Belize Sustainable Ocean Plan

Welcome to

Belize Sustainable Ocean Plan

Belize Sustainable Ocean Plan Geospatial Workshop

Utilizing SeaSketch and Marxan

Date: April 14 – April 16, 2025

Location: Toucan Room, Belize Biltmore Plaza, Belize City, Belize

This is brought to you by

Belize Sustainable Ocean Plan

in partnership with

BELIZE COASTAL ZONE MANAGEMENT AUTHORITY & INSTITUTE

The Nature Conservancy Belize

Belize Fund For A Sustainable Future

BLUE BOND and Finance Permanence Unit
OFFICE of the PRIME MINISTER

Belize Sustainable Ocean Plan

Day 3: Marxan

Belize Sustainable Ocean Plan Geospatial Workshop

Date: April 16, 2025

House Keeping

Arrival & Registration

Please arrive at least 15 min. before, so you have time to check in. The workshop begins promptly each day.

Break Times

Morning Break: 10:15 – 10:30 AM

Lunch Break: 12:30 – 1:30 PM (Lunch provided. Tickets will be distributed)

Afternoon Break: 2:30 – 2:45 PM

Wi-Fi Access

Free Wi-Fi available. **WIFI: Bwplusbiltmore**

Restrooms

Restrooms are located outside

House Keeping

Phones & Devices

Please silence phones and devices during sessions.

Laptops/tablets welcome for note-taking and workshop tasks.

Engagement

Please participate actively in all activities.

Group discussions and team tasks are key parts of the workshop.

Feedback

Daily feedback will be conducted.

Health & Safety

If you feel unwell, inform a facilitator privately.

DAY 3 - AGENDA

Focus: Input validation, gap identification, and forward planning

Time	Session	
9:00 am	**Doors Open, Networking**	
9:15 am	**Day 2 Recap & Overview of Day 3**	Review insights and validate previous outputs
9:30 am	**Marxan Costs Overview**	Group input on costs and lock-out zones
10:15 am	**Coffee Break**	
10:30 am	**Activity: Identify Costs**	
12:00 pm	**Activity: Results Review**	
12:30 pm	**Lunch**	
1:30 pm	**Activity: Using SeaSketch Planning Tool to draw lock-out areas for Marxan**	
2:30 pm	**Coffee Break**	
2:45 pm	**Synthesis of all inputs**	Present combined outputs (features, costs, zones)
3:00 pm	**Group Discussion and Reflection**	Identify unresolved issues and data gaps
3:45 pm	**Summary Review**	Confirm inputs for modeling
4:00 pm	**Workshop Wrap up and Next Steps**	Share next steps, contact updates, and participant feedback
4:30 pm	**Adjourn**	

Belize Sustainable Ocean Plan

Day 3: Marxan

Belize Sustainable Ocean Plan
Geospatial Workshop

April 16, 2025

Day 2 Recap and Agenda Updates

April 16, 2025
9:15 – 9:30

Session Goal:

- Reflect on Day 2 takeaways; align expectations for Day 3.

Share Feedback

Expected Outcome:

ACTIVITY

Wave Check – What's Surfacing?

1. What is a feature?
2. Can you explain the relationship between SeaSketch and Marxan?

Marxan Costs Overview

April 16, 2025
9:30 – 10:15

Session Goal:

- Provide overview of cost in Marxan

Understanding what costs are in Marxan and how they might identify appropriate spatial data inputs to reflect costs in the BSOP context.

Expected Outcome:

Presenter:

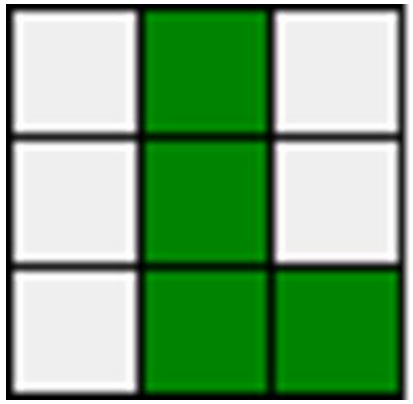
Rick Tingey

Principal

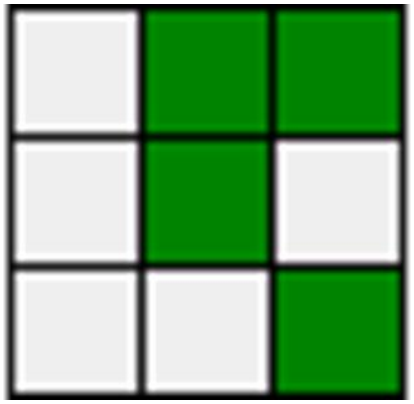
S3 Spatial Support Systems

Marxan Outputs

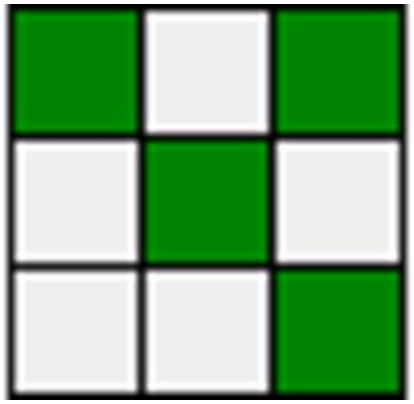
Solution 1



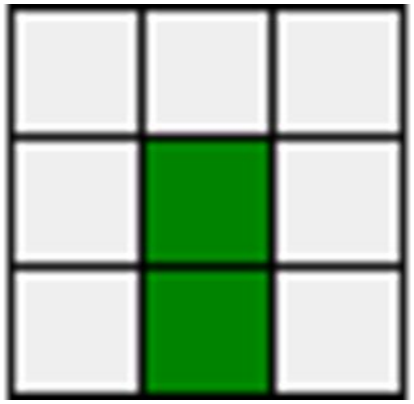
Solution 2



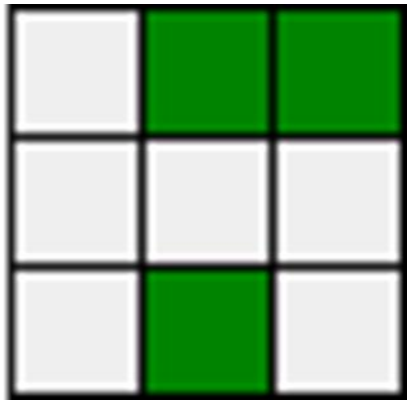
Solution 3



Solution 4



Solution 5



1	3	3
0	4	0
0	3	3

Numbers represent how many times each Planning Unit was selected

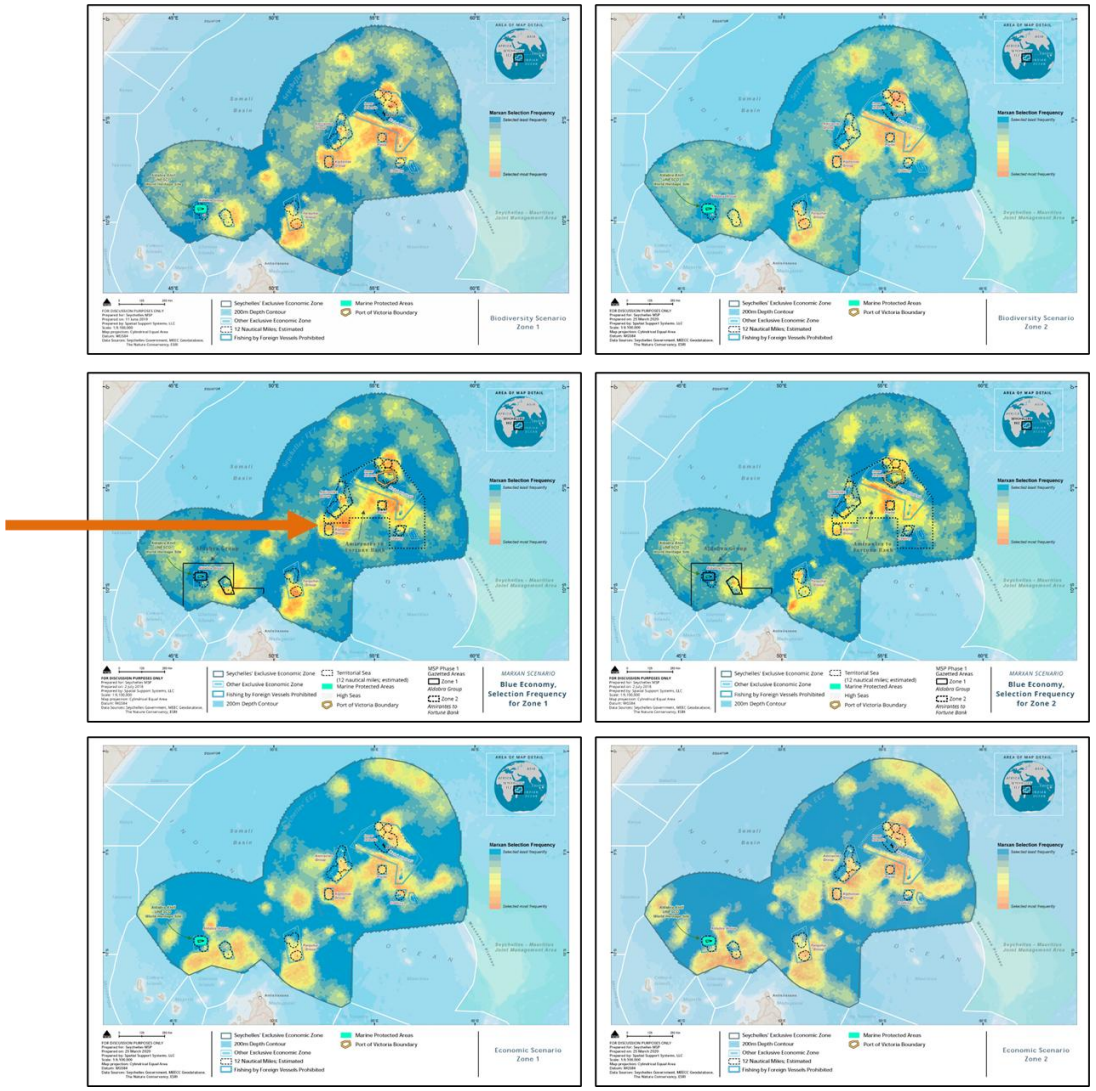
Seychelles Examples

3 spatial 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 spatial scenarios.

Selection Frequency values highlighted specific areas.

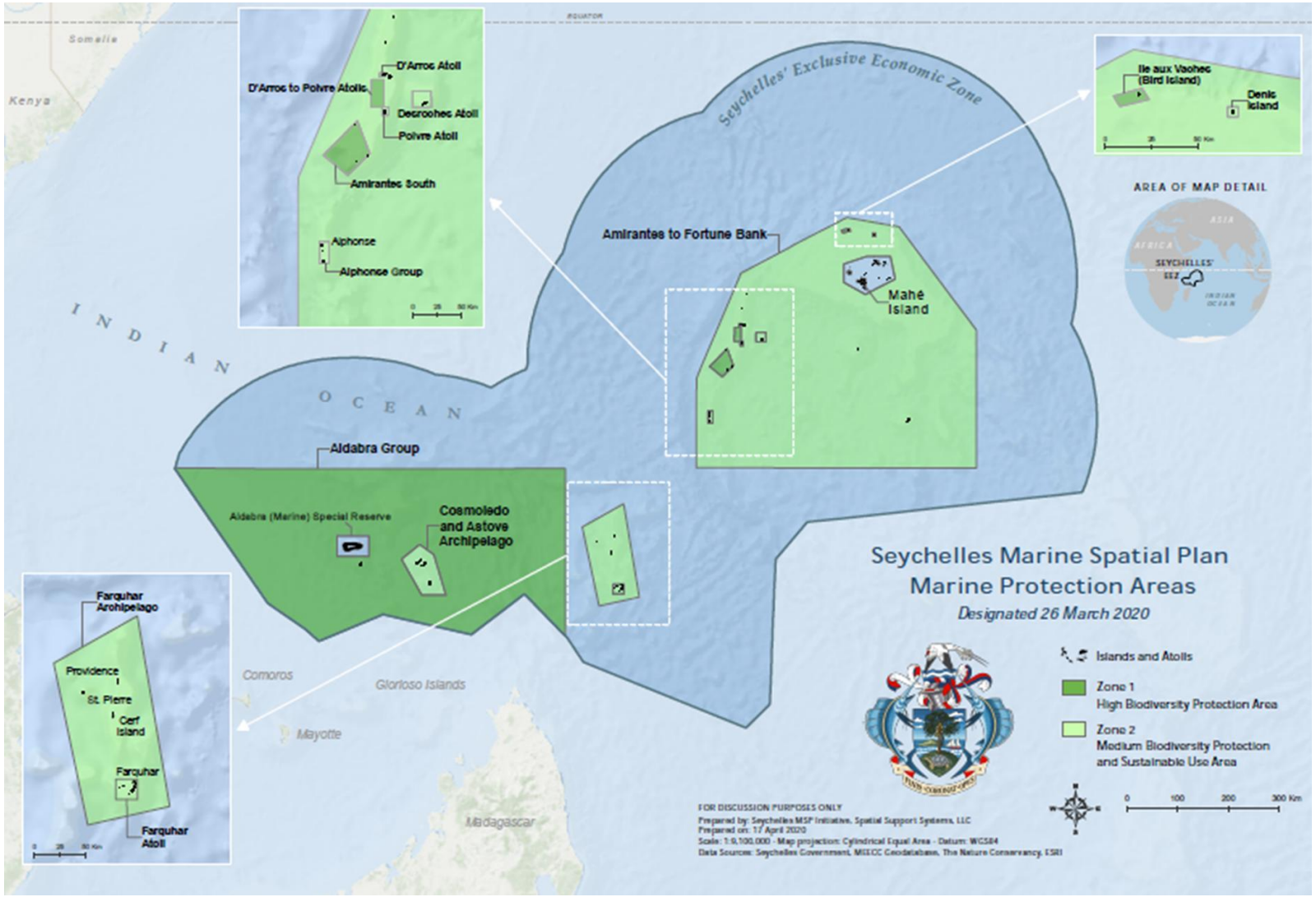


BIODIVERSITY BIAS SCENARIO

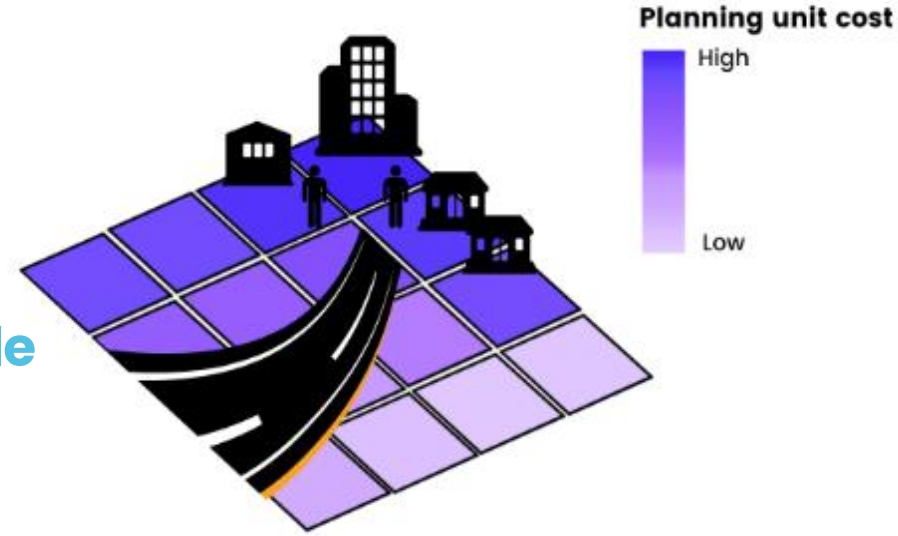
BLUE ECONOMY BIAS SCENARIO

ECONOMIC BIAS SCENARIO

Final Seychelles Zoning Design

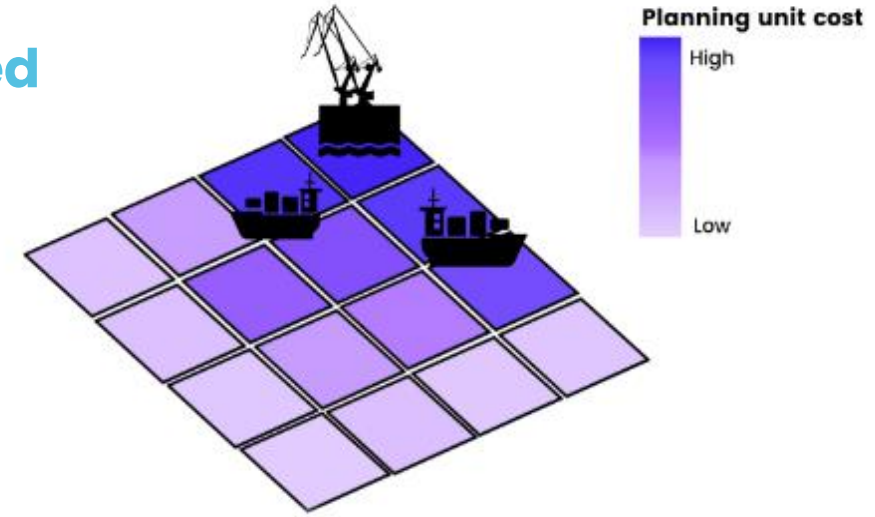


What is a Cost?



In Marxan, costs are values that make it less desirable to select a planning unit for protection.

Cost = What Marxan tries to **minimize**



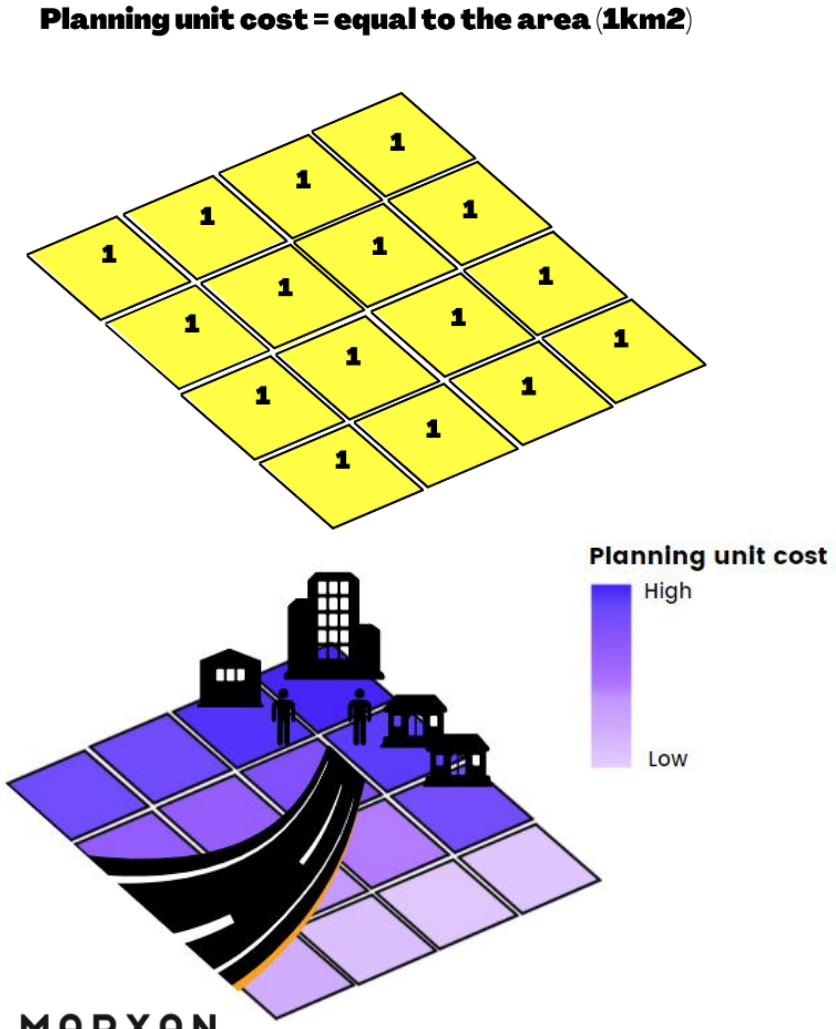
The cost layer directly affects which areas are selected

- ***Socioeconomic impacts***
  - *e.g., fishing revenue, tourism value*
- ***Conflicts between ocean uses***
- ***Ecological risk***
  - *e.g., areas with pollution or development pressure*

A planning unit with a high-cost value is less likely to be selected in output scenarios.

MARXAN
conservation solutions

Costs are Summarized by Planning Units



Costs reflect socioeconomic (or environmental) factors, which, if minimized, could help the conservation plan be implemented more ***efficiently, effectively*** *and* ***reduce conflicts.***

- **Action Costs ($$)** – Costs associated with doing conservation
- **Proxy Costs** – May be used when specific cost data not available (e.g., coastal population, accessibility/ distance to key features)
- **Opportunity Costs** – Economic losses due to implementation of a conservation action

MARXAN
conservation solutions

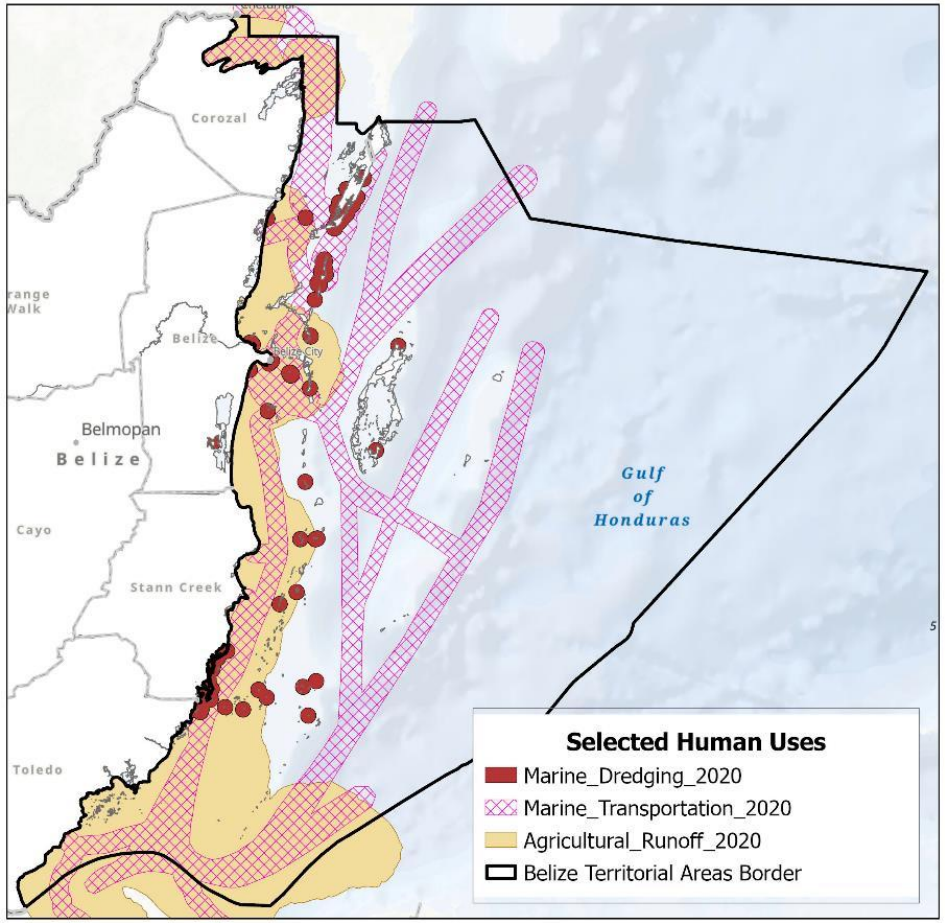
Example Cost Scenario

Avoid Existing Human Uses

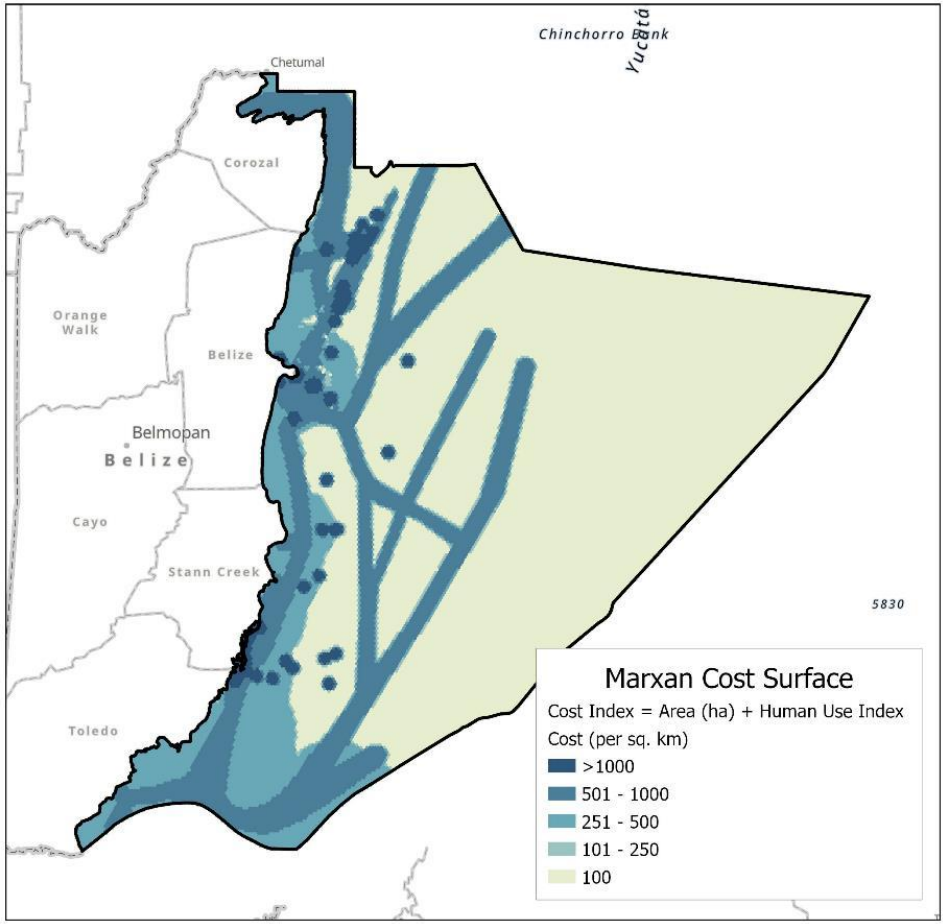
Cost Function:

Activity	Cost Index
Agricultural Run-off	2.5x
Marine Transportation	5.0x
Marine Dredging	10.0x

Human Uses (example)



Cost Surface



MARXAN
conservation solutions

Best Practices for Choosing Costs

Match Cost to Your Objective

- **Action cost** if you want to minimize budget needs
- **Opportunity cost** if you want to reduce user conflict (e.g., fishing, tourism)
- **Ecological cost** if you want to avoid risk to sensitive areas

Use Data That's Available and Trustworthy

- Use **real data** when possible (e.g., tourism zones, participatory fishing maps)
- **Proxies** are acceptable Use area as a fallback, but be clear it's a proxy (e.g. for management expense)

Best Practices for Choosing Costs

Keep It Simple and Transparent

- One clear cost layer is better than a complex mix
- Avoid “black box” cost indexes

Make It Meaningful to Stakeholders

- Use understandable terms
- Explain what the cost represents in each scenario and why it matters

Belize Marxan Application in 2015

Cost Layer	Weight	Description & Buffers
Coastal Settlements	**2**	**Population centers.** A buffer was applied based on population size (Belize City: 10 km, Towns: 5 km, Villages: 3 km).
Aquaculture	**1**	Operational **shrimp farms**. A 500m buffer was applied from the mouth of impacted streams.
Agricultural Runoff	**3**	High-concentration areas of **pesticide and herbicide** runoff. No additional buffer applied.
Marine Transportation	**1**	Major **shipping routes**, water taxi lanes, and ports mapped as linear features.
Dredging (Mining)	**4**	Large-scale **mining or dredging** operations (exceeding 16,000 cubic yards per year). A 1.5 km buffer was applied.
Dredging (Registered Quarry)	**4**	Extraction activities involving 5,000-16,000 cubic yards. A 750m buffer was applied.
Dredging (Artisanal / Small Scale)	**1**	Small-scale extraction with hand tools only. A 250m buffer was applied.
Coastal Development	**3**	Highlighted **developed and cleared land** areas. A 1 km buffer was applied.
Fishing Pressure	**3**	Areas targeted for **commercial fishing**.
Highly Vulnerable Areas	**1**	Areas identified as highly **vulnerable to climate change** (e.g., reef degradation, sea level rise).

QUESTIONS

Coffee Break

10:15 – 10:30

Identify Costs

April 16, 2025
10:30 – 12:00

Session Goal:

- Get stakeholders input on cost inputs to Marxan

Participants have identified a preliminary list of costs and associated weights as Marxan inputs, as well as potential additional datasets to be considered.

Expected Outcome:

Presenter:

Will McClintock

Director - McClintock Lab - SeaSketch

Walk through of OUS heatmap to discuss potential use as a cost layer.

ACTIVITY

IDENTIFY COST

- Using cost and data explanations on the printouts **“Marxan Costs Table”** and reflecting on the OUS heatmap information that Will just explained;

- Fill out the following recording form.

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conservation solutions

Sample of recording form:

- Pink = High cost
- Orange = Medium
- Green = Low

- **Cost layer**: Name of data set to be used to represent an area
- **Spatial Accuracy:** Comment on whether the data set accurately describes the cost
- **Impact Level:** How strongly do you want to avoid this factor in a protected area?
- **Your Priority Rating:** How strongly do you feel about including this in the Marxan analysis?
- **Rationale/Notes:** If you think there's a cost layer we don't have in SeaSketch or OUS, kindly add it here and provide your reasoning for including this cost.

Cost Layer	Spatial Accuracy	Impact Level	Your Priority Rating	Rationale/Notes
	□ High □ Med □ Low	1. Lowest Impact 2. Little Impact 3. Moderate Impact 4. Highest Impact	□ High □ Med □ Low	
	□ High □ Med □ Low	1. Lowest Impact 2. Little Impact 3. Moderate Impact 4. Highest Impact	□ High □ Med □ Low	

ACTIVITY

WORLD CAFÉ ROUND 3

Instructions:

- Rotate through **2 cost tables** (12-15 minutes per table)

While reviewing, consider the following:

- Do you agree with the costs and weights that have been used in previous analyses?
- What are the implications if we ignore this cost?
- Which of these cost types feels most relevant to your sector?
- What trade-offs do you anticipate needing to make?
- Think about what cost data they trust and what's missing.

ACTIVITY

WORLD CAFÉ ROUND 3

Remember! OUS outputs could be used as cost inputs.

Vote with dots

- **Pink = High cost**
- **Orange = Medium**
- **Green = Low**

Note: *Please list any costs you can think of that aren't included in t current list and suggest how these data might be obtained.*

Read Out of Results

April 16, 2025
12:00-12:30

Session Goal:

- Share cost inputs and shared decisions.

Verified list of identified costs and associated weights as Marxan inputs from previous activity.

Expected Outcome:

ACTIVITY

READ OUT OF ACTIVITY RESULTS BY GROUP

Instructions:

- Each group (or table host) will present:
  - Key cost layers they prioritized
  - Suggested impact level and priority
  - Any concerns or disagreements

Lunch 12:00

We Return at 1:00

Table Check-Ins

- Any Materials needed
- Temperature of the Groups
- Any Concerns or Questions before we proceed

DAY 3 - AGENDA

Focus: Input validation, gap identification, and forward planning

Time	Session	
12:30 pm	**Lunch**	
1:30 pm	**Activity: Using SeaSketch Planning Tool to draw lock-out areas for Marxan**	
2:30 pm	**Coffee Break**	
2:45 pm	**Synthesis of all inputs**	Present combined outputs (features, costs, zones)
3:00 pm	**Group Discussion and Reflection**	Identify unresolved issues and data gaps
3:45 pm	**Summary Review**	Confirm inputs for modeling
4:00 pm	**Workshop Wrap up and Next Steps**	Share next steps, contact updates, and participant feedback
4:30 pm	**Adjourn**	

Using SeaSketch Planning Tool to draw lock-out areas for Marxan

April 16, 2025
1:30-2:30

Session Goal:

- Obtain stakeholder input on lock-out inputs to Marxan

Identified potential lock-out areas to be considered in Marxan analysis.

Expected Outcome:

Presenter:

Will McClintock

Director - McClintock Lab - SeaSketch

Lock-Out Areas

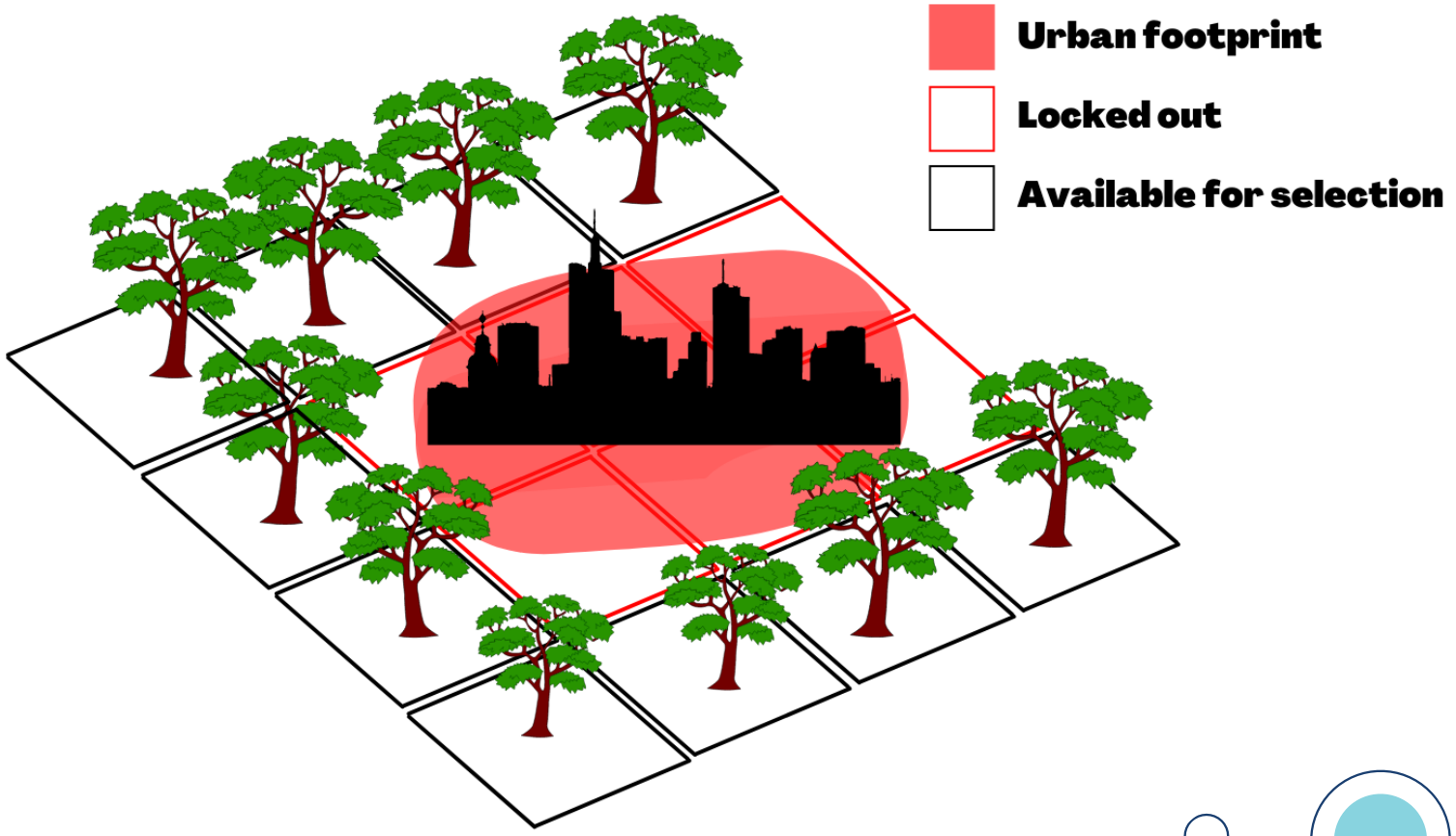
Areas to be excluded from the Marxan solution.

Common lock-out areas include locations that are:

- Already used for critical infrastructure (e.g., shipping lanes, submerged pipeline and cable corridors)
- Politically or culturally restricted (e.g., military exclusion zones, submerged archaeological sites)
- Other economically, culturally, or socially important areas

Lock-Out Areas

In Marxan, lock-out areas are treated as non-selectable. These are areas that should **NOT** be considered for Biodiversity Protection Zones



ACTIVITY

PRACTICE USING SEASKETCH TO IDENTIFY LOCK-OUT AREAS.

Instructions:

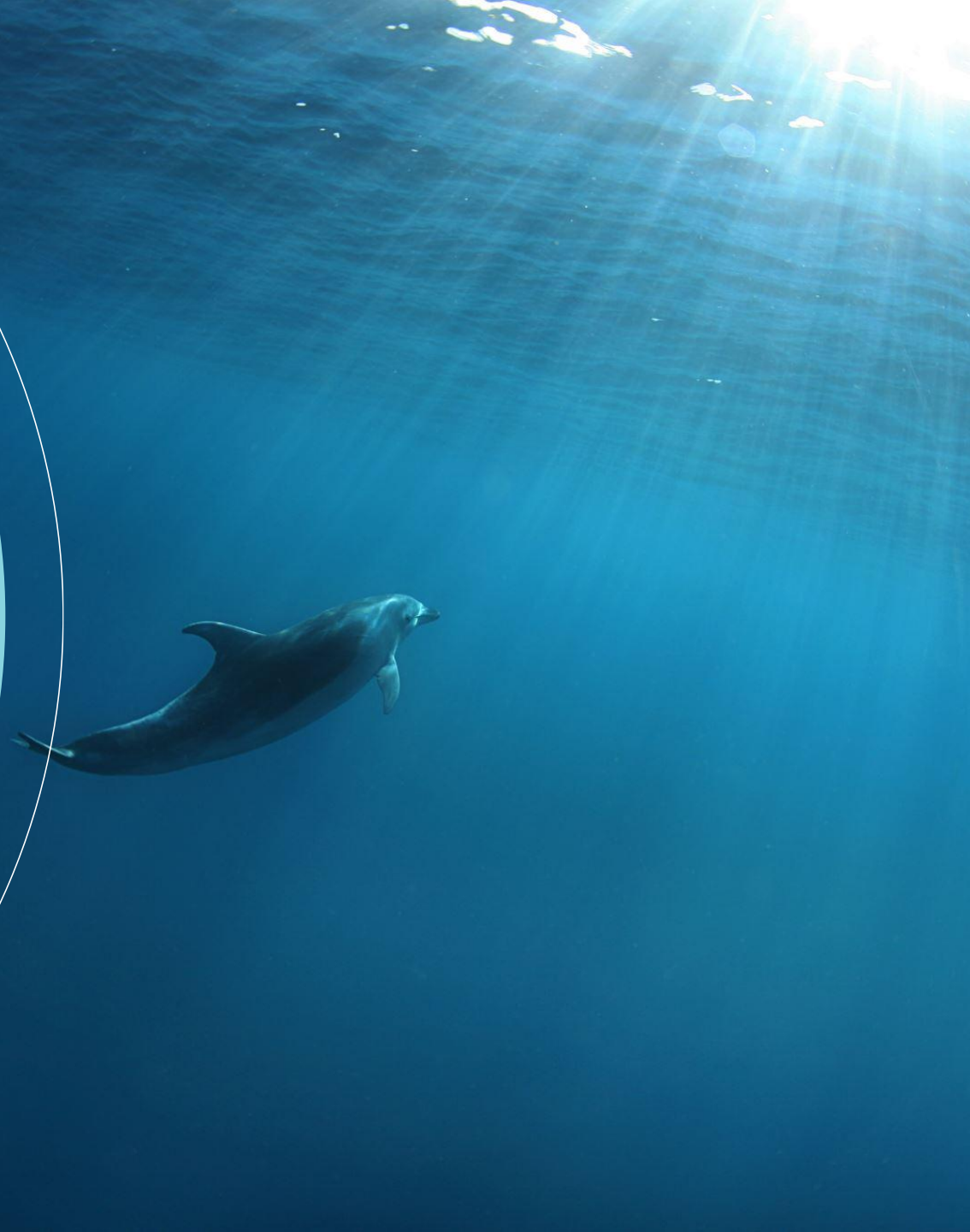
- In small groups or pairs, use SeaSketch to draw draft lock-out areas
  - Note: Lock-out areas are NOT good candidates for conservation *(e.g., military zones, highly developed areas, high-conflict areas)*
- Post your sketches to the shared forum
- Include in your forum comments:
  - A name for the proposed lock-out zone
  - Rationale for the lock-out (e.g., traditional use area, highly developed area; high conflict area)
- Be prepared to explain your reasoning

Coffee Break

2:30 – 2:45

Small Group Discussion

April 16, 2025
3:00 – 3:45



Session Goal:

- Provide an opportunity for participants to reflect on preliminary Marxan inputs.

Additional thoughts, comments, and context for Marxan inputs to be considered in the next steps.

Expected Outcome:

ACTIVITY

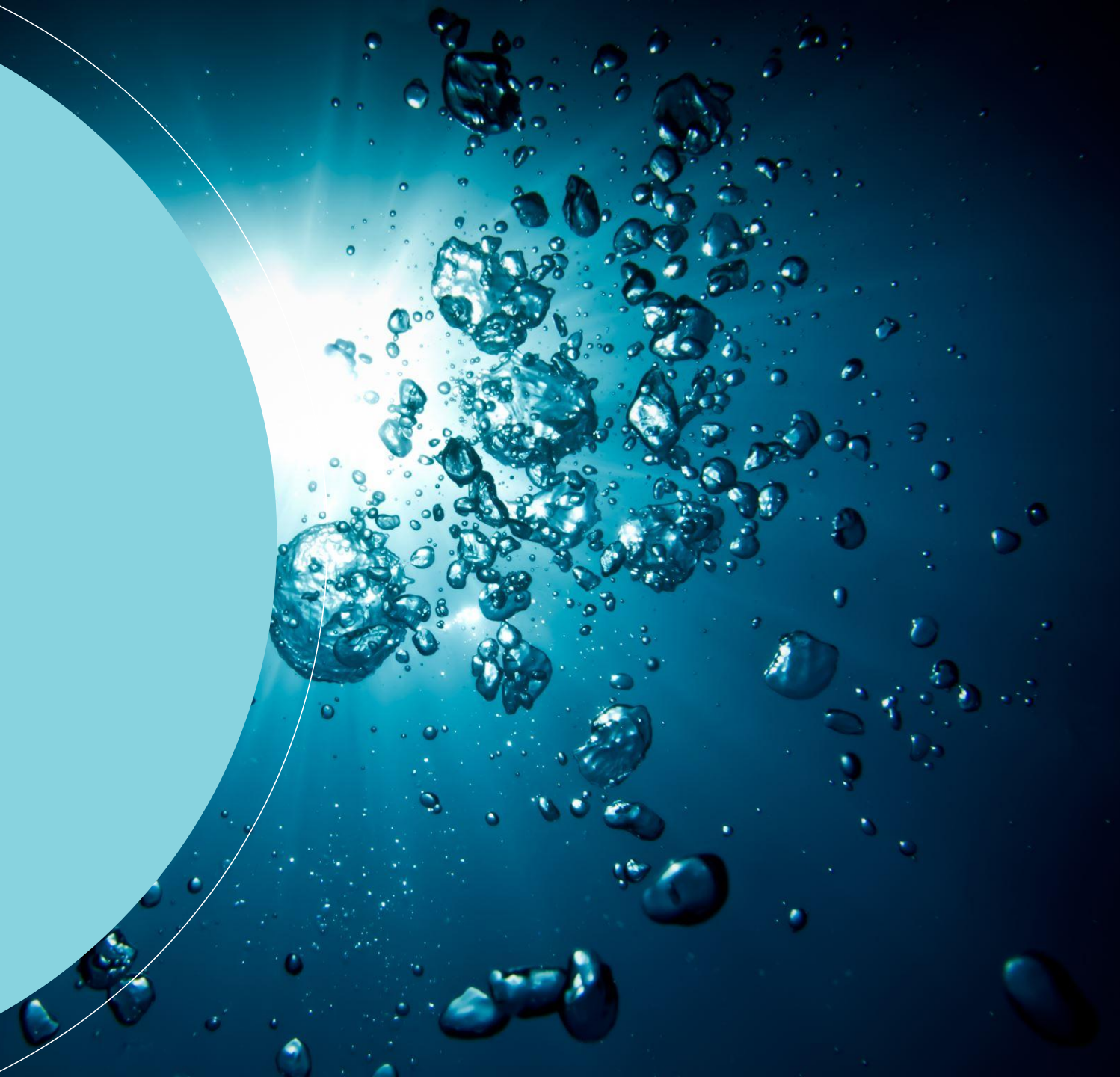
WORLD CAFÉ ROUND 4

Instructions

- Based on the Lock-out areas you observed:
  - Are you in agreement with what was posted to the forum by the team you analyzed?
  - Would you adjust the boundaries of the lock-out area?
  - Are there any other comments regarding the lock-out activity?

Synthesis of All Input

April 16, 2025
2:45 – 3:00



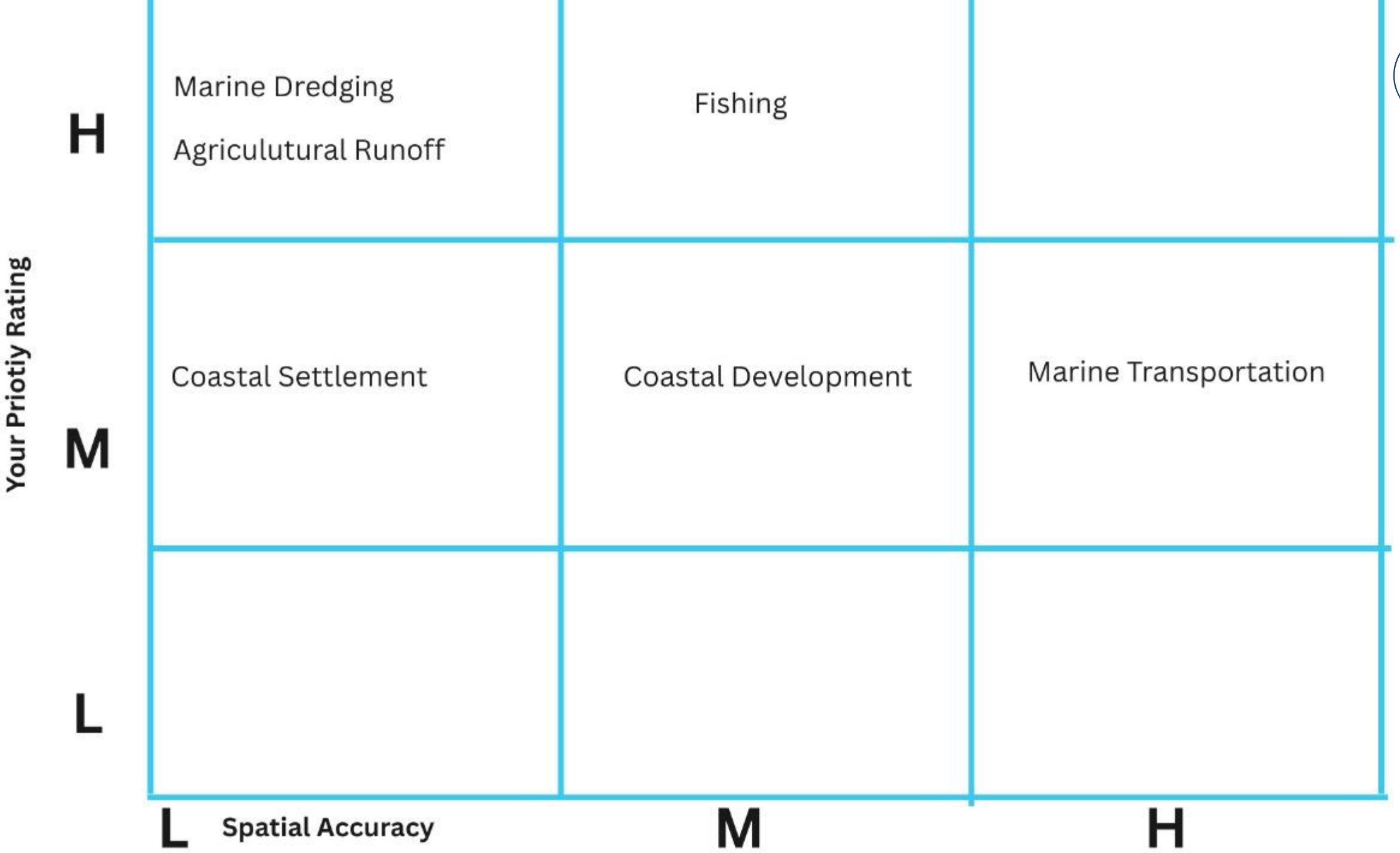
Session Goal:

- Present overview/summary of all input (related to Marxan inputs) provided throughout the workshop.

Expected Outcome:

Understand the breadth of feedback provided and potential areas of consensus/disagreement

FEATURE	CURRENT % OR TARGET % PROTECTION		NOTES
	Current %	Target %	
Spawning Aggregation Sites	100%		Spawning Aggregation Sites should be included as a layer on SeaSketch
Manatee Sightings & Migration		100%	
Benthic (Sandy, Flats)		50%	Supports many economic industries
Seagrass		75%	
Mangrove	33.4%	70%-85%	All magroves should be protected
Turtle Nesting Sites	100%		
Indicator & Commercial Species (Sea Urchins, Sharks, Snappers, Pelagics		50%	
Coral	50.3%	50%-75%	% Coral coverage is not accurately reflected on SeaSketch
Coral Reef / Mangrove (In the context of shoreline protection)	50.3%	50%-75%	% Coral coverage is not accurately reflected on SeaSketch


Marine Dredging
Agriculutural Runoff
Fishing
Coastal Settlement
Coastal Development
Marine Transportation
H
M
L
Your Priotiy Rating
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Spatial Accuracy
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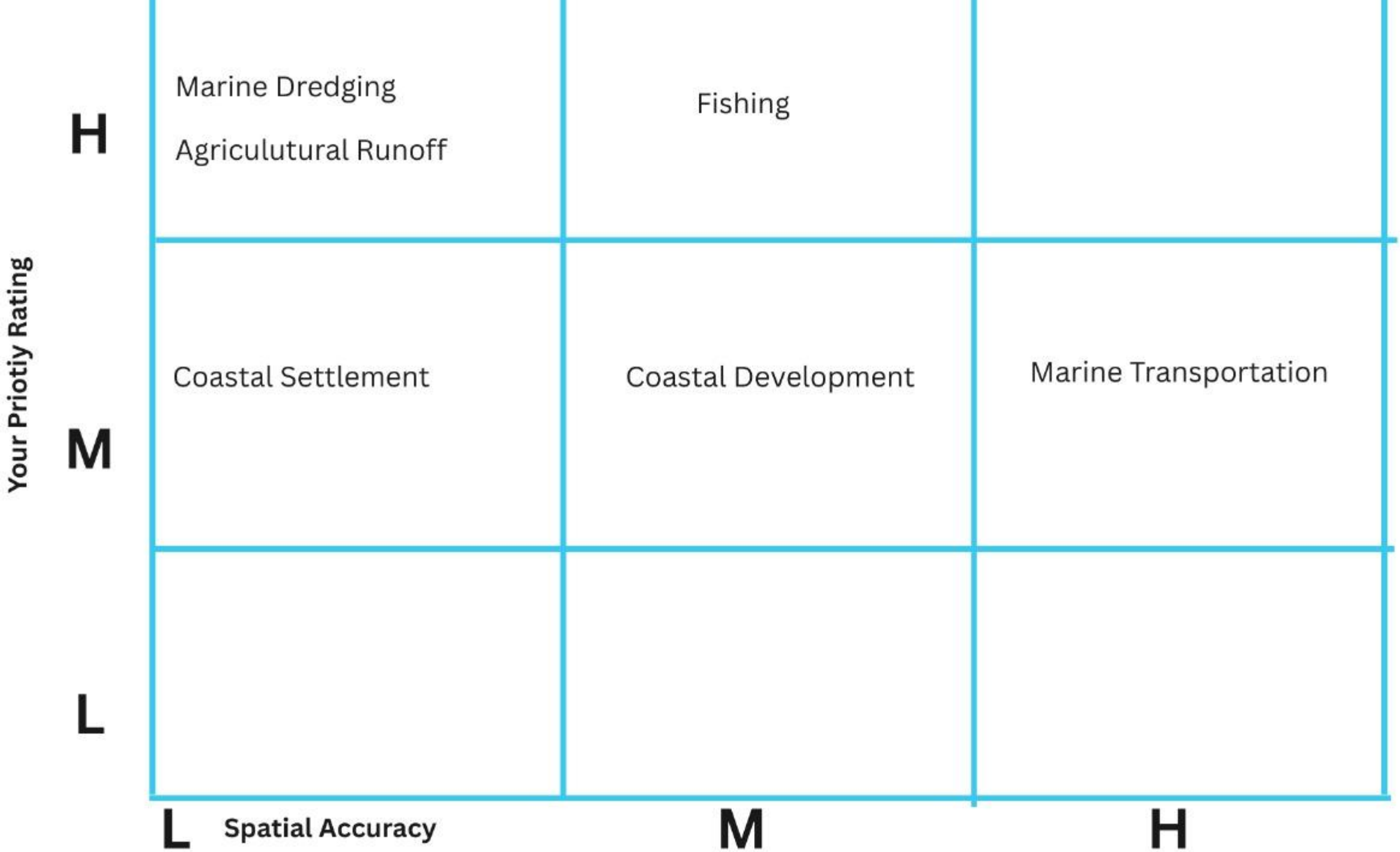
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Marine Transportation
H
M
L
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L
Spatial Accuracy
M
H

FEATURE	CURRENT % OR TARGET % PROTECTION		NOTES
	Current %	Target %	
Sharks		30%	Good baseline data exists for Turneffe, Lighthouse, Sapodilla Cayes, and Ambergris Caye. Community members in Placencia, Independence, and Sien Beight are in favor of protection.
Endemic Seagress species that are found in Placencia			

Simplified Gradients of Agreement Scale

To facilitate efficient and transparent decision-making during the workshop, we will utilize Gradients of Agreement Scale when needed:

Whole-hearted Endorsement

"I strongly support this."

Agreement with Minor Reservations

"I can support this, even if I have small concerns."

Mixed Feelings

"I have concerns but will not block the group's direction."

Major Reservations

"I have serious concerns that should be addressed before moving forward."

Cannot Support

"I do not support this and believe it should not proceed."

HOW TO USE: *When asked, put your hand up for the item that best represents your position*

Wrap UP

April 16, 2025
3:00 – 3:30

Belize Sustainable Ocean Plan

WORKSHOP WRAP UP AND NEXT STEPS -

What happens after the workshop (data collection & cleaning, Marxan scenario modeling, synthesis reporting)

When and how participants will be engaged again

Participants

Share one takeaway or insight

Name a moment of clarity or impact

Belize Sustainable Ocean Plan

PARKING LOT

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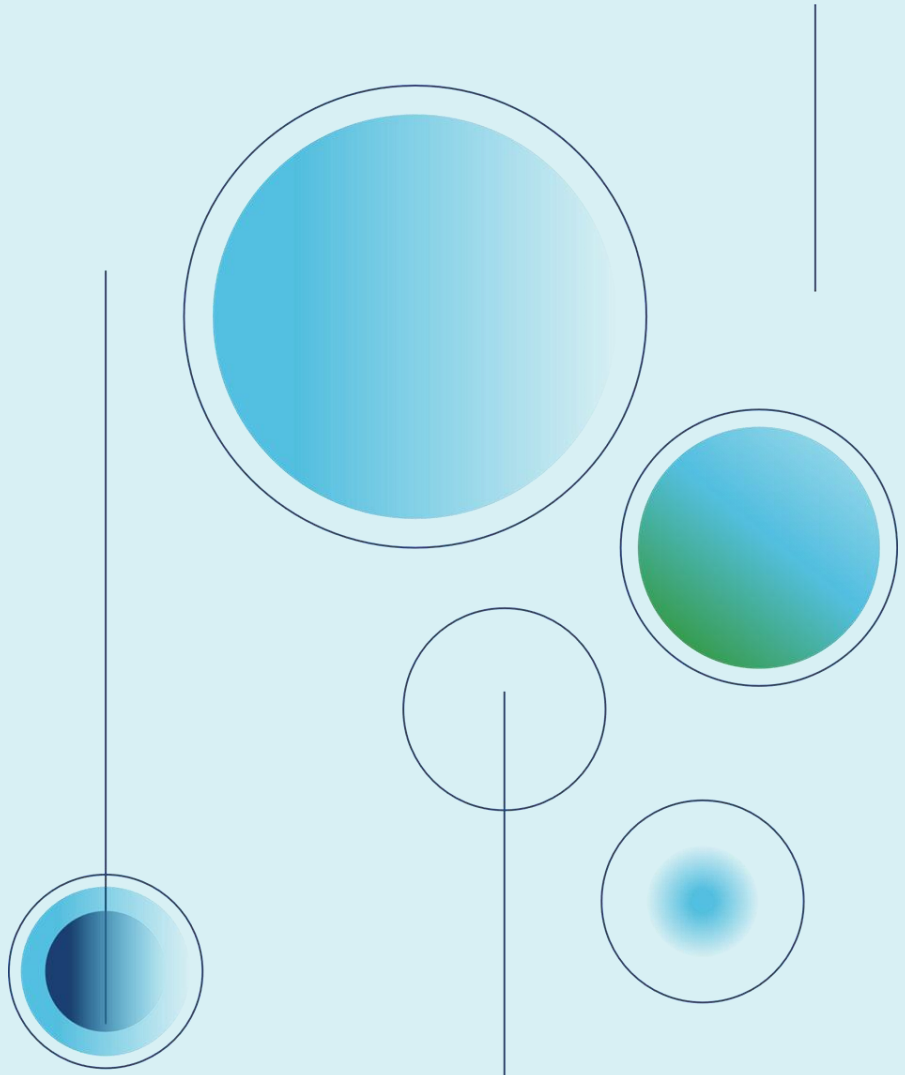
FEEDBACK SURVEY



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Thank you for participating

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