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DELIVERABLE: FRAMEWORK STRATEGY PLAN FOR THE PROPOSED PORT HONDURAS MARINE RESERVE (PHMR) REPLENISHMENT ZONE EXPANSION TOWARDS THE NATIONAL GOAL OF 10% REPRESENTATIVE OF PHMR.

August 2014

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DELIVERABLE: FRAMEWORK STRATEGY PLAN FOR THE PROPOSED PORT HONDURAS MARINE RESERVE (PHMR) REPLENISHMENT ZONE EXPANSION TOWARDS THE NATIONAL GOAL OF 10% REPRESENTATIVE OF PHMR.

Contract No.: EPP-I-00-04-00020-00

CONTENTS

LIST OF ACRONYMS

BERDS	Biodiversity & Environmental Resource Data System
GOB	Government of Belize
GUZ	General Use Zone
ICUN	International Union for Conservation of Nature
MAREA	USAID Regional Program for the Management of Aquatic Resources and Economic Alternatives
MFFSD	Ministry of Forestry, Fisheries and Sustainable Development
MPA	Marine Protected Area
NGO	Non-Government Organization
NTZ	No Take Zone – Old SI
PCNP	Paynes Creek National Park
PHMR	Port Honduras Marine Reserve
RZ	Replenishment Zone – new zones (2013 onwards)
SI	Statutory Instrument
TIDE	Toledo Institute for Development and Environment
TNC	The Nature Conservancy
TPPL	TIDE Private Protected Lands

EXECUTIVE SUMMARY

Based on the results of the PHMR monitoring program until 2010 and information from the scientific literature, it was recommended by Foster (2010) that the no take area within PHMR be increased to incorporate between 20-30% of the Reserve Area (Bohnsack et al. 2000, Day et al. 2002, Airame et al. 2003 and Fernandes et al. 2005) and be greater than 5km in diameter. During 2013 consultations, TIDE learned that fishers are fully conscious of the importance of RZs; however, some more outspoken fishers were not prepared to willingly give up existing fishing areas for expansion of RZs. It has therefore become apparent that new innovations in marine protected areas design are needed in PHMR in order to overcome the gridlock created by the previous options.

The design suggested in this framework aims to introduce new zone types that are believed would more likely gain acceptance and support from PHMR stakeholders in addition to expansion of conventional RZs, yet still meet conservation targets for commercial species management, habitat protection and endangered species conservation. The following criteria were incorporated into the development of this strategy for expansion of PHMR's RZ in alignment with the Fisheries Department National Replenishment Zone expansion initiative: National goal to increase RZ protection to incorporate 10% of all ecosystem types within Belize's territorial seas, feedback from professionally mediated stakeholder consultations, including Managed Access Fishers, Sports Fishing operators and tour guides, local ecological knowledge, and sound science.

An incremental approach to implementation of new replenishment zones is recommended, with new types of restricted zones introduced to reach the national goal of 10%. Overall the proposed strategy would bring the total area under enhanced protection to 15% of PHMR. Special Management Zones (Manatee & Goliath Grouper Special Management Zones, Protected Wetlands Sport Fishing Zone and Zone 4 (see map Appendix 1) as a no fin fishing zone and one of the rotating zones as sport fishing zone) would make an additional 17 % of PHMR. In all, this would make 32% of PHMR under some form of elevated protection.

INTRODUCTION

It is recognized that in other parts of the world, e.g. the Great Barrier Reef in Australia, there exists a framework for marine protected areas management that is far more advanced than that seen in PHMR or any other marine protected areas in Belize (figure 1). Recent consultations with PHMR stakeholders in reference to potential RZ expansion in PHMR revealed strong resistance to any further increase in RZs in PHMR beyond the small extension to connect West, South and Middle Snake Caye NTZs, for which consensus was reached during stakeholder consultations in 2013. Deeper investigation suggests some of this resistance to be due to perceptions that new RZs would prevent activities vital to fishers, such as bait fishing which is not currently a priority conservation target. Given that opportunities are therefore missed to meet higher priority conservation targets that affect stakeholders less, e.g. manatee protection, Goliath grouper protection, it is therefore suggested that new types of zone be designed and introduced in PHMR, following a multiple zone-type approach similar to that in use on the Great Barrier Reef.

The design suggested here aims to introduce new zone types that are believed would more likely gain acceptance and support from PHMR stakeholders in addition to expansion of conventional RZs, yet still meet conservation targets for commercial species management, habitat protection and endangered species conservation. RZ expansion can only be successful if supported by PHMR stakeholders and therefore an attempt is made here to incorporate feedback from stakeholders into the RZ expansion design.

Figure 1: Signboards on beaches, docks and fish landing sites in the Great Barrier Reef, Australia give clear indications of different zones in the reserve, with matrix style charts indicating what activities can and cannot take place in each zone. Penalties for infractions are clearly indicated, and useful information about where to get free maps, as well as hotlines for reporting illegal activity, injured marine animals, vessels in distress and other useful information. This design has come about from a mediated stakeholder consultation process incorporated into science based zonation recommendations aimed at addressing specific conservations and management targets while minimizing side effect impacts to other stakeholders.

BACKGROUND

Based on information from the scientific literature, recommendations for a minimum MPA size, specifically designated as a no take area, range from 4-20km in diameter to effectively conserve biodiversity (Salm 1984; Friedlander et al. 2003; Shanks et al. 2003). In addition, studies have shown that many species utilize seagrass beds, mangroves and coral reefs at various stages of their life history (Acosta and Robertson 2003; Roberts et al. 2003; Mumby 2006). Thus, an increase in the no-take area of PHMR would ensure inclusion of a larger area of each of these key habitats, thereby protecting connectivity between functionally linked habitats (McLeod et al. 2009). Moreover, specific studies have also demonstrated the success and benefits of long-term no take areas. A decrease in macroalgal cover and an increase in live coral cover, attributed to the recovery of herbivorous fish populations, has been observed at sites within the Exuma Cayes Land and Sea Park, Bahamas No-Take Zones (Mumby and Harborne 2010). Populations of the Caribbean Spiny Lobster, *Panulirus argus*, located on patch reefs within Conservation Zones (no take areas) at Glovers Reef showed significant increases over a five year period from 1996 to 2001 (Acosta and Robertson 2003).

Based on the results of the PHMR monitoring program until 2010 and information from the scientific literature, it was recommended by Foster (2010) that the no take area within PHMR be increased to incorporate between 20-30% of the Reserve Area (Bohnsack et al. 2000, Day et al. 2002, Airame et al. 2003 and Fernandes et al. 2005) and be greater than 5km in diameter. Recommendations for the placement of the new no take areas, based on information regarding ecosystem presence and community suggestions from 2010 consultations can be seen in figures 2-3.

Figure 2: Port Honduras Marine Reserve showing Foster's (2010) proposal 2 - extension to the no take zone (hatched area) that would incorporate 25% (105km^2) of the reserve area.

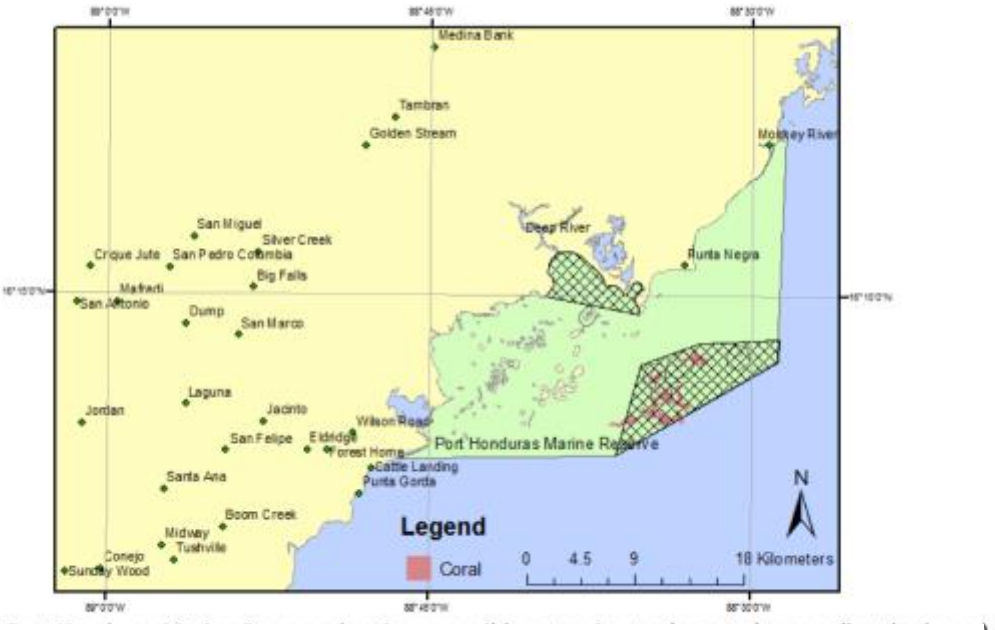

Figure 3: Port Honduras Marine Reserve showing Foster s (2010) proposal 3 - extension to the no take zone (hatched area) that would incorporate 20% (83km^2) of the reserve area.

While there was support in Monkey River for the first of these three options, community response in Punta Gorda was divided, with many concerned that a contiguous zone connecting the Deep River Area with the Snake Cayes would be too prohibitive to continuance of their livelihoods. It was decided that more scientific information was needed to underpin the proposed options and the idea was shelved until the recommendation in 2013 by the Belize Fisheries Department to increase percentages of Replenishment Zones (RZs) to 10% of PHMR. This formed the basis of research to inform the 2013 consultations, during which commercial species data from both fisheries dependent and fisheries independent sources was presented from TIDE's 2000-2012 Fisheries Assessment as a part of the USAID MAREA program to demonstrate the spillover capacity of the existing RZs in the PHMR.

During 2013 consultations, TIDE learned that fishers are fully conscious of the importance of RZs; however, some more outspoken fishers were not prepared to willingly give up existing fishing areas for expansion of RZs. These fishers claimed that there are limited areas in the reserve that provide the fish products that they rely on for a living and may lack confidence in the concept of long term benefits that giving up additional areas may provide them with according to contemporary MPA design theory.

However, despite efforts during consultations to demonstrate the effectiveness of increased RZ size as a means to enhance commercial species replenishment and spillover, concerns lay in the short term detriment this would cause to fishing activities currently taking place in General Use areas close to the RZs of the Snake Cayes. It has therefore become apparent that new innovations in marine protected areas design are needed in PHMR in order to overcome the gridlock created by the previous options. A new approach is therefore proposed here aiming to emulate a system that has been demonstrated to work effectively in the Great Barrier Reef of Australia, with multiple types of zones aimed at addressing specific management and conservations objectives, while minimizing short term impact on affected PHMR stakeholders. Ideas presented here have

not been proposed to stakeholders at this point, but are considered as a starting block to introduce new concepts for stakeholders to consider in a professionally mediated setting.

Stakeholder Engagement 2014:

New zone types introduced here are concepts suggested in light of public consultations in 2013. Further professionally mediated consultations are recommended to introduce these concepts to stakeholders and provide opportunity for stakeholder-based adaptive design of new zones, including regulations covering what can and cannot take place in each zone, seasonal variations in regulations and rules guiding rotating RZ systems. A structured, professional mediation process is recommended for this objective, with special management regulations aimed at addressing the specific conservation targets, while allowing many of the economic activities important to fishers and other stakeholders to continue unaffected. It will thereby be apparent to stakeholders that their input during public consultations has been incorporated, making it more likely to gain acceptance from PHMR stakeholders and therefore easier to enforce.

CRITERIA FOR REPLENISHMENT ZONE EXPANSION

The following criteria were incorporated into the development of this strategy for expansion of PHMR's RZ in alignment with the Fisheries Department National Replenishment Zone expansion initiative:

- National goal to increase RZ protection to incorporate 10% of all ecosystem types within Belize's territorial seas as replenishment zones incorporating stakeholder input, sound scientific evidence and use of marine management tools (such as Marxan analysis) demonstrated to have worked well elsewhere.
- Feedback from professionally mediated stakeholder consultations, including Managed Access Fishers, Sports Fishing operators and tour guides to ensure that needs of all livelihood options are being considered.
- Local Ecological Knowledge gathered through multiple formal and informal consultations with fishers from recent years.
- Scientific information on:
    - Marxan based recommendations from TNC
    - Endangered species, e.g. manatee and goliath grouper – research projects on these are taking place in 2014
    - Commercial species population health – conch, lobster, sea cucumber, finfish
    - Habitat mapping information from remote sensing and ground truthing
    - Marine and riverine water quality.
    - Fishing activity of Managed Access licensed fishers.
- Resistance to change among stakeholders concerned about the livelihood impacts of expansion of conventional RZs. To address this **incremental approach** to implementation of new replenishment zones is recommended, with new types of restricted zones introduced to reach the national goal of 10%.

Overall the proposed strategy would bring the total area under enhanced protection to 15% of PHMR. Special Management Zones (Manatee & Goliath Grouper Special Management Zones, Protected Wetlands Sport Fishing Zone and Zone 4 (see map Appendix 1) as a no fin fishing zone and one of the rotating zones as sport fishing zone) would make an additional 17 % of PHMR. In all, this would make 32% of PHMR under some form of elevated protection.

STRATEGIC ACTIONS TOWARDS RZ EXPANSION

a. Examination of available scientific information:

TNC provided TIDE with recommendations for RZ expansion based on the results of their recent Marxan analysis, which incorporated various types of national level ecological data identifying areas of critical habitat most important to protect in order to maintain ecosystem resilience and connectivity. These were presented to TIDE staff in February 2014 to incorporate feedback from those with local knowledge of the reserve, and to enable TIDE to consider ecologically based recommendations from this high powered spatial management tool in the design process.

TNC provided TIDE with two maps to facilitate this process. Figure 4 shows what was originally proposed and presented to TIDE. Figure 5 shows TNC's amended solution based on TIDE's feedback. This final design will then be taken to consultation following the strategy presented in this report.

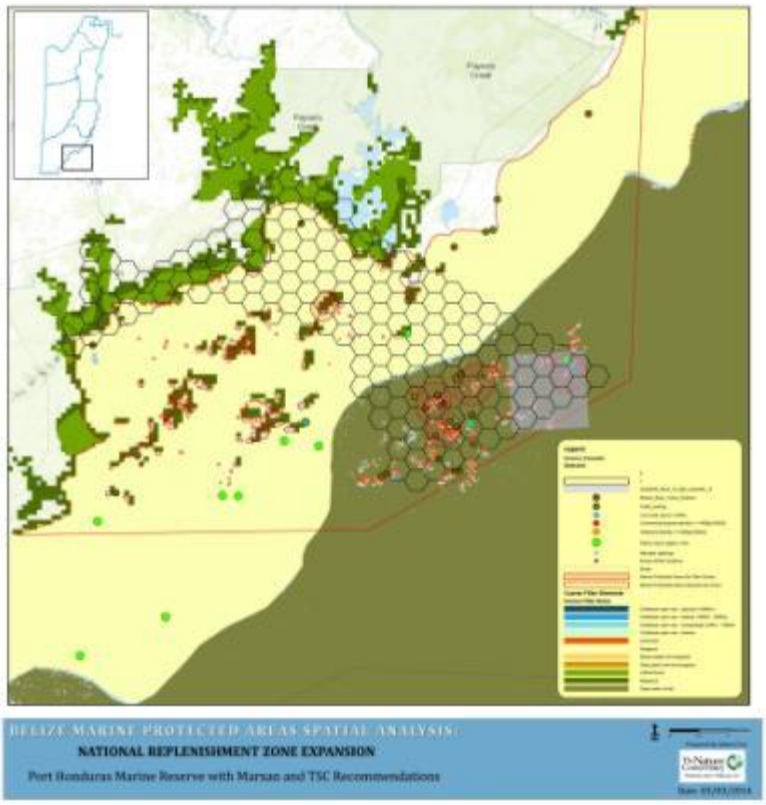

Figure 4: Recommendations of TNC's national level MARXAN analysis, prior to TIDE feedback based on local ecological knowledge and management recommendations.

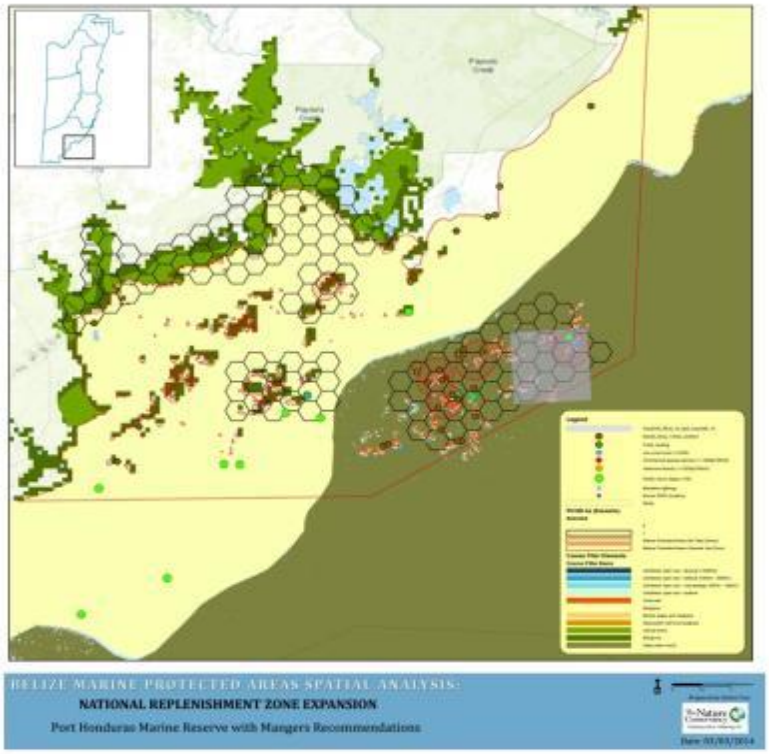

Figure 5: Revised MARXAN recommendations after incorporations of local ecological knowledge and management recommendations from TIDE.

b. Stakeholder Engagement through Formal Mediation

Adaptive management is not only a scientific process but also a social one. The efficacy of replenishment zones will depend greatly upon the level of buy-in from resource users and their compliance with the regulations. In an attempt to secure buy-in from the fishing community, TIDE proposes to use formal mediation to engage stakeholders on the issue of replenishment zone expansion.

The goal of formal mediation is to structure a conversation between stakeholders in a manner that allows all stakeholders to have equal input towards future management decisions, without dominant speakers monopolizing dialogue and decision making, and without meeker stakeholders being prevented from communicating their equally valid opinions and ideas (due to intimidation or shyness) for incorporation into the design process

A professional mediator serves to keep the conversation focused and directed. The goal of employing mediation in natural resources management is not only to reach a compromise in which all stakeholders are satisfied with the outcome, but also to foster a better working relationship among those who have an interest in the management of an important natural area.

To achieve these goals, TIDE intends to conduct a stakeholder analysis of PHMR to broaden and diversify the stakeholder base beyond commercial and sport fishers, as it is recognized that other divisions within the community have not historically been given an opportunity to be involved and influence decision-making relating to PHMR management. For more information see table 1.

It is proposed that a series of innovative, interactive workshops be held with old and newly identified stakeholder groups from the three buffer communities of PHMR (Punta Gorda, Monkey River and Punta Negra) as well as watershed communities located in freshwater catchment areas that drain into PHMR. The goal of these initial workshops would explicitly be to NOT attempt to tackle the real life zoning issues of PHMR, but to familiarize stakeholders with new zoning concepts, and to play interactive "games" and stakeholder roleplaying exercises designed to provide attendees with the experience of looking at coastal management issues from other points of view and negotiate with other interest groups in a mock setting. By having fun, people learn to respect, listen to and consider needs of other stakeholders. Only in later workshops would the real life issues be brought to the table in a professionally mediated setting, once people are familiar with the new zoning concepts and have had the opportunity to experience the challenges and benefits of effective stakeholder engagement to arrive at decisions that are as equitable as possible to all.

It is proposed that in later consultations, an impartial, third-party mediator be contracted to facilitate later negotiation sessions with the stakeholders who will be impacted by the future management of PHMR. This would be a novel approach not only for PHMR but also for the wider Caribbean. Of 21 Caribbean MPAs surveyed in 2009, none had used a formal conflict resolution mechanism (Gombos et al. 2011). By pioneering this innovative approach and sharing lessons via a network of Caribbean MPA, TIDE could potentially improve outcomes for MPA management region-wide. TIDE does not currently have funds to afford professional mediation services and will therefore need to seek funding before this approach can be adopted.

c. Incremental Approach Process for Protection Zones

Replenishment study (Stage 1) - Based on the first phase of expansion proposed and ongoing consultations, it has been agreed among stakeholders that three of the Snake Cayes (Middle, South and West) are to be combined into one RZ, known hereafter as the "2013 hexagon", with the eastern half designated as a preservation zone (Figures 6 7, 8), encompassing the existing preservation zone of Middle Snake Caye. Before this delimitation is conducted and the new SI enforced, TIDE recommends a baseline study to determine current recruitment levels of the main commercial species (conch and lobster), comparing areas inside the existing circular Replenishment Zones with areas which are currently in the General Use Zone (GUZ) but that are to be encompassed by the new RZ expansion. By comparing recruitment before and after establishment of the expansion, it may be determined whether recruitment of conch and lobster has increased as a result. This summer (2014), TIDE is conducting a lobster juvenile recruitment study comparing old RZs with the new ones and they hope to repeat this with conch next year.

Monitoring of commercial species under TIDE's fisheries assessment program between the present and when the SI comes into force, and then after the SI comes into force, may determine whether this action has resulted in increased spill-over from the RZs to the GUZ. If so, this would provide the necessary scientific evidence to support the concept of spill-over effect – a crucial factor in building stakeholder support for the use of RZ expansion as a fisheries replenishment tool.

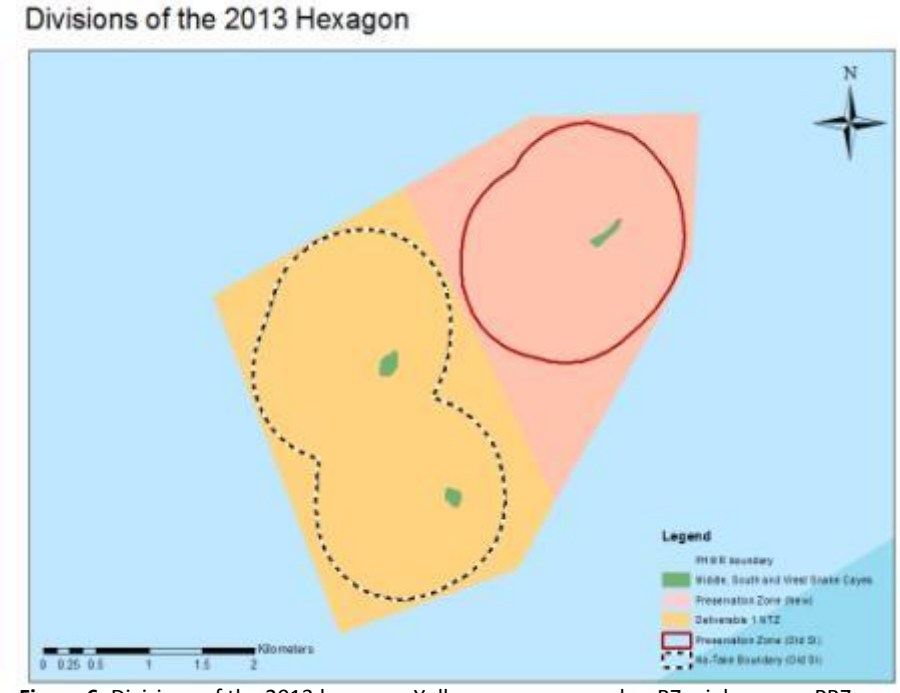

Figure 6: Divisions of the 2013 hexagon. Yellow area proposed as RZ, pink area as PRZ.

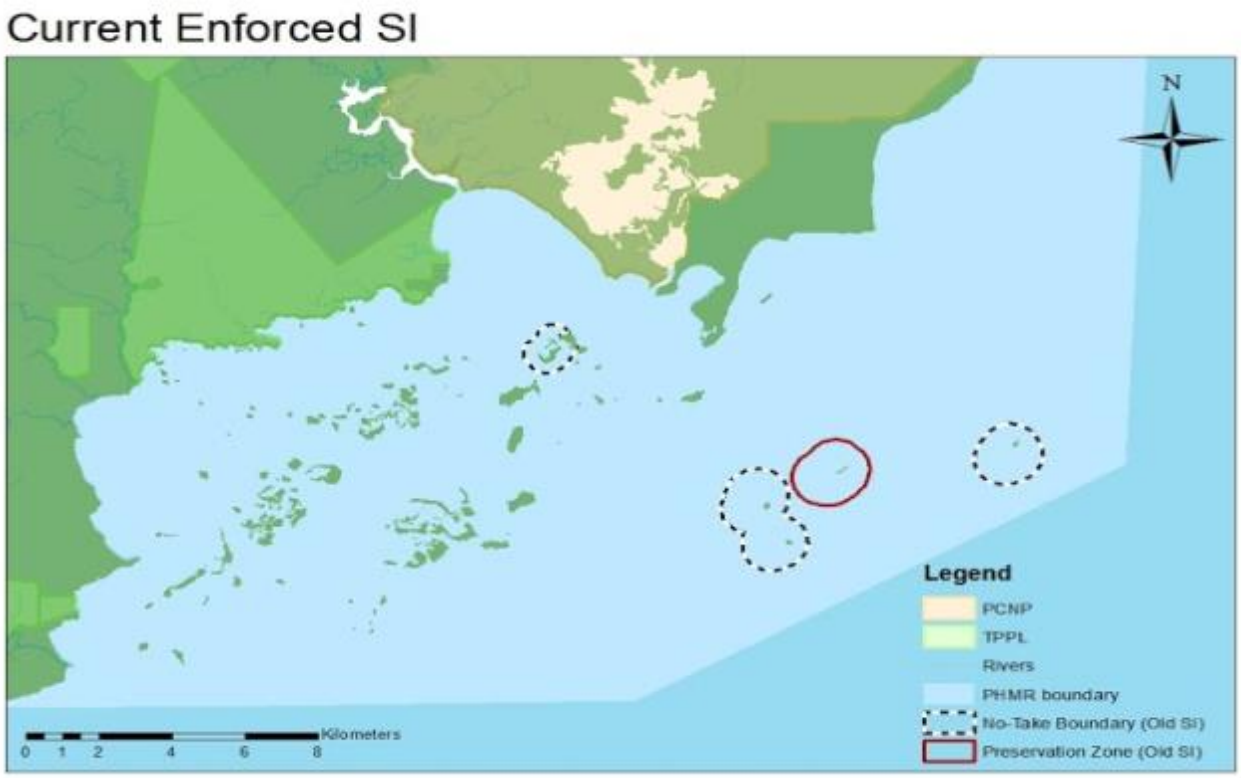

Figure 7: Original NTZs designated by 2000 statutory instrument

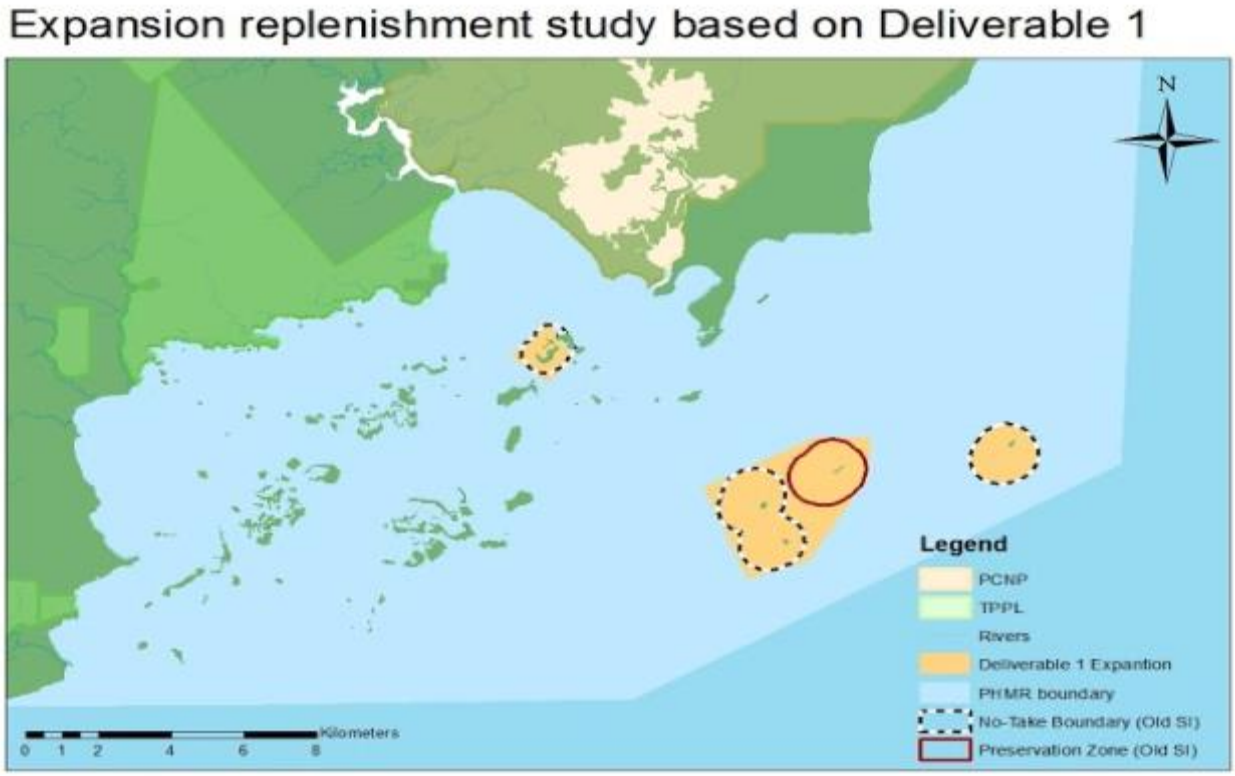

Figure 8: initial expansion agreed to during 2013 stakeholder consultation meetings – largest orange area encompasses Middle, South and West Snake Cayes and is known as the 2013 hexagon.

Managed Access log book data and TIDE/TNC's fisheries assessment program may help to determine potential increases in commercial species population densities. Furthermore, if fishers start experiencing more catch in subsequent years this may build confidence among fishers that further incremental expansion of the Snake Cayes RZ to encompass all four Snake Cayes under one contiguous zone (Figure 8). This would likely be an effective management strategy for bolstering commercial species replenishment in PHMR. It is proposed that an incremental expansion strategy be agreed upon with stakeholders, whereby further expansion would be considered based on results of fisheries monitoring and recruitment studies, as well as feedback from fishers regarding whether they are experiencing increases in catch.

Manatee and Goliath grouper Special Management Zones (Stage 2) - The Deep River area is known through research to be a key nursery area for the IUCN listed critically endangered Goliath grouper *(Epinephelus itajara)* and the IUCN listed vulnerable West Indian manatee (*Trichechus manatus)* (Graham 2010, 2011). It is proposed that this be designated as a manatee and Goliath grouper Special Management Zone (Fig. 9).

Figure 9: Locations of proposed Manatee and Goliath grouper special management zones in the Deep River area, and small areas near the mouths of Rio Grande, Middle River and Golden Stream.

Local Ecological Knowledge (LEK), primarily from fishers and the TIDE rangers, has indicated that manatee sightings are higher in areas where major river systems join the reserve. For this reason it is suggested that the river mouth areas of Rio Grande and Middle River and Golden Stream are also included as Special Management Zones for manatee (Figure 9).

For manatees, strict guidelines on boating routes, maximum vessel speeds and rules for tourism based manatee encounters, to be informed by a 2014 targeted research project conducted by TIDE to investigate baseline population and migration patterns of manatees in PHMR. In light of extensive research (Graham 2010, 2011) on the impact of fishing on the critically endangered.

An outright moratorium on fishing of Goliath grouper is recommended in the Special Management Zones in PHMR. While suggestions have been made to impose gear restrictions in these zones instead of a moratorium, fisher consultations and feedback from reserve staff indicate that this would be impractical, due to hand lines that are used for Goliath grouper also being used for multiple other commercial species. Additionally, this would be unenforceable, as in the case of set lines (lines attached to a mangrove root or pole in the sea left unattended by fishers for several hours at a time to catch Goliath grouper), which are virtually impossible to find by anyone except the setter, and impossible to know who is responsible. Therefore a moratorium is considered the only viable management strategy.

Existing traditional rights to fish for Goliath grouper in this zone, such as during Garifuna Settlement Day celebrations, would continue to be honored under special permit. Line fishing, bait fishing and conch and lobster fishing would also continue to be permitted at all times in Special Management Zones, as a compensatory measure for increasing size of RZs in the ecologically sensitive Snake Cayes area. Section 7 provides a more details communication and mediation process description.

Inner coastal TIDE Private Protected Wetlands Sport Fishing Zone (Stage 3)- The land-sea transition zone between TPPL Block 127, Block 130 and PHMR is recognized by local sport fishing guides as a hotspot for world-class sport fishing, especially of permit. Concurrently, TPPL Rangers report this coastline to be an enforcement challenge as it serves as a major access route for illegal hunting activities inside Blocks 127 and 130. The coastline here, which is dominated by dense mangroves penetrated by multiple natural waterways provide small boat access to a large inner brackish lagoon system similar to Punta Ycacos lagoon. TIDE's terrestrial protection funds currently are not sufficient to enable appropriate enforcement to prevent against such incursions, thought to mainly occur at night.

It is proposed that this area be designated as a "TIDE Private Protected Wetlands Sport Fishing Zone" (Figure 10) for which it is suggested that prospective users (sports fishers affiliated with licensed sport fishing operators) would pay a fee that could be allocated to TPPL for use of this zone for sport fishing of permit etc. on an exclusive basis. These funds could then be used to increase protection of TPPL and to enforce the sport fishing regulations in the inner lagoon, although it is thought that sport fishing guides would report sightings of illegal activities in the lagoon.

It has been recognized during 2013 RZ expansion consultations with PHMR stakeholders that some of the resistance to RZ expansion in PHMR is due to concerns that this will prohibit bait fishing in this area. As bait fish are not the priority conservation targets of this proposed zone, bait fishing would be allowed along the PHMR side of this coastline, but not in the wetlands.
Sport fishing is currently allowed in the entire of PHMR with the exception of the 1% preservation zone, yet sport fishing guides report dissatisfaction that their interests are not being

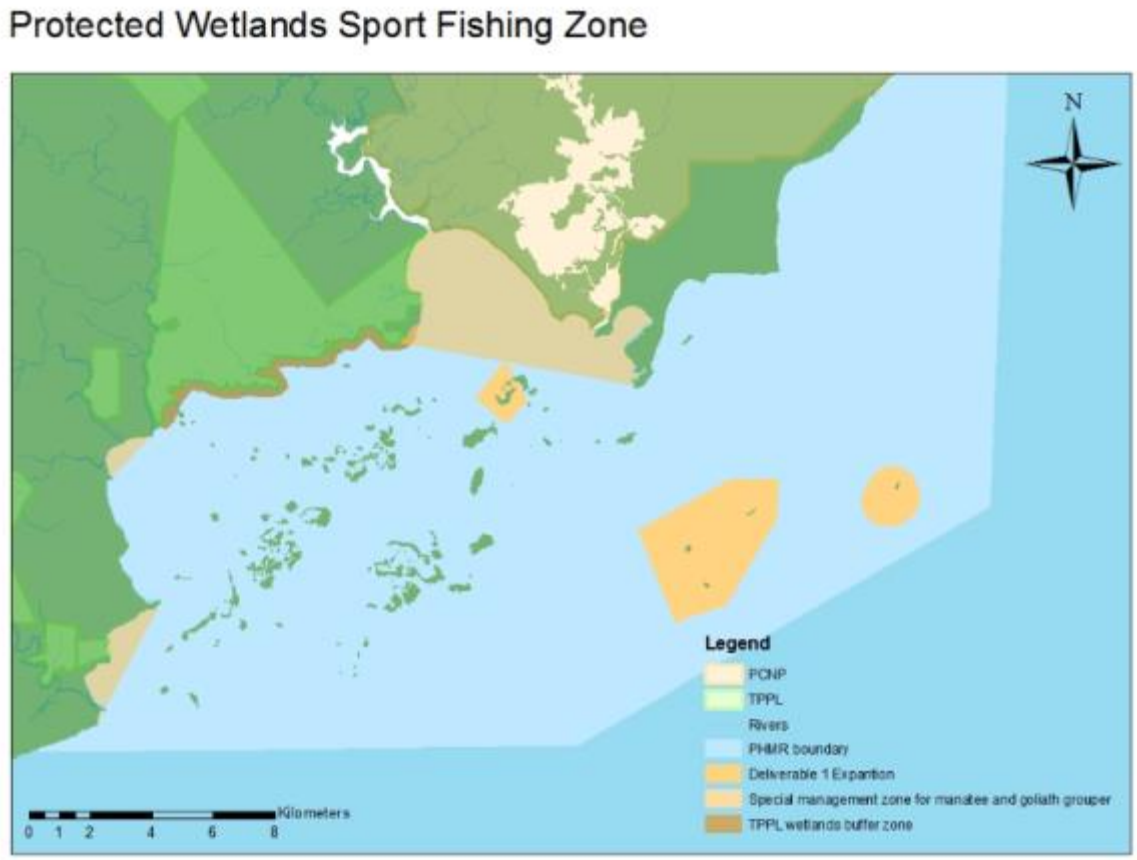

Figure 10: Showing location of TIDE Protected Wetlands Sport Fishing Zone along coast of Blocks 127 and 130.

taken into consideration in that there is nowhere that is exclusively allocated for sport fishing. Sport fishing tourists are willing to pay large amounts to visit PHMR and partake in world class sport fishing of permit, tarpon, snook and bonefish. Guides report bigger tips when they can give guests the experience of exclusivity, especially if they can fish in an area where there are no other boats (particularly commercial line fishing boats). It is thought that sport fishers would be willing to pay a fee for exclusive access to the inner lagoon system in Blocks 127 and 130, which could become a marketing tool, demonstrating effective management to preserve the sport fishing experience and providing a haven for this activity to occur without coinciding with commercial fishing activity.

This may place PHMR as a more desirable destination to prospective sport fishing tourists when choosing here over other destinations where no regulations exist to protect sport-fishing interests. This would require a unilateral agreement among sport fishing operators to require this fee to be paid by sport fishing tourists (similar to a successful initiative in Roatán, Honduras to enforce a non-statutory fee for using a marine reserve by unilateral agreement among dive shops to charge this to all their customers). Further consultation with stakeholders is necessary to determine

activity of local commercial snook fishers and bait fishing in this area. It is proposed that these activities could continue without fees along the ocean side of this coastline, to protect the interests of local Managed Access licensed fishers.

Zone 4 (Snake Cayes zone in Appendix 1) inclusion as a "no fin-fishing zone" and connection of 2013 hexagon around West, South and Middle Snake Caye with East Snake Caye as a conventional RZ (Figure 11). Stage 4

TIDE intends to monitor the effects of the 2013 hexagon with the participation of fishers to show the positive benefits of this expansion. Once fishers see the benefits, it is thought they will be much more willing to accept the idea of further expansion, a key factor in making further expansion a success. To make the RZ effective, and even with perfect compliance from local fishers, there will remain a need for sound enforcement to prevent trans boundary fishing. TIDE is investing in improving enforcement in PHMR with the aim of improving compliance with RZs. To compensate fishers for the short-term economic loss of foregoing fishing within RZs, TIDE is investing in alternative livelihood options for fishers with support of TNC, USAID, KfW and other funders. A seaweed farming trial is in the early stages and further alternatives are being explored, such as conch penning.

This is an important coral reefs site, and therefore TIDE is trying to follow the biophysical guiding principles (pg. 30) recommending to try to encompass entire reefs. Also, by having a buffer zone between the outer border of the reserve and the Snake Cayes that is more restricted, it will be harder for illegal trans-boundary fishers to enter unchallenged. The ideal from the

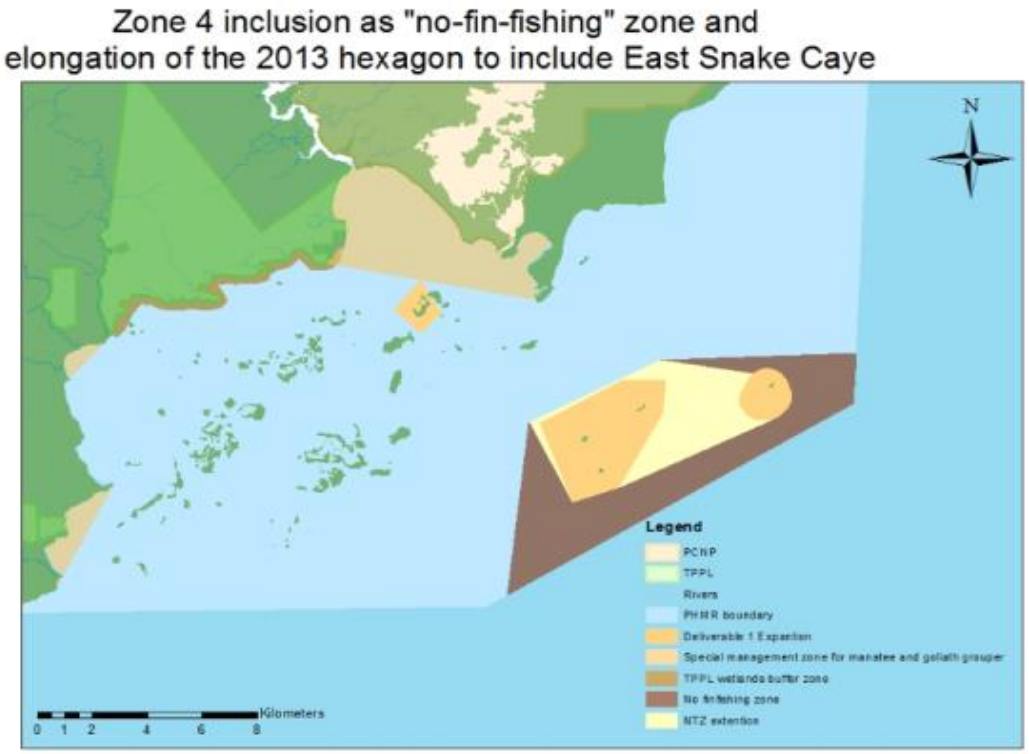

Figure 11: Zone 4 (dark brown) inclusion as "no-fishing" zone and elongation of the 2013 hexagon to include East Snake Caye.

conservation standpoint would be to have this as RZ so that no benthic species extraction would be allowed, but fishers are not going to support this at the start, so we thought it better to start

with fin fishing rules and hopefully work towards protection for other commercial species later on. Experience shows that fishers have a harder time getting used to new boundaries than to new rules within existing boundaries.

Sport fishing tagging study to determine connectivity between Deep River area and other parts of PHMR (Stage 5)

It has commonly been assumed that a high degree of fish and other ecosystem connectivity exists between Deep River area and the Snake Cayes, and this informed the basis of the proposal in 2010 to connect the two areas with one RZ. However, recent satellite imagery obtained from Remote Sensing Solutions GmbH under TIDE's habitat mapping project has revealed bathymetric, coastal current and sedimentation conditions that suggest a higher degree of ecosystem connectivity to exist between Deep River and the inner and mid ranges of cayes stretching northeast to south west in PHMR (Figure 12). By comparing TIDE water quality data (Figure 13) with the satellite information, the Snake Cayes are now thought to be under greater influence from oceanic currents and Monkey River to the north and north east, rather than from Deep River.

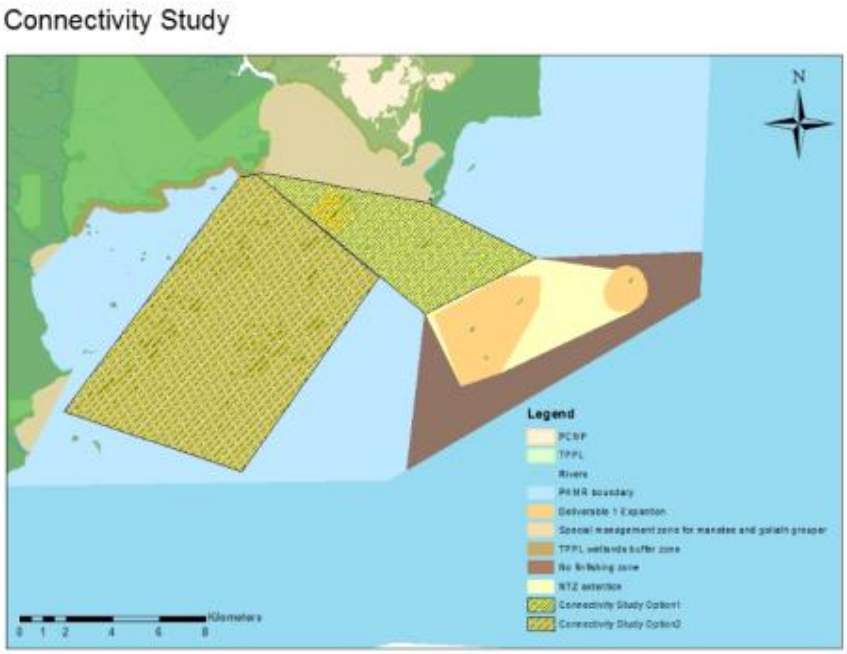

Figure 12: Areas under consideration for sport fish tagging studies and genetic studies to determine connectivity of Deep River area with Snake Cayes versus inner ranges of cayes in PHMR. Connectivity Study option 1 more closely follows recommendations from original Marxan recommendations, but is less likely to garner support from stakeholders due to concerns over too much impact on livelihoods. Option 2, while not connecting Snake Cayes to mainland via RZ corridor, may protect habitat that is more connected based on remote sensing data, commercial species surveys and connectivity studies of sport fish tags and genetic studies. Option 2 is also bigger than option 1, resulting in a greater area of PHMR

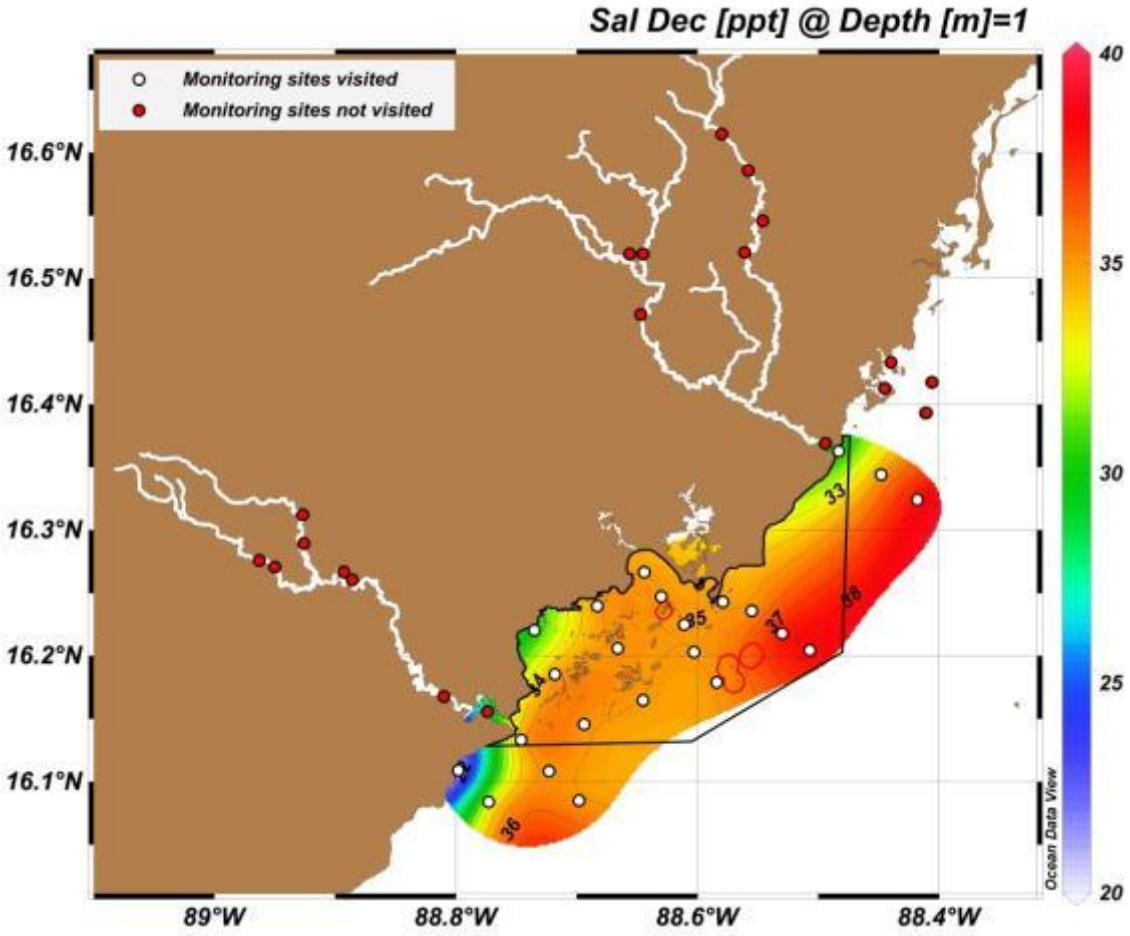

Figure 13: TIDE water quality data, such as this surface salinity map from December 2013 indicates greater influence at Snake Cayes from northeasterly oceanic currents rather than from Deep River area, whereas inner ranges of cayes are more sheltered from this oceanic influence, experiencing more influence from river runoff from Deep River, Middle River and Golden Stream. This is a common pattern observed during times of higher rainfall.

A **sport fish tagging study** being conducted by Dennis Garbutt, Dr. Robin Coleman and TIDE's research team is hoped to elucidate ecosystem connectivity of these areas with Deep River (zone 3 in map Appendix 1). This would provide the basis for increasing protection of the cayes in zones 1, 2 and 3 of Appendix 1 zone map.

Additionally, a **genetic connectivity study** is proposed as a means to obtain high quality interconnectivity information, depending on the outcome of the sport fish tagging study. This ecological corridor may not only be more important in terms of preserving ecosystem connectivity, but may be a more popular idea with fishers than increasing RZ size around the Snake Cayes. Further professionally mediated consultations are necessary to move forward with this proposed strategy outlined in the stakeholder consultation section of the Introduction to this report.

Connection of Deep River Special Management Zone with rotating RZs, rotating Sport Fishing Zone and rotating Open Zone (Stage 6):

Consultations have shown that many fishers are reluctant to accept large areas of PHMR as being under RZ protection due to the perceived permanence of this action. Fishers may be more willing

to support inclusion of RZs under a rotating system (Figure 14), whereby four zones of equal size would rotate every 3-5 years (time span to be determined with consultations, best available science and contemporary MPA theory). In each cycle, two of these areas would be under full RZ protection (including no sport fishing due to sports fishers having been given exclusive access to TIDE Private Wetlands sport fishing zone), one designated as a sport fishing zone (no fee to sport fish in contrast to TIDE private wetlands sport fishing zone, lobster and conch allowed, sport fishing allowed but not commercial fin-fishing), and the other as an open zone (General Use).

Effectiveness at achieving fisheries sustainability objectives of the rotating RZs would be monitored via population surveys by TIDE research team of commercial species (conch, lobster, sea cucumber, finfish) and sport fish species (snook, permit, tarpon, bonefish). Regular commercial species underwater surveys conducted by TIDE research team, as well as managed access catch log data could serve to monitor replenishment effectiveness in closed zones. It is anticipated that commercial fishers and sport fishers alike would experience increases in catch in open zones due to large areas being RZs, with excellent catches once closed zones open again. While commercial species in previously closed zones would be catchable after zones open, a 3-5 year rotation cycle would permit species to regenerate for a long time before being fished again, and during closed periods there would be significant spill over from these large RZs into neighbouring general use areas, with potential to support current fishing pressure and possibly sustain an increase in fishing pressure in future. Monitoring and evaluation would be required before advocating any increase in fishing pressure, but this would garner support from commercial and sports fishers.

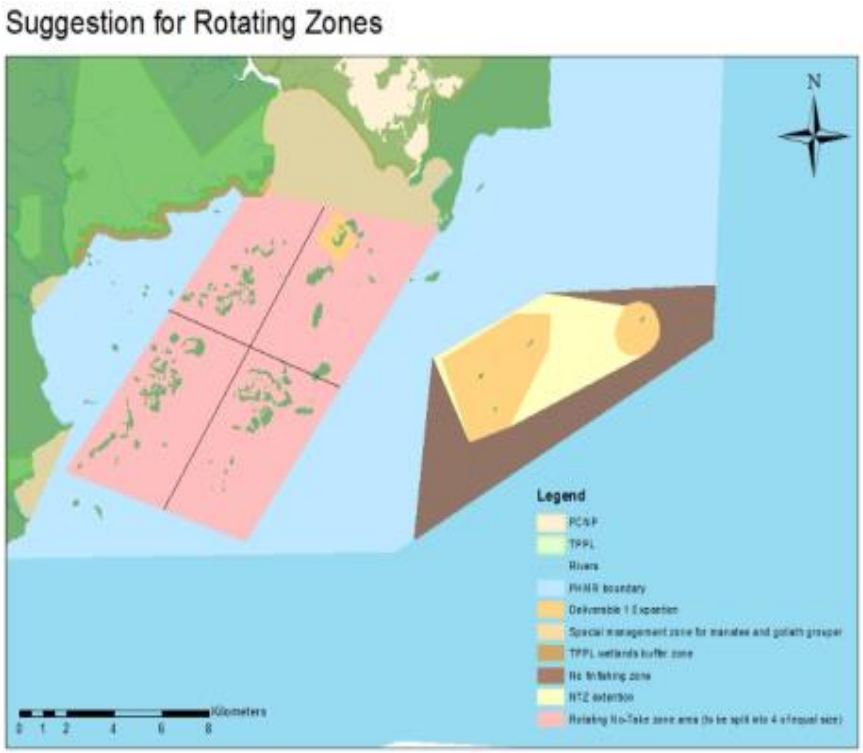

Figure 14: Approximate divisions of the four proposed rotating replenishment zones (dimensions to be guided by structured consultations), if the connectivity studies support ecosystem connectivity between Deep River area and Inner ranges of PHMR cayes. These could rotate on a 3-5 year basis (consultations), with two no take zones, one sport fishing zone and one open zone (general use) in any given rotation cycle. The four rotating zones would be equal in size, so that % under RZ status would not fluctuate from cycle to cycle.

d. Economic Diversification Zones

It is proposed that there be Economic Diversification Zones in PHMR where sustainable livelihood diversification projects can be piloted. These could include practices such as conch nurseries, caged fish farms etc., while a USAID funded seaweed farming project is already being piloted by TIDE (Figure 15). Ongoing and planned TIDE projects such as the 2014 habitat mapping survey will help to inform the suitability and locations of these diversification options. It is hoped that by producing alternative livelihoods and training to fishermen, new sustainable livelihoods that allow fisherfolk to maintain cultural connections to the sea can endure. This would reduce failure of alternative livelihood initiatives because the alternatives would be activities in which fishers can use their local fisherfolk knowledge.

RZ expansion will only really be effective if there is good compliance. Local resource users must buy in to the regulations. In order for that to happen, users need to see the benefits that RZs bring. By involving fishers in the monitoring of the recent 2013 expansion, and assuming we can effectively enforce the regulations against illegal transboundary fishers, it is anticipated that the fishers will see the benefits of RZs and be more likely to buy in to further expansion. Thus this incremental approach is considered to result in more effective and longer lasting positive impacts on sustainable fisheries management and continuing livelihoods.

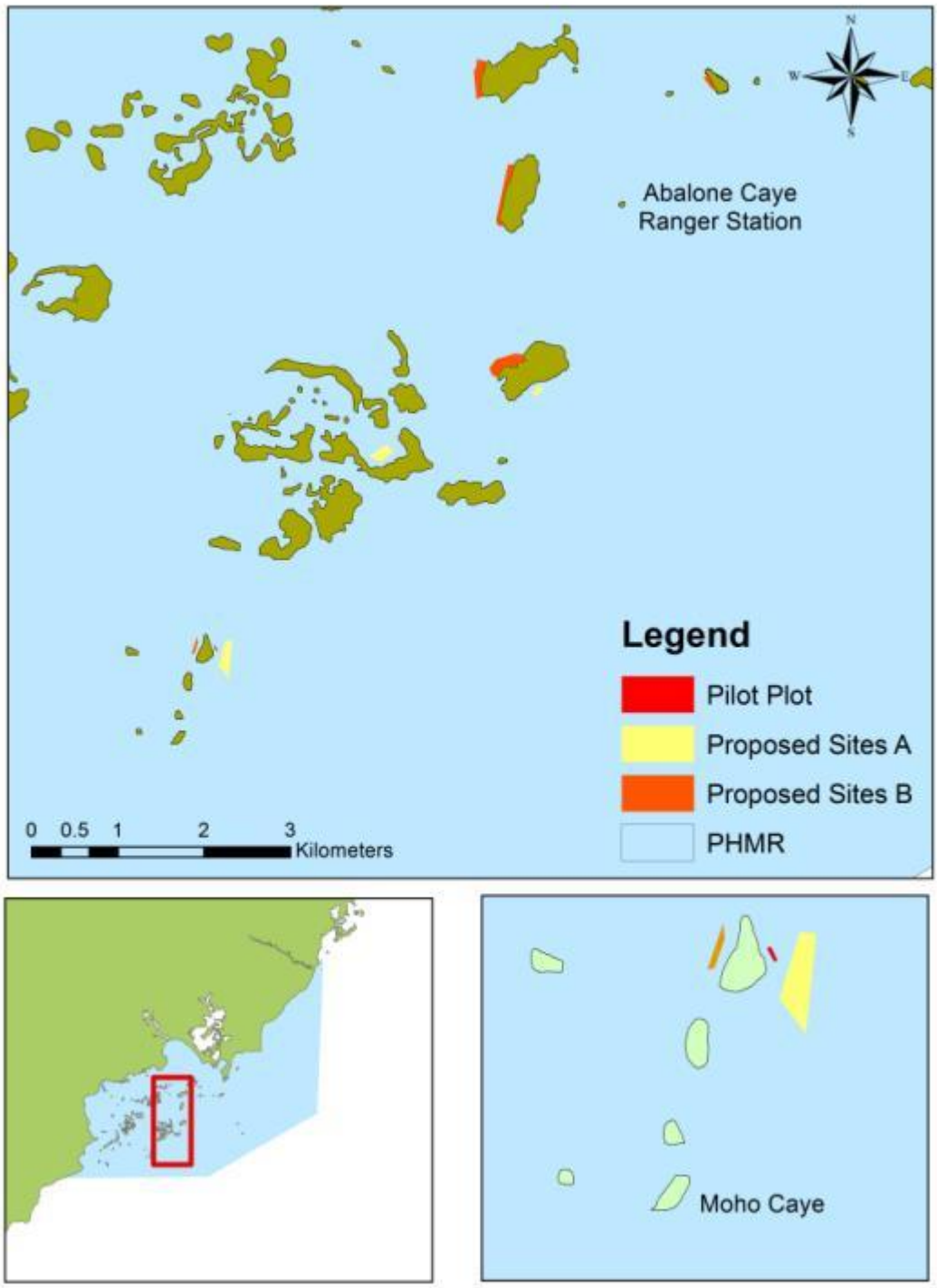

Figure 15: Sites in PHMR being proposed for seaweed economic diversification - Red: pilot site currently being used to test feasibility of seaweed farming in PHMR. Assuming success of the pilot phase, project may be expanded to proposed sites A and B. Yellow: sites suggested by Placencia seaweed farmers. Orange: Sites suggested by research team, Belize Fisheries Department and PHMR fishers.

SUMMARY PERCENTAGE COVER CALCULATIONS

Stage	Area under Increased Protection (Ha)	% of PHMR
0. Present Protected Area (Figure8)	1322	3.3
1. Proposed 2014 No-Take Expansion (Figure 9)	1781	4.4
2. Manatee and Goliath grouper Special Management Zone (Figure 10)	3103	7.7
3. Protected Wetlands Sport Fishing Zone (Figure 11)	1218	3.0
4. Zone 4 - no fin-fishing (Figure12)	2915	7.2
5. Connectivity of Snake Cayes as RZ (Figure 14)	2842	7.0
6. Rotating RZ's (total area) (Figure 15) Rotating RZ's 2	9999	24.8
	5000	12.4

MEDIATION PROCESS TIMELINE

TIDE is currently waiting to hear the results of the National Steering Committee for stakeholder participation. When this is received the timeline below can be acted upon:

Timeline Stage	Goal	Time - frame
1) Call for mediation proposals	Get ideas/second opinion from professionals about what should be involved in the mediation process	Month 1
2) Conduct stakeholder analysis	Identify who stakeholders are to gauge scale of mediation	Month 2
3) Mock mediation process with TIDE staff	Practice stakeholder engagement techniques for TIDE staff to become familiarized with new approach	Month 2
4) Invite interest groups identified during stakeholder analysis to put forward candidates to represent them	Ensure appropriate representatives of each stakeholder group or community are included in mediation. Mock mediation process will help inform the characteristics required of the individuals selected.	Month 2

5) First full consultation - scenarios workshop	Local involvement and awareness of new mediation methodology. Roleplay exercises using various fictional scenarios, getting stakeholders used to seeing coastal management issues from other points of view, learning to respect and consider needs of other stakeholders besides self. Build awareness of different options for marine management in mock setting.	Month 3
6) Second consultation - Current Proposal Ideas as described in D2	Stakeholders already familiar with new engagement processes, used to considering ideas in new and constructive ways, present TIDE's ideas and encourage teams to work in groups composed of multiple stakeholder interests. Must come back to final consultations to present plan.	Month 4
7) Third consultation – present results from previous session. Work on real life PHMR scenario.	Groups present plans that have incorporated multiple points of view, then given real life PHMR scenario with professional mediator present. Repeat procedures from second consultation with real life PHMR scenario.	Month 5-6

Once the consultation process is completed and an agreement of new concepts to trial is passed (e.g. rotating no take zones) a timeline for implementation can be generated. This will be specific to what is agreed on during the mediation process.

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APPENDIX 1: FISHING ZONE MAP AND FISHING MAP DESIGNS

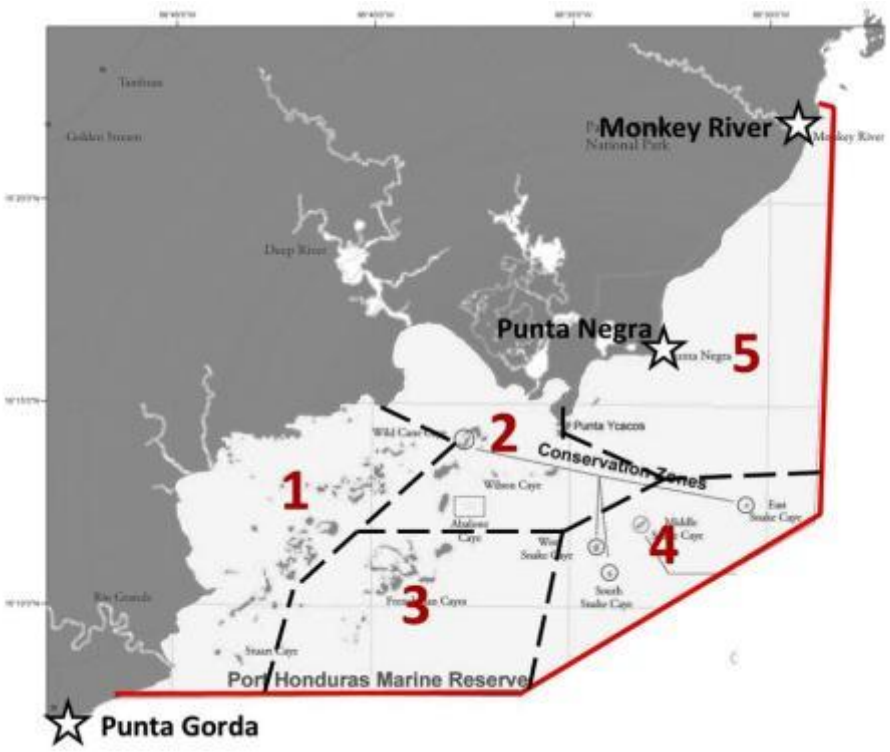

Figure 16: Zoning map being used for TIDE's ground truthing work in support of a remote sensing based habitat mapping project being conducted in PHMR in 2013. This is used in this document simply as an easy reference for describing different areas of the reserve and does not relate to the proposed management zoning plan.

Zone Descriptions:

PHMR Habitat Mapping Zones
Zone 1 - Rio Grande and Garbutt Range: Includes coastal waters between this island range (muddy inundated mangrove cayes) and mainland coast. Zone 1 has significant freshwater input from Rio Grande, Middle River, Golden Stream and Seven Hills Creek, as well as abundant runoff from TIDE Private Protected Lands (see TIDE protected areas map) in form of drainage from extensive wetlands along coastline. Human impact on Rio Grande is low – mostly runs through intact Broadleaf Forest and untouched mangroves in lower reaches. Characterized by low salinity and dissolved oxygen (see TIDE 2012 water quality report (Foley 2012). Zone 1 is poor for lobster, conch and finfish but good for sport fishing species (permit, tarpon, bonefish). Zone 1 cayes thought to be important refuge and nursery for juvenile fish of multiple species. Water greenish/brown, especially close to river mouths, very poor underwater visibility.
Zone 2 - Deep River and Abalone-Wilson: Significant freshwater influence from Deep River and surface run off from Paynes Creek region. A hotspot for manatees, juvenile Goliath grouper, popular for bait fishing and goliath grouper fishing, but not so much other fish products. Lobster and conch populations low, possibly due to low DO (observed in TIDE water quality data over several years) potentially caused by cloudy waters and sheltered conditions resulting in poor mixing from calm seas and minimal current. Human impact on Deep River is low, although Menonite farming area Pine Hill is growing in size and is located in the watershed. Mostly runs through intact Broadleaf Forest, pine savanna and untouched mangroves in lower reaches. Water greenish/brown, very poor underwater visibility. Extending seaward are Wilson Caye, Head Caye and Abalone

Caye - location of TIDE marine ranger station. Popular for lane snapper, conch, lobster. Cayes heavily mangrove dominated but with dry land created by stony coral rubble washing up. Not muddy and inundated as much as inner cayes. Water greenish, medium-poor underwater visibility.

Zone 3 - Frenchman: Southern central zone of PHMR dominated by Frenchman Cayes, a complex network of mangrove cayes, frequent manatee sightings. Fishing activity by Punta Gorda fishers relatively high due to close proximity to Punta Gorda. Popularity for bait fishing and lobster traps. Frenchman is the south part of the middle range of cayes of PHMR, extending in a band seaward from Moho Caye in zone 1. Zone 3 includes all cayes in this range south of TIDE's marine ranger station at Abalone Caye. Less freshwater influence than inner zones 1 and 2. Still sheltered but more influence from oceanic currents and more mixing of water. Deeper than inner zones (10-15m). Water greenish, poor underwater visibility.

Zone 4 - Snake Cayes: The four outermost cayes of PHMR. Most oceanic influence. Shallow patch reef environment surrounds east shores of the four Snake Cayes (West Snake, Middle Snake (PRZ), South Snake and remotest East Snake. Since establishment of PHMR each Snake Caye has had a small NTZ surrounding it to 0.5 miles from shore, with Middle Snake having PRZ status (research access only). 2013 fisher consultations with TIDE and BFD resulted in collective agreement on connecting three of the four Snake NTZs, creating a line surrounding West, Middle and South. These reefs were recorded as being the healthiest in the MBR in 2010, but have since declined, with lionfish finally being discovered there in 2013. There is a constant threat of illicit fishing by Guatemalan fishers, although the true extent of this activity remains unknown. TIDE fisheries data identifies a possible increase in illegal extraction in the NTZs since 2011. Water often clear blue or green. Reef depth <1m-15m, with offshore banks descending to 20m or more in places. Cayes sandy, stunted forest with shifting sand beaches and coral rubble soil inland. Beaches are hotspot for turtle nesting, monitored by TIDE. All Snake Cayes area is a focal point for TIDE conservation and research on reef health and fisheries sustainability. Shallow reef banks exist north and south east of the three inner cayes, important to Punta Gorda fishers for lobster, conch, sea cucumber and finfish. TIDE has a ranger substation on West Snake Caye, enabling night patrols of NTZs from 2013 in response to concern over illegal fishing.

Zone 5 - Monkey River: significant erosion of the mainland coast north of Punta Ycacos by northeasterly wind and currents. Sea south of Monkey River mouth sediment laden from the river. Seafloor more dynamic than rest of PHMR, offshore parts 30-40m shifting sand and mud. Furthest part of PHMR from Punta Gorda and therefore patrols in this northern region are less frequent. Smaller Punta Negra is a creole village that has seen a decline in population from 300-<20 over the last 15 years. This has been attributed by some to the banning of gill nets upon the establishment of PHMR in 1997. Remaining residents still actively fish using other methods. Most Monkey River fishers do not fish south of zone 5. The Monkey River watershed is more human impacted than other watersheds of PHMR from upstream deforestation, agriculture, livestock farming, river bank (riparian) deforestation and in-river gravel mining, all of which may have impacted the profile and water quality of the river. Loss of a cemetery, street of houses and park to erosion in Monkey River Village is believed by residents to be caused by impacts on the river. Fisheries in and near the river have also been impacted.

APPENDIX 2: GUIDELINES FOR EXPANSION OF REPLENISHMENT ZONES IN BELIZE (NATIONAL STEERING COMMITTEE FOR THE EXPANSION OF REPLENISHMENT ZONES IN BELIZE)

Biophysical Guiding Principles (Adapted from Great Barrier Reef Marine Park Authority)

The National Steering Committee for Replenishment Zones was established in 2013 with a mandate to guide the implementation of expansion of RZs in Belize. This committee is composed of:

- Belize Fisheries Department (BFD)
- National Protected Areas Secretariat (NPAS)
- Coastal Zone Management Authority & Institute (CZMAI)
- Belize Fishermen Federation (BFF)
- The Nature Conservancy (TNC)
- Healthy Reefs Initiative (HRI)
- Belize Coast Guard
- APAMO (of which TIDE is a member)
- Belize Fishermen Co-operative Association (BFCA)
- Environmental Defense Fund (EDF)
- Wildlife Conservation Society (WCS)
- Ministry of Tourism
- Forest Department

In order for the Belize Fisheries Department (BFD) to support the proposal, TIDE would send letter to BFD requesting changes to the PHMR Statutory Instrument (SI). BFD then gets the Government of Belize's Solicitor General to draft the new SI. **NOTE:** Before this process we have to go through our consultation process with stakeholders as articulated in this proposal.

Principle	Explanation
Have larger (versus smaller) replenishment zones	More effective in minimizing edge effects and generally more cost effective; also more effective for more mobile organisms; should be big enough to allow individuals of target species to complete all life stages; Dependent on local area, scale and management capacity
Have sufficient replenishment zones to ensure against negative impacts on some part of habitat type or bioregion	Amount and configuration of replenishment zones may be different for each habitat type or bioregion (e.g. may consider protecting larger areas where mangroves and coral reefs occur in close proximity; also consider

	proximity to each other e.g. should be ~ 10-30 km for reef fish species)
Replenishment zones should encompass entire reefs	Reefs are units with high level of connectivity. Dependent on scale and size of reefs.
Include reefs that are, or expected to be, resilient or resistant to climate change	These will be important sources of coral recruits to replenish areas affected by bleaching, etc.(possibly use HRI indicators to identify potentially resilient sites)
Represent a minimum amount of each habitat type in replenishment zones	Aim for 30% of each habitat type for representativeness in the overall network or system, across fisheries zones.
Include cross-shelf and latitudinal diversity in the network of replenishment zones	As above. The replenishment zones should also represent the diversity of the system. Cross shelf diversity is also important in the case of linked habitats (e.g. mangroves-seagrasses-coral reefs within 2.5 km of each other – recommendation of 50%).
Base choices on the best available information and apply the 'precautionary approach'	Natural world = variation An insurance against uncertainty.
Include special and unique places (rarity)	Important to capture these in the network and ensure that it adequately protects biodiversity; protection of spawning and nursery areas (e.g. spawning aggregation sites – 80%)
Take into consideration adjacent marine and terrestrial uses in determining replenishment zones.	Good to include existing replenishment zones and areas adjacent to terrestrial protected areas, as then likely to have greater integrity and value.
Connectivity	Source vs Sink – incorporation of both based on currents
Include areas that do not need high investment	Areas should not be degraded or located in areas where there are high threats/impacts. Focus should be on maintenance, not restoration.

Social, economic, cultural and management feasibility Guiding Principles

Principle	Explanation
Maximize complementarity of replenishment zones with human values, activities and opportunities	Achieved by: ➢ Following a consultative process ➢ Protect traditional users as far as possible ➢ Protect areas the community identifies as special or unique ➢ Minimize conflict with users
Ensure that selection of replenishment zones takes into account social costs and benefits	Recognize the following: ➢ Relative social costs & benefits ➢ Spatial equity ➢ Planned and approved activities ➢ Requirements for monitoring ➢ Potential for revenue generation for MPA management
Maximize placement of replenishment zones in locations that complement present tenure arrangements	Take into account the following: ➢ Existing zoning, management plans, strategies, etc. ➢ Tenure ➢ Potential future fishing pressure (e.g. expansion in the deep-water fishery) ➢ Reduce conflict amongst users (tourism & fishing)
Maximize public understanding and facilitate enforcement of area	Design replenishment zones with simple shapes, with clear boundaries, and that are enforceable.