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Do Boaters Overfish and Under Spend? A Case Study in the Exumas, Bahamas

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# **Do Boaters Overfish and Under Spend? A Case Study in the Exumas, Bahamas**

A capstone independent study project submitted in partial satisfaction  
of the requirements for the degree of Master of Advanced Studies

in

Marine Biodiversity and Conservation

by

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June 6, 2008



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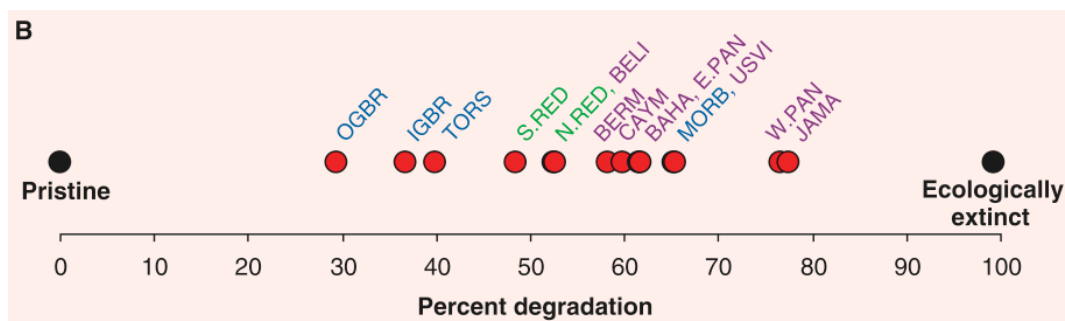
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The beautiful Bahamian reef fauna and the coral that support them are poised to disappear. Rated as 60% degraded in 2003 (Pandolfi et al. 2003), the reef ecology continues to decline under a multifaceted assault (Fig. 1). This downward slide in reef animals is not recent; it began with the arrival of Europeans in the Caribbean. By 1900, reef fish populations were substantially degraded (Pandolfi et al. 2003). Their infrastructure, the corals were slower to succumb, reaching the degraded stage after World War II, but long before global warming, large-scale development and high nutrient levels became factors. The only plausible explanation was overfishing. When examining Bahamian reefs today and trying to sort out which assaults are most important to attack, overfishing continues to be the primary stressor, only now assisted by a host of new threats. Overfishing not only depletes stocks but also denies the corals interaction with functional groups necessary for their health. Without a strong herbivorous contingent of fish, reefs have slid into a macro algal trophic level that is difficult to reverse. New market demands for previously unfished, but reef critical, herbivores such as parrotfish will further degrade the reefs unless these functional groups are managed (Bellwood 2004). Overfishing of reef fauna must be brought under control if the Bahamas are to avoid further degradation and the demise of their reefs.



**Figure 1. Coral reef degradation**

(Pandolfi et al. 2003)

Recreational boaters from the United States and other nearby countries have long been blamed for overfishing in the Bahamas. They are accused of exceeding their catch limits and exporting seafood via their own boats. Others accused of overfishing include commercial scale, foreign poachers, primarily from the Dominican Republic. Countering, foreign recreational boaters place the responsibility for overfishing on local commercial fishermen. Accusations of overfishing are rarely verified and have served as an excuse stall credible rule making.

### 1.1 FOCUS OF STUDY

There are many components to the overfishing issue (Fig. 2). This study focuses on the extent of overfishing of reef species by foreign boaters. It also considers the

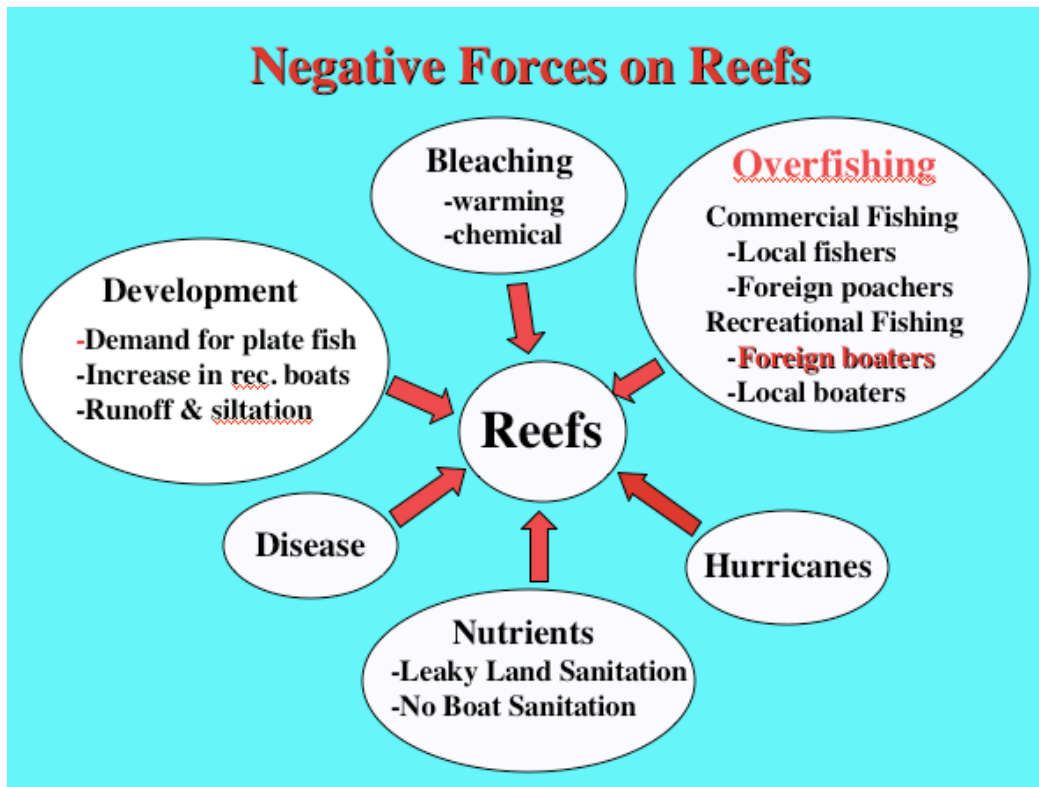


Figure 2. Negative forces on reefs

contribution foreign boaters make to the local economy and their willingness to pay for conservation measures. With estimates of the amount of seafood recreational boaters and local commercial fishermen catch, a comparison is made about their relative contribution to the overfishing problem. A determination of boater's spending provides an estimate of their contribution to the local economy. The willingness to pay for reef conservation and moorings indicates whether more money can be extracted for marine conservation projects. The study was conducted in the Exumas, a group of out islands southeast of Nassau that are representative of the reef degradation and development found throughout the Bahamas.

## 1.2 BAHAMAS BACKGROUND

### 1.2.1 Fishing

At 3% of the GNP, commercial fishing is a small, but lucrative activity for fishermen in the Bahamas. The primary commercial species are spiny lobster (*Panulirus argus*), Nassau grouper (*Epinephelus striatus*) and queen conch (*Strombus gigas*). Lobster, at a current price of \$15 per pound constitutes 88% the total landings value (Dept. of Fisheries 2007). The price of grouper at \$5-8 per pound while not as high has been sufficient to cause a significant decline in grouper landings and their protection during spawning season. It is the assault on lobster, grouper and other reef fish that negatively impact not only the animals but also the reefs. Queen conch occupies a different ecosystem; nearby turtle grass flats. Their collection does not impact reefs but their numbers are included in this report for economic comparison with commercial catches.

With fishing representing only 3% of the GNP, the Department of Fisheries is poorly funded with a \$2.3 million budget in 2007-2008 (Commonwealth of the Bahamas, 2008) and thus without significant political power to tighten regulations or enforce the current regulations to deter overfishing. The Department of Fisheries, hamstrung by a lack of manpower and boats, is largely dependent on the Royal Bahamas Defense Force (RBDF) to enforce fishing regulations but this agency is also are without sufficient funds or equipment to chase higher priority illegal immigrants and drug runners much less or enforce fishing regulations. Control of overfishing is an economic problem at the mercy of political priorities. “As expressed by the director of the Department of Fisheries, “there is a lack of government realization about enforcement (Braynen 2008)”.

The fishing regulations themselves have some weak components, all indirectly related to political pressure. Most important is the lack of catch limits for local commercial fishermen. Without limits or enforcement, the fishermen catch what they want. Outside of Nassau in the out islands, there are no records on what is caught and sold locally. Since 75% of the commercial landings in Nassau come from the out islands (Bethel, 2008), it is easy to conclude that there is significant, unmonitored catch that is never recorded. Another particularly weak regulation is the use of compressed air. To undermine the prohibited use of traditional SCUBA gear, fishermen have substituted hookah equipment that compresses air on the surface. This allows divers to remain underwater for even longer periods of time and be more efficient in their collection of fauna. Because hookahs came into widespread use, the Department of Fisheries rather than placing restrictions, allowed their use. Politics can also directly affect regulations. In January 2007, catch limits for foreign recreational boaters were reduced but reversed

in October of that year in response to the strong objection of the U.S. sport fishing community (Table 1).

<b>MAXIMUM ALLOWED ON BOARD</b>	<b>January 1, 2003</b>	<b>January 1, 2007</b>	<b>October 19, 2007</b>
MIGRATORY FISH (KINGFISH, DOLPHIN, TUNA ,WAHOO)	6 FISH PER PERSON PER VESSEL	6 FISH PER VESSEL	18 FISH PER VESSEL
TURTLE	0	0	0
CONCH	10 CONCH PER PERSON	NO CONCH	6 CONCH PER VESSEL*
CRAWFISH (LOBSTER)	6 CRAWFISH PER PERSON	6 CRAWFISH PER VESSEL	10 CRAWFISH PER VESSEL
DEMERSAL FISH (GROUPER, SNAPPER, GRUNT)	20 LBS PER PERSON	20 LBS PER VESSEL	60 LBS OR 20 FISH PER VESSEL (WHICHEVER IS THE LESSER)

\*export requires CITES permit

(Source: Bahamas Dept. of Fisheries)

**Table 1. Fishing regulations for foreign boaters**

Despite the weakness of regulations cited above, there has been positive action in two marine conservation issues. Able to build a case that grouper stocks are declining, the Department of Fisheries persuaded the government to implement a three-month season (Dec.- Feb.) in 2007 to protect spawning grouper. In 2000, the government committed to establishing a network of Marine Protected Areas (MPAs) that will cover 20% of the shallow water banks in the Bahamas by 2020. None have been established to date, though five will be proposed in a cabinet paper to the Prime Minister in the summer of 2008 (Burrows, 2008). All regulations on size, season, closure and gear however, are undermined by lack of enforcement.



### 1.2.2 Tourism and Development

As overfishing and reef degradation continues, tourism development in the Bahamas is booming. Tourism contributes 60% for the GNP and is seen as the weapon for combating a 10% unemployment rate (CB-Dept of Statistics 2006). The stated goals of the Bahamas government is to establish a mega resort as an “anchor development” on each of the 15 major islands to provide infrastructure and spur economic growth (Smith 2005). All new developments have to submit an environmental impact assessment (EIA) to the Bahamas Environment, Science and Technology Commission (BEST) but after approval, there is no on-site monitoring of construction or operations (Burrows 2008). The government’s development policy has resulted in a building boom largely unmonitored for it impacts on the land or marine environment.

### 1.3 EXUMAS BACKGROUND

The Exumas are a chain of 300 islands and cays that stretch for 100 miles, starting approximately 35 miles southeast of Nassau. They are a boundary between the shallow water of the Great Bahama Bank and the deep water of Exuma Sound. The Great Bahama Bank is shallow with depths ranging to 75 feet where intermittent coral heads are interspersed among the sand. It is considered the most productive commercial fishing grounds in the Bahamas. Depths in Exuma Sound range to 5,000 feet and provide fishing for many pelagic species.

Population in the Exumas has remained relatively constant at 3,500 (1% of the Bahamian population) over the last 10 years (Commonwealth of the Bahamas 2005). Fishing is not a major occupation here involving only about 30 people as their major

source of income. Most of the fish they catch is sold locally to residents and restaurants, as there is no commercial fish market. This fishing effort increases during lobster season with the additional fisherman trying to supplement their income (Styles 2008). Much of the lobster is frozen and sent to Nassau for export or resale in the Bahamas, even to some restaurants in the Exumas (Styles 2008).

Approximately 20% of the length of the Exumas is dedicated as the Exuma Cays Land and Sea Park (ECLASP) and is managed by the non-profit, Bahamas National Trust. This park was dedicated in 1958 and initially allowed a daily quota of fish takes. “Recognizing unsustainable pressures on fish, lobster and conch populations, as well as coral reefs,” the entire park was declared a no-take fisheries area in 1986 (Bahamas National Trust 2006). Dedication of the park, while considered a conservation success story by many, was viewed by some local fishermen as a “take” and they continue to poach within its boundaries. Scientific studies have shown the park has biomass levels four times higher than outside its boundaries (Knowlton 2008). The corals however, have yet to show signs of improvement (Mumby 2007). The park has been so successful that local fishermen find it hard to resist the lure of \$1000 return from inside the park versus a \$400 return outside and so poaching enforcement is a major park management activity (Barbenitz 2008).

Unlike other parks managed by the Bahamas National Trust, the ECLASP is entirely run on money it generates from moorings, gift shop sales, donations and the sale of amenities such as ice, water and internet service (Barbenitz 2008). Moorings have been installed in the area of park headquarters where current is strong and anchoring room limited. Moorings have also been installed in two prime anchoring sites without

such constraints and have generated some disapproval by boaters. Moorings generate approximately 66% of the annual income of the park.

## 2.0 METHODOLOGY

Random surveys and structured interviews were administered in five harbors in the Exumas. Elizabeth Harbor is the largest harbor in the chain and where the majority of the data were collected. Additional sampling locations further north in the Exumas chain included Staniel Cay, Sampson Cay, Warderwick Wells and Norman's Cay. In Elizabeth Harbor, a random survey was conducted on foreign recreational boaters. Photographs were taken of the four major anchoring areas in the harbor to create a panorama of all the boats to be involved in the study. Boats in the photographs were numbered and were then selected by a random number generator. Boat names were determined for the selected boats and interviewed where convenient, primarily onboard but sometimes on the beach. When a selected boat moved out of the harbor before it could be sampled, a boat anchored adjacent to that location was selected. In the four harbors sampled north of Georgetown, a random survey was not required as the number of boats in each location was sufficiently small to interview all boats.

The major questions to be answered by this study were:

- To what extent do foreign boaters contribute to the overfishing of reef species?
- To what extent do boaters contribute to the local economy?
- What is boater's willingness to pay for reef conservation and moorings?

To answer these questions, the boaters were asked,

- How much did you catch last week?
- How much did you spend last week?
- Will you pay higher entry and mooring fees?

The two contingent valuation questions on willingness to pay for reef conservation and moorings were asked for three different payment amounts. The boater survey instruments also included questions on boat description, trip information, cruising history, fishing gear and use of the Exumas Cays Land and Sea Park. Finally, open-ended questions were asked to discern reasons for cruising in the Exumas, concerns about the reefs and attitudes about moorings. The survey instruments for boaters, restaurants and fishermen are provided in Appendices 1-3.

Structured interviews of government officials, NGOs, fishermen and restaurants were also conducted to give background information to the issue of overfishing. A list of the interviewees is presented in Table 2.

TYPE	NAME	ORGANIZATON	POSITION	LOCATION
Government	Mr. Michael Braynen Mrs. Charity Ambrister Mr. Earliston McPhee Ms. Petherina Hanna	Department of Fisheries Department of Tourism Department of Tourism Department of Tourism	Director Out Islands Sustainable Tourism Exumas	Nassau Nassau Nassau Gerogetown
Non Government Organizations & Conservationsts	Felicity Burrows Tamica Rahming Tom Barbenitz Basil Minns Terry Bain Larry Smith Neil Sullivan	Nature Conservancy Bahamas National Trust Bahamas National Trust Minn's Water Sports Save The Exuma Park (STEP) Bahama Pundit Bahama Pundit	Marine Specialist Marine Specialist Park Warden Conservationist Conservationist Journalist Geologist	Nassau Nassau Warderwick Wells Cay Georgetown Little Farmers Cay Nassau Nassau
Restaurants	Curtis Smithson Nevelle Kevin Kenneth Sussanah Treavor	Four Seasons Peace and Plenty Eddie's Edgewater Chat & Chill Staniel Cay Yacht Club Sampson Cay Yacht Club	Executive Chef Manager Manager Owner Manager Chef	Great Exuma Georgetown Georgetown Stocking Island Staniel Cay Sampson Cay
Fishermen	Tracy Garvin & Stanley Terrance Obby	seafood wholesaler (part of a group of 10-12) (part of a group of 4-5) (part of a group of 4-5)		Georgetown Black Point Long Island Long island

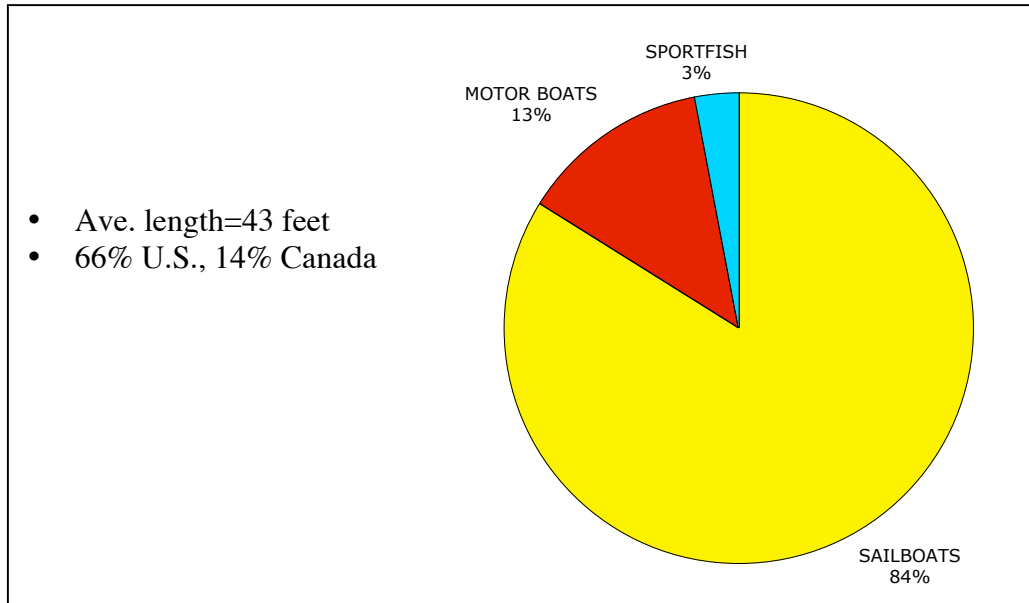
**Table 2. List of interviews**

### 3.0 RESULTS

#### 3.1 RECREATIONAL BOATERS

##### 3.1.1 Description of Boats

Sailboats comprised the majority of the boats sampled at 84% (Fig. 3). Sport

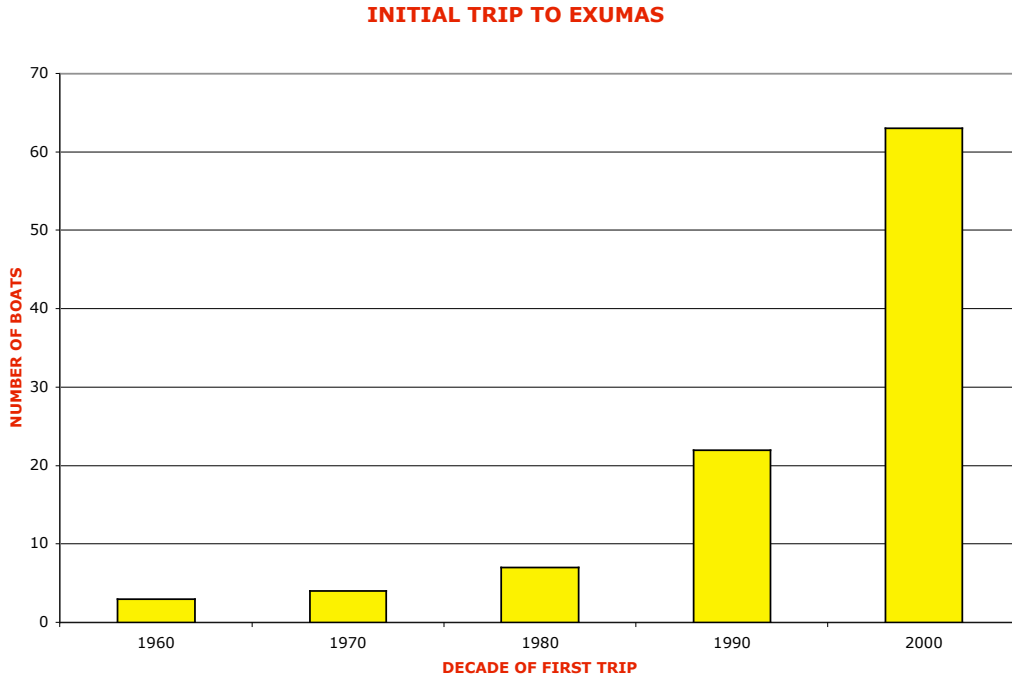


**Figure 3. Type of boats sampled**

fishing boats whose focus is pelagic fishing represented 3% and other types of motorboats making up the remaining 13%. Boat length ranged from 30 to 71 feet with an average length of 43 feet. The country of origin was predominantly United States at 66% followed by a significant and growing contingent of Canadian boaters at 14%. When entering the country, the boats favored the check in locations of Nassau (27%), Bimini (18%) and Georgetown (11%).

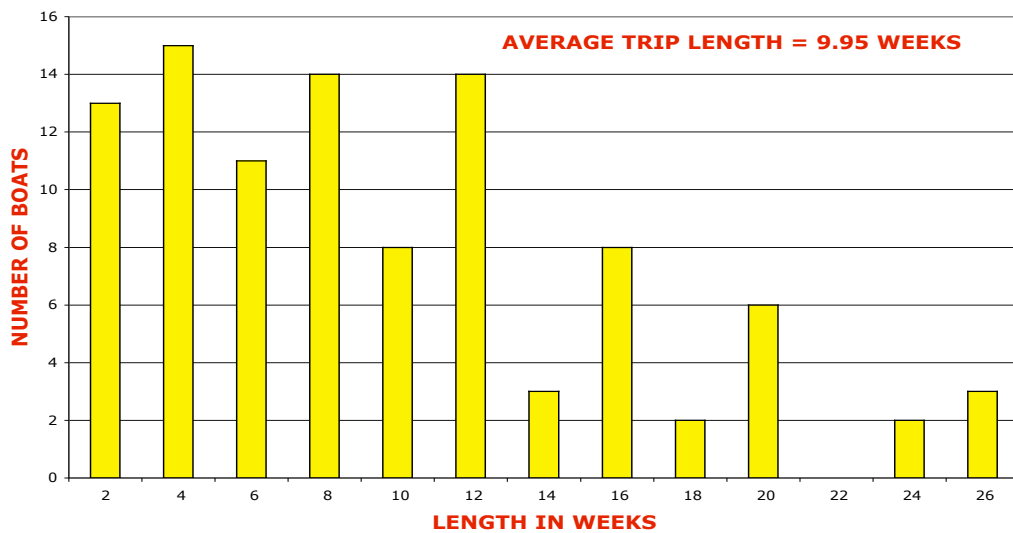
##### 3.1.2 Cruising Habits

A few boats (3%) have been coming to the Exumas since the 1960's but the majority (67%) had their first trip to the Exumas in the current decade (Fig. 4).



**Figure 4. Decade of first trip to the Exumas**

The 2008 cruising season lasted between 1 and 26 weeks depending on whether a boat was just transiting through the Exumas or on its way to other locations. The average stay was 10 weeks or 2 1/2 months. Based on their length of stay in the Exumas, the 100 boats sampled represent 995 boater weeks (Fig. 5). When asked if they planned to return



**Figure 5. Trip length**

next year, 52 % indicated that was their intention. The primary reason these boaters come to the Exumas over other nearby cruising areas is remoteness and the feeling that they are more natural than either the Florida Keys or the northern Bahamas. Weather typically warmer than the Abacos in the northern Bahamas was second most cited reason (Table 3).

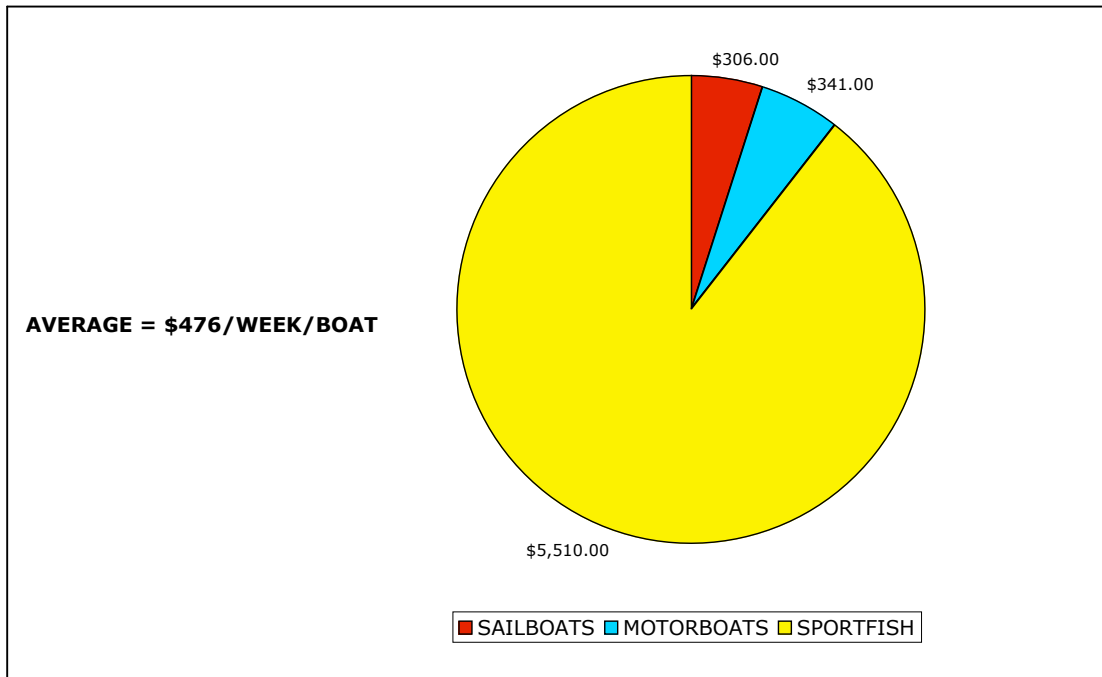
<b>REASON</b>	<b># RESPONSES</b>	<b>PERCENT</b>
<b>MORE NATURAL THAN THE N. BAHAMAS &amp; US.</b>	<b>22</b>	<b>17%</b>
<b>RELATIVELY WARM WEATHER</b>	<b>19</b>	<b>15%</b>
BEAUTIFUL	15	12%
ON THE WAY TO CARRIBBEAN, OTHER ISLANDS	14	11%
GOOD ANCHORAGES	12	9%
GOOD SOCIAL LIFE	10	8%
GEORGETOWN GOOD BASE FOR TRANS. & SUPPLIES	9	7%
RECOMMENDED	7	6%
FISHING AND DIVING	7	6%
A NEW PLACE TO VISIT	5	4%
EXUMAS CAYS LAND & SEA PARK	4	3%
FRIENDLY	2	2%
SAFE, LOW CRIME	1	1%
<b>TOTAL</b>	<b>127</b>	<b>100%</b>

**Table 3. Why boaters come to the Exumas**

The season for cruising in the Exumas is usually December through May. Hurricanes and heat deter extended trips in the summer and fall. The boats coming to the Georgetown have been declining the last couple of years. According to records kept by the boater community, the maximum number of occupied boats in Elizabeth Harbor at any one time has dropped from 405 in 2005 to 290 in 2008 (Kristofs 2008). This is consistent with statistics from the Department of Tourism that show a similar decline in boat arrivals over the same period (CB-Dept of Tourism 2008).

### 3.1.3 Expenses

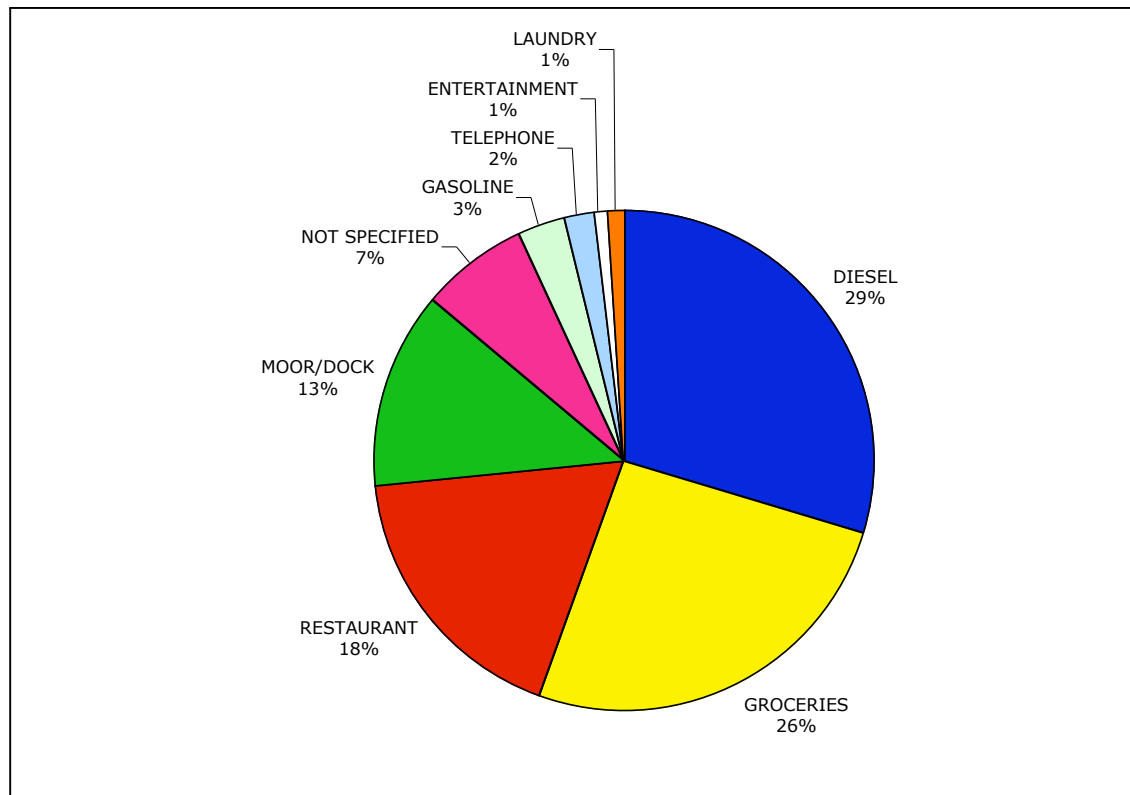
The money spent by foreign boaters varies significantly depending on boat type. The minority fraction of sport fish boats (3%) declared average weekly expenses of \$5,510 while other motorboats and sailboats spent an average of \$341 and \$306, respectively (Fig. 6). Diesel fuel and groceries were the top spending categories at 29%



**Figure 6. Average boater expenses**

and 26% respectively, followed by restaurants at 18% and moorings/dockage at 13%. The overall average expenditure per week was \$476 (Fig. 7). The boater's contribution to the local economy for the 2008 season using boater weeks and weekly expense data from the survey and number of boats arrival in the Exumas from the Department of Tourism (2008) is estimated to be approximately \$3 million (Table 4).





**Figure 7. Boater expenses by category**

	<b>GROSS CONTRIBUTION TO ECONOMY</b>
AVERAGE # WEEKS/TRIP	9.95
AVERAGE WEEKLY EXPENDITURES	\$476.00
TOTAL # BOATS PER SEASON*	630
<b>TOTAL</b>	<b>\$2,983,806.00</b>

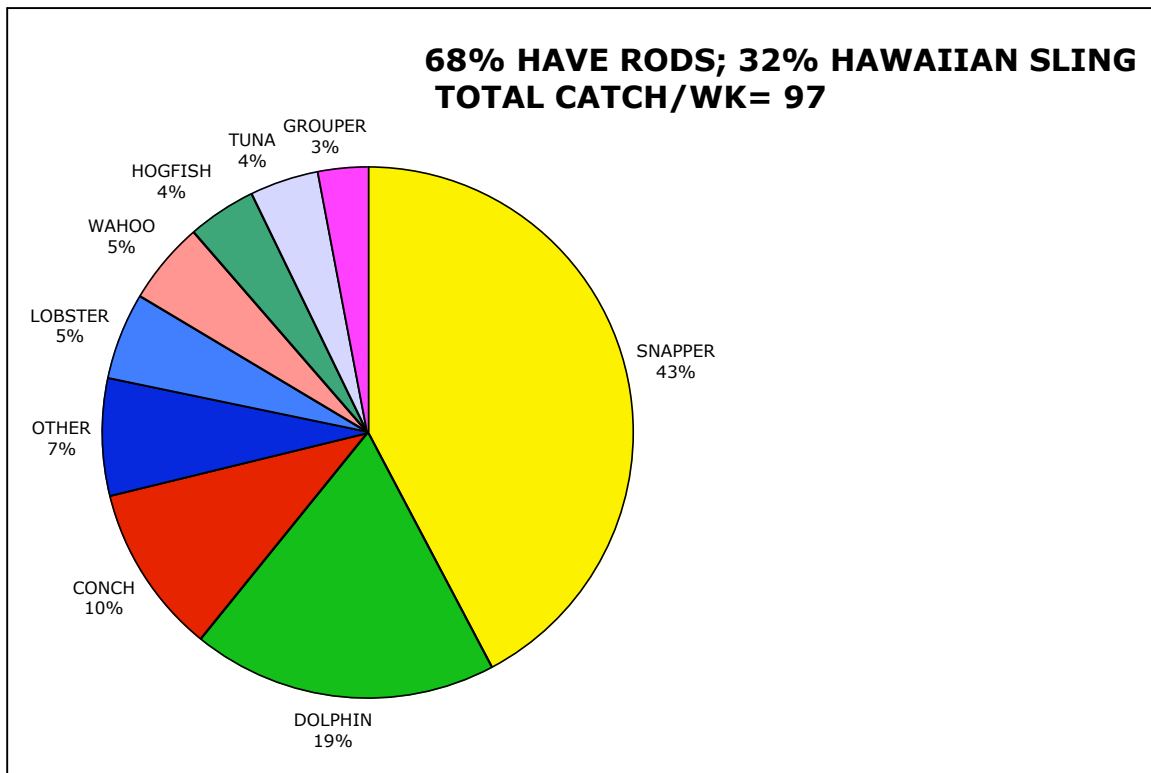
\* Bahamas Dept. of Tourism, 2007.

**Table 4. Estimated gross contribution to local economy**

### 3.1.4 Fishing

Fishing gear on foreign recreational boats was limited to rods and Hawaiian slings or pole spears. In the study sample, 68% of the boats had rods on board that were almost exclusively used for offshore trolling in deep water when transiting between islands.

There was only occasional mention of rods used for bottom fishing. Hawaiian slings and pole spears, the primary gear for catching reef fish and lobster were carried by 32% of the boats (Fig. 8).



**Figure 8. Total catch by species**

The total number of fish and shellfish caught in the entire sample of 100 boats was 97 in one week. Snapper was predominant at 43%, followed by dolphin (19%) and conch (10%). A total catch of 970 pounds per week was estimated multiplying the number of fish caught per week (97) by an average 10 pounds per fish using the weighted average from percentage of fish sampled, multiplied by average species weight (Florida Museum of Natural History 2008) (Table 5).

	FOREIGN RECREATIONAL BOATERS		LOCAL COMMERCIAL FISHERMEN
	ALL FISH <sup>1</sup>	REEF FISH	
# OF FISH CAUGHT /WEEK/100 BOATS	97	54	
AVE. WT. / FISH(LBS.) <sup>2</sup>	10	3	
LBS. OF FISH/WEEK/100/BOATS	970	162	
LBS. OF FISH/WEEK/BOAT	9.7	1.6	260
# OF BOATS FISHING/WEEK <sup>3</sup>	290	290	30
TOTAL LBS. FISH/WEEK	2813	464	7800

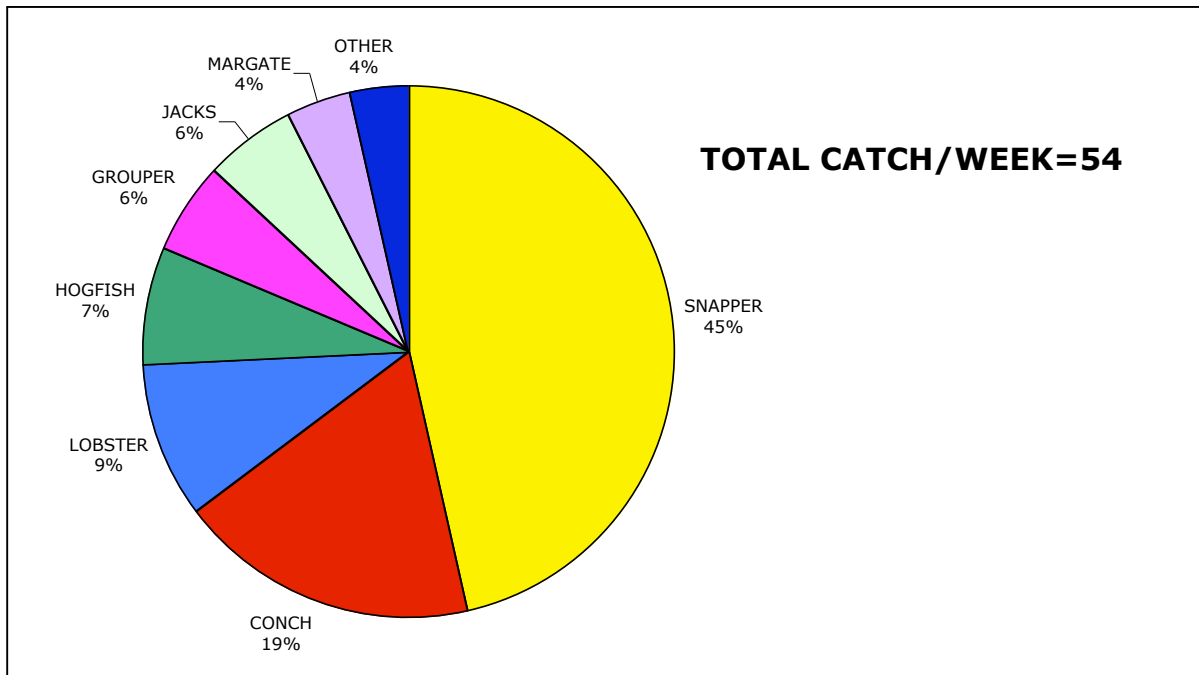
<sup>1</sup>PELAGIC AND REEF FISH

<sup>2</sup>WEIGHTED AVERAGE OF SPECIES CAUGHT

<sup>3</sup> ONE WEEK MAX. IN ELIZABETH HARBOR FOR FOREIGN RECREATIONAL BOATERS (Kristofs 2008).

**Table 5. Comparison of recreational boater and commercial fisherman catch**

When pelagic fish were eliminated from the sample to focus on reef species, the number of fish caught per week dropped to 54. Still, the predominant fish caught was yellow tail snapper (45%), followed by conch (19%) and lobster (9%). The more valuable reef fish for eating such as grouper and hogfish represented only 4% and 5% of the fish caught, respectively (Fig. 9). For these reef species, a total catch of 162 pounds was estimated by multiplying the number of fish caught per week by an average of 3 pounds (Department of Fisheries 2007). The average catch per boat per week was thus 1.62 pounds. Using the maximum number of boats in the Elizabeth Harbor in 2008 of 290 boats, it was estimated that 464 pounds of fish were caught per week by foreign recreational boaters (Table 4).



**Figure 9. Reef catch by species**

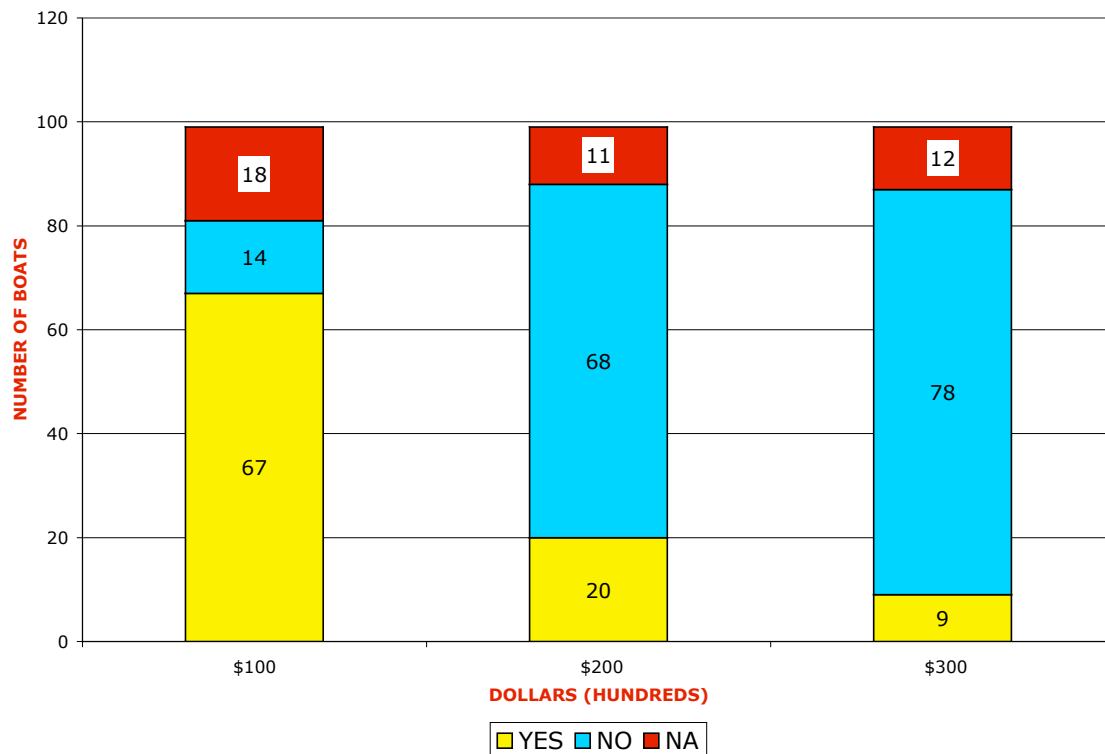
### 3.1.5 Reef Concerns

Boaters were asked an open ended question as to what concerns, if any, did they have about reefs in the Exumas. Twenty one percent responded that there were less fish or that they had to dive deeper to find fish. However, 16%, typically those on their first trip had no concerns about the reefs. Another 11% felt the reefs themselves were dead and disappointing (Table 6).

REEF CONCERNS	# RESPONSES	PERCENT
FISH ARE GONE, LESS FISH, DIVE DEEPER FOR FISH	42	21%
NO CONCERNS	32	16%
REEFS ARE DEAD, DISAPPOINTING	21	11%
DEVELOPMENT, HOTELS, GOLF COURSES ARE A PROBLEM	16	8%
BAHAMIANS ARE OVERFISHING, USING TRAPS, SMALL CONCH & LOBS	15	8%
MORE FISH, CONCH, TURTLES, LOBSTER THIS YEAR	15	8%
LIONFISH	11	6%
LACK OF ENFORCEMENT	10	5%
CHEMICAL BLEACHING IS STILL HAPPENING	7	4%
BOATERS/ TOURISTS ARE NOT CAREFUL OF REEFS	6	3%
FISHING RULES ARE CONFUSING; AIMED AT TOURISTS, NOT LOCALS	5	3%
BOATERS ARE OVERFISHING	5	3%
TRASH AND USED OIL A PROBLEM	5	3%
POACHING IN PARK AND NO RESPONSE	3	2%
NO CONSERVATION PROGRAMS, LOCALS DON'T CARE	3	2%
USE OF HOOKAS ALLOW TOO MUCH FISHING	2	1%
	198	100%

**Table 6. Reef concerns**

When checking into the Bahamas boats 35 feet and longer have to pay \$300 which includes a fishing license. When asked if they were willing to pay \$100 more when entering the Bahamas to pay for reef conservation, 67% said yes. At \$200, the willingness to pay dropped to 20% and went to 9% at \$300 (Fig. 10). The primary



**Figure10. Willingness to pay for reef conservation**

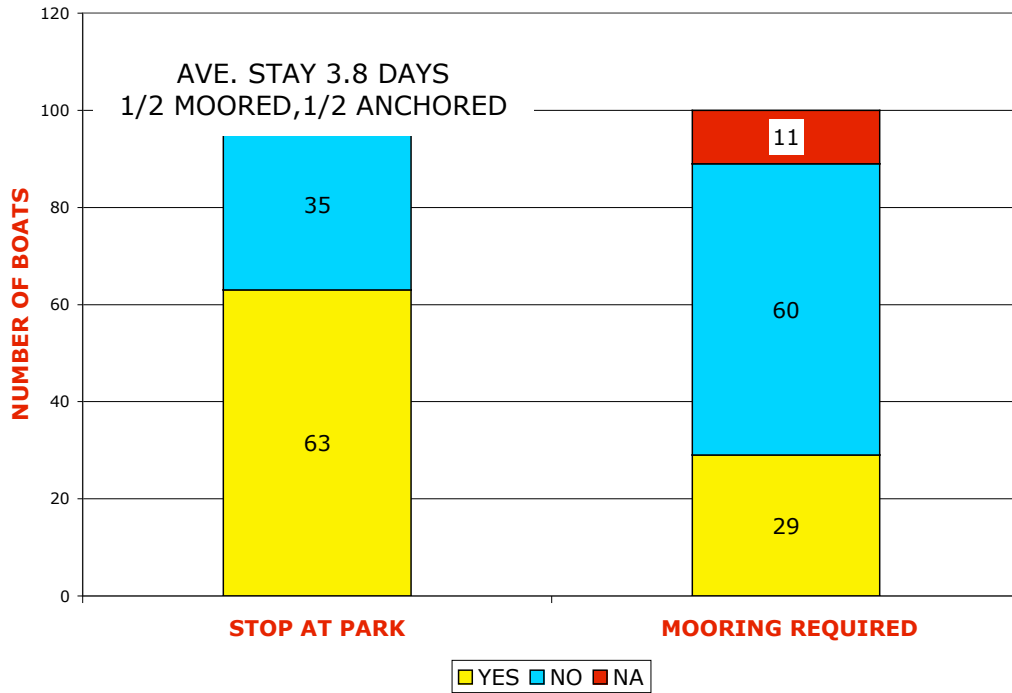
reasons cited by those unwilling to pay were that 1) the money wouldn't be spent well by the Bahamian government and 2) entry fees are already too high (Table 7). Entry fees are the highest in the Caribbean and have deterred some boats from entering the Bahamas, especially those on short trips from the U.S.

COMMENTS	# RESPONSES	PERCENT
WON'T BE SPENT WELL BY BAHAMIAN GOV'T	24	37%
ENTRY FEES ALREADY TOO HIGH	21	32%
NO LOCAL CONCERN; NEED TO POLICE LOCALS	4	6%
BOATERS ALREADY AVOID CHECKING IN	3	5%
DEVELOPMENT & HOTELS ARE A BIGGER PROBLEM	3	5%
GO TO ALTERNATIVE PLACE OR NOT COME AS OFTEN	3	5%
BOATERS ARE NOT HURTING REEFS	3	5%
WANT TO SEE IT CONSERVED; WILL PAY MORE	1	2%
FEE STRUCTURE WRONG	1	2%
WOULDN'T MAKE AS MANY TRIPS	1	2%
IF SPENT IN PARK	1	2%
TOTAL	65	100%

**Table 7. Why should boaters pay more?**

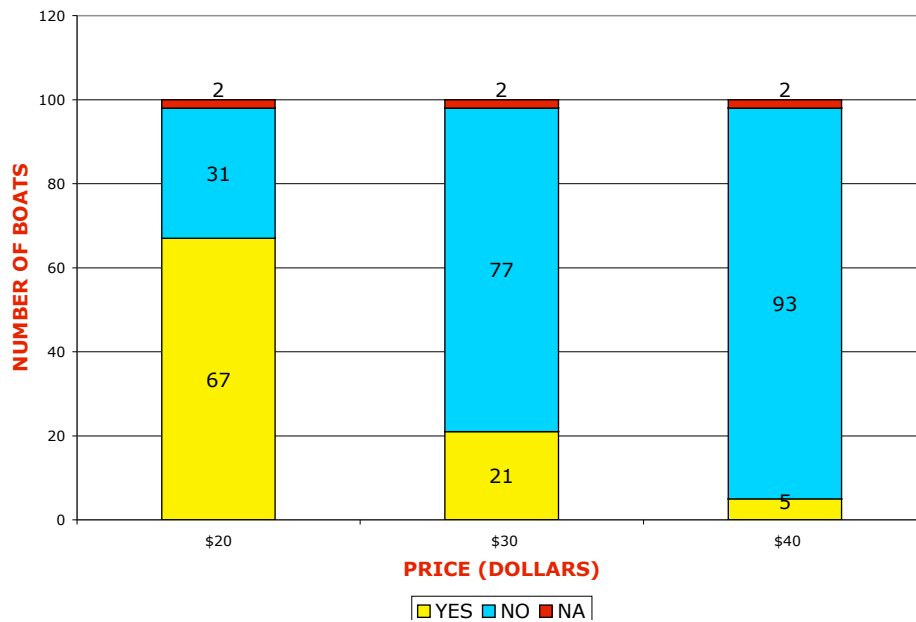
### 3.1.6 Moorings in the Exuma Cays Land and Sea Park

Approximately 63% of the boats surveyed visited the ECLASP. They stayed in the park an average of almost 4 days and were equally divided between time spent moored versus anchored (Fig. 11). Only 30% of the respondents felt that mooring should be required. Mooring rates increase on a sliding scale based on boat length and range from \$15 to \$50 dollars per night. The park records (Barbenitz 2008) show that the average rate is \$19 per night, which corresponds with average length of a boat being 43 feet.



**Figure 11. Park visits and mooring requirements**

When asked if they would pay \$20 for a mooring, 67% of the boats said yes. As the price of the mooring was raised to \$30 and \$40, the willingness to pay for a mooring decreased to 21% and 5% respectively (Fig. 12).



**Figure 12. Willingness to pay for moorings**



The open ended, unsolicited comments on moorings that followed these questions indicate a tolerance for mooring but a resistance to their requirement. The most repeated comment was that moorings were justified to protect coral and when anchorages were crowded but should not be required in sandy areas with adequate swinging room (Table 8). There was some resentment that moorings had been placed in two of the favorite anchorages and took up the best locations for anchoring. If the mooring price was raised to \$30, 17% of the comments indicated that boat owners would come to the park less often or only in bad weather when some boats feel more secure on a mooring. Requiring mooring would drive boats away according to 11% of the comments.

<b>COMMENT</b>	<b>#</b>	<b>%</b>
OK TO REQUIRE MOORINGS TO PROTECT CORAL; WHEN ANCHORAGE CROWDED	12	19%
MOORINGS SHOULD NOT BE REQUIRED IN SANDY AREAS; LOTS OF SAND	11	17%
AT \$30, WOULD COME LESS FREQUENTLY; ONLY IN BAD WEATHER	11	17%
IT IS A MISTAKE TO FORCE MOORINGS; BOATS WILL STOP COMING	7	11%
MOORINGS ARE NOT RELIABLE,CAN'T BE TRUSTED; HAVE TO BE MAINTAINED	5	8%
PREFER TO ANCHOR; WILL NOT MOOR	4	6%
THERE ARE NOT ENOUGH MOORINGS FOR REQUIRED MOORING	3	5%
SHOULD BE A COMBINATION OF REQ'D MOORINGS & DESIGNATED ANCHORAGES	3	5%
COST OF MOORING IS GETTING GOT BE A FACTOR ON TOP OF HIGH FUEL COSTS	3	5%
PARKS IS SELLING OUT TO BIG BOATS WITH HIGH MOORING FEES	2	3%
GET RID OF ALL MOORINGS EXCEPT WARDERICK WELLS	2	3%
	<b>63</b>	<b>100%</b>

**Table 8. Mooring comments**

### 3.2 FISHERMEN RESULTS

Fishermen interviewed represented of two locations, Georgetown and Black Point. They ranged in age from 30-50 years old and all had fished their whole lives. They fished a nine-month season from August to March which coincides with the lobster season.

Fishermen from the Exumas are not commercially organized; there is no fish market in the Exumas (Styles 2008). It is estimated that 30 fishermen get 80-100% of their revenue from fishing (Styles 2008). They generally run smaller, 15-foot Boston Whalers and make day trips to their fishing grounds. Their trips can range from one mile to the windward reefs in Exuma Sound to 30 miles west on the banks. They use traps, free dive and some have hookahs. Their fish catch is sold primarily to local restaurants. Several times during lobster season, frozen lobster is gathered and shipped to wholesalers in Nassau for retail distribution. Local commercial fishermen catch about 240-280 pounds per boat in a week (Styles 2008, Garvin 2008) and since there are approximately 30 fishermen, their total weekly catch is estimated at 7,800 pounds (Table 4).

Fishermen from both Georgetown and Black Point said the number of fish is declining and that they had to go further to find them. As fuel prices rise, they mentioned a tendency to delay checking traps. All the fishermen interviewed said they liked the Exuma Cays Land and Sea Park and wanted more parks and marine protected areas (MPAs). Fishermen from Georgetown thought more enforcement was needed, and that parks would be poached if not manned. The oldest fisherman stated that hookahs and spear guns should be outlawed (spear guns are prohibited but it is not enforced). All men loved their fishing jobs and did not want to quit fishing.

### 3.3 RESTAURANT RESULTS

The restaurants interviewed varied in size, serving from 225 to 7000 lunch and dinner meals per week (Table 9). This small data set shows a trend of smaller restaurants using locally supplied seafood at a lower price per pound. Larger restaurants requiring a reliable, year round source for fresh and frozen seafood, order from Nassau and the U. S. at higher prices. Grouper was the favorite seafood representing 33% of the orders, followed in descending order by snapper, conch, lobster and dolphin. None of the interviewees thought fish was harder to obtain but all said it had become more expensive. One restaurant that obtains its fish locally, estimated that prices had increased 25% in the last four years.

FISH	STANIEL CAY YACHT CLUB	EDDIE'S EDGEWATER	CHAT & CHILL	PEACE & PLENTY	FOUR SEASONS	
					FRESH	FROZEN
SNAPPER	\$0.00	\$2.40	\$0.00	\$6.50	\$0.00	\$0.00
GROUPE	\$7.50	\$5.00	\$5.50	\$8.50	\$13.45	\$12.95
MAHIMAHI	\$5.00	\$0.00	\$5.50	\$6.50	\$0.00	\$0.00
CONCH	\$4.00	\$2.00	\$2.00	\$5.75	\$8.00	\$5.50
LOBSTER	\$13.30	\$15.00	\$0.00	\$23.00	\$0.00	\$19.00
% LOCAL	80%	100%	100%	0%	0%	0%
% NASSAU	0%	0%	0%	100%	0%	100%
% USA	20%	0%	0%	0%	100%	0%
# SERVED PER WEEK	225	300	550	1000	7000	

**Table 9. Price of fish and their source by restaurant size**

## **4.0 CONCLUSIONS**

### **4.1 FISHING CONCLUSIONS**

When comparing the reef catch of foreign recreational fishermen (464 pounds) and local commercial fisherman (7,800 pounds, Table 5), the results indicate that the contribution to overfishing from foreign recreational boaters is a relatively small portion (6%) of the total local commercial catch. This number might be adjusted upward if the survey had been conducted in March (the last month of lobster season) instead of April but there is equal likelihood that the estimated number of fishermen is low and that realistic changes in these variables would not change the conclusion that contribution to overfishing by local commercial fishermen is significantly higher than the contribution from foreign recreational boaters. This conclusion is supported by findings on gear used and distances traveled to fish. Only 32% of the foreign recreational boaters carry gear (Hawaiian slings and pole spears) to catch fish and lobster while free diving. Local commercial fishermen have an advantage being permitted to use traps and compressed air. Also, the fact that local fishermen have to travel long distances to catch fish imply that they have been extending their fishing territory in ever increasing arcs out to 30 miles, a situation that is not substantially contributed to by recreational boaters because they make few trips to the banks at those distances or depths. A continuing increase in fuel costs (currently \$5.50/ gallon) will severely impact these fishing efforts and as focus returns to closer fishing grounds there may be more interest in protecting and determining a sustainable catch level.

These results reflect the current situation in the Exumas. They do not exclude the possibility that historically, recreational boaters collected a higher proportion of the local

fish or that “rogue” fisherman currently exceed their catch limits and sell the fish to other boaters or in the U. S. However, at this stage of degradation in the Exumas, when the general observation of those that have been in or visiting the Exumas over the last 30-40 years indicate that there has been a significant decline in reefs and reef fish, it seems apparent that foreign recreational boaters are not now the substantial contributor to overfishing. The management implication of this conclusion is that to reduce overfishing on the deteriorating reefs of the Exumas, enforcement and regulations should be directed primarily at local commercial fishermen.

This study also reveals a link between tourism development and demand for reef species. The policy of the government is to place a mega resort on each of the major islands for economic stability and then permit smaller, ecotourism resorts more appropriate to the out island ambiance. Notwithstanding that one mega resort, the Four Seasons has already been built and at least two others, Crab Cay and Hermitage Estate have been approved for development on Great Exuma, at least five smaller resorts are also approved (McClain 2008) and are more likely to increase the demand for local reef species than the larger resorts if restrictions are not placed on local commercial fisherman.

#### 4.2 ECONOMIC CONCLUSIONS

Recreational boaters are another form of tourist but in addition to the benefits of their expenditures, have the costs of fishing and pollution attached. This case study has estimated the benefits of recreational boaters at \$2,983,806 gross dollars into the local economy per season (Table 4) and does not include their volunteer efforts or donations.

The maximum costs of their fish catch, including the pelagic fish, can be estimated at \$365,000 (9.7 pounds per boat x 9.95 weeks x 630 boats x \$6.00 per pound). The benefit of foreign boaters clearly exceeds these fishing costs and probably the sanitation costs associated with recreational boaters that were not part of this study.

In the past, recreational boaters have been a major income source in the Exumas. Though there are jobs associated with grocers, bakers, restaurants, internet cafes, etc. that are highly dependent on recreational boater expenditures, increasingly the boaters are becoming less important to the local Exumian economy. Within the last ten years, their relative importance has been superceded by income from tourism, land development and construction. New developments in the Exumas currently approved by the Bahamas Investment Authority have a total project value of \$1 billion and an employment projection of 1770 jobs (Appendix 4).

## **5.0 RECOMMENDATIONS**

This study is small, covered a small period of time and only pertained to the southern Bahamas which are not as developed as the northern Bahamas nor do they attract as many boats. The recommendations that follow are based on results of this study and interviews. As more studies are contemplated, they might consider substantiating or ruling out the following recommendations.

### **5.1 ENFORCEMENT**

The fist priority in reef protection is to obtain the money to finance enforcement. Currently, the three hundred dollars (\$150 for boats less than 35 feet) collected by customs goes into the central government. There is a willingness of 2/3 of the

recreational boaters to pay an additional \$100 if they are certain the money will be spent on conservation. A well publicized, program to strengthen and enforce fishing regulations on local and recreational boaters funded by entry fees should be considered. The entry fees could be set on a sliding scale up to \$400 dependent on length of stay. Additionally, check out of the country should be required to determine not only their length of stay but also to deter illegal entry and fishing. Though boaters would complain, especially sport fishers, the Bahamas are in a good position to withstand any threatened withdrawal of these tourists because they have a product that can't be replaced in terms of nearby location whether as a destination or as a transit way. A sliding scale will appease those who transit over from the U. S. for the weekend and rather than just funding the "government", their monies would be going to resource protection. Additionally, having up to date fishing rules available at customs would clear up questions caused by currently dispersing the regulations from 2003 (Table 1).

Additional sources of funding for enforcement beyond allocating boaters' customs fees to Department of Fisheries and an outright increase of their budget will be difficult to produce. The large NGOs do not look like a potential source for enforcement as in some other countries. Neither the Bahamas National Trust which had their budget increased in 2007 from \$250,000 to \$1 million annually to administer 28 properties nor Bahamas office of the Nature Conservancy are considering donating monies for enforcement. Sustainable funding for enforcement of the proposed MPAs is the subject of a current study but those monies would not include fisheries management and enforcement.

Until the government realizes the necessity of enforcement, the Department of Fisheries should consider some targeted enforcement exercises in strategic locations to deter illegal fishing by all fishing groups. For example, a “raid” in the Jumentos and Ragged Islands, just south of the Exumas and a frequent fishing destination since the Exuma’s stocks have declined, would serve notice on the entire fishing community. Just the rumors from one or two enforcement actions would certainly have a substantial impact. Prior to such an action, the current regulations for all fishing groups would have to be well publicized (not just stated as amendments) for several months.

## 5.2 FISHING REGULATIONS

### 5.2.1 Catch Limits

Catch limits need to be set for local commercial fishermen. It is clear from this study that local commercial fishermen are overfishing reef species and without catch limits and enforcement, will continue to do so. The Department of Fisheries has no catch data outside of Nassau and needs to implement a system to weigh and quantify catch in the out-islands to provide a basis for setting limits. At the same time, the catch limits for foreign recreational boaters as of January 2007 should be reinstated (Table 1).

### 5.2.2 Gear

Enforcement would also allow the Department of Fisheries to close the loophole on hookah equipment. Prohibiting SCUBA but allowing hookah equipment are inconsistent and have facilitated local commercial fishermen in fishing unsustainably. Additionally, there should be payment for and limits on the number of traps. Traps are the primary gear for catching reef fish and are largely responsible for depleting reef



populations. As a result, previously noncommercial fish, such as parrotfish are now being brought to market in Nassau (Rahming 2008). Parrotfish and other reef grazers are a necessary functional group in reef ecology and need protection if the reefs are to maintain any measure of resiliency to combat other threats to the reefs. Further study on the by-catch of these traps would be valuable.

### 5.2.3 Reporting

The Department of Fisheries should facilitate reporting of fishing violations on the web, similar to their lionfish system. By initially partnering with an NGO to set up and collect the data, a database will have been established when enforcement becomes available. Just the existence of a reporting system may deter some illegal fishing.

## 5.3 MOORINGS

Moorings are useful to protect coral, increase the capacity of an anchorage and bring in money for various marine conservation projects. Moorings are currently at headquarters in two desirable anchorages in the ECLASP. The park and Elizabeth Harbor are considering requiring mooring and/or payment for anchorage. This study indicates that while 2/3 are willing to pay a \$20 nightly fee in the park; requiring mooring would probably decrease visits. Payment for anchoring in addition to the option of mooring whether in the form of an entry fee or a nightly fee would probably be more easily tolerated. Those who have been coming to the Exumas for more than 20 years will probably be unwilling to give up their freedom to anchor or to pay regardless of their ability to pay. Another consideration might be to charge an entry fee to either location. In either case, mooring and anchoring areas should be designated on charts.

#### 5.4 DEVELOPMENT

The Bahamas Investment Authority should be informed about the about the relationship of development and demand for local reef fish. The concept of marine resource carrying capacity for large and small resorts distributed among the out-islands should be developed.

#### 5.5 LOCAL MANAGEMENT/ OWNERSHIP OF FISHERIES

The Bahamas have always been an open water fishery and do not have a cultural history of sharing or being locally responsible for their marine resources (Braynen 2008). However, given the dispersed nature of the Bahamian archipelago and the difficulty enforcing and administering the fisheries program from a central location even with additional funds, the groundwork for local ownership should be initiated. An out-island group such as the Exumas could be the first pilot project.

It is naïve to think that the reef resources of the Bahamas will survive under current management systems especially given the results similar systems created further south in the Caribbean. Whereas designation of MPAs will be helpful, it is not a substitute for the hard work of fisheries enforcement. Only a significant change in regulation and enforcement can hope to protect the Bahamian reefs from the further degradation of overfishing.

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# Appendix 1. Boater Survey

Questionnaire Number	Random number
Boat information	Name Type Length Nationality
Trip Information	What date did boat cleared customs? Where did the boat clear customs? How long do you plan to stay in the Exumas? How many trips have you made to the Exumas? What year did you start coming to the Exumas? Why did you come to the Exumas instead of other places in the Bahamas? 1) 2) Are you planning to come next year?(Y/N) If boat fees was \$100 higher to help conserve the reefs, would you still come?(Y/N) \$200 higher \$300 higher
Expenses	How much money did you spend last week? Groceries                      Transportation Restaurants                    Fuel/Water Entertainment                Telephone TOTAL
Fishing Effort	How many days did you go fishing last week? How many days shallow/reef fishing? How many days deep waterfishing? Where did you fish?
Fishing gear	Which of the following fishing gear did you use? Rods Nets Hawaiian sling Other
Fish Caught	Number      Size How much fish did you catch in the last week? Groupers Lobster Snapper Mahi-mahi Other Discards Total
Snorkeling	How many days did you snorkel or dive in the last week?
General Questions	What concerns if any do you have about local reef fisheries? 1 2  Are you aware of the Exumas Cays land and Sea Park? Did you stop at the Exumas Cays Land and Sea Park? How many days did you stay? Do you think mooring in the park should be required? Would you be willing to pay \$20 to moor in a protected area? \$30 \$40  Would you like to see more Marine Protected Areas(no take) in the Exumas? Are you aware of the Moriah Harbor Cay Land and Sea park?

Appendix 2. Restaurant Survey

Survey Number			
Name of Restaurant			
Name of Respondent			
How many months of the year is the restaurant open?			
How many months long is the high season?			
How many people work here?			
How many people do you serve a week?			
How many pounds of fish did you order last week?			
How many pounds of fish do you order in the slow season?			
How many local fish suppliers do you have?			
How are they paid?			
Do you purchase fish outside the Exumas?			(Y/N)
Do you know where the fish come from?			
Fish	Bought	Brought In	Local Price Non local price
Purchased	Locally		
	%snapper		
	%grouper		
	% mahi-mahi		
	%conch		
	%lobster		
	Other		
Has it been harder to buy local fish this year?			(Y/N)
If yes, do you see the decline in fish as a problem for your restaurant?			(Y/N)
What would you like to see happen with fishing in the Exumas?			

Questionnaire number						
Personal Information						
Name						
Sex						
Age						
Birthplace						
Address						
How many years have you lived in the Exumas?						
How many years have you been fishing?						
How many people live in your household?						
Equipment	Boat Type	Number	Length	IN/OB ENG	HP	Engine age?
Fishing gear	Traps	Nets	Rods	Hawaiian Sling	Scuba	Other
Expenses						
How much money did you spend on the fishing operation last week?						
Fuel						
Labor/share						
Bait						
Gear						
Ice						
Other						
Total						
Fishing Effort last WEEK	Where do you f	Distance(mi)	# of trips	Ave hours/trip	Fishers/trip	
					male	
					female	
Fishing Effort per year	How many months/year do you fish?					
	What months do you fish?					
	Why don't you fish in off months?					
	Lobsters protected					
	Nassau grouper protected					
	Other					
Fish Caught per week/trip	Snapper	Number	WT(lbs)	Price	TOTAL	
	Grouper					
	Conch					
	Lobster					
	Mahi-mahi					
	Other pelagic fish					
	Other					
	TOTAL					
	Restaurant	Other				
	What percentage of catch is sold?					
Fish Sales & Income	Is fishing the boatowner's prim (Y/N)					
	What fraction of your income comes from fishing?					
	Does the boatowner work at any other jobs other than fishing in the past year?(Y/N)					
	If yes, what types of work?					
	What fraction of your income came from those jobs?					
	Are you satisfied with your job options?					
General questions						
	Do you think the number of reef fish have declined since you have been fishing(Y/N)					
	If yes, for what reasons?					
	Do fisherman in this community do anything to help conserve the reef fish and (Y/N)					
	If yes, what ?					
	Is it enforced?					
	Are they successful?					
	What could be improved?					
	Do you like the Exuma Cays Land & Sea Park?( Why?					
	Do you support other MPAs nez (Y/N) Why?					
	If yes, what would be fair rules?					
	Locals					
	Boaters					
	Other Bahamians					
	International					
	Would you like to quit fishing? (Y/N) Why?					

### Appendix 3. Fisherman survey

<b>Project Name</b>	<b>Description</b>	<b>Project Value</b>	<b>Project Status</b>	<b>Employment</b>
<b>Holmes Crab Cay</b>	Residential resort and marina development	\$240 million	APPROVED	355
<b>The Hermitage Estate</b>	Resort development, 200-room five star hotel; 200 timeshare suites; golf courses; corporate retreats; marinas; 102 single family residences; 585 condominiums; 80-room theme hotel; wellness centre; tennis courts; golf school; club house.	\$428 million	APPROVED –	800
<b>Kevalli Cove Resort</b>	Small 15 room eco hotel	\$6 million	APPROVED	7
<b>Renaissance Resorts</b>	26 room resort facility	\$8.2 million	APPROVED –	10
<b>The Reef at Little Exuma</b>	40 room boutique hotel on 245 acres, villas restaurant and docking facilities	28 million	APPROVED IN PRINCIPLE	110
<b>BVG Emerald Island Ltd.</b>	10.22 acres for six 3-storey, 12 unit residential condos, five 3-storey 2-unit town homes 5 residential town homes restaurant, swimming pools 2 recreational facilities	\$196.8 million	APPROVED	350
<b>80/50 Club</b>	Private residential club	\$85 million	APPROVED	113
<b>Children's Bay Cay Corporation</b>	15 residential homes with related facilities; 15 slip marina	\$25 million	APPROVED	25
		1 billion		1770

**Appendix 4. Exuma projects approved by the Bahamas Investment Authority, 2008.**