



# Incorporating in-situ observations and indigenous knowledge into MPA design



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ICCB Conference, 2023





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# Incorporating in-situ observations and indigenous knowledge into MPA design

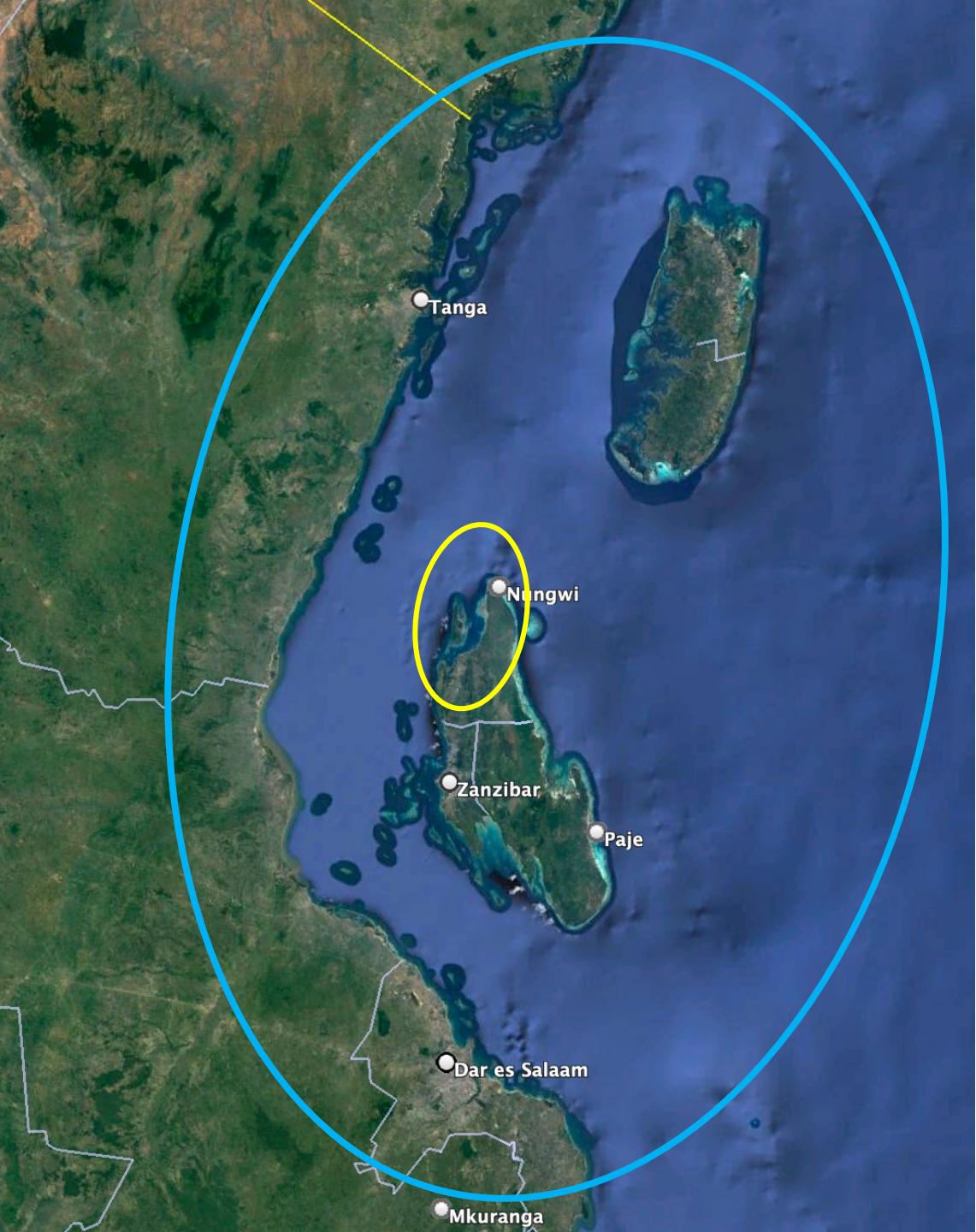
## Outline

Objective and Motivation

Implementation method

Preliminary results and management implications

Conclusions and future work

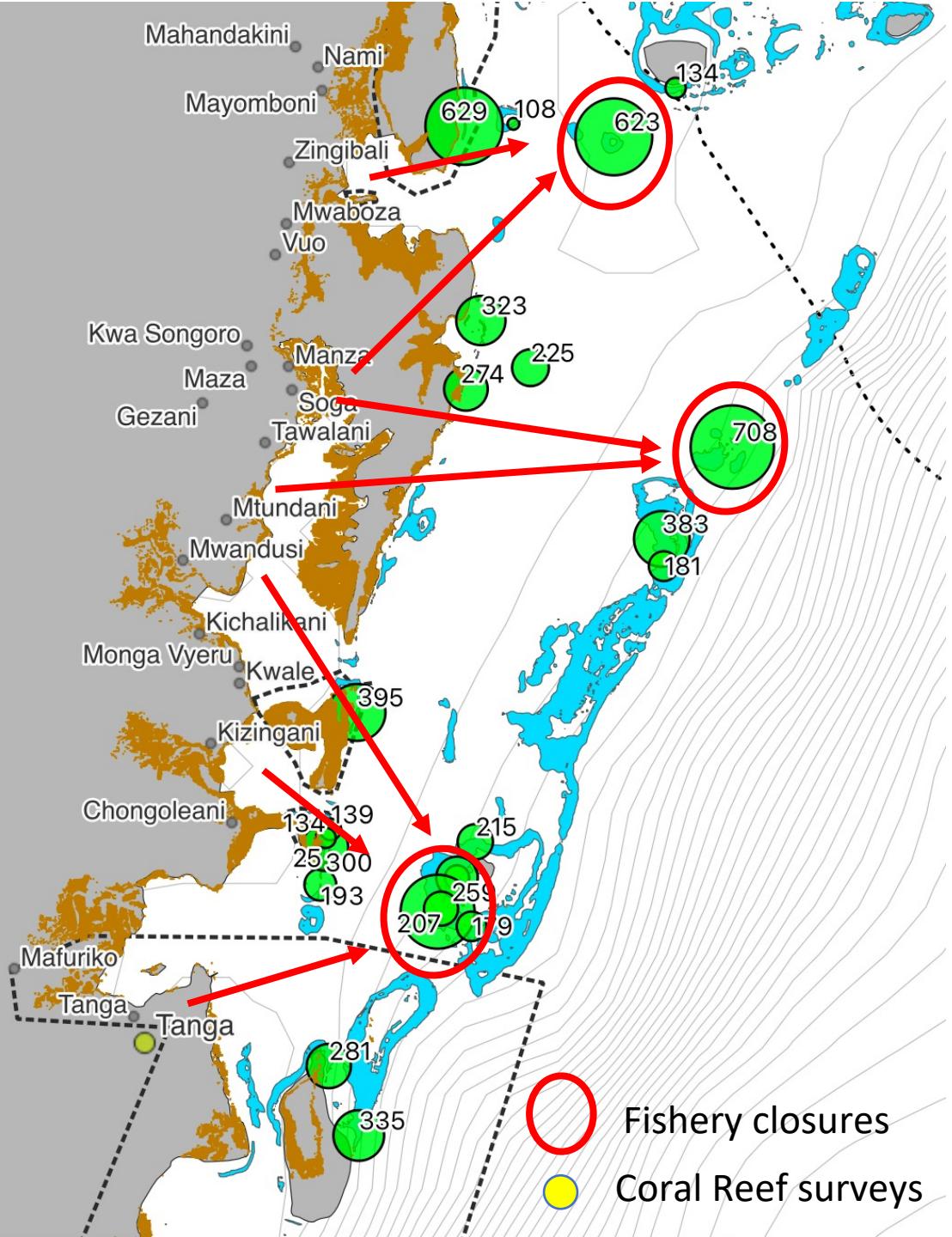


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## Goal

To develop a network of MPAs that **maximizes ecological value while limiting impact on local communities**

Demonstrate our approach for **northern Zanzibar** but to be extended across the whole of **northern Tanzania**



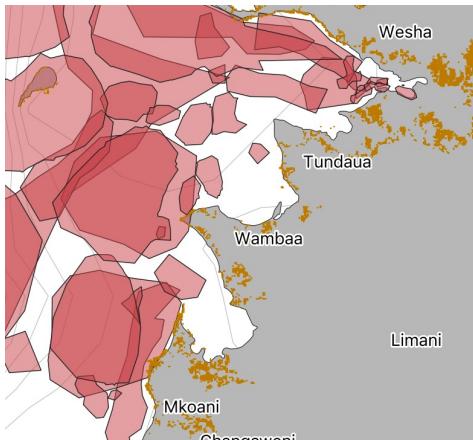
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## Motivation

- Coral reefs are highly variable on small spatial scales
- Communities depend on resources in complex ways

# Methodological Approach

Fishery  
Mapping



Indigenous  
knowledge

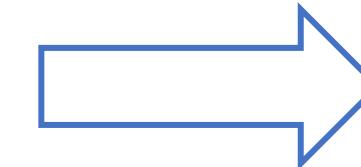
Ecological  
Surveys



In-situ  
measurements

# Implementation Method

Zoning



 MARXAN  
conservation solutions



Improved  
management

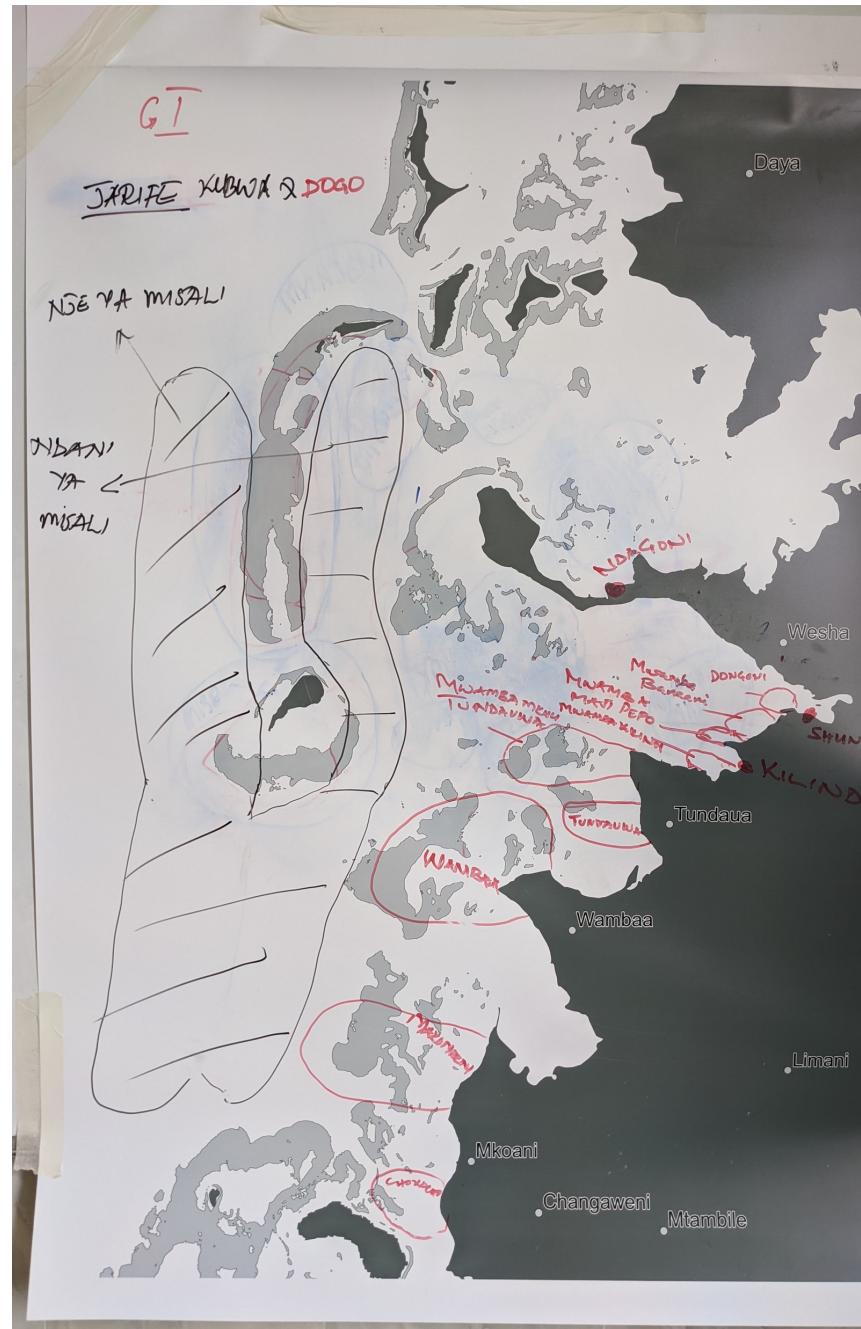
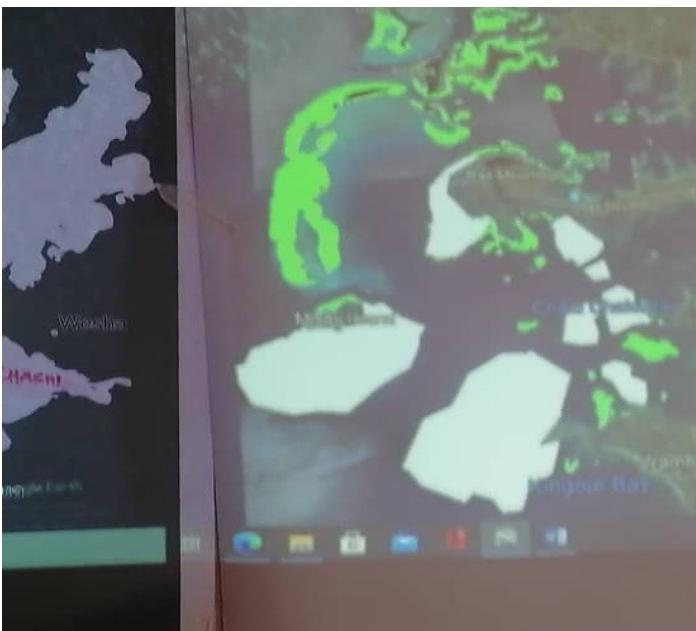
# Fishery Patterns Mapping

## Method

1. Interview fishers of all fishing gears and all communities
  2. Draw maps of fishing grounds
  3. Digitize on Google Earth
  4. Collect Metadata

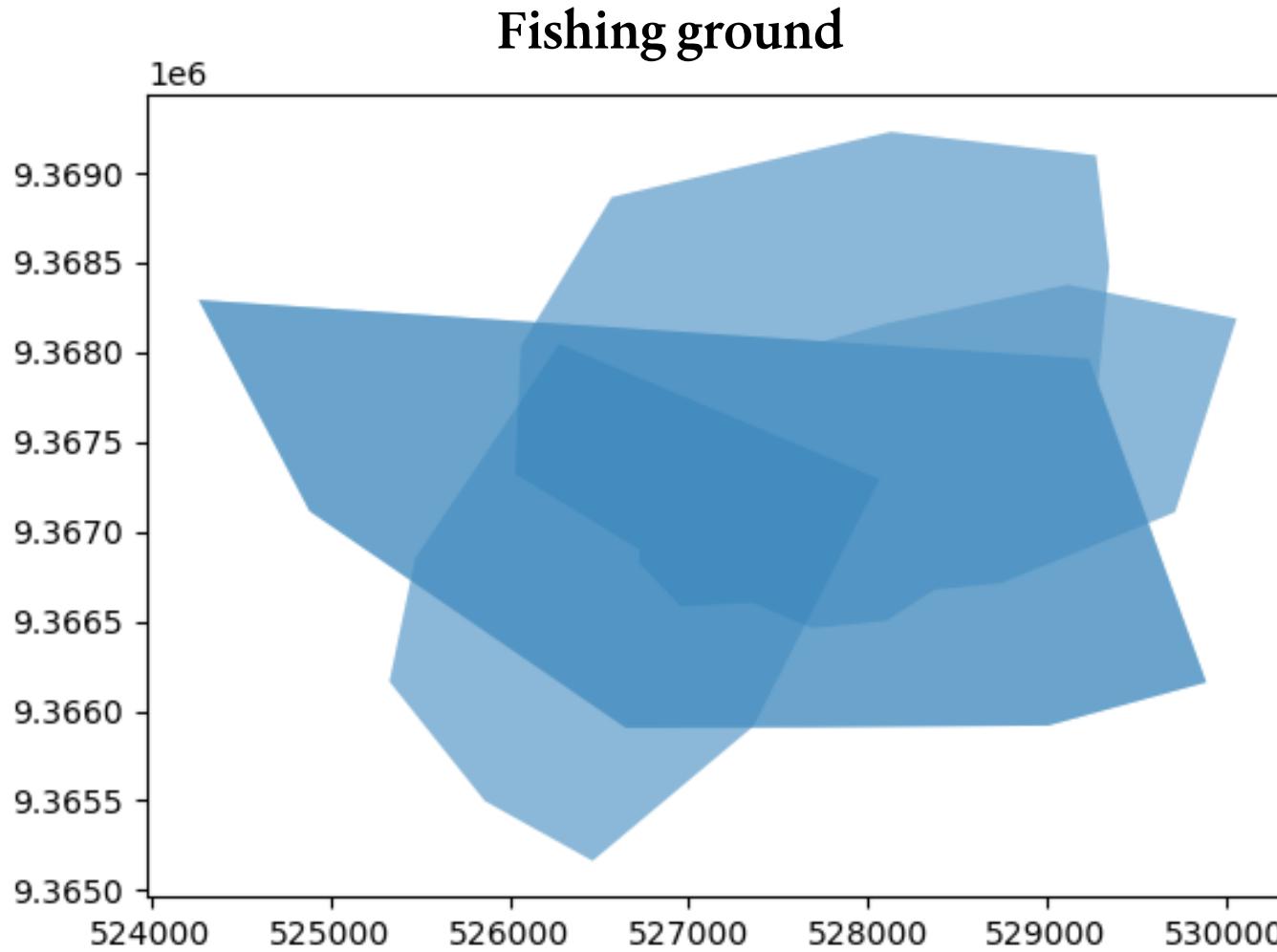
## Resulting Data

- Fishing effort
  - ETP species distribution



# Processing the shapefiles

# Fishery Patterns Mapping



1. Fishing grounds per community and gear group (g)
2. Level of effort (f) per season (s) [0-10]
3. Presence/absence sharks, rays, turtles, marine mammals [0-1]

# Processing fishing effort and species distribution

# Fishery Patterns Mapping

$$F = \sum_s^{Ku,Ka} \sum_g f_{g,s} * G(g) * S(s)/A$$

$$S(s) = \begin{cases} \frac{7.5}{12}, & s = Apr - Nov \\ \frac{4.5}{12}, & s = Dec - Mar \end{cases}$$

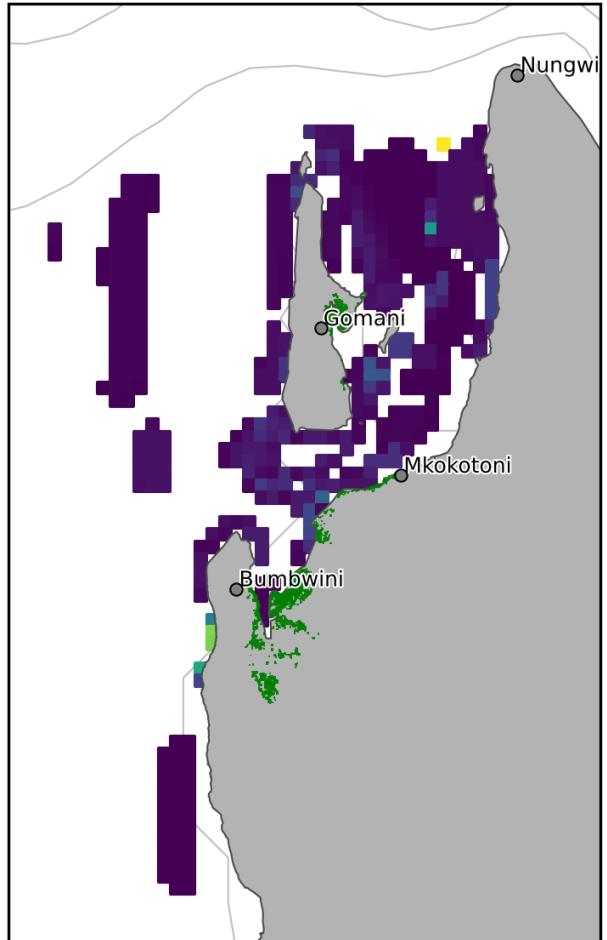
F, total effort on a given fishing ground  
 $f_{g,s}$ , effort [1-10] for a given gear  $g$  and season  $s$   
 $G(g)$ , fishing gear coefficient func of # units and capacity  
 $S(s)$ , season coeff func of duration of each season  
 $A$ , area of the fishing ground

Gear, g	Local name	# units	pax	total	%, G(g)
Gillnet/Seines	Jarife	372	11	4092	0.1
Longline	Mishipi	6800	3	20400	0.52
Ring net	Mtando	52	17	884	0.02
Beach seine	Juya	27	17	459	0.01
Traps	Madema	4,214	3	12642	0.32
Spear	Pweza	106	6	636	0.02

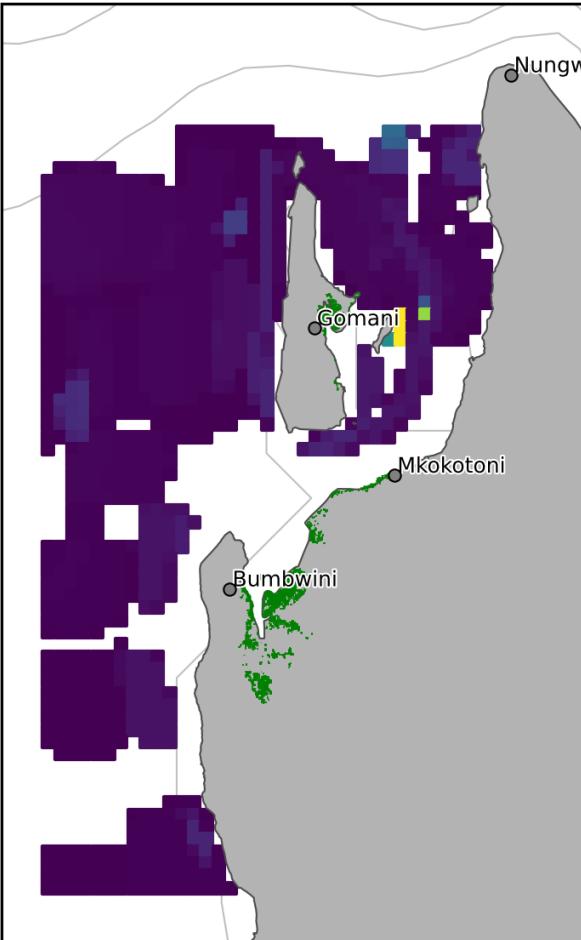
# Effort by Gear

## Fishery Patterns Mapping

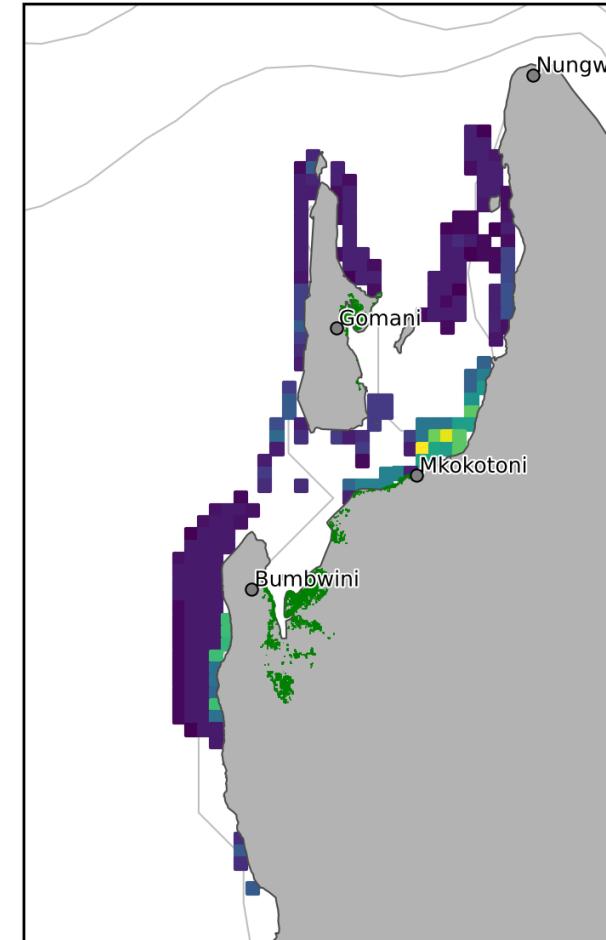
Traps



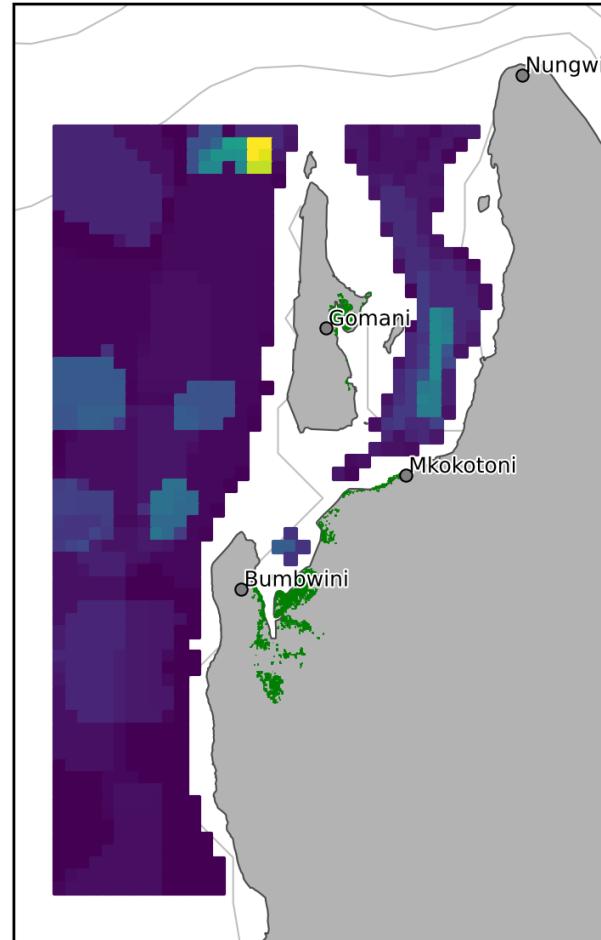
Longline



Spear



Ringnet

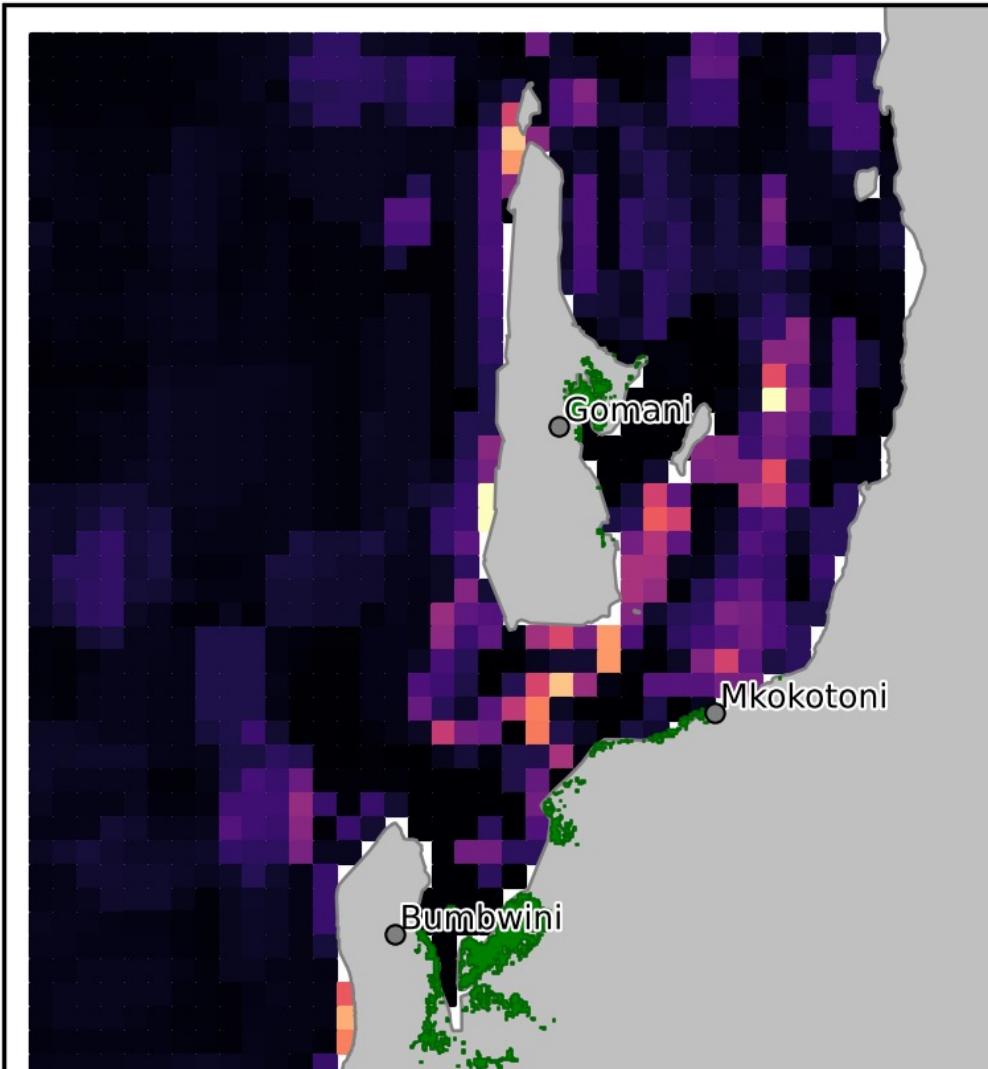


# ETP species distribution

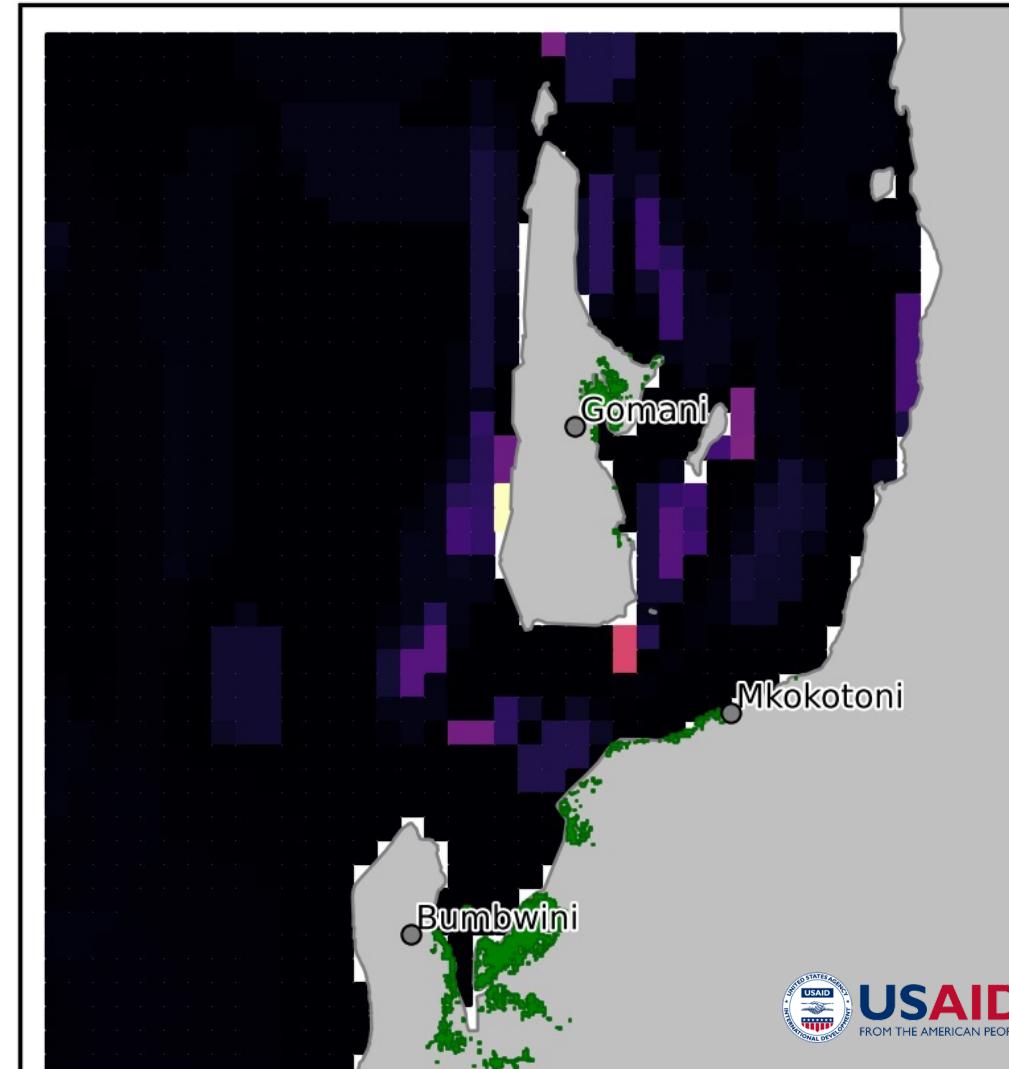
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## Fishery Patterns Mapping

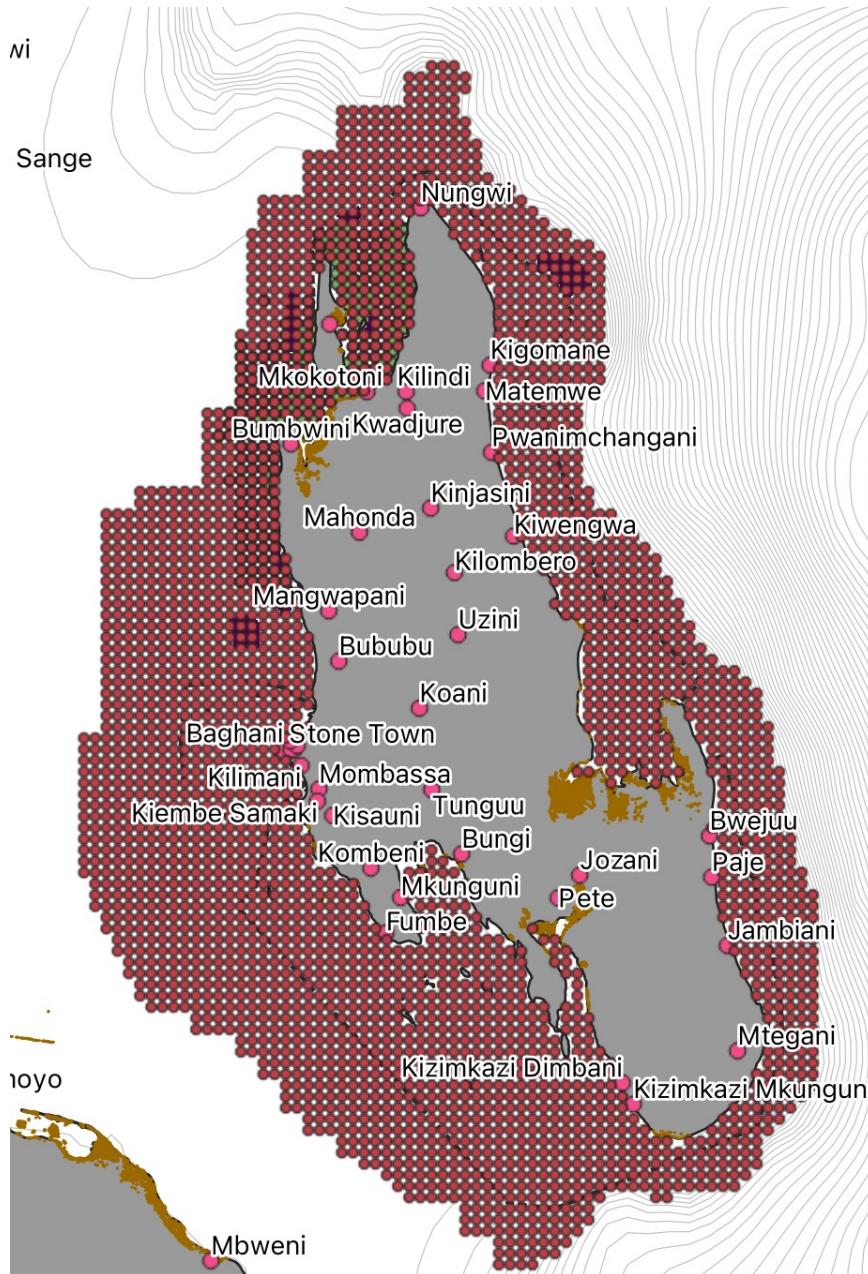
Marine Mammals



Sharks



# Ecological Survey

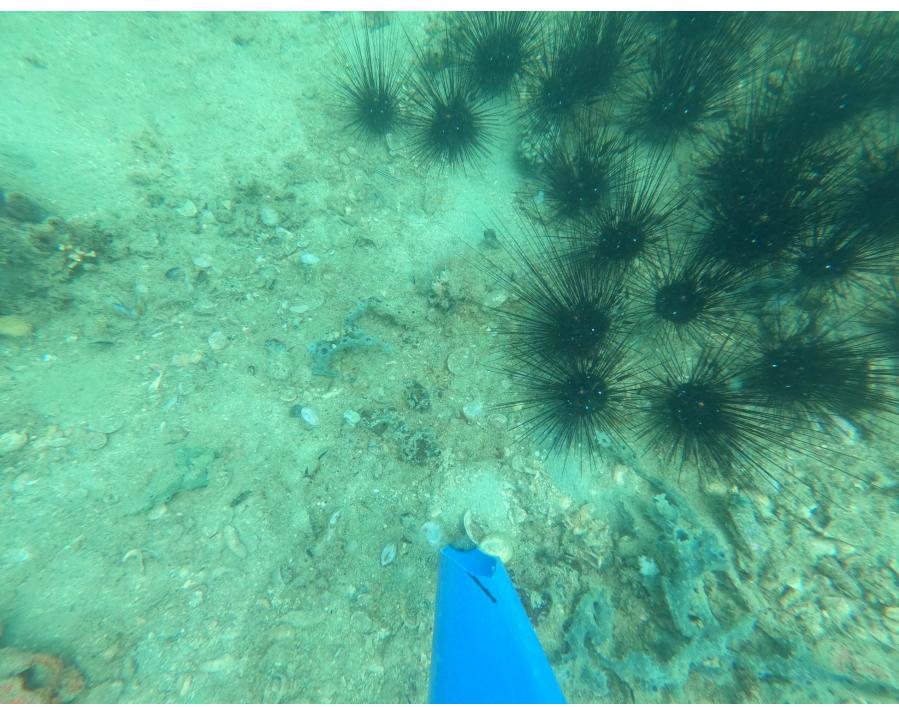
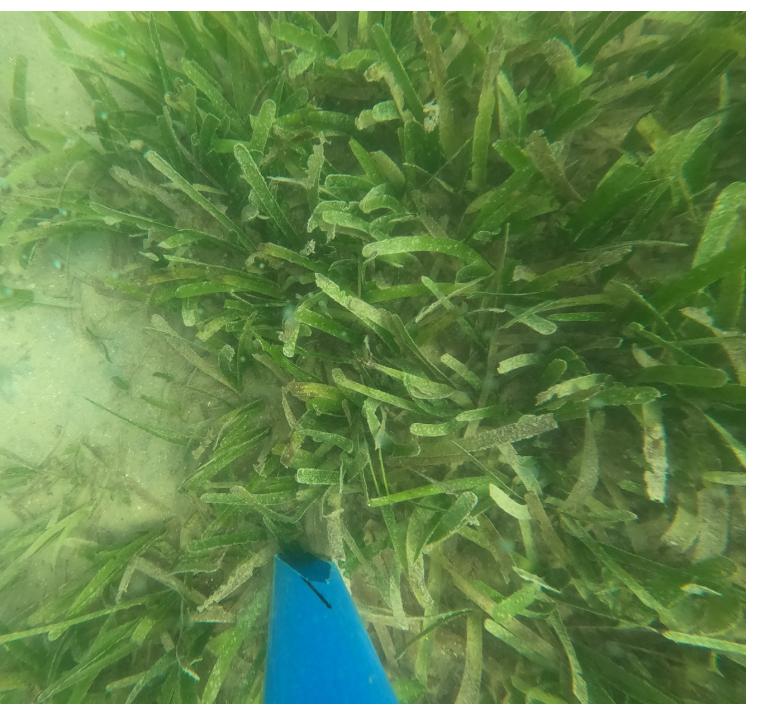
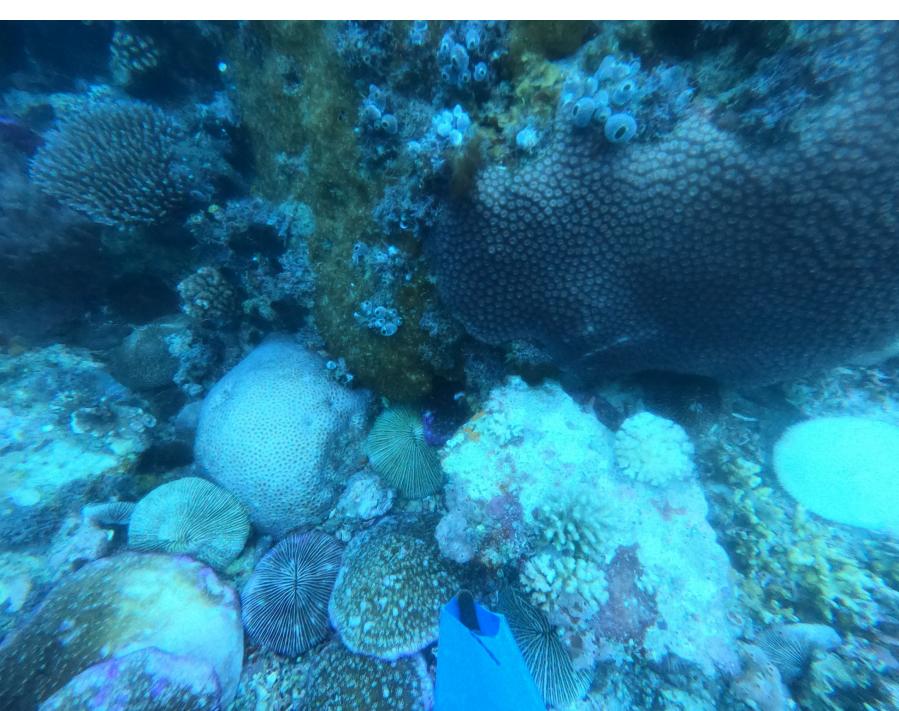
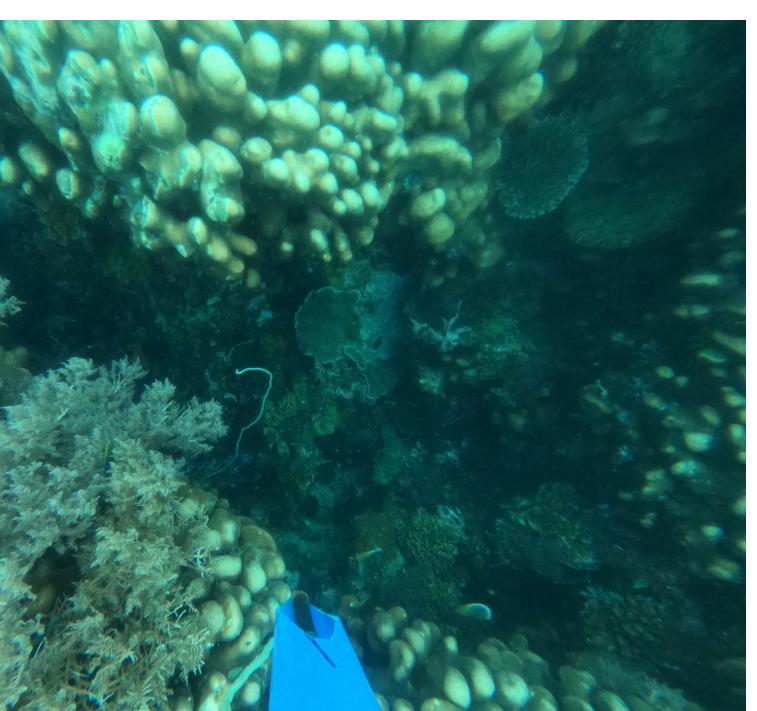


## Method

- GoPro used to collect **quadrants**
- Simple **benthic classification**
- **CoralNet** for the analysis
- **3 replicas** for >8000 stations

## Resulting Data

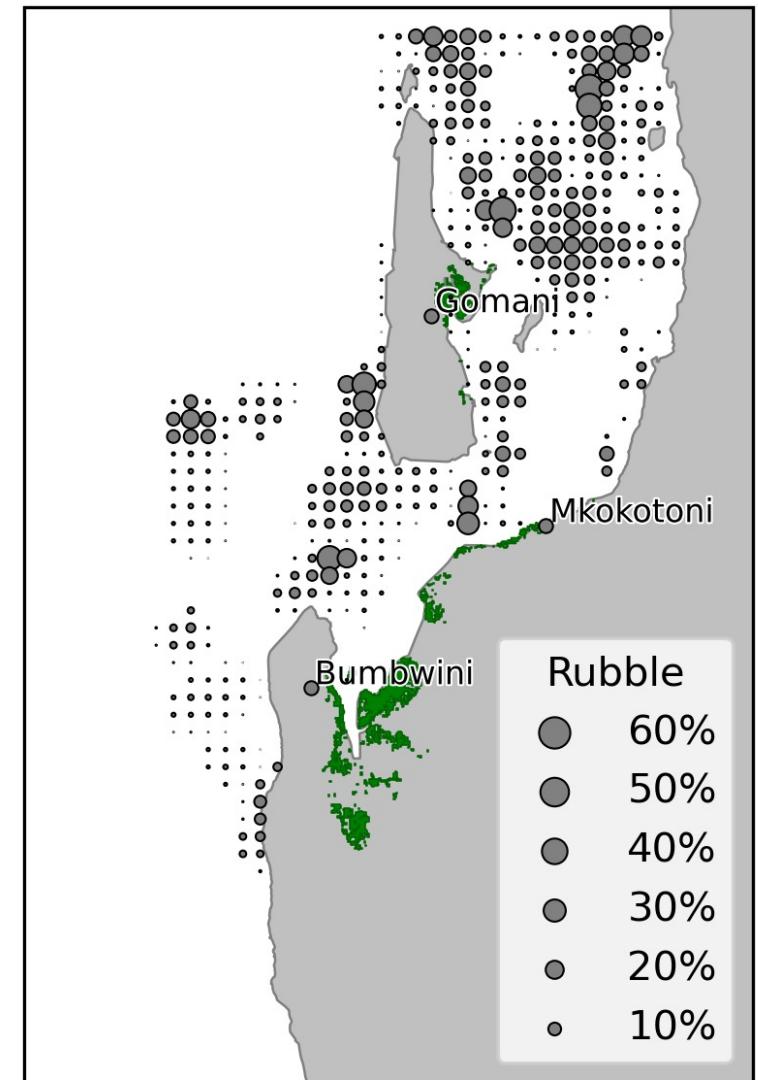
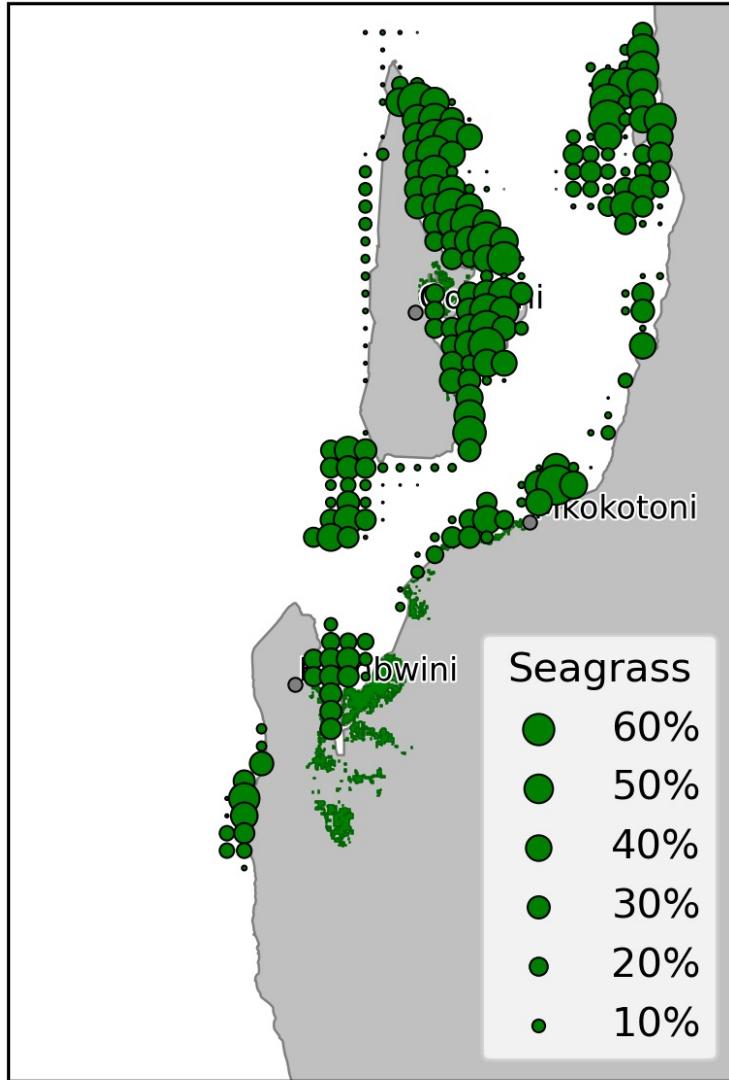
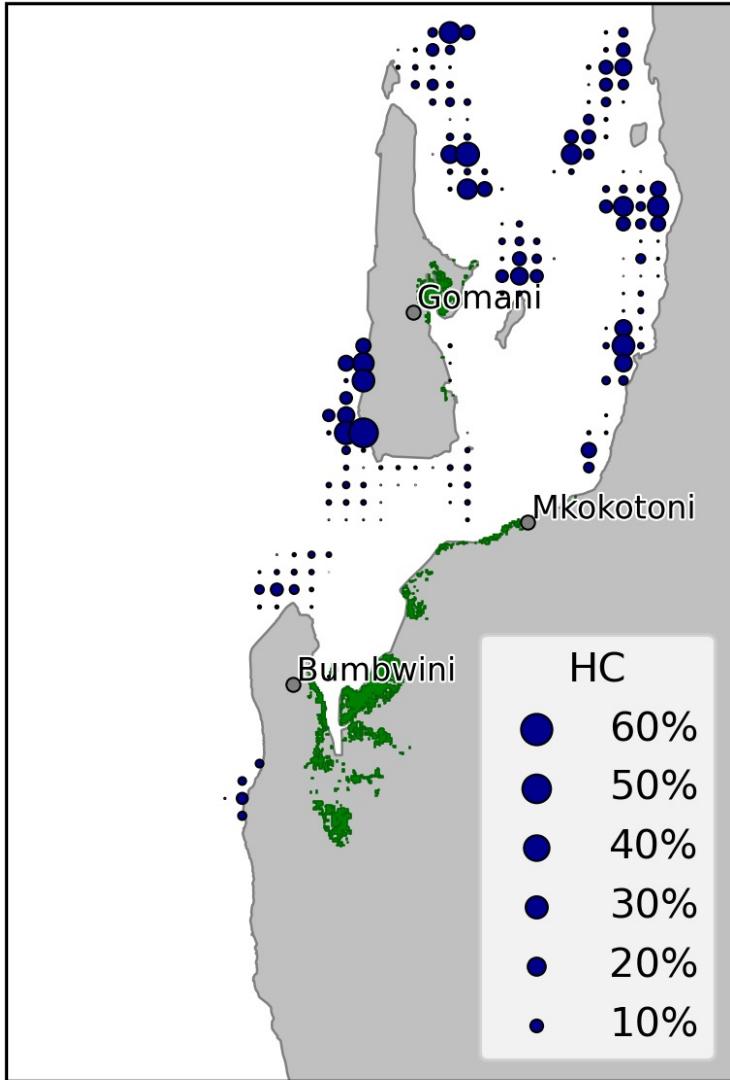
- Coral cover, seagrass, rubble and more



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# Benthic Mapping



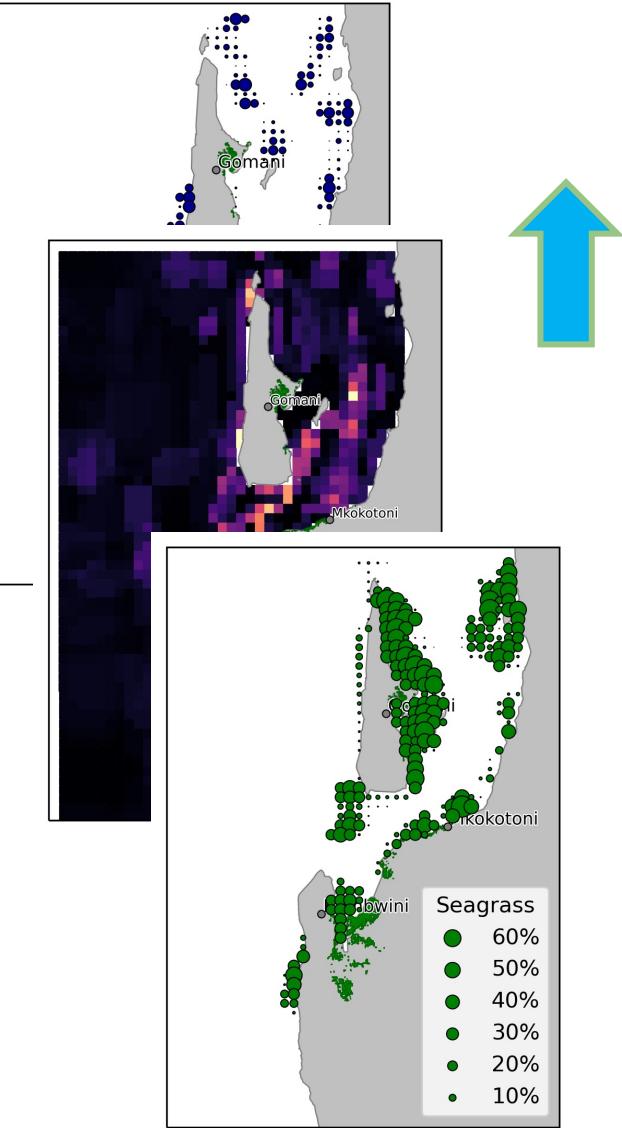
# Ecological Survey

Ecological  
parameters  
maximized

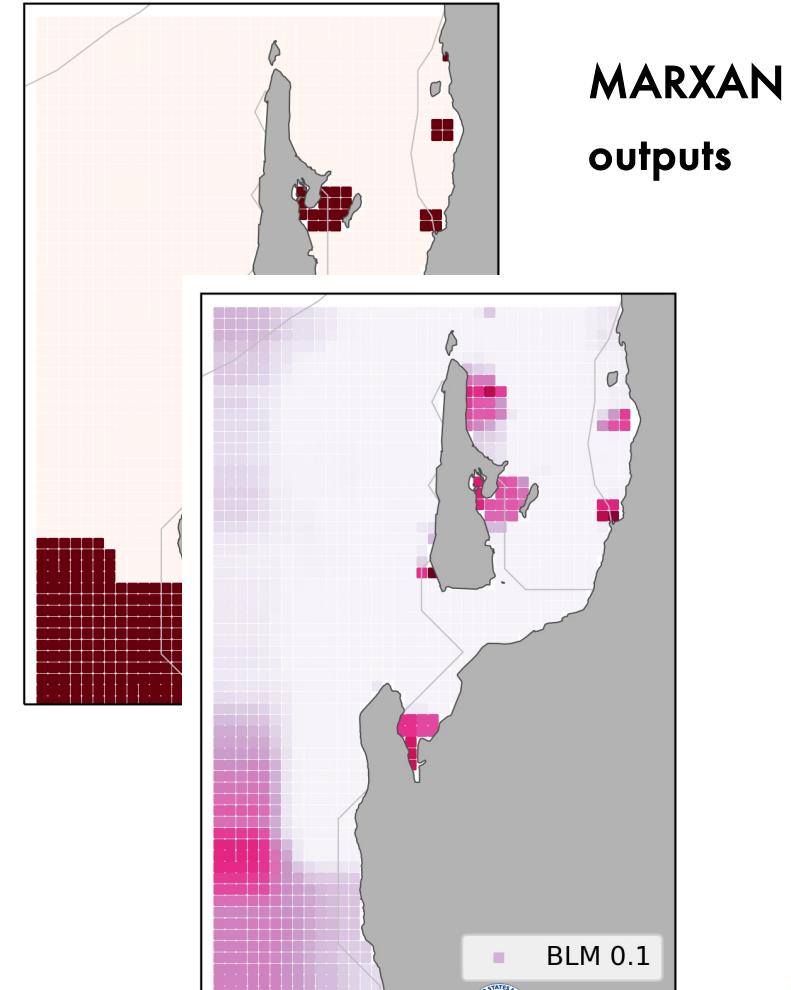
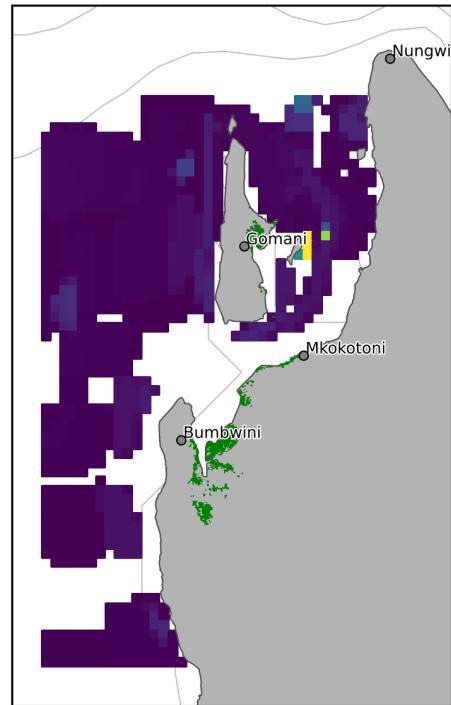


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## Spatial Prioritization



Fishing effort  
minimized

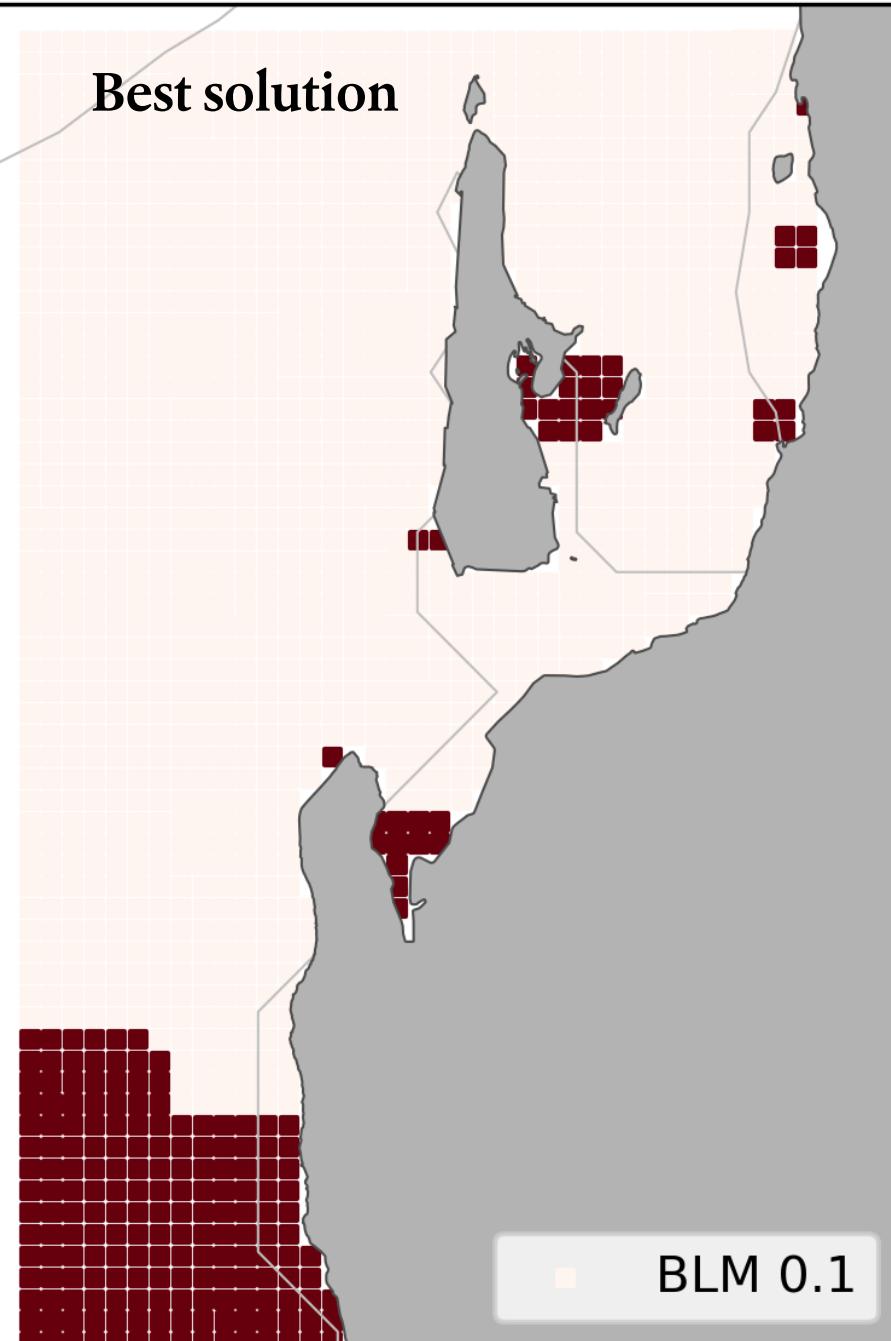


MARXAN  
outputs

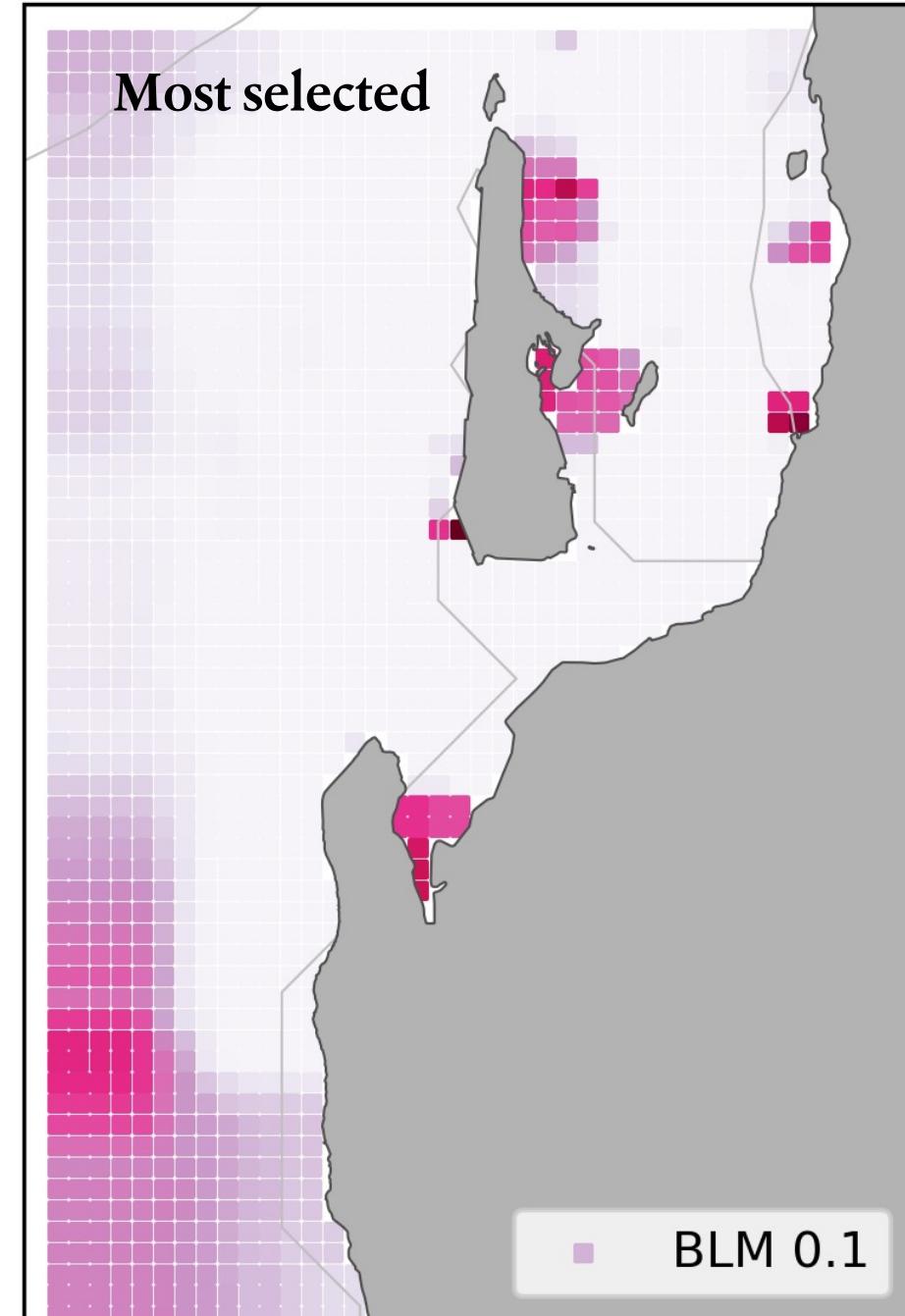


# Spatial Prioritization

Best solution



Most selected



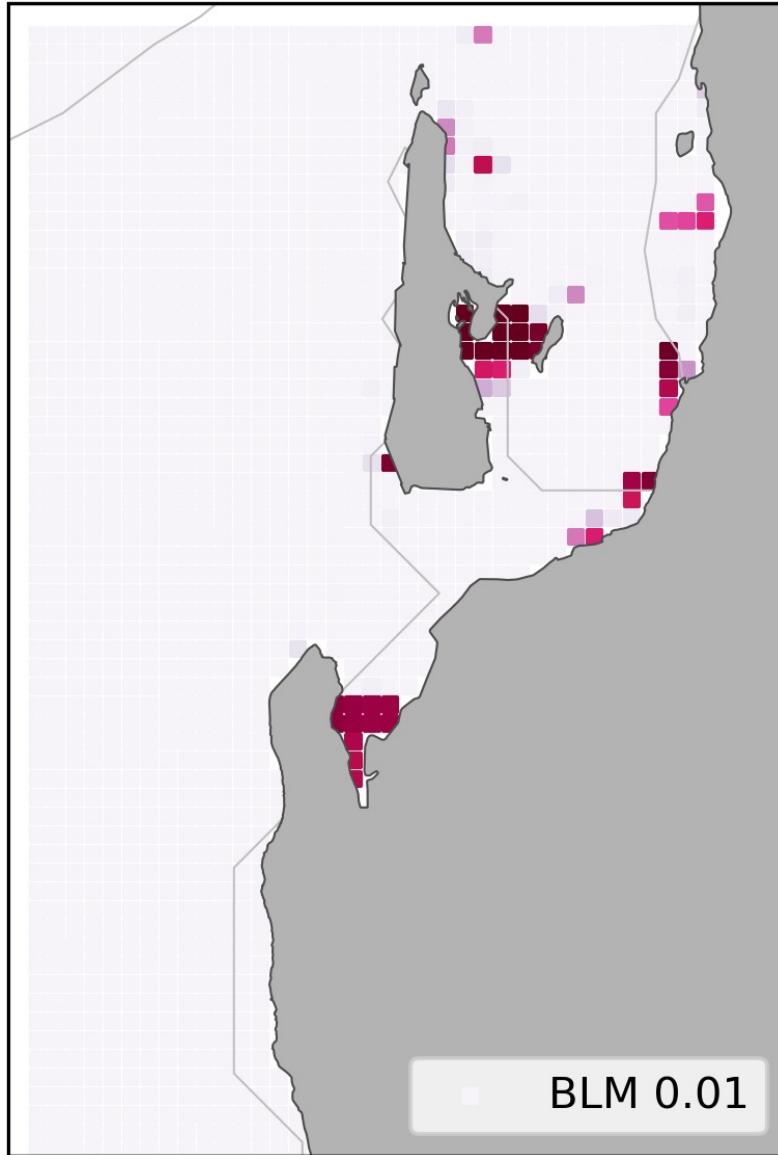
■ BLM 0.1

■ BLM 0.1

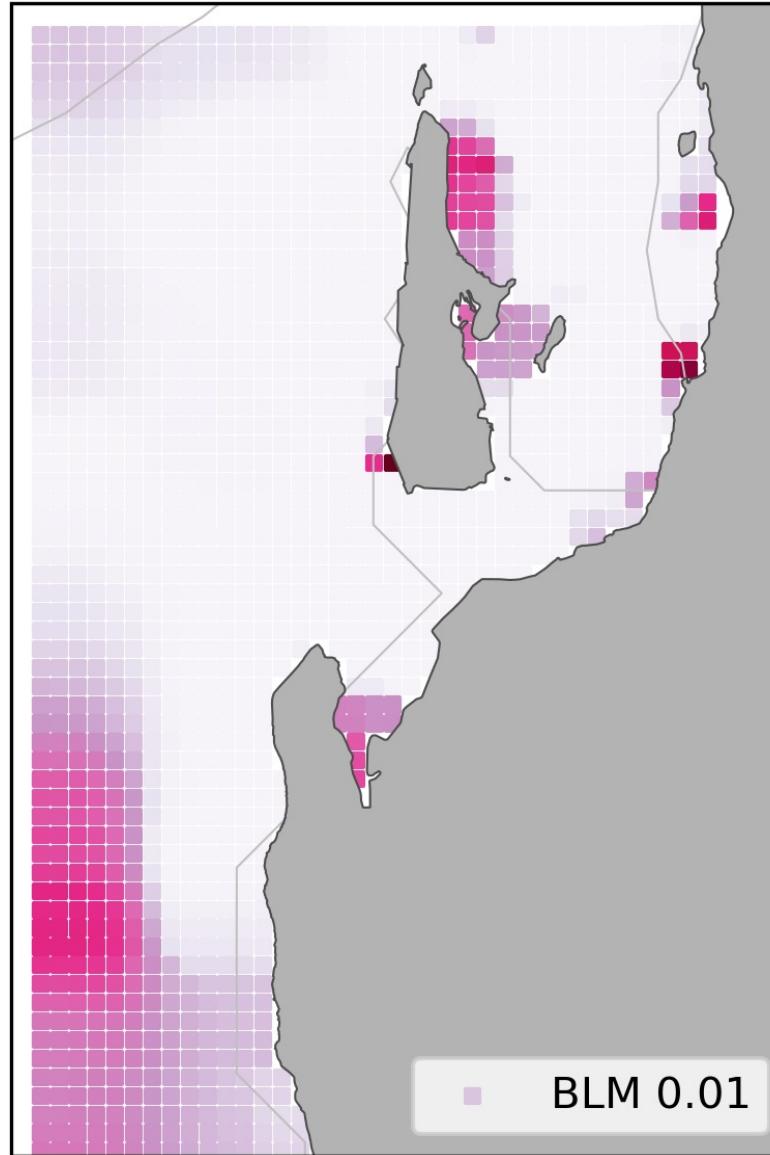
# Scenarios

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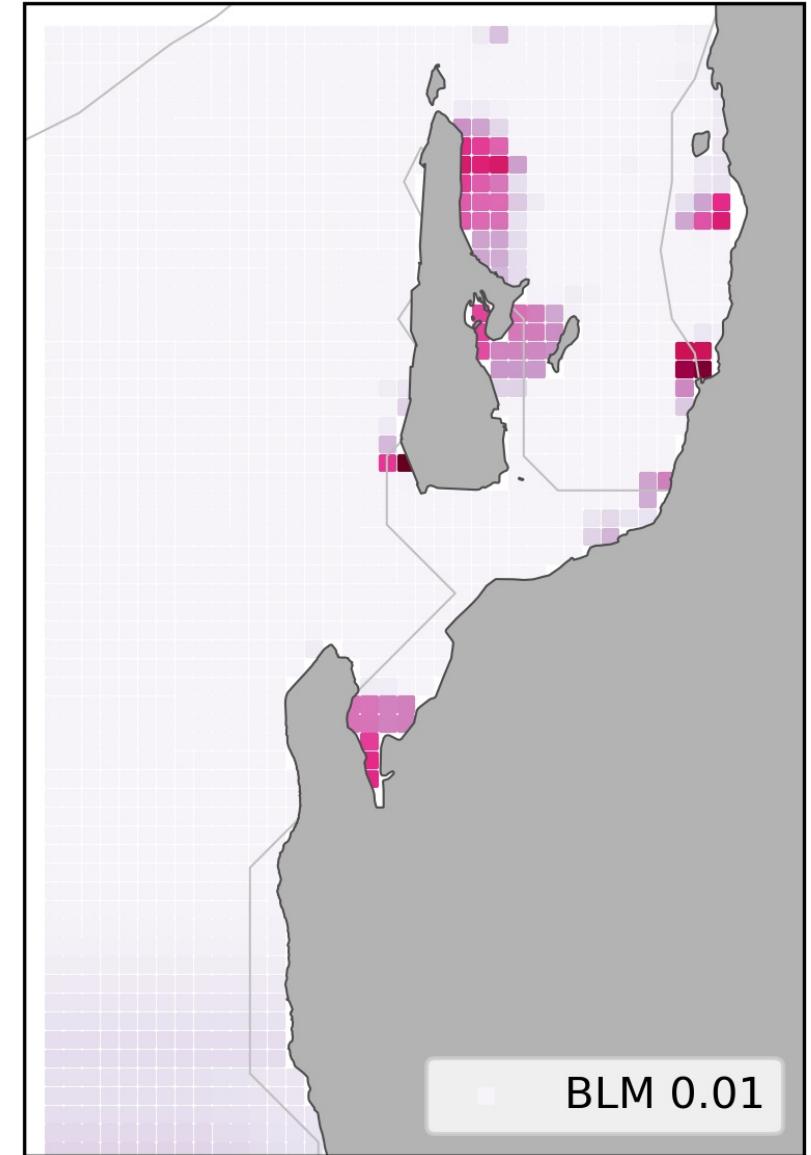
Yes Cost, No ETP



No Cost, Yes ETP



No Cost, No ETP



BLM 0.01

■ BLM 0.01

■ BLM 0.01

# Conclusions and Future Work

## Conclusions

- We rely on **in-situ observations** for ecological assessment
- We **incorporate community needs** into the planning
- We demonstrate a **scalable and effective** tool for MPA planning

## Future (and ongoing) Work

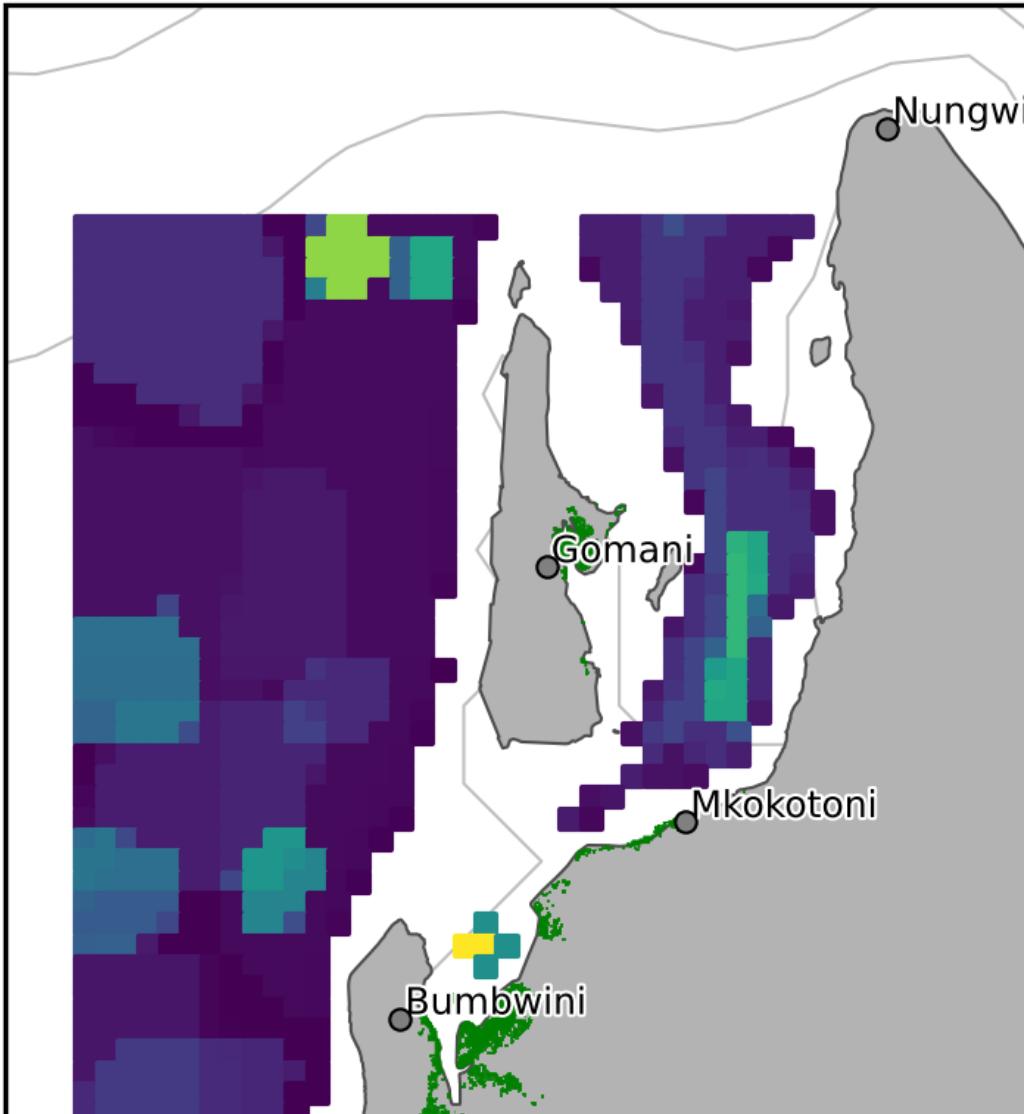
- Work with communities to support the development of **MPA network**
- Scale this process **nationally**

# Thanks

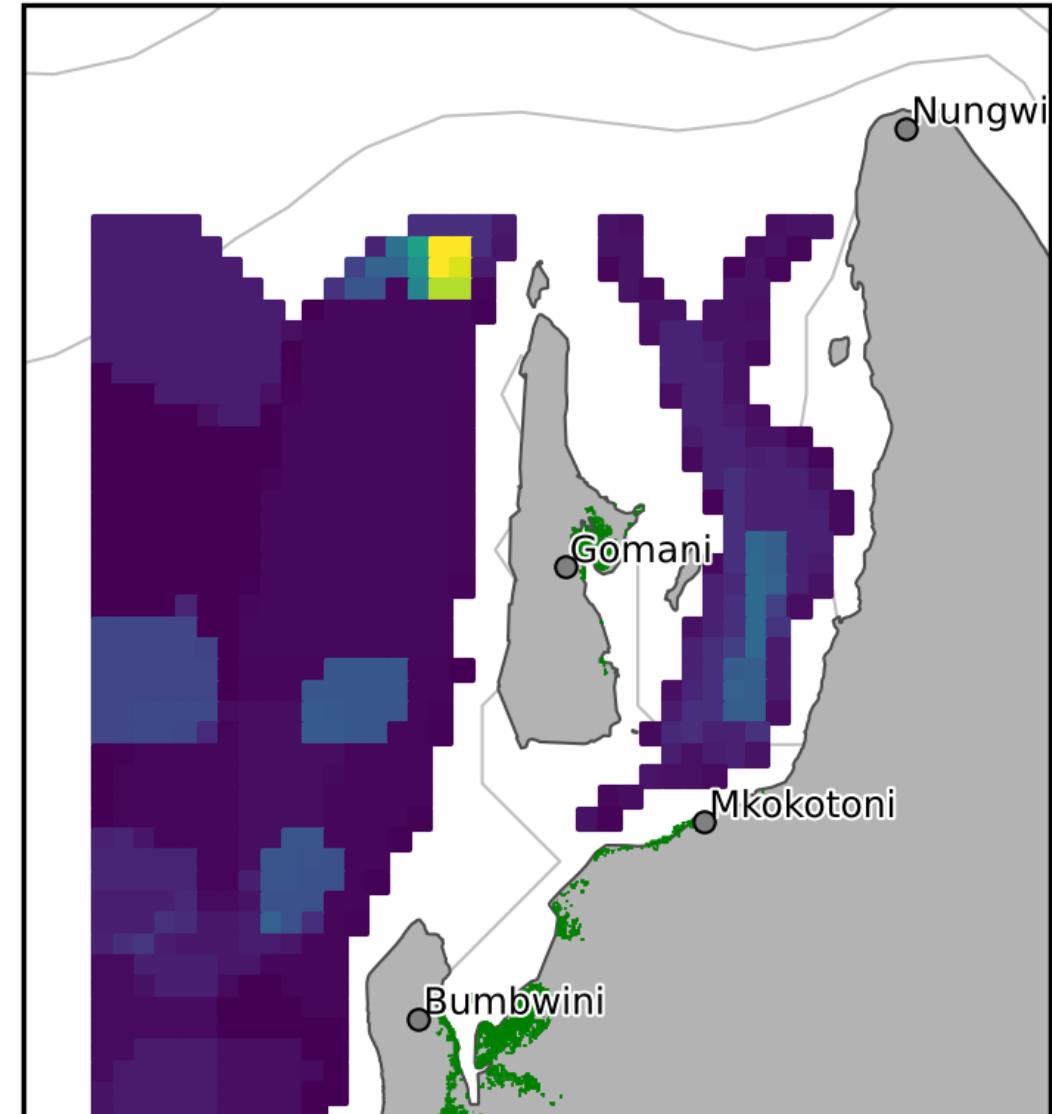
# Seasonal trends in effort

## Fishery Patterns Mapping

Dec – Feb, ring net



Apr – Oct , ring net



# Ecological Survey

