



USAID REGIONAL PROGRAM FOR THE MANAGEMENT OF AQUATIC RESOURCES AND ECONOMIC ALTERNATIVES

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Regional Plan for the Conservation and Management of the Nassau Grouper in the Gulf of Honduras and Bay Islands.

REGIONAL PLAN FOR THE CONSERVATION AND MANAGEMENT OF THE NASSAU GROUPER (*Epinephelus striatus*)

IN THE GULF OF HONDURAS AND THE BAY ISLANDS

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INTRODUCTION

The management of marine - coastal resources of Central America has been object of governments and international cooperation programs and projects, being USAID one of the main cooperating partners, providing technical and financial resources to achieve the equilibrium between the use of resources and the wellbeing of the coastal local populations.

To achieve the consolidation of this process, the **USAID Regional Program for the Management of Aquatic Resources and Economic Alternatives (MAREA)**, represents an opportunity to face the challenges that the coastal marine communities continue to face, as well as those that the national and regional authorities related with conservation and sustainability face.

The Program objective is to reduce threats posed by unsustainable fishing practices and coastal development by laying the foundation for access-rights mechanisms to strengthen coastal and marine resource management and conserve critical marine and coastal bio-diversity in Central America.

Such Program is implemented together with the Central American Commission for Environment and Development (CCAD) and the Fishery and Aquaculture Sector of the Central America Isthmus (OSPESCA), both organizations being part of the Central America Integration System (SICA). Among OPESCA's main functions is to join efforts to harmonize and apply the fishery and aquaculture legislations, as well as to manage programs, projects, regional fishery and aquaculture agreements or covenants, with the purpose of assuring the protection of fishery species and take the necessary measurements to defend the endangered species or of becoming endangered.

For such purpose, USAID Regional Program for the Management of Aquatic Resources and Economic Alternatives, KRA 2.4 (Draft/update and implement model plans and programs for the recovery of endangered species and their ecosystems, promoting sustainable economic development for local communities). is working in the Gulf of Honduras with the purpose of contributing to the conservation of economically important species that are endangered, such as the Nassau Grouper (*Epinephelus Striatus*).

This document contains the *Regional Plan for the Conservation and Management of the Nassau Grouper (Epinephelus striatus) in the Gulf of Honduras and the Bay Islands*. In the document a number of measures that should be adopted and implemented at the regional level are defined, for recovering the natural Nassau Grouper populations in Belize, Guatemala, and Honduras. The document was prepared based on the actual information available on the status of the conservation and management of the species in the region.

This document is a technical document that, in first instance, and as an assessment of the situation of the current status of the conservation of the Nassau Grouper in the Gulf of Honduras and the Bay Islands, describes the situation of the fisheries of this specie. It frames the political and legal context and formulates a number of necessary measures to improve the conservation and management of the above referred zone. Such plan was prepared based on a broad review of the information available on the status of the current situation of the exploitation and conservation of this species in the region. It also includes a consultation process held in Belize, Guatemala and Honduras, through participatory workshops with the stakeholders in each country. The information generated was synthesized, discussed and agreed during the Regional Workshop, with the participation of representatives from the three countries.

Such plan identifies the main problems and situations faced in the management of the Nassau Grouper in the region of the Gulf of Honduras and the Bay Islands, and it also presents a number of viable solutions to this problem. The basic structure of the management plan lies on two management measures that cover the main actions that should be implemented. The discussion of the priorities of the implementations of the proposed sequential measures were discussed and agreed at the regional level.

The plan does not intend to interrupt the management of national fisheries, and therefore, does not focus on defining the control levels that could keep the populations above its limits, or the mortality levels under its limits. On the contrary, the plan's goal is to compile the solutions proposed by the regional actors involved in this fishery, and at the same time to develop mechanisms, objectives and time periods to achieve this process through realistic and applicable measures.

The plan intends to serve as a catalyst to eliminate certain behaviors that restrict the efficiency of the management of the Nassau Grouper fishery in the region, and therefore, improve the productivity of the fishery and its sustainability in the long term. In short, the plan seeks to face the short term pressures which hinder the long term sustainability.

SUMMARY OF THE FISHERY

Description of the Fishery

In recent decades the value of the exports and the local markets of Nassau Grouper have been diminished, and in some cases, the price have remained constant, promoting excessive fishing as a mechanism to offset the loss of income by increasing the catch volume. Scientific evidence shows that the abundance of the Nassau Grouper in the Gulf of Honduras has been significantly diminished since the beginning of the fishery in the sixties. The main cause of the reduction has been fishing during the reproduction season, in the aggregation sites. Other factors have also influenced in this diminishing, including changing to other more profitable fisheries such as conch and lobster, the reduction in the prices of Grouper, the closing of markets such as the United States, and the poor abundance of the specie in the coasts of Guatemala, where it does not have a market.

Today, the importance of the Nassau Grouper fishery in the Gulf of Honduras is relatively low compared to previous years. Until recently, the species was considered important in Belize and Honduras, the latter ranking second in exports to the United States until 2008. The stock assessments and records of Nassau Grouper exports have shown a reduction in the abundance of this species in the Gulf of Honduras. Moreover, several traditional spawning aggregation sites have suffered overfishing. In the Gulf of Honduras, Nassau Grouper is fished using different fishing gear. Fishing is done with hook and hand lines, but fishermen also use harpoons, gill-nets and in some sites they use Antillean fish traps.

In Belize, groupers are caught mostly using harpoons, while lines and hooks are the second most common fishing gear used (Star et al. 2007). However, Nassau Grouper fishing in Belize has fallen since 2000, due to the reduction of its abundance and the legislation which bans fishing in the spawning aggregations. Interviews with Belize fishermen indicate that since the closing of the spawning fishery, the Nassau Grouper is no longer a species of economic relevance. The fall in the Nassau Grouper exports also coincided with a rise of lobster and conch exports. In 2000, the cooperatives of Belize stopped purchasing Grouper as a result of the fall in its price.

The coastal communities in Belize, which currently capture Nassau Grouper in the Gulf of Honduras, are Punta Negra, Monkey River, Placencia and Hopkins. The fishermen of the Belize north communities, of the communities of Sarteneja, Chunox, and Cooper Bank catch Nassau Grouper in Glovers Reef. The catch of Nassau Grouper is quite occasional; the main fisheries are lobster and conch.

The coastal zone of Guatemala has very little reef habitat, since it is characterized by sand and soft limo bottoms, which is not the appropriate habitat for the Nassau Grouper. No studies have been yet undertaken in the mangrove and sea grass areas in the Amatique Bay, in order to determine if these could be breeding areas for the Nassau Grouper. The main fisheries in Guatemala are snook, shrimp and snapper.

According to the fishermen of the Guatemalan community of Quetzalito, located in the eastern coast of Punta de Manabique, it is extremely rare catch Nassau Grouper. Sometimes, this fish is captured with drift nets used to capture lobster or in long-line shark fishing. However, an important part of illegal fishing by Guatemalan fishermen is evident in the Belize waters from Gladden Spit to Glovers Reef to Sapodilla Keys.

Until the beginning of 2008, Honduras exported Nassau Grouper to the United States, as fresh whole fish through three packaging plants, J.B. Seafood in Guanaja, Flying Fish in Roatán, and Caribbean Seafood in La Ceiba. These plants no longer export Nassau Grouper to the US market. The exports of Nassau Grouper fell from 7% per total export weight in 1996, to only 0.7% in 2007. Such exports were of great economic importance for the Island of Roatán, however, most of this fish was being caught outside the Gulf of Honduras, specifically in Costa Misquita. Today, small commercial fishing boats only fish Nassau Grouper in this zone as an incidental catch while they seek snapper species. This species no longer has a commercial value for the fishing industry in Honduras, and is considered as marginal small scale fishing for a few communities in the Bay Islands. Nonetheless, for these communities it still is economically important.

The fishing communities of East Roatán, such as Punta Gorda and Santa Elena, Mangrove Bight and Savannah Bight in the Island of Guanaja, and Los Cayitos of Utila, sell Nassau Grouper directly or through intermediary fish packing plants. Nevertheless, these communities are reporting a reduction in Nassau Grouper fishing, which is being replaced, in importance, by the Yellow fin Grouper, *Mycteroperca venenosa*. In addition, in the last 15 years, the price of the Nassau Grouper has fallen in real terms by 50%. This, combined with the reduction in its abundance, is assuring that fishermen in the Bay Islands use traps and harpoons to fish grouper, and also use assistance like Global Positioning Systems (GPS) and Sonar Fish Finders to locate spawning aggregation sites.

At present, in Honduras, the main fishery of Nassau Grouper for the Gulf of Honduras is in Los Cayitos de Utila. The local fishermen make up one of the most active small-scale fisheries in the North Coast of Honduras. Groupers, including Nassau Grouper, are caught by fishermen between December and March, with 1 ½" galvanized steel mesh, with high resistance, large entry funnels. Most of the fishermen have 4 to 6 traps in known spawning sites, for 3 to 4 days at both sides of the full and new moon. The known grouper fishing sites in Utila are in deep waters, between 30 m and 45 m. It has been estimated that between 150 and 200 individual traps are placed by the local fishermen during the months of December to March. Grouper fishing with traps in Utila coincides with the season of strong winds and waves associated with the beginning of the year and the "north" storms. Prolonged periods of bad weather can stop the fishermen from placing their traps, but, inversely, it can also stop them from picking them up.

The Nassau Grouper represents 25% of the total catch of grouper in the period (between December and March). Currently, fishermen in Utila sell their product to local buyers that later send it to La Ceiba to be sold in seafood processing plants. It is possible that at the national level it is sold as Grouper filet, but at present, it is impossible to trace the species. Recently, the fish buyers from the Cayman Islands and Jamaica are buying fresh fish from Honduras, and since the closing of the US market, they are buying

Nassau Grouper of all sizes. There are no export records for these transactions and nobody seems to be monitoring this.

In the Northeast Coast of Honduras, the main fishermen communities are Omoa and Puerto Cortés. The Omoa fishermen traditionally have fished the small reef areas besides the city, around the reefs of Punta Sal and in the Tela Bay, at the east. It is believed that these reef areas have been strongly over exploited, mainly for the grouper and snapper species. Today, the fishing is directed to species such as the Lane Snapper (*Lutjanussynagris*), catfish, and pelagic species such as marlin and swordfish. Some fishermen use harpoon while diving for lobster and conch. It is unlikely that there is at present an important population of Nassau Grouper in the fishing areas of Omoa and Puerto Cortés.

However, other species can be found such as the Nassau Grouper and the Yellow-fin Grouper (*Mycteroperca venenosa*) in the fish markets of Puerto Cortés, especially in the month of February. It is possible that these fish are caught during the night hours in Belize waters, with hooks and lines, and then taken to the markets early in the morning, which suggests that the Honduran fishermen go to the spawning aggregations in the south of Belize, since in February you can find large fish in the markets. To date there are no reliable records, nor any efforts from the authorities to control this situation. The closest DIGEPESCA office in this area is in San Pedro and they have no habitual presence in the zone.

The current Nassau Grouper exploitation, together with the elements of its life cycle, such as the formation of spawning aggregations, its longevity, late sexual maturity and high loyalty to the site (Sadovy and Eklund, 1999), have resulted in the gradual disappearing of traditional sites, which lead to the total disappearance of this species.

Biological Characteristics of the Species

The Nassau Grouper, *Epinephelus striatus*, is a species that lives in the Western Atlantic coral reefs and the Caribbean Sea (Sadovy and Eklund 1999). Generally, they live in relatively shallow reefs, but they can be found in depths of up to 300 meters during the reproductive migrations (Starr et al. 2007).

The distribution range of the species covers the West Atlantic from the Bermuda Islands, Florida, Bahamas, the Yucatan Peninsula, and the entire Caribbean up to the south of Brazil. In the Gulf of Mexico, the Nassau Grouper is found only in the Campeche Bank in the Yucatan Coast and in the Florida Keys. In the Gulf of Honduras it is mainly in Belize and Honduras, and in a lesser extent in Guatemala.

It is a predator that can exceed 80 cm long and reach a minimum size of sexual maturity of 40 cm (or 4 years) (Sadovy and Eklund, 1999). Contrary to the majority of the members of the Serranidae family that are protogynic hermaphrodites (change from female to male), the model of sexual development of the Nassau Grouper is predominantly gonochoric (separate sexes) (Sadovy y Colin, 1995).

- Reproduction, larva stadiums, growth and maturity.

The scientific studies available for the Meso-American Reef Region indicate that the reproductive period of *E. striatus* goes from December to February in Belize (Carter et al. 1994, Sala et al. 2001) and Honduras (Fine, 1990, 1992).

The Nassau Grouper uses a peculiar strategy to reproduce. This strategy consists of the formation of spawning aggregations, or reproductive aggregations, in determined sites of the reef during specific periods of the year. These periods coincide with the days of the rainy season full moon. In the Gulf of Honduras, this annual strategy is predictable spatially and temporarily, therefore the local fishermen have known them for more than 80 year and have exploited them without any type of regulation (Sadovy y Eklund 1999).

The Nassau Grouper eggs are clear and floating. After they are fertilized, the winds and tides take the eggs far from the reefs, and within the 24 hours, the larvae hatches. The larvae have transparent eyes, no fins and have a large yolk-sac, which is their source of food for the next five days. After hatching, the larvae spend from 25 to 45 days in the plankton, and feeds from other zooplankton. In the zooplankton they eat namely crustacean, shrimp and larva from other fish. Once they reach about 20 millimeters in size they go to the bottom and establish their residence in the reef. There is some evidence that the larvae can recruit in the same area where the adults spawned.

After the juvenile fish have settled in the reef they have a cryptic lifestyle. There is some evidence that as they grow, they move from the sea grass prairies to shallow sand zones with small coral groups, after the patches, and after to deeper waters. The young groupers seem to feed mainly from crustacean.

Adult groupers are often found in deeper waters in the massifs and channels of the frontal zone of the deep reef.

- Movement and migration patterns

According to scientific studies, the Nassau Grouper can displace itself over considerable distances during migrations prior to forming spawning aggregations (Bolden 2000), and it has even been determined that it can displace itself from sites of Belize to México (Carter et al. 1994). It has been determined that in the Belize Reefs the Nassau Grouper is capable of going to deep waters (up to 255 m) to conclude each monthly spawning in the traditional sites (Starr et al. 2007).

The Nassau Grouper that live in the Glover reef do not leave the atoll during their life cycle. It is unlikely that it can swim long distances in deep waters, since it requires neighboring extensions of the reef to migrate. The Nassau Grouper movement patterns in the Glover reef indicate a solitary behavior in small distribution areas. This pattern is broken only during winter full moons, when broad synchronic migrations of the population take place towards their spawning place (Star et al. 2007). The results indicate that the replacement of the depleted populations cannot happen through adult

migration between the isolated atolls, but it completely depends on the larvae recruitment. This situation can also be happening in the Bay Islands in Honduras.

- Habitat

The majority of the fish species live in different types of habitat during their life cycle and the Nassau Grouper is not the exception. The life cycle of the Nassau Grouper implies at least four different types of habitat (Green Reef Environmental Institute 2001). The Nassau Grouper eggs and larvae are found in open sea, floating in the superficial waters plankton. The juveniles normally occupy mangrove and reef debris zones, where they feed from small crustaceans and fish. The sub-adults and adults live in the reef cracks and abyssal depths, and feed from large crustaceans and fish. Last, during the reproductive season, the adults move towards the habitat of the massifs and channels, particularly in the areas close to the reef promontories, where they take advantage of the currents to help them to scatter their eggs.

The duration of the Nassau Grouper pelagic eggs and larvae stages vary from 25 to 45 days, and it takes place at open sea. After this period, there is the benthonic phase, starting from the first juveniles that live in the mangroves and the debris bottoms, which is the preferred type of habitat in this breeding stage. As the juvenile grow, they move to reef cracks and when reaching the adult phase they migrate to the abyssal depths. Last, when reaching sexual maturity, during the spawning events, the individuals visit the reef massifs and channel zones. The types of habitats of the mangroves, sea grass and coral reefs are crucial for the survival and subsequent reproduction of the species, therefore protection, conservation and monitoring efforts should be considered as one of the components of the management strategy for the Nassau Grouper.

- Food

Adult groupers feed in a generalized opportunistic manner. They use the ambush strategy, for which they keep near the bottom and launch themselves opening their mouth, creating a void suction, to trap their prey. They tend to feed namely at dawn or dusk.

The predominant diet of the Nassau Grouper in Belize is scale fish (58%), benthonic crustacean (16%), and mollusks and nectonic cephalopodes (6%) (Carter et al. 1994). Most of the species in the diet of the Nassau Grouper are produced in superficial waters (Star et al. 2007).

It is general knowledge that the groups change their diet as they grow and eat more fish than crustacean (Green Reef Environmental Institute and Fishing Department of Belize, 2001). The largest groupers, as they descend to deeper waters, start to feed mainly of fish.

- Predation

The predators of the Nassau Grouper include the whale shark that eats its eggs and larvae, most of the psivorous organisms, that feed of Grouper juveniles and shark and humans that catch juveniles and sub-adults.

The individual Nassau Grouper adults have few predators, except large carnivore fish such as barracuda, sharks and eels. Larger sea mammals could also predate groupers. It is possible to have inter-specific competition between Serranides, considering the similarity in food habits, distribution and sizes between the members of this family.

Environmental Characteristics of the Species

The Nassau Grouper uses multiple types of sea and coastal habitats throughout their life cycle, including the open sea surface (eggs and larva), as juveniles it use the mangroves and the rock habitats, as sub adults and adults it lives in the reef cracks and abyssal depths, and after reaching sexual maturity it lives in the reef massif and channels zones.

The main threats to the breeding Nassau Grouper habitat in the Gulf of Honduras are ecosystems' degradation, fragmentation and destruction. Other threats include a reduction in the quality of the water, especially near the coast, and the introduction of invader species such as the lion fish. Natural phenomena such as hurricanes and storms, and man-originated activities such as climate change, have been pointed out as the main threats for most of the ecosystems.

It has been estimated that climate change will affect fish populations and communities in all their life cycle phases. The reef fish larvae are sensitive to changes in the environment conditions, which could probably affect the species distribution and the abundance of adult populations. (Munday et al. 2007). Different studies have identified possible impacts in the growth, dispersion, and survival patterns of fish larvae, as well as in the ecologic and genetic connectivity between populations (Sale, 1991; Cowen 2002; Munday et al 2008).

On the other hand, the climate change impacts to the coral reef structures will have serious consequences for the fish populations and the communities. Recent coral bleaching episodes due to a rise in the sea temperature (2002 Wilkinson), and the rapid spread of associated coral pathogens have seriously degradation the reefs worldwide (Wilkinson 2002). There is a general incertitude about the magnitude and direction of the changes in the fish species of the reef due to climate change (Munday et al 2007). Therefore, this information should be carefully considered. It is strongly recommended to develop the research on the specific effects of climate change on the Nassau Grouper populations in the Gulf of Honduras, to understand better the future challenges in the management of this species.

In any case, the healthier the Nassau Grouper population is, the better the chances will be to adapt to these uncertain changes. The same thing happens with the reefs and other types of habitat used by groupers. Therefore, the protection of a critical habitat

network would help to recover the Grouper populations, which are two important actions to increase the resilience to climate change.

In view of protecting and efficiently managing this species, the quality of the above referred environments is indispensable. Support to research studies and establishing effective monitoring and protection programs are key to better understand the current dynamics of the populations, and the connectivity processes between the different types of habitat. It will be necessary to undertake studies focused on the potential effects of climate change and the acidification of the oceans on the Nassau Grouper populations in the Gulf of Honduras. Such studies should be centered on the changes in the duration of the larvae stage, the larva survival rates, and feeding behaviors, among others.

MANAGEMENT PLAN SCOPE

The Gulf of Honduras lacks of a regional entity to manage its marine-coastal resources. The administration falls upon the national governments of Honduras, Guatemala and Belize, specifically on the National Fishery Departments and Directorates. CCAD and OSPESCA have promoted some coordination efforts, where important consensus has been achieved for the management of the important marine-coastal resources. However, the Nassau Grouper has not received the required attention.

This Plan intends to improve the management of the Nassau Grouper (*Epinephelus striatus*) fishery in the Gulf of Honduras, which is geographically defined as the waters covering the South of the Glover Reef in Belize, along the entire Caribbean Coast of Guatemala, and the east part of the Caribbean Coast of Honduras, including the Bay Islands and Cayos Cochinos.

The Plan establishes the regional management strategies that the fishing departments of the three countries, fishermen, non-governmental organizations and managers of protected areas can implement. Such strategies promote the conservation of the current populations of Nassau Grouper; promote its recovery, with the purpose of increasing the populations of this species.

The plan aims at promoting cooperation among the three countries of the Gulf of Honduras, improving communication through the harmonization of regulations, promoting data exchange and the expansion of control and monitoring activities. In addition, the plan indicates the additional scientific information needs that support the management activities in the region, including regional research. It is also expected it will provide strategies that will guide and coordinate the participatory actions and management among the fishing departments, the fishermen and the NGOs of the three countries.

This Plan is based on the basic ecosystem based-management principles, in order to protect the habitats and ecosystems functions that maintain the Nassau Grouper populations during their different life cycle phases. In addition, the Plan aims at responding to the human context of the Nassau Grouper fishery in the Gulf of Honduras, through a participatory management that will involve the local communities, and the support of the authorities in the process. Moreover, the Plan identifies opportunities to diversify the fishery and this way reduces the direct dependency of the local communities on this species.

Management Plan Operations and Review

Not all the countries of the Gulf of Honduras have specific policies related to the exploitation and management of the Nassau Grouper. Belize is the only country that has an advanced normative for the management of this species. This tri-national Plan

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proposes to fill some gaps that currently exist, by using the existing national policies as the base, establishing additional objectives, and strategic goals to promote regional management.

The Plan provides the necessary tools to the Governments of Belize, Guatemala and Honduras, in charge of the conservation and sustainable management of the resources of the Gulf of Honduras, so they can control the non-sustainable fishing of the Nassau Grouper. The measures proposed in the plan cannot guarantee, but will help preventing the collapse of the fishery, and will promote coordinated research and monitoring efforts that will allow obtaining the necessary data for an effective recovery of the species.

Also, the Plan includes strategies that contribute to organizing the fishery of Nassau Grouper and to promote the governance of the species in each one the countries of the Gulf of Honduras. The Plan should be reviewed and implemented under a participatory and inter-institutional approach, where the fishing departments of each one of the countries, the departments of the management of marine protected areas at the national level, and other national government institutions related with this issue should be involved, as well as the municipalities and other local governments, involved fishermen groups and conservation non-governmental organizations.

Considering the nature of the adaptive management and the national sovereignty of the territorial waters, as the process evolve, it is necessary to create an enabling and flexible environment for the implementation of these strategies. The actions should be implemented at the local level, but coordinated regionally, taking international treaties into account, as the Threatened Classification of the Nassau Grouper according to the IUCN Red List of Threatened Species, and the precautionary approach for fishing established in the United Nations Convention on the Law of the Sea.

CURRENT MANAGEMENT OF THE FISHERY

II. Background

Historically there have been different levels of Nassau Grouper Management in the countries of the Gulf of Honduras.

Efforts in Belize

Carter and Marrow (1991) recommend the creation of Marine Reserves in 20% of the spawning banks of the Nassau Grouper, which would later be increased to 30% of the Barrera Reef habitat. The value of 30% was calculated on the base of the evidence that the populations of less than 20% of the biomass of the non-exploited reproductive population is at risk of collapsing. The remaining 70% of the marine habitat will be managed using traditional regulation methods. Finally, Carter and Marrow (1991) recommend a permanent limit in the entry of the fishery that will be established at the levels of 1991.

Other regulation methods proposed included establishing a limit of minimum size of 30.5 cm or 12.0 inches of standard length, in which 50% of the females achieve sexual maturity (Carter and Marrow, 1991). The recommendation for management were updated in 2001, including the closing of the aggregation fishing, establishing a minimum catch size of no less than 2 inches or 50 cm, the designation of aggregation sites as protected areas, and the development of alternative sources of income for the traditional fishermen affected by the closing of fishing in aggregations (Green Reef Environmental Institute 2001)

One of the key elements in the successful Belize efforts to protect the Nassau Grouper was the creation of a National Work Group for spawning aggregations. The National Work Group was established in July, 2001, when the results of a national survey on the Nassau Grouper spawning aggregations was carried out at the beginning of 2001, which revealed a very low number of fish spawning. During 2002, a coalition of seven non-governmental organizations worked successfully to protect 11 Nassau Grouper spawning sites, and to introduce a four-month ban. Since the beginning of 2003, the Work Group has been strengthened and it has periodically met every two months to share information and develop management strategies.

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Later, in 2007 a recommendation for the inclusion the precaution principle was included with regards to the management of spawning aggregations as fragile systems of crucial importance to maintain the populations of fish (Heyman y Wade 2007). Heyman y Wade (2007) recommended a total ban of possession of Nassau Grouper, and invoking the precaution principle, also recommended the on-going and indefinite closing of multi-species aggregation sites that spawn in Belize. In view of assessing the efficiency of the closings in time, Heyman and Wade (2007) recommended to maintain and increase the monitoring efforts in the aggregations of multiple-species.

An analysis of the situation in Belize, by Gibson (2007), indicated the need of providing further assistance for management and oversight, public awareness and alternative livelihoods. In addition, it was considered crucial to maintain political will at the highest level to enforce the laws. The actions supported by all the Caribbean countries could be the best hope to recover the species (Gibson, 2007). On the other hand, the oversight provided by Friends of Nature in the Gladden Spit aggregation resulted in an increase of the Nassau Grouper and the snapper (*Lutjanus cyanogen*) (Heyman and Wade 2007). Unfortunately, diminishing continue in most of the other sites, where the oversight has been less consistent (Heyman and Kjerfve 2008). With the ongoing descent in the numbers, the Work Group recommended additional measures (Gibson 2007).

Efforts in Honduras

The Nassau Grouper fishery has received less attention in Honduras. In the mid-2000s, The Nature Conservancy supported some studies to verify the presence of spawning aggregations in the Natural Marine Monument of Cayos Cochinos. With the information generated, the Fundacion Cayos Cochinos in consensus with the local communities was able put under protection four aggregation sites, during the spawning season.

In 2000, the major of Utila approved a municipal agreement that banned fishing up to 1 mile radius around the entire Island of Utila, but the same was revoked by the major himself in 2001, and it was not enacted again.

In 2008, a study was performed on the situation of the exploitation of Nassau Grouper in Honduras. Such study proposed important management measures for this species. That same year, a National Work Group for Spawning Aggregations was formed, but it did not have the expected results. No active participation was achieved from its members.

In January 2011, DIGEPSA included in the ban resolution the prohibition to fish Nassau Grouper, from December 1st to March 30th, in the spawning site called Caldera del Diablo, located east of the Island of Guanaja. However, according to the ban document, the location of this site is in Utila, which leaves this regulation void.

Efforts in Guatemala

In the case of Guatemala, this fishery has not been managed since this species is seldom fished in its coastal waters.

Current Management of the Nassau Grouper

There is no management of this species in the Gulf of Honduras; it is however done at the country level. To date, Belize is the most advanced country in terms of management, while in Honduras the management level is almost zero. There is no apparent conservation effort or a management strategy at the local or national level throughout the Atlantic Coast of Honduras for Nassau Grouper, nor for other important Grouper species. In Guatemala there are no regulations for the management of this species.

In fishery management, Belize has made significant advances to moderate fishing and establish marine reserves, a process that has been supported by the fishermen, NGOs and scientists participation. Today, there are management measures in Belize that include the protection of spawning aggregation sites, minimum sizes and maximum catch and a ban season. In addition, In Belize, it is forbidden to landing fish filleted Nassau Grouper. The management of this fishery in Belize includes the systematic generation and analysis of information of fishing of this species, which is obtained from the annual monitoring of the most important spawning aggregation, and the landing fish data collected.

It is considered that there is a high participation in the management given the core role played by the fishing cooperatives in the fishing structure of Belize. These cooperatives have strong links with the Fishing Department, which allows a flow and feedback in the information management and monitoring processes.

There is also a marked institutional presence and monitoring capacity of the resource. The Fishing Department, together with the National Defense Department, and the co-manager NGOs carry out on-going patrolling in the marine protected areas.

The National Spawning Aggregations Working Group of Belize plays an important role in the management and monitoring of the Nassau Grouper and other species spawning aggregation sites, and their participation is crucial in the conservation of the species in Belize. Currently, the members of the Belize Work Group are representatives from 13 organizations: The Belize Audubon Society, Fishermen Cooperative Association of Belize, the Belize Fishing Department, the coastal zones Authority and Institute, Friends of Nature, Green Reef Environmental Institute, Hopkins Fishermen Association, the Complacency fishermen cooperative, The Nature Conservancy, Toledo Association for Sustainable Tourism and Empowerment, Toledo Institute for Development and Environment, the University of Belize, Wildlife Conservation Society, and the Worlds Nature Fund.

In Honduras, there are only two management measures in force. The first one is the ban resolution 002-2011 that includes in no catch of Nassau Grouper, from December 1st to March 30th, in the spawning site called Caldera del Diablo, located east of the Island of Guanaja. The second is the temporary ban in four sites of Cayos Cochinos. However, it is only two of the sites where this species spawns. At present, these sites

are patrolled, and there is a permanent presence of the co-manager NGO and the Navy. Such patrolling is affected by bad weather during the Nassau Grouper spawning season, which also limits the access for fishermen during this season.

Honduras has a fishing inspector in the Gulf of Honduras region, based in Omoa, and an inspector for the Bay Islands. There is a Naval Base in Puerto Cortés, but in general it has not been involved in enforcing the fishing law in the zone. To date, there is no patrolling nor are there any no-Nassau Grouper-catch regulations in the few Omoa reef zones.

In the case of the Bay Islands, the fishing inspector concentrates its efforts in the industrial ships licensing, which no longer applies for the Nassau Grouper. There are co-manager NGOs of the marine protected areas that make some patrolling efforts, namely in the Island of Roatán, nonetheless, there are no regulations for the fishing of this species in these areas.

In Honduras, very little information has been generated about the Nassau Grouper. There is no systematic information on land filling, or monitoring of the spawning aggregation sites. The few data generated has been to verify the presence of spawning aggregations in some sites. The few records available are from private companies that exported in the past.

Today, DIGEPESCA is preparing a Ministerial Decree which is considering the inclusion of a number of protection measures for the Nassau Grouper and other grouper species. These includes a ban season from December 1st to March 30th every year, that also interdicts the export parts from purchasing fish and marketing the species in the local market during this period.

Guatemala has two fishing inspectors, one in Puerto Barrios and another one in Livingston. There is no navy presence and the fishing inspectors have no boats assigned. There are no management measures for the Nassau Grouper due to the fact that this species is not very common in the zone. However, the species is marketed at the national level, with product coming from illegal fishing by Guatemalan in Belize waters. Therefore, control measures for this illegal trade should exist.

At present, there are already management measures at the level of the region of the Gulf of Honduras which will be presented further in this document and it is expected that they will be implemented at the regional level.

Legislation and regulations in force

Following is a summary of the legislation and regulations in force related to the Nassau Grouper in the three countries of the Gulf of Honduras:

Table 1 - Existing legislation and regulations in the three countries of the Gulf of Honduras

Country	Fishing Law	Creation of No Catch Areas and Marine Reserves	Ban	Size Regulations
Belize	Fishing Law of Belize Chapter No.210 Reviewed in 2000	Legal Instrument No. 161 of 2003 Declares specific spawning sites as marine reserves	Legal Instrument No.162 of 2003 2003b: Interdicts fishing and possession of Nassau Grouper between December 1st and March 31st.	Legal Instrument No.49 of 2009 2009: The fish caught should not be less than 50.8 cm of total longitude nor more than 76.2 cm of total longitude The fish has to be disembarked whole.
Honduras:	General Fishing Law of Honduras Chapter No. 5 Decree 154-1959	Management Plan for the Natural Marine Monument of Cayos Cochinos: Declares 4 spawning sites temporary no catch areas	Agreement 002-2011, January 2011: Bans fishing Nassau Grouper, from December 1st to March 30th, in the spawning site called Caldera del Diablo.	X
Guatemala	Fishing Law of Guatemala Decree 80-2002		X	X

DECISION-MAKING FRAMEWORK

Summary

The management of the Nassau Grouper in the Gulf of Honduras should be structured in such a way that it becomes an interactive process using the inputs from the monitoring information for decision making and in consensus between all three countries.

The first step in this process is the adoption of the measures proposed in this document, so that the three countries agree on the bases of the management of the Nassau Grouper. After, the effort should be made in Guatemala and Honduras to address the deficiencies in data collection on the small-scale fishery of Nassau Grouper (artisanal) in the Gulf of Honduras, as well as data on the ecosystems from which this species depends and its critical habitat. The latter should also be reinforced in Belize. In the case of Honduras and Guatemala it is necessary to conduct an assessment of the fish spawning aggregation sites, which sites should be subsequently monitored on an ongoing basis.

In third place it is necessary to prepare legal documents that protect the measures proposed in the case of the ban during the spawning season, a permanent ban in the sites, and the regulations on sizes and landing fish. Such documents will be presented to the competent institutions for their review and subsequent approval. The greatest effort in this stage should be made in Honduras and Guatemala, since Belize is already advanced with its legal framework.

Forth, a campaign should be implemented for the information and disclosure of the approved regulations in order for the population and competent authorities know and apply them. In addition, it is necessary that Guatemala and Honduras update their fishing records, the inventory of their vessels and the fishing licenses at the artisanal scale, as well as the number of active fishermen that exist in the region. But, most important, that they develop a mechanism to keep this information updated, as one of the fundamental pillars of the management of this and other fisheries.

An active participation of the fishing authorities of each country is expected, as well as the involvement of the fishermen and other involved organizations.

Following is the general objective and the specific objectives of the Plan for the Conservation and Management of the Nassau Grouper in the Gulf of Honduras and the Bay Islands:

OBJECTIVES, GOALS AND STRATEGIES

General Objective

The general objective of the plan is to address in a coordinated, systematic and participatory manner the necessary actions to guarantee the conservation and sustainable use of the Nassau Grouper in the Gulf of Honduras and the Bay Islands, by implementing regional management strategies that consider the social, economic and cultural reality of this region, and through a coordinated inter-institutional work and with participation of the local communities.

Specific Objectives

The specific objectives of the Plan are:

- 1) Establishing a temporary ban during the season of reproduction of the Nassau Grouper in the Gulf of Honduras.
- 2) Establishing a permanent ban for fishing in existing spawning aggregation sites.
- 3) Establishing minimum and maximum catch sizes of the Nassau Grouper, and landing fish of whole fish.
- 4) Establishing a functional network of fishing refuges that includes at least 20% of the continental platform of the Gulf of Honduras.
- 5) Establishing a registration and licensing system for small-scale fishing in the Gulf of Honduras that will be regionally shared and managed by the fishing departments of each country.

Objective 1:

Establishing a temporary ban during the season of reproduction of the Nassau Grouper in the Gulf of Honduras

Goal

Establishing a temporary ban during the season of reproduction of the Nassau Grouper in the Gulf of Honduras to protect spawning aggregations in the three countries of the Gulf of Honduras

Rationale

The reproductive strategy of the Nassau Grouper implies the formation of spawning aggregations in specific sites in the reefs, during specific periods during the year, around the winter full moon, between December and March. In the Gulf of Honduras, this reproduction strategy is known by the local fishermen, who have exploited this species without any regulation during this season, for more than 80 years. The non-regulation of this species has led to the gradual disappearance of a number of aggregations, both in Belize and in Honduras. Establishing a ban in all three countries, during the same season, where the fishing and marketing ban for this species would result in allowing the opportunity to the Nassau Grouper to migrate to spawning areas and to reproduce.

Strategy

Currently, Belize has a temporary ban during the reproduction season of the Nassau Grouper in the 11 marine reserves and other sites at the national level. Honduras has a temporary ban in 4 sites in Cayos Cochinos and in one site in Guanaja. It is necessary to establish a ban in Honduras and Guatemala in order to harmonize the regulations in all three countries. The ban should be established from December 1st to March 31st every year, the season that corresponds to the season of reproduction and migration to spawning sites. Such ban is necessary, with participation of the fishing communities for the oversight, in order to facilitate the enforcement of the laws and reduce illegal fishing. This regulation is relatively easy to implement using supervision and monitoring of the disbarment.

There is background of illegal fishing among the three countries. By harmonizing the regulations, this strategy will help reducing illegal fishing. It is necessary to make changes in the fishing legislation in Guatemala and Honduras and to integrate the concept of protection in the Nassau Grouper reproduction season. It is also important that the marketing of the Nassau Grouper among the countries of the Gulf of Honduras be regulated to avoid contraband during the ban season of one of the countries.

The necessary resources for its implementation include: human resources with monitoring and oversight technical capacities. The impact of conservation is high and measurable through monitoring- The main limitations include lack of trained technical resources and lack of information from the users in the landing fish.

Such ban is focused on protecting the Nassau Grouper during its reproduction season. The advantage falls upon the protection not only of the spawning site, but also during the migration to and from the same. The implementation of this ban requires special control and monitoring efforts. Given how scattered the landing fish sites are, the national

fishing authorities should have a broader coverage in terms of control and oversight. A feasible alternative would be to limit the number of authorized landing fish sites.

The main advantage of this measure is that the trafficking and commercialization in a country will be reduced; while in other country is a ban, due that this is going to be applied in the three countries. The social economical impact of this measure is reduced because is a high season in other sectors, such as tourism which allows fishermen to perform alternative activities for the generation of financial resources for their livelihoods. Besides, other commercial fish species are available during this season. It is necessary to perform a fishery economic valuation of the specie to really know how much annual economic benefit generates to the fishermen.

The requirements of this measurement should be done through a campaign with the purpose of sensitizing fishermen regarding the long term benefits of the ban. Financial resources, political will and communication at the level of government (police and municipalities) are necessary for socialization purposes; also it is necessary to strengthen the existing fishermen and fishermen associations so that they can be vigilant of the resource. Funds for patrolling, equipment, salaries, fuel and maintenance, among others are needed.

Term

The establishment of a temporary ban during the Nassau Grouper reproduction season should be ready no later than November 30th, 2012, with the purpose that the ban starts December 1, 2012.

Objective 2: Establishment of a permanent ban to fishing in the existing spawning aggregation sites

Goal

Establish a permanent fishing ban in the existing spawning aggregation sites, with the purpose of reducing the fishery pressure and the impacts that are generated due to current bad fishery practices.

Justification

Up to this date, the fisheries management has had an approach in species and not in ecosystematic. Such approach maximizes the efforts in catching and in the direct protection of just one specie in particular, ignoring the critical habitats, connectivity and other components as well as interactions of the ecosystem. The indirect social and economic costs can be representative in the long term.

Often is better to prevent the specific stage fisheries of a vital cycle of a species that are definitively vulnerable to the catch or that are critical for the production in general. An example would be the species that get together in specific areas to reproduce. If fishing

is allowed in reproduction areas, this could disturb not only the reproductive activity of that year, but it could wrongfully destroy the individuals in reproductive age, leaving so few to contribute in following years. A permanent ban could be required if particular characteristics of the reproduction habitat exists and this are affected by fishery.

The benefit of their protection is multiple due to that the Nassau Groupers spawning sites are many times used by other species such as snappers. This management measure already exists in Belize and in one site in Honduras; therefore it will be easier to apply it regionally.

Strategy

Such objective is based in the process that was developed in Belize for the protection of spawning aggregation sites. A basic requirement is to know the location of the spawning sites so they can be marked and the necessary regulation for their permanent protection can be developed.

One of the challenges is surveillance, which is difficult because of the distance between the aggregation sites and because some zones can be dangerous during night patrolling. Nevertheless it is indispensable that this measure should be accompanied with a good sensitization, including videos in where local fishermen teach others regarding the reduction of the specie and the consequences that its disappearance can bring. The creation of economic alternatives can be key so that the local fishermen can keep or improve the quality of their livelihoods while they wait for the medium and long term benefits that will be obtained from the closing of sites.

The social economic impacts of implementing this measure can be considered significant because not only the catch of the Nassau Grouper is banned, but that of other species such as snappers, horse mackerels and other grouper species as well. In the case of Belize, the impact was mitigated because the fishing for other species in the site is allowed; nevertheless control and surveillance with patrolling is required, through a restricted number of fishermen.

The fishermen can fish throughout the year always that they avoid the spawning areas. The restricted areas to these sites allow the repopulation and this can serve as a spawning ground and supply through the spillage effect in the rest of the area. Other alternative is that the fishermen can take tourisms to these restricted areas to observe the whale sharks that arrive to feed from the grouper eggs and at the same time promote the sighting of groups of groupers during spawning season. Having tourism in the area during this season helps control the illegal fishing of the Nassau Grouper.

The economic impact for the implementers of this measure is strong, due to the high surveillance and control costs. The necessary resources for implementing this measure include the technical capacity for monitoring and surveillance among others. Also additional resources are needed for the socialization and characterization of this measure, as well as for the demarcation of the spawning areas, particularly trained human resources, including inspectors, park rangers and navy force.

The sites are distant from each other, which increases the surveillance costs, although technical surveillance systems can be installed to reduce costs and at the same time enable patrolling. Nevertheless, the conservation impact of this measure is high and can be measured through monitoring. With this measure not only the grouper specie would be conserved and recovered, but also other species as well.

The main constraints include the lack of trained technical resource and information by the users in vessels. Other constraints include the lack of resources and a consensus regarding the importance of the measure between the users and government and lack of cooperation between the different agencies and institutions. Nevertheless, a sensitization campaign should be implemented which will be directed to users and authorities with the purpose of encouraging them to comply with it. A financial mechanism should be negotiated to cover the operational costs as well as training needs.

Term

The establishment of a permanent ban to the Nassau Grouper Spawning Sites should be ready no later than November 30th, 2012, with the purpose that the ban may start December 1st, 2012.

Objective 3: Establishment of Nassau Grouper Minimum and Maximum Catch Sizes and Minimum Landing Fish Size for the Whole Fish

Goal

Establish a regulation that organizes the Nassau Grouper's minimum and maximum catch sizes and requires the landing fish size of this specie as a size regulation mean.

Justification

The regulation based in the precaution approach exercises a careful prevision with the purpose of avoiding unacceptable or prejudicial situations, taking into account that the changes in fishery systems are slowly reversible, difficult to control, insufficiently understood and exposed to changes in our scales of values.

The establishment of minimum sizes protects the fish that haven't reached the first reproduction size. The maximum sizes protect the biggest size adult reproducers "big mamas", which significant produce more eggs than those of smaller size. The filleting of the product on board does not allow establishing the size of the caught fish.

The adoption of regulations in sizes and landing fish sizes helps control the indiscriminately juvenile and reproducer big size female adults' fishery. It is fundamental to change the traditional management in where the catch is allowed immediately before fish reaching the optimum size. With the establishment of the minimum and maximum

sizes (these are considered mega reproducers) the total of reproducers that can reproduce cannot be achieved, although a high percentage of this is reproduce, which helps the maintenance of populations.

Strategy

The approach of this measure is oriented to protect the species, forbidding the fishery of organisms that haven't reach in average the minimum reproduction size. Also, this measurement looks to protect the bigger size organisms' populations, which have a much bigger reproductive result. The implementation of this conservation and management measure requires that fish that has been caught is completely landing fish size and not fillet, so that the competent authority of each one of the countries can verify its compliance.

Belize has minimum and maximum regulations for the landing fish size of the whole fish of this species. Such regulations should be taken as a base for the other countries. The conservation impact is focused in the protection of juveniles and adult fish. This strategy is already functioning in Belize.

The necessary resources to implement this measure include inspectors to monitor the landing fish size and measurements. The legal feasibility of the measure is high, but the feasibility of its implementation is low, due to the control and surveillance costs. In Honduras, this is a new type of regulation, therefore there is no experience regarding its application. The social economic impacts still remain unknown.

Currently the inspectors are not accompanied by military or police and many times they are threatened. It is necessary to reach an agreement between the Fishery Directorate and the Navy Force, with the purpose that they can accompany the inspectors, the inspections should be performed in the disembarking sites as well as in the processing plants, recollection centers, supermarkets and restaurants. The measurement should be implemented parallel with a sensitization campaign for the restaurants, so that they comply with the regulations.

From the point of view of the measures applicability regarding the measure in Honduras, it is considered difficult because the majority of fishermen disembark the grouper already filleted, which forces to make a change in the legal framework that regulates the disembarks. Nevertheless, the artisanal fishery commercializes it completely, which will facilitate the control of sizes. Besides it is necessary to consider that Honduras has never had regulations oriented to scale fish, therefore the receptivity of measures of this type is unknown.

Legal documents should be elaborated for their revision and approval. Previous to this, it is necessary to reach a consensus with the local communities, from which it is expected that they proposed these measures and get involved in the following up.

The permanent presence of inspectors is required once that this measure is implemented in the landing fish sites or in processing plants to regulate the application of this norm. One of the biggest challenges is that there are multiple disembark sites, therefore common disembark areas should be proposed to reduce the effort. It is

necessary that Honduras and Guatemala adopt these regulations to harmonize this normative in the three countries and to be able to implement it with a greater success.

Term

The establishment of a regulation of maximum and minimum sizes, as well as the land sizing of the entire fish, should be approved no later than March 31st, 2013, so that its application can start April 1st, 2013, at the same time that the ban for the season opens.

Objective 4: Establishment of a fishery refugees' functional network in the coastal zones that include at least 20% of the continental platform of the Gulf of Honduras

Goal

Establish a fishery refugees' network that is representative of the Government of Honduras and that involves inter institutional participation and local communities.

Justification

The recovery of fisheries through the establishment of fishery refugees is a key step to mitigate the decline of the livelihoods of the local communities that depend of them. At the same time, these fishery refugees allow the recovery of entire ecosystems, which maximizes the recovery of fisheries when protecting the different Nassau Grouper life cycle stages as well as of other key species of the Government of Honduras.

The Nassau Grouper lives in different types of habitats during their life cycle stages. Normally the juveniles occupy mangrove zones and coral rubbles, feeding of small fish and crustaceous. The sub adults and adults live in the reef cracks and abyssal depths and feed of crustaceous and big fish. Last, during the reproductive season, the adults deploy to the habitat of solids and channels, particularly in the areas close to the reef promontories, in where they take advantage of the currents to help disperse their eggs. The need of creating fish refugees in these coastal zones is to assure the protection of these key habitats.

It has been demonstrated that the fishery refuges do not only allow the recovery of commercial species, as in the case of the Nassau Grouper, but of those associated with the ecosystem. This will make that the areas become healthier, resilient and adaptable to climate change. Just the establishment of fish refugees by the Government of Honduras, can help mitigate the degradation and recovery of ecosystems and their associated species.

Strategy

The fishermen and Government of Honduras key actors should be aware of the importance, functions and long term benefits of the fish refugees. The participation and

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appropriation by key actors is necessary to be able to achieve a fish refugee's functional network.

The refugees should be agreed by the fishermen but supported by the authorities. The incorporation of responsible fishing areas is needed in the fishery refugees, which will be managed by the fishermen with the accompaniment of the involved institutions and organizations. The legal framework of refugees should be established.

The necessary resources to implement this measure include costs, personnel and technical support, the control and surveillance in the refugee, the biological monitoring, specific staff for these areas and their monitoring. Finally the most important constraints that do not allow the implementation of this measure are financial resources for the biological monitoring, control and surveillance and the lack of governance reflected in the disrespect to the law, lack of political will and lack of acceptance in the community. This last element can be mitigated with the sensitization of the fishermen and their integration to the process to be able to achieve their ownership.

The identification of economic alternatives is necessary so that the fishermen's incomes that stop being generated when closing a fishery or a specific fishing area can be compensated. The diversification of the fishery is necessary. Other species that their use is feasible should be identified. This process could be accompanied of the maximization of the productive chain, through the integration of aggregated value to the products to be able to achieve a greater benefit for the fishermen.

It is necessary that the refugees have a monitoring system that allow measuring their recovery in a medium and long term, and in this way generate the necessary information so that the fishermen, as well as the authorities, can validate the retributions and benefits that are generated.

The feasibility of the implementation of the measure is low, because of the government's institutional weakness in the control and surveillance. More rigorous laws are needed as well as avoid the laws' differential application, it is a very difficult measure to implement because is not only the protection of the species spawning areas, but it should be linked with the control and surveillance (measure that is not complied due to the government's weakness). Nevertheless, the implementation of this measure, it will have a great benefit in the long term, making a sustainable fishery and improving the ecotourism conditions.

Term

The establishment of a fishery refugees' network, should be developed in two essential phases. The first phase involves the empowerment of the fishermen and authorities in the process. This can be achieved in the first 12 months. Next, 18 months are required for the area of the legal documents, which have to be approved.

Objective 5:

Establishment of a registration system and licensing for small scale fishery in the Gulf of Honduras, so that it can be regionally shared and managed by the fishery departments of each one of the countries

Goal

Establish a mandatory registration and licensing system of vessels and small scale fishermen in Guatemala and Honduras, same as the one that is implemented in Belize to complete the national registry and connect the licenses data bases with the fishing infringements in the three countries.

Justification

The fishery control depends of the capacity to supervise, monitor and regulate the exploitation of a resource. As such, it is essential to know the number of persons that are focused in a specific fishery. From a social economic point of view, it is also useful to know how many people depend of a particular fishery to understand the relative importance of the resource in the local livelihoods, food security and economy in general.

An important element of a precautionary approach is to establish legal or social frameworks for all fisheries, requirement that is not currently given. As minimum, such frameworks should establish the normative that controls the access to fisheries (for instance all vessels should have a license), data presentation requirements and processes for the planning and execution of a complete fishery regulation.

Strategy

Two registration systems should be created in Honduras and Guatemala: one for vessels used for small scale fishery and other for the fishermen. These registration systems should complete the registry and license systems existing in Belize and improve the existing vessels registration system in Guatemala.

It is necessary to create and maintain a vessels registration system, which includes vessels that are used for landing fish that is sold or partially or totally exchanged, in other words commercial fishery. The vessels can be registered and marked with a registry number that should be visible in one of the sides of the vessel. All fishing vessels will have the obligation to register and keep an updated registry in the Fishery Department of each one of the countries; also all the required paperwork has to be submitted again.

It is necessary to create and keep a fishermen registration system, similar to that of the vessels, which should include the fishermen that totally or partially commercializes (sells or trades) their product.

Same as the vessels' license, each year this will be renewable and mandatory. The fishermen will receive an identification card that includes a specific non-transferable number which will be linked to their national identification number.

Inspections are necessary to be performed through random patrolling in the catch landing fish control points and that the fishermen that work in the vessels can support in determining the compliance levels. This can be complemented with maritime patrolling according to the existing logistic and economic resources. Fines will be applied to the owners of the vessels and to those fishermen that do not have fishing licenses. This measures will be applied with the purpose of encouraging the compliance of regulations and discourage that the productive chain works with persons as well as vessels with no license.

The creation and update process of a license, no matter that it is for a fishermen or the owner of a vessel, shouldn't take too much time and the process should be so accessible that it encourages its use. This can be achieved performing visits to each one of the fishing communities, taking a laptop that has the data base and a printer to print the cards so that the fishermen and vessels can be registered *in situ* and licenses immediately issued.

The data base should be stored in a central data base with on line access to facilitate the access to it, no matter the terminal or computer from where it is being accessed and also to facilitate its use by the Fishery Departments of each one of the countries. Information and sensitization campaigns should be developed to announce in the communities about the need and importance of being registered and the competent authority should notify the visit dates to the communities.

It is necessary that the three countries present annual reports with the updated registration information regarding the number of active fishermen and vessels, to be able to keep a licensing control.

A registry of the fishery infringements should be kept in the same license data base program, with the purpose of keeping fishermen and vessels control as well as history infractions; in this way they can be identified and matched with the committed infringements. This can be used as a data base to expand the fines or penalties in the persistent infringements. The other countries should be notified of the infringements that are committed by national fishermen in the territorial waters of another country, through a monthly report of the fishing infringements that will be distributed among the countries for their knowledge.

These fishery infringements should be digitalized and stored in a data base to allow a fishery infringement control throughout the time and be able to identify the persistent offenders, the areas in where the felonies are being committed and the most common types of felonies. Currently no type of registry has been considered in any of the three countries or information shared among them. But this information may be very useful in the compliance in the selection of future regimes through the identification of illegal activity areas and evaluate if the application is changing the compliance level.

It is necessary to pay special attention to the vessels registration between Guatemala

and Belize, to be able to identify the persons and vessels that have a double license and to look for a mechanism to discourage duplicity.

Term

Honduras and Guatemala have been trying to implement the fishermen and small scale vessels licensing during several years. Considering the importance and functionality of the fishery management licenses, the licenses should be issue as soon as possible. It will be difficult to progress in the fishery management if there is no previous regulation through the licensing. Also the licenses could become a data base for the exchange and mutual responsibility in the management of shared resources.

Summary of objectives and proposed activities

No.	Objective	Important Actors	Activities	Term
1	Establishment of a temporary ban during the Nassau Grouper reproduction season in the Gulf of Honduras.	The Fishery Departments of the three countries, fishermen groups, co management NGOs, OSPESCA	<ul style="list-style-type: none"> • Technical studies for the validation of sites / • Anthropological studies with communities • To involve fishermen in the planning and consultation processes • Integration of a technical committee for the elaboration of the document • Disclosure and sensitization of the measure • Elaborate the ban proposal document • Publication and socialization of the ban resolution • Monitoring of reproductive aggregations and in the landing fish zones • Control and surveillance of sites • Present the proposal of the technical committee to OSPESCA fishery and legal team for its regional harmonization 	To November 30th, 2012
2	Establishment of a permanent ban to fishery in existing spawning aggregation sites.	The Fishery Departments of the three countries, fishermen groups, NGO co managers, OSPESCA	<ul style="list-style-type: none"> • Involve the fishermen in the planning and consultation process • Integration of a technical committee for the elaboration of a document • Disclosure and sensitization of the measurement • Elaborate the ban proposal document • Publication and socialization of the ban resolution • Monitoring of the sites and landing fish zones • Control and surveillance of the sites • Present the technical team's proposal to the Fisheries and Legal teams of OSPESCA for its regional harmonization 	To November 30th, 2012

3	Establishment of the Nassau Grouper minimum and maximum catches sizes and the entire landing fish.	The Fishery Departments of the three countries, co managers NGOs, OSPESCA	<ul style="list-style-type: none"> • Involve the fishermen in the planning and consultation processes • Integration of a technical committee for the elaboration of the document • Disclosure and sensitization regarding the measurement • Elaborate the size and landing fish regulation document • Publication and socialization of the agreement or normative • Monitoring of the land fishing zones • Present the technical committee proposal to the OSPESCA fishery and legal team for its regional harmonization 	To March 31st, 2013
4	Establishment of a fishery refugee functional network that at least includes 20% of the intercontinental platform of the Gulf of Honduras	Fishery Departments, Tourism Ministries, Health and Food Inspectors, tourism providers' services, Tourism Chambers and Commerce Chambers	<ul style="list-style-type: none"> • Technical studies to prioritize the sites • Involve the fishermen in the planning and consultation processes • Sensitization campaigns • Integration of a technical committee for the elaboration of the document • Disclosure and sensitization regarding the measurement • Elaborate the fishery refugees establishment document • Publication and socialization of the agreement or decree • Monitoring of fishery refugees • Control and surveillance in the sites • Present the proposal to OSPESCA technical and legal team for its regional harmonization 	First phase: November 2012 Second phase: May 2013
5	Establishment of a registration and licensing system for small scale fishery in the Gulf of Honduras that is regionally shared and managed by the Fishery Departments in each one of the	The system can be elaborated by a consulter in assistance with the Fishery Departments of Honduras and Guatemala. The system can be implemented by the fishermen associations, NGOs	<ul style="list-style-type: none"> • Hiring of the company that will elaborate and implement the registration and licensing program • Implementation of fishermen and vessels licensing • Licensing control, following up and monitoring • Present the technical team 	Completed August 2012

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countries.

in coordination with
the Fishery
Departments

proposal to the OSPESCA
fisheries and legal team for its
regional harmonization

COMPLIANCE AND MONITORING OF THE PLAN

It is important to highlight that the elaboration of a management plan is the simplest part of the process. What is difficult is to assure its compliance as well as implementation. It is necessary to define mechanisms for the compliance and monitoring of the Regional Plan for the Conservation and Management of the Nassau Grouper. It is necessary to take into account that it is a tri-national plan, therefore the applicability of national policies and laws should be considered.

In first instance, we look for the adoption of the plan by the governments of each one of the countries, specifically by the Fishery Directorates. Also it is necessary to have the support of OSPESCA. The implementation responsibility of the Regional Plan for the Conservation and Management of the Nassau Grouper should belong to the actors involved in this fishery in the Gulf of Honduras and not just of the Fishery Departments of the three countries. Nevertheless, such process should be guided by the Fishery Departments of the three countries.

Because this plan is based in the suggestions and recommendations formulated by the different groups that directly and indirectly are related with the Nassau Grouper fishery in this region, the participation and compliance of the key actors in the implementation of the Plan is expected. It is necessary to identify the second tier platforms to promote the compliance and monitoring of the plan. The Non Governmental Organizations and similar organizations that are related to the co management of the protected marine areas as well as fishery relevant groups such as the *Red de Pescadores del Caribe de Guatemala* (Guatemala), and FENAPESCAH in Honduras, that groups all the fishing cooperatives of the south of Belize, which should also have an important role in the following up of the plan.

It is the responsibility of each one of the actors that already have a role, no matter if it is in use, management or regulation of the Nassau Grouper fishery regulation, as a group or as an individual, to work to assure the sustainability of this species for future generations.

It is necessary to generate information and disclosure mechanisms to make known the management plan and have closeness with the key actors to identify the mechanisms to implement the proposed actions. Several of these actions require of a previous consultation process with the purpose of achieving feedback from fishery users and in this way minimize the rejection to the compliance of activities. The forbidden strategies should be accompanied of alternatives that allow the fishermen to perform alternative economic activities for their livelihoods or trainings that involve new sustainable fishing methods or the diversification of fisheries, in other words the use of nontraditional new species. The implementation of these types of actions in a great percentage assures the compliance of the Management Plan.

If the compliance by fishermen is achieved, then the compliance of those that commercialize it is achieved, in other words the intermediate and final buyers, supermarkets, and restaurants and other important actors of the productive chain. If there is no offer, there is no demand and vice versa. To be able to achieve the product buyers' compliance assures in a great percentage the compliance of the normative because they make the market.

For this, it is necessary to work in informative campaigns that convince the buyers and consumers not to buy the Nassau Grouper and at the same time promote the consumption of other viable species. To strengthen the compliance, it is necessary to accompany the implementation with control and surveillance. As it has been stated by the fishermen during the consultation processes, the control and surveillance has to be assured and included in the new regulations. The consultation process should be directed not only to government officials and nongovernmental organizations, but it has to include the opinions of fishermen, market chain, and consumption and tourism sector and in general, other parts that are interested.

The fishermen have a fundamental role and they are expected to be belligerent regarding denounces and participation in the surveillance using mobile telephones and communitarian surveillance committees. Nevertheless there is a tremor that denounces have consequences for those that denounce, therefore a denounce mechanism that is sufficiently formal has to be facilitated to the fishermen.

The licensing should be realize during the first stages of the implementation of the Management Plan, with the purpose of registering the fishermen and vessels and in this way be able to keep a control and regulate the fishery. The license registry should be updated each year and this allows the users to be informed regarding the new regulations, as well as dispositions and at the same time a space is created to be able to train them in fishery sustainable practices and economic alternatives. Also formats can be use to obtain fishermen and vessel owners feedback, because it is important to gather suggestions and therefore improve the system every year.

The monitoring will also be developed through the information that is presented by the Fishery Departments of the three countries. Such reports should be monthly presented to OSPESCA and will include licensing and denounce process reports. At the same time, they should include the landing fish information. Besides, all of these information will be available in an on line data base, to which the different users, managers and

authorities will have access to, with the purpose that the information that is being generated helps to improve the fishery management, as well as to measure its effectiveness.

It is necessary to revise the Regional Management Plan at least every five years. Such revision should include all the parts involved.

RECOMMENDATIONS FOR FISHERY AUTHORITIES AND CO MANAGERS

Following some recommendations that arise from the consultation and validation workshops:

Governance Recommendations

- It is of vital importance to present the results of the Evaluation of the Nassau Grouper Management and Conservation State in the Gulf of Honduras to the fishermen during socialization meetings or take advantage of the annual fishermen cooperatives and associations.
- It is necessary to provide more diffusion to the information regarding the reproductive season of the species.
- It is important that the fishery authorities of the three countries, together with the Tri National Fishery in the Gulf of Honduras Forum emulate the Gulf of Fonseca Mechanism to work in multiple countries in such a way that the recommendations of this plan can be formalized by the authorities of the three countries.
- Finally the mechanisms that could support the management plan's implementation of the strategies and actions were discussed. The example of the Mangrove Corridor Project in the Gulf of Fonseca was presented and the regional agreements that have been reached in such project in regards the bans, regulations, closing the shark and *cascos de burro* (a native mollusk) fishery as well as the application of the fishery access rights. It was commented that in the area of the Gulf of Honduras similar initiatives have existed, such as MAR agreements and the TriGOH Fishermen. For the Gulf of Honduras OSPESCA and CCAD can promote these agreements among

the governments. It is recommended to revise and retake some successful actions of these processes.

- It is necessary to correct the mistakes in the current legislation such the case of the ban resolution 002-2011 in where the protection declaration of the Caldera del Diablo site in Honduras is declared, but the geographic location has a mistake. In this situation it is not necessary to make a change in the legislation, not just a modification to the agreement. Also it is important that the ban can be for all Honduras and not just for the Caldera del Diablo site. Additionally a prohibition for the use of harpoon in Honduras should be introduced.
- It is convenient to establish more strict regulations to avoid fishing during spawning. It is necessary to protect the rest of the spawning sites through the closing of these sites for fishing.
- An alternative to the prohibition of the traps is to encourage in fishermen the use of biodegradable materials to tie the trap closing hatch in such a way that if the trap stays out for long periods of time this turns rotten and the door opens and the trap does not become a ghost fishing gear.
- Finally in relation to governance, it is important that the Governments of the countries in the Gulf of Honduras, with the support of OSPESCA and the MAREA Program to promote the harmonization of the fishery regulations. So that the regional management can be effective, all of the countries should follow similar fishery regulations, promoting the coherence of management efforts in the entire zone.

Management Recommendations

- The development of alternative challenges for the generation of incomes for the artisanal fishermen that have been affected by the closing of fishery in aggregations of spawning, it plays a critical role in the success of the Nassau Grouper management strategies.
- The diversification of the fisheries same as giving an aggregated value to the products is fundamental. One of the examples that was mentioned was the local tuna catch post management, in such a way that they can keep their quality and become into a first “sushi level” quality product, suitable for high markets, this is one of the options. The purpose is to provide a viable economic alternative for fishermen, in the case that the grouper fishery is closed. Such diversification can also include the pelagic fishery, the fishery in deep waters and the sea cucumber fishing. The identification of alternative income sources, including the pig-rearing, aquaculture (cages and enclosures), and agriculture continue to be a priority in the region. Other alternative activities to the Nassau Grouper fishery may include the algae cultivation.
- It is necessary to consider the creation of a fishermen international coalition, managers, conservationists and scientists from Belize, Guatemala and Honduras, maybe through the Tri-National Alliance of the Gulf of Honduras (TRIGOH). This will

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help to approach the fundamental aspects of fishery, conservation and research of Nassau Grouper. To achieve a regional initiative is important to take into consideration a common fishery management plan as well as a conservation plan, together with the support of the scientific investigation.

- It is necessary to perform the centered studies in climate change potential effects as well as the ocean acidification in the populations of Nassau Grouper in the Gulf of Honduras. Such studies should be focused in the changes in the duration of the larval stage, the survival larva rates, and feeding behavior among others.

ACRONYMS

BICA	Bay Islands Conservation Association (Utila, Honduras)
CSO	Central Statistic Office (Belize)
DIGEPESCA	Fish and Aquaculture General Directorate (Honduras)
FUNDAECO	Foundation for the Eco Development and Conservation (Guatemala)
FUNDARY	Foundation Mario Dary (Guatemala)
GDP	Gross Domestic Product
GSSCMR	Gladden Spit and Silk Cays Marine Reserve
INE	Instituto Nacional de Estadística (Guatemala)
IUCN	International Union for Conservation of Nature
Lps	Lempiras (National Currency, Honduras)
MPA	Marine Protected Areas
NGO	Non-Government Organization

PMAIB	Programa de Manejo Ambiental Islas de la Bahía (Honduras)
SEA	Southern Environmental Association (Belize)
SI	Statutory Instruments (Belize)
SPAGs	Spawning Aggregations
TIDE	Toledo Institute for Development and Environment (Belize)
TRIGoH	Tri-National Gulf of Honduras Alliance
UCME	Utila Center for Marine Ecology (Honduras)
WCS	Wildlife Conservation Society
WTTC	World Travel and Tourism Council

DEFINITIONS

Spawning aggregations: accumulation of individuals in amounts 3 or 4 times greater than the natural densities with reproduction purposes

Benthic: that lives in benthos, in the bottom of the sea

Gonochoric sexual development: having the sexes separate in different individuals

Fidelity to the site: organisms that frequently return or stay in the same site

Nektonic: that lives in the nekton, in the water column

Sexual maturity minimum size: size to which 50% of the population is in reproductive age

Ban season: time period in which fishing is forbidden

Serranidae: Fish family that belongs to groupers

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APPENDIXES

List of interviewed people and organizations during the consultation process

The following people were interviewed for the preparation of this report or participated in the consultation workshops:

BELIZE:

George Ramirez	Fishermen Cooperative of Rio Grande, Rio Grande
Seleem Chan	TIDE, Punta Gorda
Celia Mahung	TIDE, Punta Gorda
Reylando Martinez	Southern Environmental Association (SEA), Placencia
Dennis Garbutt	Sapodilla Cays Marine Reserve manager, Sapodilla Cays/Punta Gorda
Virginia Burns	Wildlife Conservation Society Glovers Reef Belize City
Lyndon Rodney	Department of Fisheries Punta Gorda, Punta Gorda
Mauro Gongora	Department of Fisheries Belize City, Belize City
Dra. Arlenie Perez	Belize University, Belize City
Nicanor Requena	Environmental Defense Fund, Punta Gorda
Julianne Stockbridge	The Nature Conservancy, Belmopan
Roberto Pott	Healthy reefs initiative, Belize City
Celso Cawich	Environmental Research Institute (ERI), Belize City
Amador Pott	Belize Audubon Society, Punta Gorda
Luke Nuñez	Hopkins Fishermen Association, Hopkins
Collin Gillet	Coastal Zone Management Authority and Institute, Belize City
Cesar Munoz	Sarteneja Fishermen Association, Sartaneja
Martin Reyes	PG Fishermen Association, Punta Gorda
Paula Jacobs	PG Fishermen Association, Punta Negra
Derwin Garbutt	Monkey River Fishermen Association, Monkey River
Alex Garbutt	Monkey River Fishermen Association, Monkey River

GUATEMALA:

Angélica Méndez	Caribbean Fishermen Network, Livingston
Elías Valdez	DIPESCA, Livingston
Lester Carballo	DIPESCA, Puerto Barrios
Mario Salazar	FUNDARY, Puerto Barrios
Noé Ortega	Fisherman and Park Ranger Fundary, Quetzalito
Moisés Zaldívar	Fisherman, San Francisco del Mar
Blanca Rosa García	MARFUN, Guatemala
Hugo Hidalgo	MARN, Puerto Barrios

Cleopatra Méndez	FUNDAECO Costas, Livingston
Abraham Castro	Fisherman, Sarstún
Alonso Ramírez	Bahía Amatique (APABA), Puerto Barrios
Jorge González	<i>Tras Malleros de Livingston (ASOPELIV)</i> , Livingston
Celso Nery	Garífunas Fishermen (APTG), Livingston
Luz Marina	Fish Collection Plant, Puerto Barrios
Carlos Mechel	Environmental Advisor, Puerto Barrios
Manuel Ixquiac	CONAP, Guatemala
Juan Ramon Pocon	CISP, Puerto Barrios

HONDURAS:

Jose Antonio RoMero	<i>Departamento de Investigación Científica DIGEPESCA</i> , Guanaja
Pablo Rico	World Wildlife Fund (WWF), La Ceiba
Jimmy Andino	<i>Iniciativa de la Langosta Espinoza</i> , La Ceiba
Gracia Matamoros	Roatan Marine Park, Roatan
Lidia Dolores Medina	<i>Unidad de Manejo Ambiental Municipalidad de Roatán</i>
Jenny Myton	Coral Reef Alliance (CORAL), Roatán
Ian Drysdale	Health Reefs for Healthy People, Roatán
Pamela Ortega	Bay Islands Conservation Association (BICA), Utila
Adrián Oviedo	Fundación Cayos Cochinos, La Ceiba
Roberto Rivas	<i>Proyecto Golfo de Honduras</i> , Puerto Cortes
Edgar Hyde	<i>Asociación de Pescadores Artesanales (APESCA)</i>
Relina Yolany Asiego	<i>Asociación de Pescadores de Utila</i> , Utila
Noé Chavarría	<i>Federación Nacional de Pescadores Artesanales de Omoa</i> , Omoa
Russ Summerell	Flying Fish, Roatán
Edwin Castillo	<i>Mariscos Agua Azul</i> , Roatán

List of Participants in the Regional Workshop

No.	Name	Organization	Country
1	Reylando Castro	SEA	Belize
2	Seleem Chan	TIDE	Belize
3	Manuel Ixquiac	CONAP	Guatemala
4	Julian Suazo	SAG – CITES	Honduras
5	Peter Hearne	USAID	Honduras
6	Gabriela Pineda	OSPESCA	Honduras
7	Eloisa Espinoza	DIGEPESCA	Honduras
8	Alicia Medina	WWF	Honduras
9	Arlene Rodriguez	Roatan Marine Park	Honduras
10	Jimmy Andino	Proyecto Langosta Espinosa	Honduras
11	Adoni Cubas	MAREA	Honduras
12	Wilson Ramos	PROLANSATE	Honduras
13	Calina Zepeda	TNC	Honduras
14	Ivo Orellana	MAREA	Guatemala
15	Pablo Rico	WWF	Honduras
16	Diana Vasquez	CEMU	Honduras
17	Roberto Pott	Healthy Reefs	Belize
18	Jose Romero	DIGEPESCA	Honduras
19	Sergio Martinez	MAREA	El Salvador
20	Yolanda Aciago	CEMU	Honduras