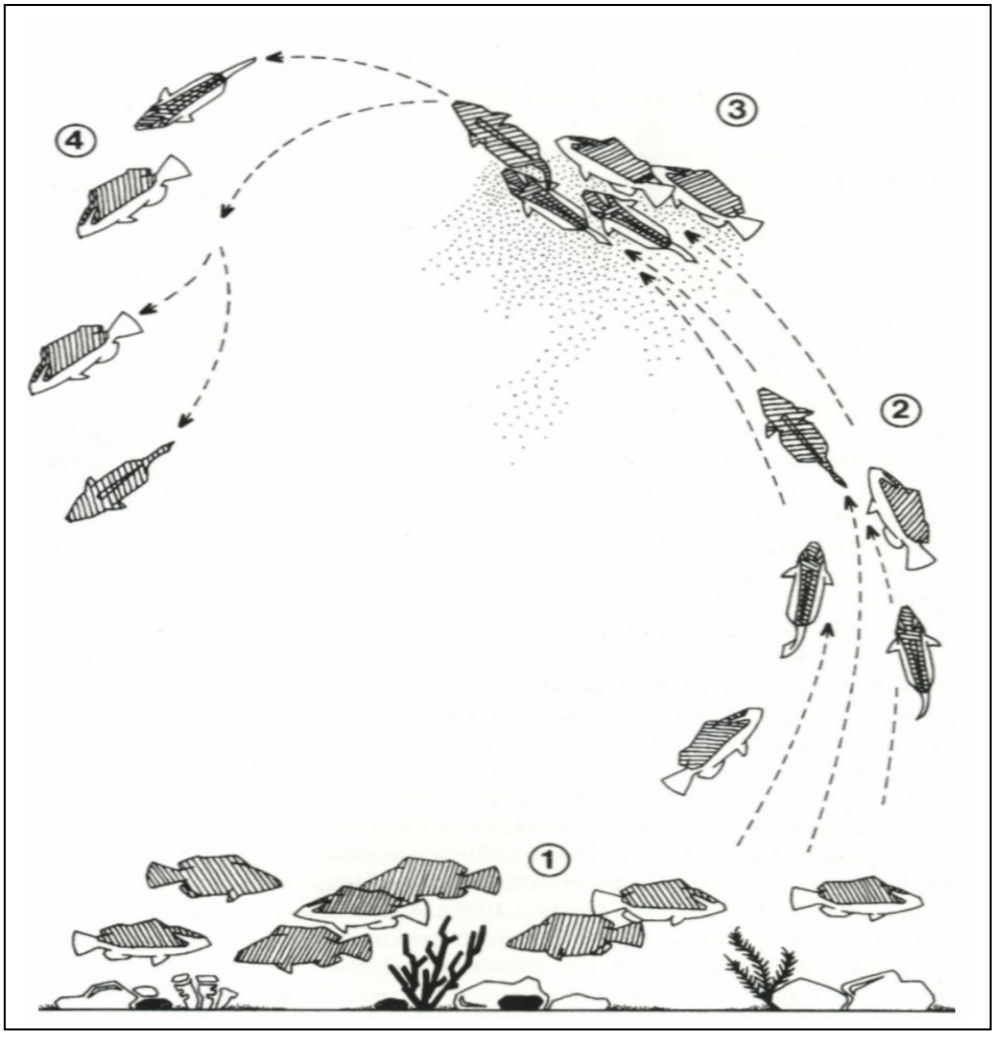
# PROCEEDINGS OF THE FIRST NATIONAL WORKSHOP ON THE STATUS OF NASSAU GROUPERS IN BELIZE




MONDAY, JULY 30, 2001
RADISSON FORT GEORGE HOTEL
BELIZE CITY

**"WORKING TOWARDS SUSTAINABLE MANAGEMENT OF NASSAU GROUPERS IN BELIZE"**

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## Foreword

As part of Green Reef's aim to promote responsible, sustainable use of Belize's marine resources, they strived to bring about greater awareness and concern for the Nassau Grouper. This fish species was historically one of the most important commercial fisheries in Belize, but decades of unmanaged aggregation-style fishing, along with extensive harvesting by spear fishermen, has led to the decline of stocks to levels where it is feared that the important spawning aggregations may no longer form. Taking into account all of these factors, Green Reef developed a comprehensive Nassau Grouper Recovery and Advocacy Program which addressed the need for updating stock information, increasing education and awareness regarding the status of the species, implementing effective management of the fishery and providing realistic economic alternatives for the fishermen who had traditionally fished the aggregations.

In coordination with a team of professionals consisting of representatives from the Belize Fisheries Department, Hol Chan Marine Reserve, Bacalar Chico National Park and Marine Reserve, Belize Audubon Society, the Toledo Institute for Development and Environment (TIDE), The Nature Conservancy, and the University of York/UK Darwin Initiative, Green Reef coordinated the first ever national assessment of Nassau Grouper spawning aggregations during January of 2001.

Green Reef recognized the need for increased education and awareness, and in response to this need, produced a series of educational materials including fact sheets, pamphlets, reports and a video. Green Reef also advocated effective and immediate management of the known aggregation sites in order to protect the remaining stocks. In order to provide alternative economic options for the fishermen that have traditionally fished the Nassau Grouper spawning aggregations, Green Reef and The Nature Conservancy coordinated a set of Scuba and Fly-Fishing training programs in Hopkins during December of 2001.

One of Green Reef's main objectives in organizing the Nassau Grouper Recovery and Advocacy Program was to provide a forum in which scientific research could be combined with effective management while taking into account the historical and cultural context of the peoples who have traditionally utilized this resource. Recognizing the need to widely disseminate the information obtained in the national survey as well as to explore management options and gain insight into the views of stakeholders and resource users, Green Reef and the Belize Fisheries Department hosted a national workshop in July 2001. The workshop, "Working Towards the Sustainable Management of Nassau Groupers in Belize," brought to light a variety of important issues and concerns regarding the future of the fishery. Green Reef is committed to protecting these resources, and through the successful completion of its Nassau Grouper Recovery and Advocacy Campaign Program it hopes to achieve awareness of the threats facing reef fish spawning aggregations, and encouragement of effective management and protection for the Nassau Grouper, while promoting viable options for the fishermen who rely on this species for their livelihood.

## Executive Summary

On July 30, 2001 a wide cross section of Belizean citizens, policy makers, government officials, NGO's and international conservation groups came together to take part in the workshop, "Working Towards Sustainable Management of Nassau Groupers in Belize," which was co-hosted by Green Reef and the Belize Fishery Department. The aim of all those in attendance was to look at the historical and current status of the Nassau Grouper stocks in Belize, discuss why the stocks have declined so radically during the last several decades, provide recommendations for management and explore options for economic alternatives for the traditional resource users of the fishery.

After hearing from scientists, fishermen, policy-makers and government officials as to the current status and management of the Nassau Grouper in Belize, an extensive panel discussion ensued with active participation from all attending the workshop. This discussion brought to light a multitude of various factors that must be realized when looking at the future status and management of the fishery. Additionally, in realizing that any effective management is going to need support from resource users, a consensus was reached by all in attendance that further time and considerations were needed in order to fully and equally explore all available options for management and economic alternatives. A motion to form a multi-sectorial Spawning Aggregation Working Group was supported by all in attendance and nominations were made which included representatives from the Belize Fisheries Department, Coastal Zone Management Authority/Institute, Fishing Cooperatives, the Tourism Industry and the conservation community. Terms of Reference and a Time Line for Action were proposed and accepted for the Spawning Aggregation Working Group in hopes that clearly identifying their objectives would expedite the process. It was apparent to both conservationists and fishermen that it would be necessary to publicize a clear decision on the status of management of the Nassau Grouper before the next spawning moons of December and January.

The following papers and presentations were presented at the workshop. Additionally the findings of the Spawning Aggregation Working Group, an updated report on the current status of management, figures of aggregation sites being examined for closure, and Green Reef's Position Statement are included to provide a comprehensive perspective of this issue.

Green Reef is optimistic that through continued dialogue and cooperation with members of the Spawning Aggregation Working Group, stakeholders, and the Belize Fisheries Department, effective and sustainable protection of Belize's Nassau Grouper stocks can be realized before the next spawning aggregation season.

**Acknowledgements**

*Green Reef would like to recognize the wide variety of technical, administrative and logistical support that was provided by a range of institutions, agencies and individuals in order to make the workshop, "Working Towards Sustainable Management of Nassau Groupers in Belize," a success. Green Reef would like to extend their gratitude to all the people that helped to make the workshop a success.*

Green Reef Staff and Volunteers
Fishermen from San Pedro, Placencia, Independence and Hopkins
The Ministry of Agriculture, Fisheries and Co-operatives
Belize Fisheries Department
Coastal Zone Authority and Management
Hol Chan Marine Reserve
Bacalar Chico National Park and Marine Reserve
National Fishermen Cooperative
Northern Fishermen Cooperative
Caribena Cooperative
Placencia Cooperative
The Nature Conservancy
Wildlife Conservation Society
Dr. Brian Luckhurst, Bermuda Fisheries Department

*Special thanks are extended to the presenters, whose papers and talks make up this document, as well as to The Nature Conservancy for the maps of the spawning aggregation sites, which provide an effective visual for understanding the locations of these important areas.*

*This publication was compiled and produced by Green Reef Environmental Institute with the financial assistance of the Oak Foundation and the Global Environmental Facility/Small Grant Programme.*


## Workshop Proceedings

*The following papers and presentations were presented at the workshop, "Working Towards Sustainable Management of Nassau Groupers in Belize." These proceedings have been edited for purposes of clarity and conciseness. Audience comments and questions have been included to highlight the interactive, participatory nature of the Workshop. When applicable, the comments and questions from the audience are placed immediately after a presenter's talk.*

**Welcome Address**

*Mr. Mito Paz, Executive Director, Green Reef Environmental Institute*

On behalf of the Ministry of Agriculture, Fisheries & Cooperatives, I extend a hearty welcome. I am very pleased to see the wide cross section representation of the Belizean population and international researchers at this National Workshop entitled, "Working Towards Sustainable Management of Nassau Groupers in Belize." Join us in watching a short introductory video.

Your presence here today illustrates your interest and desire to participate in the sustainable management of Belize's marine resources. It is our hope that during this workshop, there will be a dynamic sharing of ideas and recommendations for the management of Nassau Groupers in Belize. With this in mind, we invite you to reflect on the theme for this National Workshop: "Working Towards Sustainable Management of Nassau Grouper in Belize." Over the course of the day, let us contemplate on what our future holds in the protection of Nassau Grouper in Belize and let us all work together to develop proper management strategies for their protection.

Welcome to the National Workshop on the Status of Nassau Grouper in Belize. Your participation will determine the future for Nassau Groupers!

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## A Message from the Ministry

*Honorable Daniel Silva, Minister of Agriculture, Fisheries & Cooperatives*

Thank you very much, our masters of ceremony; Miss Beverly Wade, the Fisheries Administrator; Members of the Fishermen Cooperative Movement and Association; Mr. Mito Paz, Executive Director of Green Reef; Mr. Brian Luckhurst, Senior Fisheries Officer from Bermuda; other distinguished guests from the head table; other important guests, Ladies and Gentlemen: a pleasant good morning.

The Nassau Grouper Fishery has been considered to be commercially significant as far back as the 1920's. However, as in the Caribbean region, Belize is now faced with a challenge of sustainably managing the populations that now exist in our waters. We are now experiencing the trend toward the dying or disappearing of Nassau Grouper banks, and it is time that we take action to ensure that they do not disappear completely in Belize. In order to successfully manage our fisheries resources there must be a team effort and it is a job that the Fisheries Department cannot accomplish in isolation from the other stakeholders.

Today's seminar is a very heartening experience. It is an excellent example of this team effort where we have the scientist, the conservationist, the Fisheries Department and the users of the Nassau Grouper resources together to discuss the status of this resource, and in a community spirit give suggestions and recommendations on ways to manage this fishery sustainably.

Today we also have the opportunity to be exposed to the experiences of other countries in the region in the management of their Nassau Grouper Fishery. This gives us a chance to look at similarities between the different fisheries and to see how we could adapt and apply the advancements they have made to our situation. Today we have a chance to hear from the fishermen for whom the Nassau Grouper fishery has played a significant role in your livelihood for generations. Some of you were introduced to this fishery by your fathers and grandfathers and this is very important. As managers we must use our efforts to sustainably manage this fishery.

Also, take into consideration the social and cultural implications of this management. This is why this whole team approach is very vital if we are going to succeed with this effort. The Ministry of Agriculture, Fisheries and Cooperatives strongly believes in this multi-sectorial, integrated approach to the management of our marine resources in Belize. The establishment of the Belize Fisheries Department Authority will ensure that this is achieved, by allowing the wider stakeholders of our marine resources to have direct input into their management.

My friends, it's a pleasure being here today to welcome you to this very important seminar. I am honored by your invitation and look forward to your recommendations for formulating a national recovery plan that will lead to sustainable management of the Nassau Grouper resources in Belize. Ladies and Gentlemen, I wish you fruitful deliberations for the remainder of this seminar.

**Historical Overview of Nassau Grouper Aggregations in Belize**

*Dr. Jacque Carter, Dean, University of New England and Research Fellow Wildlife Conservation Society*

I first came to Belize when I was 19 years old, back in 1974, and the first place I arrived was Long Caye at Glovers Reef, and the first thing I saw was a Nassau Grouper. I'm a little older now and I'll let you do the arithmetic, but I am still coming to Belize, and fortunately I am still seeing Nassau Grouper, but not as many. And I am most pleased to be here today and have this opportunity to present a historical overview of what I have come to know about this fish and to share that with you.

As I look out upon the faces that I see today, I think we share a common interest in Nassau Grouper, but I also see that we are a rather a diverse group of people and that we see the issue from different perspectives, which reminds me of a little story that I think illustrates the challenges that we face.

Once there was a man who loved to fly in hot air balloons, and one day his joy of flying took him higher and higher and further and further until he was so high that he was lost. Well, unsure of his location he descended to the ground until he came upon a man in an open field below. He cried out, "Hello, could you please tell me where I'm at?"

The man on the ground said with a smile, "Well, it looks to me like you are in a hot air balloon about a hundred feet off the ground."

Being slightly embarrassed, the man in the balloon looked at the man on the ground and said, "You know what, I'll bet you a hundred dollars that I can guess your profession."

The man on the ground thought about this for a minute and agreed to the bet, thinking that it was impossible for this fellow to be able to guess what his line of work was. So, the man in the balloon said, "I'll bet you're a scientist."

To his great surprise, the man on the ground said, "Well, yes, I am a scientist, but how do you know?"

He said, "It's quite obvious. For a response to my earlier question, you gave me information that was clearly stated, very accurate, very precise and absolutely useless."

After a few moments the man on the ground said, "You know, I'll bet you two hundred dollars that I can guess what you do."

"You're on," said the balloonist.

The man said, "I am sure you must be either a policy maker or a government official."

Stunned by the answer, the man in the balloon said, "Why I am, but how could you possibly know?"

He said, “It’s really very simple. When you arrived, you were lost, you didn’t know where you were going or where you had been, and after you received detailed, accurate and precise information regarding your location, you still remained lost, you still don’t know where you are going, and you still don’t know where you’ve been.”

I like the story because it portrays our current dilemma as scientists, as fishermen, as managers over what to do about groupers, and I think each of us at some point in time has found ourselves either in the balloon or on the ground. So let me begin with giving you an idea of what I have come to know about the Nassau Grouper. The Grouper, or Mero, as it is called, is a member of a large family of fishes commonly known as the Sea Basses. There are about sixty-two different genera and four hundred and fifty species of these fishes worldwide. They occur in very warm tropical waters, and they can reach depths of 600 meters. In Belize, there are about 36 species of groupers and Sea Basses that are known, and they are a diverse group of fishes comprising both little fishes like Hamlets and Jimmy Hinds to the larger Rockfish and the Jewfish, and I guess the name of the Jewfish has now been changed to the Goliath Grouper.

Groupers can be distinguished from other fishes by the presence of three spines on their cheek and a complete lateral line that runs along the length of the body to the tail. They have a rounded tail as opposed to a pointed or forked one, and they have a very large mouth that, unlike the snappers, has an upper jaw that overhangs the lower jaw when they close their mouths. All the basses have this in common. The Nassau Grouper, as the film indicated, can be easily recognized by the dark patch on the caudal fin that looks like a thumbprint. The dark bars that line the body and the dark streak that goes through the eyes are typical of this fish; no other fish has these. It is one of the most common large fishes in the Caribbean, and it occurs in a large area that stretches from Bermuda all the way to Florida, and throughout the Yucatan Peninsula all the way down to Venezuela.

Nassau Groupers are primarily an island-loving fish as opposed to hanging out along the continental margins like the Red Grouper does. It is particularly common in the Western Caribbean, and Belize, in particular. Grouper of all ages and sizes live solitary lives. They don’t hang out in groups for most of the year. They are most abundant in shallow water less than 50 meters, but they do occur much deeper, and they often take on a redder appearance as they go deep. They typically seek shelter in the reef in adjacent grass beds.

Nassau Groupers, like their cousins the Rockfish, the Yellowfin, the Jewfish and Tiger Grouper, aggregate every year at specific localities along the Reef in Belize, and they produce eggs that are pelagic and drift in the water column. When I was studying the grouper we knew of six banks that were documented, and there have been many more reported since that time.

Shortly after the full moon of the new year, the grouper gather in large numbers in front of these banks. This takes place in about 30 to 50 meters of water on predominantly sandy bottom, which is often swept clean by strong current. Anybody who has had the

opportunity to dive on these sites has had to swim as fast as possible to try to get back into a boat.

Spawning occurs just prior to or after sunset. Schooling fish take on a dark, sort of bi-color, pattern; I like to say they are wearing tuxedos for this event. They form small spawning groups within the school. Spawning takes place at sunset when males and females move off the shallows and into deeper water. Here they rise quickly to surface in small groups releasing eggs and milt into the open sea. Males are often seen nudging the bellies of females as both sexes swim rapidly toward the surface. Spawning continues for several days following the occurrence of the full moon.

Nassau grouper eggs are clear and float. After they are fertilized, wind and tidal driven currents carry the eggs away from the reef. Within 24 hours, baby fish called larvae, hatch from the tiny eggs. The larvae have transparent eyes, no fins and a large yolk sac which is their food for the next five days. The long spines you see here help them float in the water. These spines may also deter fish from being eaten by their predators.

After hatching, the larvae spend about 25 to 45 days as plankton, when they feed on tiny crustaceans, shrimp and other fish larvae. Once they reach about 20 millimeters in size they settle out on the bottom and take up residence on the reef. They will come back in from the deep and as they go over the rock they descend to the bottom. There is some evidence that the larvae could recruit to the same area where the adults are spawning. For example, some fish go to the bank at Northern Two Caye or Emily or Glovers and release their eggs. There might be some evidence to suggest that there is some captioning of those eggs to bring the larvae back to those sites. This is part of the science that we are still investigating.

After the juvenile fish have settled on the reef, they take up a cryptic life. They don't stray very far from the cracks and crevices of the reef. There is some evidence that as they grow larger they move from the shallow grass beds into the sandy areas with small clumps of coral, then into the patches, and then into the deeper waters.

The juveniles seem to feed predominantly on crustaceans. Adult groupers are often found in deeper water in the spurs and groves and the deep fore reef area. As you can see, the larger fishes, as they descend towards deeper water, begin to feed more predominately on fish. Adult groupers are generalized opportunistic feeders; as ambushers, they stay close to the bottom and they launch out, expanding their mouth like a vacuum that can suck in the prey. They tend to feed mostly at dawn and at dusk. They are more active at those times, which we have found from tagging studies and sonic tracking studies that have been done in the past. It is generally known that groups shift their diet as they grow older and they feed more on fishes than on crustaceans.

Nassau Groupers are long-lived fish; they exhibit slow growth and unseasonable growth. They grow more quickly as juveniles, about 80 to 200 millimeters a year. They are reported to live over 25 years in captivity and, unlike snappers, they are slow to mature

and reproduce, reaching maturity and spawning typically between 400 and 500 millimeters, or 4 and 5 years of age.

The slow growth and late development of these fish is complicating their management, but it is also confused by the fact that they are believed to be hermaphroditic, with most individuals starting out as females, and at some point later in their lives they switch sex and begin to function as males. The reasons for this are poorly understood and the extent to which sex change occurs in these fishes is also unclear. Recent studies in the Caribbean have suggested that most of the individuals don't change sex. However, the studies that I did here back in the 80's, with fishes at Caye Glory and Northern Two Caye, did show that some fish's reproductive organs were undergoing transitions from males to females. This is a slide that shows the eggs that are developing in the gonad tissue, and along the margin we have developing sperm tissue. So this fish is transitioning from a female to a male on the bank.

Nassau Groupers have traditionally been one of the most important resources in Belize. In the 1920's for a few weeks each year, local fishermen would gather at temporary camps at Caye Glory to catch the grouper. The fishers, before refrigeration was available, were particularly fortunate that this fishing season occurred just before the beginning of the Lenten season, so the fish could be salted and sold to neighbors in Guatemala and Honduras. In the early years, fishermen from the two northern villages of Caye Caulker and San Pedro were the principal participants in the fishery. This was due in large measure to the fact that they were better equipped in about every measure than the Creole neighbors to the south, due to the profits that were gained from the highly lucrative lobster fishery. Substantial expenses were incurred by fishermen.

The fishermen would often form alliances. This was necessary to provide for the cost of food, salt and other essentials, as well as to help them function as a team in the catching, processing and preserving of the catch. Crews would make plans weeks before the harvest. They would gather their supplies and leave for the bank. If fishermen were not going to sleep on board the boat they would have to build a hut. This trash hut, as it was called, was made from palm thatching. The shelter provided sleeping platforms and stilts over extremely shallow water.

In addition to gathering supplies and building shelters, fishermen were engaging in the construction of fish pens, holding pens, cleaning tables and three-tiered drying racks called tenedores. Fishing would begin at dawn after breakfast. It was a short trip to the bank with a small fish cart behind them carrying the bait. Each fisherman would work a single hand line of linen in the beginning, and switch to filament, and then they would haul the grouper to the surface as fast as possible. After the fish were winded, the air from the bladder would fill up and the fish would come to the surface, where the air would be released with an ice pick or similar instrument. The fish were then put on a stringer or a cord and would remain there until they were brought in to be processed. Fishing would end about noon. The fishermen would come back for tea, as it was called back in those days. In the afternoon, everybody would be busy butchering, preserving fish, salting them, and drying them in the sun with the Caye Glory dry corn process.

The fishery remained active from the 20's through the late 60's. To give you an idea of its historical importance in terms of the economy: in the 1960's, Belize had about 600 full time professional fishermen, and another 300 fishermen were farmer/fishermen who would supplement farming by going to the banks and catching fish. At that time, the fleet had approximately 500 boats of all sizes distributed along the coast. By the 50's and 60's as many as 300 boats would appear at Caye Glory. It was not uncommon for a crew of three men to catch and salt 1,500 to 2,000 fish in a season. Compare that with what you will hear today. From 1972 to 1984 groupers constituted the second most important valuable fish in the fishery, and in 1984 it was reported that 200,000 pounds of grouper were caught, worth approximately $500,000.

During the 1970's and 80's, non-regulated fishing, combined with a change in the fishing industry, together with groupers' natural tendencies to grow slowly, conspired to cripple the fishery. At this time northern fishermen from San Pedro and Caye Caulker were rapidly dropping out in favor of the lobster industry. But now something much more dangerous than the Nassau Groupers fishermen had arrived from the islands of San Pedro and Caye Caulker.

The spear guns and the American tourist began to arrive in the late 60's. Two visitors from Florida brought with them to the Coral Beach Hotel in San Pedro a new fishing device called the spear gun. And in just two short years the guns were everywhere and were used with extreme fishing speed to kill and capture fish. Groupers were particularly vulnerable because they were curious of swimmers by nature and they were easy to shoot. The hoteliers employed fishermen to spear for their guests. Some of the most effective spear fishermen were the Americans themselves. Many who owned and operated these hotels speared fish. Those that couldn't be eaten at the hotels were sold to the Coop.

No longer were these large fish taken for a few weeks out of the year. Beginning in the 1970's, they were taken every day, every week of the year, from every possible habitat. Scuba gear enabled gunners to reach depths unthinkable to free divers, and during the closure of the lobster season the lobster fishermen in San Pedro and elsewhere would equip their boats for extended trips as far away as Glovers Reef. On one such trip that I was on, the fishermen in our boats speared 800 pounds of grouper in just two days from the east and southern walls of Glovers. Most of these fish were adult grouper. Most were probably ten years old. In a very short period of time fishes were removed from the reef of Belize with the same efficiency as the buffalo from the great plains of the United States.

Meanwhile the Carib and the Creole fishermen at Caye Glory saw smaller and fewer fish arrive. Several of the "old heads" (older fishermen), frustrated by the lower catches, left Caye Glory for the more promising banks at Glovers, Turneffe and Northern Two Caye. In those days it was politically popular to blame the bubbles of scuba divers, the floods lights from Jack Cousteau's visit to Caye Glory, the Mexican fishermen from Xcalak off Rocky Point, hurricanes, you name it, as the reason for collapsing in fishery. I often heard such explanations from officials, from Coop managers and from fishermen, but I also listened to the older fishermen: the Cabrals, the Jacksons and the others who could

remember their father's days on the bank, and those times when the entire village went sailing and huts dotted the reef. And they spoke more plainly of the problem and where the heart of the matter really lies.

As I listened I came to realize that the problem in Belize is the same problem facing the New England cod fishermen, and Gulf of Maine fishermen, and abalone fishermen off the coast of California, and the Louisiana shrimpers off the coast of Mexico. It was the tragedy of the commons or of the resources of the sea. Like resources on land that belong to everybody and anybody, they were considered to be there simply for the taking until there was little left to take. It was over fishing: catching fish faster than they could replace themselves. First slowly with hand lines, and then later with greater efficiency with spear guns and modern technology.

By the time I arrived on the grouper bank in 1980 there were still six active banks. There were many fish landed but all the signs of trouble were there. By 1986, Caye Glory, in comparison to Northern Two Caye, had smaller fish on average and they had a skewed sex ratio with females outnumbering males. This is a very clear evidence that you see in an over-fished to heavily-fished bank.

Landings for the country peaked during the mid-80's, when hand line fishing was joined by modern fishing techniques. Foreign fishermen from Bermuda and other places came with large boats equipped with fish finders. Fish traps were used, but on the banks mechanized reels were deployed on deeper reefs. Day fishermen from Belize ran out in skiffs and high-speed boats, and ice boats from the Coop went right to the bank to catch and to buy the fish. By 1986 the fishery was in decline and continues to decline today. Nassau Groupers in Belize and elsewhere are threatened fish. If Belize intends to have grouper as a component of its fisheries in the coming years, and intends to maintain a balanced coral reef, then groupers need to be managed wisely and the few we have left we need to be very careful about.

The goal of a good management plan should be to perpetuate the grouper in fishable abundance throughout its range and generate the greatest possible economic and social benefits from its catch and utilization over time. That is what we want to strive for. As a step towards meeting this goal, ten years ago, in 1991, we prepared for the government a Fisheries Management Plan for grouper. In this plan we recommended that fisheries reserves be established for 20% of the coastal habitat, that we implement traditional management practices in areas where the fish are still caught, and that we close one reef, Glovers Reef, to fishing.

Glovers was considered the best reef to close for fishing because it would impact the fewest number of fishermen, it was adjacent to the management zone for a park that was already there, it was easy to monitor, and it represented a sizeable portion of the Belize spawning stock. Over the years various elements of this plan have been implemented by the Belize Fisheries Department, but it has been ten years since this report was generated, and despite this we have fewer grouper today than when I started many years ago. You see, in our case scientists, policy makers and fishermen are like trains running on parallel

tracks: On one track there are the scientists looking out the window, and they see the Nassau Grouper and opportunities for their protection. On the opposite track you have the fishermen looking out, and they see boatloads of groupers that can provide valuable food and income for their families. And in the middle track are the policy makers, who see the fish, but mostly over the heads of the fishermen and the scientists. The only problem is that we all see the same school of fish. Scientists, policy makers and fishermen need to get on the same track for the benefit of the grouper. It's time that we revisited all the assumptions that this earlier management plan provided. We should decide to disregard what doesn't work, and we should try to strengthen what does work, based on what we hear today. Hopefully by doing so we will provide ourselves with a new plan, a better plan, for the management and conservation of grouper, and a plan that this time takes into consideration not only the needs of the fish, but also the sociological and the economic needs of the fishermen and the people of Belize. Thank you very much.

## Spawning Aggregation Fisheries Management in Florida: A Fisherman's Perspective

*Peter Gladding, Florida Commercial Fishermen*

Good morning. Ladies and Gentlemen, people of Belize. Thank you for having me. We, as you, have the same problem with our fisheries. Only we have a lot more laws concerning our fisheries than you do, and everything we decide to do takes an act of the Congress to get it done. Most of the laws we applied to our fisheries haven't worked or some have but very few. Our fish are still in a state of decline so we were told that we are going to have a marine reserve within our Florida Keys National Sanctuary. To let you know what a marine reserve is, it's a reserve where nobody touches anything.

We had a working group of 25 people, a very diverse group of people from everywhere. We were allowed five fishermen on this working group, so we had a big boat block if we wanted to use it. When we put an area in a reserve, we don't want to have to do it twice. We decided that we overlay this reserve on top of a multi-species spawning aggregation, and it's not much unlike the Gladden reef here. We have seven or eight species of fish that spawn on this area all times, different times through the year. So we put the reserve on top of this to see if protecting this spawning area would result in more larvae and more fish in the future. The reserve went over big with a lot of groups, but with some fishermen it didn't go over. It's a new concept for fishermen. It's a Fisheries Management tool and the tools we have been using have worked to some degree but I believe that this tool will work a lot better. For when the fish come together to spawn, as all the fishermen know in this room, they are really easy to catch. It is a kind of slaughter.

After spawning is over the fish break up and they are a little bit harder to catch, and we have a lot of different circumstances than you have here. During spawning season, our fish decrease in price by forty to sixty percent. So we decided if we stop taking fish during the spawning time in this area, then it means more fish in the future. But that is not all, we will catch those fish when they are not spawning, and in different areas, so they will still be worth much money to us. Then we don't have to catch as many fish, for the lower the price goes, every fisherman knows, the more fish you must catch.

We have some fish that are protected by spawning season closures. That was not good enough because we have to leave a recreation limit open for recreational fishermen. South Florida is a boating capital in the United States, with many recreational fishermen. Commercial fishing is not a major problem, but recreational fishing is. So instead of just closing the spawning season commercially (because we'll never get away with closing at the recreational level), we put in quite a large reserve to protect the fish from everybody. Now, a lot of other people wanted the reserve for other reasons: Some people wanted to protect the habitat for future generations. Scientists wanted an area for studying that was not touched by man. As fishermen, we wanted to protect the spawning aggregation so that spawning will take place and there will be more fish in the future. And all the other things that come on as pluses to other people, but mainly fishermen are benefited. No fisherman wants to wipe out spawning aggregations. It looks like yours has gone downhill for the Nassau grouper. And if you loose the Nassau, then fishermen are going to target another

species of fish. That's common nature with fisherman. Then you are going to put pressure on that fish.

If you can pinpoint the areas where these fish spawn and put the reserve over the top of them, it's another type of reserve as well, 365 days a year. You benefit from this reserve in the future, and if your tourism should get good, it's good for the economy of your country. Also, if you charter boats it naturally puts you right in the business of taking people out to view the Belize National Reserve. It has a lot of potential, and it's a win-win situation for everybody once your fish spawn. As I think about it, the larvae are going to move back to the estuaries and then you are going to have more fish coming up in the future. You are not going to have a big recruitment of fish if you keep on taking fish when they are spawning. You wipe out the spawn area, you wipe out that aggregation of fish, and then you are not going to have any fish in the future.

The reserve, like I said, is a new concept to us and we spent 3 years battling among 25 people, but we all came up with the consensus that this is what we need to do if we expect to have a healthy fishery in the future. Thank you.

**Fishing for Nassau Groupers in Belize: A Fisherman's Perspective**

*Omar Arceo, Fisherman, San Pedro Town*

I was a commercial fisherman. The way I learned to catch grouper was by spearing. I did tremendous damage with spear fishing. I used to do it on a seasonal basis between the spawning moons of December, January, February, and March up to late April. I learned the movement of the moon so I knew when the fish were more abundant, especially the grouper. I used to be a skin diver. We had to go deep for this grouper. It was hard work, but it was easy with a powerful spear gun. I never used a Hawaiian sling. I loved to spear; it was my hobby.

This was my experience catching grouper, or any kind of fish that was in front of me. I used to have a friend with me, or maybe a team of us would go, or four of us in a boat, and we would spent up to ninety days offshore without coming back home. We would harvest a total of five thousand pounds of corned fish in ninety days. So between four of us we used to spear nine to fifteen dozen fish a day from 9:00 in the morning until 2:00 pm. We had to have enough time to harvest it, and between those times the groupers were in their spawning activity. We were really damaging because after the grouper spawned, they would come to the shallows and lean on the coral between 3 feet of water to 10 feet of water.

We normally didn't use a spear gun, as we used to hook them, gaff them and put them on dories, and we had a guy there beating them with a stick. Now that activity used to happen maybe 4 days after the moon. The grouper used to come to the shore, to the shallowest part of the reef and hang there. But at other times, that activity didn't happen at the reef.

We were used to skin diving. I used to skin dive from 50 feet to 60 feet of water with a powerful spear gun. I could take as many fish as I wanted because the fish were so thick that whenever you speared one, another one used to follow. But then you have to be careful how to spear them. You can't spear a fish and damage the flesh. You have to be able to shoot the fish in a dead shot. So I gained from the experience of my father. He taught me how to spear fish and I took it as a hobby. I went down to as far as 95 feet free diving. So I did tremendous damage on a seasonal basis. I did this from December to April. My experience was mostly with grouper but I speared other kinds of fish as well. I was always looking for grouper because grouper was one of the quality fish that is more valuable on the market. It is between US$2 a pound to US$4.50 a pound at the moment so I used to get between $4.00 Bz to $9.00 Bz a pound for fillets. During the years, whenever I used to spear the fish, I used to see less of them spawning. The fish that I used to catch never used to have as much as spawn as I saw on those that I used to pull in on a hand line.

But still I was damaging because now and again we used to get a grouper with eggs that were acting tame and I used to spear it. So throughout those years I have been fishing, I started to see the decline of the fish. In the early 90's I started to see a decline of the fish and a decline of fisherman. I noticed that when spearing, grouper was declining. I had to go deeper, around 60 feet all the time to find this fish. The fish were still there and were

only moving from the shallow to the deeper water. More fishermen were spear-gun hunting the fish after the hand-line weeks were over.

The 90's were when I started to see the decline of the fish and then the decline of the fishermen. I started to withdraw from the fishing industry and start to turn my work into a guiding service. Throughout that year I profited from it. I had a wealthy season with this work and I lived very well. I used to sustain myself, as I was independent and I didn't have a family to feed, and I made tremendous dollars with it.

Throughout my experiences, I know that I did my share of damage. I would like for all of us to come together and start to think how to educate ourselves, learn how to fish the grouper, because it is still demanded by the restaurants and by visitors, although we locals cannot consume it unless we are fishermen.

My suggestions are: If we want to protect this Nassau Grouper now we need to implement some strict laws that we should not fish them any more on the movement of the moon. We could fish them after the moon, after they have already spawned (four days after the full moon). To see if we can increase the grouper population, we could give them a chance to expand, to spawn and whatever they need to do. We need to have more patrolling; the Fisheries Department needs to be involved and to give more seminars to the fishermen and educate them. Yes we are going to fish them but we need to fish on a different level.

And throughout my experience one thing I never liked is what used to happen at the grouper bank. I used to free dive the grouper bank and I used to find huge fishing traps being lowered down on the bank with a lot of small lobsters as bait. Within an hour they used to pull 80 to 100 grouper in the traps. That's what I never used to like.

We shouldn't fish during the spawning moons, that is three days before the full moon and three days after the full moon. Let's start to fish it after the new moon when the grouper have already spawned. We can see what is the percentage of the grouper that we catch on the spawning site with their eggs. I know that there are millions and millions of eggs in a roe but unfortunately the majority of the eggs are eaten in the wild and only a few will survive to become adults.

We are running into difficulties right now not only due to over-fishing but also from development. Not only in Belize, but in other countries also, the mangroves getting damaged and the seabeds are being dredged. These areas are also important for us to protect because this is where the small fishes live. We cannot implement good laws to protect from this kind of development. We need the development, so we have to be flexible on it. But throughout my experience I have seen the grouper has declined. I would like for us to make a team here together and find how we can protect the grouper or any other fish during the spawning months. Thank you.

*Alfonso Nuñez, Fisherman, Hopkins Village*

Basically what Mr. Arceo said is very, very right. I started fishing for groupers since 1991 at Caye Glory. Grouper fishing was one of the most income-earning fish that fishermen in Belize fish for. Usually, annually for the new grouper season I earned something like $1,500 to $2,000 for that month. But since 1996 the production went very, very low. For the last grouper season when I went fishing in January, the catch was very, very poor. I barely caught 1,000 grouper for that season. Grouper fishing in Belize, especially at Caye Glory, is becoming very, very unprofitable. The bank of Caye Glory is fished out. If it is possible, the fishermen and Fisheries Department and the conservationists need to come up with a plan with the help of the fishermen to protect grouper.

When I started fishing grouper at Caye Glory in 1991, we used to catch almost 1000 pounds of fish in one day. For the past years, from about 1991 to 1996, every year usually you would make a good catch, but since 97 sometimes for the season you hardly bring in 1000 pounds of grouper for the whole season. Even some of the fishermen who used to fish at Caye Glory do not go to fish anymore. Some fishermen look at conservation as something negative but it is time that we start to think about it as something positive, because if we don't protect what we have today, in days to come we will be left with nothing. Thanks.

## Nassau Grouper Aggregation at Glovers Reef: A Case Study

*Dr. Enric Sala, Deputy Director, Center for Marine Biodiversity and Conservation*
*Scripps Institution of Oceanography*, La Jolla, California
Research Fellow, Wildlife Conservation Society

Miss Wade, Ladies and Gentlemen, thank you very much for convening this workshop and for giving us the opportunity to talk about what we have seen in Belize in the last years. I would like to thank first the Fisheries Department and Green Reef for organizing this workshop that I think will be very important. And I would like also to thank the fishermen from Hopkins who helped us enormously when we went to the spawning site and we were able to measure and weigh the fish.

**Nassau grouper spawning aggregations**

- Groupers aggregate at specific locations and moon phases to spawn
- Critical moment for the survival of the species
- Females can produce 6 million eggs
- Groupers gather for a few weeks and then leave the spawning sites

The spawning aggregations of Nassau Groupers and other groupers were very common throughout the Caribbean before, but now unfortunately most of these aggregations have disappeared because of over fishing. The Nassau Grouper was the most abundant grouper in the Caribbean, and it was the most fished grouper in the Caribbean. In the early 70's there was one aggregation in the Bahamas that had one hundred thousand fish, but now this aggregation is gone because of over fishing.

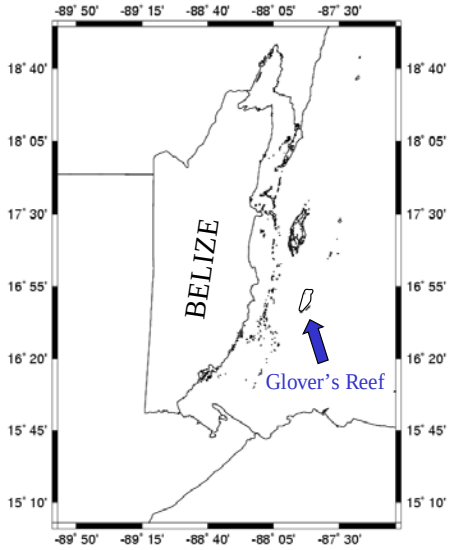
There were one hundred thousand groupers in one single aggregation and now most of these have disappeared. So what are the consequences of over fishing these spawning aggregations? The first one is that the fisheries collapse and this has an immediate impact on the human communities. In some places the groupers become locally extinct, as they are completely gone. In the United States the Nassau Grouper had

**Nassau grouper spawning**

- Aggregations historically common throughout the Caribbean
- Nassau grouper was the most common grouper in the Caribbean
- Up to 100,000 groupers in an aggregation in early 1970s
- Most aggregations have now disappeared because of overfishing

spawning aggregations, but they were over fished and there are no spawning aggregations left in the United States. The species is so rare now that it is a candidate for the endangered species list. The American Fisheries Society put the Nassau Grouper on their list of Fishes at Risk of Extinction.

When the fishery of the grouper collapses, the fishermen have to fish the species that are less valuable, so they have economic losses. They get less money for the same amount of fish fished and there is also a decrease of exports. And at the end there is also a loss of Eco-Tourism opportunities because many people from other places love to come here to Belize to see lots of groupers.

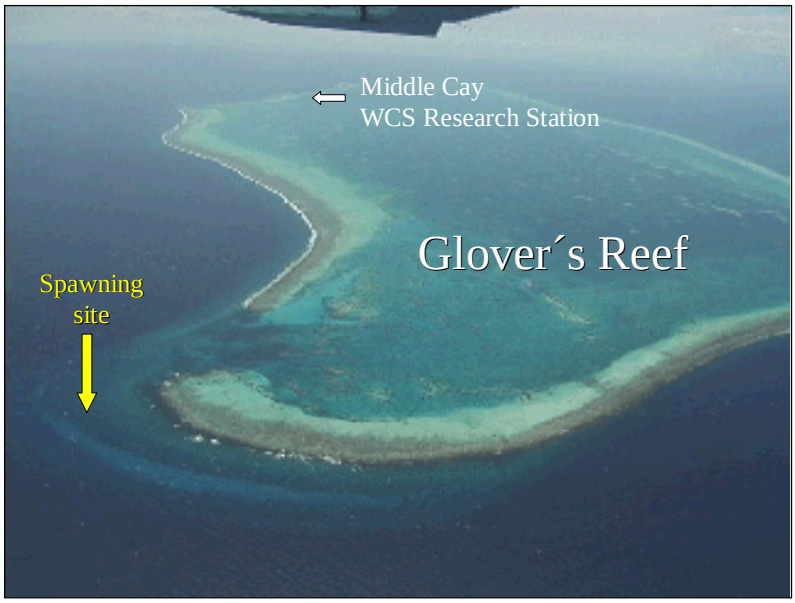



**The Glover's Reef grouper spawning aggregation**

- Offshore atoll
- Harbors one of the last grouper spawning aggregations in Belize

I am going to talk about the spawning aggregation in Glovers Reef. This is one of our last spawning aggregations in Belize and one of the last in the Caribbean.

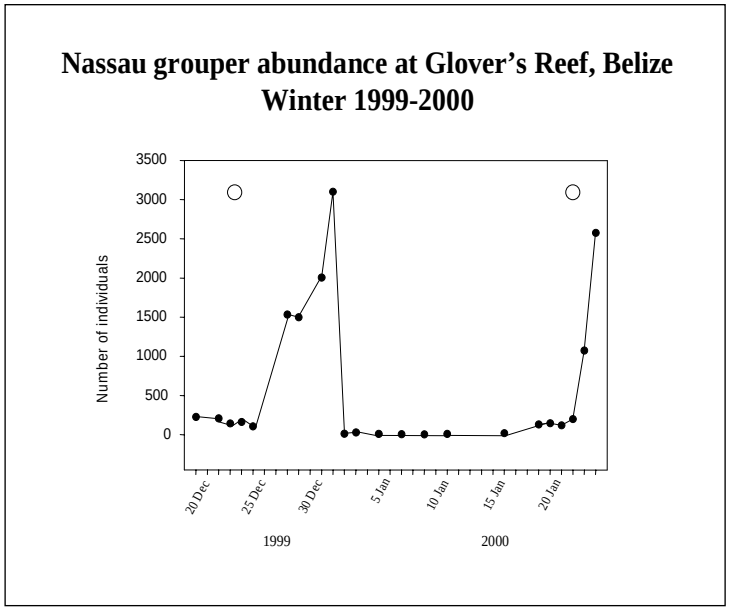
This is an aerial view of Glovers Reef from the north; this is Middle Caye where the Wildlife Conservation Society has a research station. This is the spawning site on the northern site of the atoll.



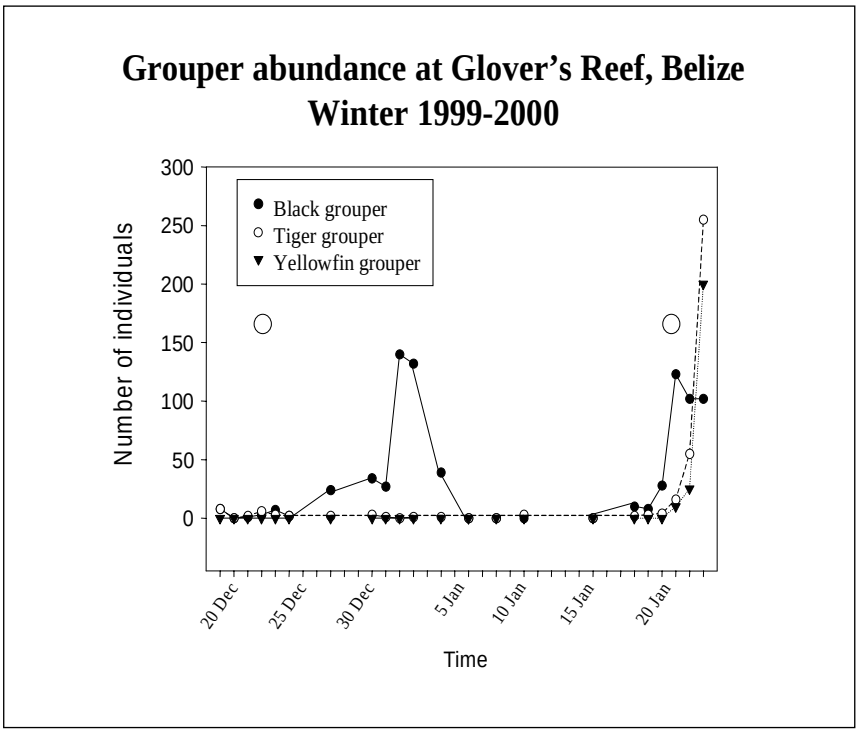

What do groupers do when they go to Glovers? In December 1999 and January 2000, we dove as often as the weather

permitted. Every point on the graph is a day of diving. We saw that in December 1999 groupers came a few days after the full moon, they stayed a few days for spawning, and then they left.

We estimated by underwater counts with video cameras and divers that there were about 3,100 groupers. The fishermen from Hopkins caught maybe between 300 and 400 or maybe a little more. Then they disappeared. For a month they were not there, and then they came after the full moon of January. We estimated a maximum of 2,700 Nassau Groupers at that time.



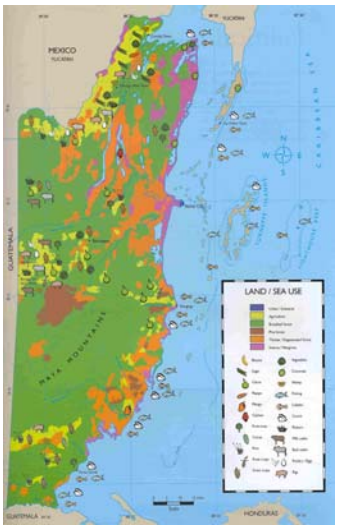

This site is very important because besides Nassau Groupers there are other special groupers that spawn at the same site. So we have black groupers, which in 1999 to 2000 had spawned after the full moon of December and after the full moon of January. Then we have the Tiger Grouper and the Yellowfin Grouper, which spawned after the full moon of January; the Yellowfin also may spawn after the full moon of February.




So this 3,100 groupers in Glovers Reef in 2000 and the 2,700 that we can see now are lots of groupers. Well, we don't have much data for the aggregation before but fortunately for Glovers Reef we have one single point here. Danny Westby dove in the 70's, and he did the first under water count. He estimated that there were about 15,000 groupers at the aggregation. So this is a decline of 82% in only 25 years. This is a very, very dramatic for any kind of fishery.

So where is the fishing at Glovers Reef? We don't know how the fishery started but we know from fishermen in Dangriga that they had been fishing the aggregation intensively in the 70's, and then they abandoned the fishery, so now the fishermen are mostly from Hopkins. In 2001, the aggregation was open for fishing to the fishermen from Hopkins and the quota, the maximum catch of fishes allowed, was 900 groupers, which is 30% of the entire aggregation. And we can see that the fishery has declined dramatically from the time in the 70's when a fisherman from Dangriga told us that they caught up to 200 groupers a day. While in January 2001, as Alfonso said, their catch was very, very low. The four boats caught a total of 25-50 groupers per day, and when they caught 90 that was a big number.

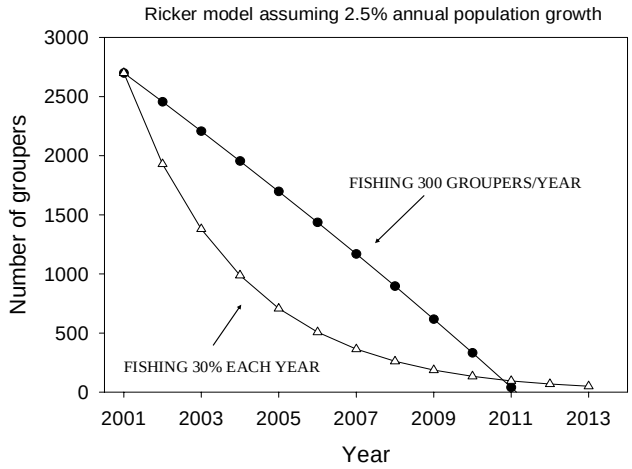
**Fishing the Glover's Reef grouper spawning aggregation**




•Spawning aggregation fished intensively since the 1970s
•Open to fishing, quota of 900 groupers (30% of the reproductive stock) in 2001
•1970s: 175-200 groupers / day
•2001: 25-90 groupers / day

What will happen to the Nassau Groupers if the fishery continues? If we fit the same model, which is called an exponential decline, to the data we have from Glovers using Danny's data and our data now from Glovers, we could predict that the aggregation will be gone by 2015, but this is the best-case scenario.

**What will happen to Nassau groupers at the Glover's Reef spawning aggregation?**




Let's start now in 2001 with 2,700 groupers and apply a fisheries model. We assume, from data from other places in the Caribbean that the grouper populations grow 2.5% every year, so every year there are 2.5% juveniles. Assume that there is no mortality; there is no fishing going on outside the

spawning site so all the mortality of the groupers will be at the spawning site. If there are 300 groupers caught every year, and the population grows 2%, and there is no mortality outside, this is a very optimistic model. Still, the aggregation will be done by 2011. If the fishery is allowed 30%, as it was this year, this is more optimistic and the aggregation doesn't disappear until 2013.

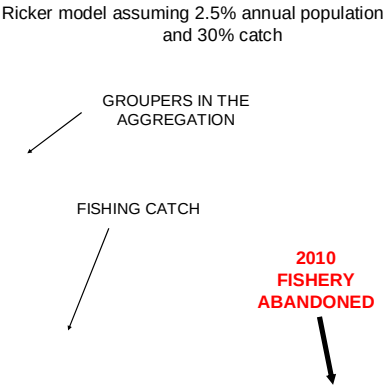
**How many groupers are worth fishing?**

•Every fishing boat's operating costs for going fishing to Glover's are $800
•1 pound of fillet = $5
•10 pound fish = 3.3 pounds of fillet

•Minimum number of groupers to be fished to make it even:

$$\frac{\$800}{boat} \times \frac{1 grouper}{3.3 Lb} \times \frac{1 Lb}{\$5} = 48 groupers / boat$$

How many groupers are worth fishing, and at what point in time will the aggregation not be worth fishing? In 2000, the cost for every boat was about $800 to buy the fuel, the food and the supplies for the hut and everything. So in one pound of fillet, that was $5 in 2000, how many dollars is it now? $9. Ok, the number will change a little bit, but the ballpark figures will not change much. The average fish caught is 10 pounds, but this gives only a few more than 3 pounds of fillet; the rest is bones, skin and the head. So the minimum number of groupers to be fished to break even is 48 groupers per boat. If you guys catch less than 48 groupers per boat you will lose money.




This model is the number of groupers in the aggregation; this is the fishing catch, assuming that 30% is allowed every year as it was this year; and this line here, this is 48 groupers, so the fishery will be abandoned in 2010 because in 2011 there will not be enough groupers even for a single boat.

**BUT these models:**

- Are optimistic
- Assume optimum reproduction
- Assume optimum growth of the population
- Assume no mortality outside the spawning season
- Do not take into account uncertainty

**MOREOVER:**

- The spawning aggregation is at a historical minimum
- Disturbances have stronger impacts on groupers
- Below a certain (unknown) size, the aggregation will disappear
- At this low abundance, reproduction rate decreases

Remember again that these models are very optimistic. They assume that the reproduction is perfect, that the population grows a lot, and that there is no mortality outside the spawning site. This model doesn't take into account the natural fluctuation of the population. And also under these lower balances the reproduction rate goes down, and we don't know when the aggregation will disappear, but from other places we know that eventually to reduce the aggregation to two groupers makes it disappear.

**Economic benefits of fishing the Nassau grouper spawning aggregation at Glover's Reef for the fishers**

(after fixed investments costs)

Annual revenue $\frac{600 groupers}{year} \times \frac{3.3 Lb}{grouper} \times \frac{\$5}{1 Lb} = \$9{,}900$

Annual operating costs $4 boats \times \frac{\$800 oper.costs}{boat} = \$3{,}200$

Net revenue (profit) $Revenue - costs = 9{,}900 - 3{,}200 =$

$=$ **BZE $6,700 per year for the fishers**

Total benefits for Belize include benefits to the consumer from eating fish, and export of consumer surplus minus other operating costs

Let us imagine that instead of fishing the aggregation, the aggregation was used to bring divers. There are thousands of divers worldwide that would all love to come to Belize to see a spawning aggregation. There is nowhere else in the world where they can do this. Assuming, optimistically, that the catch at Glovers Reef is 600 groupers per year. We know how many pounds of fillet this produces and we know how much a fillet costs, so it brings in about BZ$10,000. This is what the groupers will give.

**Economic benefits of using the spawning aggregation for ecotourism**

(after fixed investments costs)

Annual revenue

$$20\,divers \times \frac{\$3{,}200}{week} \times \frac{2\,weeks}{spawning} \times \frac{2\,spawnings}{year} = \$256{,}000$$

Annual operating costs

$$\left[20\,divers \times \left(\frac{\$50\ food + \$10\ \text{tan}\ ks + \$10\,water + \$40\,electr.}{diver\ /\ day}\right) + \frac{\$200\,boat\_fuel}{day}\right] \times 28\,days = \$67{,}200$$

Net revenue (profit) $\text{Re}\,venue - \cos ts = \$256{,}000 - \$67{,}200 =$

**= BZE $188,800 per year**

If you say that every boat spends BZ$800, for 4 boats that is BZ$3,200. The net profit for the fishermen is this minus this, which is BZ$6,700 per year for all the fishermen. I think that the ballpark figure is not wrong. The total benefit for Belize, including the benefit of the consumer eating fishes, which is not quantifiable, and also the sale to restaurants and the exports, is what the economists call multipliers. You multiply this times a number, which is difficult to quantify at this point, to know how much income the groupers bring to Belize.

What we showed before was the amount of money that is produced if the aggregation is fished. Image now that you turn the aggregation into this diving operation. Let's say that only 20 divers are allowed to come to this very unique place in Belize. Every diver spends BZ$3,200 per week as this is what divers pay to go to Manta and to Slickrock per week. Say that every spawning event is two weeks and there are two spawning events per year. This is more than a quarter of a million dollars Belize for only 4 weeks of work.

The annual operating costs for this operation, once the investment has been made, are as follows: You have to give food and fill the tanks for divers; they want to take showers; you use fuel for electricity; and then perhaps 20 divers are brought to the reef by 2 boats, at a hundred dollars of fuel to go from the island to the spawning site. This is $67,000 of annual operating cost for this operation. This value minus this gives almost BZ$197,000 net profit to the stakeholders. These are the primary benefits for this operation. The secondary benefits are called multipliers. The money spent by the group is spent by others, which leads to the creation of additional income and employment. The secondary benefits from these multipliers are larger for eco-tourism than for fishing the aggregation because more services are needed and more infrastructure is created.

**Economic benefits of using the spawning aggregation for ecotourism**

(after fixed investments costs)

**Primary annual benefits for ecotourism operation**

**+**

**Secondary benefits (Economic impacts):**

**•Money spent by each group is respent by others**

**•Creation of additional income and employment**

**•Secondary benefits are larger for ecotourism than for fishing**

**Groupers alive = BZE $188,800 per year**

**Groupers fished = BZE $6,700 per year**

If we compare these figures again, of what groupers are worth alive and what groupers are worth fished, in only a few years the difference is almost 30 fold. Having groupers alive produces 30 times more income to the stakeholders, not to Belize. To Belize you have to multiply this times the amount of income that would go into this theoretical exercise to the fishermen turned guides.

**Can Nassau grouper from other places replenish Glover's Reef if the spawning aggregation disappears?**

•300 groupers tagged at the spawning site with plastic tags

•20 groupers with plastic tags fished at Glover's since Jan 2001

•No groupers with tags fished outside Glover's

•Recolonization must be by larvae from other spawning aggregations, but...

**How many are left?**

Let us say that the spawning aggregation at Glovers disappears? Can groupers from other places re-colonize the atoll? Carter and Will Heyman's studies show that some fishes can move hundreds of miles along the barrier reef from southern Belize to Mexico. But at Glovers we don't know. We don't know if they cross the strait between Glovers and the barrier reef. This year in January we

tagged 300 groupers with plastic tags. If one of you catches one of the groupers that have the plastic tags there is a reward. Please call Andrew Branson at Middle Caye and he will give a reward for every one of these tags. So, we tagged 300 groupers in January and 20 groupers have been caught already at Glovers, which is 7% of the aggregation size. No groupers have been fished outside of Glovers yet. This is preliminary, but we assume that the population of adults at Glovers is isolated and there is no significant exchange. We believe that they don't cross the strait of 20 miles. So if the aggregation disappears, the re-colonization must be by X larva produced in other aggregations.

But how many aggregations are left? This is what Mito will talk about later. In conclusion, the size of the grouper's spawning aggregation at Glovers Reef is at a very historical minimum of less than 3,000 groupers. In the last 25 years, it has decreased more than 80%. If the fishery continues, the aggregation will disappear and the fishery will collapse probably within a decade. These models were optimistic assuming that there was no fishery outside and the reproduction was optimum, etc. So the biggest conclusion here is that fishing the spawning aggregations is not sustainable. If fishing of spawning aggregations cannot be managed, it leads to disappearance of the aggregation. Finally, as a theoretical exercise just to think about possible alternatives, the economic benefits of not fishing the aggregation are almost 30 times larger than the benefit of fishing the aggregation to extinction.

**Audience Comments and Questions from "Nassau Grouper Aggregation at Glovers Reef: A Case Study"**

**Melanie Mcfield:** I am Melanie Mcfield with World Wildlife Fund. I think maybe some of the fishermen are still a little bit dazed at that number (What was it? $190,000?) profit that is potentially available from tourism on the banks. One thing I wanted to mention is that sometimes it seems like that was all pretty quick and it is a great exercise to do, but I think the fishermen should keep in mind that there are a lot of projects available right now that will help them get into the tourism industry. I don't know how much of that you have been exposed to already, but there are special training exercises to become tour guides and dive masters. There is a lot involved to be able to transfer from fishing into scuba diving, because you do need licenses and maybe bigger boats and things like that, but there is a lot of help available. I hope everyone will keep on looking at this and take that seriously as an option.

**Peter Gladding:** That's what we are finding out in the marine reserve. We protect our fish, and there will be fish in the future. We can fish outside of the reserve, and tourists will be picking up the tab while our fish will be protected. So it's a win-win situation. We have Jewfish: We protected them for 10 years, and some people want to open Jewfish back up, but right now he is more valuable to take pictures of. For our economy, people taking pictures of Jewfish is more valuable than harvesting that fish, as we get to use that fish over and over and over again to make money. That is what you can do with the grouper, and if you can put in a reserve where nobody can touch it, people will pay to see a grouper. They will pay to take pictures of your grouper, and your resource will be protected, and they will be coming back for those fish, and outside the reserve you will have fish.

**Mito Paz:** Just a comment, as a component of the Green Reef Advocacy and Research Program that Green Reef is embarking on. We also have a component that calls for training fishermen that are going to be displaced if we have some kind a management for this grouper fishery. We have planned later this year to do some dive-training courses at Hopkins and maybe some sport-fishing courses. We are also looking at a possibility of setting some fishery aggregating devices so that we could promote the deep-sea fishing. These projects are going to come along later this year. Thanks.

**Dwight Neal:** Good morning. The name is Dwight Neal from the Fisheries Department. I hate to be the one to be throwing cold water on people's bright ideas, but I want to offer a word of caution to the fishermen when they look at these nice numbers that I have been shown on the screen there. Those numbers are based on what a hotelier or some package operator will be grossing whenever a tourist uses or buys one of their packages. That does not necessarily mean that that is what the fishermen would be entitled to as a gross number. I think that the more realistic number was the $200, or something like that, per boat that I saw being put on the screen. That is the first thing. The

other thing is that we have to be careful that when we start locking up large sections of the reef that we don't displace so many people that we start doing ourselves more damage than we do good. I am not saying that we are doing the wrong thing, but I am just saying that we should be cautious whenever we start making decisions. Some of these numbers look quite nice, but certainly, if we dig a little deeper, we would find that they are not what they are saying at face value.

**Daedra Isaacs:** My name is Daedra Isaacs and I am from BACONGO. While I agree with Mr. Neal that there are some uncertainties built into the switch over, I'd like to say that there have been proven cases where conservation and other sustainable management method for fisheries and natural resources can work. What I want to ask, and maybe Green Reef would answer this later today, is to explain your advocacy program and to explain some of the presentations that were made here today. The ideas may seem too optimistic at the outset, so we need exchange programs between areas within our region where similar problems are being experienced, where fishermen and people who are in that industry can be exposed to how other areas have dealt with problems, and how other fisher folks who have transferred into other economic alternatives have found the entire process - and what their stories are now. And that can be a part of the whole education process. To let the people involved know other people who have gone through this and these are some of the expected results and the challenges that you will face. Maybe Green Reef could consider possible exchange programs where lessons can be transferred. This is for both the management of the Green Reef and for the fisher folk who are involved in this type of fishing industry.

**George Myvette:** George Myvette, Fisheries Department. Just in relation to what Mr. Neal brought up. As we search for solutions for the management of the Nassau Grouper, I would want to reflect on the fact that we need to definitely engage the fisherman, the fishing community, because I think as Mr. Neal hinted, the benefits that one could easily put up on the screen are economic benefits and there are other benefits as well. There are social multiple effects, but I would like to say that there also are costs. There are costs, especially in social terms, and I hope that as we strive for a solution we could bring out today, especially from the fishing community, what those costs are, not only in economic terms but also in social terms, so that they become a variable in this overall equation to find a sustainable solution. Thank you.

## National Grouper Assessment Report

*Mito Paz, Executive Director, Green Reef, Belize*

Belizean Fishermen have long been aware that Nassau Grouper aggregate by the thousands to spawn every year during the full moon in December and January, at very specific times and places. Fishermen in the 1960's used to count on harvests of up to 2 tons per day at a site called "Emily", but fishermen now report catching only one or two fish per day at the same site. Concerned about fishermen's reports of declines, Green Reef organized a national grouper assessment, which was completed during the full moon in January, 2001. Participating organizations included the Fisheries Department, Hol Chan and Bacalar Chico Marine Reserve Staff, Toledo Institute for Development and Environment (TIDE), Belize Audubon Society, The Nature Conservancy, Wildlife Conservation Society, U.K. Darwin Initiative, Scripps Institute of Oceanography, and many concerned commercial fishermen, dive guides, and volunteers. The 10-day assessment covered 9 aggregation sites spanning the reefs and atolls of the entire country of Belize. The Nassau Grouper Research and Advocacy Campaign was made possible through the financial assistance from the Global Environmental Facility/Small Grants Programme, the Oak Foundation and The Nature Conservancy. The overall objective of the project is to prevent the further decline and the eventual collapse of the endangered Nassau Grouper stocks by conducting a current stock assessment and development of economic alternatives, community education and outreach programs, legislation, and advocacy campaign. Results of this survey and recommendations for the management of the Nassau Grouper fishery are what I will be presenting today.

**INTRODUCTION &**

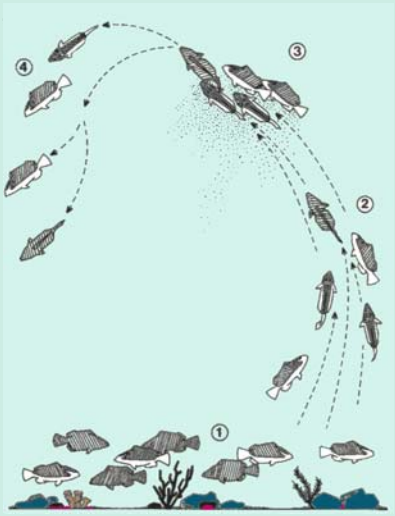
- During the 1950's, annual grouper catches in Belize were as high as 100,000 lbs & during the 1960's, Nassau Groupers were fished at a rate of about 2 tons per day from a single aggregation site at Caye Glory (Emily).
- Alan Craig recorded these photographs from the annual Nassau Grouper catch at Caye Glory.

During the 1950's, annual grouper catches in Belize were as high as 100,000 lbs, and during the 1960's, Nassau Grouper were fished at a rate of about 2 tons per day from a single aggregation site on the Belize Barrier Reef. As late as 1994, groupers comprised more than 30 % (38,383 lbs) of the total finfish exported from Belize, of which 64 % (24,764 Lbs) consisted of Nassau Grouper. More recently, in 1999 and 2000, a long known aggregation site located at Glovers Reef was surveyed by the Wildlife Conservation Society and found to be comprised of just 3,100 adults, from which fishermen caught some 219 individuals during the same season.

**Spawning behavior of Nassau Groupers**

**SPAWNING BEHAVIOR:**

- Spawning usually occurs near to sunset, when an increasing number of females express bi-coloration (see '1')
- Several bicolor females may then start nudging & pushing a solitary male in dark coloration, with the resulting small sub -group then ascending into the water column, led by a single dark male (2),
- The sub-group releases sperm & eggs into the water column (3), and
- Then the group disbands & returns to promontory floor (4).
- The fertilized eggs then simply float away in the current, to all parts of the Nassau Grouper's Range.




Nassau groupers are solitary during most of the year and then come together to spawn in large aggregations. In Belize, Nassau groupers have historically aggregated around the full moons in December and January at specific locations called reef promontories at the outer reef shelf. Spawning usually occurs at sunset. At this time, the fish start milling about a few meters above the promontory substrate, and an increasing number of groupers express bi-coloration and courting behavior. Groups of 3 to 25 individuals rush upwards to the surface to release sperm and eggs. During these aggregations groupers produce planktonic eggs that are fertilized externally and simply float away in the current. A large Nassau grouper can produce 5-6 million eggs.

**Surveyed Sites and Methodology**

The survey included the following sites:

- A total of 9 sites were surveyed during the 2000-2001 spawning year. These included:

**Lighthouse Reef:**

Sandbore Caye (10)
Half Moon Caye (4)

**Turneffe Reef:**

Dog Flea Caye (9)
Caye Bokel (Control)

**Glovers Reef:**

Northern Channel

**Barrier Reef:**

Ambergris Caye (11)
Caye Glory (3)
Gladden Spit (7)
Sapodillo Caye (12)


The survey plan called for the organization of locally experienced divers into teams that simultaneously surveyed the nine aggregation sites. Each team consisted of one dive master, two dive-certified assistants, a boat captain and one or more local fishermen as assistants. Dives were planned to commence on the day before the full moon of January 8, 2001, and to be continued through January 16, 2001.

Each team was equipped with an underwater video camera, dive computers, a GPS, and a generalized data collection sheet. Different parameters were recorded at all aggregation sites. These included: GPS co-ordinates, depth of aggregation, estimate of number of fishes, color-phase expression, behavioral activities, water temperature, current direction, current speed, vertical & horizontal visibility, coral cover & condition and the variety & number of any other schooling or aggregating species.

**FIELD RESEARCH METHODS:**

- Between and/or after dives, each team interviewed fishermen for information on
  - Their home villages & fishing effort
  - The number of years fishing aggregation bank
  - The market sold to &anticipated price
  - Fork length, weight, sex & egg weight on a sample of the daily catch, and
  - Any available anecdotal information regarding the trend of the fishery at each bank.

## Survey Results

**SURVEY RESULTS:**

**LIGHTHOUSE REEF: SANDBORE CAYE**

- Color Changes: All Four Phases
- Aggregation Number: 4,000 +
- Peak Day After Full Moon: Day 5
- Behavior: Courtship

Two Groups Based On Size & Time Of Arrival

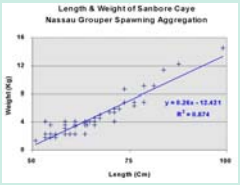
AT RISK

~ 4,000

**SURVEY RESULTS:**

**LIGHTHOUSE REEF: SANDBORE CAYE**

- Total Catch / Gear: 130 Individuals / Traps
- Effort (Man Days) / CPUE: 30 / 4.3
- Age Group: 5 – 13 Yrs
- Sample Sex Ratio: 5.6 (F) : 1 (M)
- Other Species of Interest:
  - 40 Black Grouper
  - 5 Tiger Grouper




**SURVEY RESULTS:**

**LIGHTHOUSE REEF: HALF MOON CAYE**

- Color Changes: None
- Aggregation Number: None
- Peak Day After Full Moon: No Peak
- Behavior: Cleaning, Moving North
- Fishing Activity / Catch: None
- Other Species of Interest:
  - 25 Black Grouper
  - 6 Tiger Grouper
  - 200 Dog Snapper
  - 100 White Marget
  - 100 Horse Eye Jacks
  - 75 Schoolmasters

EXTINCT

< 15

**SURVEY RESULTS:**

**TURNEFFE REEF: CAYE BOKEL (THE ELBOW)**

- Color Changes: All Four Phases
- Aggregation Number: <15
- Peak Day After Full Moon: ?
- Behavior: Courtship
- Fishing Activity None
- Other Species of Interest:
  - 23 Black Grouper
  - 5 Tiger Grouper
  - 500 Mutton Snapper
  - 500 Horse Eye Jacks

CRITICAL

< 15

SURVEY RESULTS:

TURNEFFE REEF: DOG FLEA CAYE

- Color Changes: All Four Phases
- Aggregation Number: 100 Max (after fishing)
- Peak Day After Full Moon: Day 7
- Behavior: Courtship, Two Groups Based On Size & Time Of Arrival

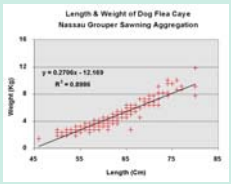
THREATENED

~ 100

SURVEY RESULTS:

TURNEFFE REEF: DOG FLEA CAYE

- Total Catch / Gear: 261 Individuals / Hook & Line
- Effort (Man Days) / CPUE: 62 / 4.2
- Age Group: 5 – 13 Yrs
- Sample Sex Ratio: 5.5 (F) : 1 (M)
- Other Species of Interest:
  - 5 Black Grouper
  - 2 Tiger Grouper




SURVEY RESULTS:

GLOVERS REEF: NORTH CHANNEL (1999-2000)

- Color Changes: All Four Phases
- Aggregation Number: 3,100 (before fishing)
- Peak Day After Full Moon: Day 9
- Behavior: Courtship, Spawning
- Total Catch / Gear: 219 Individuals / H & L
- CPUE: 9.1
- Age Group: 5 – 13 Yrs
- Sample Sex Ratio: 3 (F) : 1 (M)

AT RISK

~ 3,100

SURVEY RESULTS:

GLOVERS REEF: NORTH CHANNEL (2000-2001)

- Color Changes: All Four Phases
- Aggregation Number: 2,700 (before fishing)
- Peak Day After Full Moon: ?
- Behavior: Courtship, Spawning
- Total Catch / Gear: ~300 Individuals/H & L
- CPUE: 6
- Age Group: 5 – 13 Yrs (assumed)
- Sample Sex Ratio: ?

AT RISK

~ 2,700

SURVEY RESULTS:

BARRIER REEF: AMBERGRIS CAYE AT ROCKY POINT

- No Individuals Observed During The Entire Survey
- Other Species of Interest:
  - 5 Black Grouper
  - 10 Dog Snapper
  - 3,500 White Marget
  - 100 Horse Eye Jacks

EXTINCT

0

SURVEY RESULTS:

BARRIER REEF: CAYE GLORY (EMILY)

- Color Changes: All Four Phases
- Aggregation Number: ~ 15 (after fishing)
- Peak Day After Full Moon: ?
- Behavior: None
- Total Catch / Gear: 18 Individuals / H & L
- Effort (man-days) / CPUE: 25 / 0.7
- Other Species of Interest:
  - 60 Black Grouper
  - 50 Yellow-Fin Grouper
  - 600 Mutton Snapper
  - 215 Jolt-Head Porgy

CRITICAL

~ 20

SURVEY RESULTS:

BARRIER REEF: GLADDEN SPIT

THREATENED

- Color Changes: All Four Phases
- Aggregation Number: ~ 100 (after fishing)
- Peak Day After Full Moon: Day 5
- Behavior: Courtship
- Total Catch / Gear: 6 Individuals* / H & L
- Effort (man-days) / CPUE: 16 / 0.4
- Other Species of Interest:
  - 40 Black Grouper
  - 10 Yellow-Fin Grouper
  - 1,500 Mutton Snapper
  - 100 Horse-Eye Jacks

~ 100

SURVEY RESULTS:

BARRIER REEF: SAPODILLA CAYE AT RISE & FALL

- Color Changes: None
- Aggregation Number: None
- Peak Day After Full Moon: No Peak
- Behavior: Feeding
- Fishing Activity / Catch: None

EXTINCT

< 10

## Discussion

➢ Six of nine Nassau Grouper aggregation sites surveyed during the week of January 8th, 2001, in Belize remain in use.

➢ Two of these sites (Caye Bokel & Glory) had less than 50 individuals demonstrating reproductive coloration & behavior, and have been classified as being *critically threatened* with extinction.

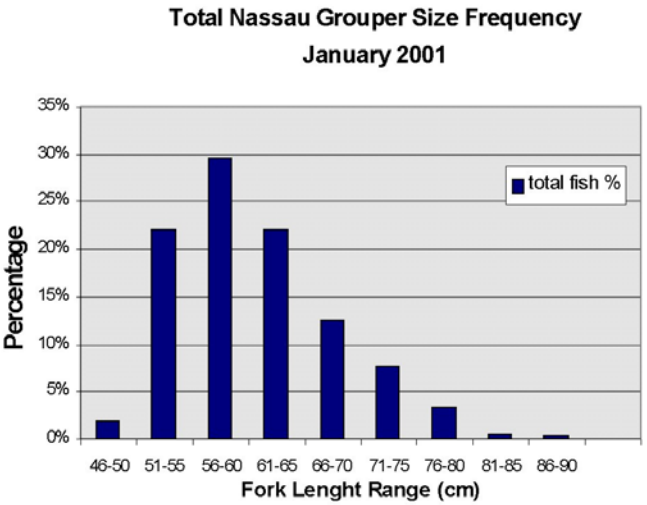
➢ Two sites (Dog Flea Caye & Gladden Spit) had less than 500 individuals demonstrating reproductive coloration & behavior, and these sites have been classified as being *threatened* with extinction because they continue to be fished.

➢ Two sites (Sandbore Caye & Glovers Reef) had several thousand individuals demonstrating reproductive coloration & behavior, and these sites have been classified as being *at risk* because they also continue to be fished.

➢ Local fishermen at the Sandbore Caye site had noted that Nassau Grouper were declining independently of fishing effort; and the Dog Flea Caye site may actually have been fished to extinction during the survey.

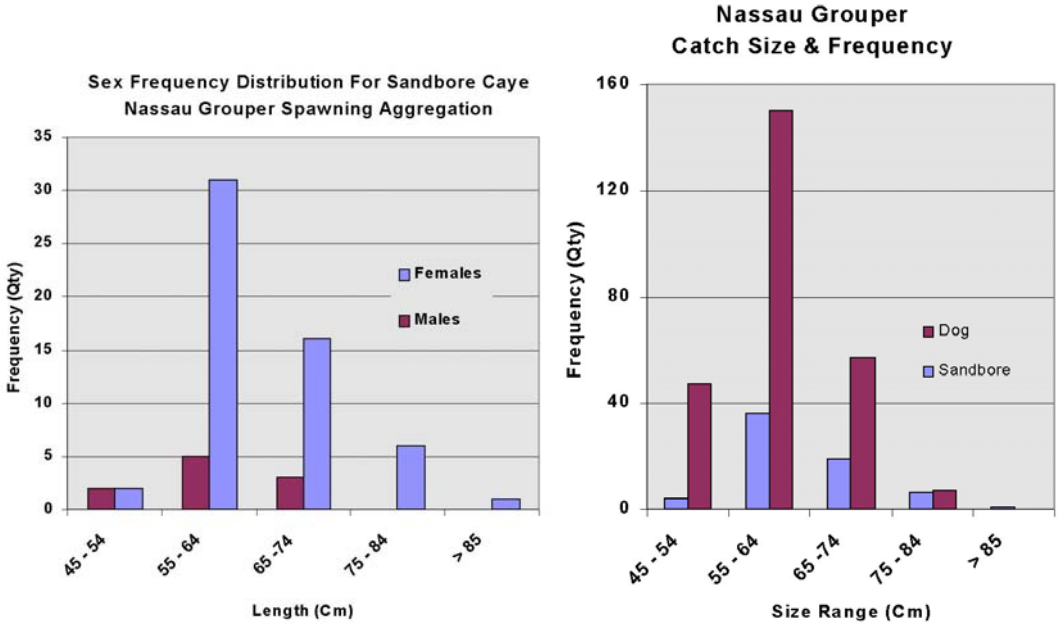
➢ A total of 715 Nassau Grouper were captured with traps, and hook & line using 183 man-days during the January 8th, 2001, aggregation event, for a national CPUE of approximately 3.9 fish/man-day (including the 2001 catch from Glovers Reef).

➢ Size/age data summarized by Sadovy & Eklund (1999) for the Bahamian Nassau Grouper suggest that Belize's 2001 catch of individuals between 15 & 20 inches (shown at right) may largely have consisted of animals between 5 & 13 years of age.




- The sex ratio of 79 individuals sampled from this catch was female dominant by a factor of approximately 6:1.

- This ratio also corresponded very closely with the light/dark phase ratio observed at the Sandbore Caye aggregation site, and the general observation of light phase dominance at all four aggregation sites surveyed.




- The survey also found that many other species of fishes, including Black, Yellowfin & Tiger Groupers, White & Black Margets, Dog Snappers and Horse-Eye Jacks formed spawning aggregations at these sites during the same period.

- Such activity suggests that suitable aggregation sites may be uncommon, and therefore critical, to protect from pollution as well as species-specific over-fishing.

**Management Recommendations:**

- **First:** The practice of fishing spawning aggregations in general, and Nassau Grouper aggregations in particular, must be stopped. Such fishing only provides short-term profit to a few individuals in exchange for guaranteed long-term collapse of any fishery in which it is practiced.

For this reason, we recommend closure of the fishery from December 1 to January 31 each year (as a minimum) during which time Nassau Grouper should not be held, sold or exported.

- **Second:** Fishing pressure on immature & newly mature Nassau Groupers must be reduced, in order to allow them to add to the population by spawning.

For this reason, Nassau Grouper having less than 20 inches (500 mm) Standard Length (nose to tail, before the fin), should not be held, sold or exported at any time.

- These measures (summarized below) should be adopted for a minimum period of 5 Years in order to allow at least one generation of local Nassau Grouper to mature and join Belize's aggregation population & participate in spawning.

- **Third:** All known aggregation sites, including those specifically in use by Nassau Grouper, should be designated as species-specific protected areas, thereby forever guaranteeing all of Belize's Nassau Grouper aggregation sites a place in the public domain for the enjoyment & benefit of all Belizeans.

Such sites would not be expected to exceed a few square miles in area, and should accommodate multiple use activities to afford fishermen access to commercial marine species, which do not specifically use the area for aggregation spawning.

- **Fourth:** The 40+ fishermen known to fish Nassau Grouper at aggregation sites should be assisted with the development of alternative income earning activities that can provide a greater return on investment than capture & sale of Nassau Grouper from spawning aggregation sites.

**Economic Considerations**

- The 2000 – 2001 Nassau Grouper catch was estimated to have a wholesale value to fishermen of approximately US $ 8,000, inclusive of fish fillets & roe, and this was entirely sold in Belize.

**SUMMARY CONCLUSIONS:**

- A national survey of Nassau Grouper aggregation sites in Belize has established that 6 of 9 sites remain in use; but 5 are severely threatened by commercial fishing.

    - Five historical Nassau Grouper aggregation sites remain to be surveyed.

    - This census indicates that Belize's Nassau Grouper aggregation sites are critically threatened with extinction.

- Belize urgently needs to **close its known aggregation sites** to fishing & impose a minimum size limit of 20 inches for a period of at least 5 years to allow its Nassau Grouper stocks some opportunity for recovery.

- **Alternative income opportunities** need to be developed for fishermen, and Belize's aggregations sites should be continuously **monitored** during the moratorium period for validation or improvement of regulatory measures.

- Belize needs to develop a **long-term strategy & action plan** for management of the fishery.

## Audience Comments and Questions from "National Grouper Assessment Report"

**Peter Gladding:** When we created the reserves in Tortugas, we as commercial fishermen decided that if a boat was needed to do any research within the reserve it had to be done by the boats that were displaced from it. They agreed to that and I get work from it. So we have a reserve and whether you are going to use it for charter or for research, the work goes to the fishermen that were displaced in the reserve. It was well accepted by our group. Thank you

**Will Heyman**: I just want to add to that, at the area at Gladden Split where we have been working, we have been hiring a lot of fishermen who have been working in that area also. And that is one of several economic alternatives that are available to fishermen displaced from aggregation fishing. Some people have talked about economic alternatives available to fishermen, and I just wanted to point out that TIDE down in southern Belize was seeing this a long time ago and is doing a lot of training for fishermen, both as sport fishing guides and kayak guides. Also, the Friends of Laughing Bird Caye along with TIDE did training for scuba diving, where people from the area were trained; we trained 21 scuba divers. A lot of those guys are now working in the industry, both as researchers and also as guides. And several of them are making a good living and are quite happy about it, so there are possibilities. Thank you.

**George Myvette:** Just a little bit of history, reflecting on some experiences that we had in Glovers Reef a year, two years ago. There was talk about probably redefining certain boundaries of the Glovers Reef Marine Reserve. For those of us who might not be familiar with the area, there is a general use zone, and then there is a preservation zone, and of course there is certainly a no-take aspect of the reserve. In the discussions that came up was the concern of stakeholder participation; there were some very, very valid points brought up by the fishing community, and I think as we are looking at finding solutions, we will need to understand that in terms of proportionate representation of access to resources the fishermen will need to be, in my view, assisted. Unbeknownst to me at the time, I think there were five to six Cayes at Glovers Reef, and actually at the time there was really no permanent holding by the fishermen out there. I am not suggesting now that we enter into any discussions that would interrupt significantly, but I am simply saying that if we are looking to equitability at some point, we need to address some of the silent but important issues in terms of resource management.

## Management and Conservation of Belize's Reef Fisheries: Fisheries Department's Perspective

*Beverly Wade, Administrator (Ag.), Fisheries Department, Belize*

First of all I want to say that my presentation is going to skip through a lot of the history because it was well presented by Doctor Carter and portion of it by Enric Sala, who did a very, very good job. I would just like to say that on the whole, the Nassau Fishery in Belize has basically resulted from intense fishing over spawning aggregations over 2 weeks during any one year and the groupers are caught mainly by hand lines, spears, guns, and traps. However, during the aggregation they are caught only by hand lines. Historically we have documentation of 13 sites where groupers aggregated in Belize or from where fishermen were fishing groupers. Some of the most popular ones are seen here, and they were mentioned several times today by the different presenters, because those were mainly the sites that made up the fisheries. They were the sites that fishermen were exploiting for this precious resource.

Unfortunately, today only 3 of these sites are really being considered as being commercially important, and as the data showed, they are commercially important because of the number of fish or the number of pounds that is now being produced at these sites. As mentioned earlier, the Nassau Grouper Fishery really started as far back as the 1920's, where production was being documented from Caye Glory. I think Craig had documented that in the 1920's they were catching as much as 120 pounds of grouper from the Caye Glory or Emily Site, and later on Vasquez documented that during the period of 1972 to 1984 the fishery was still very healthy in Belize, and this fish was considered the second most commonly caught and the most valuable finfish in Belize.

However, since 1984, the fishery really started to show signs of its collapse, and this table gives you a historical account of what was being caught in Belize in terms of Nassau Grouper. It basically shows you that from an average of 200,000 pounds we went all the way down to less than 50,000 pounds in 1991 and in 1992. I think that today it is even less. I know earlier Mito mentioned that the catch was 25,000 pounds, but I don't know if that is only Nassau Grouper; I think is a combination of some of the other fillet that is brought in. In 1998 we went back to one of the cooperatives to get an estimate on production, and we got some data from Northern Fishermen Cooperative. In 1999, because of the collapse of the fishery at Caye Glory, they had less than 1,000 pounds of Nassau Grouper for that season.

In terms of management and conservation, the Fisheries Department, with its mission to provide the country and the people of Belize with the best possible management for aquatic and fisheries resources, and with a view to optimize the present and the future benefits through efficient and sustainable management, has had the management of the Nassau Grouper as one of its priorities. It has as one of its priorities to put some sort of management plan and a strategy in place for the Nassau Grouper resources in Belize. Hence the partnership with Green Reef, to look at the Nassau Grouper population in Belize and to try and improve management - management that is sound scientifically and management that has also taken into consideration the social aspects of the fishery.

However the current management that we do have in place includes in the Fisheries Laws of Belize a statement that "No person with the intent to take fish should use any trap, wire or net other than lobster traps in the vicinity of Buttonwood Caye, Caye Glory, Mauger Caye or any other area where trapping of fish is prohibited." This legislation clearly needs updating. It was placed with the intent to protect those sites that were considered to be the major fishing areas for Nassau Groupers and fishing was only allowed by hand line and not by traps. There are also other fisheries regulations that relate to other finfish fisheries, and in particular with the Nassau Grouper Fishery that we are talking about here today. The use of SCUBA is not allowed in the fishing of this resource and the setting of traps outside the reef is prohibited. Also the use of poison is not allowed, and mesh size of 3 inches or less should not be used for nets when catching finfish.

In 1992, the Fisheries Department carried out an exercise, and a technical report was developed by the Research Unit then in the Fisheries Department headed by Ms. Stephanie Auil Marshalleck. In that report most of the findings here were outlined because it was around that time that there was a significant increase in the Nassau Grouper Fishery. The Fisheries Department decided to do an in-depth look into the fishery, and from that technical report a couple of management options were highlighted. I just want to highlight them here today, because I know we have been talking about complete closure of the fishery and complete closure of some banks. I want to enter some more options that are available that could be addressed to the fisheries as was highlighted in that report from the Fisheries Department. The first was that it was recommended that a size limit for the Nassau Grouper be implemented in Belize. It was expressed that a size limit should be put in place where it was accommodating adults that had spawned at least once in their life cycle, and that size limit was also recommended by Doctor Carter in one of his reports in 1991. Also suggested was a permanent limited entry for the main spawning grounds in Belize, and that was partially implemented in some of the Marine Reserves. One of them was at Glovers Reef, where there was a closed season for that bank during the spawning aggregation, except where people were given special licenses to fish the fishery.

It has been a ministry policy that the traditional fishermen from Hopkins are allowed to fish that bank, and I think that is the data that Mr. Salas presented today. There were about 7 boats that were actively fishing the bank during the spawning season. But ordinarily that bank is closed to all those fishing except for those fishermen that were given special permission by the department to continue fishing the bank. It was also stressed that there was a need for the continuation of surveillance in the areas where laws were in place, to monitor and to regulate the fishing to make sure that people were not setting traps on the banks and to ensure that the areas that were said to be closed were being respected.

Now there is some other option that could be taken into consideration and, as mentioned here today, there is the option to permanently close the spawning areas. It is thought by some scientists that maybe if the spawning areas are closed permanently, at least for a period of 5 to 10 years, that maybe we could see signs of the population coming back. Even this we are not sure about, because I don't think there are any grouper sites that we have actually seen come back after they have been considered completely depleted. And

something else that we have now to take into consideration is the prohibition of the sale of live fish. It is becoming popular in some of the restaurants in Belize now to have live fish as an option on their menu, and I have personally been to restaurants where there are Nassau Groupers that are very, very small. This kind of a trade has been something that has caused the demise of the grouper fisheries in several different areas in the world. A good example is in Bali, where they are trying to cope with the destruction of the sale of live grouper to the Oriental market. Prohibiting the sale of live fish is a management option that we would have to look at if we wanted to discourage this type of exploitation of the resource.

The second management option is gear limitation, as expressed by Doctor Carter. The onset of the spear gun coming into Belize really made a difference in the status of the population of the Nassau Groupers. It was one of the things that added to their demise because it was a type of gear that was more efficient at exploiting the resource. And the final management option is to put a quota in place, as several countries have done. Glovers Reef has a quota right now, but as expressed by Doctor Salas, it is something that needs to be re-looked at because if the quota is 30% of the total population then it is really not a sustainable option.

So I give you some suggestions as to where we could go, and after hearing all the technical presentations from the experts here today and from my fellow colleague, Brian Luckhurst, who will give a presentation after myself about how they are dealing with their grouper fishery in Bermuda, we need to get a response from you, the major stakeholders, as to your ideas, your concerns and your recommendations on what is being presented here today. The Fisheries Department knows that there needs to be something done now in regards to the management of Nassau Groupers, and that is why we are having this seminar today, to hear all the different views and to get a better picture of the status of the population today. It is really a day for us now to hear from you, the fishermen, and to hear from the tourist people and the general stakeholders as to what are the viable options, what can work, what won't work - because something has to be done. With that in view I would like to thank you very much.

## Policies, Legislation, and Management Options

*Dr. Brian Luckhurst, Senior Fisheries Officer, Fisheries Department, Bermuda*

First of all I would like to say how much I appreciate the invitation that came from Mito to attend this workshop and share a few ideas and thoughts based on our experience in Bermuda. You have heard a lot of information this morning and you will see the title of my talk concerns policies, legislations and management options. I'm going to skip over the first two fairly quickly and focus mainly on the management options. I think that will kind of bring to a head much of what we have heard this morning.

Just a few words about policies. Short and sweet, in the greater Caribbean there are very few countries which have policies specifically relating to spawning aggregation of any kind. Most policies probably represent stopgap measures, to address problems that may arise and require management or political responses. Ultimately those policies are translated into legislation, provided that there is an infrastructure mechanism to do that and when the problem persists so that it really becomes a political issue.

I am going to talk about legislation just a little bit. I'm going to specifically focus on Bermuda as this is obviously the area that I know best and it provides some fairly graphic examples of what happens when you do not respond appropriately in the time frame required. I believe that Bermuda was the first country in the greater Caribbean area to institute the seasonal closures of spawning aggregation.

In 1974, Bermuda implemented seasonal closures of two known sites. Ironically there were known spawning aggregation sites for Nassau Grouper in deeper water seaward of these Red Hines sites. When these sites were seasonally closed and defined, the Nassau Grouper sites in deeper water were not included. Here you call them banks and we call them hind grounds. These hind grounds in Bermuda still remain in effect today and there is still a fishery that goes on. Let me first show you the actual site. This is the map of Bermuda. It is at the top of the extinct volcanic cone; the emergent parts of the cone are the actual islands of Bermuda themselves.

In this form that is the entire reef platform, there are two offshore banks, which represent volcanic pedestals, which arise from the sides of the sea mouth. The two sites are the Red Hines spawning aggregation sites, and they are research sites that I have been working on for the last 10 years or so. Their location, near the edge of the drop off in around 13-14 fathoms of water and just outside in around 24 fathoms of water were the Nassau sites right here and right here.

So these two sites were seasonally closed to all fishing activity within the defined boundaries, which gave several miles on either side for buffers. The landing figures we had in our Fishing Statistical Program, but the message that comes home loud and clear is that the Nassau Grouper Aggregations were essentially fished out from 1975 to 81. Seventy-five was the first year that we had any data and in 6 years reported landings declined 95%. I think this provides a fairly graphic example of what happens when you do not take management action when facing fishing on aggregations.

I will further say that this entire process was actually accelerated by the fact that fish pots were used in Bermuda as the primarily method of capture, and they are extremely efficient. Fish traps fish 24 hours a day, 7 days a week. If the fisherman is not there, the trap is still fishing, and Bermudan fishermen use this for deadly effectiveness. You can see this decline, as by 1981 there were only 3,000 pounds of groupers reported landed in the entire year.

If this was a heart monitor and Nassau Groupers were the patient, the patient is dead and it has been for 20 years. There is absolutely no sign of recovery at any of the 3 aggregation sites. I failed to show you the third one but it is on the challenger bank that I talked about. There is a message here: when these sites are fished down to very low levels, then they disappear they don't come back. There is no evidence that I am aware of, in the Greater Caribbean area, for recovery after an aggregation has been fished down and ceases to form.

On the other hand, the Red Hinds provide another example of sorts. Starting, as I said earlier, in 1974 these Hines ground were protected seasonally. They were closed over a 4-month period for spawning, and you can see that traps are still in use here. The effectiveness of the closures was problematic in the sense that there was still poaching. The landings declined and then turned around here as fish traps are still being used. It is not quite clear what happened here, but what we think happened in sort of a broad generalization is that as the larger grouper like Nassau declined, other species became important, such as Tiger Grouper, Yellowfin Grouper, and Black Grouper. As they declined in numbers they followed a similar curve to this, and there was more direct fishing on Red Hines in slightly different areas with traps. Landings came back up a little bit and sort of stabilized through the 80's. 1990 was a pivotal year in Bermuda as we had all kinds of problems in trying to manage the use of fish traps and fish pots, and finally the Government came to the conclusion that they were unmanageable. We simply couldn't effectively manage; we had regulations, we had pages and pages of do's and don'ts, and this and that, but the bottom line was that we just couldn't manage them, and so ultimately the Government decided to just ban the use of traps. That is a very significant thing because there are major significant differences in the catch-ability of different species, including groupers, between the use of traps, a passive gear type, and the use of hand lines, an active gear type.

As I said, when traps are in the water they are fishing all the time. If you go out with a boat and actively fish you have to be there. If you are not there, or the weather is lousy and you can't go, the fish have some protection. So, what this represents, and you can see, there has been stabilization over the last 10 years. With hand-line fishing only, this initially represents a drop in catch-ability. When you eliminate traps from the equation and you can use only hand lines, you just simply can't catch as many Red Hines in the same time period because catch-ability is lower with hook and line.

So just to finish off the story, I think I have given you the main message here. The other thing I wanted to point out is that we have a bag limit in place for Nassau's and many other species of groupers of two per person per day. This is for everybody.

In 1996, we did a major revision of our regulations and we decided, on the basis of the extremely low numbers that we were seeing, that Nassau Groupers and the 5 other species should be afforded complete protection. So in 1996, which is coincident with the I.U.C.N. Report, we placed them all in the protected species order so you cannot catch them, you cannot posses them and you cannot sell them.

Just to mention two other locations briefly: The US has fishery regulations in place that ban the possession of Nassau Groupers, and as Peter alluded to earlier, this action was taken because of the drastic decline seen in all of the US territorial waters: Florida, Puerto Rico and US Virgin Islands. Just a little finishing point: In the Bahamas this year they closed 3 Nassau Aggregation Sites over the spawning season.

Let's talk about management options, as this is really the heart of the matter. I suggest that management options sort of fall into two main groups - biological or ecological and socio-economic. On the biological side you really need to determine the state of knowledge concerning Nassau Groupers and their overall biology and life history and, very importantly, determine what your level of understanding is about the dynamics of spawning aggregations. Spawning aggregations are the Achilles heel of groupers. You have to really understand what is going on there, and I don't think any of us will claim to understand that well exactly what the dynamics are. We are slowly getting there but the problem is that if scientists take too long to providing information for managers, there may be no groupers left.

We need to understand issues like site fidelity, migration pathways and all of those things a lot better to propagate effective management. As we study socio-economics, we need to know what is the economic value of the fishery to the national economy? The point that Mito made so eloquently is that there are viable economic alternatives for fishermen if spawning aggregation sites are closed. There are programs in place to increase involvement of the fishermen in management processes and I have been very impressed by the programs which have been but in place here in Belize to involve all of the stakeholders. I believe that it is the critical element of making this kind of management planning a success. I put this in bold: a lack of information about spawning aggregations should not be used as an excuse for inaction. I am going to come back to that again.

Just a word about the precautionary approach - this is something that I think is embraced by pretty much every Fishery Manager in the world now, and that is that we have to make decisions with incomplete data and with incomplete understanding, and whenever there is uncertainty about the status of a stock or elements of its evaluation, we need to be more conservative than ever. So, the greater the level of uncertainty, the more conservative the management should be.

I am just going to quickly go through now a number of management options and talk a little bit about each one of them. Of course, one management option is always to do nothing. That is always an option. In other words, maintenance of the status quo. I hope that you all are convinced by now, after this morning's talks, that doing nothing is not an acceptable alternative. The consequences of doing nothing will ultimately lead to the demise of every single Nassau Grouper Aggregation. So doing nothing is not really a reasonable option, I won't go through all of this, but I just make the point again at the end that there is no evidence for the establishment of any aggregation once it has disappeared in any country or any island.

Here are some other options, and as I have said, this is not an exhaustive list. You could look at limitations on catch. There are some fairly good historical records here in Belize, which you could use to try to establish what might be a reasonable catch limit. Unfortunately, in the face of incomplete understanding of the dynamics, it's quite possible that you would still set a catch limit too high and as Enric's model showed you are still going to be on the downward slide. One practical element concerning this option is that you would need some effective monitoring system to provide real time feedback, and because of the short duration of the fishing activity, this is really not a practical option.

When placing limitations on fishing effort, I have talked a little bit about the difference in catch-ability between using traps and hand lines. You could also have some form of limited entry system where you limit the numbers of boats. Again, managing that option requires a lot of resources and a lot of input. Your real problem is that catch-ability, the amount of fish that you take out per unit of effort, is so much higher during the aggregation time than during the other times that even if you let just a small number of boats in, they still going to catch too many fish.

Limitation on fishing gear types is an option, but there are significant differences between active and passive gear types and again it's a problem that the fish are just too easy to catch. You can catch too many in too short of time, so gear limitations are not a recommended option. Seasonal closures prevent access to the fish when they are most vulnerable, and it allows spawning biomass to be realized. This requires effective enforcement and commitment to the longer-term management option. It works best when fishermen commit to the action because there is a strong social pressure to conform, and the stewardship of the resource requires that longer-term commitment. You have to give up something today in order to have something tomorrow and for your children. Very importantly, there need to be economic alternatives to fishing at the aggregation so that fishermen can make a transition from one activity into the other. When you are talking about something like closure for the greater good of the whole eco-system, fishermen have to be seriously considered in the process and provided with reasonable alternatives. The last option is one that has been already mentioned: permanent closure, with incorporation of spawning aggregation sites into a marine protected area or reserve.

There are multiple benefits of this option. The biological integrity of the whole spawning aggregation will be maintained. Spawning stock biomass will have an opportunity on a continuing basis to have reproductive output. The results of that successful reproduction

will be demonstrated in terms of larvae and juveniles moving out from the protected areas into surrounded areas where they may be fished. As we have seen in several presentations, there are a number of other species that use the same sites either at the same time or on the same moon phase but in different months. So it is clear that there is something special about these promontories, these aggregation sites. If you think about it, you can see that many different fish populations are benefited by the closure of one single site. It really simplifies management a lot and it still gives you what you need, and that is a reduction in mortality on those fisheries when they are most vulnerable. I am going to suggest that enforcement is often more effective when such sites are in MPAs, because after a while everybody gets to know where they are. They get to know what the boundaries are. There is a process, and Peter could probably talk about this as well, whereby there is gradually acceptance of the concept and the idea. It's one of those axiom's "Don't tell me about it, show me."

So when we talk about potential benefits, if we can demonstrate those benefits in a very tangible way then we make believers of more people, and that is something that I think is also very important. Just a few final words and I consider this to be a very important point. Due to the time frame in which spawning aggregation have been seen to decline or known to decline and disappear, decisive management action is required. I am going to suggest that this entire issue really needs to be looked at as if our patient is the Nassau Grouper. It is in emergency; it's in I.C.U., and if some rapid and appropriate action is not taken the patient is going to die. And once the patient is dead it is not coming back. So what I am going to suggest is that there needs to be a real sense of urgency to act on this.

I don't think that it is acceptable to say that we going away to think about this and see what happens next year. Because next year there may be more crosses over the aggregation sites. More of those sites may cease to form, and once they are gone I think that would be a national tragedy for Belize. You have the most marvelous system here, you have opportunities that many other countries don't have, and I think that it would be a national tragedy to see the loss of these sites.

For my final thought, I am going to show a little graphic taken from a report on Nassau Groupers. You see these two different symbols? The squares show where they disappeared in Bermuda, in Cuba, in Puerto Rico, in the U.S.Virgin Islands. You still have one here in Belize. I hope you don't see those stars turned into squares.

**Management Options for Nassau Grouper**

*Panel Discussion with audience participation*

Let me introduce first the panel: you have Doctor Vincent Gillett, who is the CEO of the Coastal Zone Management Authority and Institute. You have Mr. Alfonso Nuñez, who is a fisherman from Hopkins. You have Mr. Heredia, who is also a fisherman, from San Pedro. You have Doctor Will Heyman, who is The Nature Conservancy (TNC) representative. You have Alan Burn, who is a member of Board of Directors for the National Fishermen Cooperative. You have Mr. Dwight Neal, who is the new Coordinator for the Research and Capture Fishery Unit for the Fisheries Department. You have Ms. Beverly Wade, who is the Administrator of the Fisheries Department. And finally you have Mito Paz, who is one of the people who was really key in coming up with this program.

Now just to give a little more information, you will be able to see here in this chart some of the ideas that came up during the presentations that were made. Now, I don't want you to feel that you are limited to these. We just want to create a background, a foundation, that you can build on, and we are willing to listen to you and give other alternatives that you might not see here. Don't feel that you are restrained to these. This is just a start, and what we want to do basically is to show some of the options, and of course you can come up with some more right now.

And what we will do is that we will look at the pros and the cons. Are you For or Against? In that way we are able to know how to move and how to go backward. With that I would like now to open the floor to anyone. When you are going to talk, please mention your name and your affiliation and then your question or your comments.

**Andrew Branson:** My name is Andrew Branson. I'm from the Wildlife Conservation Society, based on Middle Caye on Glovers Reef. In your introduction, Alfonso, you said that you wanted us to consider where we were, where we were going and how to get there. My question may appear facetious but what I want to say is that during the course of this morning we heard some interesting addresses from a range of observers, all of whom seem to suggest that the population of Nassau Grouper is far less now than it was several years ago. And immediately before lunch we saw a very splendid presentation given by Mito, which summarized the status of most of those aggregation sites.

But I was interested to ask the question, particularly given that we have so many fishermen here, if that stock assessment, if the evaluation of the stock that we saw, is one which all the fishermen can agree with. Or were there any of those sites or locations where the fishermen thought that the information was in error? Were there times of the moon when there were more fish, were there places where the observer missed the aggregation? I thought that the surveys were very well done. I thought that the information was very compelling, but before we move to discussing the options, I would be really keen to know if we have agreed where we start from, and so again I pose the question: "Is there anybody here who would like to disagree with the evaluations that we seen presented to us?"

**Alfonzo Avilez:** Thank you very much. I think that is a valid question and I would like to pass the mike on to Mr. Nuñez, who is one of the fishermen and who was one of the persons that made a comment. Then if Mr. Heredia and Mr. Burns could also give some insight.

**Alfonso Nuñez:** After the results of the research by the scientists, if we have to think about conservation of Caye Glory, the fishermen from Hopkins could always come together to talk about alternatives to fishing grouper, maybe do other things to survive.

**Mr. Heredia:** Personally I believe that what was discussed here today, and hearing the people that were talking about these issues, and especially as I have been a fisherman for many years, and also with my fishing co-op over there for almost 30 years, I feel that yes, we need to do something quickly, but at the same time I have always said that whenever we are bringing conservation measures and things like it, is very important to keep in mind the fishermen. What will we do with the fishermen immediately, because they have to survive? And will we act immediately or seriously? That would be my biggest thing. I want to see what we can do with alternatives, in order that they will have a living and survive in the future also. It will take a while before the fish recover, and so with any conservation measures that you make, I believe we should see what we can do for them before anything is changed.

**Alan Burns:** What I can speak from is not from personal experience of grouper fishing because I have not really concentrated on catching grouper, but I can say that being affiliated with National Fishermen from the middle of the 70's, I have seen the decline in the catch, the decline in the numbers that we have received at National over the years, coming right up to now. We have not purchased any whole grouper, I think, for at least 8 or 10 years so I think that speaks for itself, right there. I am sure that we are still receiving grouper in the form of fillet because the majority of our fishermen at some time or another do spear fishing and do deliver fillet fish of which grouper must be a large portion, but I could not say exactly how much.

**Beverly Wade:** Just a quick question to the fishermen. Do you think the grouper have moved? Do you think that is the situation? I think that is what Mr. Branson was asking. If you think that those sites that they sampled are actually the oldest sites here in Belize, or do you think that the grouper have moved on to other areas on the reef.

**Manuel Heredia**: From my experience on the island I can recall the one they were talking about earlier, Rocky Point. I can recall when they first discovered the bank there. Thousands and thousands and thousands of grouper were over there. There was a very good catch the first year, but mostly the tour guides were the ones who did the fishing that year. The second year I can recall that there was some fishing, but the biggest attraction was from the big numbers of tourists, who were taking video cameras and under-water cameras out there. I don't know if that had a big effect on the grouper, but I can only say that after that, that was the end of that bank. So I do believe that they moved to some areas probably not far away, but up to now we have not found where they are. It was not really

over fishing. I believe more, from my point of view, that is was too many cameras and video cameras that were around. So we also have to be very careful about that. Probably the scientists would know if that had a drastic effect.

**Mr. Gillett:** I'm surely not a grouper fisherman, although I have spent a couple of days out on the grouper banks trying to get some groupers, and my experience has been that my lack of experience in catching any kind of fish showed that there weren't many fish at the grouper banks. However, having said that, I think that this information you have been presented with this morning clearly demonstrates or continues to show the pattern of decline that I have become familiar with over my years of association, first with the Fisheries Department and now with the Authority. That decline has been evident since 1984, which was when I began to read some of the reports before going to the Fisheries Department in 1986. That again was documented in Jack's report in 1991 and indeed the report that Beverly referred to, done by Auil in 1992.

I can recall when a colleague of mine was doing some research work out on Caye Glory in 1994. His research work was in fact somewhat over-turned by the fact that he could not find any of the groupers out at the bank, so clearly there was a decline. And so far, the empirical data suggests to me that, in fact, the grouper fishery has collapsed. When one looks at the figures that we have historically, from over 200,000 pounds in 1984 to less than 5,000 or 10,000 pounds today, that is a decline going down to as far as 0.025%. Now if that is not qualitatively indicative of a collapse, then I need to be convinced by the empirical data that that is not so. So I think that we have to recognize and put things in their proper prospective. We are dealing with a collapsed fishery and therefore, what should our focus be in terms of defining any possible management measures?

**George Myvett:** Thank you, Mr. Alfonzo. Let's look at this just in terms of the science, and I am trying to provoke some discussions here. As managers and as scientists, we have our own perspective on things, but certainly I think the fishermen have equally credible and sometimes provocative thoughts and orientation on this very issue. One of the issues that I have sort of bantered back and forth with some fishermen is the identification of those banks and placing them on a map. They have basically said there are times when these fishes move. I think Ms. Wade, by way of trying to provoke some discussion, said, "Do you really think they move?' As scientists say, in a specific area, in a localized area of a bank, is a spawning aggregation likely to move in one year or between years? This is something that I would want to have some comments on, number one. Number two, again in terms of these sites, I think for the most part they have been found by fishermen. They have been historically identified by fishermen, and scientists basically follow up and do the investigative work. Essentially I want to ask: To what extent do we believe that we have covered comprehensively the spawning sites in Belize, or do we believe that there are others to be discovered? Thank you.

**Enric Sala:** I think that it is very human to try to deny what is overwhelmingly clear. I'm going back to your suggestion that there may be other reasons for the disappearance of the groupers. All of my colleagues and I here agree that what causes the disappearance of the aggregation is fishing. I have seen results in reserves where I have worked and Peter

can tell us about the case of the Jewfish in Florida. Groupers are fished everywhere, and yet when you create a marine reserve and you don't allow fishermen there, and when you bring only tourists with cameras, videos, flashes, everything, the number of groupers increases every year, every year, every year. Peter, they started it in Florida with a Jewfish spawning aggregation with how many groupers? A few, now you have 300. There is overwhelming evidence all over the world that these aggregations disappear because of over fishing, and I think it is dangerous to try to fall into denial because this is a way of wasting time and trying to see if we cover all the sites or perhaps they moved deeper. Meanwhile the groupers are going down and as we have seen this morning they don't come back.

**Peter Gladding**: I'd just like to mention about the Jewfish. We had them fished down to almost nothing then there was a ten-year closure. We have tagged 2,000 Jewfish and every time we make the trip to the Gulf we tag 30 fish on a rock the year before, even though we have done it a month before. I go back and half the fish we catch are not tagged, so the recruitment has really grown. And by the way, Jewfish grows about 250 pounds roughly in ten years. So we brought back a resource and it has really come back.

**Alfonzo Avilez:** That opens a lot of discussion based on what Mr. Heredia said and based on what Mr. Enric is saying. We don't know; maybe a study has to be done here to see if our fish are camera shy. It could also be that, we have no idea.

**Comment:** Sometimes, we would go fishing and they find the grouper far away from the bank. The fishermen were right on the edge like in about 300 feet of water and we were there three days, four days and we didn't catch any fish. Then another boat came by and we moved and anchored right beside of the boat and we caught grouper. So, thank you.

**Alfonzo Avilez:** So, basically you are trying to say that probably where you used to traditionally fish, the fish moved to another area. Was it a far distance away, about 4-500 yards? Looking at it from a scientific point of view, would it be a far movement for the spawning aggregation or would it be a case where they might just be using the larger area, that is my question. Would a quarter mile, would one mile, would five miles, would ten miles or a hundred miles be a movement? What would be the limit of saying it is a movement, a large movement? I think Doctor Luckhurst could comment on that.

**Brian Luckhurst:** Yes, thanks. I can just comment that in my experience when we try to define the area in which we find the spawning aggregation it is usually measured at least in Bermuda in terms of a nominal area of, let's say, 200 to 300 meters in the long axis if we look at it as a rectangle off shore. Perhaps 200 to 300 meters by 150 meters; within that nominal boundary we find spawning fish. We catch and tag fish throughout that area, and in the instance of the tiger grouper aggregation in Viagas in Puerto Rico that I have worked on, we have several different estimates over a period of 3 years. Those estimates, which were done both by divers and by plotting the locations of all the fishing boats up to about 15 boats, showed variable areas and size. But after 3 years we were able to define sort of the maximum outer boundary within which spawning fish were caught.

So, I don't think there is a simple answer to that. I think in general most scientists tend to think of a generalized area with some defined boundary but within that the fish may very well move around. If you are talking about a movement of a mile or more I will suggest that that is a displacement. That is a different site.

**Alonzo Avilez:** Thank you very much. Will.

**Will Heyman:** We have been looking at the question as to whether fish come back to the same sites to a certain degree using fish tags. I just want to point out a couple of small points and then a pattern that we are seeing to address this issue. One is concerning data from several groupers that we tagged with radio tags. We've got a piece of equipment down under water so that when the fish comes nearby, it records when it comes. We have tagged about 15 groupers and the recorder can only hear the tag if the fish is within about 100 meters or less.

The fish that we tagged right there at the aggregation sites seemed to stay right there until after the spawning time, and then they all disappeared. Similarly we tagged the Mutton SWnapper back in 1999, and again it's not a grouper, but I think the pattern is very much the same. One of the fish that we tagged swam 255 miles up into Mexico and was caught by fishermen up there, and then another fish was caught 2 years later by Lawrence in the back reef at exactly the same spot that is was tagged. So what it's telling us is these fish seem to be coming right back to these same points and yet they travel very great distances.

**Greg Smith:** Greg Smith, with Green Reef. Besides being conservation oriented, I am also a user of the Nassau Grouper population. I live approximately 2 miles south of the Rocky Point Aggregation off of Ambergris Caye. I have spoken to a fisherman who described that site as having Nassau Grouper like sardines so that would be in the thousands and ten of thousands. Now I never fished that, however I have regularly fished and this goes to the heart, I think, of what we were speaking of: the presence or the absence of these aggregations and how they impact our fisheries for the future. The first fish I ate in Belize when I came to live here in 1979 was a Nassau Grouper. I stopped eating Nassau Grouper (and these are Nassau Grouper that weigh approximately a pound, juvenile Nassau Grouper) in 1995. They are the new recruits, less than two years old, into the population where I live. So, from 1979 to 1995, I primarily ate Nassau Grouper, until they became so scarce that I realized that we didn't have Nassau Grouper juveniles any more in the habitat where they used to be.

So whether or not the fish have moved is not the essence of it, because I personally believe they have the capability of moving. I know Jacque Carter tagged a Nassau Grouper off Ambergris Caye that was caught in an aggregation I believe in Mahawal, Mexico. So they can move a couple hundred miles away and no longer be replenishing our stocks here in Belize. The essence of the problem is not whether or not the aggregation has moved, but if we are not getting the new recruitments in from that aggregation, then it's really going to impact our future fisheries.

**Alonzo Avilez:** Okay, Greg, thank you very much. So apparently it seems as though you are also contributing factors to show some of the fish being eaten out. You have something to say, Doctor Gillett?

**Doctor Gillett:** Yes, I just wanted to say that the literature does say specifically that there is spatial variation in the distribution of the groupers. However, there is a generic statement that most of the species of groupers are known to be highly specific. That it is to say you would always go to a particular location and find them within that general area, which does not mean that at any point in time at point X, but in that general area. Every year, every season, those fish are going to be there. For example, the Epinaphulus, the Cotatus, in some part of the Caribbean, are known to aggregate loosely within that particular area, and that might be bounded within, let us say, a square mile, so anywhere within that area you are likely to find the fish there. But again, not to say specifically, every season you are going to find them at point X. All right.

Again the E. stratus is known to aggregate in three sites in the Cayman Islands. And you would always expect to find them in any of those three sites, but there have been indications that they may not necessarily occupy all of those sites every year. Again, we have another species in Australia that is extremely site specific, that is to say you have primary sites where during the season of aggregation those fish are always going to be there.

**Alonzo Avilez:** Ok, Mr. Gillett, so I think that we are going to where we are right now. I think you are going to listen to a final comment, because if we remain on this we will be stuck on it. So we will get the final comment from one of the persons who has been doing grouper research in Belize for a long time. I'm not saying his word is bible but almost like it.

**Jacque Carter:** It's definitely not biblical, but I am Jacque Carter and I am with Wildlife Conservation Society and this question about whether the grouper are here but they have moved is critical to wrestle with. I am glad that we're spending some time on it because if they are here and they are just at different areas of the reef then the urgency doesn't seem to be as severe as we have been talking about. I don't think we can answer with any certainty whether or not the fish have moved to other sites unless we were to survey at the same time the entire barrier reef eco-system. But let me say this about where we are at. For whatever reason, these fish have been gathering at these points for decades, perhaps hundreds of thousands of years. It is important to them to go to the points on the reef, and if you look at the map of Belize, you will notice that at the northeast corners of these atolls, it's the projections at the Rock Point, Caye Glory and the Gladdens where not just Nassau but many kinds of fish gather. So, let's say that they are still here but they move south or they move north. I don't know if there is any comfort in that because it may just mean that they are in a different place but they may not be spawning, they may not be reproducing in these other sites, they just may be there and reabsorbing their eggs and the milt that they have produced. We do have evidence that that is what fish do when they are disturbed, or when they are injured, or when they are not able to produce in the environment that they are used to.

So, I think it is important to realize that even if they are still here at different sites we may not be getting any gain out of that because there is no evidence that they are letting their eggs go anywhere but at these points, and this point is very important. The fish seem to go there for a reason. We don't know that reason, but that is my observation.

**Will Heyman:** I would like to add to that, and for a visual of what Jacque just said I think this small report that was in your package kind of illustrates it on the front cover. What is shown in those little square boxes are all the different little sites where the fish are aggregating to spawn, and you can see that they are all points on the reef and so if the reef is a big straight place, it is unlikely to see the fish spawn.

But the important sites are at points like in Gladden Spit and like Emily Caye Glory and the northern spot of Glovers Reef, Sandborn Caye, all these places where the reef bends in at an angle. What you are going to see on the inside of the document are some graphics that show that these sites are like your elbow, the Turneffe Elbow or at Gladden. They call it the elbow. A lot of these places are right where the reef bends, and this is interesting because is bends not only in two dimensions, not just bending to the north or to the south, but as everybody who fishes there knows, the reef also bends because it drops vertically. So in three dimensions it is like the corner of a table. The reef bends in two dimensions this way and bends in a third dimension dropping off vertically. And where are the fish aggregating? Right at those points. I think, and what we have been seeing during three years working with the fishermen at Gladden Spit, and also looking at Emily several months of the year, and looking at Caye Bucal several months of the year, we are seeing a pattern emerging that I want to show you on the next page. You are seeing this almost every month of the year if you got out to Gladden. This is the pattern that guys like Lawrence and his brothers like Waga and Lennox have figured out over a long period of time. They go back to those same points and look at all the different fish, and they are all aggregating there to spawn.

So I think to answer Alfonso's point in terms of re-directing this I am going to actually keep the ball rolling here and put in a comment that says I am pro the full year-round closure at the spawning aggregation, at the multiple species spawning aggregation sites, and I would like to hear comments from fishermen as to what they might think about that.

**Alfonzo Avilez:** Okay, Gentlemen, this is where the fishermen now come in. You have heard the scientists talk, you have heard the people from the government talk, and now it is your turn. It is your turn to say exactly how you feel, what you think of the entire situation. Is it bad, is it good, or should we do something about it or should we do nothing about it, should we open it more? This is your turn to talk.

**Cadle Nuñez:** I am Cadle Nuñez from Hopkins, better known as KK. I feel very good about it, but one problem is that there are many of those fishermen around here who get their livelihood out of that. During Christmas time some of us promise our kids that if they get good grades in school we will give them something, and by fishing groupers and making fish fillet we make a little sum of money and we buy them their presents. Now,

every December, if we don't get some money, where will we go as fishermen to get some of this money?

**Alfonso Avilez:** Okay, so what you are talking about is simple economic alternatives, which also has a social impact because it has a social impact on your son or daughter if you don't give them that gift. So what based on this chart here and based on what you said would be the best management option that you would recommend.

**Respond:** To close it.

**Alfonzo Avilez:** To close it seasonally or close it year around? It would have to be year round so you have the consensus of basically this entire group, fishermen, that it is best to close it all year around. You see, because they don't find any there right now anyway, to close it they would not be losing anything, right? At least then when it comes back to other areas then you will be able to buy that bicycle, right? Any other fishermen feel a bit differently about it? I know you wanted to say something from early.

**Elmon Nuñez:** Hi, everybody. I am Elmon Nuñez, a tour guide from Hopkins and part-time fishermen. I think the best thing to do with it is close it for a couple of years and probably reopen it in the future. I wouldn't say 5, 6 years or 10 years, but I think after a while it should be reopened for the fishermen for general use. Thank you.

**Alfonzo Avilez:** Okay, so here we have another point of a limited time closure of, you said, three years? Ok you didn't mention. One of the time frames, I think one of the main things that would determine the time frame, will be basically, how long it takes a grouper to reach mature size. Now is there anything that says that? I'm going to the man that wrote the bible.

**Jacque Carter:** I am beginning to feel like Moses. We know that to make the grouper reach their first reproductive size, about 4 to 500 millimeters, takes about 4, 5 years. So you are looking at a minimum of about 5 years time before you could expect the fish that are born now to make their first trip to the bank. The smallest fish that shows up at the bank that actually has roe is going be about 5 years old and that is a small fish, and you want some of those 10-year, 12-year-old fish over there because the number of eggs they can produce is not just a few more, it is hundreds of thousands of more eggs in 5 years.

**Alfonzo Avilez:** So, therefore, that would be something that would limit the amount of time. As you see, from a grouper that would be born today, five years later he would be able to make an offspring. Therefore it won't make any sense to close it for three years because you are not really reaching an effective point.

**Dwight Neal:** I don't know if I should introduce myself because somebody at the back said that everybody should know me by now. Anyway, Dwight Neal, and I guess I am probably the grand old man of fisheries, to steal Mr. Myvett's term, because I have been there since 1978. Now, I can't say I have ever fished grouper, because every time we go to

the grouper banks I have been fishing Yellow Tail while everybody else is fishing grouper. I figured out that I caught more fish that way.

My input today is not so much an input as only an observation about a couple of things we are discussing. One, whether or not the groupers stay in one place to spawn, or whether they come back to the same location to spawn, or whether there is a possibility that they spawn at other aggregations, or whether or not when they come back they might be going to a different site, or close by, or something of that sort.

And I guess we could discuss that forever and never find out what is the truth. I think what is facing us here today are questions about what direction do we want to head, and where do we want to go with these management options that we have. And as the head of the Capture Fishery Unit that's my major focus. I am almost caught in between a rock and a hard place because my job is to make sure that we can guarantee the fishermen at some point in the future that there will be fish for them to fish. And all the social and economic implications that go along with that. I can always remember a past Fisheries Administrator saying that whenever we start looking at management measures we have to think about the fact that you can't teach conservation to people who are hungry because you will be making criminals out of them. In essence we are saying that, regardless of what you do, you have to take the primary users into consideration. We are getting some interesting suggestions, especially from the fishermen, but we also want to bear in mind that there are going to be some strong social and economic implications based on whatever decisions we make here.

Along with that there is also going to be the auxiliary task of doing the necessary, well I don't want to call it law enforcement, but monitoring of whatever management measures we put in place. So while I would be in support of permanent closures of these banks, right, there are a couple of things I would like see happening. First of all is to determine whether or not we are closing the right areas, because I don't want us in one year to close one square mile and the next year we find that, hey this is not enough, we have to close four square miles now. And then we just add to the size of these banks of these closed areas until eventually we have pushed the fishermen out completely.

Like I said, my job right now is to make sure that there is some sort of capture fishery in place for fishermen. So that is one of my first concerns, that I want to see a little bit more work even as we are thinking about closing, and even if we close that, there is some work that goes along with the closure to say that, yes, we are in fact getting 90% of the spawning banks. I guess Mito and Wildlife Conservation and all of the other people will no doubt take up that challenge. The other thing that has been bantered about is the possibility of finding alternative employment for these fishermen. I don't know how many fishermen we could accommodate as tour guides. And with the Land Use Policies that we have in the country I don't know how many of them will be able to become farmers. But if we are thinking about alternative incomes or alternative occupations we want to take this into consideration as well.

Like I said earlier this morning, I don't want to sound like I am throwing water on everybody's party, but at least I want to keep bringing in a note of caution. It is very easy to say we are going to conserve. It is a lot more difficult to manage those conservation efforts. Thanks.

**Alfonzo Avilez:** Thank you very much, Mr. Neal. We will come to you shortly Mr. Myvett. Let me get these fishermen over on this end.

**Lawrence Leslie:** I am Lawrence Leslie from Placencia, a fisherman. I oppose this all-year-round closure. The reason is because it will affect us at Gladden Spit. We fish snapper in the month of May and June so if that is closed all year round we will suffer from that.

**Alfonzo Avilez:** So you oppose the all-year-round, but you would support the seasonal closure. Mr. Myvett?

**George Myvett:** Me again. I just wanted to discuss some of these options. Most of these options are all sensible, but I think that as we discuss them they need to be discussed in reference to other things. In principle, closing an area might be an effective response, especially from the standpoint of regulators. But certainly if you close without mentioning the fact that you want to engage the fishermen and the other users of the resource in some alternative income generating activities, then I think that we might be missing the boat to a large extent because I think whatever options we come up with would need to be not only sensible but certainly enforceable.

The issue I would like to throw out to the floor is to discuss some of the alternative income generating activities. I don't want to preempt what is going on, but perhaps as a corollary to what is happening I want to ask the floor to comment on some of the likely income generating activities that might really tide these fishermen over.

Fishermen on the right just a little while ago said there is the issue of Christmas. I will recall a couple of Christmases ago, in 1999, I think it was, we had no intentions of opening Glovers Reef, but we did; a decision was made. I feel that certainly that is an indicator, to some extent, that from a management standpoint we did not truly think out in the long term the implications of closing these areas. So I just want to ask if there is some focus on these other alternative income-generating activities.

**Alfonzo Avilez:** Mr. Myvett brought up a very key point, which we will probably discuss later on, but since he brought it up we can talk about it. It is very, very important, no matter which one of the options is chosen, whether it is seasonal closure, or a temporary closure, or a set time like 5 years or 6 years of closures, there are going to be some economic problems, or lets call it socio-economic problems. And indeed, Mr. Neal's point that you can have only so many tour guides is a valid, a very valid point. So what other alternatives are you looking at? He said farmer again, and as he said, the land use policy with the farmland going mostly to foreigners is one. Yes Tom.

**Thom Grimshaw:** Well, certainly the option is not to make every fishermen a tour guide, but if tourism is going to be part of survival of the Nassau Grouper, and tourists are going to pay a fee to see the grouper, the fishermen do not necessarily need to take them and they can still be the recipient of the fee. You understand what I mean: if tourists are going to pay $100 a year or per visit to go see the Nassau Grouper, then fishermen can still be the recipient of that because that fee can be collected nationally. It is an entrance fee, like a get fee, that would go to the fishermen.

**Alfonzo Avilez:** So you are looking at the government subsidizing. Could you hold for a little while, Greg?

**Dwight Neal:** Sorry, Mr. Grimshaw. I have to oppose you head to head on that one because I have seen the effects of putting fishermen on social insurance in Canada and the results are devastating. If you don't believe me you could check with the people in Newfoundland. You don't want to do that kind of thing. Could I finish please? I prefer to see that we come up with some alternatives for income generation that do not include this kind of dole hand-out kind of thing. I'm almost certain (I don't know if Mr. Luckhurst is familiar with this) but in England they had a similar problem when they had to put fishermen in what they call it the Pokio or something like that. So, I definitely want to keep that kind of suggestion out of the pool altogether.

**Thom Grimshaw:** Yeah, but I am not advocating that at all. They can do both, why couldn't they have the benefit of the tourism fee as well as work at other activities. Why not make the money from the fee while they are doing something else besides fishing.

**Alfonzo Avilez:** When you mention about the tourism fee, the thing that I don't understand, that tourism fee is going to be collected by whom? The managing area? And then that money is going to be given to the fishermen? It is the same thing as subsidizing.

**Greg Smith:** This issue seems simple to me, and other people have already brought it up. It was identified that approximately 40 fishermen were fishing the aggregation, and not all of them are using the same site. Then Peter had suggested that the fishermen be the ones that have the contracts to take scientists out there. For example, they should also be given the contracts to do the tour guiding so that they get those exclusive things. So if somebody does want to take tourists out to see these aggregations, and we are seeing the value of that, they have got to hire a former fisherman from that aggregation. That is a viable way of including them.

**Luigi Marin:** I am Luigi Marin from Northern Fishermen. From everything I've analyzed, the facts say that we need to do something about this. I am 100% in favor of closing it, but I can also say that if we are going to close it off to the fishermen, I think it is fair enough to close it to the tourist too. What is the sense of closing it off for the fishermen and opening it for the tourist if we are not benefiting anything out of this? We as fishermen need some money out of it and what are we doing if we are going to give the tourist benefit? I mean it is unfair for us too.

Another thing I can suggest: Why not get Government involved if it is going to cause a problem for us as fisherman? Why not get the Government involved in this and say, maybe for a period of December to January, let the Government give us a grant? I mean, as these guys said, we need money for our Christmas time. Let the Government do something and give us a grant. Let's say each fisherman who does this for a living, I can give you these X amount of money. That is the way I see it and get the Government involved.

**Alfonzo Avilez:** So again you have another point like what Greg said.

**Melanie Mcfield:** Melanie Mcfield, World Wildlife Fund. In response to what Greg and the fishermen have said, there are a number of different ways to approach this. I think the concept of having some of those fees go back to the fishermen is good, but I also understand what Dwight is saying. However, it doesn't have to be a hand out directly to the fishermen. You could create something like a Business Development Fund out of that money that they can manage as a group, and then they will be able to start other businesses. One thing I have heard kicked around is handicrafts like woodcarving. Give them some training in doing woodcarving and that is another alternative that they can do independently and at home. There are a lot of different things that could be done, and using that money from the fee to do it without giving a direct hand out.

The other thing is that one of the benefits that should be written as a pro is that establishing these closed areas under the Marine Protected Areas gives you more flexibility because the fishermen are represented on the advisory committees of those Marine Protected Areas and they can have their input and you could basically structure it. So what you said won't happen, because within the Marine Protected Areas you can say as they did in Florida: you must use the fishermen, you must use these guys, and you have to use their boats. And so then the big slick tourism operator with the nice brochure can't come in and compete with you because through the Marine Protected Areas you can make them say these are the guys who are going to get the business.

**Luigi Marin:** What I am saying is that it is unfair for us, the fishermen. If you are going to close it for us, close it entirely for everybody. That is the way I see it. That is my point of view.

**Melanie Mcfield:** But that is the best way, the easiest way, for you the fishermen, to get money out of it is to have the tourist involved and make sure that you get the business.

**Alfonzo Avilez**: It is not the fishermen. He misunderstood.

**Melanie McField:** Oh, we are talking tourism fishermen? Is that what you thought we are talking or you thought tourism the divers?

**Luigi Marin:** Everybody.

**Melanie McField:** He says everybody because he is saying that the fishermen don't benefit from tourism when they see the big operators, the big slick guys, coming and making money.

**Luigi Marin:** And the small fishermen don't get anything at all.

**Melanie McField:** Yes, that is true. That is a very good point but I think . . .

**Audience** It's better to close it for everyone.

**Melanie McField:** But then you don't have a chance to make money, and if we do it the other way, where do you legislate?

**Luigi Marin:** We don't have a chance at all.

**Melanie McField:** But the way we could do it, we have a potential to make it.

**Alfonzo Avilez:** I will come to you, Mr. Myvett, right now. I think we have a little thing here that Mr. Marin is saying. Basically it is closed, period. That means no diving, no snorkeling, no sport fishing. Nothing whatsoever. Now, Mr. Marin, I think you probably understood what she was trying to say but you are saying basically, still some way or the other the big fish will eat up the small fish. So that is a point, that "We have to be taken care of."

**Luigi Marin:** Get the Government to give us a grant for this period of time. As fair as that.

**Alfonzo Avilez:** That is something that we have to look at, but right now. Mr. Gillett.

**Mr. Gillett:** I don't know if you want to cut off our nose to spite our face, and neither do I think I would want to look at handouts or Government Schemes or so on. Dwight is quite right in pointing out now that those kind of Government social insurance schemes for fishermen have failed tremendously. They fail all over the world, including Canada as you mentioned, United Kingdom, Jamaica, etc. So that might be a scenario that we want to look at with some clarity and be careful and clear about what we are thinking about. But I think that we need just to step back a little bit before our emotions get the better of us and see what the problem is.

We all agree, or we had heard this morning, that the grouper stock or the spawning aggregation sites are under threat, and there was a strong suggestion that those groupers are not going to be there in a very short term. In fact, they are not there in many instances for the fishermen to benefit from now, much less down the road.

So that is the number one problem that we have to appreciate, and whether we look at closing the season or not closing, or closing for a period of time, is another situation that we have to look at. I do take the point, however, that in determining whether the season

ought to be closed or not, we do need to look on the pros and the cons of that situation. Because as the first part of our discussion went around we know that the closure is not going to be useful if we are not sure where the aggregations are, where the fish meet at a predictable time and space. So you have to be very much certain that if you are closing this area, this is the area where the fish are going to congregate, or are likely to congregate, because otherwise you are going to be faced with the problem of shrinking the area or expanding the area, and moving here and there without chances of success. So we have to be sure and agree that you know that these are the specific sites that we are going to close.

Now again in terms of a year-round closure or seasonal closures, it strikes me as being very important to recognize and appreciate that the fish do aggregate at the particular time when they are most vulnerable. So it would seem so logical to me, and I can be wrong, that it would be appropriate to close the areas at that particular period of time, so that a seasonal closure is maybe more appropriate. We can therefore take into consideration the point that was made by Mr. Leslie from Placencia, that there are fish other than grouper, for example at Gladden Spit, that are caught. So we can take that into consideration.

And I also feel that again we don't want any social insurance handout scheme, but we do have to recognize that if we are going to take a close look at closures, fishermen are going to be displaced and therefore it is upon us to look at alternatives. Now alternatives I say in the plural because there are many options that are there, whether you are looking at tourism or whether you are looking at other participation schemes. For example, we can look at encouraging by way of policy. The government can help put up something similar to a farmers bank, a fisheries bank, where fishermen can go into this bank and get some type of collateral or support in establishing another business, whether it be in tourism or other social activity. But the point is that we have to sit down and carefully discuss the options that are available, and whatever we do, fishermen who are displaced must be the primary beneficiaries. We cannot allow the big guy in tourism to take over the whole operation, if you are going to talk about the tourism operation. Unfortunately in the model that was shown, I think the figures were based on Manta Resort rates, where you have only one operator benefiting from that eighty, or ninety thousand.

I am saying that even at that level, Manta Resort should be encouraged whether by policy or otherwise, to utilize fishermen in taking guests out to the spawning site or whatever. You know participation by fishermen must be considered in whatever we decide, and particularly those fishermen that are displaced. They must be considered in whatever alternative we consider.

**George Myvett:** Me again. To further carry on the point that Mr. Gillett was making concerning alternative income generating activities, I would like to suggest that we have the vehicles to assist this process. The Fisheries Administrator and the CEO of Coastal Zone are mandated by legislation to sensitize management plans, and I think that as we move forward with this process it is a matter of identifying specific activities. I think in that regard we would need to identify the fact that we engage the fishing communities, so that we understand that income and opportunities may be lost perhaps temporarily but

there is a need for a compensating mechanism and that could well be defined in concrete terms in days, management plans, and activities. I would also want to state that along those lines (again in terms of responses, and I know Jacque has been to some extent a part of this), the whole issue of the culturing of fish is something to consider, and I use the term fish loosely. This is something that the fishing community has been looking at to some extent. I know National has in the past looked at the culturing of a particular fish, and I know that some of the cooperatives have an interest in shrimp farming. I am simply saying that as a response, the fishing community, and not just the cooperatives, should be assisted in this regard.

Again by way of responses I recall going to Mexico a couple of years ago. In Cozumel, much of the diving is done not by high-speed sophisticated boats but by the Sarteneja-type sail boats. If you want to go diving at a site, essentially that the type of boat you jump on and it is fishermen taking you there.

So again, as Mr. Gillett said, by policy or by design, whatever the processes, I think as we move forward with this, we want to make sure that at the end of the day we get the most returns in social terms. MPAs again, and you know I am saying this in terms of a response, and I am sure that it might come up as a response in terms of Fishery Specific Protected Areas, there is no reason why the fisherman cannot be at forefront of the Management of Marine Reserves, or Marine Protected Areas. This might well be one of the tools, one of the opportunities, to get fishermen more involved in the management of their own resources. Thank you.

**Dwight Neal:** Seems like this is a three pronged fisheries attack, and both Mr. Gillett and Mr. Myvett have stolen some of my thunder, so I guess I'll just pick up the pieces from here. During the presentation this morning I went ahead and made some notes which I thought I would have contributed, but when the discussion started I forgot all about the notes and I started getting emotional. Co-management should definitely be an option that should be explored, and why I am saying this is because there are at least two examples from the Philippines where the fishermen were given the management of resources in their area, and after about five or six years it was shown that they did a terrific job, probably even better than what the Government people could have done.

The reason was that it was in their best interest that that resource be managed properly, and all that the technocrats and the government people and the NGOs did was to help them with the management of these areas when they were closed. They would be the ones to collect the fees and maybe a percent go to Government or a percent go wherever. Those are some details that have to be worked in the future. These comments, by the way, are in no particular order of importance or priority. There should be no traps in the fore reef or nets by the way in the fore reef and the back reef. That is law already, and if that is being done then somebody is violating the law, I think.

Fishermen must be an integral part of any management decision and strategy, and any co-management effort should be coordinated through the Government of Belize agencies responsible, and because I work at Fisheries, I figure Fisheries should be that agency. A

coordinated education initiative should be undertaken to sensitize the public in general, and the fishermen in particular, as to the benefit of any management policies and strategies that are undertaken.

And finally, one of the notes I have here is that a spawning aggregation working group should be formed, either coming out of this meeting here today or at some point in the near future. This group should look at all spawning aggregations, and this point is even more of a priority now because I heard Mr. Leslie, who is a good friend of mine, who is almost like a brother, saying that if we close the Gladden Spit area all year round then they would not be able to fish the Mutton Snapper. Unfortunately, I can't agree with my brother here because again he is fishing a spawning aggregation, which might follow the same trend; we don't know. So I think a spawning aggregation working group should be formed, hopefully by the end of August, and probably by the end of September. They should have some recommendations for the Fisheries Department and the Minister responsible for the fisheries as to where we should go to protect these spawning aggregations. Close them for 3 months, 6 months, 5 years, permanently, or whatever, and also to look at alternatives to income generation for the people who would be displaced.

**Alfonzo Avilez:** Okay, Mr. Neal. Mr. Neal just mentioned something that we think is worthwhile to put down. Now there are always a whole lot of other committees all over the place, but indeed it is something that could be looked at, you know. Instead of us just sitting here and making decisions, a working group could come up with basic ideas, which will then be taken back to you. Right now, Mr. Gillett.

**Peter Gladding:** During the break, Dwight, you said you catch Yellow Tail, and fishermen who catch fish find it is not hard to switch from one fish to the other. Why is it that you don't encourage the fishermen here to catch Yellow Tail Snapper? The man sitting behind me on my left really needs those fish, and he has a market for them in the U.S. You do have a lot of Yellow Tail, and the one thing it has taught us is that we have already killed out our grouper so we definitely need to catch Yellow Tail. The majority of the money that I make for catching fin fishes is from Yellow Tail, and our scientists say they are potential margates.

So you have a potential fishery there instead. I am a fisherman myself and I don't want welfare from anybody. I don't want the state or the government to get into my business any more than I have to. I'd rather switch to another fishery and make it that way. So you could help these guys learn how to catch Yellow Tail. Thank you.

**Alonzo Avilez:** One thing that he failed to tell you is that he could not catch grouper because he is too slow, so that is the point.

**Dwight Gillett:** I just want to follow up on a statement that you made a while ago, and actually the example that you used in response with respect to the Philippines. It is actually a good example of when and how governments actually underestimate the competence and ability of fishermen. So, in fact, the co-management approach is another example of how we can go and, in fact, I think you should write down with possible

management measures the idea of developing Marine Protected Areas, as Mr. Myvett was talking about. Because again, it was mentioned this morning in terms of Precaution Management Principles, about developing or using Marine Protected Areas. It is an example of the kind of precautionary measures that we can take. That kind at least is not very difficult. But we can move in that direction, and there again, the fishermen as co-managers can be an integral part of that arrangement, the Management of the Protected Area. And again one can blend MPA along with protected aggregations sites so we can focus on doing two activities, the Marine Protected Areas built around or on top of the protection of the aggregates.

So it is a good option and one that we should explore, certainly. Again in terms of the working groups, fishermen should be involved there along with the Fisheries Department. And I do volunteer the Coastal Zone Management Authority to participate fully in that process because that group should be able to come up with ideas or suggestions that can benefit all of us, in terms of the Administration policy, in terms of the benefits that can be derived for fishermen. So please keep that in mind that even in that level of the aggregate working groups, fishermen must be involved.

**Alonzo Avilez:** Thank you very much Mr. Gillett. Yes, wait one moment please.

**Catherine Paz:** Hi, I am Catherine Paz, and I am going to take another aspect. I work in the tourism sector and I have frequented Hopkins in the past 2, 3 months. Since the people in Hopkins are mostly fisherman, Hopkins is at the birth of the tourism industry, and people coming to Belize are looking for community-based tourism. Hopkins could succeed in this easily, and has tried maybe for the past 10 years. I could see the fishermen working with the small resorts. I mean getting more tourists here, taking them out as tour guides. That whole southern area has a lot to be developed.

In San Pedro 15 years ago, most of the fishermen slowly transitioned into becoming tour guides and developing tours. First, people used to fly to Belize City to do Altun-ha. Now all the tour guides take them direct to Altun-ha by boat. I think that same concept should be explored, because the south of the country has so much to offer: Hopkins, Placencia, Monkey River. That would create more jobs for fishermen to become tour guides. Not necessarily only being dive guides, but just guides taking people up the rivers or whatever there is to offer. If more people were coming, then there would be wants and needs for grocery stores. Then small fishermen could eventually open little stores, little gift shops, restaurants, but they would still be small scale, and that is what a lot of tourists are looking for in Belize.

I live in San Pedro and people go out there and find that San Pedro is way too big for a lot of people. They still have the small idea of Belize, and in the south of Belize we can offer community based tourism. I think it is the best way to go as that is where the fishermen could participate more easily than in big resorts.

**Alonzo Avilez:** Thank you very much, Ms. Paz. The only problem if that does happen is that Mr. Neal is out of a job. Let's pass it on to Mr. Will.

**Will Heyman:** Just following up on the point that Catherine Paz just made: Green Reef and the Nature Conservancy have resources available right now actually directed specifically toward Hopkins, recognizing that you guys might lose out a bit from this. So when this wraps up, could we meet briefly to pick an exact time? We have a possible opportunity for you for a dive conservation course or a sport fishing course depending on what you guys want. If we can meet when this thing closes to discuss that briefly and pick a time and get the sense from you guys as to what you want, then we can do that course. That will be great. That is one thing.

The only second point: I think this idea that Dwight originally brought up and was followed by Mr. Gillett in terms of this committee, is an excellent point, if in fact there is the urgency that we're seeing. I think that we can agree that the situation is pretty drastic. I think, as you said, getting this working committee together here and now is an excellent idea, and I just want to say that I agree that nobody knows these places better than the fishermen. Nobody understands the situation better than the fishermen. I think we need Coastal Zone, we need Fisheries. Green Reef is obviously on the committee in terms of having developed this. It might be good to get some volunteers from fishermen now who would like to sit down on a committee like this to make sure your interests are met as these policies come on line.

**Alfonzo Avilez:** Yes, I do agree with you, Will, and I would suggest that just before we finish with this session, we can meet for 15 minutes before we go into the next part. Again, as you see, there are so many impacts that could happen in the sense of economic alternatives. Just as a joke, just now we said that Mr. Neal might be left out of a job if that happens, but another person mentioned, "Well since he is good at catching Yellow Tail he could go and work with the other guy. One thing creates a serious domino effect. So what was rightly said by Dwight earlier is before we take any action, we have to study and see what is going to be the reaction.

**Mito Paz:** Yes, I would like to ask the fishermen what kind of other activities they would like to participate in, if they want to be tour guides. We want to hear from them, you know, whether they just want to continue being fishermen or if they are willing to change professions.

**Alfonzo Avilez:** Just before we go to the fishermen, so we could get a little consensus, Jacque could you hold on a little bit on your comments so we could get Mito's question answered.

**Robert Nuñez:** You all know that I am from Hopkins. Most of those lodges in Hopkins right now are owned by big foreigners, and they always bring their people in from outside Well, I am a tour guide and sometimes for the year I will get 3, 4, 5 trips, which is bad for me. If I don't go dive or do something else, how can I live? If you guys plan to bring more tourists for Hopkins, then before you guys get us to stop fishing grouper it would be little better for us to bring more tourists before we start up anything else.

**Jacque Carter:** I'm just going to throw something out on the discussion before we run out of time. First, let me say that I am for helping the fishermen. I agree with what Mr. Oradius said, that if we are going to do something in terms of closing the banks that we need to also do something for the fishermen. One of the reasons I want to see the groupers come back is so that there can be fishing. I don't think the whole country of Belize should be tour guides. Fishing should be part of your culture, and you should be able to catch and eat fish, and there should be fishermen, but having said that I need to say that the Nassau Grouper has more problems than just on the banks. It was clearly stated today by fishermen that spear fish for a living, compared to hand-line fishermen, what effect they had on the population. I think that we would mislead the group as scientists if we didn't clearly say today that even if you protect these banks and you closed them for 5 years or how many years you want for the fish to grow up, these fish are still in need of protection at the other times of the year. Spear fishing has probably done as much or more harm and continues to do more harm today than the hand-line fishermen on the bank. And if you are going to continue to allow spear fishing to occur for Nassau Grouper then I can't be confident that closing these banks is going to result over time in the return of your fishery. So you need to wrestle with the fact that spearing these fish in the places that they live all the way around is going to eliminate them from going to the bank. That is pretty obvious.

**Alfonzo Avilez:** Jacque, a good point you mentioned there. However there is one problem I foresee. It is easier to monitor if you say that the only place that spear fishing is not allowed is in protected areas. How are you going to be able to say, OK, you can't spear-fish a grouper anywhere? When the guy comes in with a grouper, it is filleted already, so how do you know if it was shot or caught on a line? Therefore if you say no to spearing grouper, it will probably be complete closure for spear fishing for any kind of fish. It would be real difficult just to say there is no more spear fishing for grouper because then they will still be able to have the spear guns. Some of the guys have some such long breath that they could spear-fish grouper down there and clean it and bring it up as fillet.

**George Myvett:** The moderator is suggesting other alternative income. Just by way of house-keeping, Alfonso, I made a recommendation to get serious about the issue of fish farming, and I am not sure if it is listed. I may have read through it too quickly, but it is something that we need to debate further. I don't want to go into the virtues of fish farming, but needless to say, I have seen it really take off in the Philippines. There are quite a few people who have been former farmer fishermen that have transferred to fish farming, so is something that definitely could be done.

Again in terms of responses, we have been looking at the whole issue of bio-prospecting. It is something that has been bantered about and we could come up with a range of ideas, but I think that certainly I would want to see the fishing communities definitely participate in this issue. Certainly in terms of lending logistic support and in terms of providing services, etc. I think that they should be onboard there.

The issue of size limits, and I don't know if we are through here with this list. I think Ms. Wade had mentioned the issue of live fish. I go to these Chinese and you see this plate

with grouper, and it pains my heart because these things are very rare, it is very rare to see a plate size grouper. But some of these fishermen are getting them into the restaurant and this might be something for the working group to look at more closely.

A point that has arisen that is very sensitive is the issue of labor. The whole issue of ensuring that local populations benefit does require that certain laws be revisited, probably in terms of redraft, and the whole issue of enforcement should be brought to the fore. I could tell you that from my experience in the Grand Cayman, and I was told the same applies in the Bahamas, permits would be required for many, many positions before one could go in the field to recruit labor for any position. It has to be advertised and the local recruitment process has to go forward, and I make the point because I see that it is blatant in the shrimp farming industry.

There is a certain level of talent here in Belize, but shrimp farmers by and large basically bring in who they want. It is something that I think we need to look at nationally because I am sure it is not just specific to shrimp farming. I think certainly for the tourism industry we want to make sure that the people from Hopkins and San Pedro and all those guys who are involved with the tourist industry are really given good consideration. Thank you.

**Luigi Marin:** I think that this workshop is very interesting, but we are meeting for too short at time to jump to conclusions. I think we need more of this because if right now we jump to a conclusion we might regret it in the future. You might not regret it but we the fishermen from Hopkins and Belize City, we will feel the pain afterwards. So let's think about another workshop and try to think about ways we can do it, because this is too short. Time soon runs out on us and we still have not come to a conclusion yet, you understand.

**Alfonzo Avilez:** Yes, Mr. Marin, that is indeed a very valid point. That is the reason why this workshop is just the stepping-stone. This one is first for you to get out ideas. Those ideas are then formulated and brought back to you. It is not a conclusion that whatever happens here we are going to make legislation from it. It goes through a process. It is not going be a one-week process thing where you have law at the next month or so. It takes a process like what was mentioned to me by the gentlemen from the U.S. He said the U.S process took 3 years for them to come up with the idea of what to do with the fish, and it took another 5 years to come up with a law and by that time the fish was extinct. Okay, now we turn to Mr. Neal.

**Dwight Neal:** Just to alleviate some of my good friend Luigi's concerns. This is one of the main reasons why I suggested that we try to get a working group together, because I already realized that we would not have enough time here, and definitely as I said earlier, fishermen have to be an integral part of any decision making by management. They should be in on these spawning aggregation decisions so that the final analysis is in their best interest.

Also I wanted to touch on the business of live fish. It is a phenomenon that is growing, primarily in the far-east and it is here with us, and my view is that it is going to get worse. Right now it is like an epidemic in the Philippines, Malaysia, parts of Thailand and

Indonesia. What is happening is that in the case of some of the tropical reef species, the Hong-Kong and the Moscow Markets are paying as much as US$500 per fish as long as you can get it alive to market. We are not talking exceptionally big fish either. We are talking about 25-inch fish, which are not that big. Larger fish have been known to go for as much as US$10,000. So that is a problem that we are going to have to deal with in a very short time, because the way that the tourist industry is right now, the restaurateurs are going to use any mechanism they see legally appropriate to sell their product.

I agree with Mr. Myvett that some of the10-inch and 15-inch fish that we see in these tanks is really criminal, but there are no size limits, so two things come out of that. One is that we want to look very, very closely at the Live Fish Trade, and it is going to be somewhat tricky because we are already okaying collection for aquarium purposes. That is the first thing. Secondly, there should be some size limit, not only for the grouper but for quite a few other species. But definitely for the grouper. I know, having worked with the Fisheries Department in Bahamas, that they have a size limit of about 14 inches. I saw in one of the reports this morning that they are suggesting 20 inches. What we want to do is to come up with some conclusion because I definitely support the idea of size limit for the grouper. We want to come up with some concrete suggestion as to what size length you have at first maturity. Now there are a quite of few examples of work that has been done, and the Fish Encyclopedia that is now in the internet, called Fish Base, has quite a bit of information in there that we can use as a baseline for making decisions in terms of size at first maturity.

Along with that I want you to seriously, seriously consider this whole business of co-management because, as Mr. Gillett suggested, the fishermen are generally smarter than we give them credit for, and I have to agree because there are quite a few fishermen who went to the same high school that I did. They choose to be fishermen and I choose to play in the sea and pretend I am doing scientific work.

So along those lines we could probably think about just having fishermen, like maybe say 5 of the fishermen from Hopkins, have them form some kind of management group, and they have responsibility for maybe some area out in Turneffe, or I don't know where, but at least we have people who we can work with. In all of this I want us to remember, as Jacque suggested, that in fact we don't want to stop fishing. We just want to make sure that if we want to continue fishing there are fish there for us to catch. We don't want to go to fish just to wet our line, as the gentlemen from Hopkins are well aware of. With that I think I will have to shut up for the remainder of the period.

**Alfonzo Avilez:** Okay, Mr. Neal, I will hold you to your word. Another point that Mr. Myvett mentioned was aquaculture. Now Mr. Myvett, are you talking about just general aquaculture or are you talking about farming specifically for grouper?

**Charles Myvett:** General.

**Alfonzo Avilez:** General, I know, because I know that they have been trying to grow groupers in the wild and in captivity. I am not quite sure how it has worked. Would anybody here have some information?

**Brian Luckhurst:** Brian Luckhurst from Bermuda. John Tucker at the Harbor Branch Oceanographic Institute in Florida is the one who really pioneered the capture of brood stock of spawning aggregations and then subsequently developed the technique to inject them with hormones, spawn them out, and then raise them. He has been successful in raising several lots. I guess the point here is that he has had enormous resources to conduct this work and to work out a system.

One of the critical elements of his system is the necessity of having a fairly sophisticated water system, plus the fact that he had to develop a specific feed to meet the nutritional needs of the groupers to grow them through the various life history phases. I won't want to guess how much money that actually cost for him to do that. Having said that I think a strong argument can be made for the fact that if, through appropriate management, you can harvest the wild stock and enhance their natural reproductive output, that is probably a far better economic alternative, if you are specifically talking about groupers. That is just my personal view that the natural reproductive output, if it can be managed properly, is probably the way to go.

**Jacque Carter:** Jacque Carter again. I am just going to follow up with what Mr. Brian said. I began working with John Tucker about 10 years ago on a proposal here in Belize to reform Nassau Grouper. The technology is now here to do that. Much of the investment has been made at Harbor Branch in Fort Parson, Florida, to do the kind of work that Brian described, to work out the feed formulation and to work the water system that you need to propagate and fishes. But even with that having been accomplished (and I believe we are closer now technologically to being able to farm groupers, Nassau Groupers, and even start reseeding juveniles into the depleted banks), I don't think we have the luxury of time with the situation you are facing here in Belize to think that aquaculture can come to the rescue. I think it will eventually come in. It is probably 3 to 4 years out. But looking at the data that Enric showed us and the number of groupers that you may have left with wild stock, I think you have to move forward now in terms of conserving what you have while you work as hard as you can to develop this alternative farming technology. This will come but you have to have brood stock. You have to have wild fish alive in Belize in order to take the eggs and milt from them. If you lose them, as they have in Bermuda, you are going to have bring fish from other regions, and they are going to have diseases and other kinds of problems. So you really need to save the grouper you have while you are working on developing farming technologies.

**Comment:** Are you saying that there is no grouper in Bermuda at all, not one?

**Jacque Carter:** No I didn't. Yes there is probably one. Just a point of clarification on the graph I showed this morning. What I showed you were reported commercial landings. That doesn't include any recreational catch, and we do occasionally get reports

from different resource user groups: divers, photographers, spear fishermen and so on. I have seen Nassau Groupers but it is truly a rare event.

I pointed out last night in an earlier discussion that I have seen two Nassau Groupers while diving in the last fifteen years in Bermuda. So for all intents and purposes they became commercially extinct in 1981, and somehow there is just this relic population that just keeps ticking along. We may be getting some level of input via the Gulf Stream from up stream populations, such as from the Bahamas, not many left in Cuba, and so on. But practically speaking they are not there. They are a rare species.

**Peter Gladding:** I want you to take us back to size limits. Everything has repercussions when you start it. If you have closed areas and you have size limits, then there is another law to face. You have to land that fish, head and fins intact. Otherwise, who is to say you are not taking the grouper? So when you change one thing, it just snowballs into the other. We now have to land all our fish with heads and fins intact, and we can't even cord and ask any more because of size to make sure that you comply with the size. It is something to think about.

**Alfonzo Avilez:** You were talking about the domino effect. Now since the whole point has turned around and we are looking more at the system of coming up with a committee, then I suggest that instead of going with pros and cons we come up with points that we want them to discuss. Points that you, the fishermen, you the scientist, or you the person, want them to take into consideration while they are meeting. Of course a couple of you fishermen will be in the group.

But again, as you say, not everyone thinks the same. Just the same way that some fish are camera shy and some not. The point is that since we have moved on a bit and we are leading towards something else, let's come up with some ideas. Yes Tom.

**Tom Grimshaw:** I just want to comment that if we take this to the committee rather than taking the initiative now to come up with some kind of approach, the recommendations could be contested for next spawning season and the next spawning season after that. If we change that initiative, and go with a committee that is not really accountable to anybody and has not really been formed yet, how will we ever make sure that we have a decision in time to save these grouper? Right now we have everybody here in the room who could make a decision.

**Alfonzo Avilez:** Yes, Tom, but that is the reason why we had mentioned that before the end of this session that that committee will be formed.

**Beverly Wade:** I think on a whole to come up with any decision today is premature. I think that what today was meant for is to get all the stakeholders together to show them what is the current situation with the Nassau Grouper today. We have had very informative presentations by the scientists and I must congratulate them, along with the team that did the survey this year, to give us a very clear picture of exactly what is happening. That is what is now prompting us that some kind of action has to take place.

I think as a body the consensus is that action should take place, and I don't think that we should limit the committee now to a few things. I think a lot has been said today, and I think it has been recorded duly, and I think that the committee should now take those things into consideration and flesh them out more comprehensively, because it is more than just giving people a conservation dive course. It is more than setting up a craft shop. It is more than stopping spear fishing.

I think we have to be very cognizant of what management really is. That it has to address all the needs that we are looking at today and it must also be practical, because as Jack and Brian mentioned before, there are several countries where management does exist, but we also have to look at the practicality of the management that does exists and what exactly is that management directed toward. So I don't think it is necessary for us today to come up with a decision and say, "Well, we are going to close all the grouper Spawning banks."

I think what should come out today is a commitment that the committee should have some kind of a time frame to work in. But there is a need for the committee to comprehensively look at what was said here today. I think it is totally premature for us to try and come up with any decision here today. What I would like to see is that a time frame is given to this committee in light of what was presented here today, so that the Fisheries Department and the Fisheries Administrator could advise the government of Belize on some recommendations for the management of the Nassau Grouper fishery at the end of the day. Thank you.

**Alfonzo Avilez:** Thank you very much, Ms.Wade.

**Nick Requena:** Nick Requena, a student from UB working along with a part of the Assessment Team that did the actual assessment in January. I think what Ms. Wade said is very important: coming up with a specific time frame in terms of recognizing the seriousness of the problem or recognizing the significance of this scarce resource. So I think it is very important to come up with a time frame for action.

**Alfonzo Avilez:** Mr. Neal. So do we have to reinstate, Mr. Neal?

**Dwight Neal:** I need to go back on my word, just to make a point of clarification. I think when I have mentioned about the spawning aggregation working group, I did suggest that in fact time limits could be set: By the end of August we have the working group in place, and by the end of September it has some concrete recommendations for the Minister. Now I threw those out as points for discussion, but I think that when we form the working group, if we ever do that, we should try to stick to those time limits, because as Mr. Grimshaw rightly said, another spawning aggregation is coming in December, and at least by November, the Hopkins fishermen should know whether or not they are able to fish.

Traditionally in Belize we have waited until the 23rd of December to tell people that there would be no 25th of December. I don't think we should continue this practice. I would like to see the time limit I suggested be enacted, but then that is just a very egotistical behavior

on my part. However, I think we should have very rigid time limits. Given all the work that has been done here, I don't think it will take the committee more than one month to come up with some concrete decisions to advise the Fisheries Administrator and the Minister about what should be done about the whole grouper fishery.

**Alfonzo Avilez:** Thank you very much Mr. Neal. Now Mr. Myvett.

**George Myvett:** Just to register my solidarity with the point made by Mr. Neal. I think that definitely we need some time frame, and I think is an urgent matter, and it should be initiated and concluded as soon as we can. Mr. Neal has suggested some time line and I don't know if that will receive any response. I think that if that is the quickest time in which we could come up with some sensible recommendation, then I would support that.

On a related point, Mr. Alfonso, you had suggested some members to the committee, and I would want to just reflect on these - the sort of configuration of a committee that I see. I think that certainly the fishing community needs to be present on that committee. I think we want proportionate representation, and I think that certainly it is a national issue and we should be looking from north to south and east to west in terms of representation from the fishing community. I definitely believe also that obviously the other stakeholders will need a role in it, primarily the tourism sector, and I think certainly some of the NGOs Conservation Community would need to be a part of this process. Also I see the primary regulatory agencies. I see the Fisheries Department, I see the Coastal Zone, and possibly the Forestry Department, as an institution that has the mandate for Protected Areas Management. I don't want to speculate on numbers but I would say that in many, many instances small numbers many times are more effective. Thank you.

**Tom Grimshaw:** I would like to put in a couple of points of clarification: One, while I am fully in support of developing a committee for spawning aggregation and I think that it is really important, I wouldn't want to see Nassau Grouper get subordinated to many other aggregations, which are a lot less vulnerable than the Nassau Grouper. So I think if the committee gets formed it should really just focus on Nassau Grouper in the short- term. Number two I think from the evidence presented today there is a pretty good case for the critical threatened status of this fish for the 2 or 3 of the 6 known sites that were surveyed last year. In respect to the others I think what we should be focusing our conversation on how are we going to compensate the fishermen this December?

**Alfonzo Avilez:** Yes, that is a good one.

**Ms. Cabral:** Maybe some of the park fees that are collected from Glovers Reef could go towards compensating the fishermen. There are park fees collected at other reserves.

**Alfonzo Avilez:** It's going back to some of the suggestions that were made as economical alternatives. But then let me give the microphone to one of the highest government officials right here with us now.

**Beverly Wade:** Again, I think it's kind of jumping the gun for us to now start to say park fees going to fishermen. I think that is the whole idea of creating the committee, because this really needs to be looked at carefully. If we make a decision now, without looking at it properly, we might regret it two months down the line or one month down the line. I think what needs to be done is to look at our fishing community who are depending on these aggregations, and if we are talking about alternative livelihoods or alternatives for these fishermen, we need to come up with good alternatives. Coming up with alternative livelihoods that are going to make a difference or are going to put as much back into the fishermen's lives as their fishing activities were doing. I think that we have to look at alternative livelihoods that the fishermen are comfortable with, and to look at management measures that we are thinking about putting into place, and to make sure that the fishermen who are directly affected by these management measures are the people who would be benefiting from the alternatives that we are putting into place.

So I think for us to be saying right now to give Glovers Reef visitors' fees to the fishermen is still premature. I think that that is why it is essential that we form this committee and have this committee look at this situation a little more in-depth, with every idea that has been put forward today, to see how we could come up with a better package rather than just skimming the surface as we are doing right now. Thank you.

**Alfonzo Avilez:** Thank you very much, Ms. Wade. Now with that said, Mr. Gillett.

**Mr. Gillett:** I think from the response I have seen from the audience, we need to look at forming this committee, and I think that some of the elements that we ought to include have been put forward by Mr. Neal, and particularly a time frame has been suggested by him. The suggestion in terms of the composition of that committee has been put forward by Mr. Myvett. So, I think that we need to get a response from the audience that, "Yes, we are going to form this committee," and, "Yes, we are to see what this composition or membership is going to be." We need suggestions and agreement as to a time table. I also have a suggestion that, at the end of the prescribed time period or somewhere near to or before the end of that prescribed time period, that we reconvene some way or some how and bring our recommendations to the floor for approval.

**Alfonzo Avilez:** Well, Mr. Gillett, you being the ex-administrator, you know that we always go through that process and there is no doubt about it.

**Mrs. Gibson:** Thanks Alfonso. As a follow up to that I think it might be useful to put down some sort of outline terms of reference for the committee as well, because as Ms. Wade said, we need to look at it in a comprehensive way. You might want to add not just the dead line, the management options that you are recommending, and the economic alternatives, but also what you will need to monitor to see the impact of the management, and also perhaps prior authorizing specific types of research. For instance, Mito had mentioned earlier there are other sites that you might wish to survey as a high priority and so forth.

**Alfonzo Avilez:** Good. With all that in place, and with what Mr. Gillett said, I think everyone agrees with the idea that we go with the committee. For us to acknowledge that I would like to ask for a show of hands, please. Whoever is in agreement that a committee should be formed to look at these, please raise your hands.

This is a committee: Let me rephrase it again. What is going to happen is that they are going to form a committee. This committee is going to look at everything that we have talked about to come up with an idea, a plan, a strategy, of how to deal with it. Okay, if the place is closed seasonally, how are the fishermen going to be given an alternative? If it is closed completely, what other alternatives or actions is this going to cause, and how are we going to deal with the fishermen? That is what this committee is going to do. So it is not to come up right now with exactly how much you are going to get, but just basic ideas.

**Fisherman:** The committee is to see what they are going to do for the fisherman when they close the bank? That was exactly what I am asking.

**Alfonzo Avilez:** Exactly, right, that is the whole point. So again, I am sorry I just had to clear the point out for some people. So again, by a show of hands, could we see whether or not you agree to the formation of the committee? Good, I think we have a majority. Now the second point would be to determine who would be on the committee, and just as a suggestion, I would say most of the people on the panel. Basically you have only representation of fishermen from three different areas.

You would say bringing someone else from down south. You have Mr. Leslie here from Placencia. Then I don't know if you want to include someone also from Punta Gorda because of the Cayes. Then you have someone from San Pedro. Here already you have from Hopkins, which would be doing the Glovers Reef area, Mr. Nuñez.

Now Mr. Burn. I don't know if Mr. Burn will be on it himself or will someone from National be a representative? Because I know your fishermen basically fish the Turneffe and Lighthouse area. Then, Mr. Marin, you are from Northern, right? Then I don't know if you want to include both Coops, Northern and National. You have Caribeña down in that area, Mr. Nuñez. Of course Coastal Zone and Fisheries would be in it. You have Mito from Green Reef. Yes, Ms. Gibson.

**Ms. Gibson:** Just to suggest the M.B.R.S project because it is a kind of a regional issue as well.

**Alfonzo Avilez:** That is a good suggestion.

**Dwight Neal:** I notice that you are mandating this head table. Can I make a suggestion, just to elaborate a bit about the mechanism? I think we should approach the fishermen in general through the cooperative, also bearing in mind that there are independent fishermen who we would want to take into consideration, primarily down south. So we are looking at the cooperatives to suggest a representative, and I don't know if the Hopkins fishermen have a cooperative, but we certainly want them to get together and have a representative.

In Placencia, they have a cooperative so that is not a problem. In addition, for the NGOs, I don't know if we would want to approach BACONGO on this because they are really sort of the umbrella organization for the Conservation NGO.

I don't know how Mito will feel in a situation like that, or Will, or everybody else. There is TNC as Green Reef, there is WCS, I guess WWF. I don't know if you want to approach BACONGO on this or you want to let them decide amongst the marine-oriented NGOs to make a decision. And for tourism you have B.T.B., and you have B.T.I.A., right? So I just wanted to put in perspective the options we have.

**Alfonzo Avilez:** Yes, Mr. Neal I agree completely with what you said, but something that I have noticed at a lot of these workshops is that if you do send the word out to the cooperatives, they end up sending someone else who was not at the original meeting and then you end up starting from scratch instead of continuing on. I have always seen that. So I think it will be best to choose someone from within the area who is here, who is part of this initial workshop. That is one of the reasons why I threw it out, and I mentioned some that you know from panels, because basically they are all representing some of the different regions. Ms. Gibson, do you want to say something? Ms. Wade, do you want to say something? Yes, Mr. Myvett.

**George Myvett:** I think the committee would benefit very much from the science presence on the committee. Certainly I see Will and Mito Paz representing the science, Mito in the sense of an NGO but certainly the science. So if you assign the head table, and it includes those gentlemen, I would say yes, but remember the science. Thank you.

**Alfonzo Avilez:** That is exactly what I was mentioning. You would have basically everyone represented at the head table, with the inclusion of people that are not here, for example from Placencia, Punta Gorda and the tourism sector, which would be either BTIA or BTB, and the inclusion of the other cooperative, which will be Northern.

**Luigi Marin:** We have a representative from Northern. What is your name? Alfonso, from Hopkins. He is a member of the Northern.

**Alfonzo Avilez:** So that means we have killed two birds with one stone right there.

**Audience:** Me, myself will be, we don't know nothing. Better I honestly believe in somebody who lives in Hopkins. That person could represent.

**Alfonzo Avilez:** It is easier that way.

**Luigi Marin:** I find it for a living I am only a committee member. I really don't know for what to live. I can't fight for them. I can't make decisions for them. But I think it will be appropriate to make one of the same fishermen to represent Northern.

**Alfonzo Avilez:** So what you could do then is ask the people to come up. What is your name sir? Mr. Nuñez, could you come up to the head table, please?

**George Myvett:** We have named Mr. Burns, as he is from National. He is part of the committee, but in terms of the protocol I was wondering if in terms of Northern you might need to maybe send something to the committee or suggest a name to the committee. We have Mr. Nuñez, because we want to make sure somebody speaks for the cooperatives you see, and Mr. Heredia speaks for Caribeña. He is a part of the committee, so it is just a protocol.

**Alfonzo Avilez:** That is a point well taken, Mr. Myvett. Basically then we are missing Placencia. Now, Mr. Leslie, could you come up again as Mr. Myvett said? We would follow the same protocol and you just now make that request and suggest a name.

**Beverly Wade:** I think we have been doing good just looking at the rest of the committee in terms of the make up. I think that as Mr. Myvett said we have to also look at the size of the committee that we are forming for several reasons. Logistics - in terms of putting a whole bunch of people in a room to discuss something, it is kind of hard to come to consensus. I think rather than say BACONGO, Mr. Myvett, I think we should identify an NGO like TIDE who has been dealing with fishermen and have been promoting alternative livelihoods. So I think they should be on the committee. I think in terms of science, Green Reef and probably Will Heyman could represent the scientific part of it and that would be two more, and one person from BTB, and one person from BTIA, and that will make a committee of 11. I think that is a committee that is covering the whole spectrum of people, and I think that is a good number to work with.

But I throw this out to the floor. I don't know what the floor suggestion is. This by no means means that we won't take inputs or consult with other people from time to time, especially organizations like NBRS. I know one part of their work program is to actually look at the aggregation sites in Belize and to promote alternative livelihoods in the region as a whole. I think that there is no reason why we can't consult the coordinator and have him sit in on a couple of sessions from time to time. But I think that eleven people on the committee is quite sufficient, with the four cooperatives, The Fisheries Department, Coastal Zone, TIDE, Green Reef, TNC, BTB and BTIA.

**Audience:** Placencia.

**Beverly Wade:** Yes, I think that should cover the deliberation that should take place.

**Alfonzo Avilez:** Ms. Wade, actually you might end up with twelve because you probably have independent fishermen in the sense of Mr. Nuñez. I was thinking that probably instead of both BTB and BTIA, you would not have to put both of them. OK then, before we continue I would like to ask one of the representatives of TIDE to please come up. So we basically have most of the members of the committee here, of which we would still go through the protocol, as Mr. Myvett rightfully mentioned, but instead of waiting for them to nominate someone, we will actually tend to gear them towards nominating these people. It's like planting the seed before we tell them to reap. So, the third part now is

what Mrs. Gibson said, Terms of Reference, we need to come with some Terms of Reference.

**Ms. Gibson:** Just some other things I can remember. We need to come up with recommendations for management and economic alternatives, and the management is to focus on the Nassau Grouper at this early stage. And I had mentioned, perhaps, monitoring and priorities for future research, and perhaps, I am not sure if you would include in that also the time frame deadline for certain activities.

**Alfonzo Avilez:** I would suggest we leave the time frame for the fourth point, because the time frame is going to be more specific. That is what we probably charge them to do and that is something we will probably leave for last. Let's drop the bomb at last. Any other point? Doctor Sala?

**Enric Sala:** What is the economic impact of the different recommendations made? If the recommendation is, for example, closure of the spawning aggregation, how many fishermen fish there and how many groupers are they catching, so we know what is the real economic impact of it.

**Alfonzo Avilez:** That might be a little bit difficult to come up with in a short period of time, but probably they could come up with points that are going to create a problem that can be looked at afterwards, probably during the process for future research.

**Enric Sala:** They should also determine the economic impact of not doing anything.

**Alfonzo Avilez:** Which is the 'no action.' Ok, any other points? Mr. Neal, you came up with some.

**Dwight Neal:** I just want to come back to the business of co-management as one of the recommendations for management. I want to see it as a part of the Terms of Reference, that we definitely look at options for co-management rather than just leave it and maybe we deal with it or maybe we don't. Because I think is something that is very significant in terms of this whole tragedy of the co-management. If you have the responsibility for managing it, and you depend on it, you are definitely going to look after it properly.

**Alonzo Avilez:** I'll be doing something here. Don't worry; it is nothing illegal. I will pass on this paper, and for the people from the panel, please write down your name and your address and your affiliation. If it is the Co-op, or especially the person who is independent, if you have a phone number please, so we could get in contact with you?

Do you have phone numbers and everything for the people? For everybody, yes. We at least need the names and the affiliation, which Co-op. Let's get back. Any other points that you might see needed in the Terms of Reference? Now, looking at the amount of points then that they have to deal with, let's go to the possible time frame. Now how much time is required?

**George Myvett:** I had suggested a month for the formation of the committee, and another month to consider the points that were written down, and to come back with some kind of recommendation. Since we have already formed the committee, I am suggesting that by the end of September the committee should have something that they can come back with to this group or to some other group with points for discussions, and public assessment or ascent or whatever, consultation, whatever we want to call it. So by the end of September we should have something sufficient done that we can come back to the public with and have further discussion on those points.

**Alfonzo Avilez:** But I think that before we go that way, with dealing as what Mr. Myvett had said, we would still require one week to get the consensus on the agreement from the four cooperatives as to the people being named to be their representatives. Just to give a week, and I think we should give them no more time than a week. So one week for confirmation by the institution that is being requested to send a representative for the committee. One week for them to respond with, "Yes, the person will be there." Then from there we continue on. Mr. Myvett.

**Charles Myvett:** Not necessarily to contradict Mr. Neal, but in terms of tracking this, since the job of forming the committee is almost done, I was thinking of maybe moving the process up from two months to maybe 6 weeks, so that we are looking at the middle of September. Keeping in mind that the process would simply involve coming back to a larger group, a larger audience, possibly the same audience, for debate and discussion. Also keeping in mind that it would need to go through the Fisheries Advisory Board and that it would need to go through possibly some legislative process. I think that by the end of October you would want this at a stage where you are looking at maybe the drafting of SI, keeping in mind also that the Fisheries Advisory Board normally meets only once a month.

So I would say maybe by the middle of September for the final report Every two months. Ok. Last Thursday. All right. If we could finish up by the middle of September for the final report, and then we have a kind a collective form and then we decide what happens after that. Thank you.

**Alfonzo Avilez:** That is some key information, Mr. Myvett, indeed because then what we would have to do, since the FAB meets the last Thursday of the month, and the next meeting is going to be in September, and after that in November, which might be a bit too close, therefore we need everything to be done by the group by the middle of September. Plans should be made to have workshop the third week in September so this report could be taken to the FAB the last week in September or the last Thursday in September. So that is something we need to look at.

**Jacque Carter:** Mr. Myvett answered my question pretty much, which was if there was legislative action which was required with the statutory instrument, then you have to backtrack your works so you don't miss the grouper season. The other question is, what time do the fishermen need in terms of making arrangements if the banks will be closed. How much lead-time would the fishermen need to know that information, or if the bank

would remain opened, either way, what do the fishermen say about how much time they need? When would they like a decision from the government about what will happen?

**Alfonzo Avilez:** Well actually, from what I understand here, there are going to be fishermen on the committee, so they should be able to bring that across. Secondly, as we were saying, we are giving until the end of September. That means that when they go to the FAB, it is then decided whether or not it goes that way, and right after that, at the end of September, then we, as well as the fishermen, will know whether it will stay open or whether it will close or what measures will be taken. Yes, Mr. Neal.

**Dwight Neal:** In terms of a deadline, to answer Doctor Carter's question more or less definitively. I think in all fairness to the fisherman we should have some kind of firm answer for them by at least a month before the December moon. We have to work in moons because that is the way the fishermen work. So I am saying, see which part of December the moon is full, and then we work a month back from that, and that would be the last possible date on which we can make any decisions to change. Otherwise the status quo. We will have to wait until the next spawning aggregation. That is just my suggestion.

**Brian Luckhurst:** I just have a question concerning the character of the Belize Fisheries Act. Does the Minister have the ability to make policy decisions that could affect closure as we have discussed, or must it be legislated? And if it must be legislated, what are the normal procedures? What is the sort of time frame required to do that?

**Alfonzo Avilez:** Okay, under the Fisheries Act or under the Fisheries Principal Regulations, which is in chapter 174 of the laws of Belize, it states that the Minister may make regulations whenever he feels we need an SI. He can change laws using SIs, bringing seasonal closures in certain areas, and that could be done in five minutes, in essence. As soon as he signs it, that is it, and then he passes it on through, it does one reading in the Gazzette. The only thing that takes longer now is if you are changing the act, you then need to go through three readings in the house. But an SI, as it is signed, is a regulation under the legislation, not a change of the legislation.

**Dwight Neal:** Just a point of clarification for my learned friend. Actually the Minister can make regulations under the principal act, and in those regulations he can decide closure, and so he can amend those regulations by a statutory instrument, which has rightly been suggested can be signed in five minutes. However, if the closures are under the regulations then the SI must be obtained otherwise. It has to go back to the principal act, which requires passage through the house. Now fortunately, these kinds of fishing management mechanisms have been incorporated and accommodated by the regulations so it is simply a matter of, if the Minister gets it by the beginning of October, by the end of October he could have signed it into law as a part of the regulations. Just a point of clarification. I don't want anybody here to think that it is as simple as to strike up a pen to get this thing modified.

**Alfonzo Avilez:** When you say tomato, I say tomatoe. Same difference. Anyway the whole point is that it doesn't have to go through that lengthy process.

**George Myvett:** I think that the gentleman was asking by what Act would that result in the closure? Does it need to go the legislative process or can it be a policy decision? That was my understanding on what was asked.

**Alfonzo Avilez:** Yes, he was asking that and then he asked if it would be done by an SI or does it have to go through the long process. I said it doesn't have to go through the process of being read in the house three times, which is required for a change in the legislation. It goes through an SI because it is a change in regulation. Anyway, let's not go over that. We know it can be done fairly quickly. Where were we? I think we went into the time frame? I think we finished with the time frame part. They should have a response by the middle of September, and come back to the forum the third week in September so we can get to the FAB the fourth week in September.

**Tom Grimshaw:** Just a question of protocol. Does the committee get to present recommendations to the FAB, or is it going to be just on a paper handed over?

**Alfonzo Avilez:** No, well that would be something that I would suggest that the committee decide, whether it be the committee or just the chair of the committee who presents it.

**Beverly Wade:** Most of the committee members sit on the FAB.

**Alfonzo Avilez:** Yes, you are right. You have Mr. Burns who is on it. No, you don't. The Fisheries Administrator is also on it, so at least you have representation. Now I think that we also need to look at one very key point, something that Ms. Wade brought up, is the logistics. Who is going to pay for all of this?

**Ms. Cabral:** One point I had to make: somewhere in Mito Paz's presentation, he said the fishermen made $8,000 last year gross off the groupers. This meeting today cost $5,000, so we could have a lot more meetings and the grouper can go extinct.

**Alfonzo Avilez:** Okay, point taken. Now I am trying to remember your first name. Ms. Cabral. Yes, point taken, but you need to take into consideration that there are many people who are going to be affected, and it is not one or two people, it is many people who are going to be affected. Therefore, you can't just make a rash decision, as was rightly said by Mr. Heyman, by Dwight, by Tom, by Jacque. You can't just make a decision and close it, because you are going to have serious repercussions and effects.

Then you are going to have fishermen like Mr. Marin, who got up and said, "Well then, what is going to happen to us? What is going happen to all the guys from Hopkins? Yes I agree. That is why using the timetable that we have, you are going to have a decision before the next period. Ok that is going to be done. So let's go into the question that I asked. I don't know if I should pass it on to Mito. Yes, I need then to pass this over to Mito. I don't know if Mito would be able to enlighten us on to this, but how do the logistics work for the meetings of this committee?

**Mito Paz:** Yes, I really have to look into this. From the committee most of the people live in Belize City, you know, and then we have representation from four of the co-ops. Some of them have to travel from down south. And of course we have TIDE, which is also from down south. Green Reef has some funding available, but for this workshop. We have to see how much more funding is left after this workshop. So this is something the Fisheries Department and I will look into and try to work out something, probably with TNC too if they are willing, and the co-ops maybe, but definitely we will look into it.

**Alfonzo Avilez:** Good. So we definitely need a time frame on that, Mr. Paz, a very quick one. So that means we should be done within the week, also for the reconfirmation. Let us give them that time frame then. Okay, now any final points or comments before we continue on. Yes, Jacque, let's see if we have a change now in the bible.

**Jacque Carter:** This is biblical actually. I was thinking that I have confidence in this committee's ability to do the work in the time that you are giving yourself. I was also thinking that it is going to take an act of congress to try to protect and conserve your fish but it will take an act of God to bring them back if you lose them.

**Alfonzo Avilez:** All right. The bible has not really been rewritten. It has been quoted. Any other comments?

**Ms. Gibson:** Alfonso, I just wanted to ask whether there will be transparency with this committee and whether they will be liaison with existing projects and ongoing interests in the area, or whether it will be a closed committee, or how it will work.

**Alfonzo Avilez:** Okay, I think Ms. Wade mentioned before that the committee should be small, but she did mention that, yes, they would be looking at incorporating people from time to time, like for example your organization MBRS. Definitely, because that information would be housed at the Fisheries Department, and all the information that we have there is open.

**Tom Grimshaw:** Will we having another workshop where we can all get together and discuss directly?

**Alfonzo Avilez:** That is what was suggested. That the information and the recommendations that the group comes up with would be brought back out to a workshop of the same people, right? The same composition, so that they could say, "Well, yes, we agree with A, B, C, no to D, yes to F, G, whatever." OK? That is the point of bringing it back. They would not just make the decisions and not bring it back to the group. The schedule: they have to finish their report by the second week in September. The workshop in the third week of September, so that the decision is made then. It will then be taken to the FAB the fourth week in September. I think the committee can decide on the date of having it finished, and the exact date doesn't have to be chosen right now. Any other points before we continue on? No? Good. Now let's have a small coffee break.

**Beverly Wade:** I think I have a suggestion we could wrap up with, and then we have a coffee break as a cocktail in the end.

## Summary of the Workshop and next steps

*Beverly Wade, Administrator (Ag.), Fisheries Department, Belize*

I will be very brief. First of all, I think the way forward has been charted out very clearly, and I'd like to congratulate the group for achieving that today. But before I go I would like to thank the organizers of this workshop, and I would also like to express gratitude on behalf of the Fisheries Department to the scientists and our visitors who made an extra effort to look at our Nassau Grouper Fishery and to help us as managers and as government to now have a basis for management.

I would like to thank especially W.C.S., who has been very supportive of the department in looking at real issues in the Fisheries Industry, and this is what prompted a lot of the studies with the Nassau Grouper. I would like to thank Andrew for being cooperative from time to time, and Jacque, and the other people who came here today. I would like to say that I have full confidence in this committee that was chosen today, and I think that at the end of the day we will be able to come up with some good results that we will definitely bring back to you. I think that today is a testimony as to the feeling of transparency for those who are worried about transparency.

I think just being here today should give you an indication on how transparent we are about this whole thing. There is nothing to hide, and it is really us helping you to manage your fishery for you, for Belizeans, so that the Nassau Groupers are not extinct in Belize, but are here for generations to come. Thank you.

## Closing Remarks

*Alan Burn, Director, National Fishermen Cooperative, Belize*

Thank you. This has really been an enlightening time for me today. I have to say that I have been really pleased to see the participation, especially from the people who had to come a long way to take part in this meeting today. What I can see from here is that we all have a stake in this resource that we are talking about, and that there is enough common sense, enough science and enough goodwill right here in this room to handle most of the problems that we are going to come up against.

I don't think that there is anything here too big for us to handle, or if we cannot handle it ourselves, we know where we can go and get help. I think everything will work out for us provided we can keep going with the same sense of purpose that we have right now. I don't feel that the situation regarding alternative economic activities for displaced fishermen is too big for us to handle. Personally, speaking as a fisherman, I can name several fisheries that require our attention right now that hardly anyone is looking at here in Belize. Just to name two of them, I can mention Yellow Tail Snapper and the Spanish Mackerel. I think that people here in this room have the expertise and knowledge of these species. I can mention Peter Gladding, who has experience with Yellow Tail fishing as well as with grouper. I think there are enough resources here that once we work together we can do it and there is no reason why one should have a sense of being left out unless we really don't communicate. I think that it is incumbent of each and every one of us to use our powers of communication to get our ideas across and to make this thing work for all of us. Thank you.

## Vote of Thanks

*Athens Marin, Capture Fisheries Unit, Fisheries Department, Belize*

I would like to extent a warm thank you to all present here, particularly Green Reef, for co-sponsoring this workshop with the Fisheries Department. Presenters, fisher folks, and all who took time to participate in this program. To Mito Paz, from Green Reef, who made it possible for this gathering and hosting the workshop. The Hon. Daniel Silva, Minister of Agriculture Fisheries and Cooperatives, for his welcome address, Doctor Carter, Dean of the University of New England, Alfeus Martin and Alfonso Nuñez for providing the local fishermen's perspective, Doctor Sala, Deputy Director: Center for the Marine Biodiversity and Conservation, for information on the current status of the grouper stock. Doctor Luckhurst, Senior Fisheries Officer Bermuda, for providing counsel and advice on the management strategies, Beverly Wade, our esteemed Fisheries Administrator whose job it will be to guide the process of sustainable management of the grouper stock, Allen Burns for his closing remarks, and to the chairman who handled this presentation in an able and efficient form and guided the discussion in a positive and constructive manner, and to all those on the panel and the floor that took part in discussion.

Fishermen who took time out of their busy schedules in order to attend the workshop for whom the entire program was planned, you are the people who are the first benefactors from a properly planned, sustainable, managed fishery. We are grateful to you for the contribution of knowledge that has been passed on to all the participants. On behalf of all the organizers and groups, and for all those that have made it possible for this exchange of beneficial information to come into fusion, I say thank you and have a good week.

## Recommendations of the Spawning Aggregation Working Group

On July 30th, 2001, Green Reef, in conjunction with the Belize Fisheries Department, organized a workshop in Belize City entitled, "Working Towards Sustainable Management of Nassau Groupers in Belize." This workshop presented a much-needed forum to bring together research scientists, policy makers, stakeholders, conservationists and the media to discuss the current state of the Nassau grouper fishery.

In light of the recognized need for further discussion and review of management options and economic alternatives for user groups, a Spawning Aggregations Working Group was formed. This group is made up of representatives from the Fisheries Department, Coastal Zone Management Authority/Institute, Northern Fishermen's Cooperative, National Fishermen's Cooperative, Placencia Fishermen's Cooperative, Caribeña Fishermen's Cooperative, Hopkins Fishermen, Green Reef Environmental Institute, Toledo Institute of Development and Environment, The Nature Conservancy, Belize Tourism Board, and the Belize Tourism Industry Association. The main responsibility of the Spawning Aggregations Working Group is to provide recommendations to the Fisheries Advisory Board on management of spawning aggregations in Belize. The group is also responsible for determining the economic impact of management recommendations; exploring economic alternatives to fishing Nassau Grouper aggregations; establishing a monitoring program for spawning aggregations; prioritizing future research objectives; and exploring co-management options.

During the National Workshop in Belize City, it was unanimously agreed that Nassau Groupers are in need of protection. The Spawning Aggregation Working Group made the following recommendations:

1) Complete closure to all activities of the area immediately surrounding the known (and traditionally fished) spawning sites. The area around each site would be kept to a minimum and would start (where possible) at the fore reef to ensure that resource users were not denied access to areas of the reef that did not necessary have an effect on the spawning sites. Maps of the sites are provided. In most cases the areas suggested for total closure are between 3-4 square miles.
2) It was noted that some of the areas being suggested for closure are already part of an established protected area. It is being recommended that in such cases, the area of interest be zoned as a wilderness or conservation 1 zone, depending on the present uses. The areas outside of the existing MPAs should be declared as Marine Reserves with special management status.
3) The Fisheries Department should (and has agreed to) undertake the economic survey and impact assessment of any management measure proposed, including suggestions for alternative income.
4) Concerning monitoring, the following recommendations are being made:

   Research monitoring should focus on:
   - The recovery of the spawning stocks in all areas.

- Assessment of the impact of whale sharks on the spawning aggregations.
- Continued monitoring of the economic impact of the management measures using any information obtained from the first survey as the baseline.

  Compliance monitoring should involve the displaced fishermen. Fishermen can be supplied with fuel and supplies, equipment such as a radio and GPS, and a small stipend and would form part of a team that would monitor activities in the areas on a rotational basis. Details of how this will be done have to be further discussed.

5) As research priority options, the following are being recommended:
   - Documenting of all species that spawn in all the sites that are recommended for closure.
   - The carrying capacity for human activities for all the areas that are recommended for closure.

     It is felt that with time other research priorities will develop.

6) Concerning co-management, no details were provided but it is recommended that the following groups be considered co-management partners:
   - BFCA
   - The fishermen's cooperatives
   - Community-based organizations in places like Hopkins and Placencia
   - Other NGOs currently working the coastal areas.

     In the existing MPAs, any co-management arrangements currently in place should be reviewed and extended if necessary to include the proposed zones.

7) In the Conservation 1 zones, there should be limited access, both in terms of numbers of boats and numbers of persons. It is felt that this can be done by limiting the number of persons per boat and the number of moorings available. There should be no access, except for research, to all the other areas that are recommended for closure.
8) The Fisheries Department should be involved in all the research and monitoring that is done in any of the sites.

Any public awareness and public consultation will be arranged after feedback is received from the FAB.

## Current Status of Belize's Nassau Grouper Fishery

Green Reef recognizes that many environmental, social, economic and cultural issues need to be addressed when promoting management of Belize's marine resources. There is a clear consensus among conservationists and fishermen that the number of groupers found at traditional spawning sites has declined immensely in the last several decades and in order to prevent complete extinction of these sites something needs to be done soon.

In light of the recognized need for the sustainable management of Nassau Grouper Fishery, Belize has adopted to date the following management options:

1. Seasonal closure to fishing of the spawning aggregation site at the Glovers Reef Marine Reserve for the period of December 1st, 2001 to March 31st, 2002. This closure only applies to Glovers Reef Marine Reserve. All other spawning aggregation sites remain open to fishing. The Fisheries Department Rangers at Glovers Reef did not appear to know of the management decisions for closure, nor of any plans for coordinated patrols of the closed area. Wildlife Conservation Society, which maintains a research station at Middle Caye, Glovers Reef, was not informed and consulted about the management decision to close the spawning aggregation site at Glovers Reef.
2. Monitoring of spawning aggregation sites continues by conservation groups, park personnel and fishermen hired as research assistants.
3. Training and development of alternative livelihood opportunities for displaced fishermen are being implemented by conservation NGOs.
4. The Prime Minister and Minister of Agriculture, Fisheries and Cooperatives gives special concession to the National Garifuna Council to continue fishing the spawning aggregation sites in Belize despite the fact that the species is facing extinction. The National Garifuna Council claims that Nassau Grouper fishing is the traditional right of the Garifuna people.

**Green Reef's Position Statement on Nassau Grouper Fishing & Conservation in Belize**

Belize's Nassau Grouper (*Epinephelus striatus*) no longer occurs in the enormous spawning aggregations for which it was known during the 1950's. Although the relative impacts of fishing, climate change and pollution on Nassau Grouper populations remain in dispute, Green Reef feels that continued, unregulated taking of gravid females at courtship & spawning aggregation sites by local fishers will result in this species' complete extirpation from Belize within 5 years.

Green Reef feels that such conditions can only be mitigated by imposing an immediate & comprehensive moratorium on fishing Nassau Grouper in Belize for a minimum period of 5 years, after which time, the take of this species should be regulated in regard to size, season, location & gear. In particular, no Nassau Grouper should be landed:

- Under 20 inches in total length;
- Between the period from 15 December to 15 February;
- Within 3 mile distance of historically recognized spawning aggregation sites; and/or
- With gear other than hook & line.

Green Reef feels that these measures should take precedence over other measures as may be envisioned for spawning aggregations sites in general, or eventually encompassed by planned fisheries law revisions, due to the highly threatened status of this species in Belize, and because they represent established fisheries regulatory practice and are consistent with the 2000 FAO guidelines for responsible fisheries management.

Green Reef also recognizes the need to develop alternative livelihood opportunities for career-fishers of Nassau Grouper, who continue to derive more than 1/3 of their annual income from their take; and the need to develop such opportunities concurrently with the implementation of the recommended moratorium on Nassau Grouper fishing. However, while this need is recognized as equal in importance to saving the Nassau Grouper from extirpation, Green Reef also feels that it is incumbent upon all members of Belizean society to contribute to the realization & actualization of such alternatives, including fishers, buyers, sellers, the government and the private sector; and that no individual or sector of society has a traditional right to the extirpation of any species for profit or livelihood.

Consequently, and in regard to the above position on Nassau Grouper fishing in Belize, Green Reef Environmental Institute is presently seeking to:

- Reduce *E. striatus* fishing mortality by developing alternative livelihood opportunities for fishers;
- Reduce local demand for Nassau grouper by increasing consumer awareness;
- Advocate for finfish landings to be in the round, rather than as fillets;
- Monitor Nassau Grouper status & moratorium effectiveness; and

- Increase Belize's capacity to produce Nassau Grouper by aquaculture, rather than by fishing.

**Figures**

*The following maps depict the spawning aggregation sites that have been considered for management protection. Some of the aggregation sites are within existing MPA's and are duly noted as such. (All maps were produced by The Nature Conservancy.)*

Figure 1 Spawning Aggregation Sites in Belize

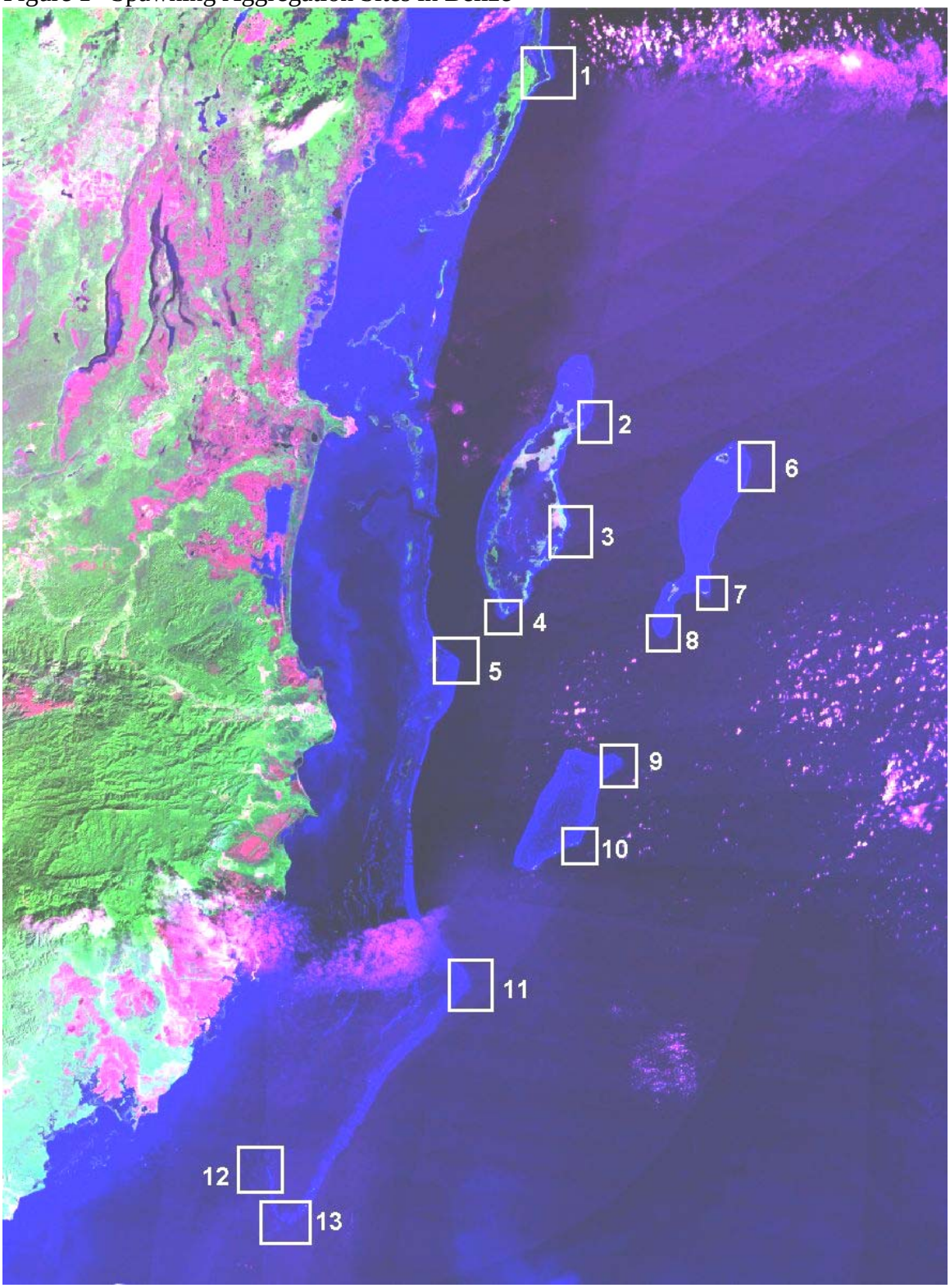
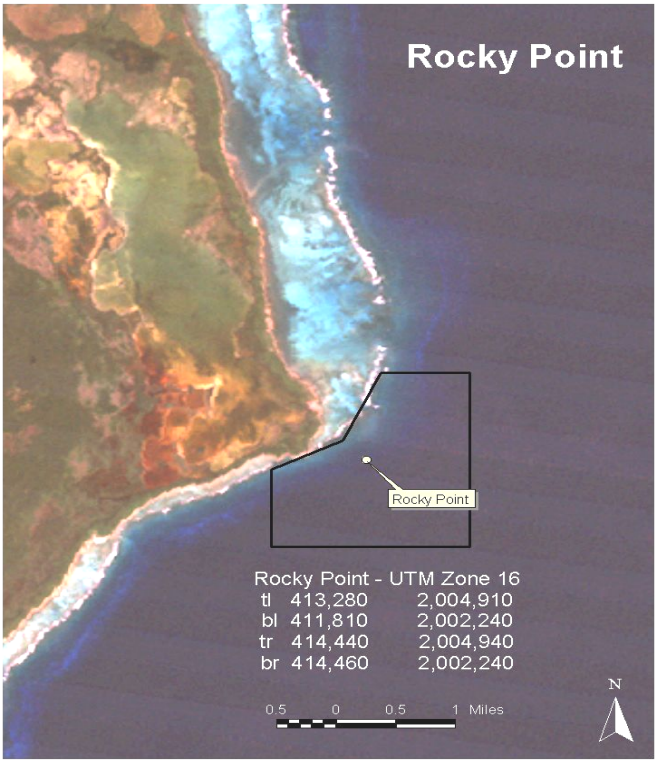


Figure 2 Proposed No-take zone at Rocky Point, Ambergris Caye. Aggregation site is located within the Conservation 2 zone of Bacalar Chico National Park and Marine Reserve.



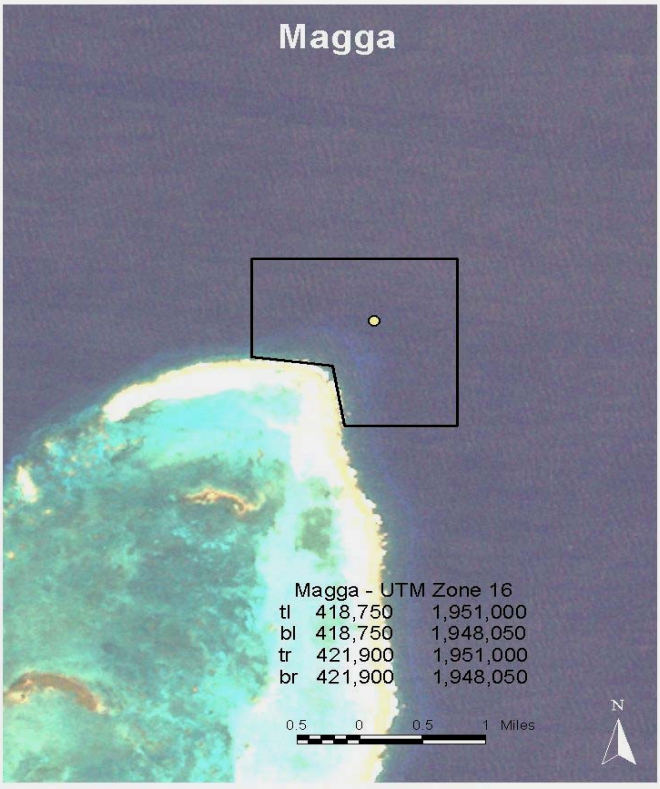
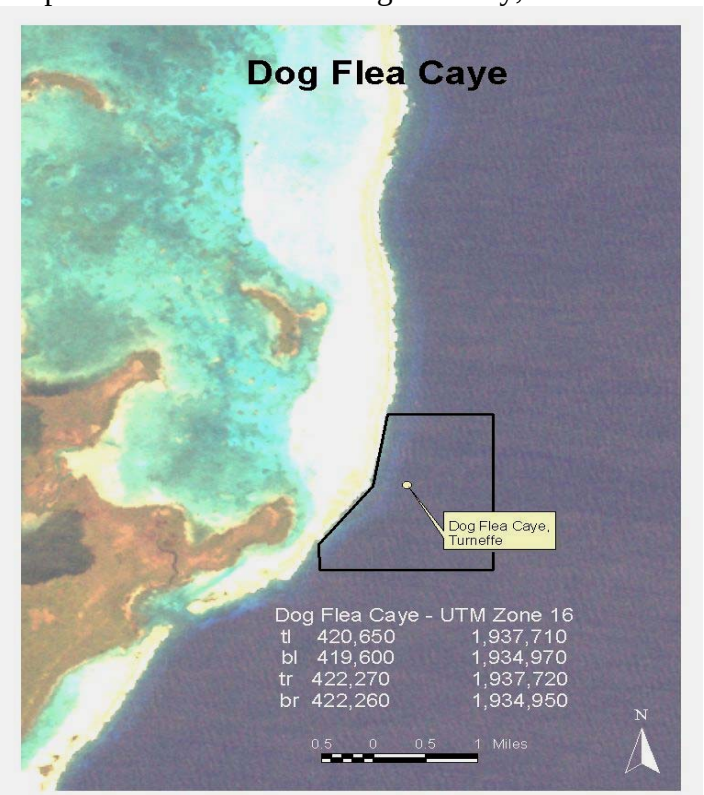




Figure 3 Proposed No-take zone at Mauger Caye, Turneffe Islands

Figure 4 Proposed No-take zone at Dog Flea Cay, Turneffe Islands



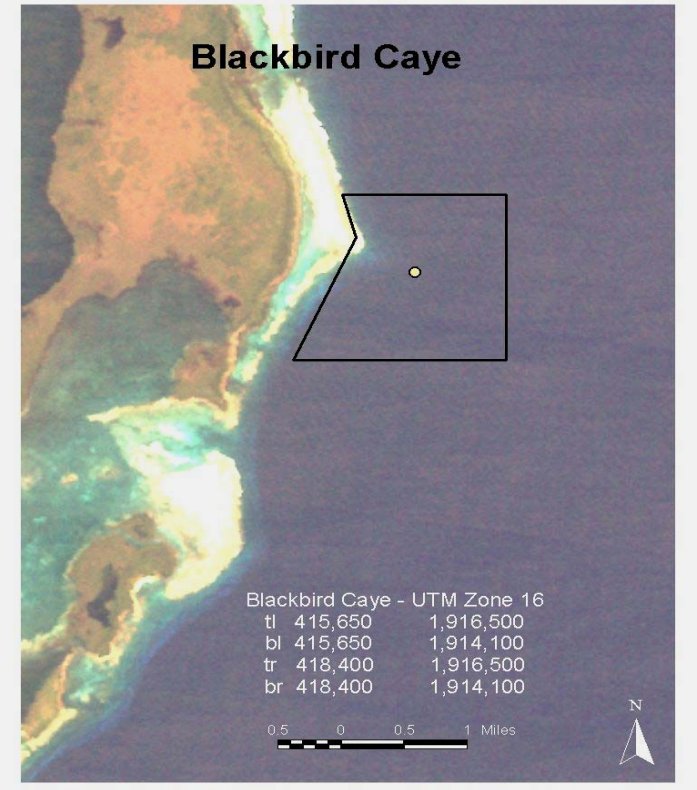
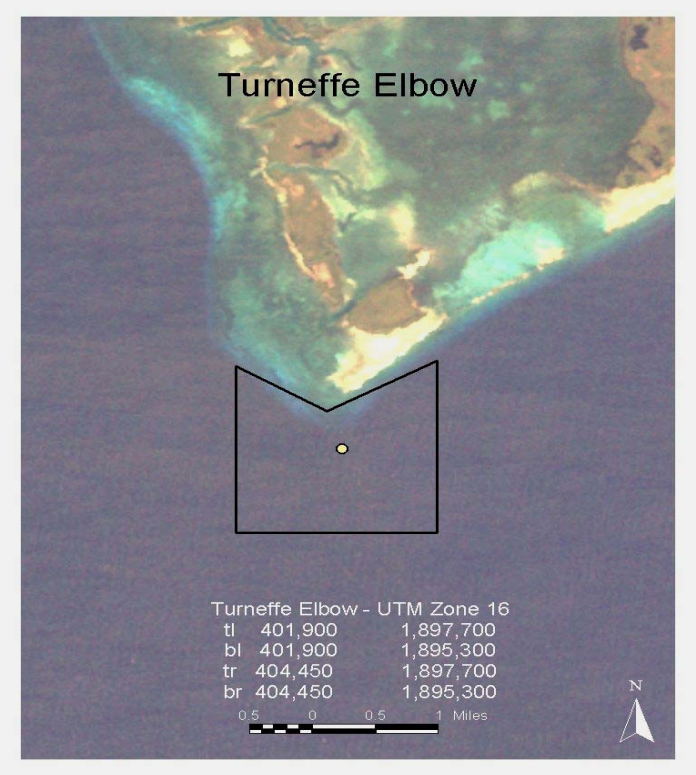




Figure 5 Proposed No-take zone at Soldier Cay, Turneffe Islands

Figure 6 Proposed No-take zone at the Elbow, Turneffe Islands



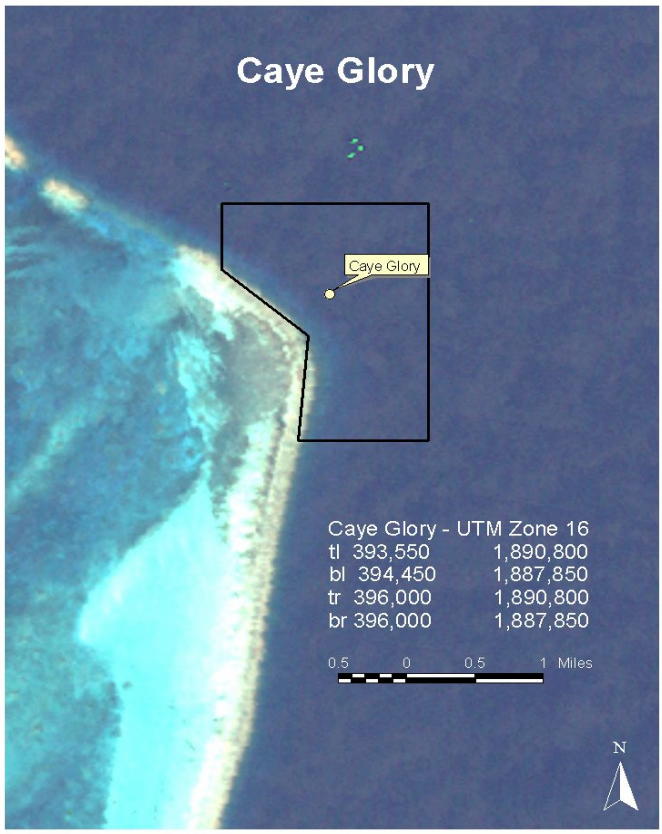
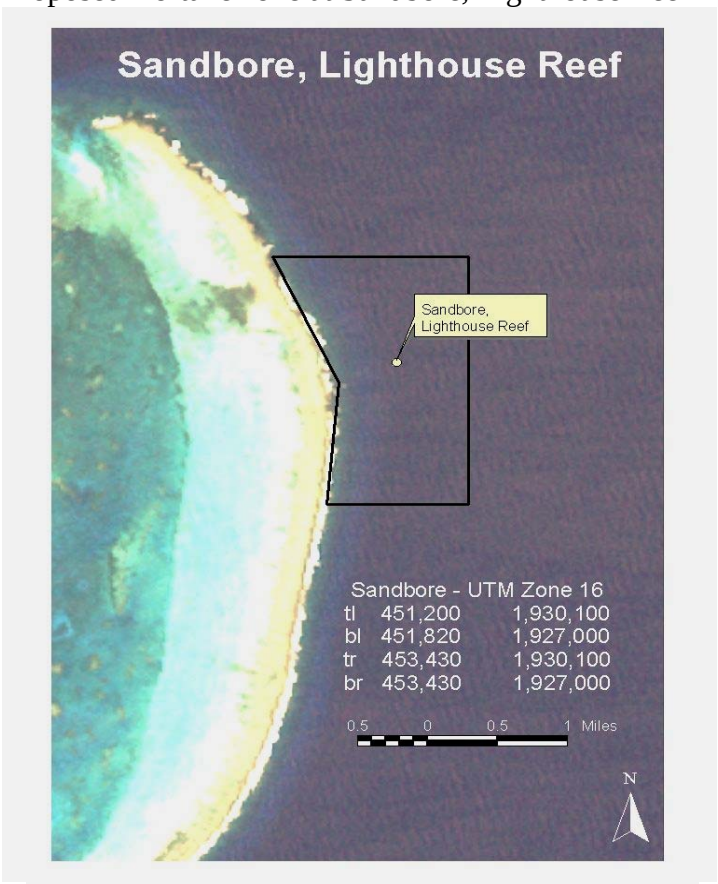




Figure 7 Proposed No-take zone at Caye Glory or Emily

Figure 8 Proposed No-take zone at Sandbore, Lighthouse Reef



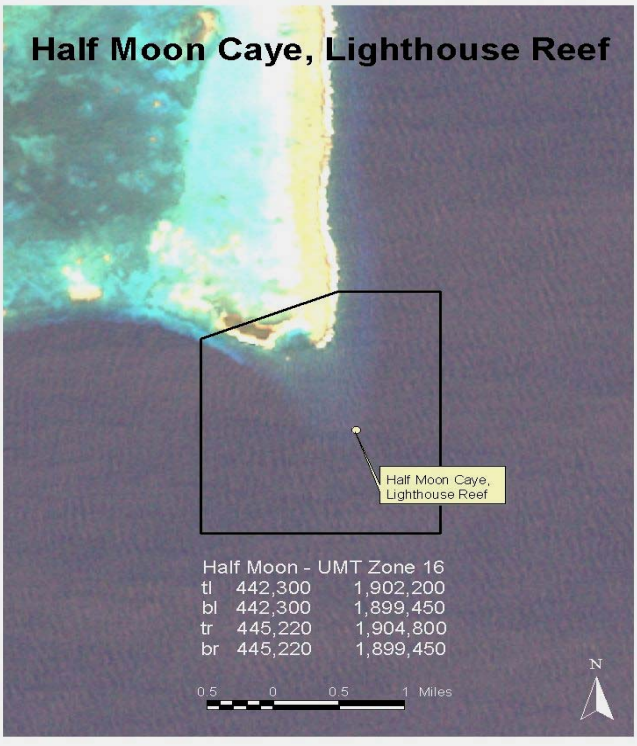
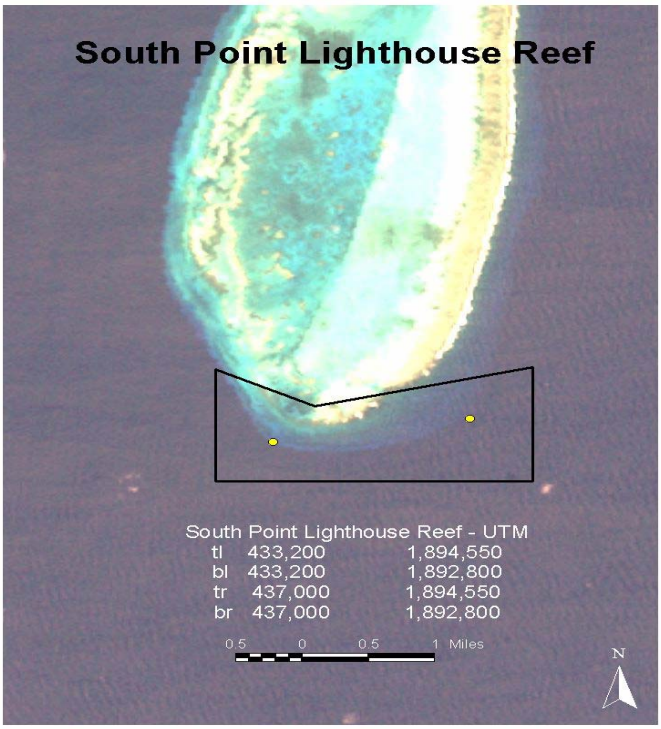




Figure 9 Proposed No-take zone at Half Moon Caye, Lighthouse Reef. Aggregation site is within the boundaries of Half Moon Caye National Monument.

Figure 10 Proposed No-take zone at Southern Point, Lighthouse Reef



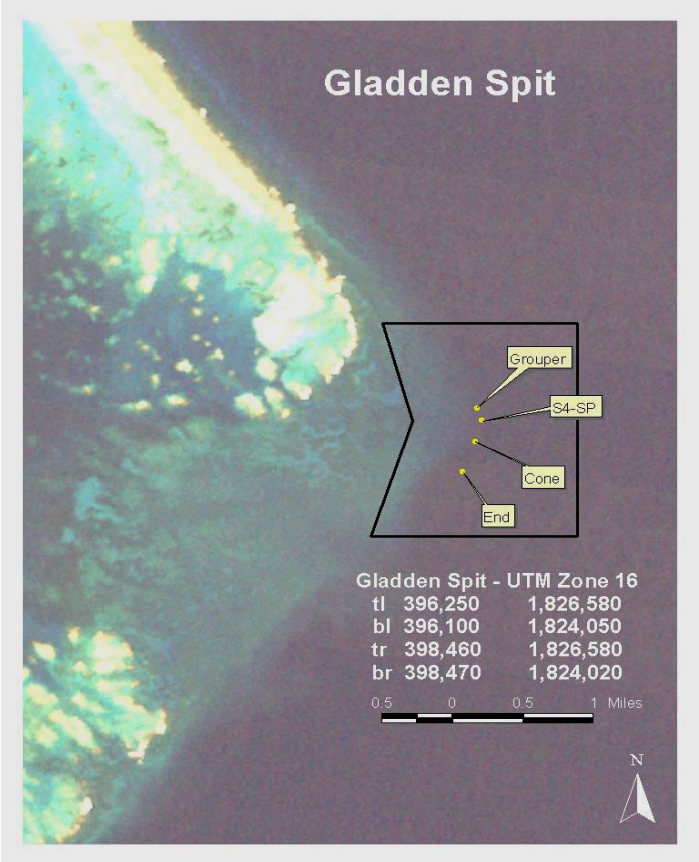
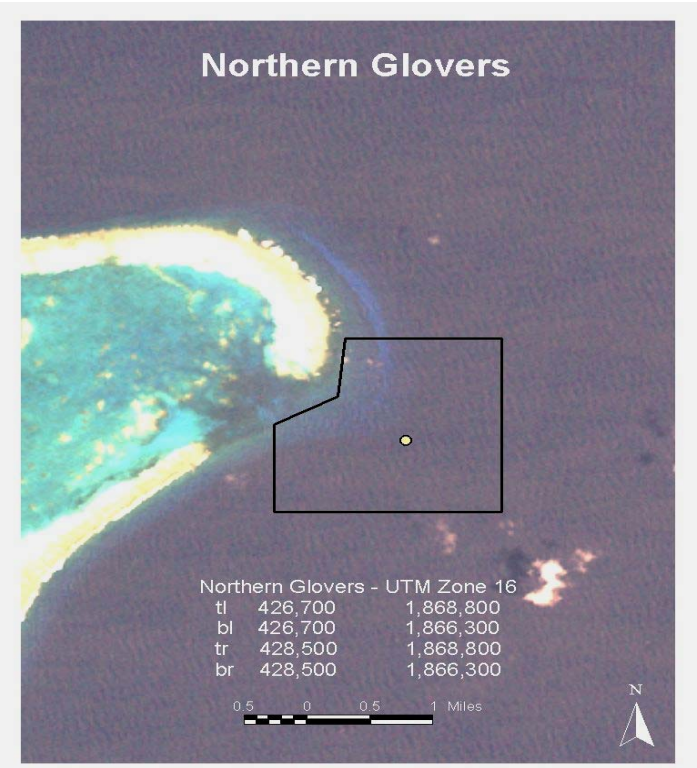




Figure 11 Proposed No-take zone at Gladden Spit. Aggregation site is within the boundaries of Gladden Spit Marine Reserve.

Figure 12 Seasonal Closure Zone at Glover's Reef Marine Reserve.



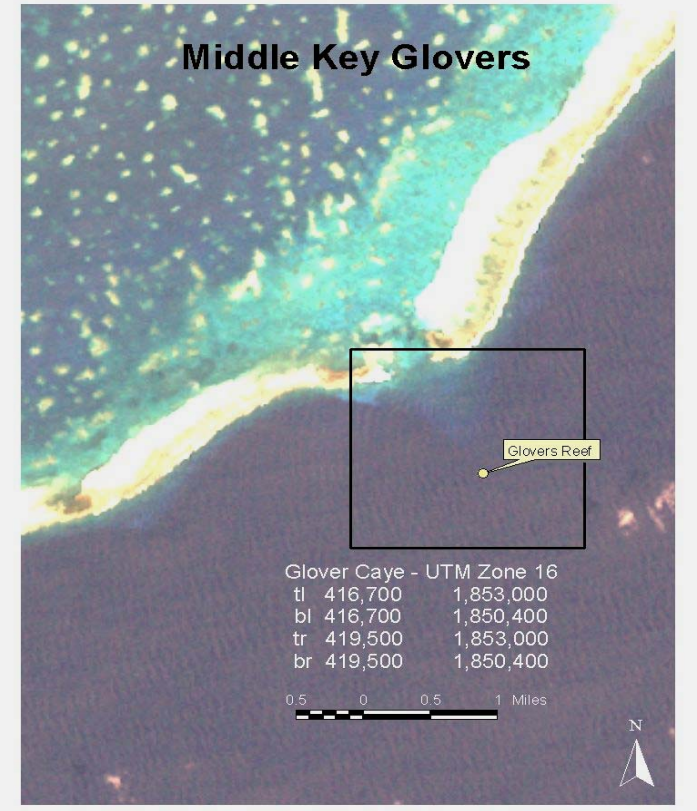
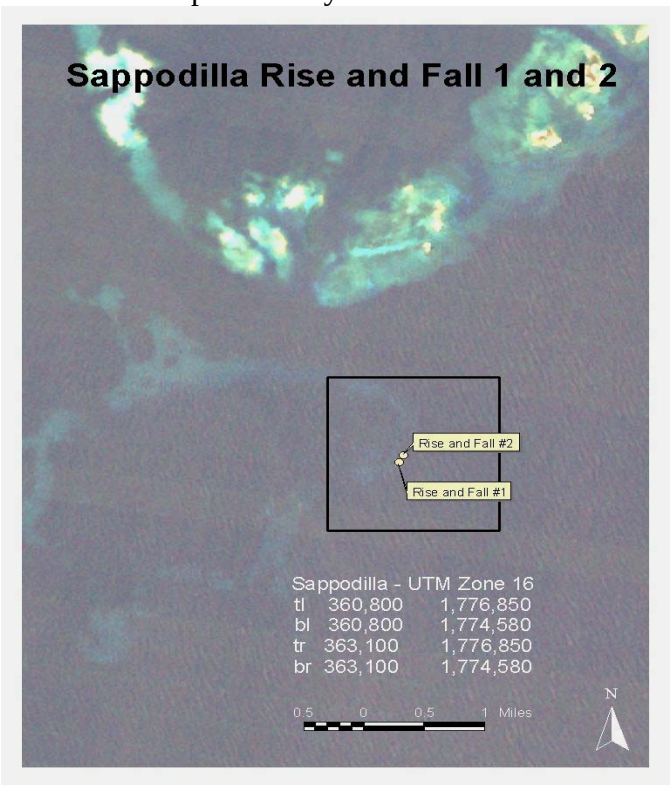




Figure 13 Proposed No-take zone at Long Cay & Middle Cay, Glovers Reef

Figure 14 Proposed No-take zone at Rise & Fall, Sapodilla Cayes. Aggregation site is within the boundaries of Sapodilla Cayes Marine Reserve.



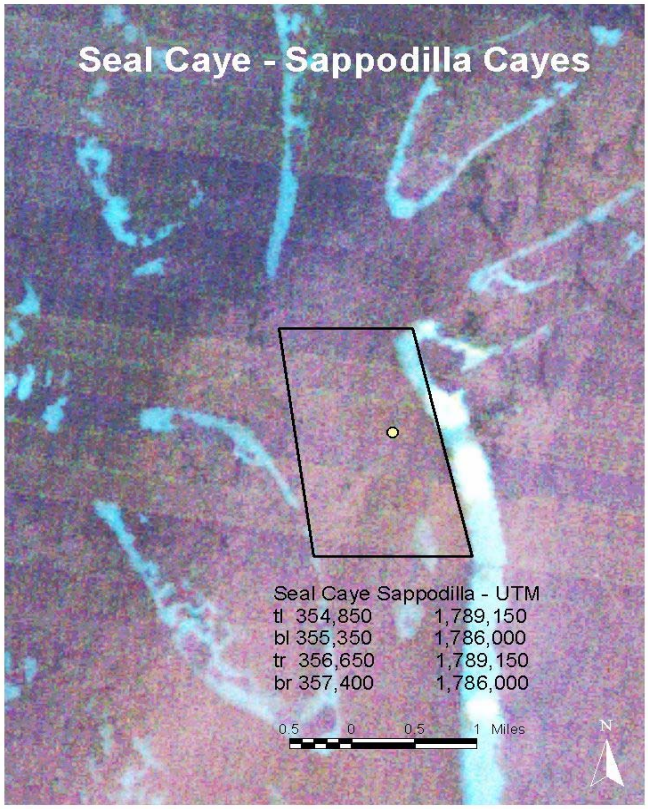




Figure 15 Proposed No-take zone at Seal Cay, Sapodilla Cays. . Aggregation site is within the boundaries of Sapodilla Cayes Marine Reserve.