Belize Sustainable Ocean Plan

Coastal Zone Management Authority & Institute

Multi-Stakeholder MSP Workshop 1: Assessments for Planning

May 8 – 10, 2024 – Day 3

Belize Biltmore Plaza Hotel, Belize City

Workshop Purpose

- Kickoff participatory spatial planning activities to achieve Milestones 4 and 6 within the scope and goals of the larger BSOP process.

- Define and initiate key assessments to enable spatial planning.

Desired Outcomes

Day 1

- Understanding of key MSP steps and assessments
- Awareness of areas under consideration for new protections
- Current conditions considered
- Possible future scenarios developed

Day 2

- Success criteria and indicators defined
- Compatible and incompatible uses identified
- Zoning approach defined

Day 3 – TODAY!

- **Understanding of the Ocean Use Survey (OUS) results**
- **OUS results verified**
- **Understanding how Marxan can inform and support the BSOP process**

Agenda: Day 3

Time	Topic
9:15	Welcome and recap of day 2
9:30	Overview of Ocean Use Survey
10:45	*Coffee/tea break*
11:00	High-level Marxan overview
12:30	Closing session
12:45	Workshop adjourns

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Housekeeping reminder

- Restroom are located outside of the building on the left.
  - Exit the main doors and turn right to leave the building.
- Breaks, snacks & lunch provided
- Wifi network: BSOP Workshop
- Wifi password: WORKSHOP2024

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Ground rules for participation

1. Arrive and return from breaks on time.
2. Listen with an open mind. Assume good intent and refrain from side conversations or interrupting.
3. Seek first to understand, then to be understood.
4. Raise your hand to ask clarifying questions.
5. Share relevant information concisely and stay on topic.
6. Focus on interests, not positions.
7. Agree on the meaning of key words.
8. Silence phones. Take calls and check emails during a break.

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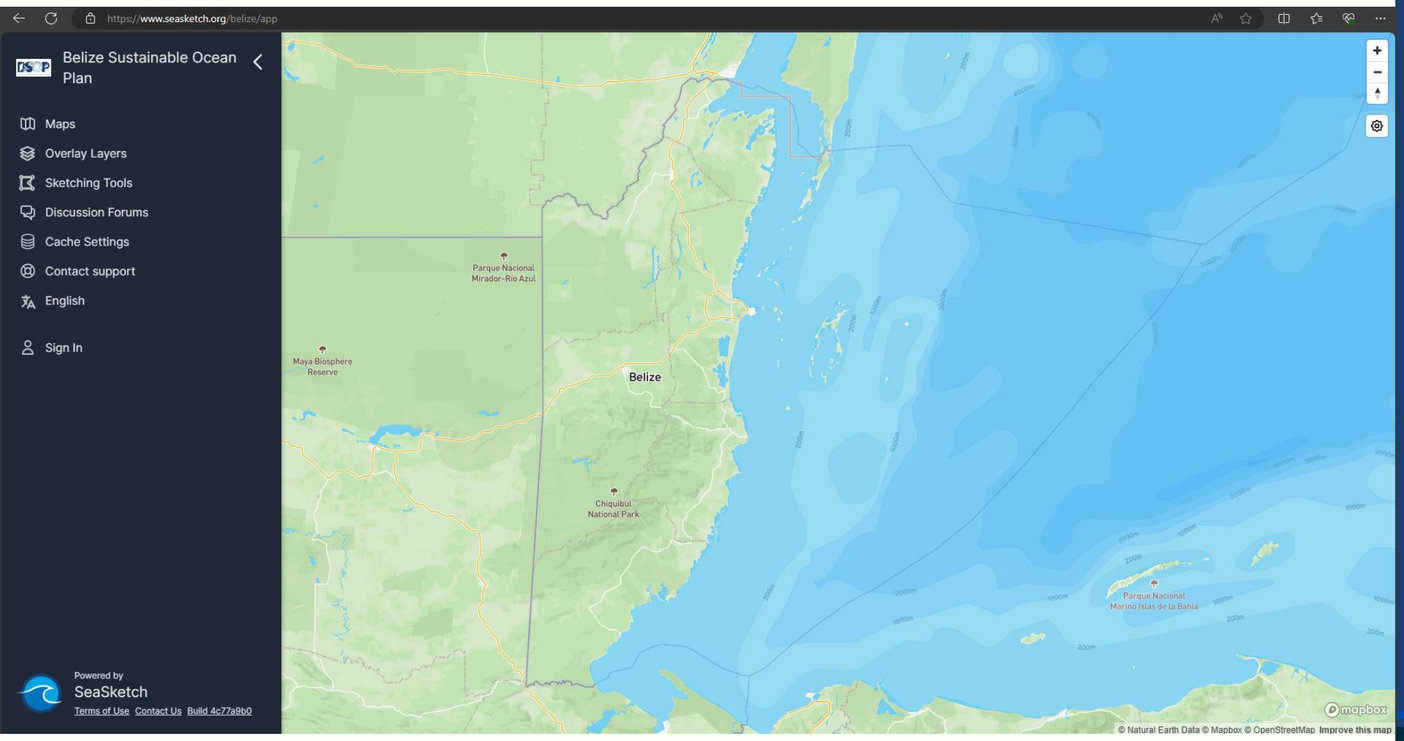
Belize Ocean Use Survey(OUS)

Agenda

- What is Seasketch?
- Review of methodology
- Overview of results
- Interactive verification session to identify gaps and/or anomalies
- Next steps (Seasketch Planning Tool, data refinement; integration into Planning Tool and Marxan)

SeaSketch was developed by researchers at the McClintock Lab at the Marine Science Institute of the University of California Santa Barbara (UCSB)

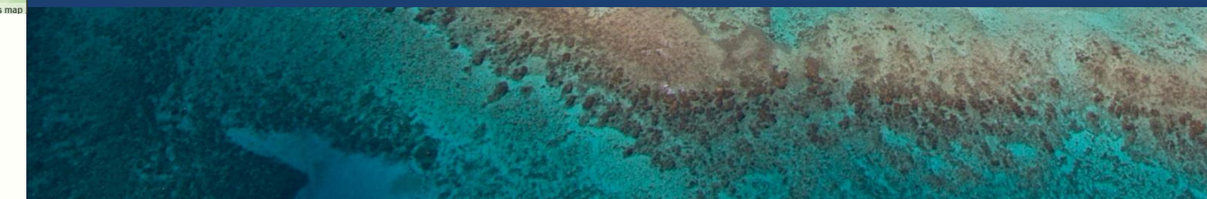
UC SANTA BARBARA



What is Seasketch?

Is a decision support platform with sketching tools for collecting mapped based surveys.

It is a platform specifically designed for MSP as it allows for all its data layers, designs and analytics to be publicly accessible.



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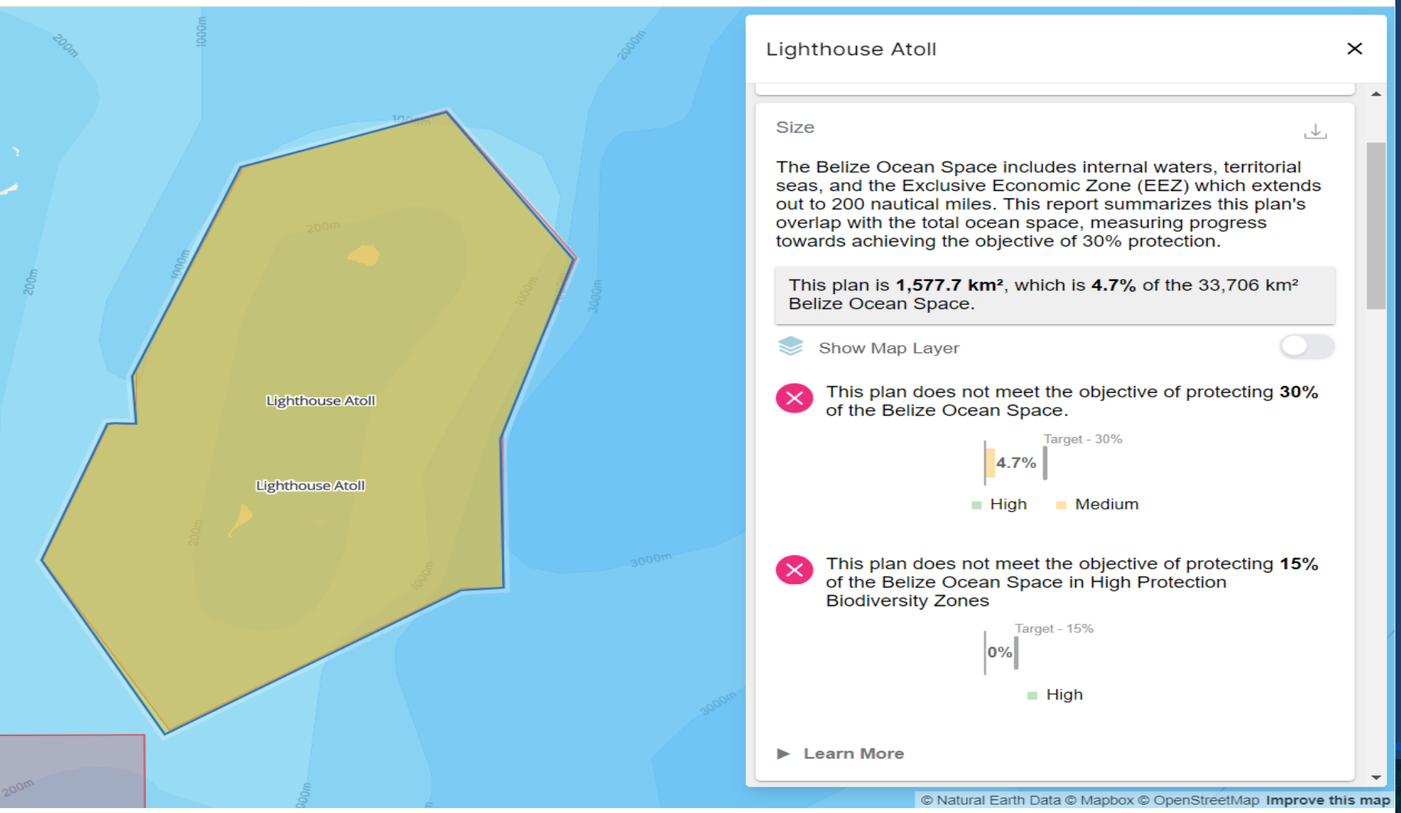

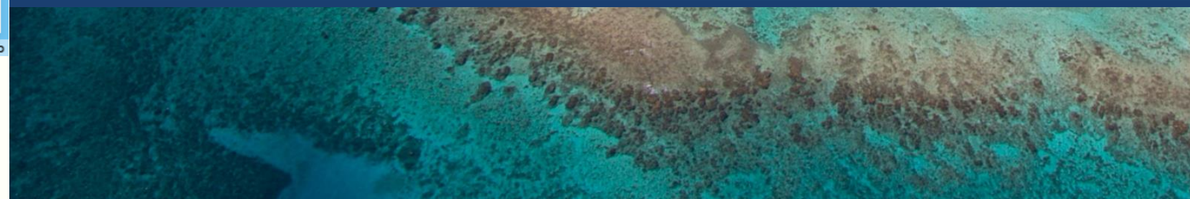

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Implementation Strategy

Consent Form

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Ocean Use Survey Informed Consent Form

Introduction:

My name is [**NAME OF ENUMERATOR**], [**SPECIFY AFFILIATION**]. I am an interviewer for the Belize Sustainable Ocean Plan (BSOP) Ocean Use Survey that is being implemented by the Coastal Zone Management Authority and Institute (CZMAI) in collaboration with The Nature Conservancy (TNC). CZMAI is a quasi-government agency and is the leading authority in the sustainable management of Belize's coastal resources and TNC is a non-profit organization that works around the world including in Belize. The BSOP is a comprehensive plan that aims to guide sustainable use of marine resources in Belize and is expected to designate up to 30% of Belize's ocean as Biodiversity Protection Zones (BPZs). The mapping of ocean use is critical for the BSOP process, and as such, this survey aims to fill data gaps about ocean activities and local knowledge on how the ocean space is being used. Respondents have been randomly selected representing sectors in their communities such as Fisheries/Aquaculture, Tourism, Coastal development, Energy, Finance & Investment. You are being asked to identify areas you use and to show how you value these ocean spaces. To capture this information, the survey is being conducted via SeaSketch. SeaSketch is a participatory mapping platform designed to sketch, value and plan uses of ocean spaces.

Purpose:

The purpose of these surveys is to better understand the various activities, interests, and concerns related to our coastal and marine areas. The information gathered will be useful in the development of the BSOP, which aims to promote sustainable ocean governance, strengthen marine resource management, and foster inclusive stakeholder engagement. Upon collection and validation, survey data will be integrated into the BSOP planning process. This information will serve as a foundational, baseline dataset, providing a detailed picture of how and where stakeholders use Belize's ocean space and resources. After all the information has been compiled, the next phase will be a planning process, where the information gathered will be presented in one collective form from the data gathered from the OUS

Your Participation:

To participate in the survey you must be 18 years old or above, your participation in these surveys is

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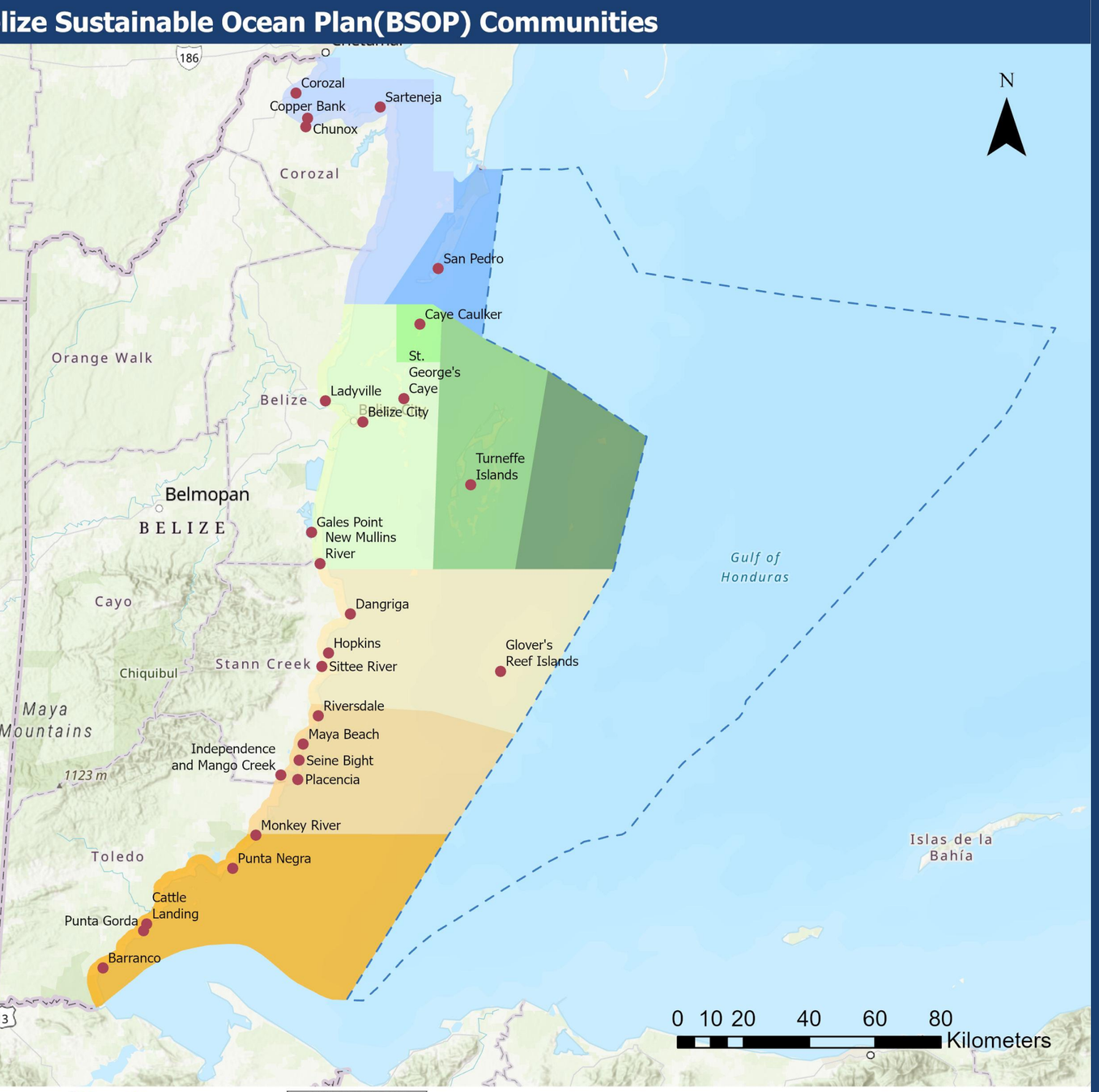
Ocean Use Survey & Particpatory Mapping Implementation Strategy

WHY ARE WE USING SEASKETCH?

Through the use of SeaSketch, a decision support tool, BSOP can determine current conditions and plan for the future uses.

This can be done with the sketching tools of SeaSketch which provide spatial information needed for the MSP process. SeaSketch also is very vital to the process as it represents the core principles of MSP by fostering inclusivity and equity as it augments planning contributions from technical stakeholders and the general public.

Decision making is further supported by SeaSketch as it can be coupled with other support and analytic tools such as MARXAN within the planning process.



Looking at Coastal Communities

- 26 Coastal Communities
- Turneffe Atoll
- Glovers Atoll
- Lighthouse Atoll

Partnerships and Collaborations

Enumerators:

One-on-one interview

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BSOP

OCEAN USE SURVEY

COMMERCIAL FISHERS

CONSULTATION INVITATION

FEB 9 2024

5 PM - 7 PM

SAN PEDRO
Town Council
Conference Room

FOR MORE INFORMATION CONTACT US:

http.bsop.coastalzonebelize.org | bsop@coastalzonebelize.org | 223-5739 or 223-0719

The Nature Conservancy Belize

Belize Fund For A Sustainable Future

BLUE BOND

BSOP
Belize Sustainable Ocean Plan

Focus-Groups

Site visit and Remote

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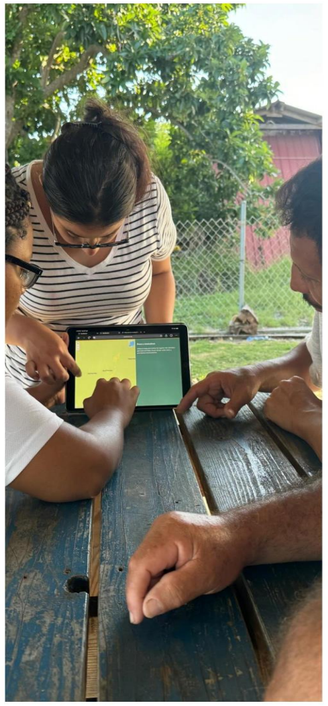


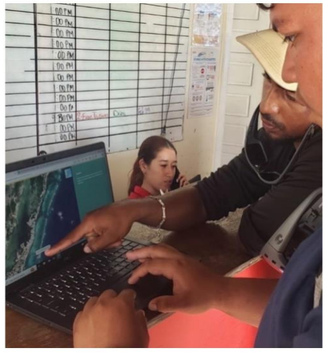
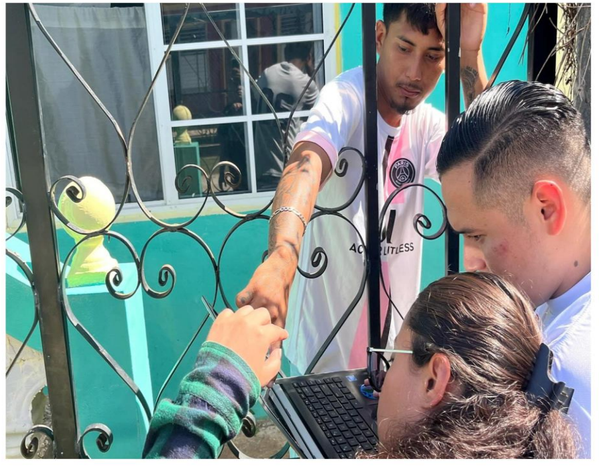

Leela's
Bistro

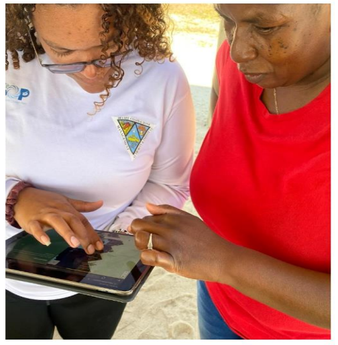





DIESEL


ARTELE
E THE SUN SETS ON THE WATER



HOPE

Welcome, Ocean Users!

We are interested in learning about how you use and value ocean space. This survey will ask you to identify areas of importance within the ocean by drawing on the map and indicating the relative value of those areas to you.

Your individual responses will be kept confidential. We will summarize and generalize information across multiple respondents to protect your privacy. The information will be used to create data to be used in an upcoming ocean planning process.

Click here to view an example summary heat map depicting valued commercial fishing areas in the Azores.

Need help? Contact Will McClintock.

Begin | Language | Settings

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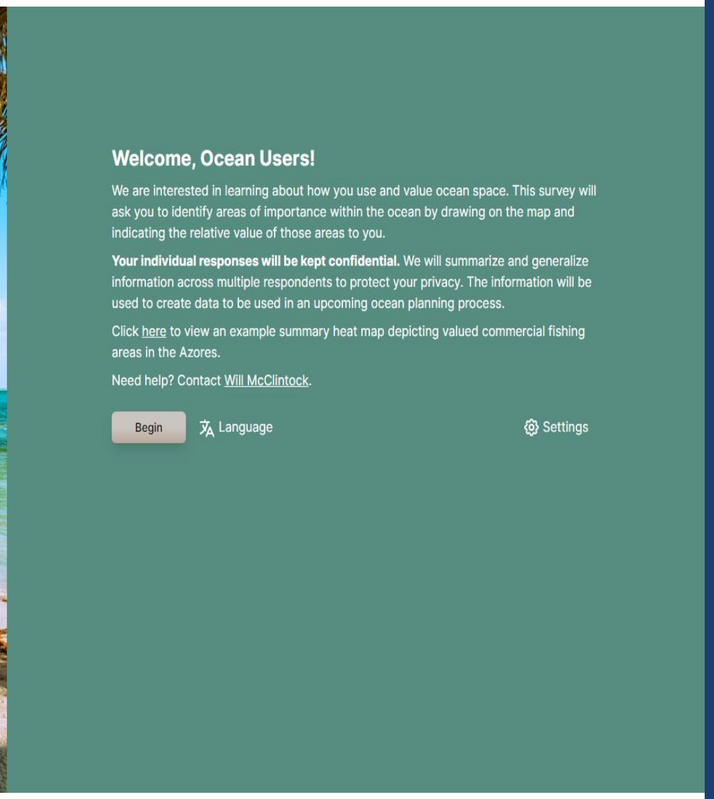
Begin | Language | Settings

Lessons Learnt



Online vs Offline

Virtual vs In-person

Focus Group Sessions

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Results

seasketch

Data updated
2024-05-07 10:01:01 PDT

563
Survey Responses

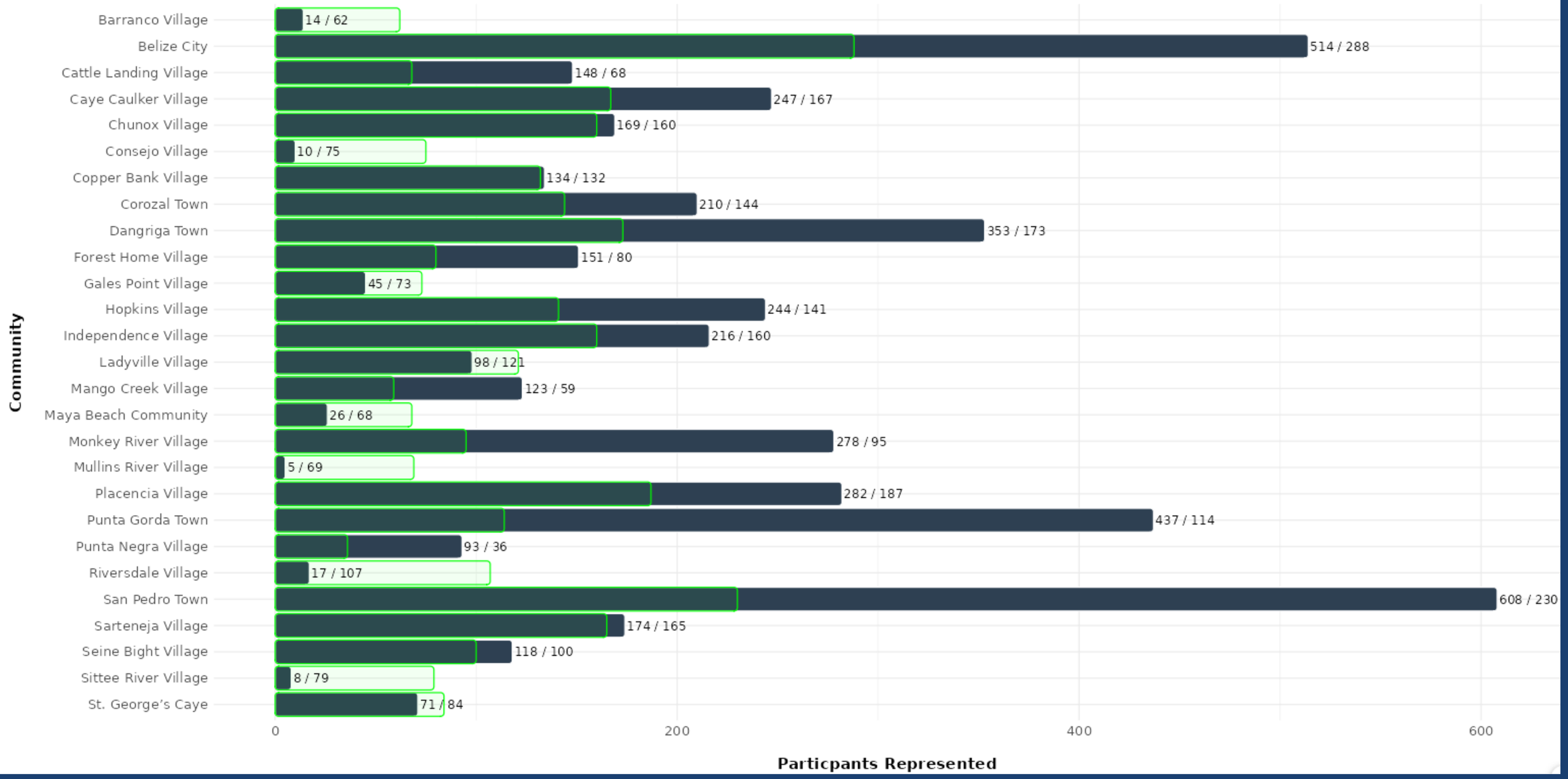
2295
Participants Represented

730
Sector Responses

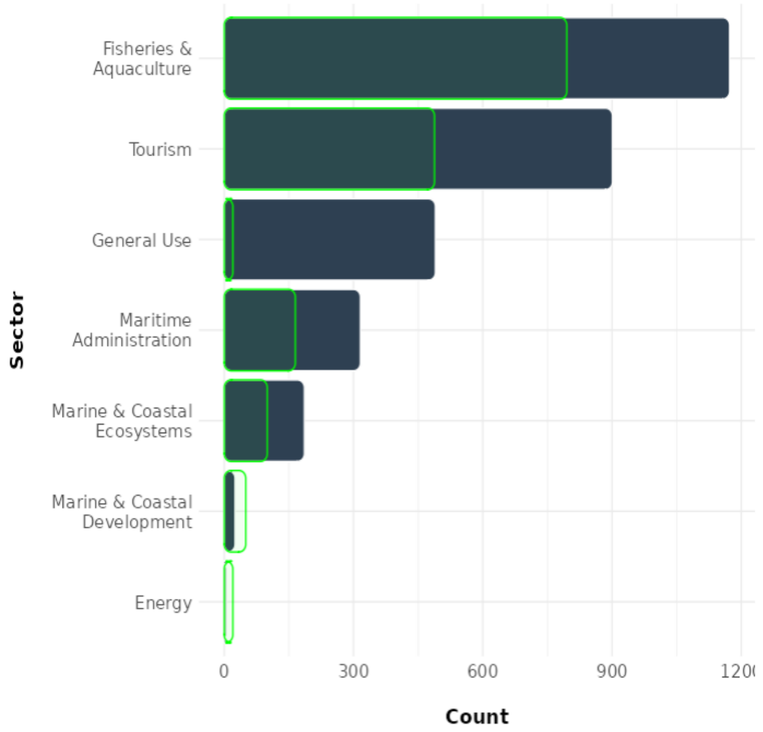
Sector Targets

	Metric	Target	Participants	Percent achieved
1	Energy	20	5	25%
2	Finance & Investment	20	0	0%
3	Fisheries & Aquaculture	795	1173	100%
4	General Use	20	490	100%
5	Marine & Coastal Development	50	25	50%
6	Marine & Coastal Ecosystems	100	186	100%
7	Maritime Administration	165	316	100%
8	Tourism	488	901	100%

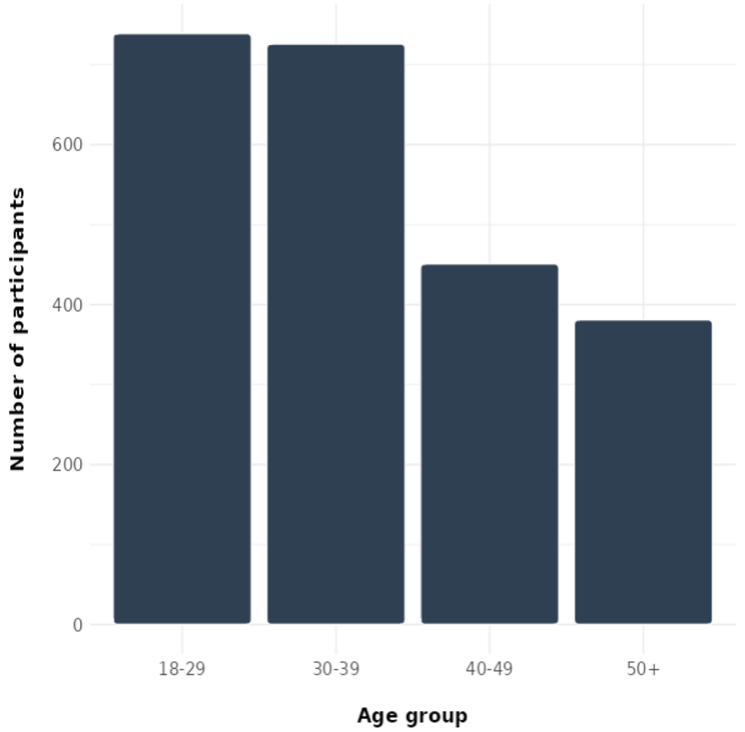
Community Targets



Responses by Sector



Demographics



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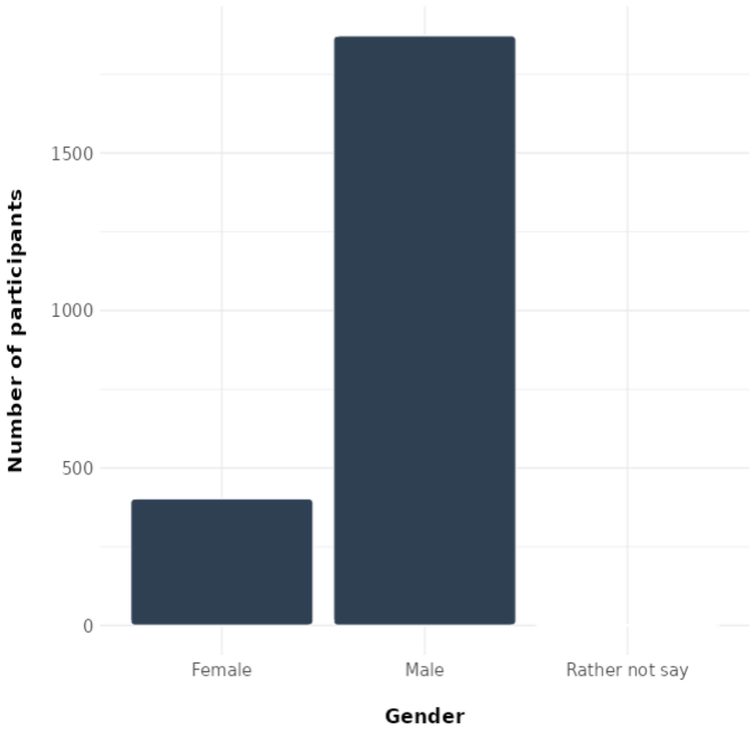
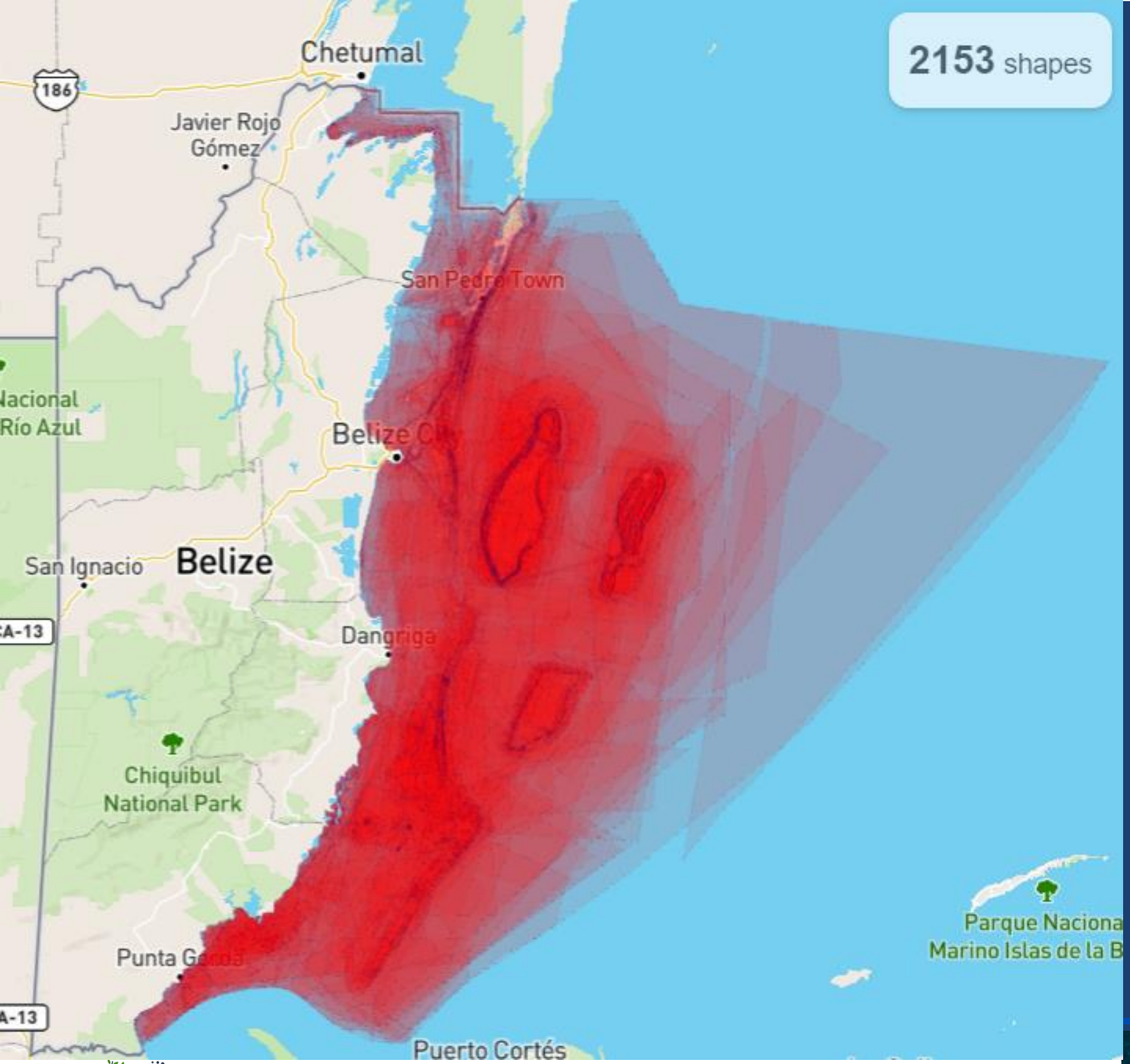
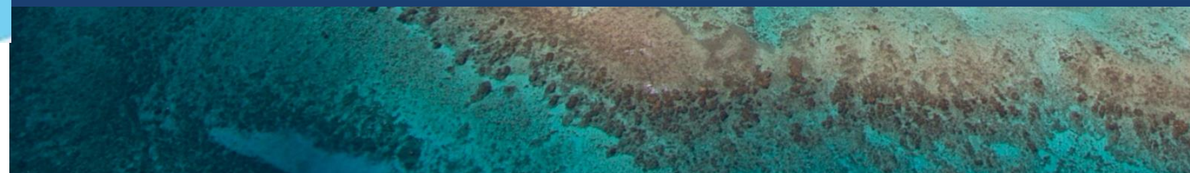


Fisheries Breakdown

	Fisheries Type	Responses	Participants
1	Aquaculture/Mariculture	5	63
2	Commercial Fishing	184	868
3	Non-Commercial - Recreational Fishing	33	121
4	Non-Commercial - Subsistence	63	173
5	Non-Commercial - Unspecified	4	10
6	None Selected	12	70
7	Sports Fishing	57	281
8	Aquarium Trade	0	0



2,153 polygons



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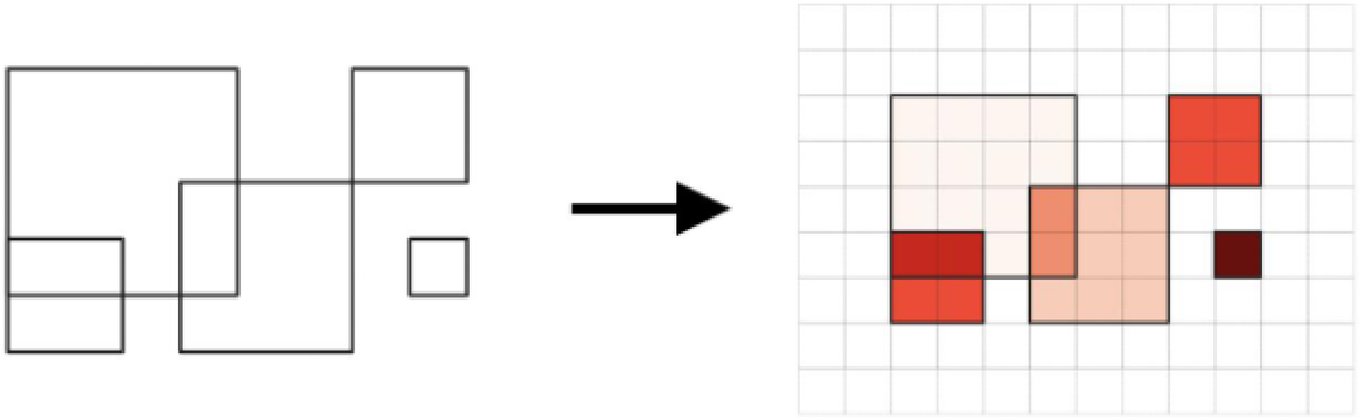

Heat Map methodology

- Spatial Access Priority Mapping (SAPM)

- assigns importance, a relative value between 1 and 10
- Respondents have 100 points of importance to allocate among the shapes they draw for a particular sector

$$\text{Value} = \frac{\text{Individuals represented x importance}}{\text{Area km2}}$$

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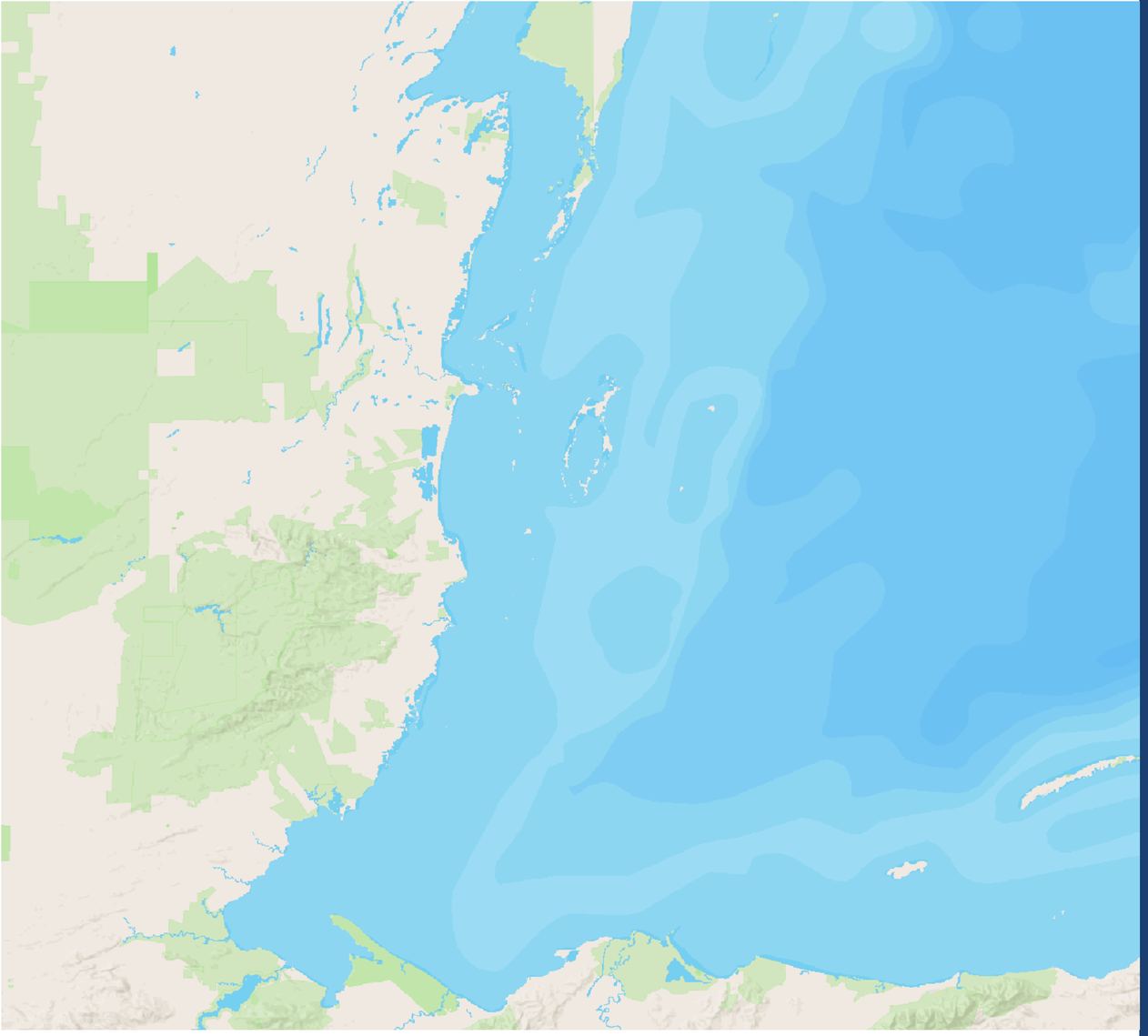
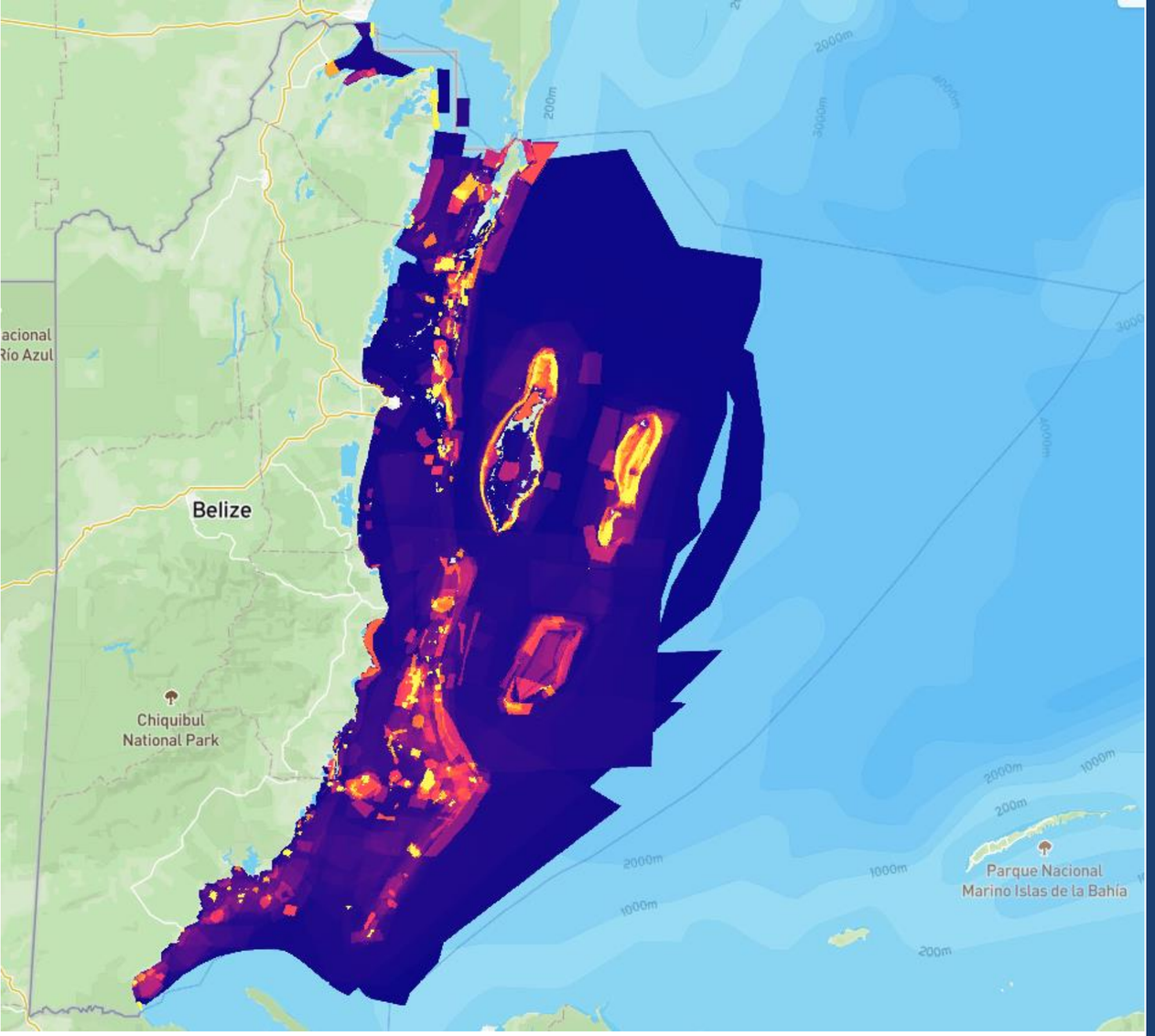


FISHERIES SECTOR

How is ocean space used and valued?



FISHERIES SECTOR

How is the Fisheries Sector using the ocean space and valuing it?

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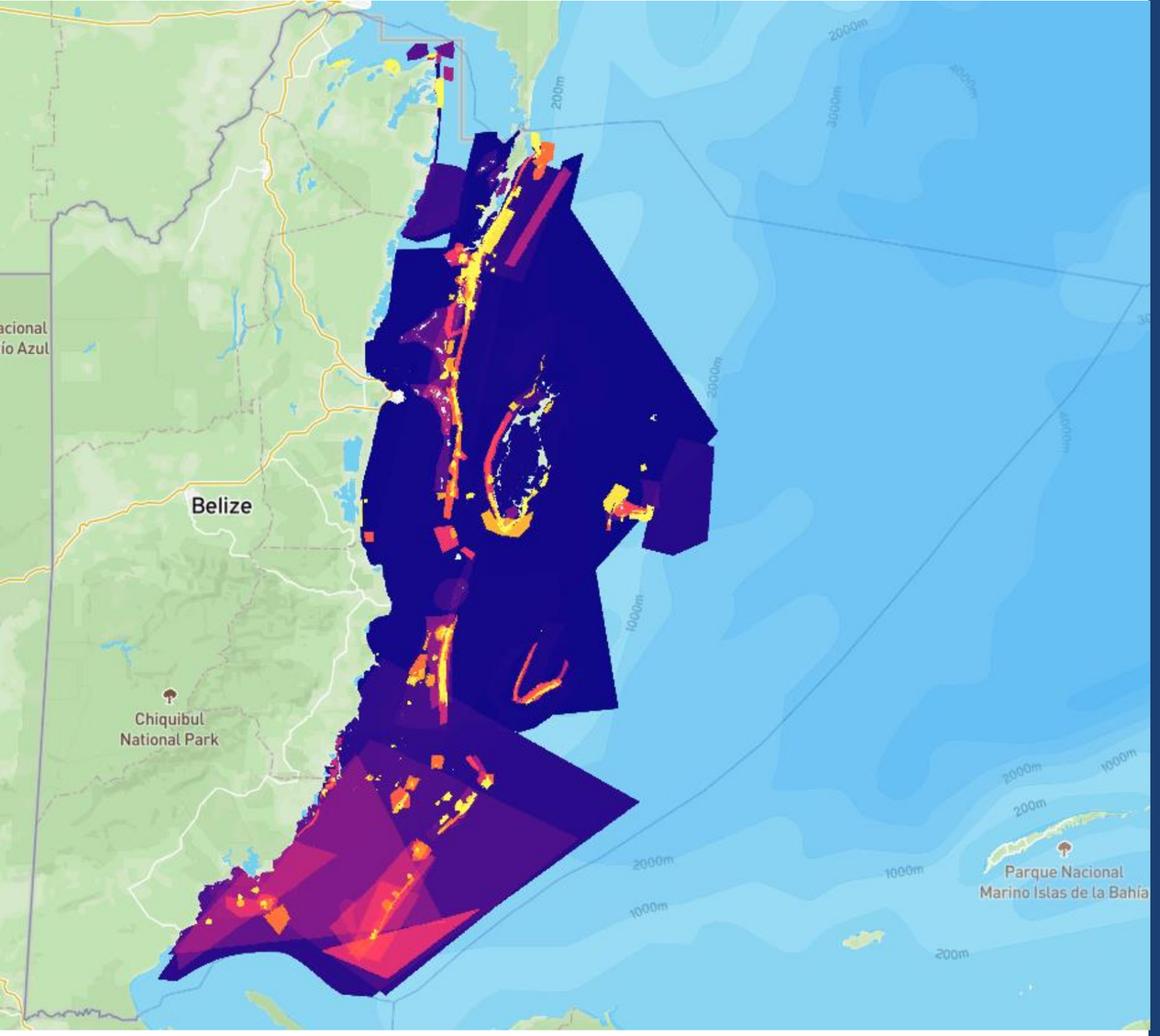
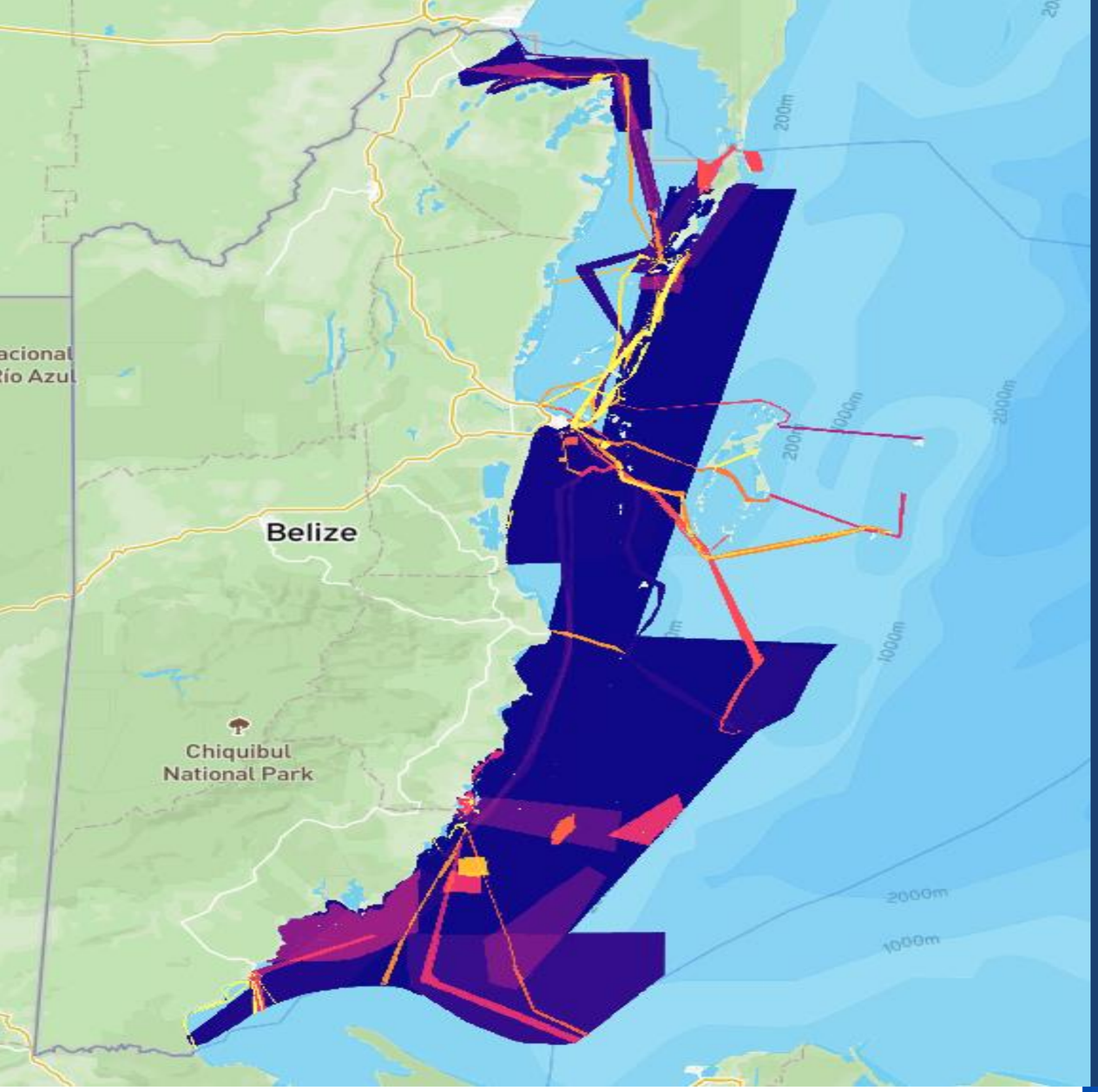


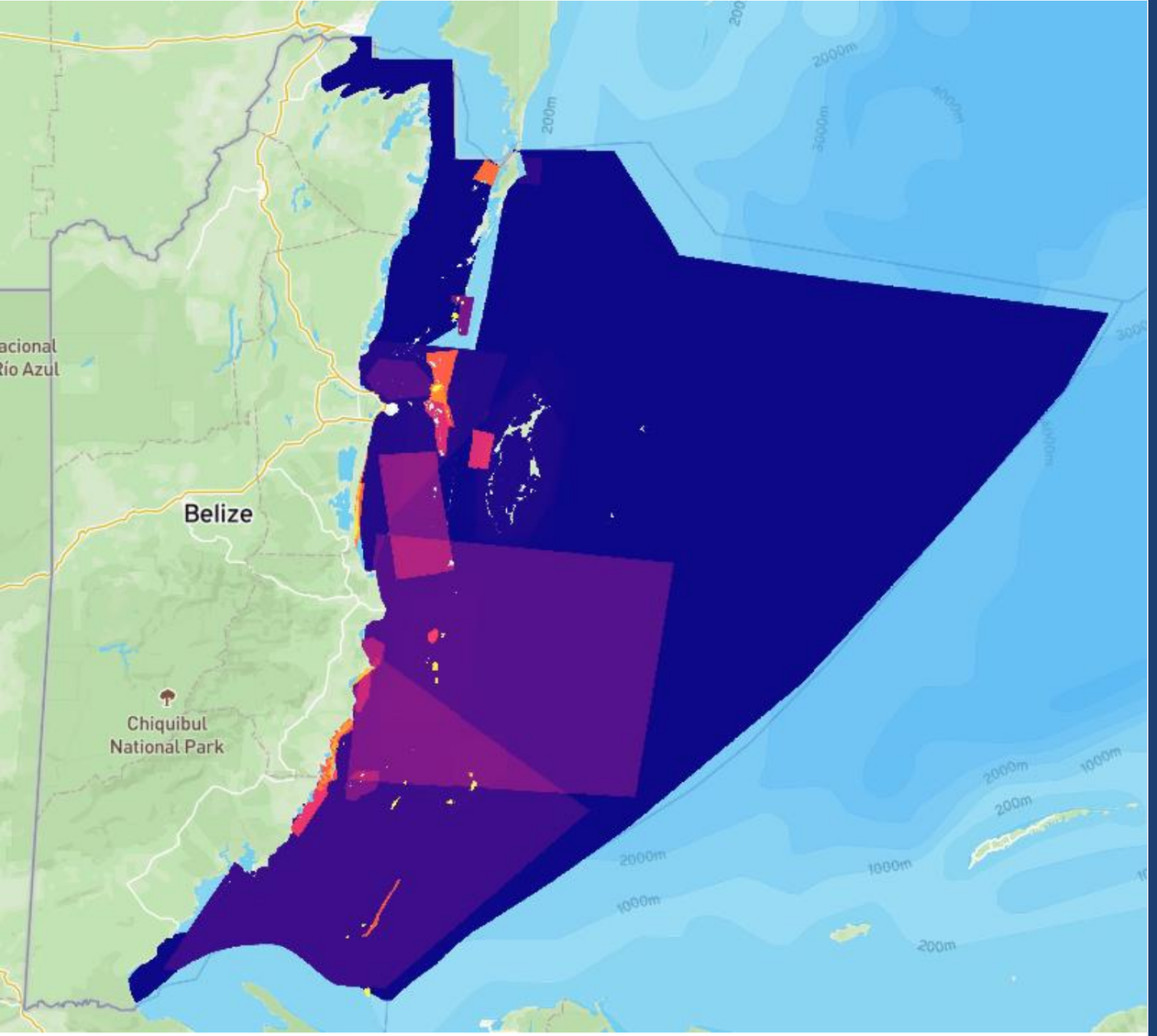
TOURISM SECTOR

How is the Tourism Sector using the ocean space used and valuing it?



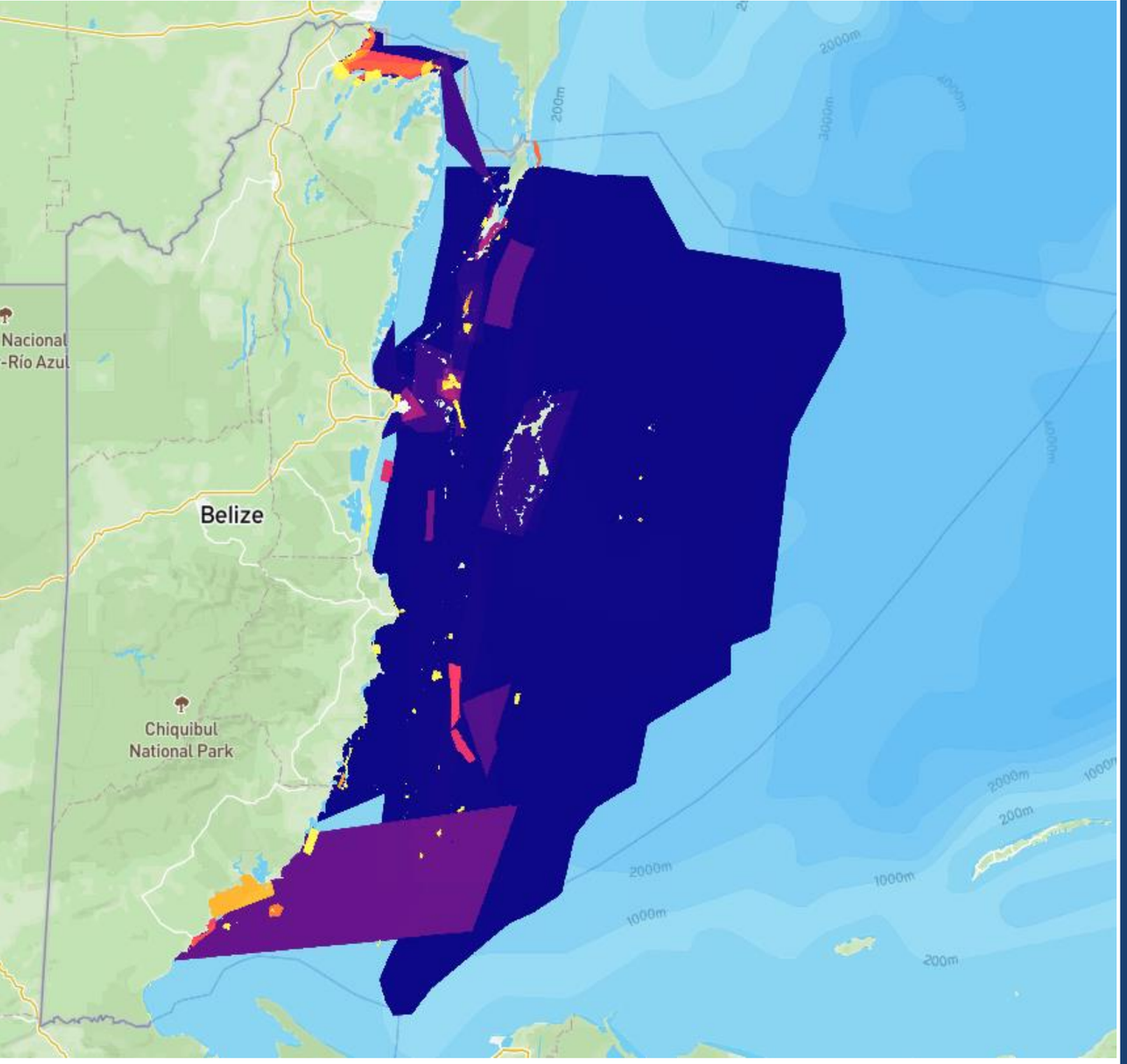
MARITIME ADMINISTRATION

How is the Maritime Administration Sector using the ocean space and valuing it?



MARINE AND COASTAL ECOSYSTEMS

How is the Marine and Coastal Ecosystems sector using the ocean space and valuing it?



GENERAL USE

How is the General Use Sector using the ocean space and valuing it?

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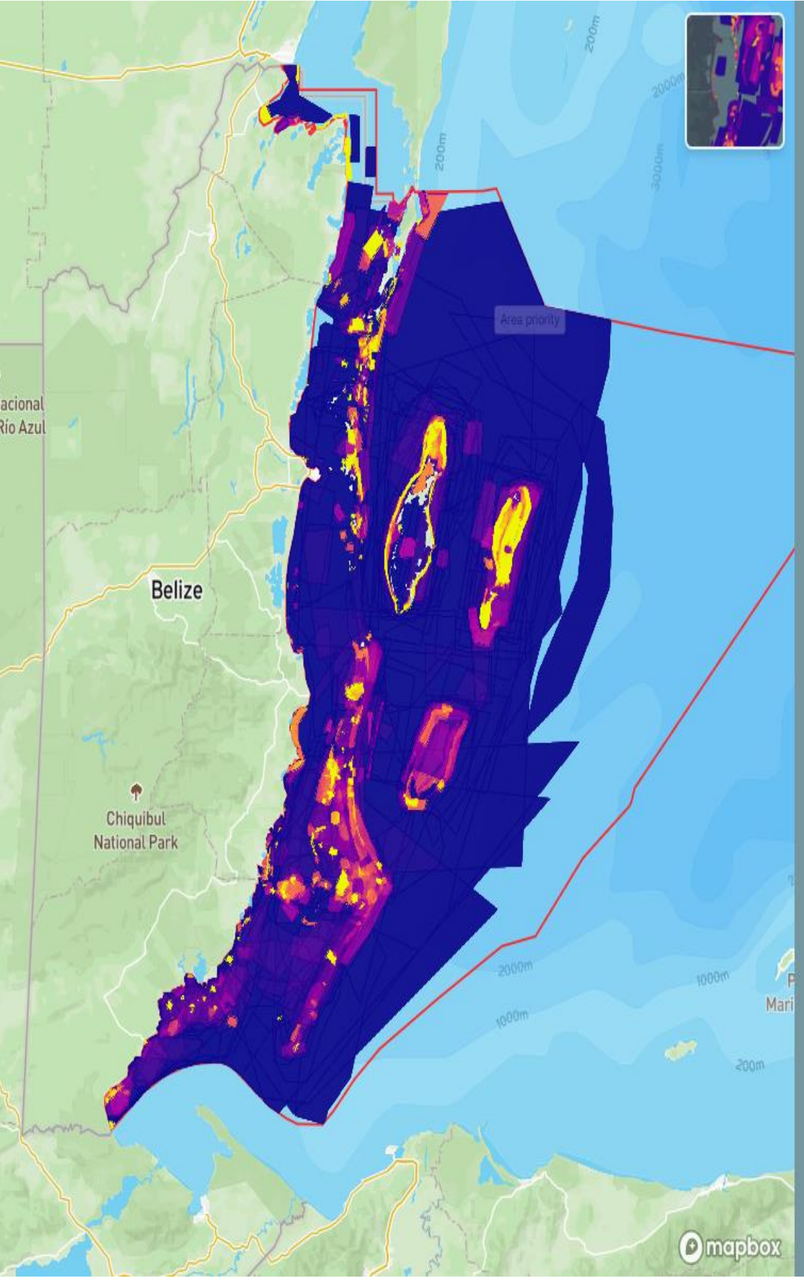


Fisheries and Aquaculture

Using a scale of 1 star (totally dissatisfied) to 5 stars (totally/very satisfied), please indicate your level of satisfaction with the heatmap as it depicts the use and value of ocean space to the aquaculture sector.

The fisheries sector includes all activities related to harvesting products from the sea, like commercial and subsistence fishing, including seaweed farming. This sector also involves recreational activities such as sports fishing, fly fishing, and deep-sea fishing.

Interpreting heatmaps

Areas of value are represented by color ranging from **blue (low), to red (medium), to yellow (high)**. Hovering over a particular area of the heatmap will reveal the quantile that value falls into, with 0-5th being the lowest values, and 95-100th being the highest.

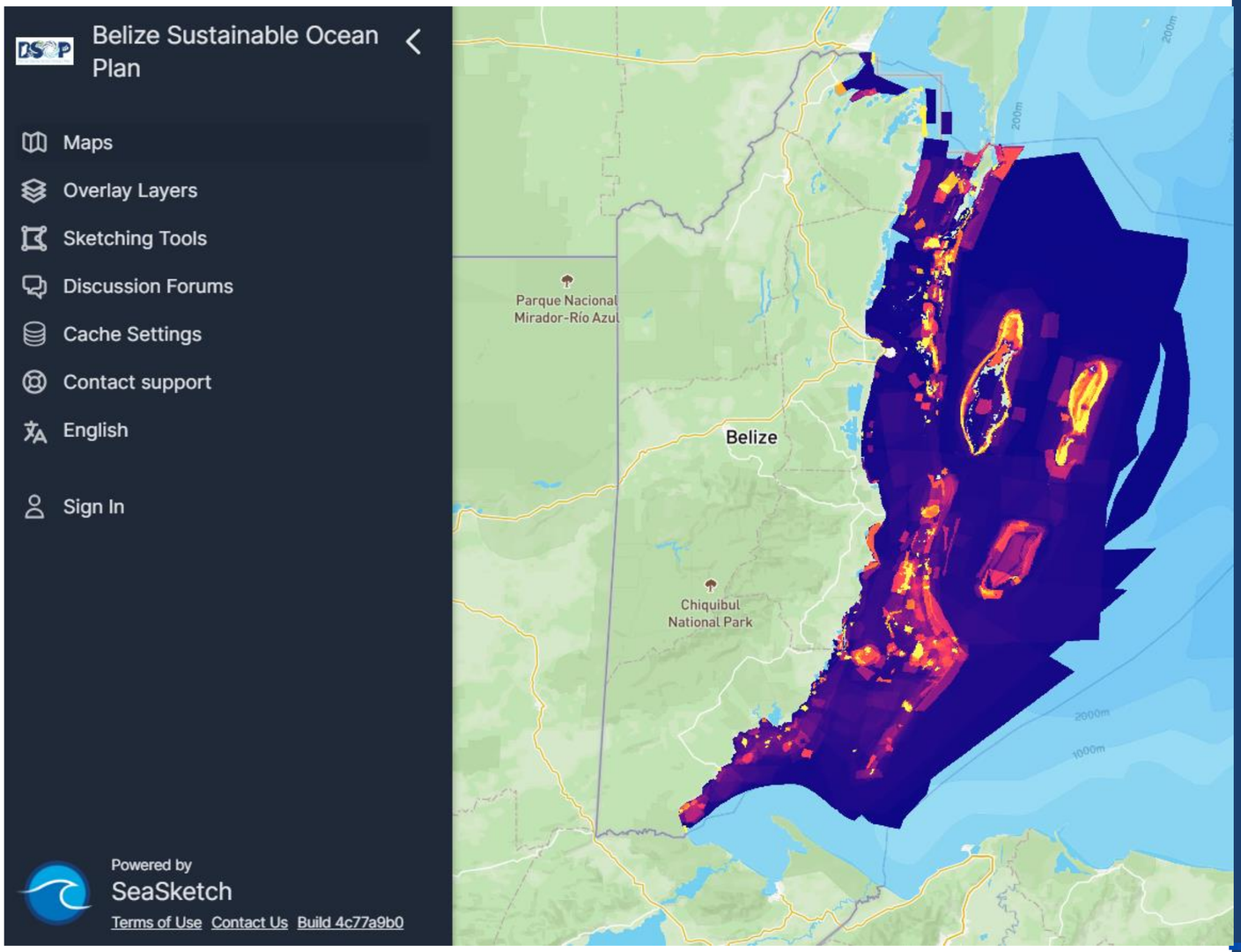
☆ ☆ ☆ ☆ ☆

Skip Question

Heat Map Review

FISHERIES SECTOR

Seasketch.org/belize



Seasketch

- Access Data Viewer
  - Overlay Layers
- Discussion Forum
  - Public Forum

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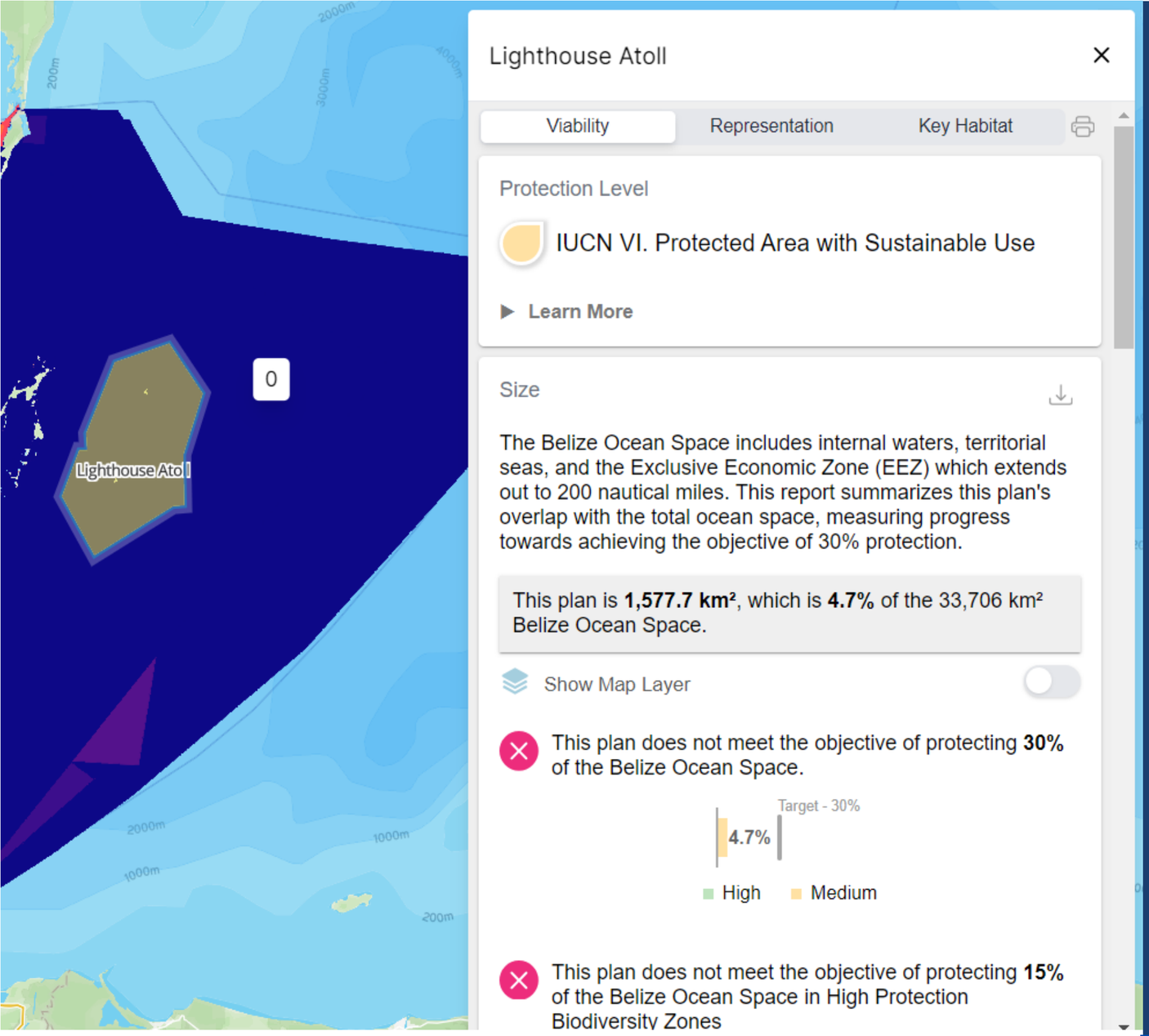

Lighthouse Atoll

Viability | Representation | Key Habitat

Protection Level

IUCN VI. Protected Area with Sustainable Use

▶ Learn More

Size

The Belize Ocean Space includes internal waters, territorial seas, and the Exclusive Economic Zone (EEZ) which extends out to 200 nautical miles. This report summarizes this plan's overlap with the total ocean space, measuring progress towards achieving the objective of 30% protection.

This plan is **1,577.7 km²**, which is **4.7%** of the 33,706 km² Belize Ocean Space.

Show Map Layer

This plan does not meet the objective of protecting **30%** of the Belize Ocean Space.

This plan does not meet the objective of protecting **15%** of the Belize Ocean Space in High Protection Biodiversity Zones

Seasketch

- Access Data Viewer
  - Overlay Layers
- Discussion Forum
  - Public Forum

Belize Sustainable Ocean Plan

Coastal Zone Management Authority & Institute

"Leading the sustainable use and planned development of Belize's coastal zone"

BELIZE COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

BSOP
Belize Sustainable Ocean Plan

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Fax: (501)-223-5738
Website: www.coastalzonebelize.org
https://bsop.coastalzonebelize.org/
E-mail: bsop@coastalzonebelize.org

COFFEE BREAK

15 minutes

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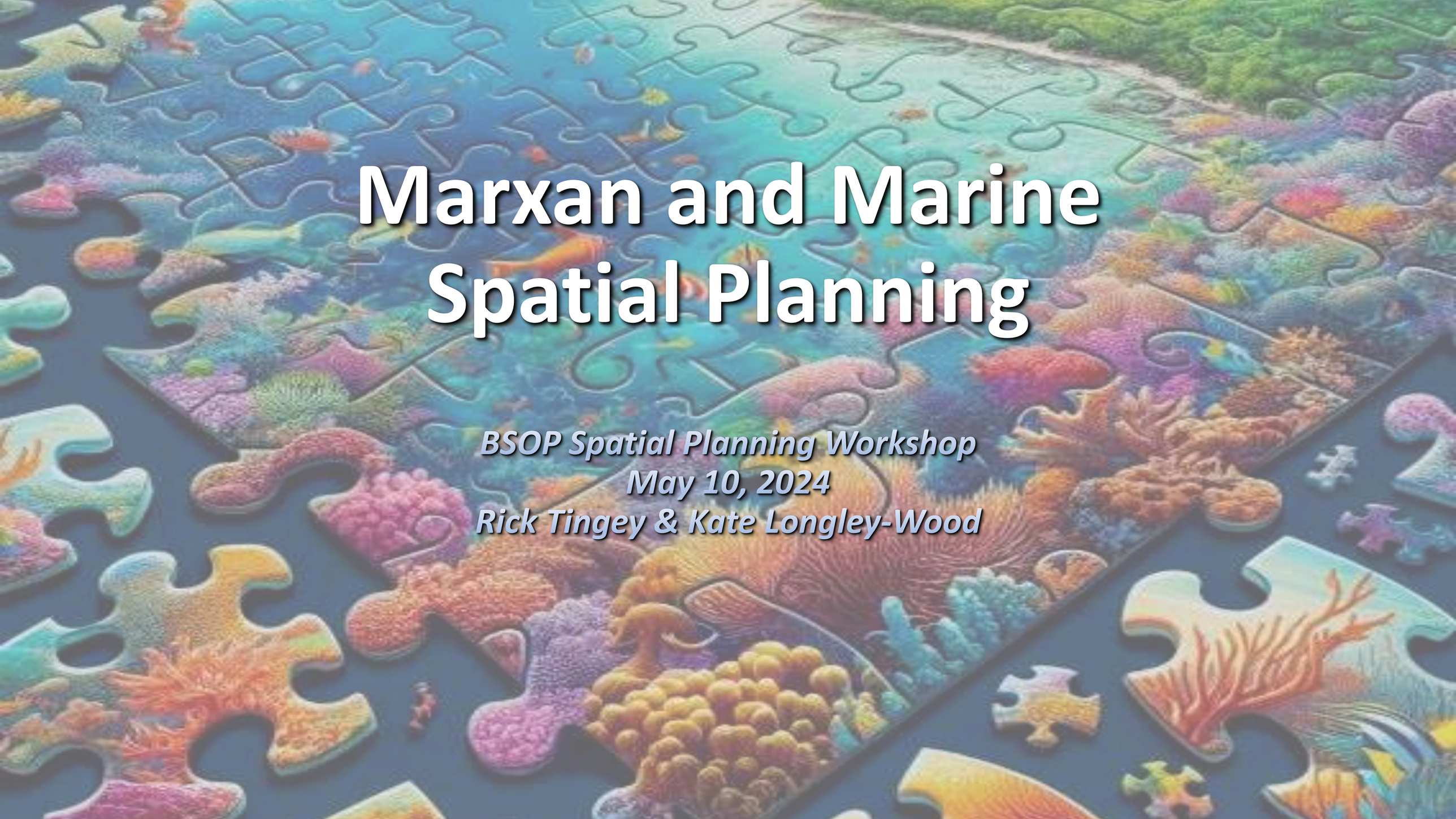


Marxan and Marine Spatial Planning

BSOP Spatial Planning Workshop
May 10, 2024
Rick Tingey & Kate Longley-Wood

MSP Presents Us With Spatial Decision Problems

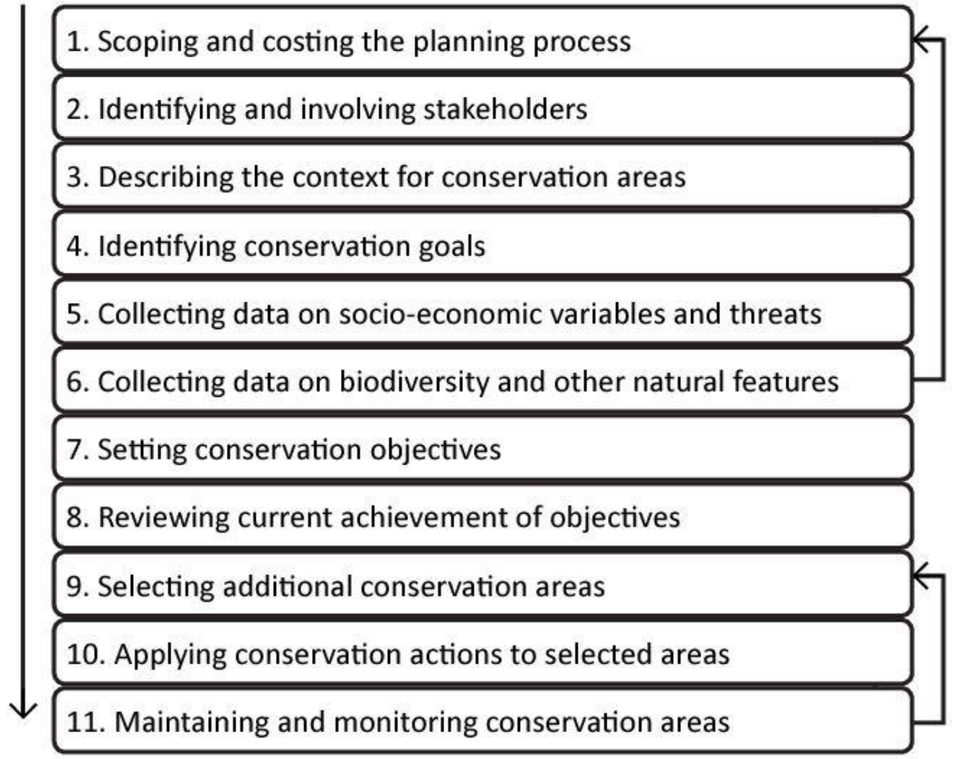
Characteristics of spatial decision problems:

- **Many alternatives**, and decisions are often surrounded by uncertainty
- Each alternative is evaluated on the basis of **multiple criteria**
- Some of the criteria are **qualitative** others **quantitative**
- More than one decision maker (or interest group) involved in the decision-making process
- Decision makers have **different preferences** on evaluation criteria and decision consequences

Systematic Conservation Planning (SCP) Can Help!

- SCP is a structured, transparent, and comprehensive process to prioritize interventions to achieve conservation goals effectively and efficiently

- Frameworks, methods, and tools to identify sites, actions, and projects to maximize conservation interventions at the lowest cost
  - **Explicit goals**: a collective vision of aspirations, such as the representation and persistence of biodiversity, provision of ecosystem services, improved livelihoods
  - **Quantitative objectives (targets)**: statements about how much of each habitat, species, ecological process or feature of interest should be represented in the system of conservation areas
  - **Cost-effective interventions**: social, economic, and other factors that constrain the implementation of conservation interventions (e.g., acquisition, management, and opportunity costs)
  - **Transparent**, **repeatable,** and **flexible** (alternatives)



Planning Goals and Objectives

- Representation of ecological diversity
- Representation of sectoral interests
- Protection of large interconnected core habitats
- Resiliency to climate change
- Collaboration between stakeholders
- Facilitating *responsible* economic development

Spatial Planning Challenges

- Historically approaches to zoning typically focused on reserves and single objectives. E.g. recreation, economic uses, protection of biodiversity.

- Complexities for prioritising multiple zone types for supporting multiple uses
  - MPAs are not just “Protected”
  - Different areas require different allowable activities depending on the values in place

- Need tools to:
  - Protect biodiversity and avoid/minimise negative socio-economic impacts
  - Reduce conflicts between users and between different types of uses and the environment

Key Questions (Review)

- How well do existing spatial plans contribute to the protection of key values?
- What are the key **gaps** in protection of valued components of the ocean space?
- Which areas meet our criteria as priorities for protection in order to fill these gaps? **Why?**

Tools and Analyses Used for MSP and SCP

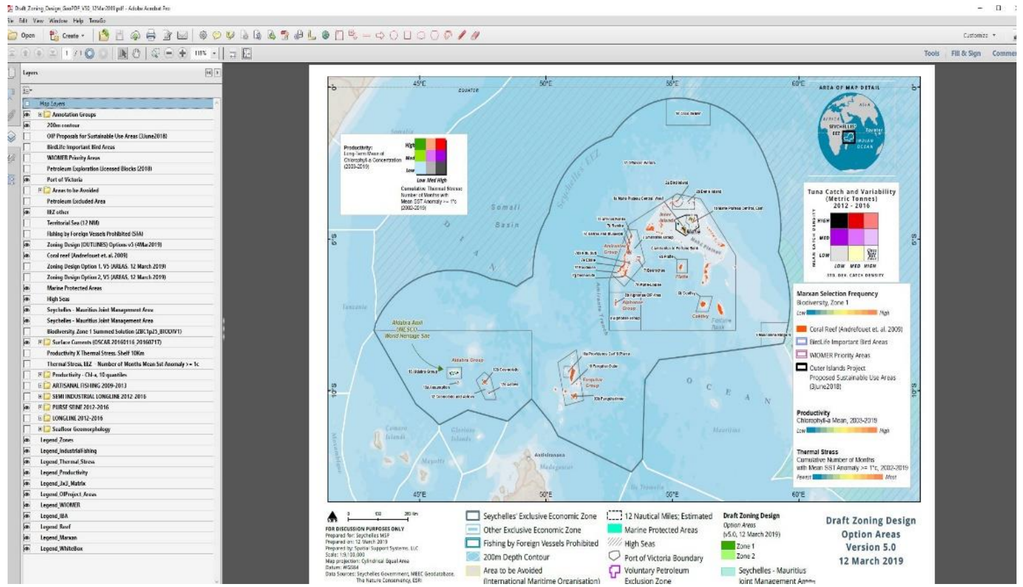
Compatibility Matrices

Draft Zone Types	Targeted Uses and Activities by Draft Zone Types (italics indicates a new use added in Jul-Aug 2014; f = future use)	Artisanal	Industrial tuna	Marine Aquaculture	Semi-industrial	Biodiversity	Fisheries Replenishment	Climate change adaptation	*Disposal-at-sea Sites*	Ferries	*Ports, Harbours, Marinas*	Reclamation	Renewable Energy: wind	Shipping: International	Minerals and Aggregates	*Natural Gas Exploration*	*Shipping: Petroleum*	Petroleum extraction	Public recreation	Recreation	Seychelles Culture	Sport fishing	Tourism	Conservation
Food Security - Fishing	Artisanal																							
Food Security - Fishing	Industrial tuna																							
Food Security - Fishing	Marine Aquaculture		N/A																					
Food Security - Fishing	Semi-industrial		TBD																					
Biodiversity and Replenishment	Biodiversity protection																							
Biodiversity and Replenishment	*Fisheries replenishment*																							
Biodiversity and Replenishment	*Climate change adaptation*																							
Multi-use Zone: Marine Services and Infrastructure	*Disposal-at-sea Sites*	?		?	?			?																
Multi-use Zone: Marine Services and Infrastructure	Ferries							?	?															
Multi-use Zone: Marine Services and Infrastructure	*Ports, Harbours, Marinas*							?	?															
Multi-use Zone: Marine Services and Infrastructure	Reclamation							?	?	N/A														
Multi-use Zone: Marine Services and Infrastructure	Renewable Energy: offshore wind (f)		N/A					?	?	N/A														
Multi-use Zone: Marine Services and Infrastructure	Shipping: International							?	?															
Non-Renewable Energy	Mining: Minerals and Aggregates (f)								?	N/A					?									
Non-Renewable Energy	*Natural Gas Exploration (f)*								?	N/A						?								
Non-Renewable Energy	*Shipping: Petroleum (f)*								?								?							
Non-Renewable Energy	Petroleum Development								?	N/A							?							
Multi-use Zone: Tourism, Recreation and Culture	Public Recreation		N/A						?								?							
Multi-use Zone: Tourism, Recreation and Culture	Recreation							?	?								N/A							
Multi-use Zone: Tourism, Recreation and Culture	Seychelles Culture							?									?							
Multi-use Zone: Tourism, Recreation and Culture	Sport fishing					?		?	?															
Multi-use Zone: Tourism, Recreation and Culture	Tourism					?	?	?									?							
Multi-use Zone: Tourism, Recreation and Culture	Conservation					H	H							M			?						M	

KEY	
compatible	High
somewhat compatible	Medium
somewhat incompatible	Low
incompatible	No
No overlap	N/A

Custom Desktop GIS tools and Web apps (data viewers, analysis and mapping tools)

Marxan



GeoPDF maps

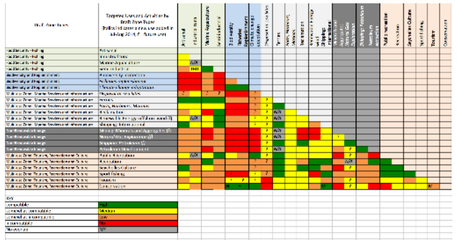
Getting Lines on a Map

Information from stakeholders & process

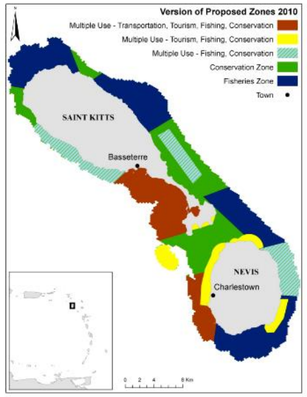
What do you care about, and what do you need to protect?

Draft Conceptual Zones

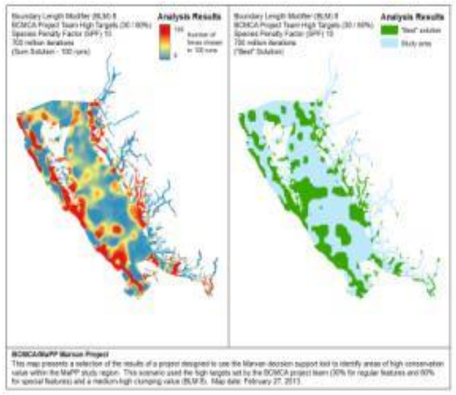
Decision Support Tools



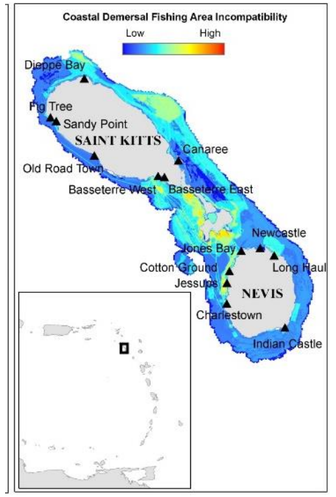
Data Layers for Uses & Activities to inform zones



Developing zones



→ Design alternatives



Analyse Information and display spatially

Turning the Matrix into the Map

Compatibility Matrix

Draft Zone Types	Targeted Uses and Activities by Draft Zone Types (italics indicates a new use added in Jul-Aug 2014; f = future use)	Artisanal	Industrial tuna	Marine Aquaculture	Semi-industrial	Biodiversity	Fisheries Replenishment	Climate change adaptation	Disposal-at-sea Sites	Ferries	Ports, Harbours, Marinas	Reclamation	Renewable Energy: wind	Shipping: International	Minerals and Aggregates	Natural Gas Exploration	Shipping: Petroleum	Petroleum extraction	Public recreation	Recreation	Seychelles Culture	Sport fishing	Tourism	Conservation
Food Security - Fishing	Artisanal																							
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Food Security - Fishing	Semi-industrial		TBD																					
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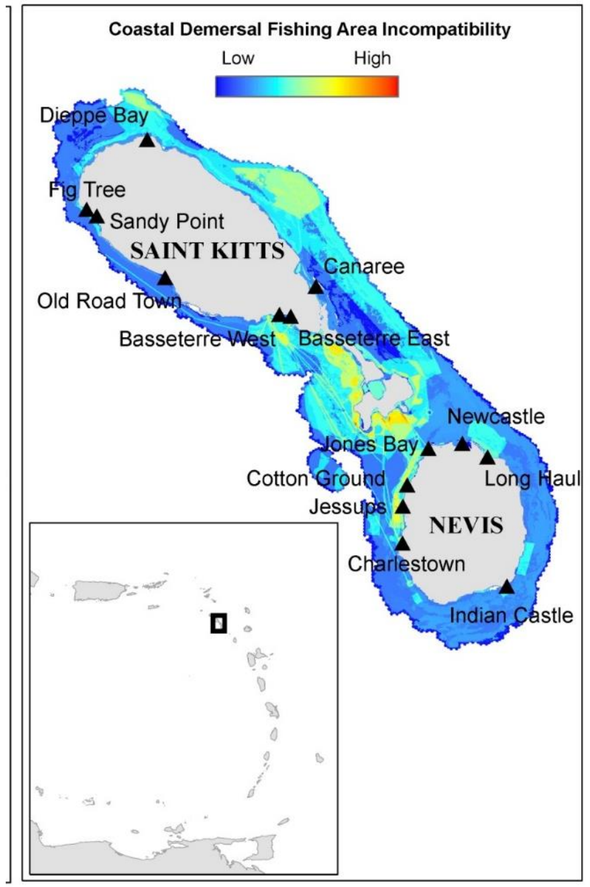
Biodiversity and Replenishment	*Fisheries replenishment*																							
Biodiversity and Replenishment	*Climate change adaptation*																							
Multi-use Zone: Marine Services and Infrastructure	*Disposal-at-sea Sites*	?		?	?			?																
Multi-use Zone: Marine Services and Infrastructure	Ferries							?	?															
Multi-use Zone: Marine Services and Infrastructure	*Ports, Harbours, Marinas*							?	?															
Multi-use Zone: Marine Services and Infrastructure	Reclamation							?	?	N/A														
Multi-use Zone: Marine Services and Infrastructure	Renewable Energy: offshore wind (f)		N/A					?	?	N/A														
Multi-use Zone: Marine Services and Infrastructure	Shipping: International							?	?															
Non-Renewable Energy	Mining: Minerals and Aggregates (f)								?	N/A														
Non-Renewable Energy	*Natural Gas Exploration (f)*								?	N/A					?									
Non-Renewable Energy	*Shipping: Petroleum (f)*								?															
Non-Renewable Energy	Petroleum Development								?	N/A						?								
Multi-use Zone: Tourism, Recreation and Culture	Public Recreation		N/A						?							?								
Multi-use Zone: Tourism, Recreation and Culture	Recreation							?	?							N/A								
Multi-use Zone: Tourism, Recreation and Culture	Seychelles Culture							?								?								
Multi-use Zone: Tourism, Recreation and Culture	Sport fishing					?		?	?															
Multi-use Zone: Tourism, Recreation and Culture	Tourism					?	?	?								?								
Multi-use Zone: Tourism, Recreation and Culture	Conservation					H	H							M		?							M	

KEY	
compatible	High
somewhat compatible	Medium
somewhat incompatible	Low
incompatible	No
No overlap	N/A

?

“Compatibility Map”



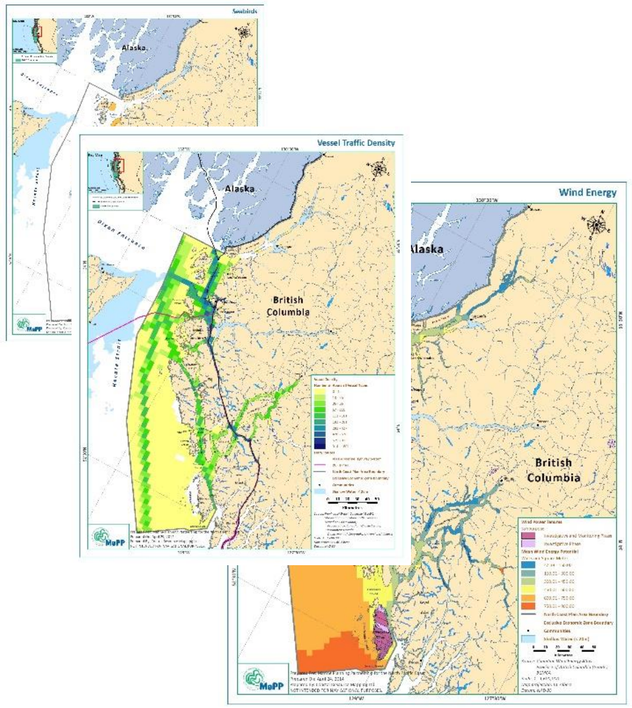
Example: St Kitts and Nevis, Agostini et al.

We need spatial data to depict the uses!

Range of Data Types for Zoning

"Simple" → "Complex"

Expert Mapping



Empirical and Quantitative

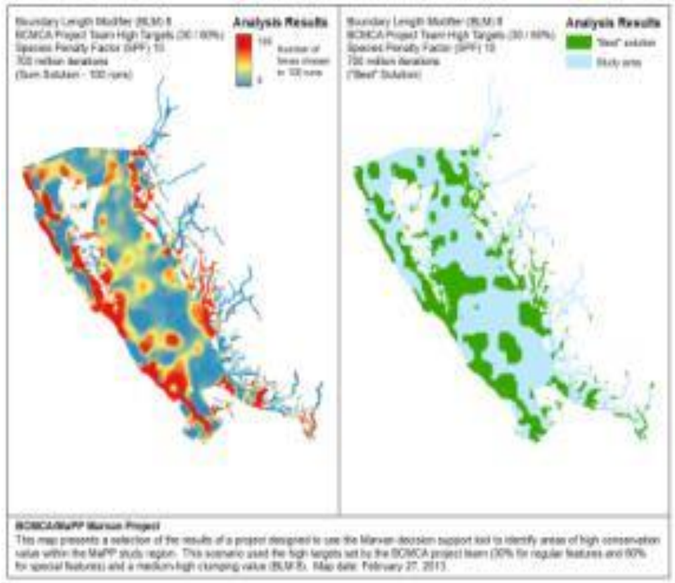
Approaches to Spatial Zoning

“Simple”

“Complex”

?

Draw Zones



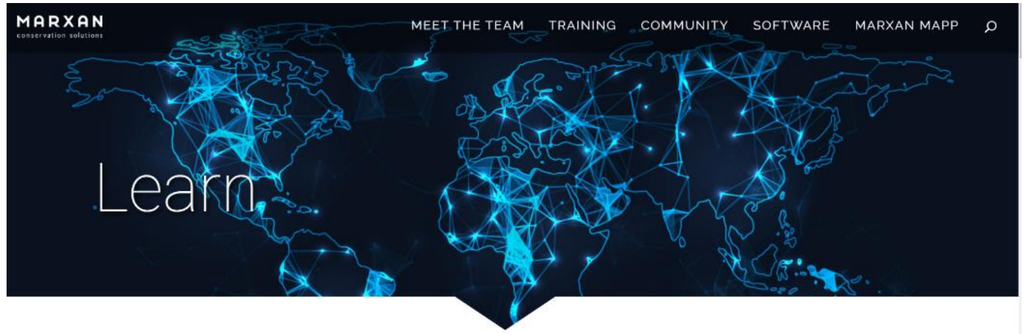
Representation

→ Design alternatives

What is Marxan?

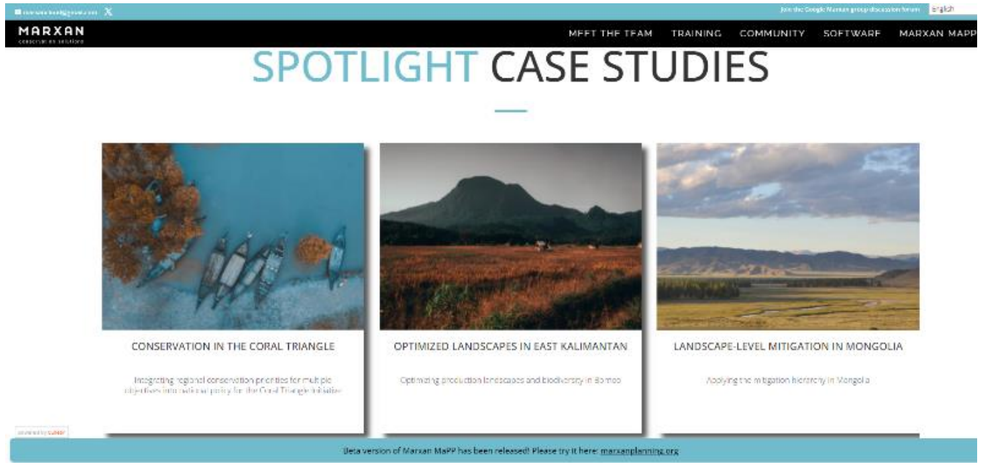
A Decision-support Framework for Systematic Conservation and Multi-Objective Planning:

- **Identify and Prioritize areas for conservation action**
- Uses **Spatial Optimization** to meet quantitative goals for representation of biodiversity and human uses.
- Supports **integration** of diverse data sets to represent values and priorities in a transparent manner
- Useful for **scenario development** and testing of assumptions

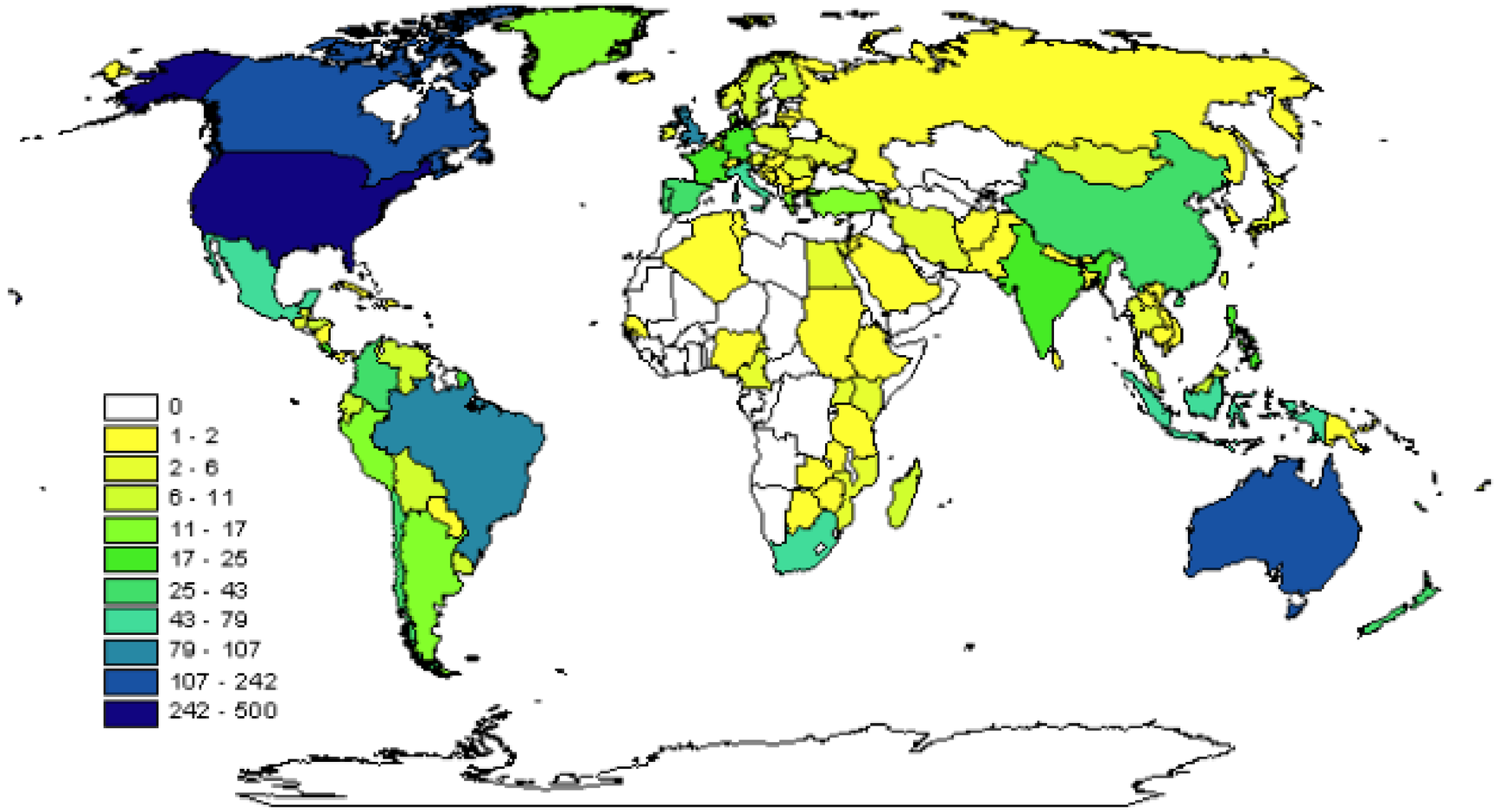


Learning Resources: (MarxanSolutions.org)

- What is Marxan?
- A Framework for Systematic Conservation Planning
- Scenario Development
- Gap Analysis
- Costs and Planning Units



Over 6,700 Users and 4,700 Organizations from 184 Countries

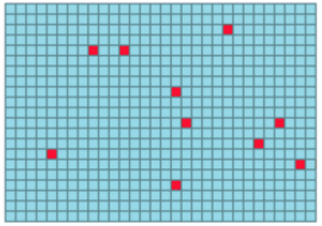


PacMARA
Pacific Marine Analysis & Research Association

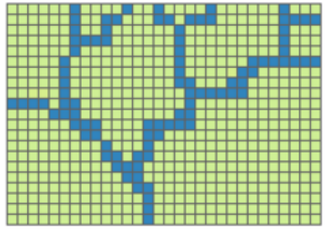
MARXAN
conservation solutions

Why is Marxan Useful?

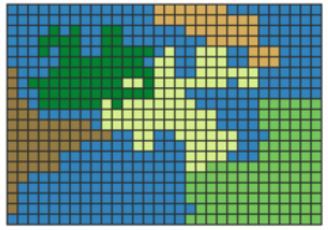
- **Systematic spatial analysis** of the distribution of valued natural and cultural resources, and the threats to those values
- Enables a project team to *systematically* assign **spatially-explicit goals** to meet specified planning objectives
- Allows us to **characterize** places and **compare** one place to another in common terms
- **Spatial efficiency** is built into the modeling framework - Maximizes spatial representation of values while minimizing user-defined “costs” (e.g. human activities, overall area selected, etc). Ideally, this minimizes conflicts between stakeholders.
- Highlights hotspot areas for simultaneous representation of **multiple values**
- Design **alternative scenarios** based on differing representation goals
- Transparent, defensible, and credible
- Where do we get the most “bang for our buck” in terms of biodiversity representation?



Total = 10 observations
Target = 20% (2 observations)



Total = 10 km of migration corridor
Target = 20% (2 km)



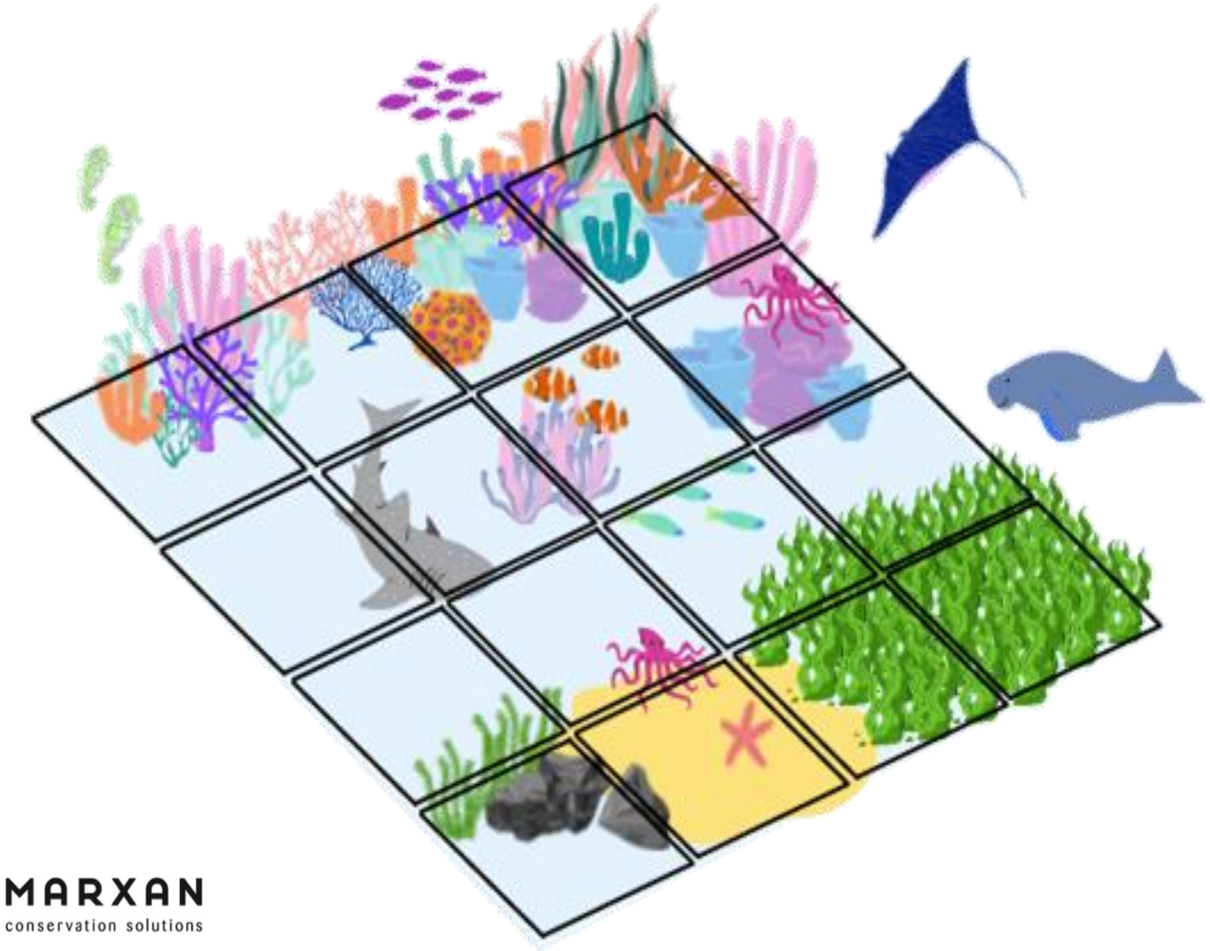
Each ecosystem type is a feature
Total area for type 1 = 10 km^2
Target = 20% (2 km^2)

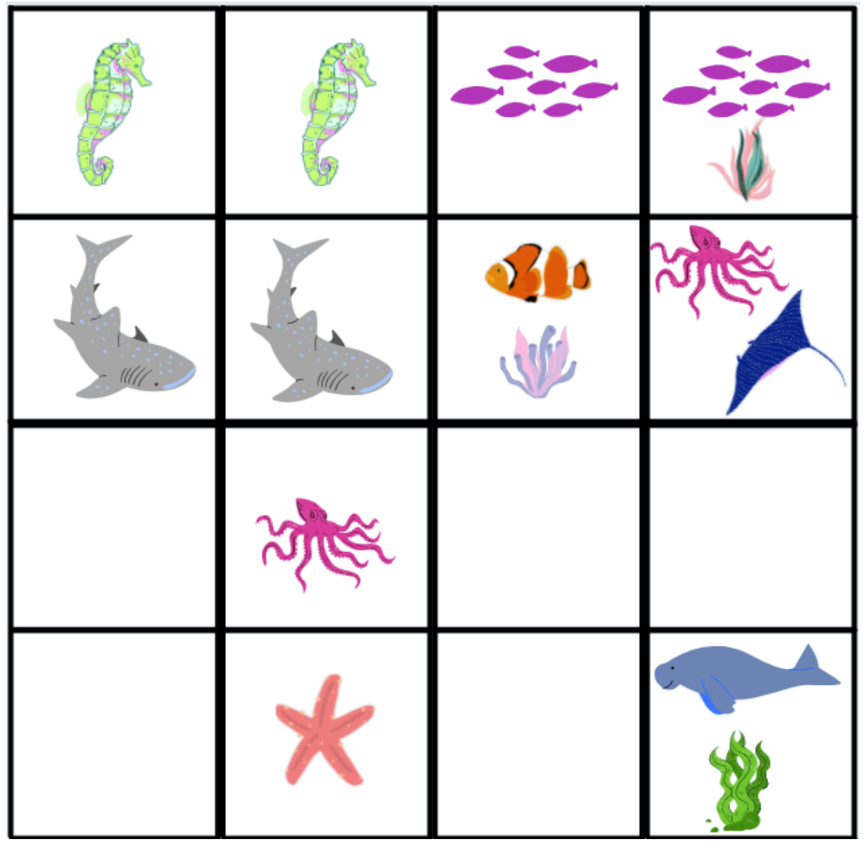
PacMARA
Pacific Marine Analysis & Research Association

MARXAN
conservation solutions

Planning Units

Sites that will be evaluated and selected as possible conservation areas and **building blocks** of the system of conservation areas





MARXAN
conservation solutions

Marxan Inputs and Spatial Design Considerations

Features

Habitats, species, or other features assigned a % protection target

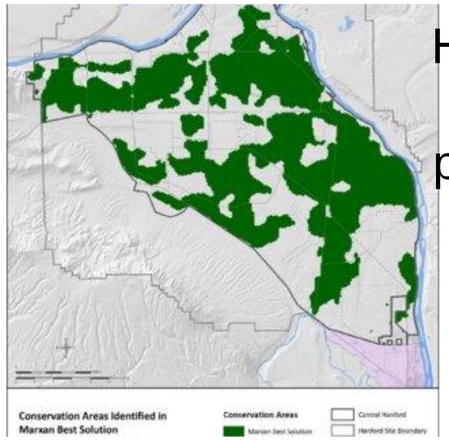
Marxan "Cost" Input

Value lost by assigning a protected area to a location

Lock In/Lock Out Areas

Areas that either need to be included, or can't be included

Boundary Length



How “clustered” should the protected areas be?

Informed by existing data and expert knowledge

Marxan Outputs

“Best Run”

- Efficiently meets representation goals across multiple targets/criteria

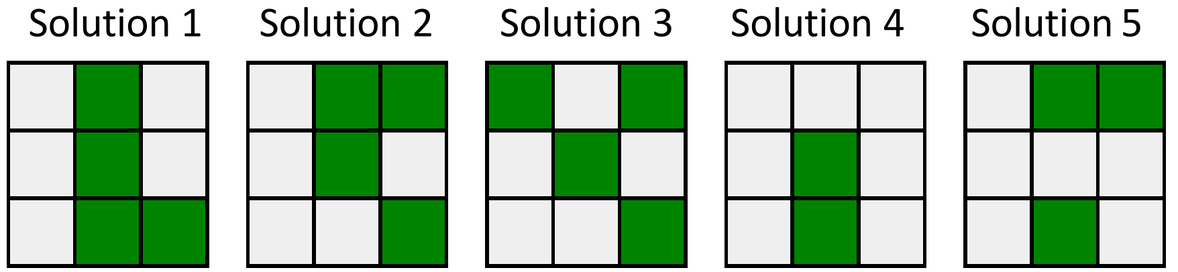
“Selection Frequency”

- How many times was each area selected across multiple runs?

“Representation Tables”

- Explicit accounting of values captured

Best Run (Spatially Optimized Result)



Selection Frequency (Summed Solutions)

Numbers represent how many times each Planning Unit was selected as a member of a Best Run

1	3	3
0	4	0
0	3	3

Marxan vs. Marxan with Zones – Differences

Marxan

- **Two zones**

("reserved or not")

- One cost function

Marxan with Zones

- **Multiple Zones and Costs**

  Example scenario:

  - ***Zone 1:*** *High Biodiversity Protection*
    - Cost: economic uses
  - ***Zone 2:*** *Medium Biodiversity Protection*
    - Cost: economic uses
  - **Zone 3:** Multiple Use
    - No costs

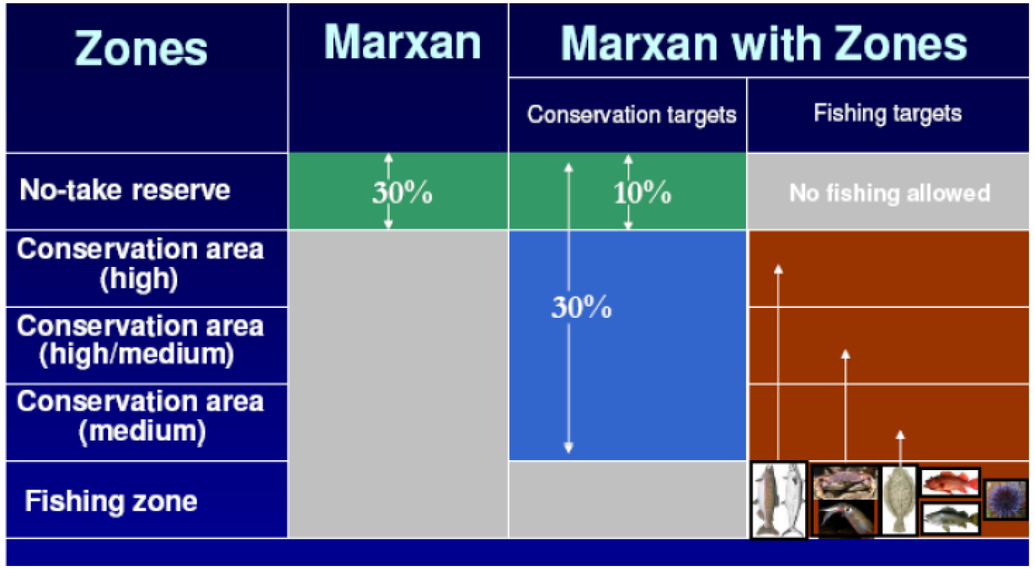


Photo: The Ocean Agency

Case Study: Seychelles Marine Spatial Plan

SPATIAL ANALYSES WITH MARXAN

Spatial Analysis Supporting MSP in Seychelles

Overarching Goals of Spatial Analysis

- Identify effective marine zone boundaries
  - Capture 30% of EEZ
    (by area and feature representation)
- Ensure protection of biodiversity
- Maintain human access to resources for a sustainable Blue Economy
- Tying MSP goals to spatial analysis goals

Key Challenges

Photo credit: Roshni Lodhia

Pre-MSP

- Existing marine protections extremely limited, **~0.04%** of Seychelles' waters

MSP Initiated in 2014

- Existing data was not representative of stakeholder activities and spatial footprints
- Participatory mapping inclusive of non-fishing activities was incomplete

Seychelles MSP Zones and Compatibility Matrix

Draft Zone Types	Targeted Uses and Activities by Draft Zone Types (italics indicates a new use added in Jul-Aug 2014; f = future use)	Artisanal	Industrial tuna	Marine Aquaculture	Semi-industrial	Biodiversity	Fisheries Replenishment	Climate change adaptation	*Disposal-at-sea Sites*	Ferries	*Ports, Harbours, Marinas*	Reclamation	Renewable Energy: wind	Shipping: International	Minerals and Aggregates	*Natural Gas Exploration*	*Shipping: Petroleum*	Petroleum extraction	Public recreation	Recreation	Seychelles Culture	Sport fishing	Tourism	Conservation
Food Security - Fishing	Artisanal																							
Food Security - Fishing	Industrial tuna																							
Food Security - Fishing	Marine Aquaculture		*N/A*																					
Food Security - Fishing	Semi-industrial		TBD																					
Biodiversity and Replenishment	Biodiversity protection																							
Biodiversity and Replenishment	*Fisheries replenishment*																							
Biodiversity and Replenishment	*Climate change adaptation*																							
Multi-use Zone: Marine Services and Infrastructure	*Disposal-at-sea Sites*	?		?	?			?																
Multi-use Zone: Marine Services and Infrastructure	Ferries							?	?															
Multi-use Zone: Marine Services and Infrastructure	*Ports, Harbours, Marinas*							?	?															
Multi-use Zone: Marine Services and Infrastructure	Reclamation							?	?	*N/A*														
Multi-use Zone: Marine Services and Infrastructure	Renewable Energy: offshore wind (f)		*N/A*					?	?	*N/A*														
Multi-use Zone: Marine Services and Infrastructure	Shipping: International							?	?															
Non-Renewable Energy	Mining: Minerals and Aggregates (f)								?	*N/A*														
Non-Renewable Energy	*Natural Gas Exploration (f)*								?	*N/A*					?									
Non-Renewable Energy	*Shipping: Petroleum (f)*								?															
Non-Renewable Energy	Petroleum Development								?	*N/A*						?								
Multi-use Zone: Tourism, Recreation and Culture	Public Recreation		*N/A*						?							?								
Multi-use Zone: Tourism, Recreation and Culture	Recreation							?	?							*N/A*								
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Multi-use Zone: Tourism, Recreation and Culture	Sport fishing					?		?	?															
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KEY	
compatible	High
somewhat compatible	Medium
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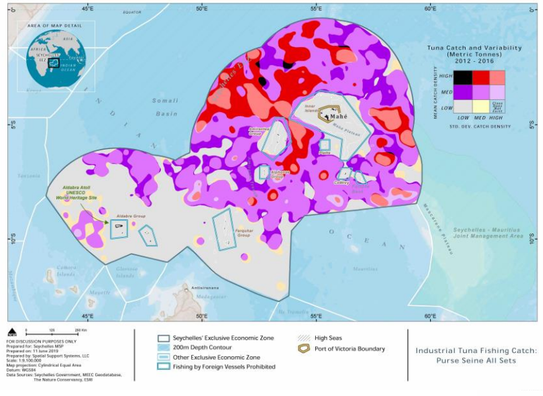
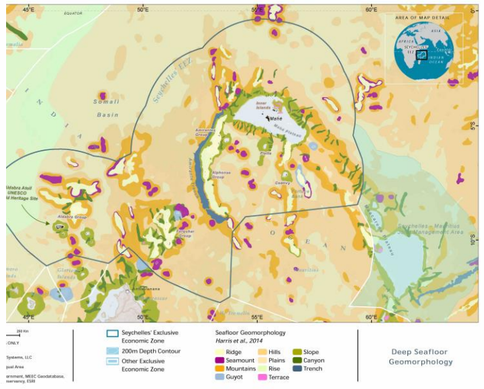
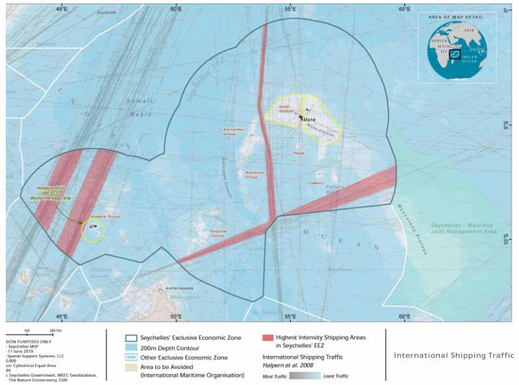
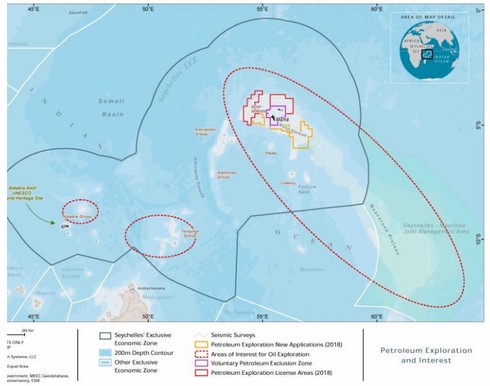
No overlap	*N/A*

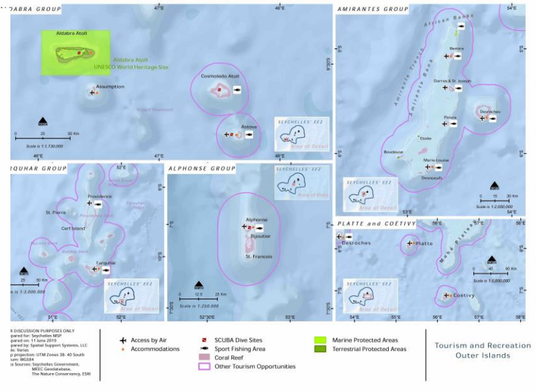
Five Themes Form Basis of Stakeholder Preferences











FISHERIES

Domestic Fisheries
Sport Fishing
EU Tuna Catch
Mariculture
Participatory Mapping

Sources: Seychelles Fishing Authority 2014; Fishing Boat Owners Association 2014, TNC 2014.

BIODIVERSITY

Source: UNDP 2015

Benthic geology
174 "features"
WIOMER Areas of Importance
BirdLife Important Areas
Participatory Mapping

Sources: Harris et al. 2014; Klaus 2015; IMaRS-USF 2005; IMaRS-USF and IRD 2005; Spalding, Ravilious and Green. 2001; UNEP-WCMC, WorldFish Centre, WRI and TNC. 2010; Seychelles Fishing Authority 2014; Seychelles National Park Authority 2014; Seychelles Port Authority 2014. See UNDP 2015 for full citations.

INDUSTRIAL & PUBLIC UTILITIES

Ferries & Shipping
IMO Marine Highways
Ports & Marinas
Renewable Energy
Participatory Mapping

Sources: Halpern et al. 2006; British Admiralty Charts; Seychelles Port Authority 2014; Ministry Land Use and Housing 2014, TNC 2014.

NON-RENEWABLE RESOURCES

Licensed Blocks
Low Gravity Areas
Seismic Surveys
Sand Mining
Participatory Mapping

Sources: PetroSeychelles 2014, 2015. TNC 2014.

TOURISM & RECREATION

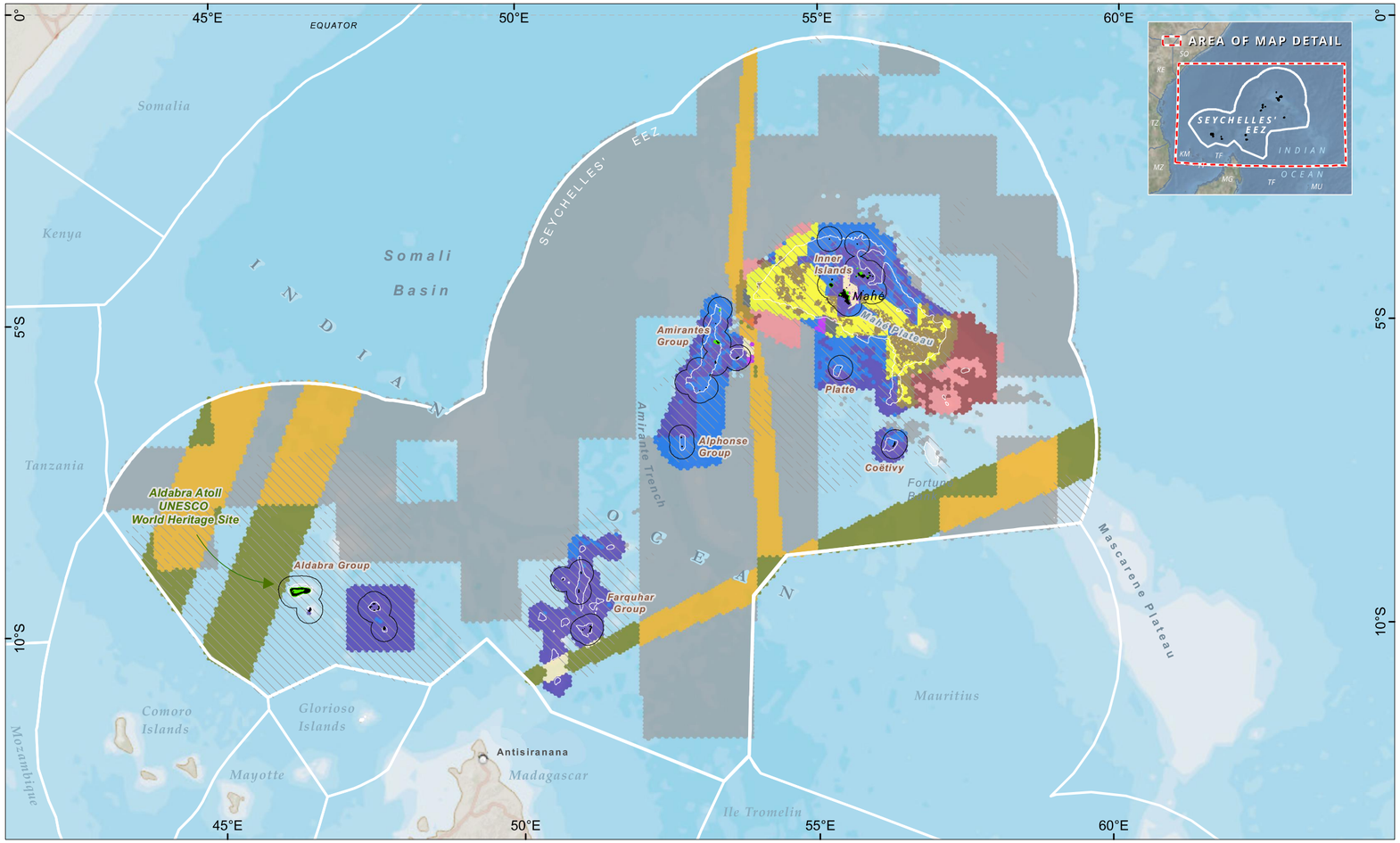
Marine Charters
Diving, Snorkeling
Viewpoints
Accommodation
Participatory Mapping

Sources: Seychelles Sport Fishing Club 2014; Ministry of Tourism and Culture 2014; Seychelles Hoteliers Association 2014.

Over 100 layers in data catalogue
MACCE is data custodian

Source: MACCE database
Analysis: Smith and Tingey, in progress

Seychelles MSP: Stakeholder Preferences (Jan-Aug 2015)



NORTH 0 125 250 Kms

FOR DISCUSSION PURPOSES ONLY
Prepared for: Seychelles MSP
Prepared on: 10 Aug 2016
Prepared by: Spatial Support Systems, LLC
Scale: 1:9,100,000
Map projection: UTM Zone 40 South
Datum: WGS84
Data Sources: Seychelles Government, TNC, ESRI

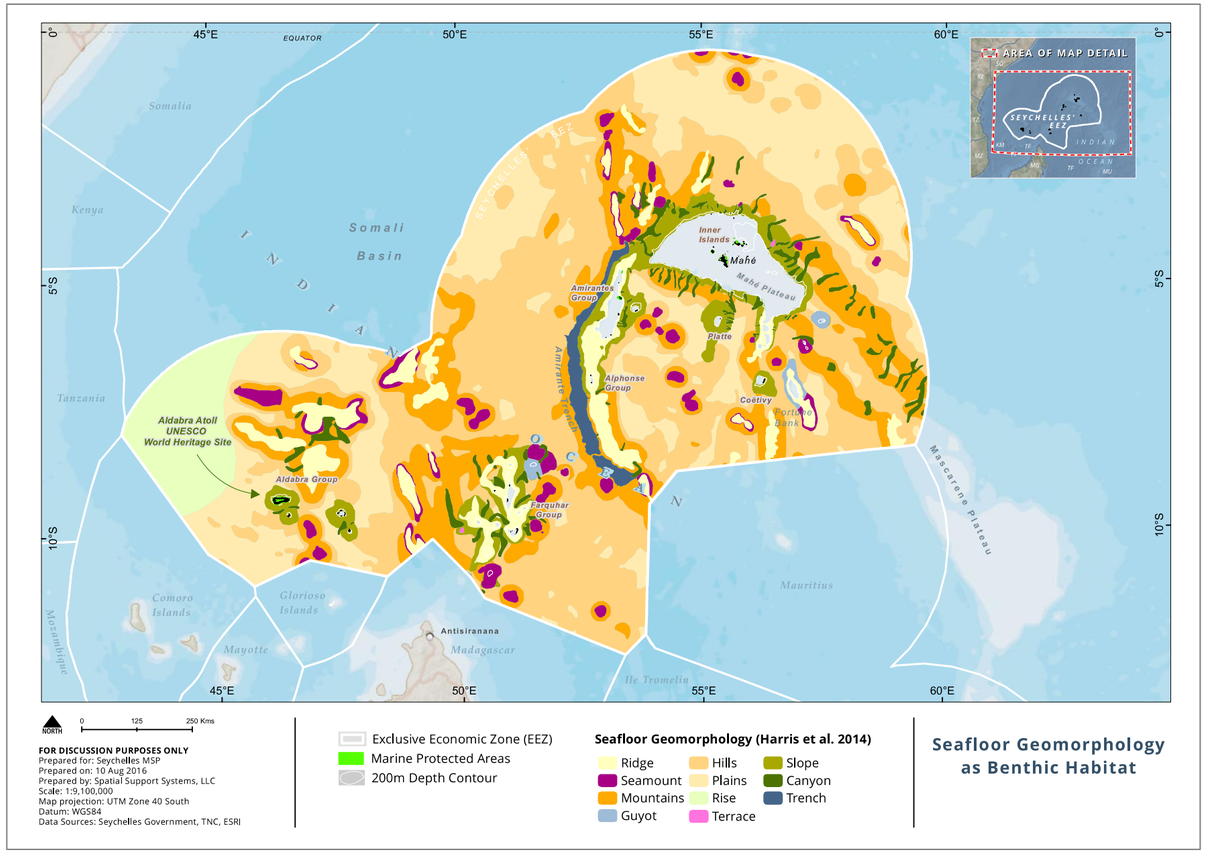
- Exclusive Economic Zone (EEZ)
- Seychelles' Territorial Sea (12 NM)
- Marine Protected Areas
- 200m Depth Contour
- UNDP Proposed Protected Area Expansion (B)

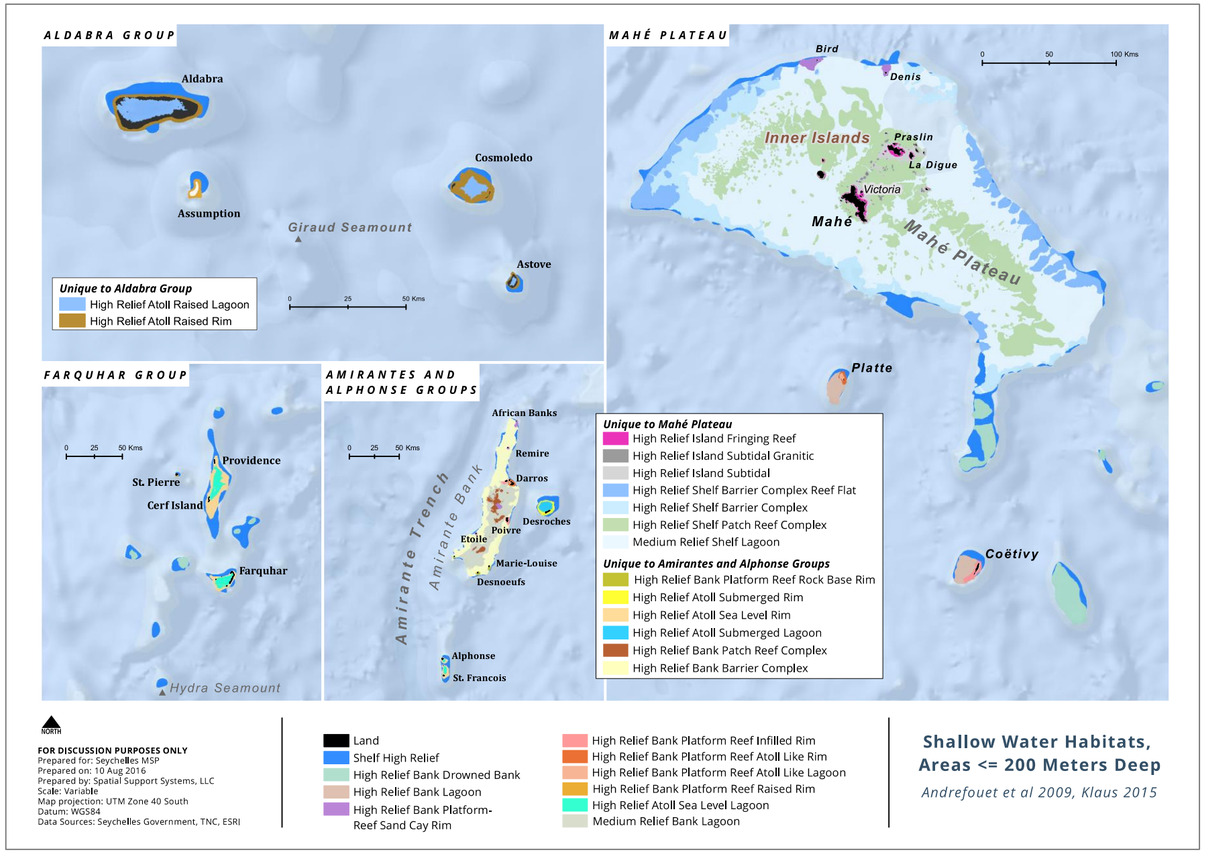
Integrated Stakeholder Preferences

Source: MEECC database
Analysis: Smith and Tingey, in progress

Habitat Features

Coarse-scale analysis using habitat representation data – shallow and deep





Source: MEECC database
Analysis: Smith and Tingey, in progress

Objective Based Zoning Framework

Zone 1 High Biodiversity Protection	Zone 2 Medium Biodiversity Protection	Zone 3 Multiple Use
To allocate 15% of the EEZ to provide high protection for marine biodiversity goals, by representative habitats and species.	To allocate 15% of the EEZ to provide medium protection for biodiversity goals, by representative species and habitats, and allow economic opportunities for sustainable uses.	To allocate 70% of the EEZ to maximise economic opportunities and Blue Economy in Seychelles.

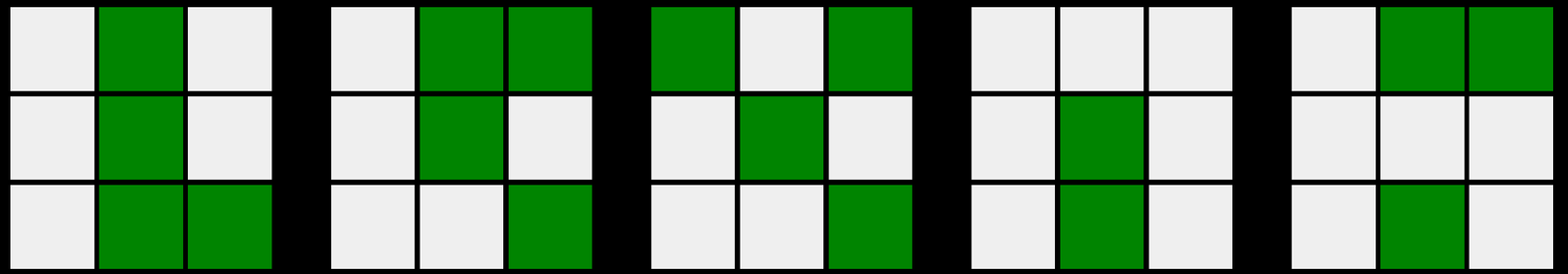
Marxan with Zones – Contrasting Zoning Scenarios

	Scenario Goal	Assumptions
Biodiversity Bias Scenario	• **Prioritises the representation of marine habitats over human uses in the selection of boundaries.** • No Cost was applied. • Serves as a baseline to assess other scenarios.	• Representation goals for shallow and deep habitats identified • No explicit goals for economic uses specified. • No explicit avoidance of high intensity extractive uses specified.
Blue Economy Bias Scenario	• **Allows overlap between human uses and areas selected for habitat representation.** • Favour the representation of habitats in areas *away from* the highest intensity of human uses (”highest cost”). • Cost is low – some overlap with uses.	• Representation goals for shallow and deep habitats identified • Explicit goals for economic uses specified. • Avoidance of highest intensity extractive use areas
Economic Bias Scenario	• **Minimises the overlap between high value economic use areas and areas selected for habitat representation.** • Zone areas selected *strongly favour* the representation of marine habitats away from priority economic use areas identified by stakeholders. • Cost is very high – very little overlap with uses.	• Explicit goals for economic uses specified. • Strongly weighted avoidance of the highest intensity extractive use areas.

Marxan Outputs Review

Selection frequency

Solution 1 Solution 2 Solution 3 Solution 4 Solution 5



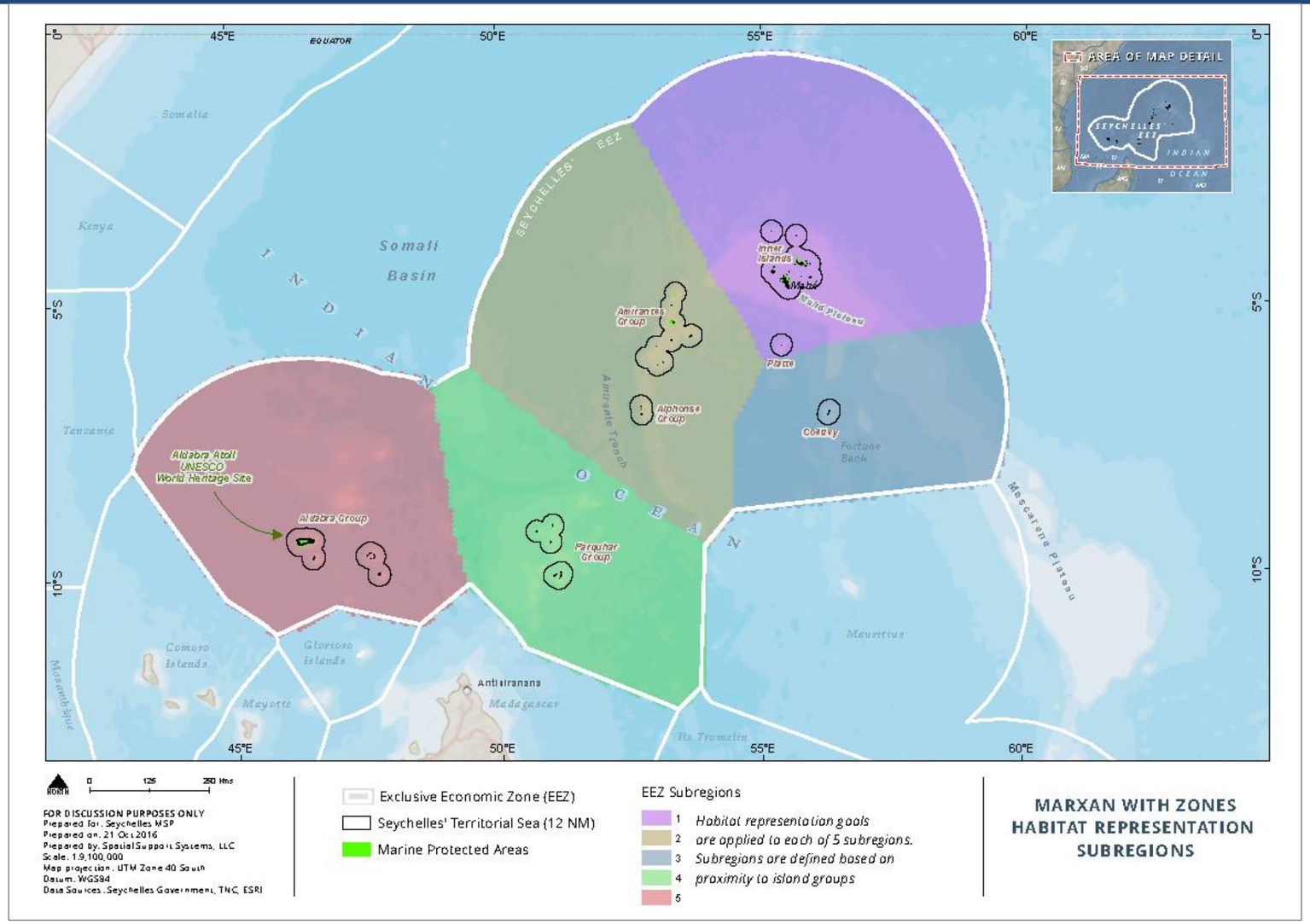
1	3	3
0	4	0
0	3	3

Numbers represent how many times each Planning Unit was selected

Marxan with Zones – Stratification of Seychelles' 1.35 million km^2 ocean

The ocean space was stratified into five sub regions

- **Redundant representation** of similar habitat features across space
- Proportional habitat representation **goals (30%) were met for each sub region**, such that the model solutions would not lean towards representing habitats all in one location.



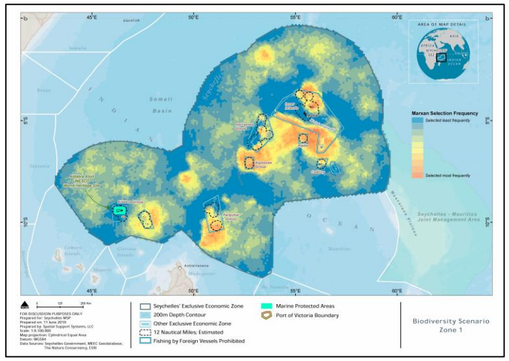
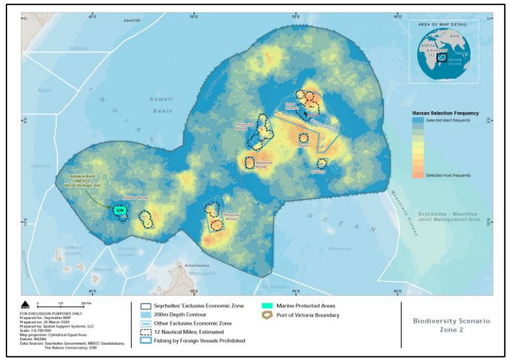
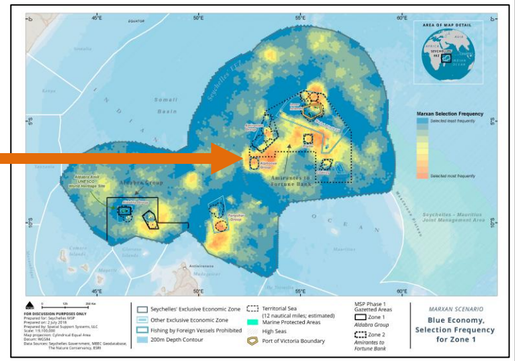
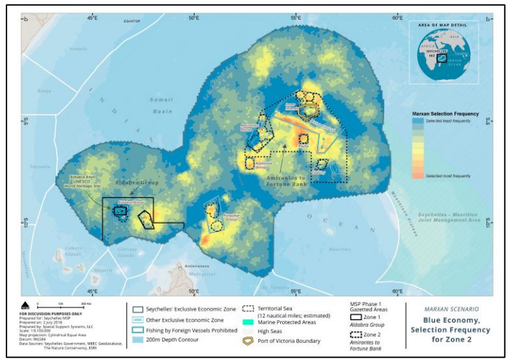
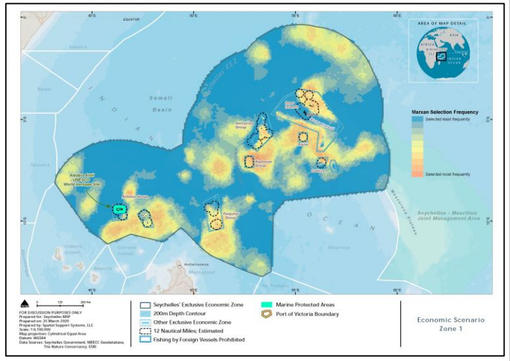
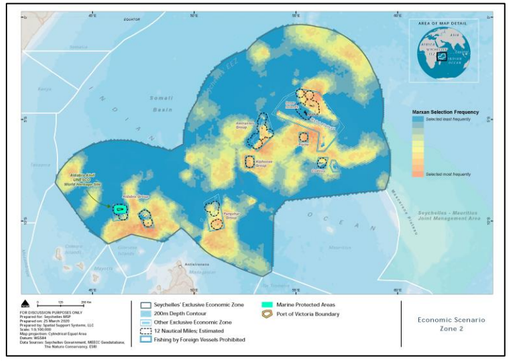
Marxan with Zones

3 scenarios x 2 Zones to identify high priority areas for biodiversity conservation.

Areas with consistently high ‘Selection Frequency’ informed the zoning design options in Phase 2 of the MSP (2019-2020).

Habitat representation goals (30%) met in all scenarios.

Selection Frequency values highlighted specific areas.

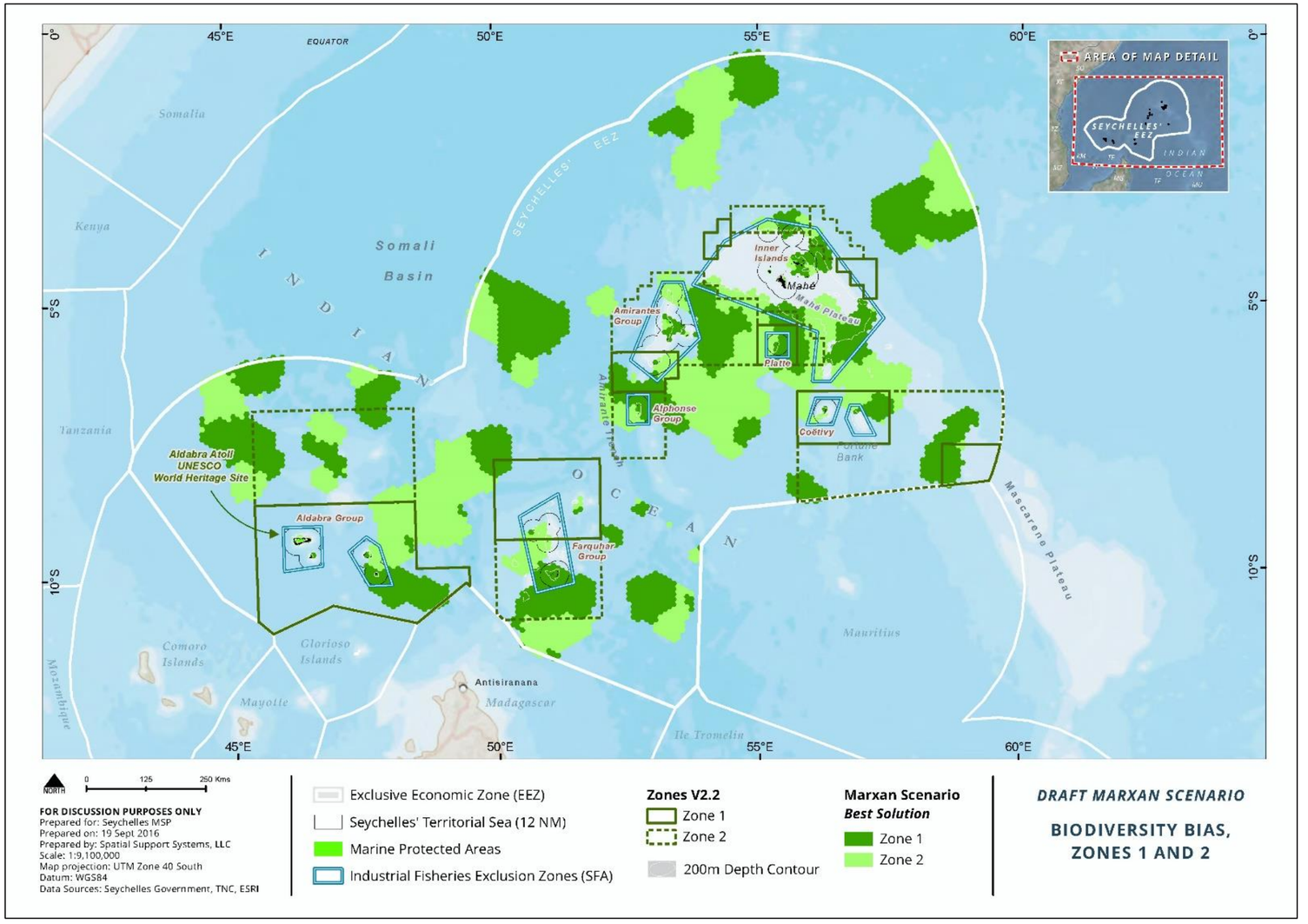
Zone 1 - HIGH	Zone 2 - MEDIUM	
		**BIODIVERSITY BIAS SCENARIO**
		**BLUE ECONOMY BIAS SCENARIO**
		**ECONOMIC BIAS SCENARIO**

Marxan with Zones

Zone 1 – HIGH PROTECTION (Dark Green)

Zone 2 – MEDIUM PROTECTION (Medium Green)

BIODIVERSITY BIAS SCENARIO

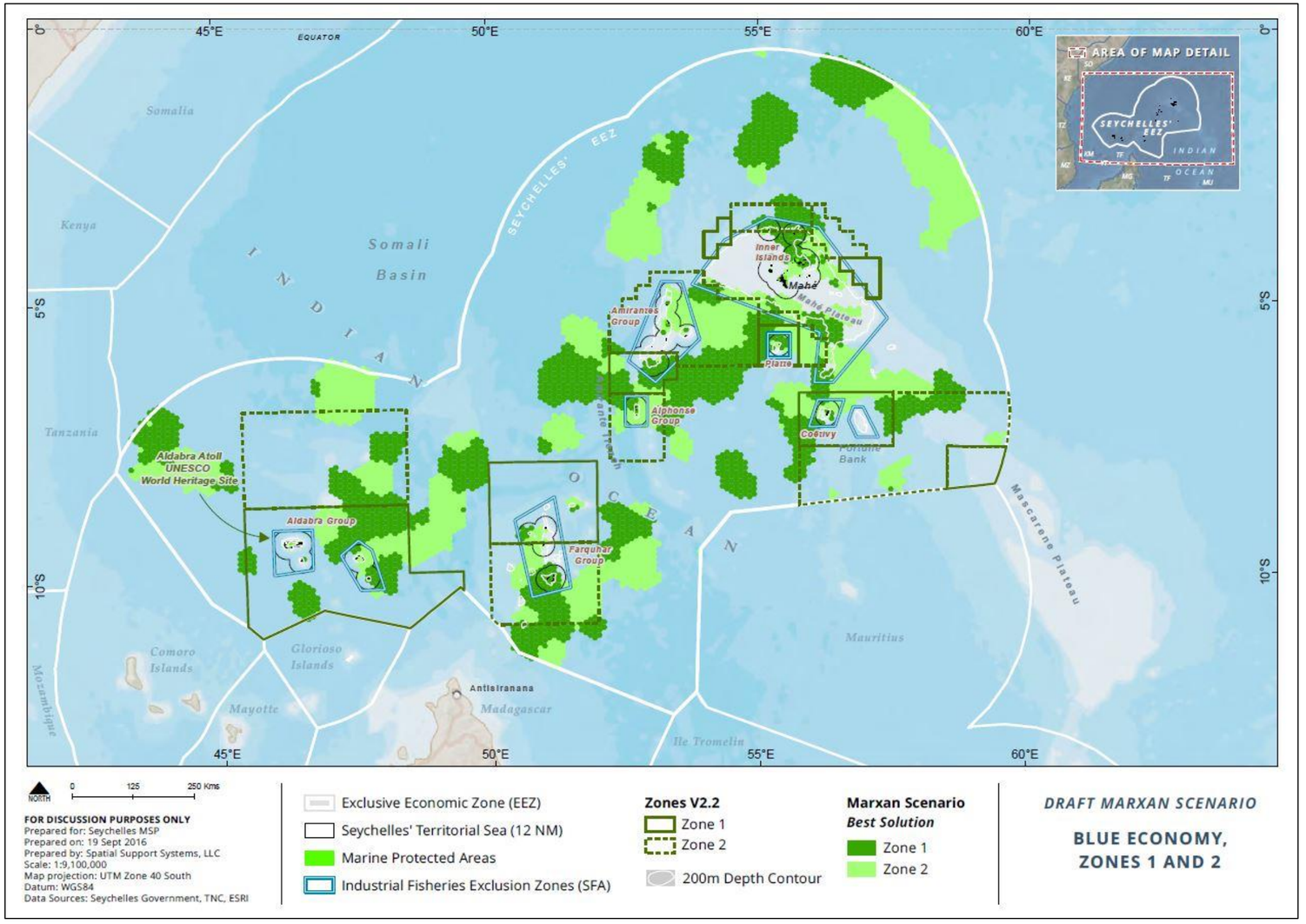


Marxan with Zones

Zone 1 – HIGH PROTECTION (Dark Green)

Zone 2 – MEDIUM PROTECTION (Medium Green)

BLUE ECONOMY SCENARIO



Marxan with Zones

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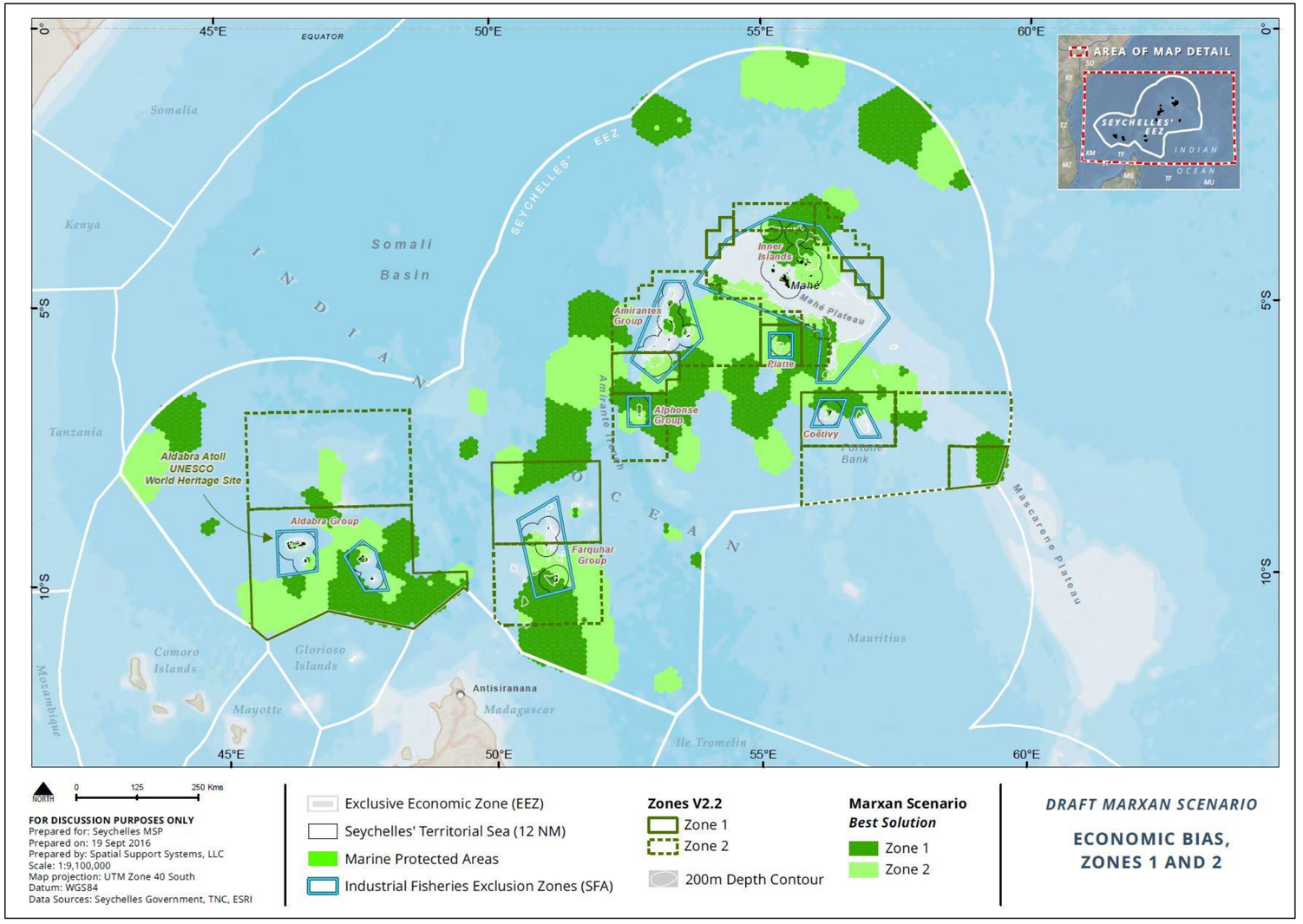
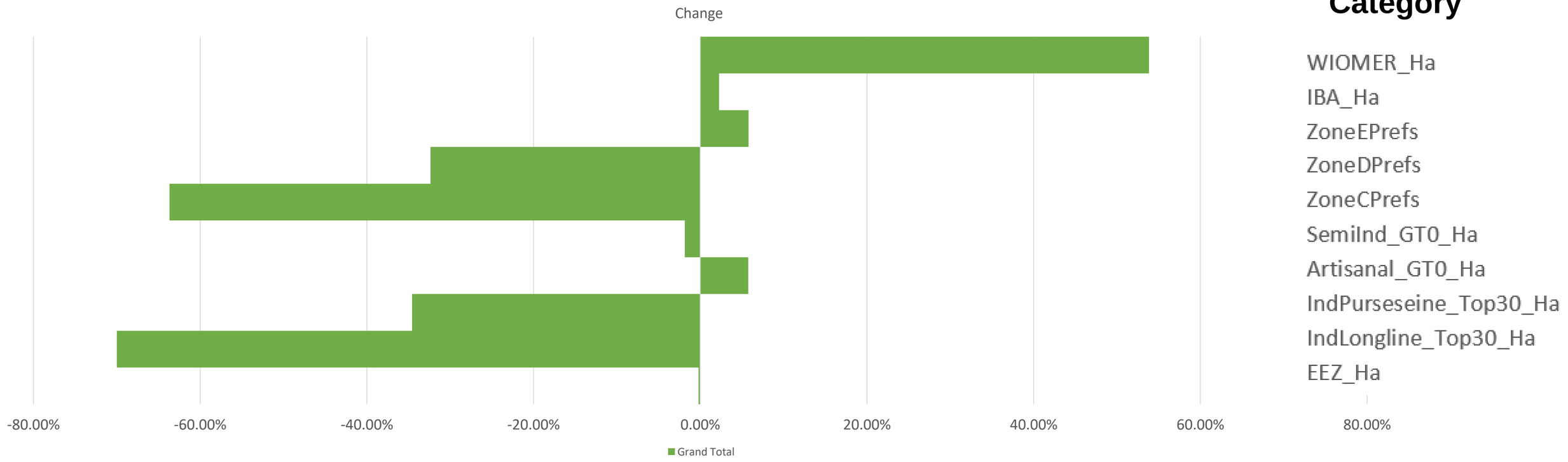
ECONOMIC BIAS SCENARIO



Analyzing Change Among Scenarios

Percent Change in Stakeholder Preference Area Representation

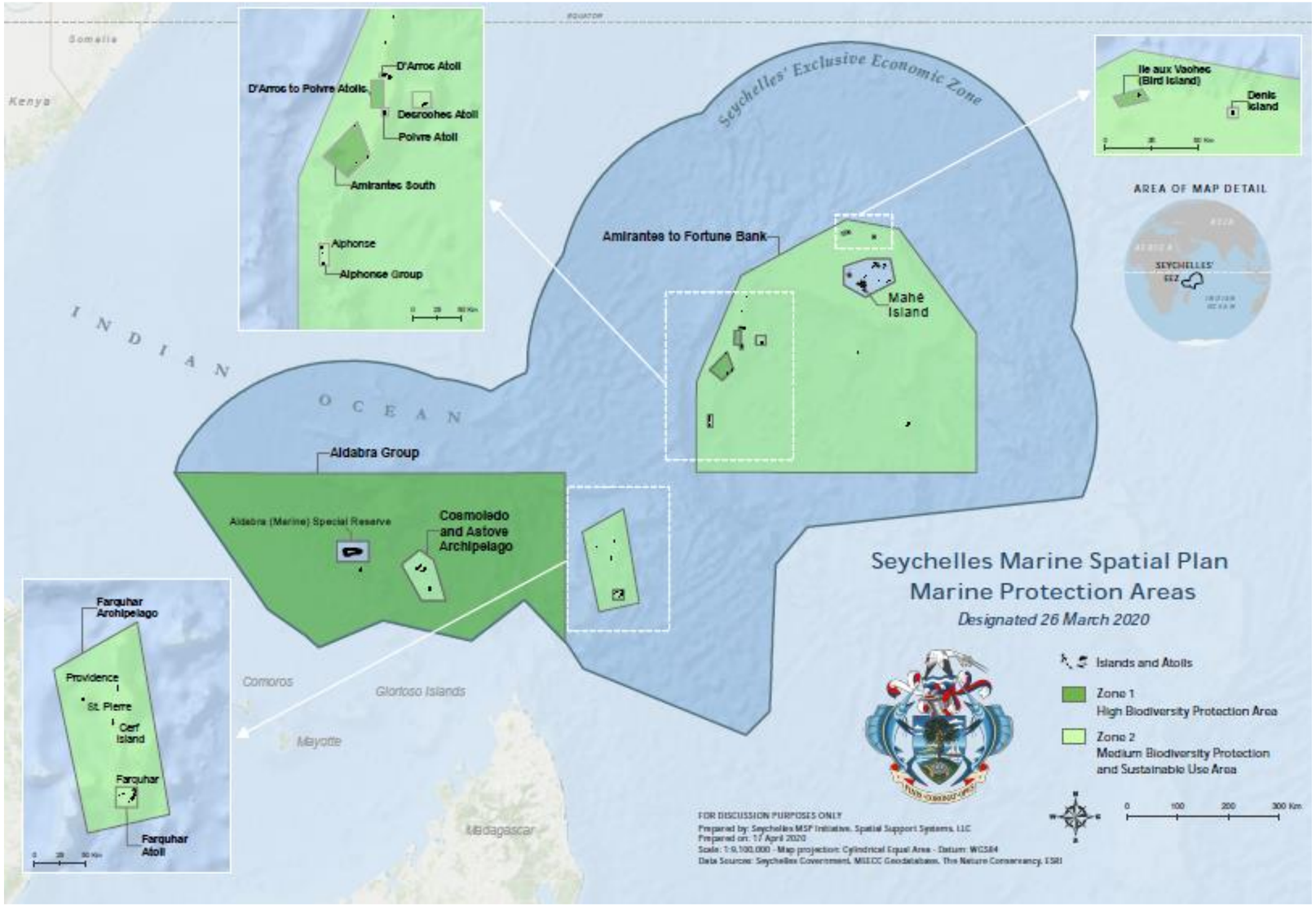
Biodiversity Bias → Economic Bias



Stakeholder Preference Category

WIOMER_Ha
IBA_Ha
ZoneEPrefs
ZoneDPrefs
ZoneCPrefs
SemiInd_GT0_Ha
Artisanal_GT0_Ha
IndPurseseine_Top30_Ha
IndLongline_Top30_Ha
EEZ_Ha

Seychelles Achieved 30% Goal in March 2020



13 Areas
Zone 1: 5 Marine National Parks
Zone 2: 8 Sustainable Use Areas

Zone 1: 203,071 km²
Zone 2: 238,442 km²

Legally designated under National Park and Nature Conservancy Act (NPNCA)

DRAFT Allowable Activities and Management Considerations

Spatial Analysis in MSP: Lessons Learned

DATA COLLECTION AND MANAGEMENT

- Regular and continued **participatory mapping is key**
- **Expert knowledge** adds value to spatial models

SPATIAL ANALYSIS

- Marxan outputs need appropriate and extensive review
- Planning process are time-constrained, **all analysis efforts contribute useful information**

MAPPING

- **Share maps!**
- Interested parties need time to digest mapped information

Reality Check

Marxan highlights areas that meet representation goals while minimizing costs.

BUT…

- Spatial data are geographic abstractions of complex realities.
- **We often don’t have any spatial data to represent features we know to be important**.
- Cannot always capture nuanced planning constraints with spatial data.
- Marxan simply can’t provide a single “right answer”. The planning solution typically represents a compromise between what is most efficient vs. other stakeholder preferences.
- **Stakeholders have different beliefs about what is important.**
- Stakeholder feedback loops are crucial and inform **iterative refinement** of zoning designs

Reality Check (Cont'd)

- Marxan is a key component of a broader decision support system

- Provides reference for place-based discussions, supported by descriptive statistics derived from the underlying integrated planning unit database.

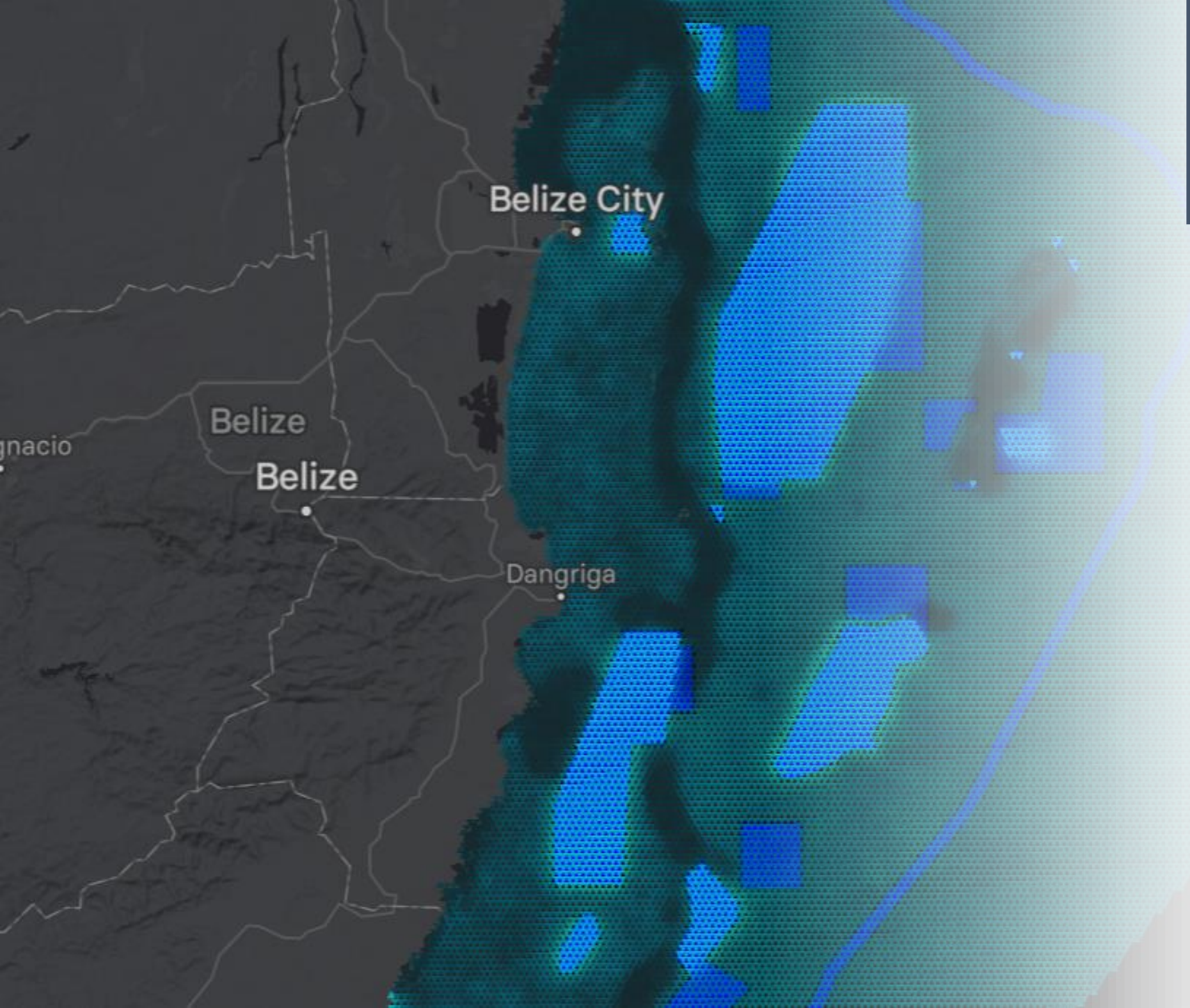
- Additional analyses post-Marxan are necessary to support zoning decisions:

    - Assessing sector-based **trade-offs** among the zoning scenarios

    - Investigating **values** captured in specific places

    - Identifying areas that have **unique or rare features**

    - Assess **replication** of features across zone areas

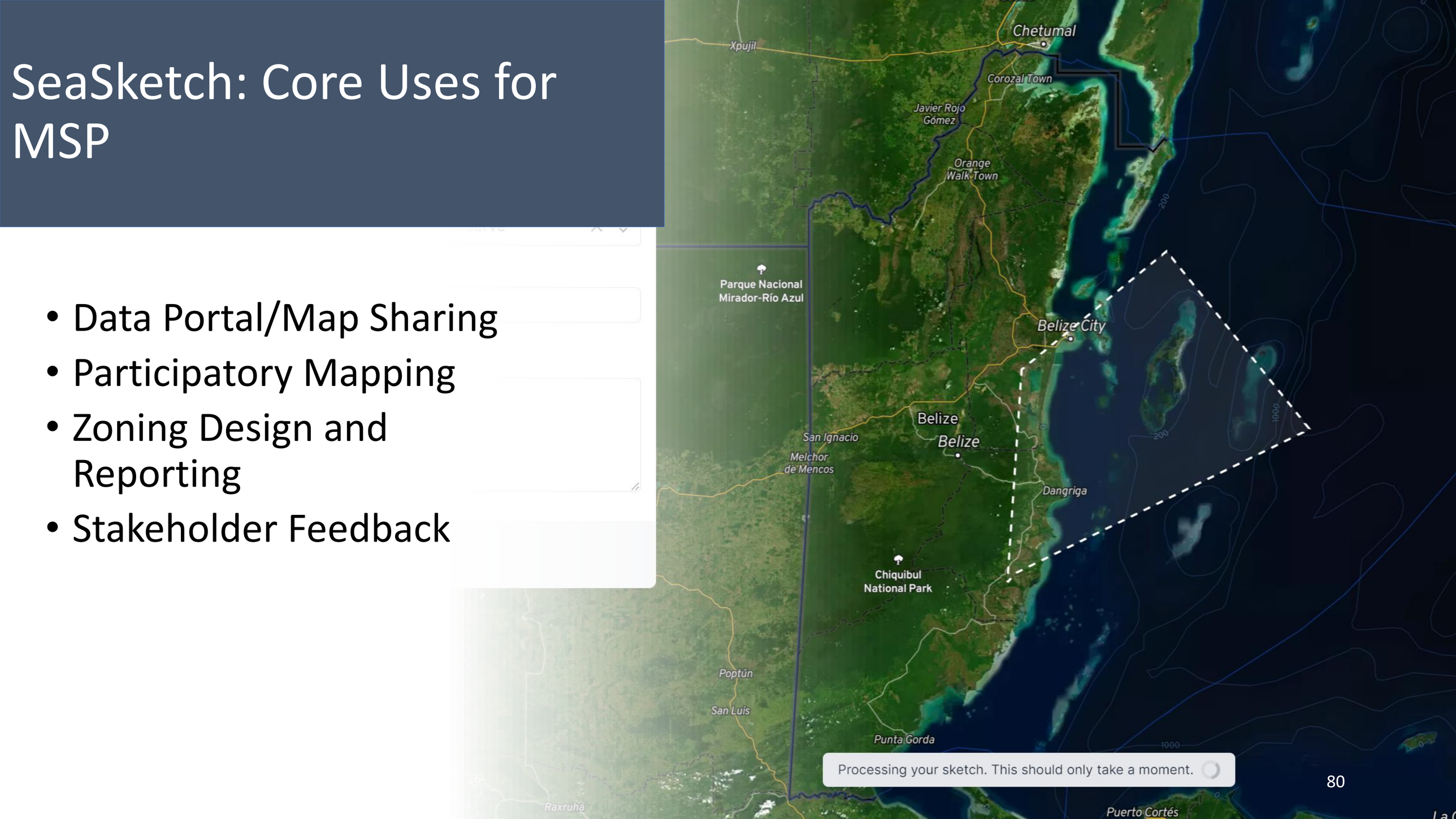


Using Marxan in BSOP

- Key workshop takeaways
- Marxan training next week
- How can the OUS be incorporated into Marxan?
- Use Marxan to further evaluate proposed areas and identify new areas

SeaSketch: Core Uses for MSP

- Data Portal/Map Sharing
- Participatory Mapping
- Zoning Design and Reporting
- Stakeholder Feedback



InVEST

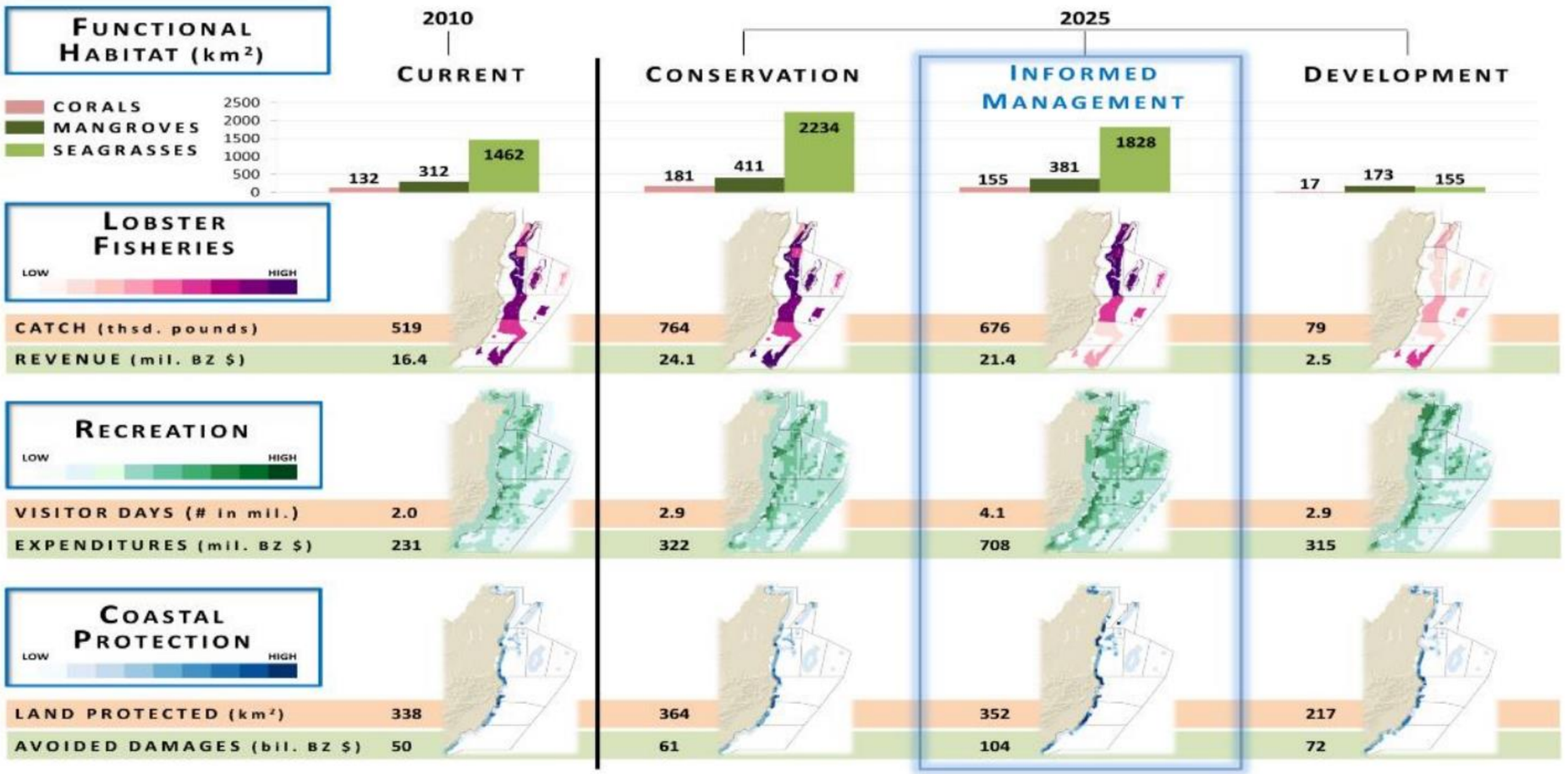
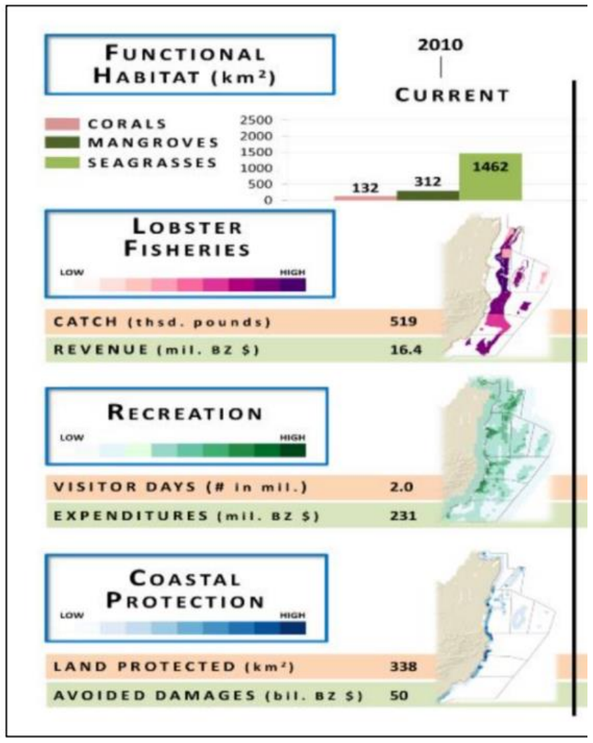


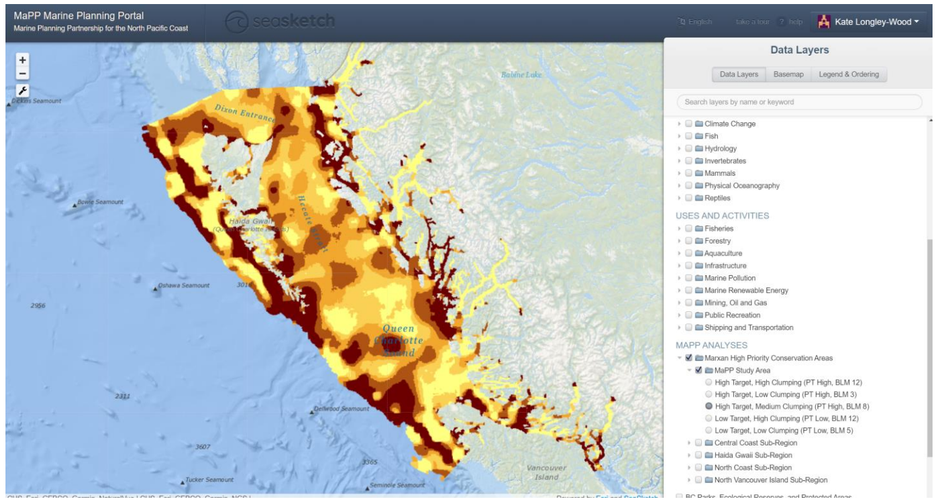
Figure 6: Functional Habitats and the Delivery of Ecosystem Services by Scenarios

Marxan and Other Spatial Planning Tools

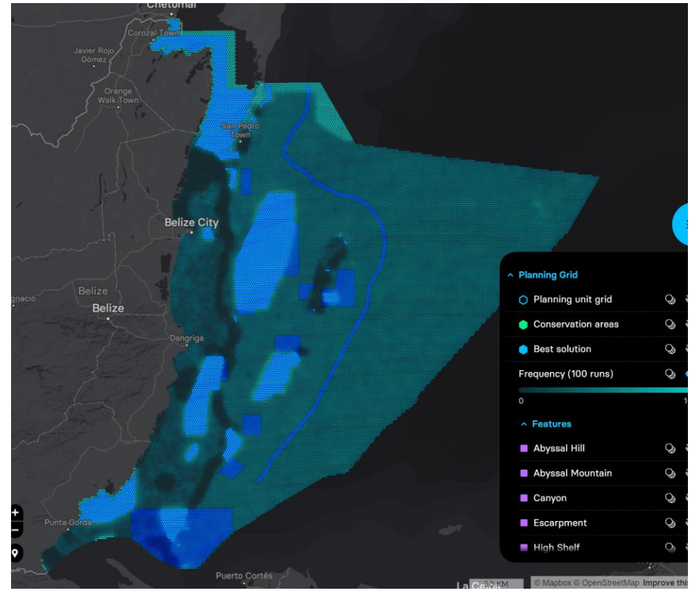
InVEST



SeaSketch



Marxan



QUESTIONS

Closing Day 3

- A workshop summary report and outputs will be posted on the BSOP website: https://bsop.coastalzonebelize.org/

- Before we adjourn, kindly share:
  - 1 thing you learned from the workshop

    OR
  - 1 take-away you will share with a colleague

Belize Sustainable Ocean Plan

Belize Sustainable Ocean Plan

Thank you for participating!