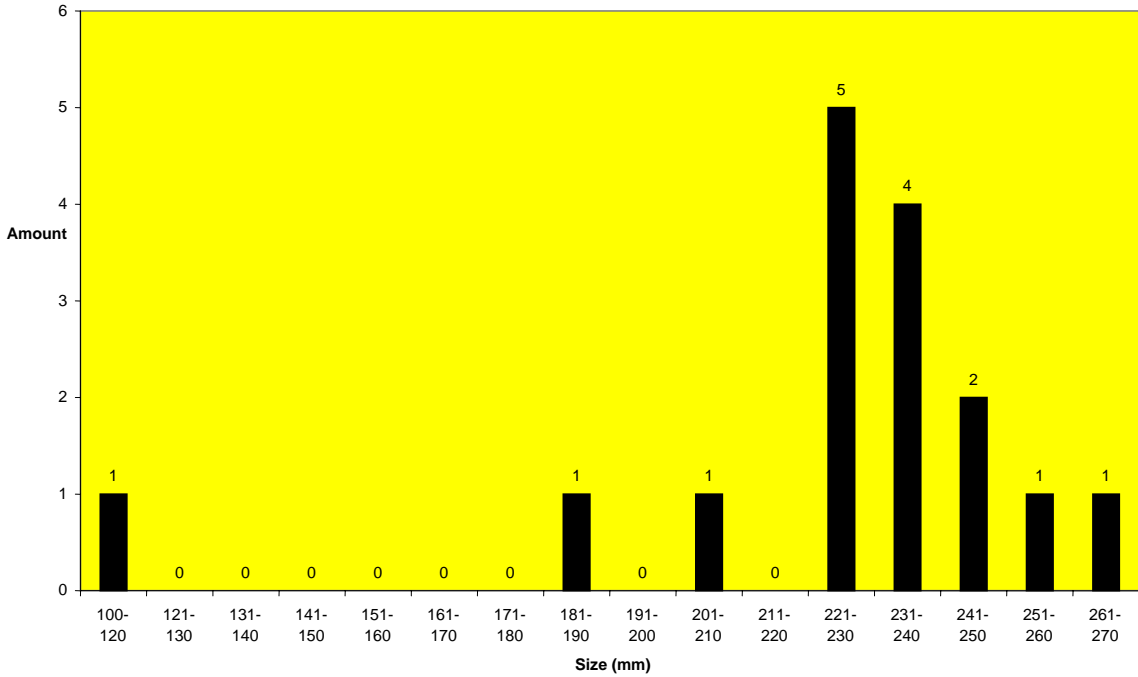
**Chart 1. Illustrates Juvenile conch found in conservation zone.**

Juvenile conch found in conservation zone



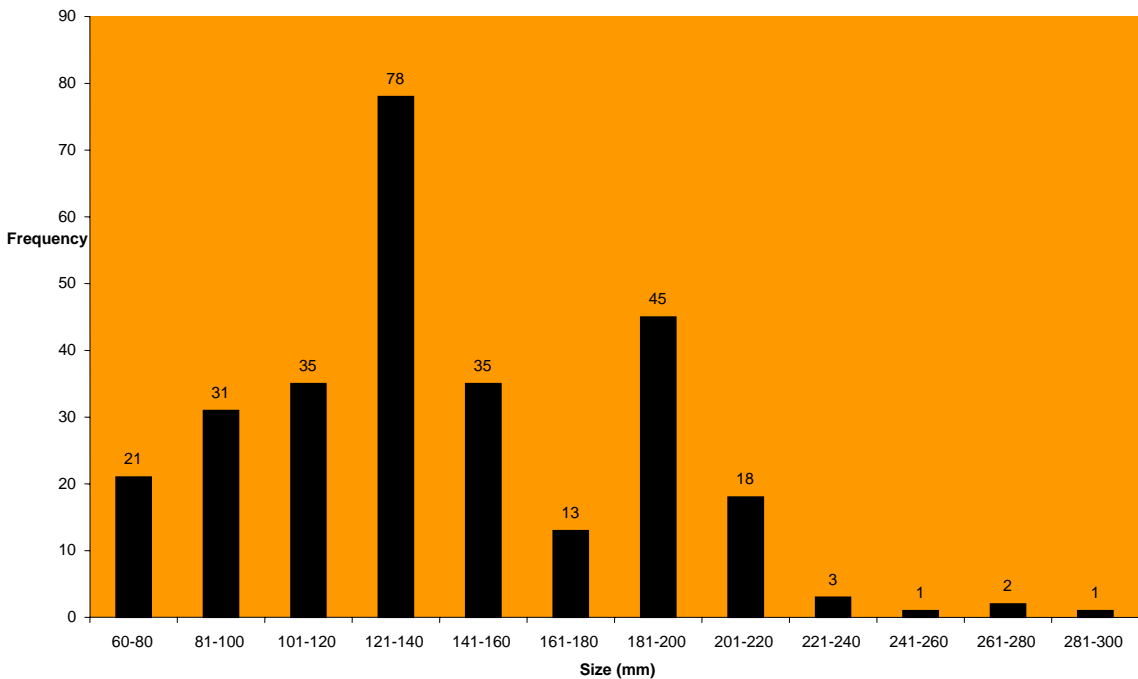
The graph above shows that an amount of eleven juvenile conchs was studied during the survey with size ranging from 70mm to 240mm in shell length.

**Chart 2. Illustrates Adult conch found in conservation zone.**  
 Adult conch found in conservation zone



The graph above shows that an amount of sixteen adult conchs was studied in the conservation zone with sizes ranging from 100cm to 270cm in shell length.

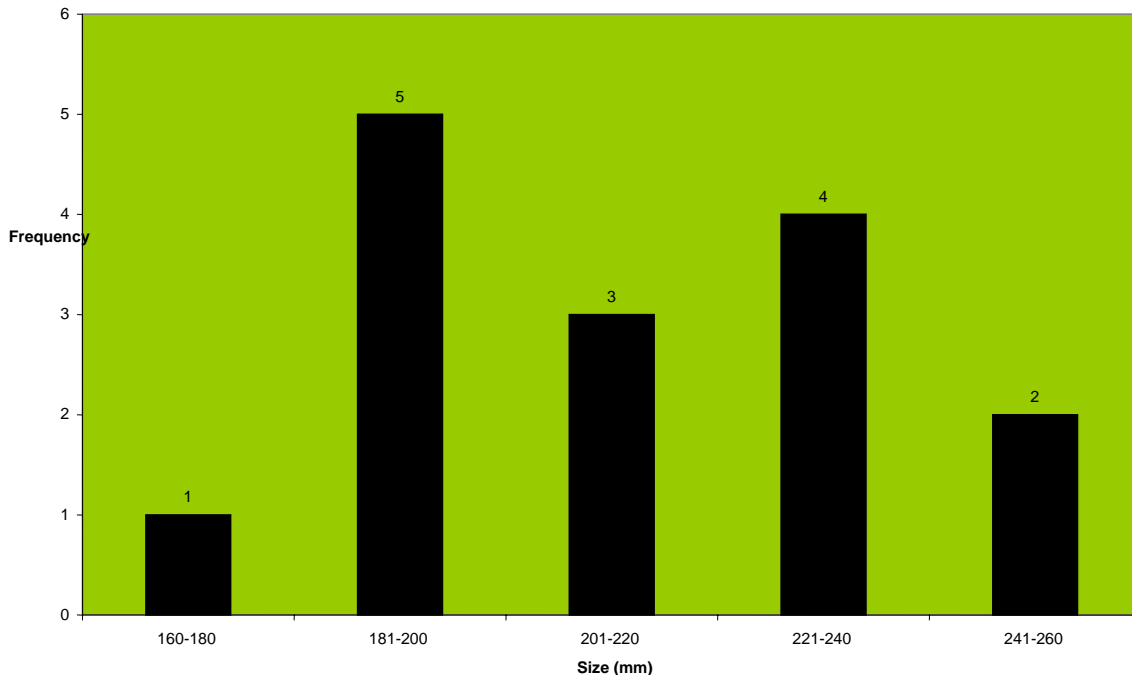
**Chart 3. Illustrates Juvenile conch found in general use zone.**  
 Juvenile conch found in general use zone



The graph above shows that a amount of two hundred and twenty three conch was studied in the general use zone during the survey with sizes ranging from 60mm to 300mm.

**Chart 4. Illustrates Adult conch found in general use zone.**

Adult conch found in general use zone



The graph above shows that an amount of fifteen adult conchs was studied during the surveys with sizes ranging from 160mm to 260mm in shell length.

## Conclusion

The monitoring conducted concluded with a result of twenty seven conchs in the conservation zone of which eleven were juvenile and sixteen adult. In the general use zone the total amount of conchs studied was two hundred and thirty eight of which two hundred and twenty three was juvenile and fifteen were adult conch. This survey mostly took place in the mornings around 9:00am until midday. The sea state was rough and the visibility was not too clear.

It was observed during the survey that some conch was seen getting ready to buried their selves in the sand flat, I suspected the weather was the motive to that due to all the tropical waves that were passing through those time of the month. I also observed as well that some copulating was taking place of which they were not molested at all.

## 4.0 Turtle survey

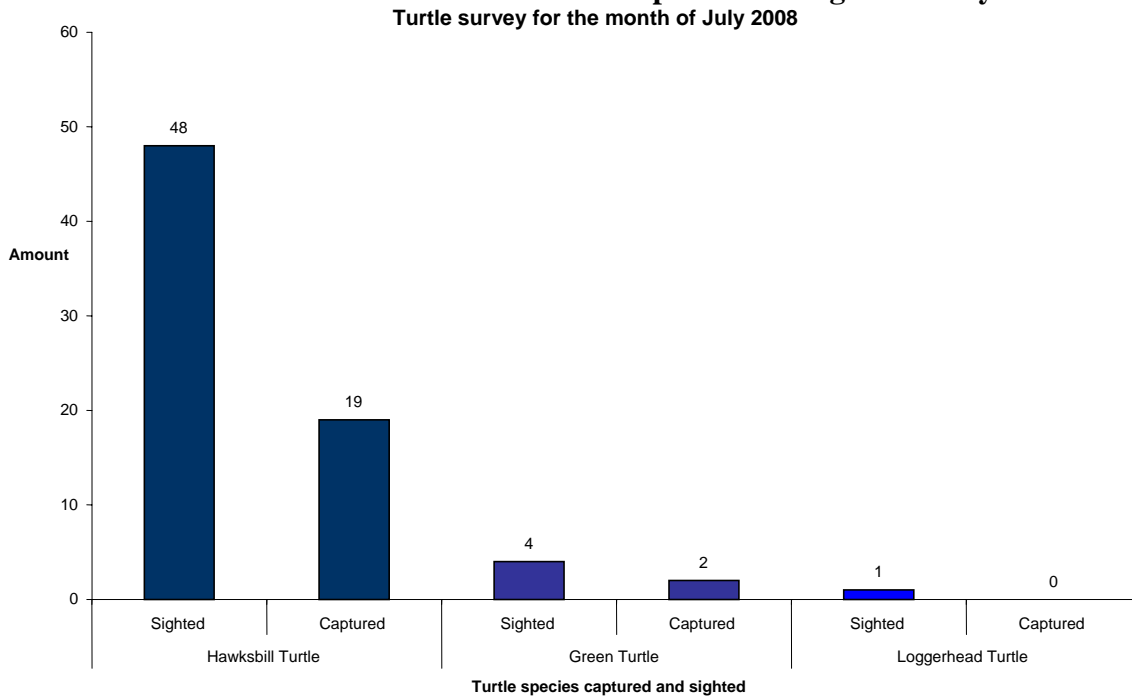
The turtle survey conducted for the month of July 2008 was done from the twenty six to the twenty nine at fourteen different locations. The time these surveys were accomplished

was between 8:00am to around 4:30 pm in the evening and the turtle team was consisted of eight to seven individuals at times. The individuals that participated in the survey were a group of students from the company Sail Caribbean, one fisherman from the fishing vessel (Princess) and the reserve staff as well as participants from WCS who headed the survey. The visibility of the sites surveyed ranged from forty to fifty feet and the water temperature was most of the time between twenty nine point zero to thirty point one degrees celsius. The salinity was sometimes between fifty two to fifty four ppt.

**Method**

The method use to conduct these surveys was done in a form where eight individuals are place parallel to each other with a space of about fifteen to twenty feet and snorkel together on the wall of the drop off to search for any type of turtle. When seen the person that sighted the species raises their hand and if possible free dive and catches the turtle or call for assistance from other professional free divers. The turtle if caught will them be place in the boat and another group of individuals will be in the boat to collect the data from the species. The data taken down will be the measurements, weights, tissue samples the depth, visibility, salinity, conductivity and temperature as well. Below is a graph showing the different turtle species sighted and captured during the couple days of survey.

**Chart 1. Show the amount of turtle seen and captured during the survey.**



Graph 1. Illustrate that forty eight hawksbill turtle was seen while nineteen was captured out of the forty eight. It also shows that for the green turtle four was seen while two was captured from it. Lastly the loggerhead turtle had one sight seen and no captured.

### ***Conclusion***

For this turtle survey conducted almost the same amount as the past year was observed. The only turtle species not captured only one was seen this year was for the loggerhead. Recently a lot of reports have been given by caye owners and guest who visits the area that a lot of hawksbill turtle have been sighted all over the atoll inside the lagoon and along the drop off of the dive sites.

### ***3.2 Lamp Survey***

The LAMP survey for the month of August 2008 was conducted from the 24th to the 28th. This time four individuals from WCS participated in the survey, Virginia, Robin, Marvin and Danny and Elias Cantun the reserve biologist. The protocol used in the survey involved two different methods, the first is by having transected lines laid flat on either sea grass or sand flats areas depending on the different types of habitat at the designated site. For the sand flat areas only conch (*Strombus gigas*) is recorded that were found within a two meter range span of either sides transect lines. The next method involves pure snorkeling, here the individuals would then hover around specific patch reefs and record all data of specific marine species such as the conch, lobsters, and some particular commercial fish which are the Parrots fishes, Hog fishes, Mutton Snappers, Black and Nassau Groupers all data collected are adults and juveniles.

For the data collected from the lobsters a tickle stick with measurements in (cm) is used to get a more accurate measurement of their carapace length. As for fish their size are estimated and noted in centimeter. To collect data for conch a caliper is used to measure the shell length, shell width and lip thickness. The presence of eggs is also noted before any interference with this species. If any sign of copulation is seen no data is collected of them. For the survey a total number of thirty three sites is studied, fourteen in the conservation zone and nineteen in the general use zone. The data collected is showed in the graphs below.

**Graph 1. Illustrates the amount and size of Adult conch (Strombus gigas) found within the general use zone.**

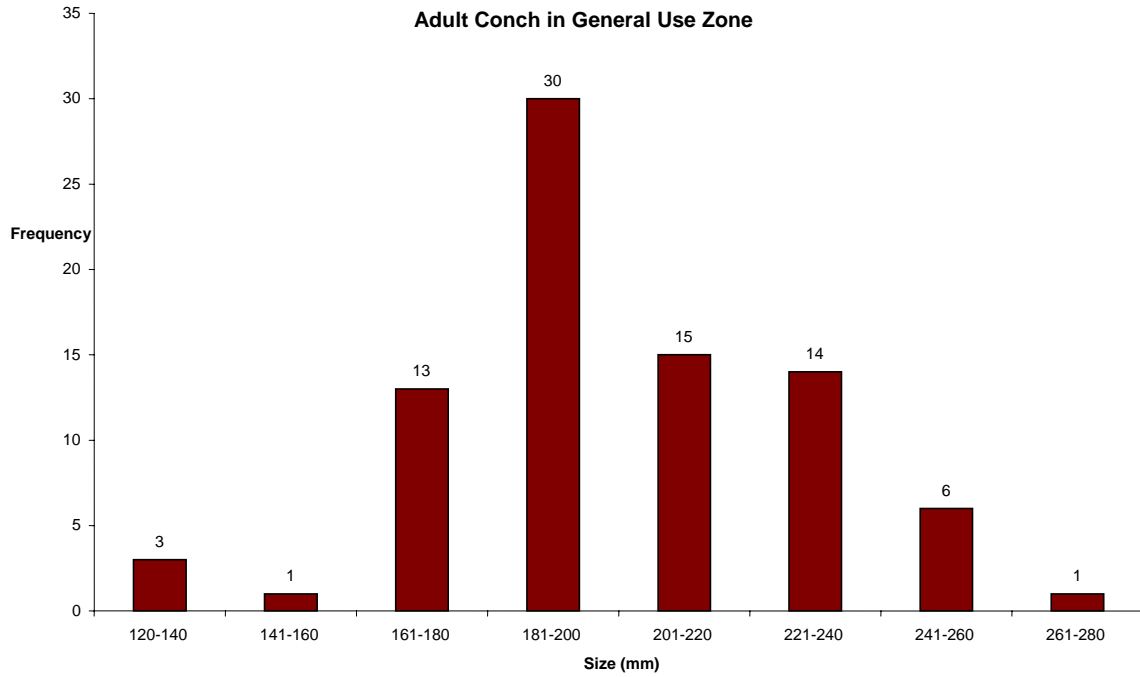


Chart1. The chart above shows that a number of eighty three conchs were surveyed. It also shows they range from one hundred and eighty one to two hundred and twenty millimeter which is the highest size of conch studied.

**Graph 2. Illustrates the amount and sizes of juvenile conch found within the general use zone.**

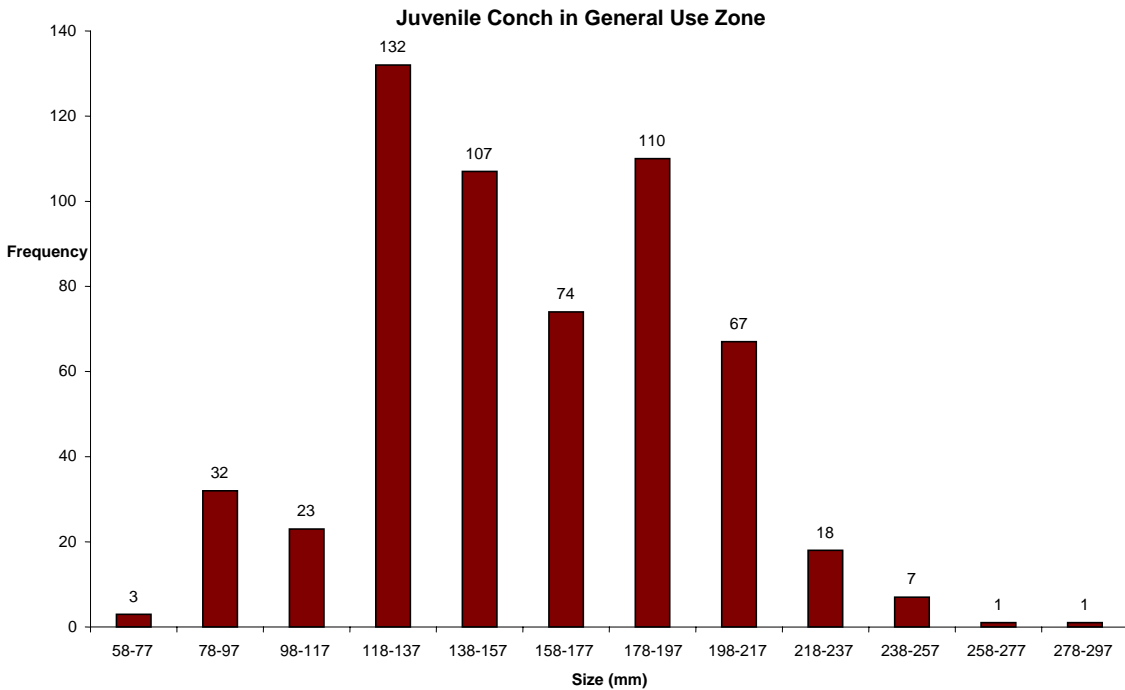


Chart2. Chart above shows that a number of five hundred and seventy five conchs was survey and their sizes were measured in millimeter. The highest size range that was measured was between one hundred and eighteen to one hundred and thirty two millimeters and their lowest was ranged between two hundred and fifty eight to two ninety seven.

**Graph 3. Shows the amount and size of male lobsters found within the general use zone**

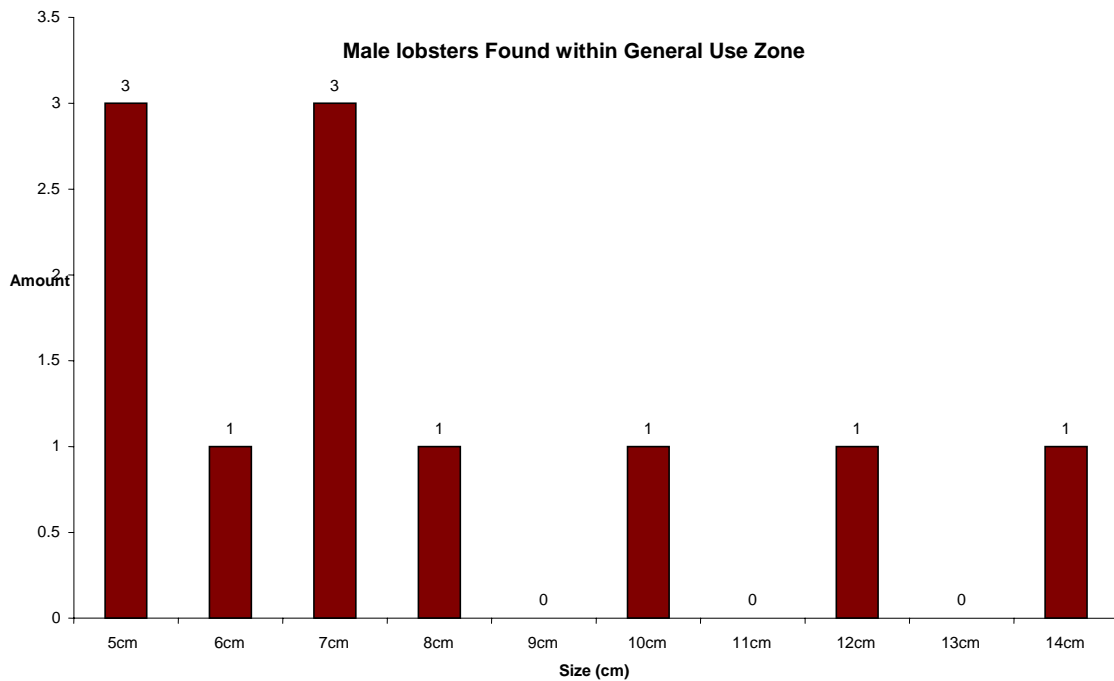


Chart 3. The chart above shows that a number of eleven lobsters were studied in the general use zone. It also shows that the highest amount studied was six with sizes of five and six centimeter and the lowest amount was all one with five different sizes shown above.

**Graph 4. The graph below illustrates the amount and sizes of adult conch found within the conservation zone.**

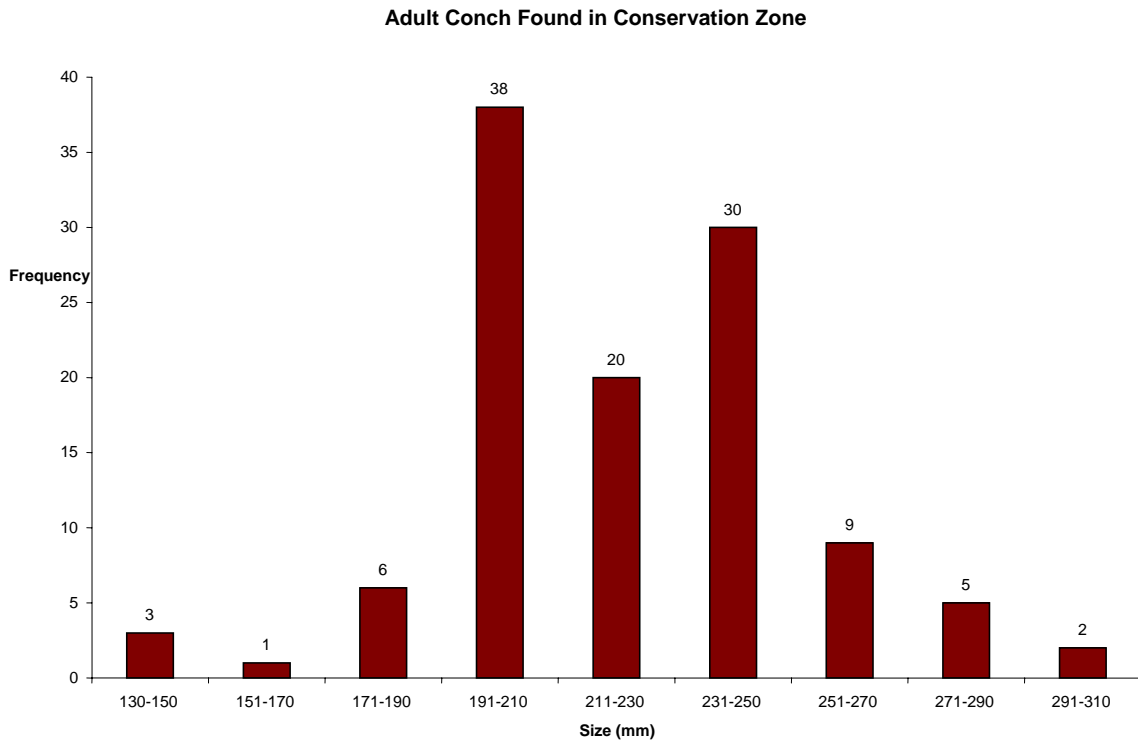


Chart 4. The chart above illustrates that a number of one hundred and fourteen adult conchs was studied in the conservation zone during the survey. Of the one hundred and fourteen conchs surveyed thirty eight was studied which was the highest amount ranged in size.

**Graph 5. The graph below illustrates the amount and size of juvenile conch found within the conservation zone.**

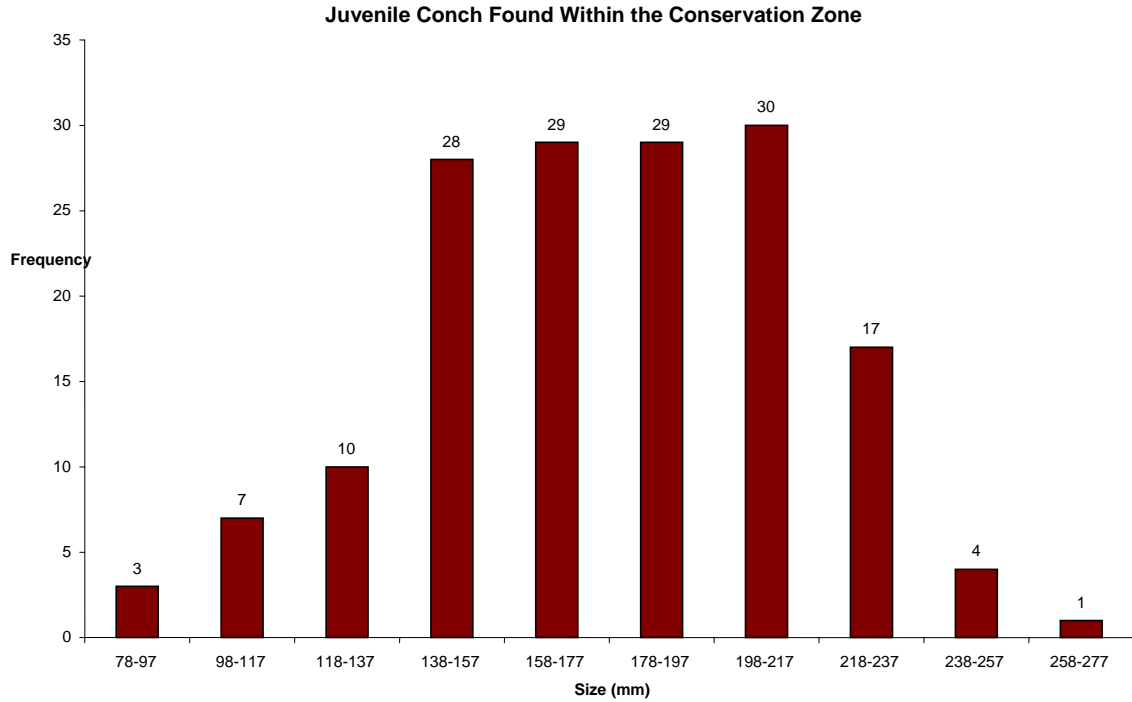


Chart 5. The Chart above shows that a total amount of one hundred fifty eight conchs was studied, of which four different size range were almost equal in frequency.

**Graph 6. The graph below illustrates the amount and sizes of male lobsters found within the conservation zone.**

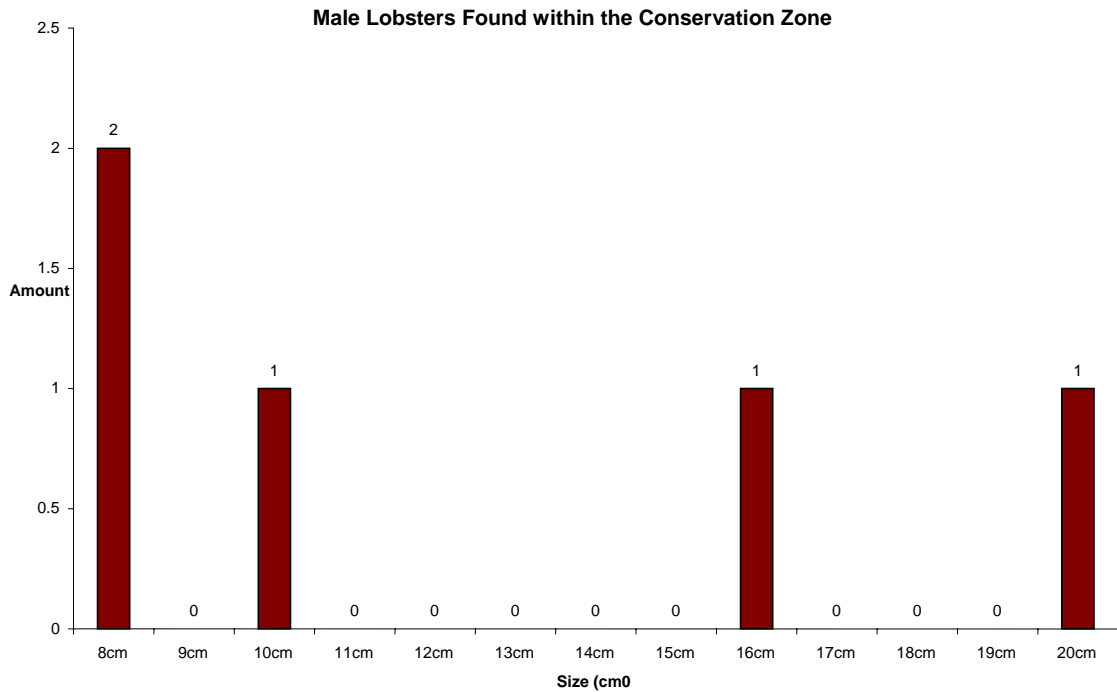


Chart 6. The chart above shows a total amount of five male lobsters were studied during the survey. The highest amount which is two ranged from eight centimeter in carapace length.

**Graph 7. Illustrates the amount and sizes of female lobsters found within the conservation zone.**

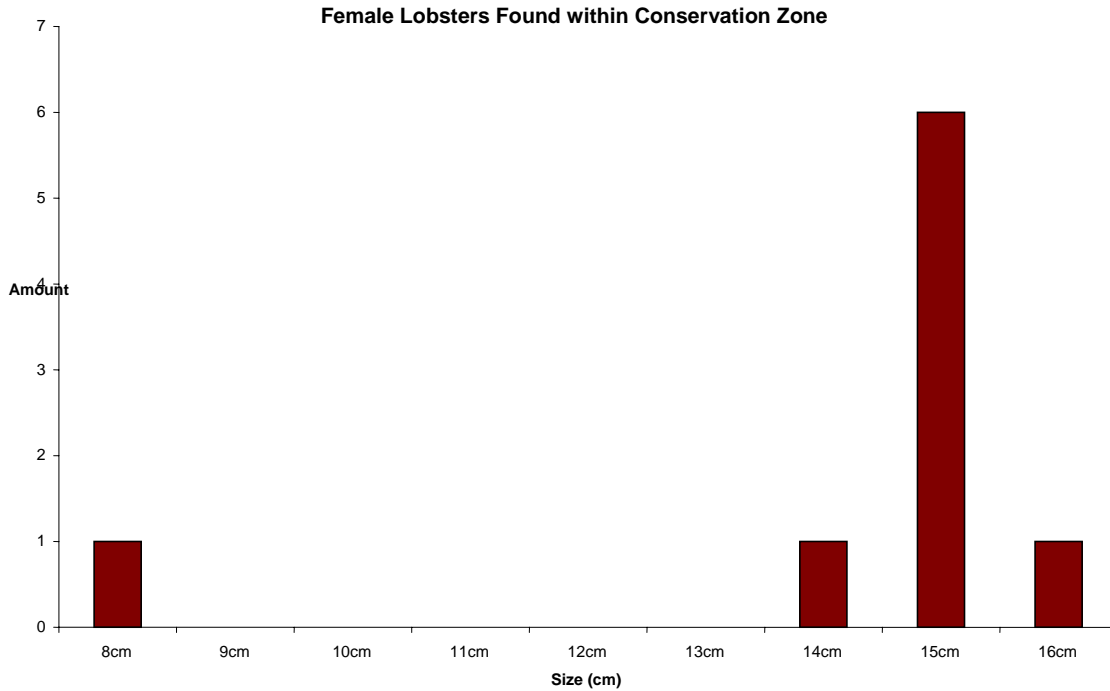


Chart 7. The chart above shows that a total amount of nine female lobsters were studied during the surveys. The highest amount which had six, ranged in the fifteen centimeters in carapace length.

**Graph 8. Illustrates the amount and sizes of the different fish species studied in the general use zone.**

**Fish Species Found Within General Use Zone**

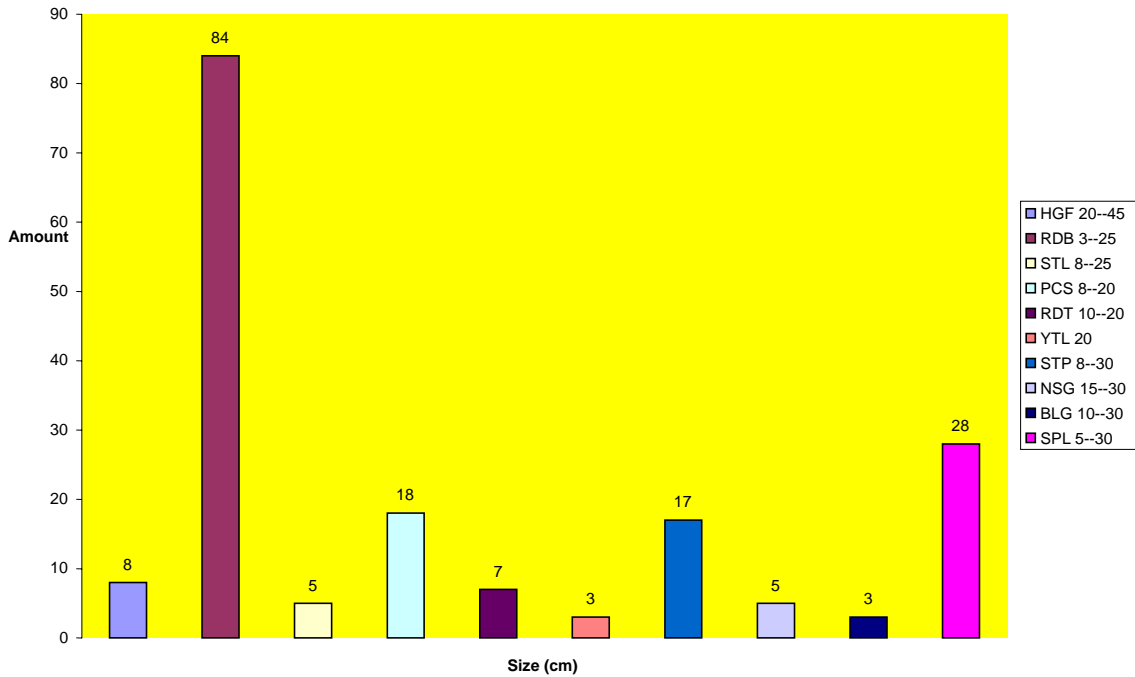


Chart 8. The chart above shows that ten different fish species was studied during the survey. It shows that the highest amount of fish that was studied was the Red Band parrot fish with a number of eighty four and lowest fish rate were the Yellow Tail parrot fish and the Black Grouper with the same amount of three.

**Graph 9. Illustrates the amount and size of the different fish species found within the Conservation zone.**

**Fish Species found within the Conservation Zone**

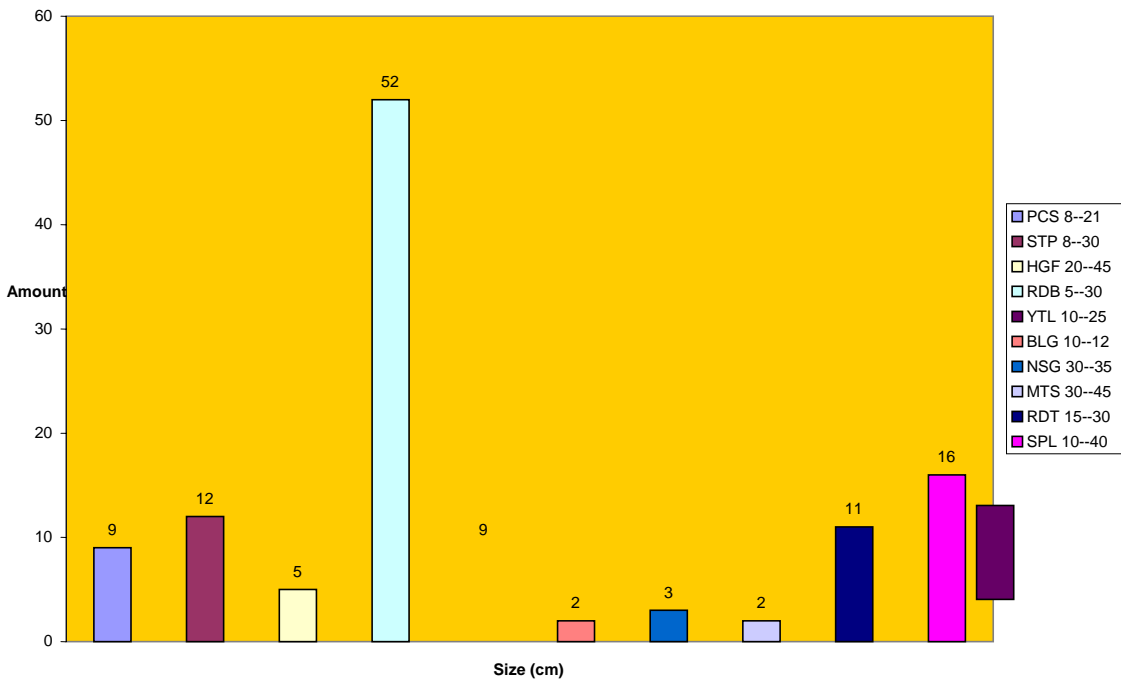


Chart 9. The chart above shows that ten different fish species was also observed during the survey. Of the ten different fish the Red band was the one with the highest amount of fifty two. In this survey two fish species studied which were the Black Grouper and the Mutton snappers had the same amount of two.

#### 4.1 Coral Bleaching Survey

Table 3. Results of Coral bleaching survey

SUMMARY TOTAL					
		Site #1	Site #2	Site #3	Site #4
Total # of Coral Species		135	131	97	107
# Ssid species		1	25	2	5
# Mann species		69	44	31	38
# Mfav species		2	0	0	0
# Past species		3	17	7	0
# Aaga species		20	6	30	26
# Mcav species		2	0	0	0
#Cnat species		12	8	7	16
# Malc species		2	2	3	1
# Ppor species		6	1	1	4
#Pdiv species		13	28	13	9
# Aten species		4	0	3	2
# Mdam species		1	0	0	0
# Acer species		0	0	0	2
# Apal species		0	0	0	2
# Dsto species		0	0	0	2
		135	131	97	107
		0.74074	19.0839	2.06185	4.67289
# Ssid species		1	7	6	7
# Mann species		51.1111	33.5877	31.9587	35.5140
		1	9	6	2
# Mfav species		1.48148			
		1	0	0	0
# Past species		2.22222		7.21649	
		2	12.9771	5	0
# Aaga species		14.8148	4.58015	30.9278	24.2990
		1	3	4	7
# Mcav species		1.48148			
		1	0	0	0
#Cnat species		8.88888		7.21649	14.9532
		9	6.10687	5	7
# Malc species		1.48148	1.52671	3.09278	0.93457

		1	8	4	9
	# Ppor species	4.44444 4	0.76335 9	1.03092 8	3.73831 8
	#Pdiv species	9.62963	21.3740 5	13.4020 6	8.41121 5
	# Aten species	2.96296 3	0	3.09278 4	1.86915 9
	# Acer species	0.74074 1	0	0	0
	# Apal species	0	0	0	1.86915 9
	# Dsto species	0	0	0	1.86915 9
	Total Old Mortality	0	0		
	<b>Mean % Old Mortality</b>	<b>0</b>	<b>0</b>		
	Total Recent Mortality	0	0		
	<b>Mean % Recent Mortality</b>	<b>0</b>	<b>0</b>		
	# Species with DS	0	0	0	0
	# Species with BB	0	0	0	0
	# Species with WP	0	15	0	0
	# Species with WB	0	0	10	0
	Total Sum of Species with Disease	0	15	10	0
	<b>Mean % Disease Infestation</b>	<b>0</b>	<b>11.4503 8</b>	<b>10.3092 8</b>	<b>0</b>
	<b>% of Mean DS</b>	#DIV/0!	0	0	#DIV/0!
	<b>% of Mean BB</b>	#DIV/0!	0	0	#DIV/0!
	<b>% of Mean WP</b>	#DIV/0!	100	0	#DIV/0!
	<b>% of Mean WB</b>	#DIV/0!	0	100	#DIV/0!
	# Species with P bleach	12	12	5	8
	# Species with PB bleach	9	22	6	0
	# Species with WB bleach	0	14	9	0
	Total Sum of Species with Bleaching	21	48	20	8
	<b>Mean % Bleaching</b>	<b>15.5555 6</b>	<b>36.6412 2</b>	<b>20.6185 6</b>	<b>7.47663 6</b>
Pale	<b>% of Mean P</b>	57.1428 6	25	25	100
Part Bleach	<b>% of Mean PB</b>	42.8571 4	45.8333 3	30	0
Whole	<b>% of Mean WH</b>	0	29.1666	45	0

bleach			7		
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A total of four sites were checked; two fore reefs and two patch reef sites. The four reef site in front of Southwest Caye showed little bleaching and in the other three sites bleaching was more frequent, especially in the patch reef sites where entire coral colonies were bleached. The fore reef sites hardly had any large algae growth and show a high occurrence of star corals which seem to be the more dominant coral species in the area.

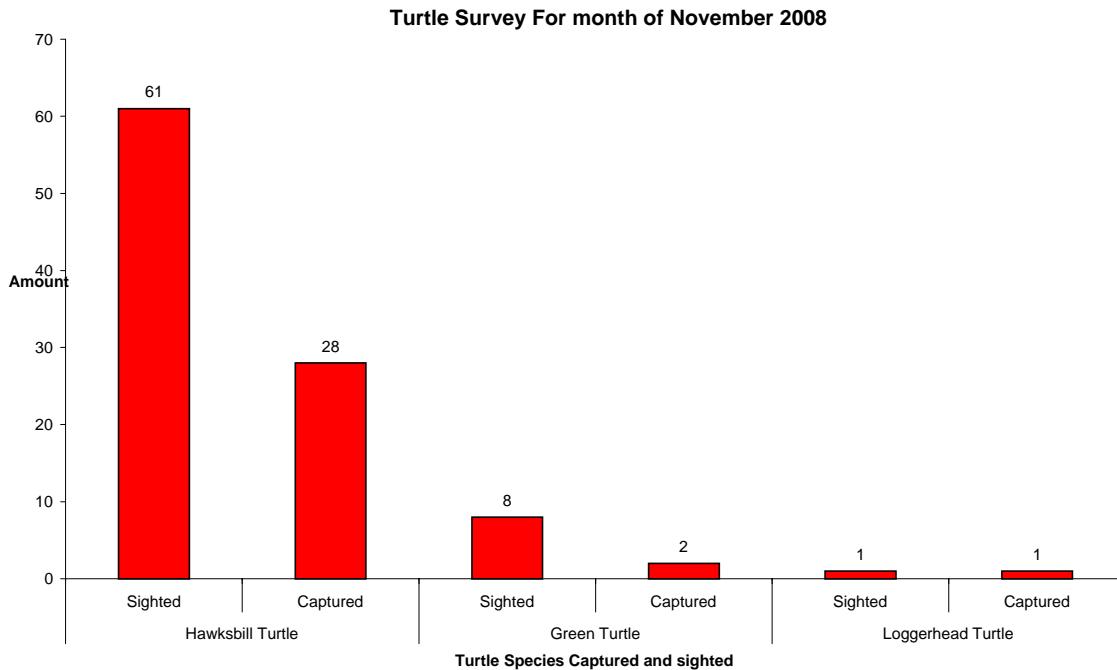
#### ***4.2 Turtle Survey***

Another turtle survey was conducted for this month of November 2008. The survey was conducted from the 24<sup>th</sup> to the 27<sup>th</sup> at fourteen different locations/ sites. All survey was accomplished between the times of 8:00am to around 4:30 pm in the evening. The team consisted of eleven individuals, four from BFD, one from TIDE, and six from WCS. During this survey some data was collected by the recorder at the different sites where any turtle was seen or captured they are the visibility, depth, time the survey starts and ends, salinity, GPS location and water temperature as well as others from the species when caught such as the type of habitat they were seen/captured, tissue samples, measurements and if ant deformities. The amount of Turtles seen in this survey was more than the previous surveys conducted of which this time a number of seventy was sighted while from that number thirty one was captured. Of the thirty one captured twenty eight was hawksbill; two was green turtle and one loggerhead.

#### ***Method***

The same method was use to conduct these surveys. Eight individuals are place parallel to the reef all the way to the drop off of the wall and are spaced from each other at a distance of about ten feet. All surveys are done by snorkeling. The team is all prepared to free dive, follow and chase the species if caught. The turtle if caught are then placed in a boat so as to collect their measurements, tissue sample is taken from the back part of the left flippers and two tags are placed on their front flippers on either side. Below is a graph to show the captures and sightings of these species.

**Chart 1. Shows the amount of three different turtle species sighted and captured during the survey.**



**Graph 1. Illustrate that sixty one hawksbill turtle was sighted and twenty eight of the same species was captured while for the green turtles eight was sighted and two captured. Only one loggerhead was sighted and one captured.**

### *Conclusion*

For this turtle survey conducted more turtles were studied this time than the past surveys conducted. A larger amount has been seen not only at the fore reef area of the reserve but as well as the inside patch reefs. It's been a year that the turtle monitoring is been taking place at the reserve and more and more sightings as well as captures has been noticed, even the other species of turtles such as the green turtles which has been declining is been noticed to be around too.

## **4.0 Trainings/Meetings**

### 4.1 Staff Meeting

Once every month a general staff meeting is held to discuss reserve issues and work schedule. Several issues are discussed at this meeting for example that of the monitoring that needs to be done and what all is needed in order to do the monitoring.

### 4.2 Advisory Committee meetings

Once every quarter an advisory committee meeting is held to discuss several different issues addressing the marine reserve.

On the 19<sup>th</sup> March an Advisory committee meeting was held at Glover's Atoll to discuss different reserve matters. The main point at the meeting was that of the introduction of

the special licenses and certain rules that will apply. It was a very heated discussion and as a result it was resolved that a meeting will be held on the 25<sup>th</sup> March in Sarteneja to discuss these issues with the fishermen themselves.

As a result on the 25<sup>th</sup> March a fisherman's meeting was held in Sarteneja. At this meeting fishermen were informed of many of the fisheries regulations that they need to follow and were also told that now captain's would be held responsible for illegal activities that occur onboard. They were also reminded that it is very important that they harvest the marine resources in a sustainable manner in order to the future of the fishing industry to be a bright one. They were also reminded that the fisheries department is faced with a lot of difficulties and that we can not always be everywhere. That is the reason why their involvement in informing the department of illegal activities is very essential and necessary.

#### *4.3 Enforcement Training*

In May Mr. Gilford Martinez and Mr. Elias Cantun attended a one day workshop in Belize City where they received valuable training in the line of enforcement. They were told and thought the importance of good public relation and procedures of arrest.

On March 26<sup>th</sup> to 28<sup>th</sup> an enforcement workshop was held at the fisheries department where Mr. Roberto Carballo, reserve manager, and Mr. Luis Novelo, park ranger, took part. The training thought us of ways and reason for us to always be professional and courteous to our users of the reserve. Also we were thought of when and how to use the different types of force necessary especial when making arrests. We were also informed of the proper procedures to follow when making an arrest so that our cases can be strong when taken to court. Finally we were shown of the proper way to use a firearm.

#### *4.2 Turtle Training*

On Sunday 20<sup>th</sup> April several individuals from both fisheries and WCS arrive at Middle Caye in order to prepare for the turtle monitoring project. We did five days of in water surveys which led us to a sighting of 49 turtles. Three loggerhead turtle were seen and all three were captured. Two green turtles were seen and one was captured. Forty four Hawksbills turtles were seen and nineteen of them were captured. The overall training was good with good results however there were several minor problems.

Firstly was that the team was not strong as before and much pressure was placed on Mr. Roberto and Mr. Luis to be the one's to capture turtles. We were lucky to have three extra individuals out on the island that offer us help and one of them actually caught a turtle. Next the team needs individuals who are strong swimmers and have the willingness to do the work. Also the surveys lots for one hour each time and needs at least eight individuals in the water. Taking this point in mind it is recommended that the team be made bigger and hence includes at least thirteen individuals and two boats (two boat captains, Katy, Robin and nine surveyors. However volunteers would be a great asset to this team and so far Warren Cabral has offer him to help.

My staff and I recommend that the individuals from the fisheries side who are really needed apart from the reserve staff is Samuel Novelo and Godwin Humes and from the WCS staff Feagon, Buck, Tyron, Virginia, Robin, and Alex. In addition to this would be a fisherman who is a really good free diver. The only problem is that a stipend would be needed and we are thinking it would be something like one hundred dollars a day. The survey is five days I will gather funding from the stakeholders to provide half of this payment which is two hundred and fifty dollars. I hope that WCS will be able to help with the next half because we think that have this deep diver will really help a lot.

On July 25<sup>th</sup> to August 1<sup>st</sup> another turtle monitoring program was done in which this time members of the fisheries department, members of WCS, a fisherman and several students participated. This time the captures were not that successful like the previous survey and only yield a capture of nineteen turtles.

## **Revenues**

A park fee of \$ 10.00 Bze per day or \$ 30.00 Bze per week is charged to all non-Belizean visitors who are over the age of twelve. The high season for tourism at Glovers is from November to May. March, April and especially May are months where a lot of tourist visit in order to dive Glovers and at the same time go dive the Whale Shark. Currently at Glovers five resorts exist: which are Glovers Atoll Resort on Northeast Caye who caters for the much more power class tourist, Slickrock and Off The Wall Dive Center Resort on Long Caye, Island Adventures and Isla Marisol on Southwest Caye. Hamanasi is the main dive boat from the mainland that visits the atoll to dive. A few outside visitors usually reach but most visitations are that from the resorts on the island. The activities carried out at Glovers are snorkeling, kayaking, diving, and fishing for consumption, windsurfing, and sport fishing (according to level of occurrence).

Charts one and two below show the number of visitations received for each month in 2008.

Daily Visitation for 2008 at GRMR

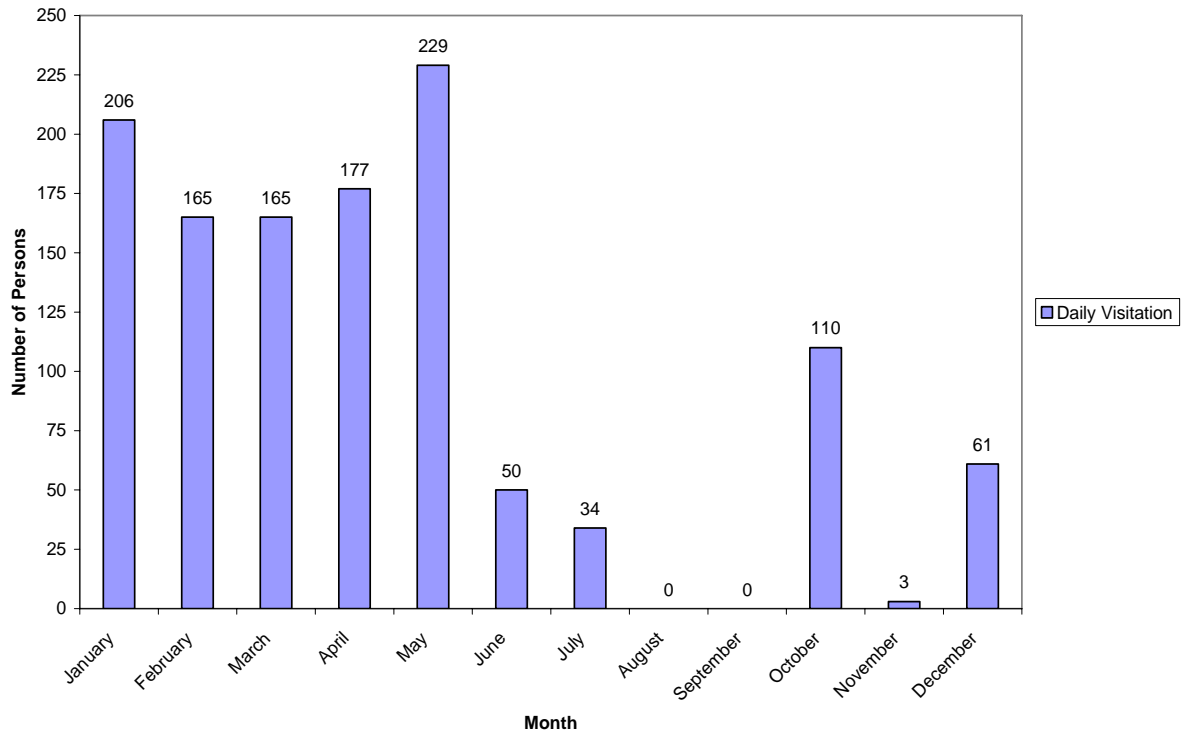


Chart 1 Daily Visitation for 2008

**Weekly Visitation for 2008 at GRMR**

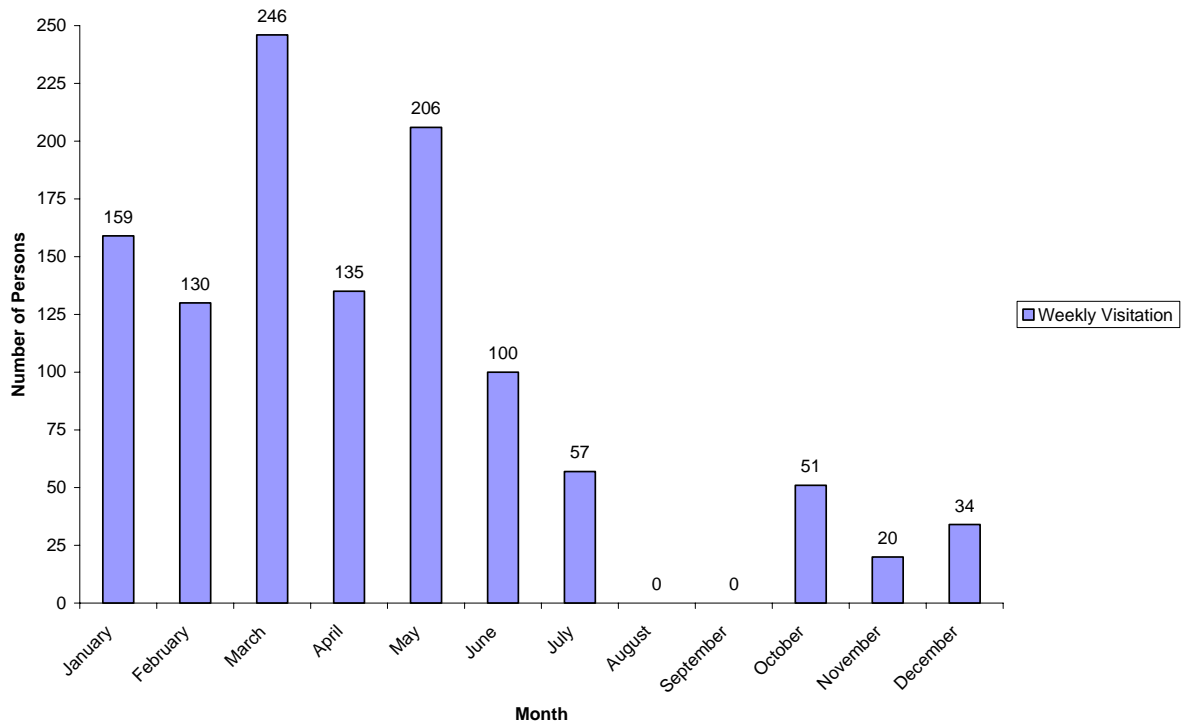


Chart 2 Weekly Visitations for 2008

Table one and two below shows the total amount of revenues collected for each month of 2008.

Table 1 Daily Revenues collected at GRMR for 2008

Month	Cash collected (Bze dollars)
January	6180
February	4950
March	4950
April	5310
May	6870
June	1500
July	1020
August	0
September	0
October	3300
November	90
December	1830
Total	36000

Table 2 Weekly Revenues collected at GRMR for 2008

Month	Cash collected (Bze dollars)
January	4770
February	3900
March	7380
April	4050
May	6180
June	3000
July	1710
August	0
September	0
October	1530
November	600
December	1020
Total	34140

The table and charts above show that a total of one thousand two hundred daily tourist visitors over the age of twelve visited GRMR in 2008 and resulted in the collection of thirty six thousand Belize dollars. In addition a total of one thousand one hundred thirty eight weekly tourists visitors over the age of twelve visited GRMR in 2008 and resulted in the collection of thirty four thousand one hundred forty Belize dollars. Revenues collection produced a total of sixty four thousand one hundred forty Belize dollars.

#### 5.0 Fuel Usage

Table 6. Fuel Used for January

Purpose	Amount of fuel used (gallons)
Transportation from Belize	16
Transportation to and from Dangriga	105
Patrol	146
Collection of park fees	10
Monitoring	12
Total	289

Table 7. Fuel Used for February

Purpose	Amount of fuel used (gallons)
Transportation to and from Dangriga	59
Patrol	108
Collection of park fees	4
Monitoring	29
Total	200

Table 8. Fuel Used for March

Purpose	Amount of fuel used (gallons)
Transportation to Belize	75
Transportation to and from Dangriga	15
Patrol	160
Collection of park fees	10
Monitoring	4
Total	264

Table 9. Fuel used for the month of April

Purpose	Amount of fuel used (gallons)
Transportation of fuel to WCS boat	10
Patrol	155
Collection of park fees	10
Monitoring	12
Total	187

In April an extra of 13 gallons of fuel remained, because the reserve staff did not make any trips into Dangriga with the reserve vessel and also due to a small period of bad weather.

In May an extra fifty gallons was issued to the reserve for the purpose of assistance to SWCMR in enforcement patrol. A detail of the use of the fuel for May is listed below in table two.

Table 10. Fuel Usage for the month of May

Purpose	Fuel consumed (gals)
Transportation to Dangriga	53
Enforcement	174
Collection of park fees	6
Assistance to SWCMR	50
Total	283

Table 11. Fuel Usage for the month of June

Purpose	Fuel consumed (gals)
Transportation to Dangriga	30
Enforcement	159
Collection of park fees	11
Total	200

Table 12. Fuel used for the month of July

Purpose	Amount of fuel used (gallons)
Transportation of fuel to WCS boat	10
Patrol	160
Collection of park fees	10
Monitoring	20
Total	200

Table 13. Fuel used for the month of August

Purpose	Amount of fuel used (gallons)
Transportation of fuel to WCS boat	5
Transportation to and from Dangriga	42
Patrol	150
Collection of park fees	10
Total	207

Table 14. Fuel used for the month of September

Purpose	Amount of fuel used (gallons)
Transportation of fuel to WCS boat	10
Transportation to and from Dangriga	35
Monitoring	150
Patrol	155
Total	375

In September an extra one hundred fifty gallons of fuel was received for the carrying out of the National conch survey.

In October however a special project –coral bleaching survey- was carried out and an extra forty gallons of fuel was received for this activity. The table below shows a detail of fuel usage.

Table 15. Fuel used for the month of October.

Purpose	Amount of fuel used (gallons)
Transportation to and from Dangriga	52
Patrol	147
Monitoring	40
Total	239