

Establishing Federal Manatee Protection Areas in Puerto Rico



Caribbean Ecological Services Field Office

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Photo credit: Alejandro Avampini



Antillean Manatee Action Plan



- Implement the Rescue, Rehabilitation and Release Program
- Assess population status and trends through aerial surveys
- Identify and designate important manatee areas
- Re-establish radio tracking study
- Update Antillean manatee Recovery Plan (1986)
- Establish conservation programs to promote awareness within the boating and fishing community
- Develop outreach and education program
- Promote habitat restoration projects
- Continue monitoring threats and assess effects of climate change



Manatee Issues in PR



- Small closed population size
- Principal anthropogenic mortality cause – boat collisions
- Harassment
- Limited biological and ecological information
 - need more specifics on patterns of movement, survival and longevity data, undetermined causes of death, new threats...

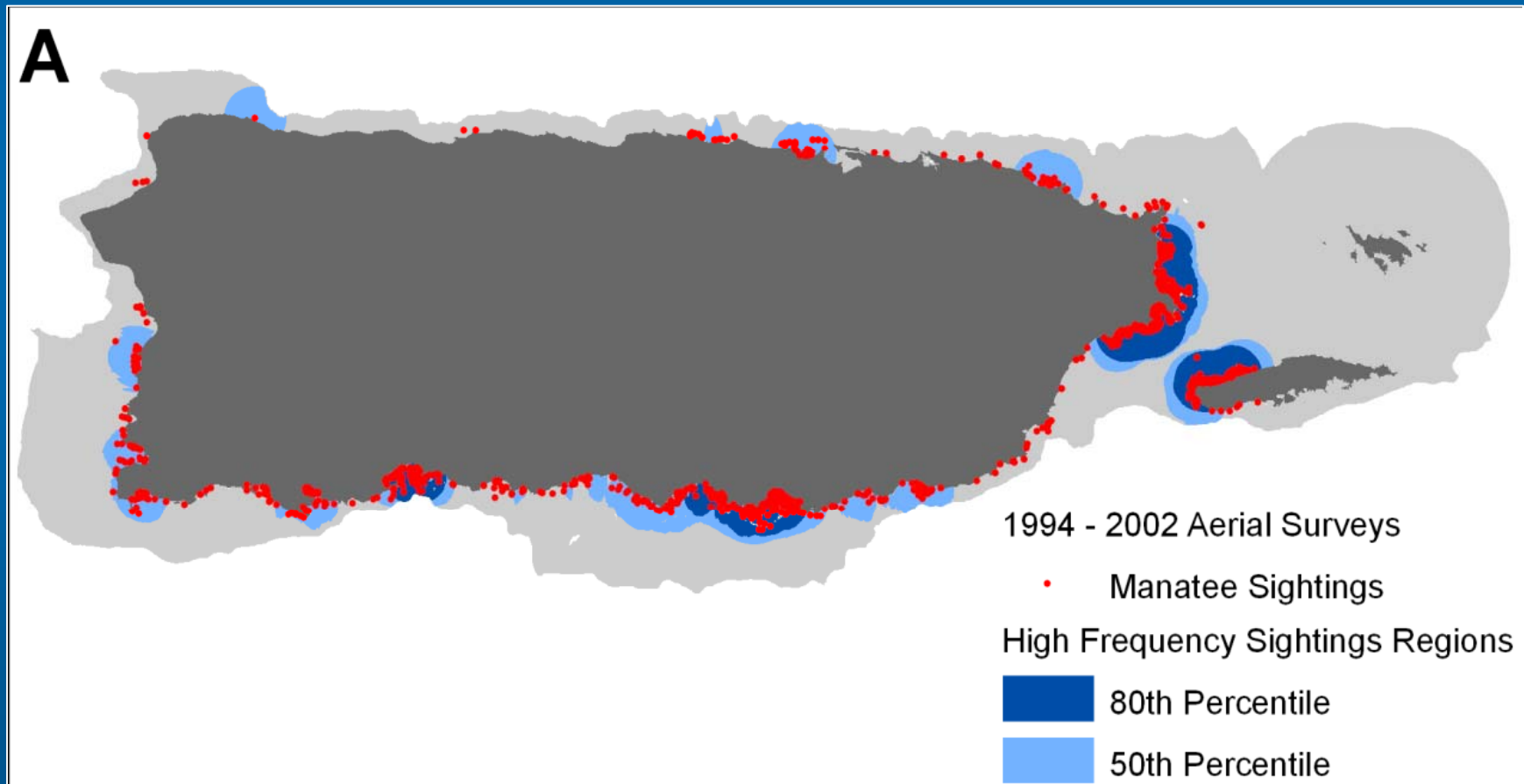




Manatee Aerial Surveys



- Data since the early 1980's
- Provide distribution and a minimum population count for that year





Manatee Aerial Surveys

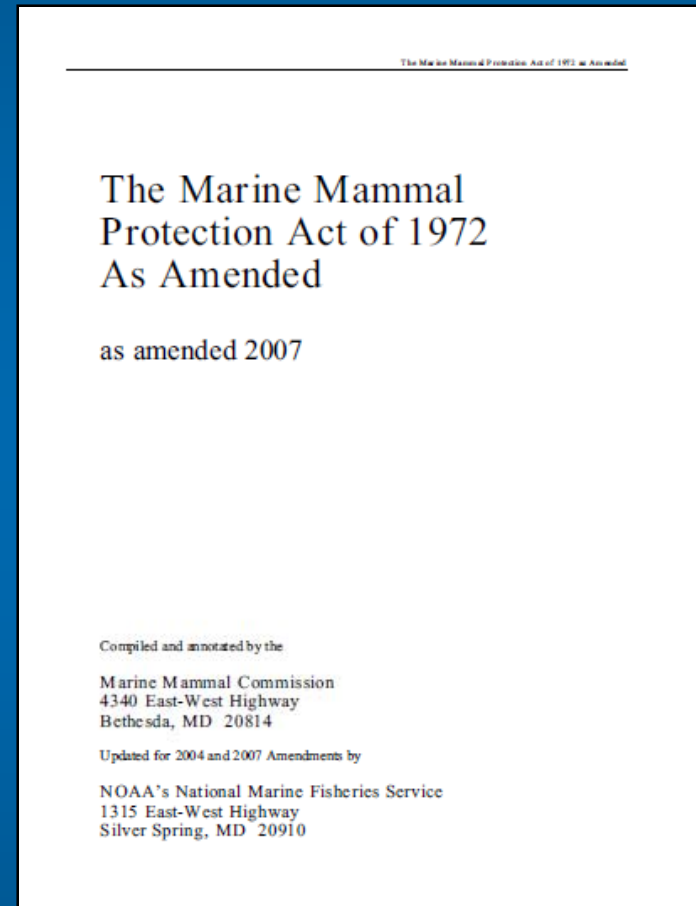
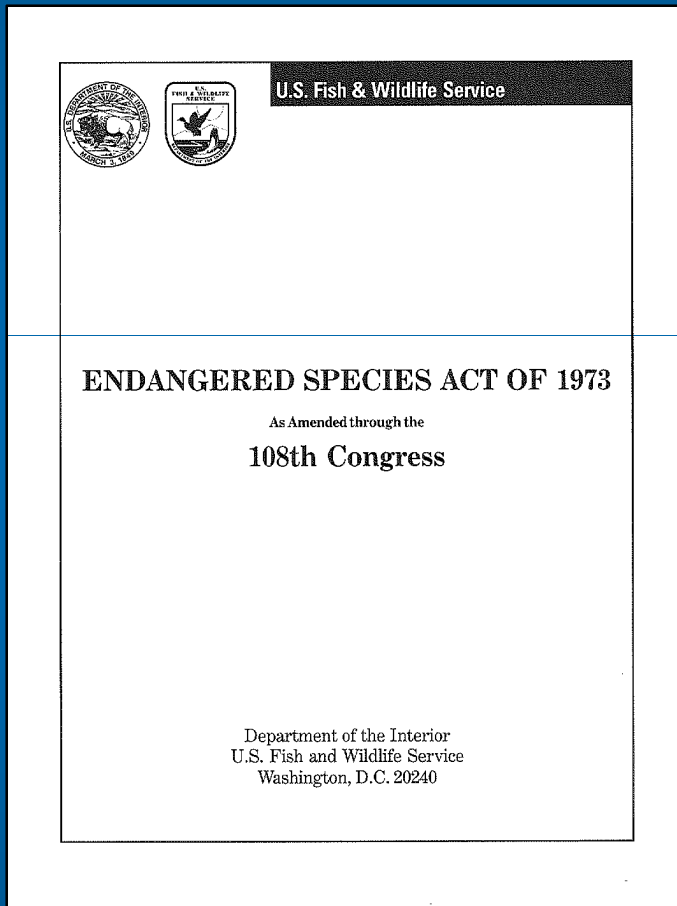


- New methods and data analysis for 2010-2013





Legal Framework





50 CFR 17 Subpart J



- Code of Federal Regulation that provides a means for establishing manatee protection areas (MPA's) within waters under the jurisdiction of the United States
- Waterborne activities will be restricted or prohibited for the purpose of preventing the taking of manatees
- FWS has the discretion by regulation, to establish MPA's whenever substantial evidence shows that the establishment of such an area is necessary to prevent the taking of one or more manatees



Manatee Protection Areas



- FWS may establish two types of MPA's:
 - **Refuges** - A manatee refuge is defined as an area in which the FWS has determined certain waterborne activities would result in the taking of one or more manatees, or that certain waterborne activities must be restricted to prevent the taking of one or more manatees, including but not limited to, a taking by harassment.
 - **Sanctuaries** - A manatee sanctuary is defined as an area in which the FWS has determined any waterborne activities would result in the taking of one or more manatees, including but not limited to, a taking by harassment.



Manatee Protection Areas



- Given the most severe anthropogenic threat to the manatee population in PR is motorized watercraft collisions and harassment, the future establishment of MPA's are considered a vital management tool for the recovery of the species
- The first step for the development of MPA's in PR has been completed:

***Identify and provide the scientific basis
to propose MPA's***

- Achieved through literature review, expert elicitation, and geospatial modeling



Manatee Protection Areas



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Objectives

1. Identify areas which include the specific ecological attributes necessary to support manatee populations
2. Identify areas where take can be reduced through the approved MPA regulatory framework.



Manatee Protection Areas



- Key ecological attributes (KEA)— biological characteristics, resources or elements required by a conservation target for success (long-term survival)

Sea grass – Freshwater – Shelter

- It was also hypothesized that manatees do not feed or rest in waters greater than 13 m (42.6 ft) depth and spend most of their time in waters less than 5 m (16.64 ft) deep



Manatee Protection Areas



- Potential MPA sites include access to all KEA within 5 km (3.1 miles)
- To calculate the potential MPA value, the geometric mean of the 4 MPA variables was calculated

Combined resource values for potential MPAs are presented below.

$$\text{MPA Value} = (\text{Sea grass} * \text{Freshwater} * \text{Shelter} * \text{Watercraft})^{1/4}$$

- Each variable was scaled relative to the maximum value for that variable within the project scope, such that values range from 0 to 1



Potential Focal Regions for Manatee Protection Areas



	Entire Population	Population Within MPAs
Scope	<ul style="list-style-type: none"> the coastal shelf and estuarine waters of Puerto Rico excluding Mona, Monito, Desecheo Islands, and the US Virgin Islands 	<ul style="list-style-type: none"> an area providing access to seagrass, sheltered waters, and freshwater within a 5 km radius where an MPA would reduce take
Vision	<ul style="list-style-type: none"> the long term conservation and recovery of the endangered Antillean Manatee and its habitats in coastal-shelf and estuarine waters in Puerto Rico 	<ul style="list-style-type: none"> the prevention of anthropogenic take, harassment, and disturbance of manatees within an area that provides high quality habitat

Key Ecological Attribute	Description of Metrics Defining Value of Attribute	Spatial Data Resources (Source Agency)
Seagrass	<ul style="list-style-type: none"> Presence within feeding depths (< 13 meters) Abundance Species composition 	Benthic habitat maps provide percent cover, but not species composition (NOAA)
Freshwater	<ul style="list-style-type: none"> Presence Abundance 	Coastal outflows from perennial streams, wastewater treatment plants, and hydroelectric plants (USGS, EPA, AAA)
Shelter	<ul style="list-style-type: none"> Presence 	Wave energy model of shallow waters with low wave energy (USGS)

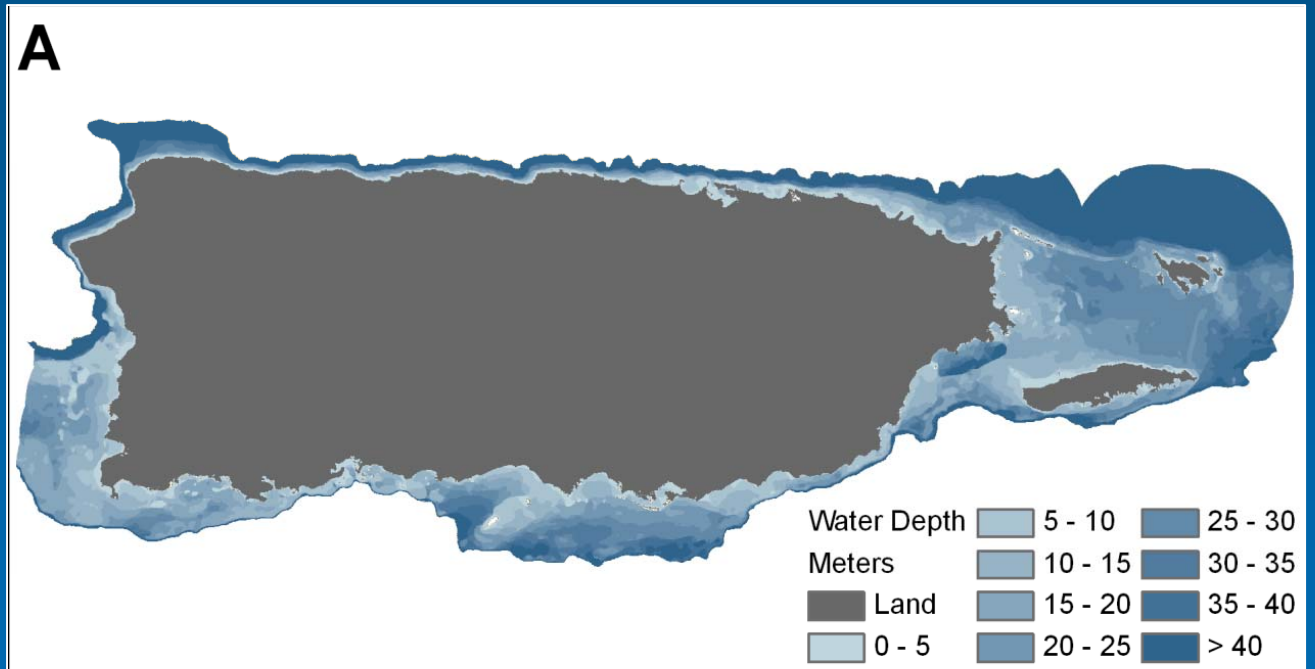


Potential Focal Regions for Manatee Protection Areas

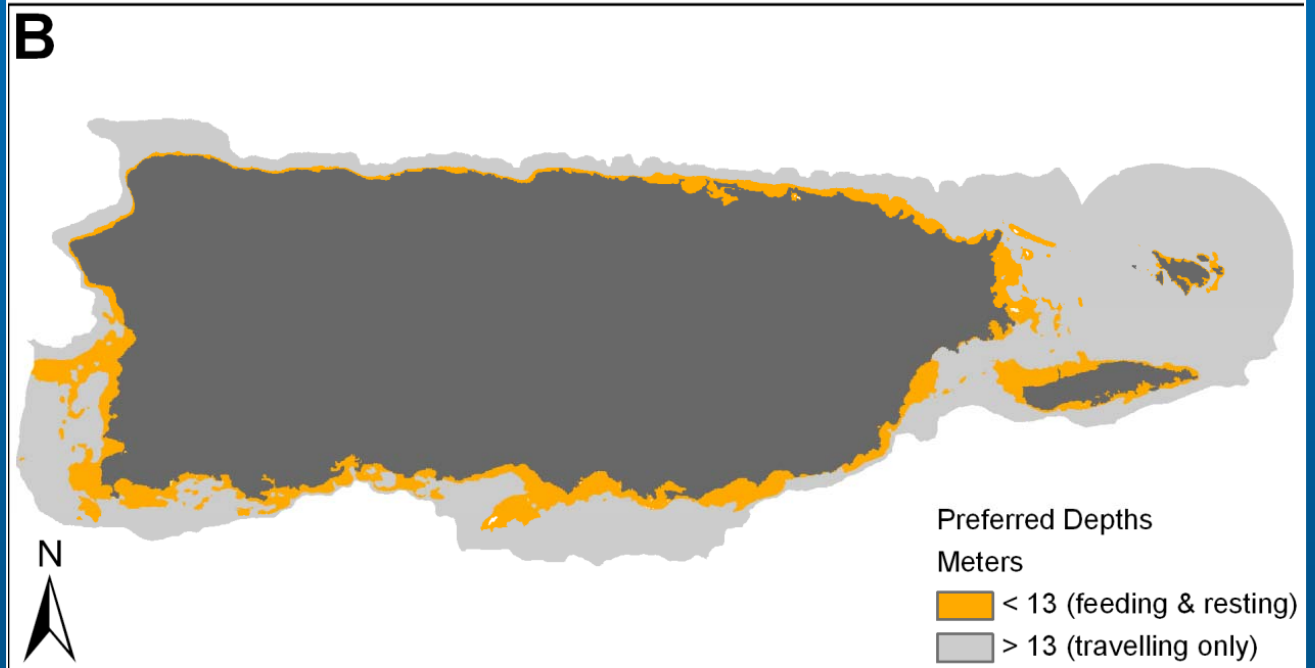


Direct Threats	Scope	Severity	Irreversibility	Threat Ranking
Abandoned gear entanglement	Med	Med	High	Med
Bycatch	Low	Low	Low	Low
Degraded/ decreased seagrass habitat	Low	Low	Med	Low
Exposure to contaminants/ chemical pollutants	Low	Med	High	Low
Harassment	Very High	Med	Med	Med
Ingestion of debris	Low	Low	High	Low
Lack/ degradation of fresh water	Low	High	High	Low
Watercraft collision	High	High	Med	High
Oil Spills	Low	High	High	Low
Poaching	Low	Low	Low	Low

(A) Bathymetry within the MPA project scope.

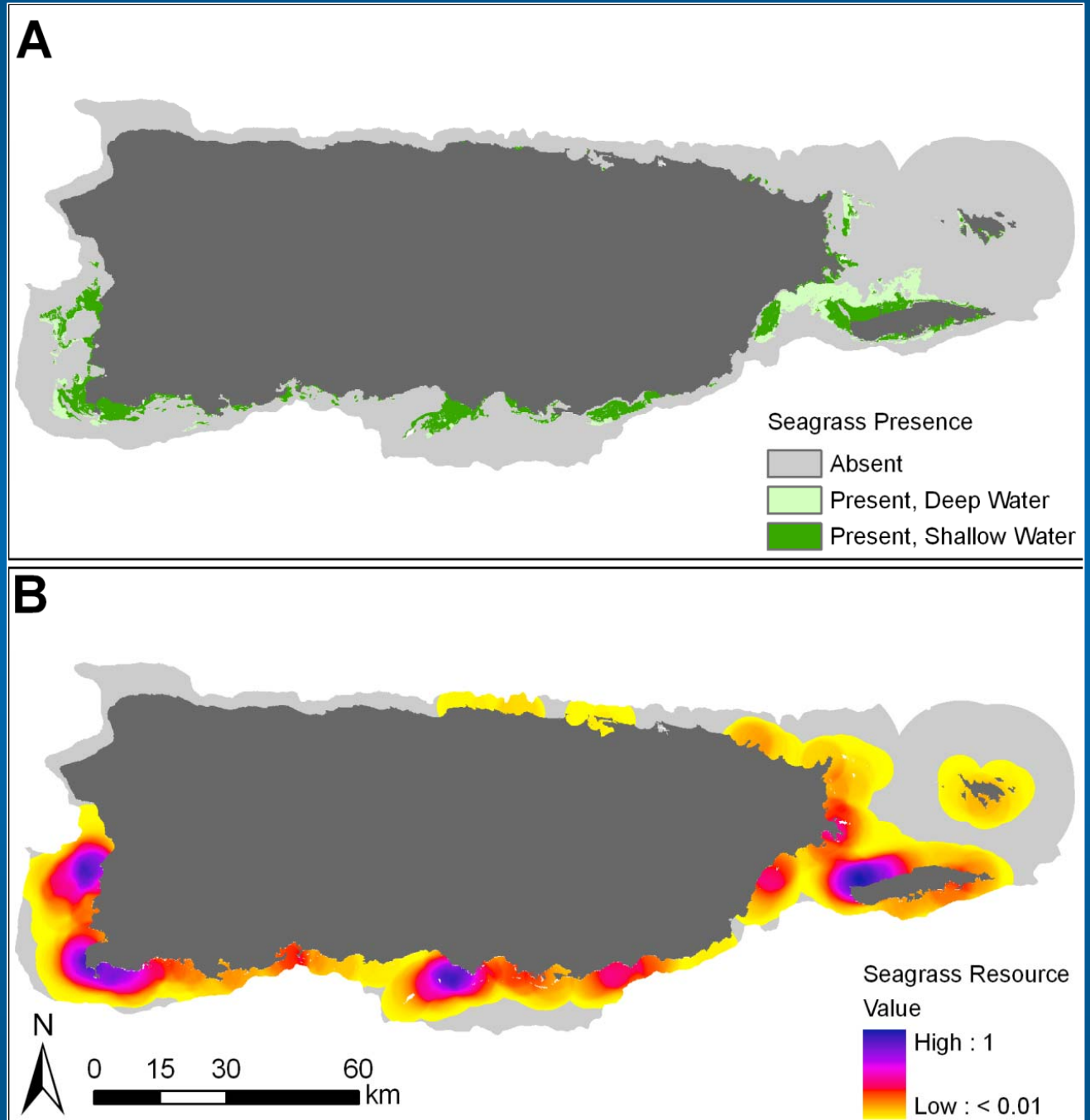


(B) Manatee foraging and resting was hypothesized to be restricted to shallow waters (<13 m depth) with deeper waters used for traveling between resources located in shallow waters.

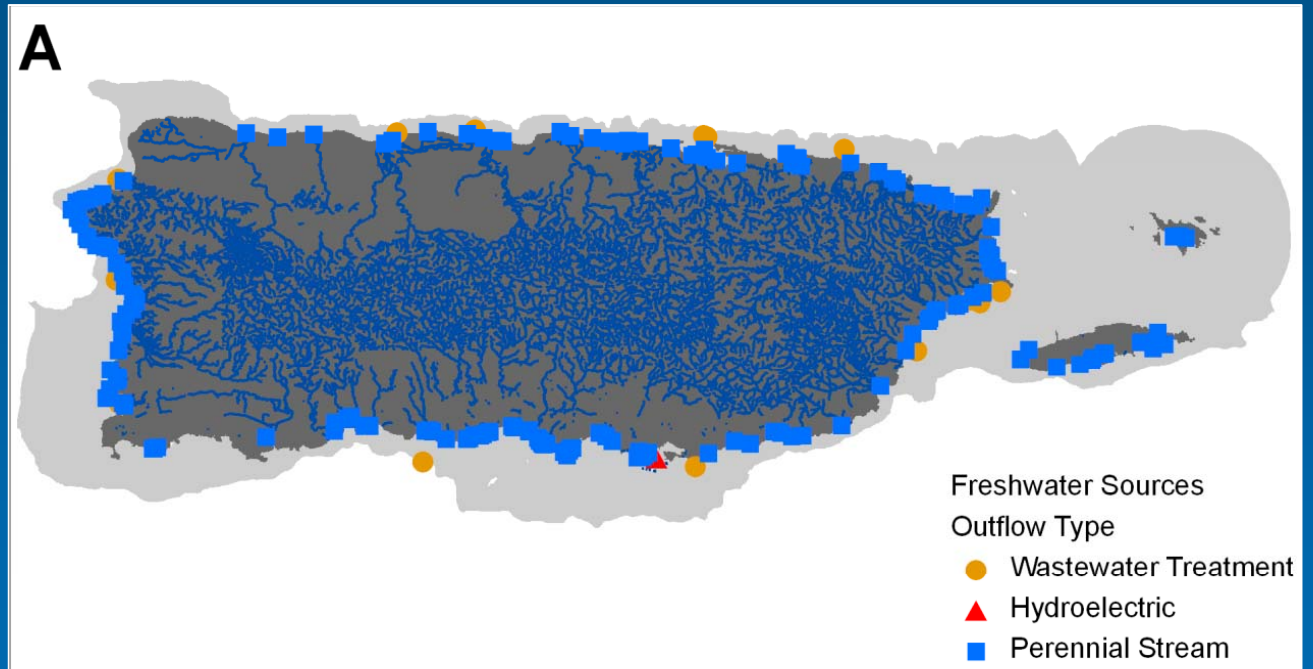


(A) Seagrass presence in deep (>13 m) and shallow (<13 m) water within the project scope. Only seagrass within shallow water was considered available to foraging manatees. Seagrass grid cells were assigned a decreasing linear value (1 to 0) from 1 m to 13 m depth (not shown).

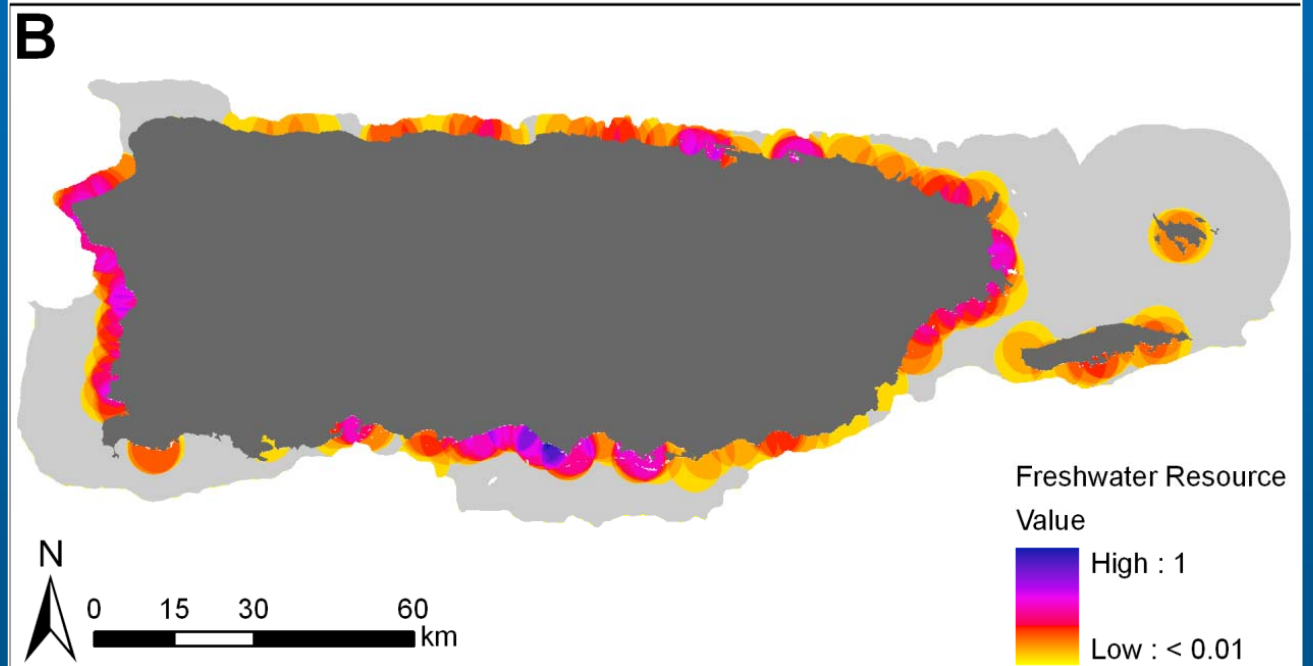
(B) The relative value of sites based on the summed value of seagrass habitat within a 5 km radius, scaled relative to the maximum. Light gray areas have zero seagrass resource value.



(A) Freshwater resources within the MPA project scope for which outflow coordinate data were available.

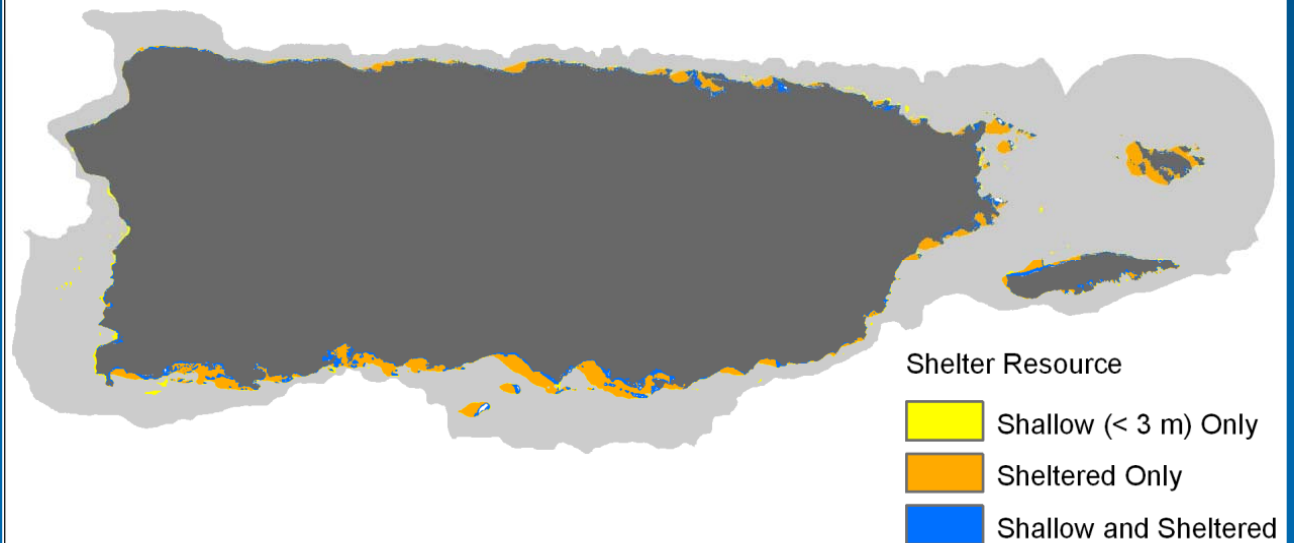


(B) The resource value is the total number of freshwater sources within a 5 km radius, summed and then rescaled relative to the maximum value of 16. Light gray areas have zero freshwater resource value.



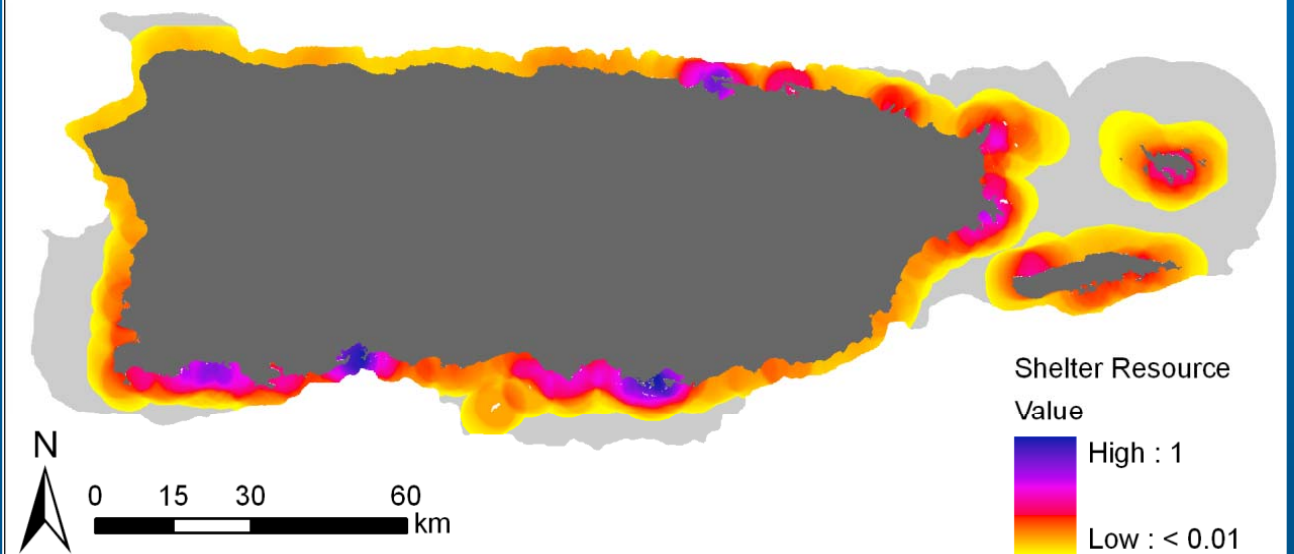
(A) Regions offering shallow, sheltered, or both shallow and sheltered waters to manatees based on a wave energy model and manatee movement patterns.

A

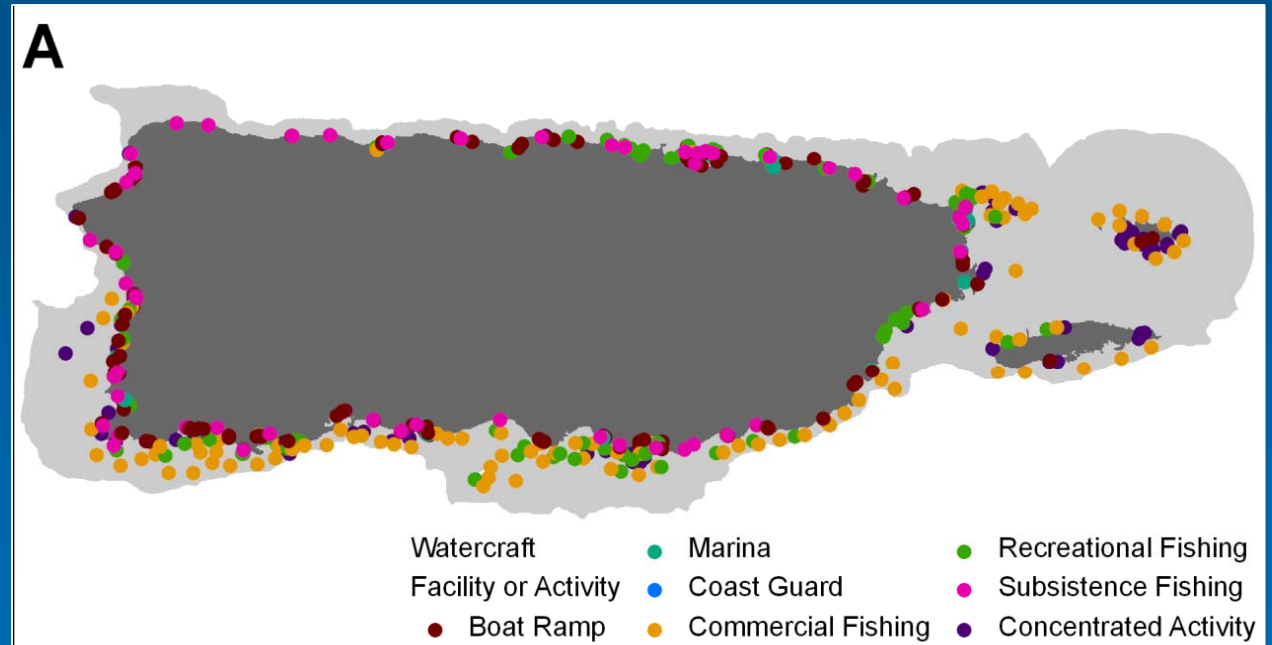


(B) Relative shelter value of coastal waters for manatees based on total area of shelter within 5 km radius (maximum = 1044 ha). Light gray areas have zero shelter value.

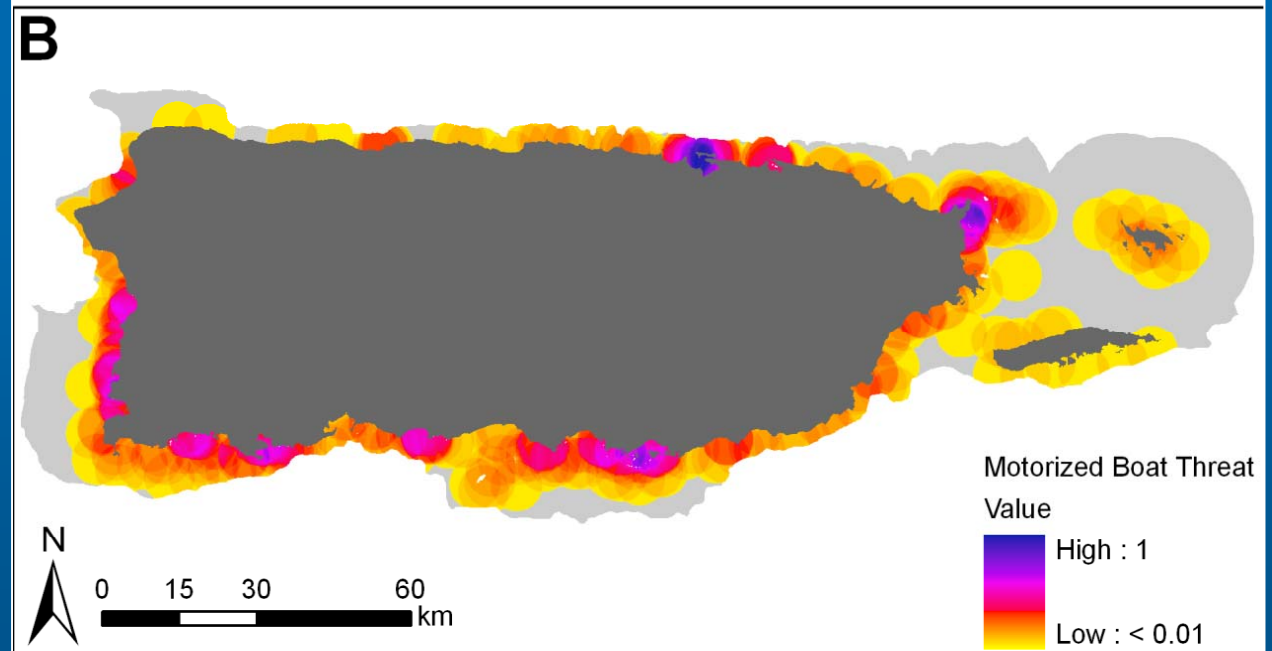
B

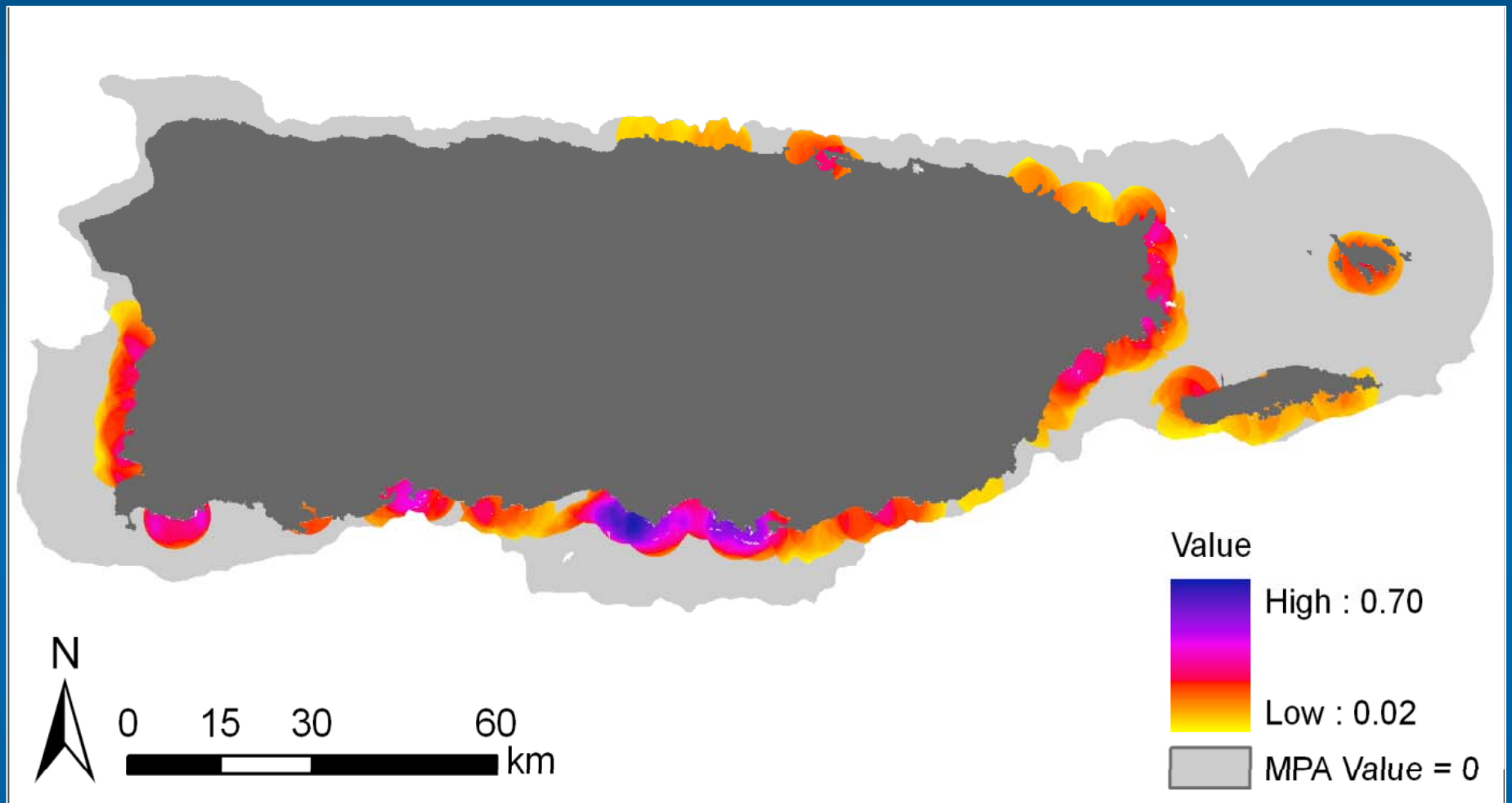


(A) Motorized watercraft infrastructure and activity within the MPA project scope.



(B) The threat risk is the total number of watercraft facility or activity records within a 5 km radius, summed and then rescaled relative to the maximum value of 36. Light gray areas have zero motorized watercraft threat.

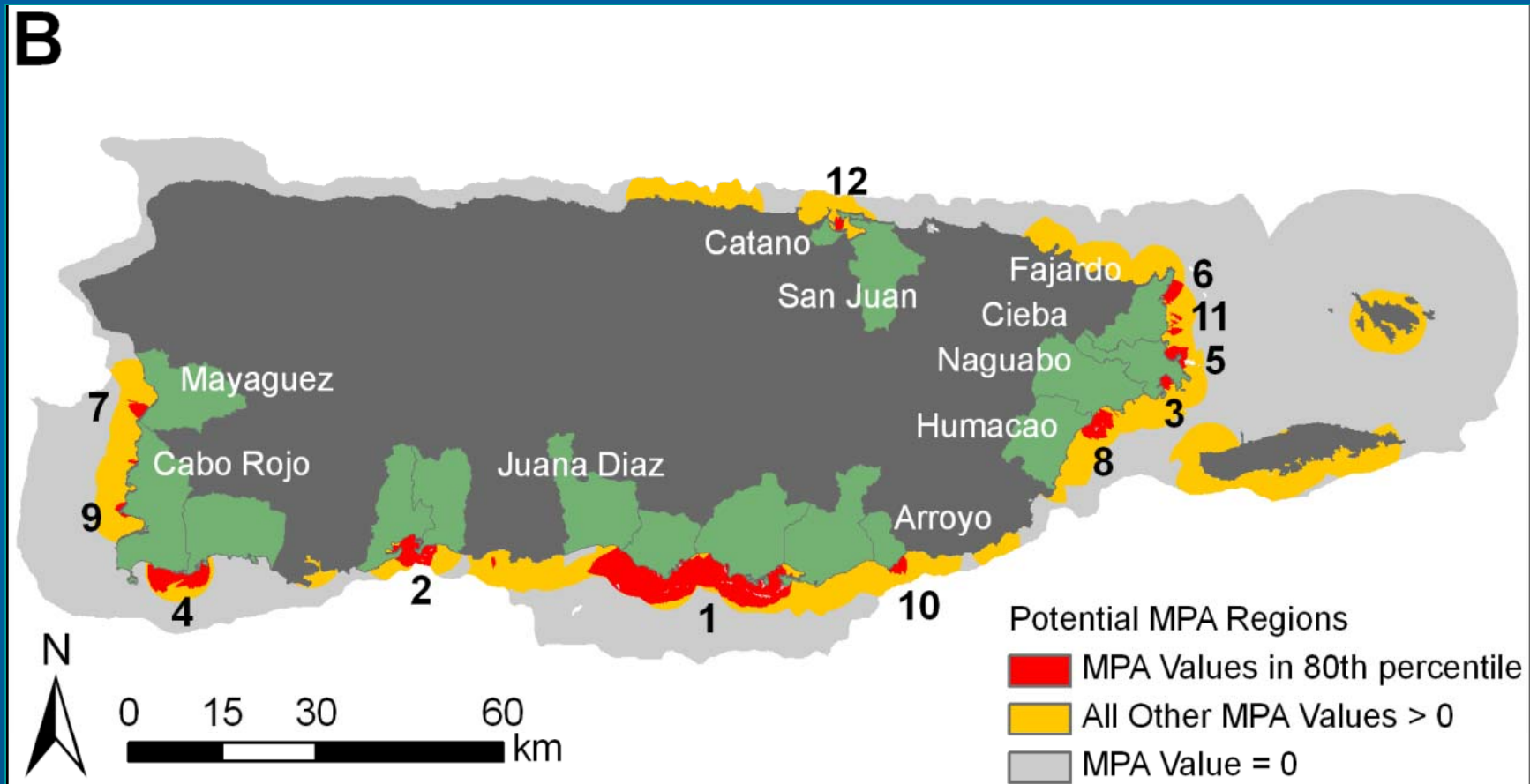




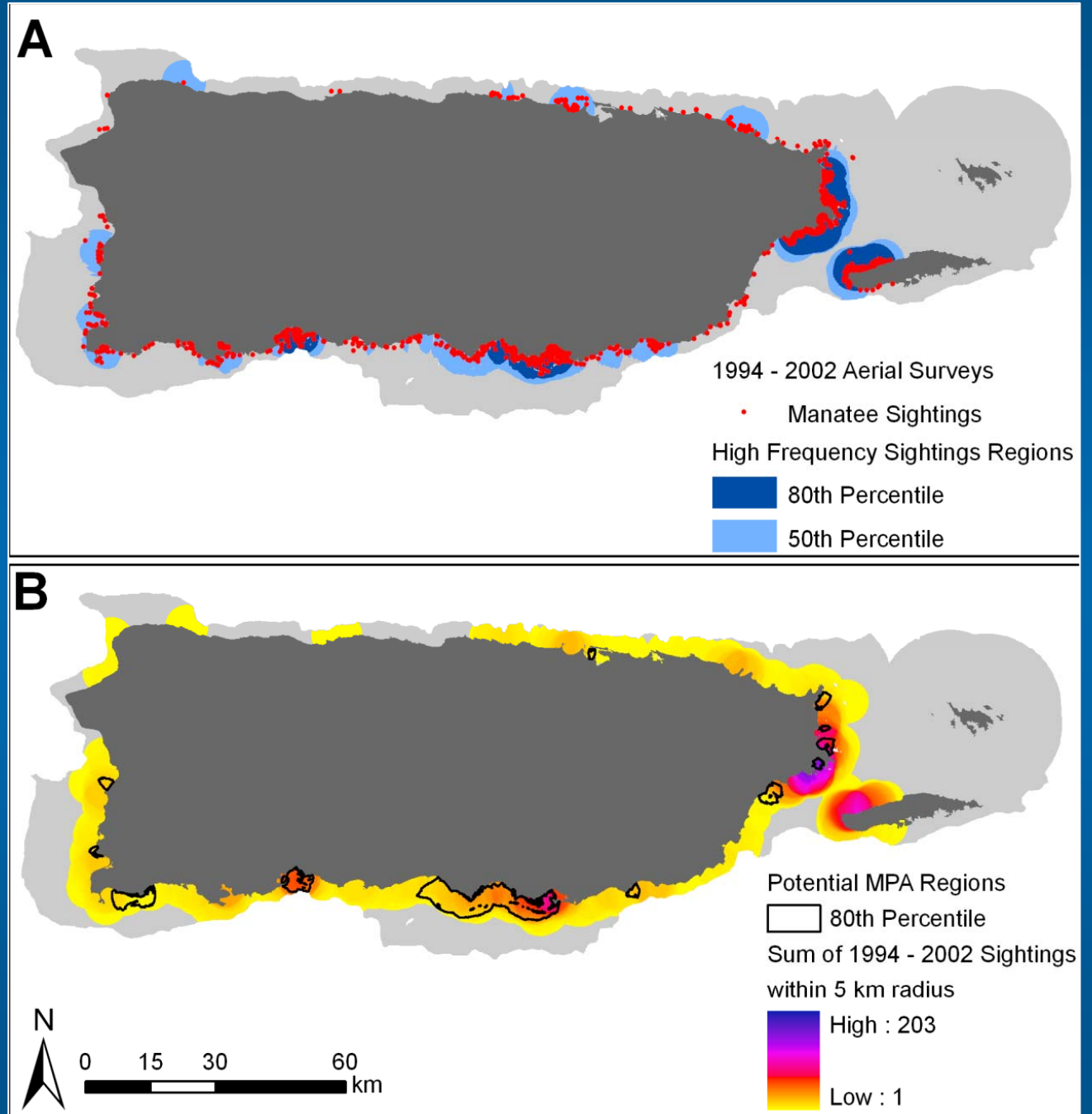
The calculated potential MPA value of coastal waters of Puerto Rico given the relative abundance (within a 5 km radius) of key ecological attributes (seagrass, freshwater, and shelter) and threats that can be mitigated through implementation of an MPA (motorized watercraft).

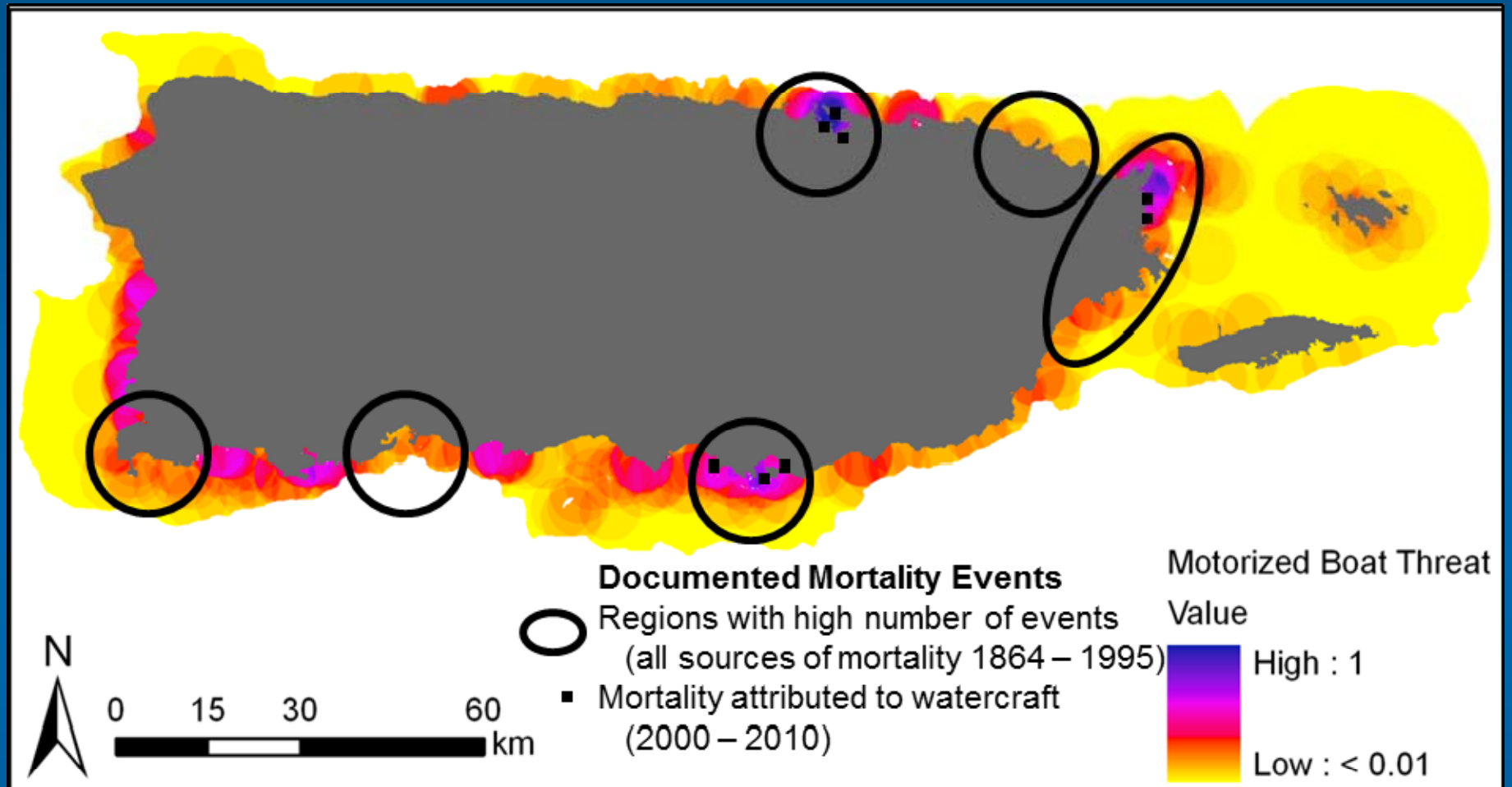


Potential Focal Regions for Manatee Protection Areas



Comparison of 1994 – 2002 manatee 50th and 80th percentile “hotspots” (e.g. regions with a high density of manatee observations) during aerial surveys (A), and the modeled potential MPA regions (B). Light gray regions have zero manatee observations.






Comparison of regions historically reporting high number of mortality events (black circles, as shown in Mignucci-Gianonni et al. 2000), locations of recent watercraft related mortality events (black squares; PRDENR, unpublished data), and modeled watercraft threat. Light gray areas have zero reported mortality events.

Potential Focal Regions for Manatee Protected Areas

Potential MPA Focal Regions

 MPA Value in 80th Percentile

 MPA Value > Median

 5km Radius Boundary


Freshwater Resources

 Perennial Streams

Benthic Habitat Type

 Land

 Mangrove

 Seagrass

 Macroalgae

 Mud

 Sand

 Uncolonized Bedrock

 Colonized Bedrock and Pavement

 Colonized Pavement with Sand Channels

 Spur and Groove Reef

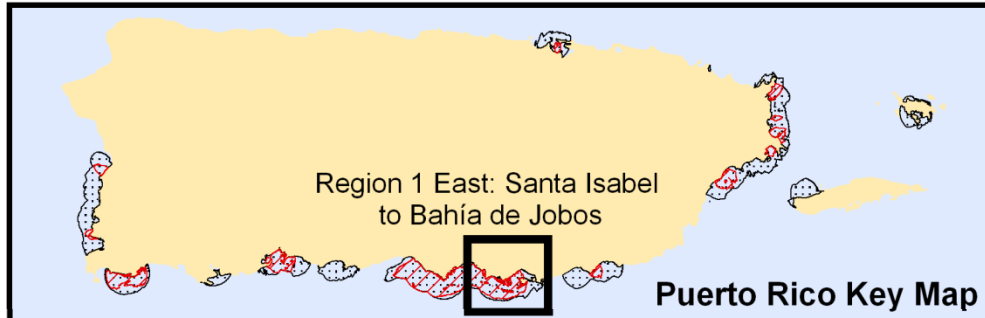
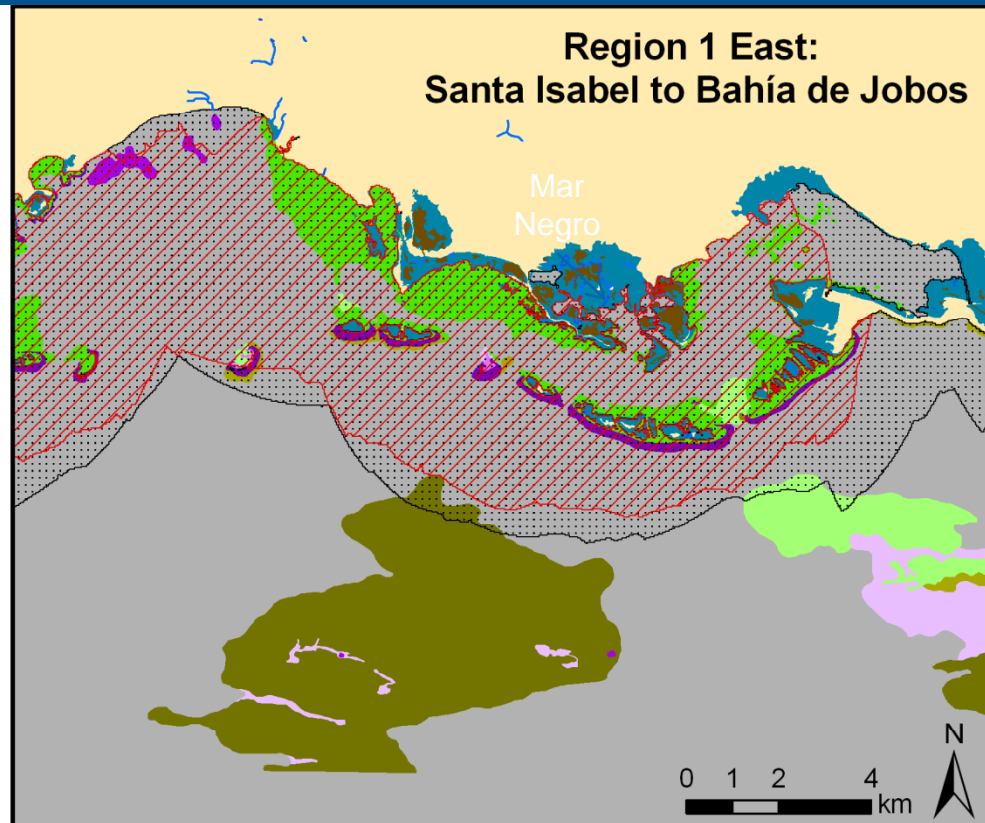
 Linear Reef

 Patch Reefs

 Reef Rubble

 Scattered Coral/Rock


 Artificial or Unknown



Potential MPA region encompassing coastal waters from Santa Isabel to Bahía de Jobos. Landmarks named on map are features associated with published manatee observations. The western half of this same area is shown in Figure 18.


Potential Focal Regions for Manatee Protected Areas

Potential MPA Focal Regions

 MPA Value in 80th Percentile

 MPA Value > Median


Freshwater Resources

 Perennial Streams

Benthic Habitat Type

 Land

 Mangrove

 Seagrass

 Macroalgae

 Mud

 Sand

 Uncolonized Bedrock

 Colonized Bedrock and Pavement

 Colonized Pavement with Sand Channels

 Spur and Groove Reef

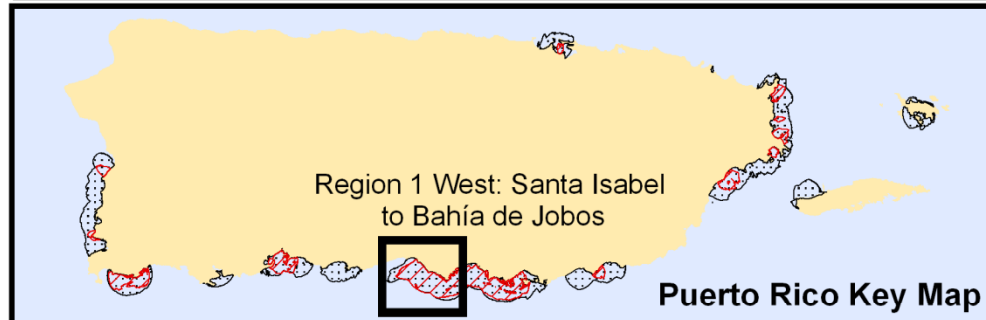
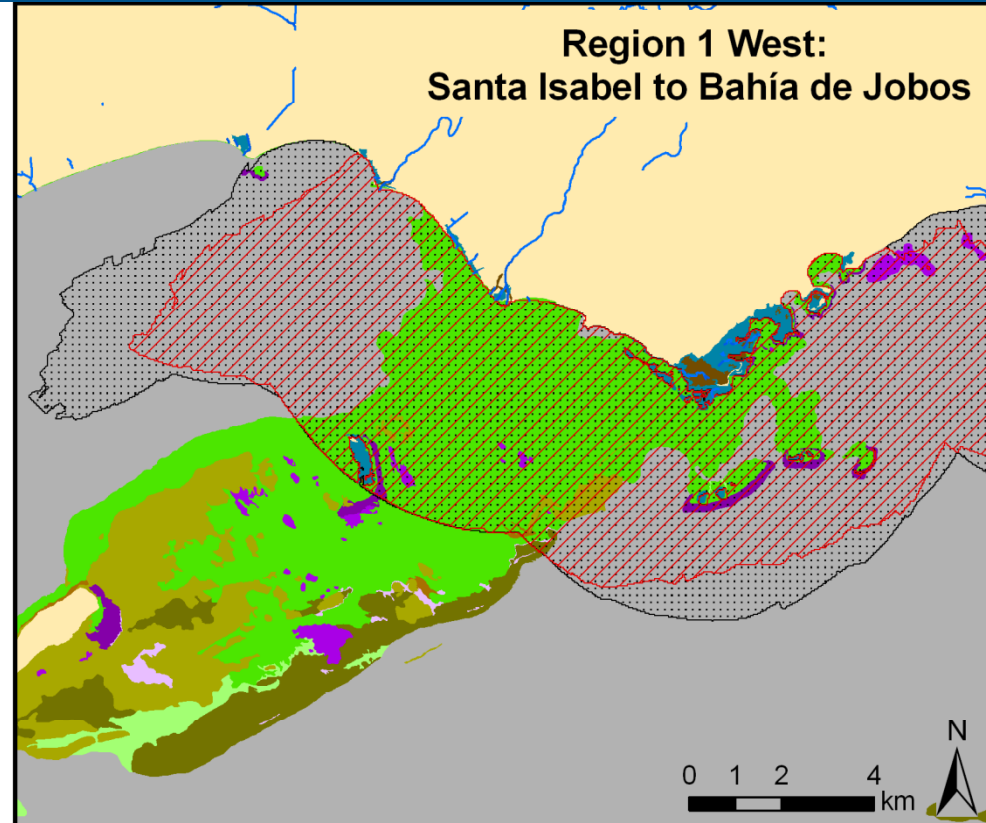
 Linear Reef

 Patch Reefs

 Reef Rubble

 Scattered Coral/Rock


 Artificial or Unknown



Potential MPA region encompassing coastal waters from Santa Isabel to Bahía de Jobos. No landmarks within this section of the region were specifically named in association with published manatee observations.

Potential Focal Regions for Manatee Protected Areas

Potential MPA Focal Regions

 MPA Value in 80th Percentile

 MPA Value > Median


Freshwater Resources

 Perennial Streams

Benthic Habitat Type

 Land

 Mangrove

 Seagrass

 Macroalgae

 Mud

 Sand

 Uncolonized Bedrock

 Colonized Bedrock and Pavement

 Colonized Pavement with Sand Channels

 Spur and Groove Reef

 Linear Reef

 Patch Reefs

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 Scattered Coral/Rock

 Artificial or Unknown

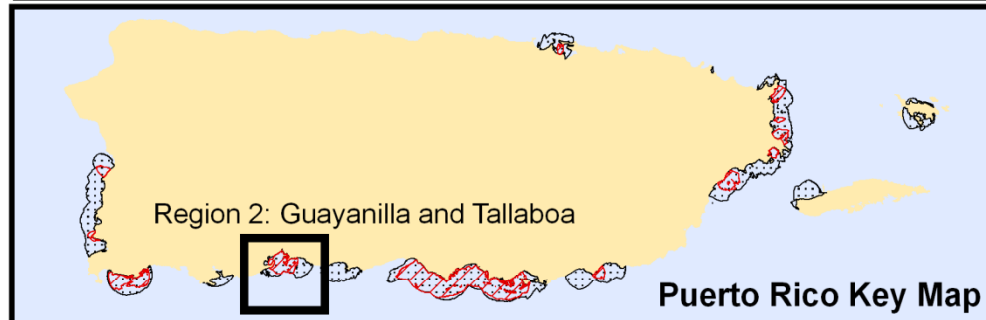
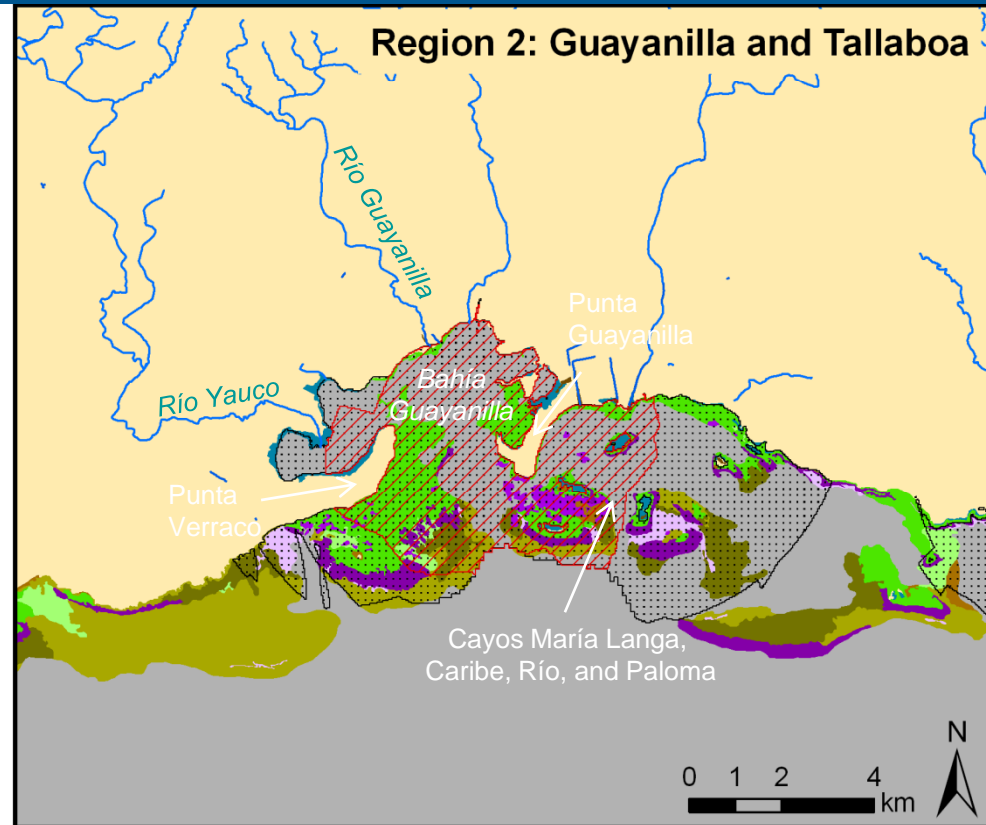



Figure 19: Potential MPA region encompassing coastal waters of Guayanilla and Tallaboa. Landmarks named on map are features associated with published manatee observations.

Potential Focal Regions for Manatee Protected Areas

Potential MPA Focal Regions

 MPA Value in 80th Percentile

 MPA Value > Median

 5km Radius Boundary


Freshwater Resources

 Perennial Streams

Benthic Habitat Type

 Land

 Mangrove

 Seagrass

 Macroalgae

 Mud

 Sand

 Uncolonized Bedrock

 Colonized Bedrock and Pavement

 Colonized Pavement with Sand Channels

 Spur and Groove Reef

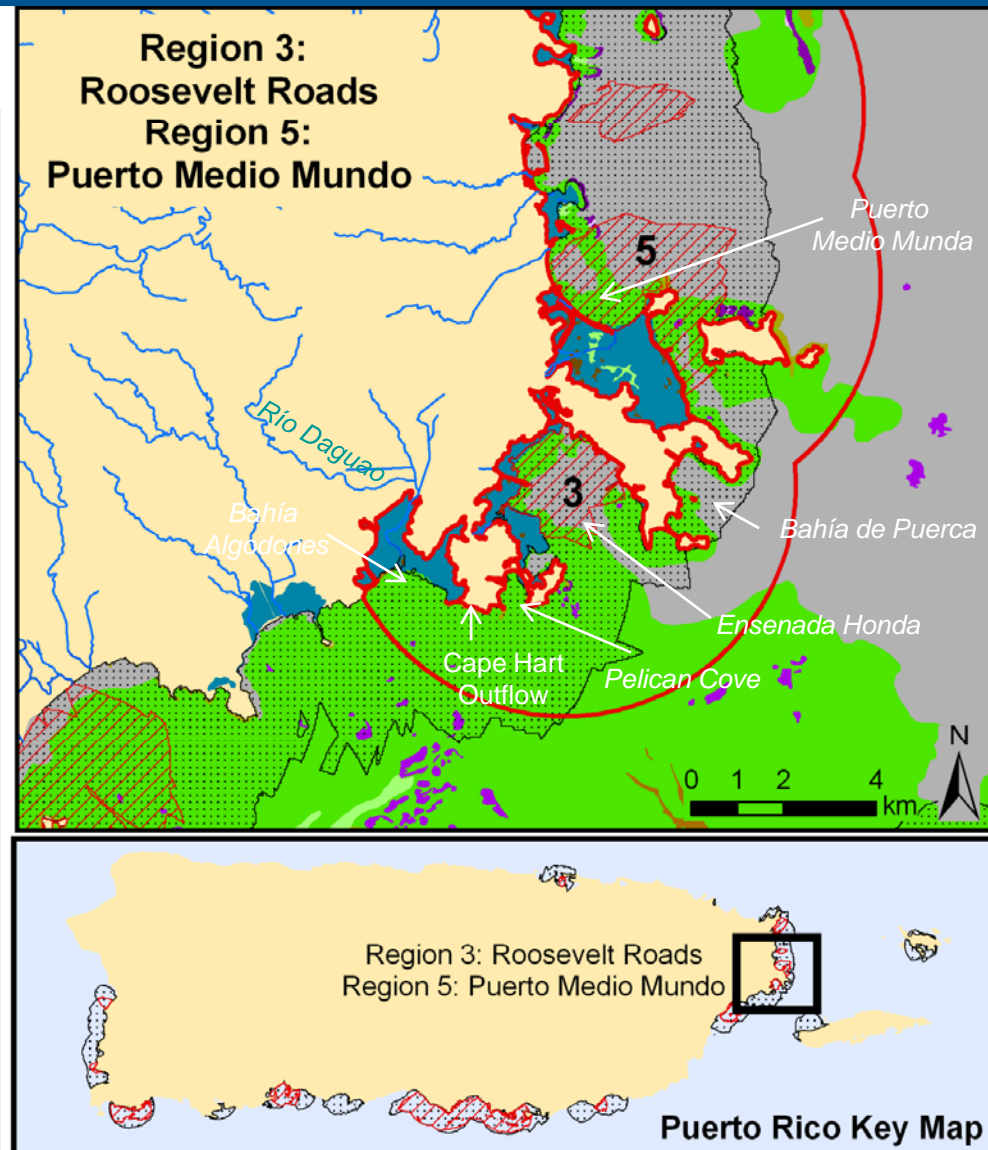
 Linear Reef

 Patch Reefs

 Reef Rubble

 Scattered Coral/Rock


 Artificial or Unknown



Two potential MPA regions encompassing coastal waters of the former Roosevelt Roads Naval Station and Puerto Medio Mundo. Landmarks named on map are features associated with published manatee observations.

Potential Focal Regions for Manatee Protected Areas

Potential MPA Focal Regions

 MPA Value in th 80th Percentile

 MPA Value > Median

 5km Radius Boundary


Freshwater Resources

 Perennial Streams

Benthic Habitat Type

 Land

 Mangrove

 Seagrass

 Macroalgae

 Mud

 Sand

 Uncolonized Bedrock

 Colonized Bedrock and Pavement

 Colonized Pavement with Sand Channels

 Spur and Groove Reef

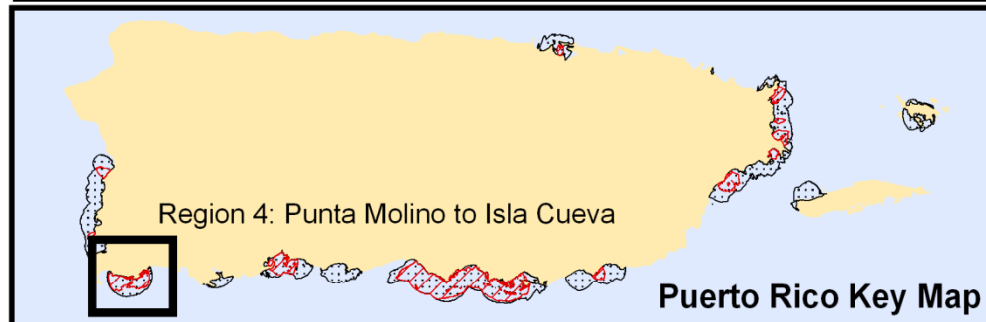
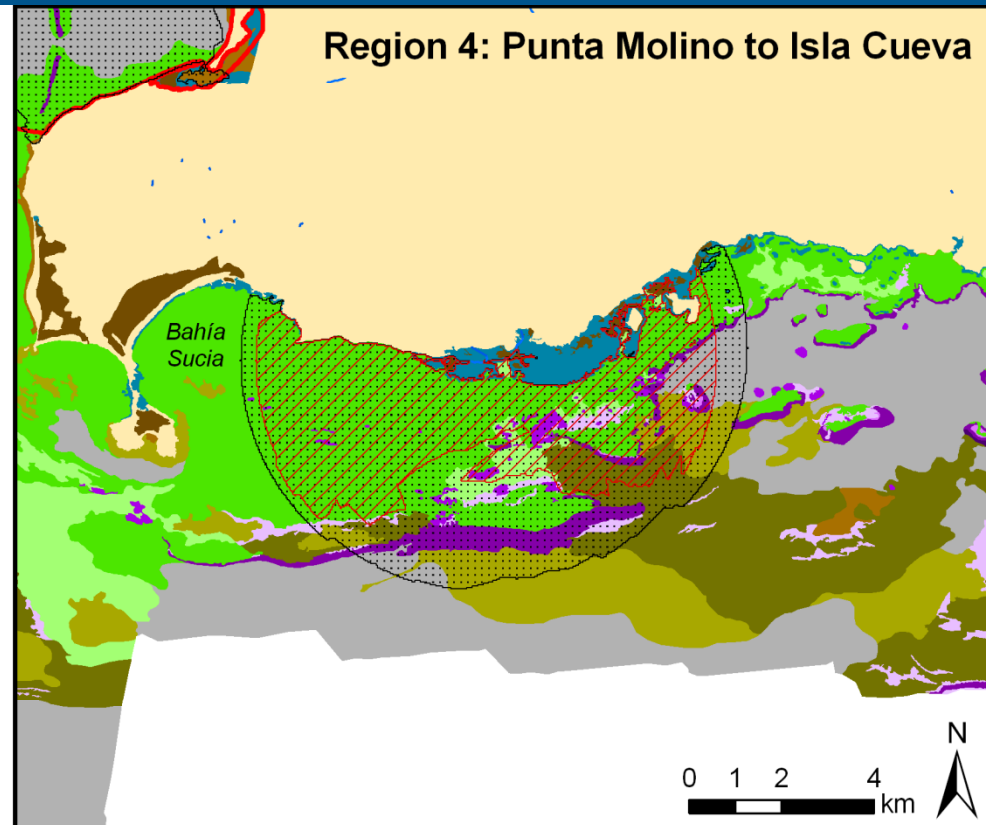
 Linear Reef

 Patch Reefs

 Reef Rubble

 Scattered Coral/Rock

 Artificial or Unknown



Potential MPA region encompassing coastal waters from Punta Molino to Isla Cueva. Landmarks named on map are features associated with published manatee observations.

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