Oyster Habitat Suitability Model (HSM) for the Pensacola Bay System

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Oyster Beds and Need for HSM

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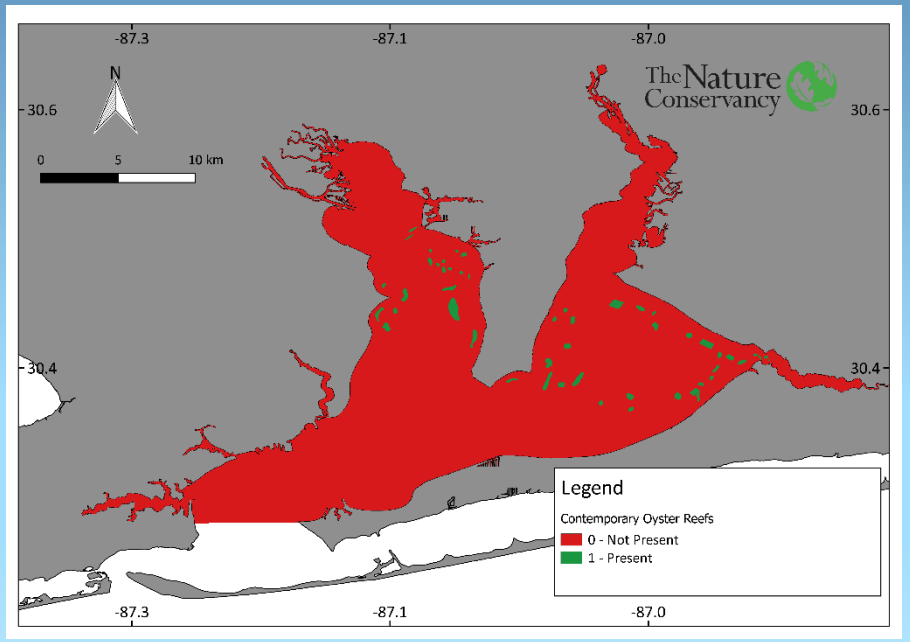
Historic Oyster Beds (1883 – US Fish Commission)

- Majority of northern Escambia Bay and all of East Bay

Contemporary Oyster Beds

- Patchy in both Escambia and East Bay

Question: Where are oyster reefs most viable now?



Project Goal

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Goal: Produce an oyster 'Habitat Suitability Model (HSM)' for the entire PBS

- Identify factors that affect habitat suitability
- Analyze available spatial data for each factor for quality/relevance
- 'Score' all locations within PBS and for each individual data layer from 0.00-1.00
- Combine all scores for a composite HSM index from 0.00-1.00
- Useful for restoration, habitat mitigation, impact analysis, etc.

Final Score Calculation:

(Component1 + Component2 + … + Component7…)/Maximum Score

The HSM is a SCREENING TOOL, not the ANSWER

Factors Considered

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- Bathymetry
- Dissolved oxygen, average annual (10-year average)
- Chlorophyll A concentrations
- Salinity, avg. annual and average wet season
- Temperature, summer month contours
- Substrate, types
- Presence of Submerged Aquatic Vegetation
- Larval distribution, spat concentrations, larval dispersal
- Water quality
- Water flow, velocity
- Disease, intensity and prevalence
- Predators, species, abundance, distribution and temporal presence
- Current oyster locations
- Shellfish Harvesting Areas, harvesting allowed or restricted
- Historic oyster habitat, past distributions
- Managed areas, spatial distribution in areas adjacent to the PBS
- Shoreline type, natural or altered lands adjacent to the PBS
- Marsh Migration Areas - where public conservation lands have been acquired and will allow for habitat migration.
- Sea Level Rise, future water depth, habitat types and salinity
- Aquaculture lease buffers, access routes into aquaculture lease areas
- Navigation channels, presence
- Military zones

Factors Included

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Two HSM maps produced:

Biological, chemical, and physical HSM

- Suitability based on organic factors
  - Contemporary Oyster Beds
  - Historic Oyster Beds
  - Dissolved Oxygen
  - Seagrass/vegetation
  - Sediments
  - Salinity
  - Recruitment

Biological, chemical, and physical HSM with avoidances

- Suitability based on organic factors, excluding avoidance areas
  - Aquaculture and Shellfish Lease Areas in the Study Area
  - Navigation channels

Factors Included

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Component	Parameter	Metric	Reference	Model Scoring
Biological, Chemical And Physical	Contemporary Oyster Beds	Presence	Fish and Wildlife Research Institute	Reefs Present = 1 Reefs Absent = 0
	Historical Oyster Beds	Presence	US Fish Commission	Reefs Present = 1 Reefs Absent = 0
	Dissolved Oxygen (bottom, summer)	mg/l	McCauley et al. 2005	DO Conc. < 2 mg/l = 0 DO Conc. ≥ 2 mg/l = 1
	Seagrass	Presence	Fish and Wildlife Research Institute	Seagrass Present = 0 Seagrass Absent = 1
	Sediments	Type	McCauley et al. 2005	Mud = 0 Muddy Sand = 0.25 Sand = 0.5
	Salinity	psu	McCauley et al. 2005	S < 2 psu = 0.5 S ≥ 2 psu = 1.0
	Recruitment	Recruits/shell	Arnold et al. 2017	variable from 0 -1
Avoidances	Aquaculture and Shellfish Lease Areas in the Study Area	Presence	Florida Department of Agriculture and Consumer Services	NA
	Navigation channels	Presence w/buffer	NOAA	NA

Assumptions and Metadata

HSM Model Assumptions and Metadata

- All data layers weighted evenly from 0.00 – 1.00
- 0.00 suitability score for an individual location/layer does not mean an overall 0.00 score for that location
- Best available data used at the time of study
- Resolution of final grid 25 x 25 m, clipped to the mouth of the Bay (EPA data used a probabilistic design with a grid size of 7.7 km^2)
- Field verification should be performed before projects proceed

EPA Probabilistic Design

7.7 km2 grid; sampled quarterly for 5 years, 1995 - 2000

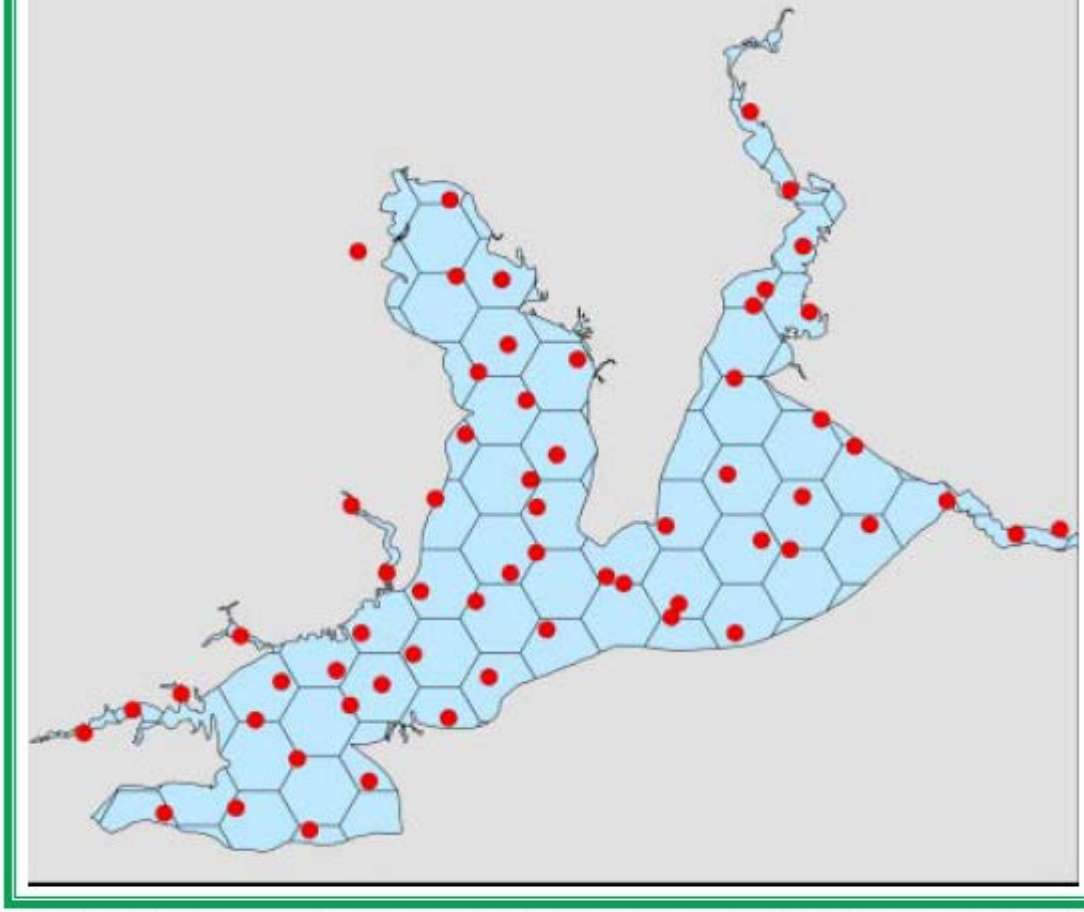
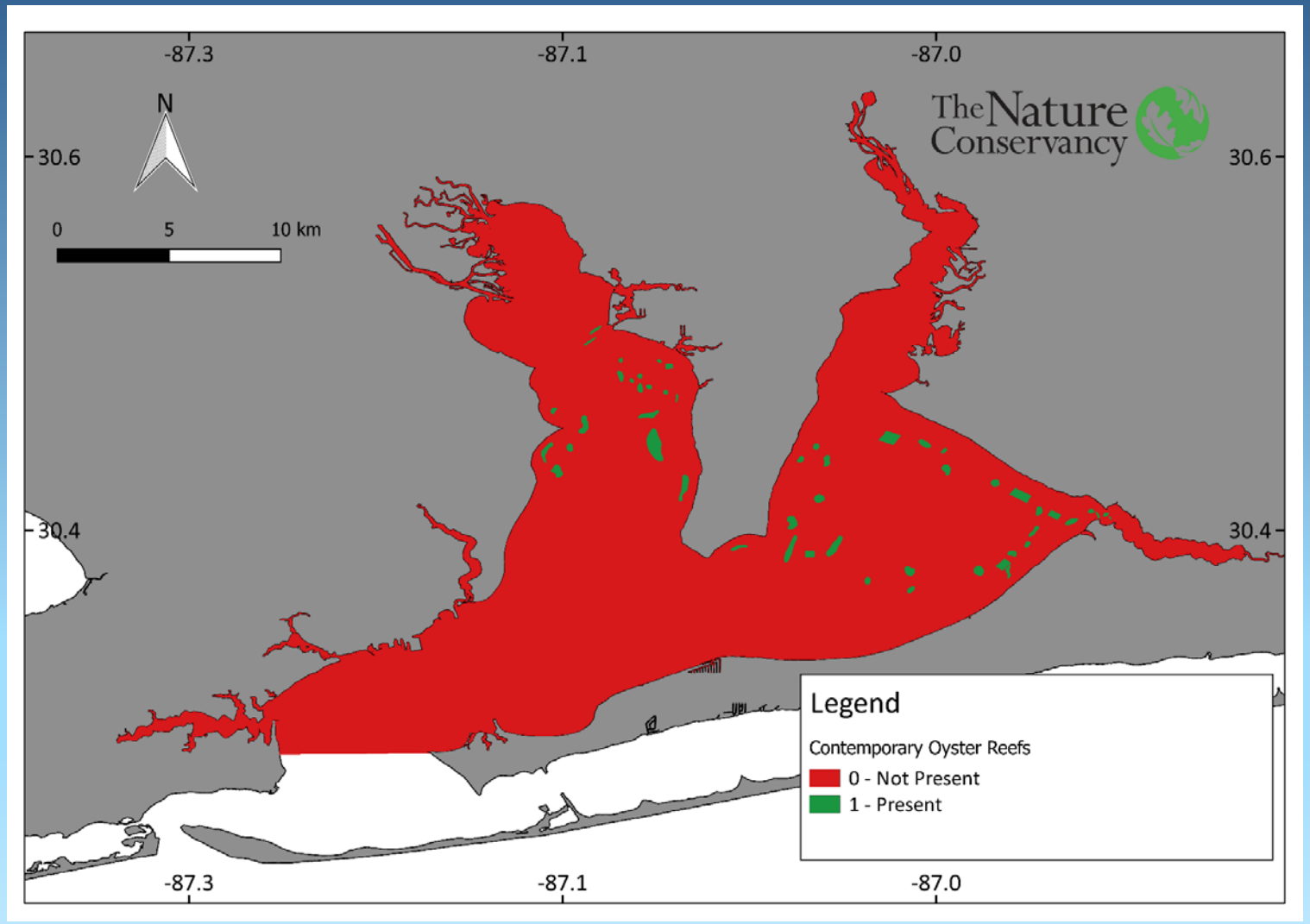


Figure 3-2 Hexagonal grid overlaid onto the Pensacola Bay System with each hexagon representing 7.7 km². Circles show the locations of sampling stations.

Source: McCauley et al. 2005

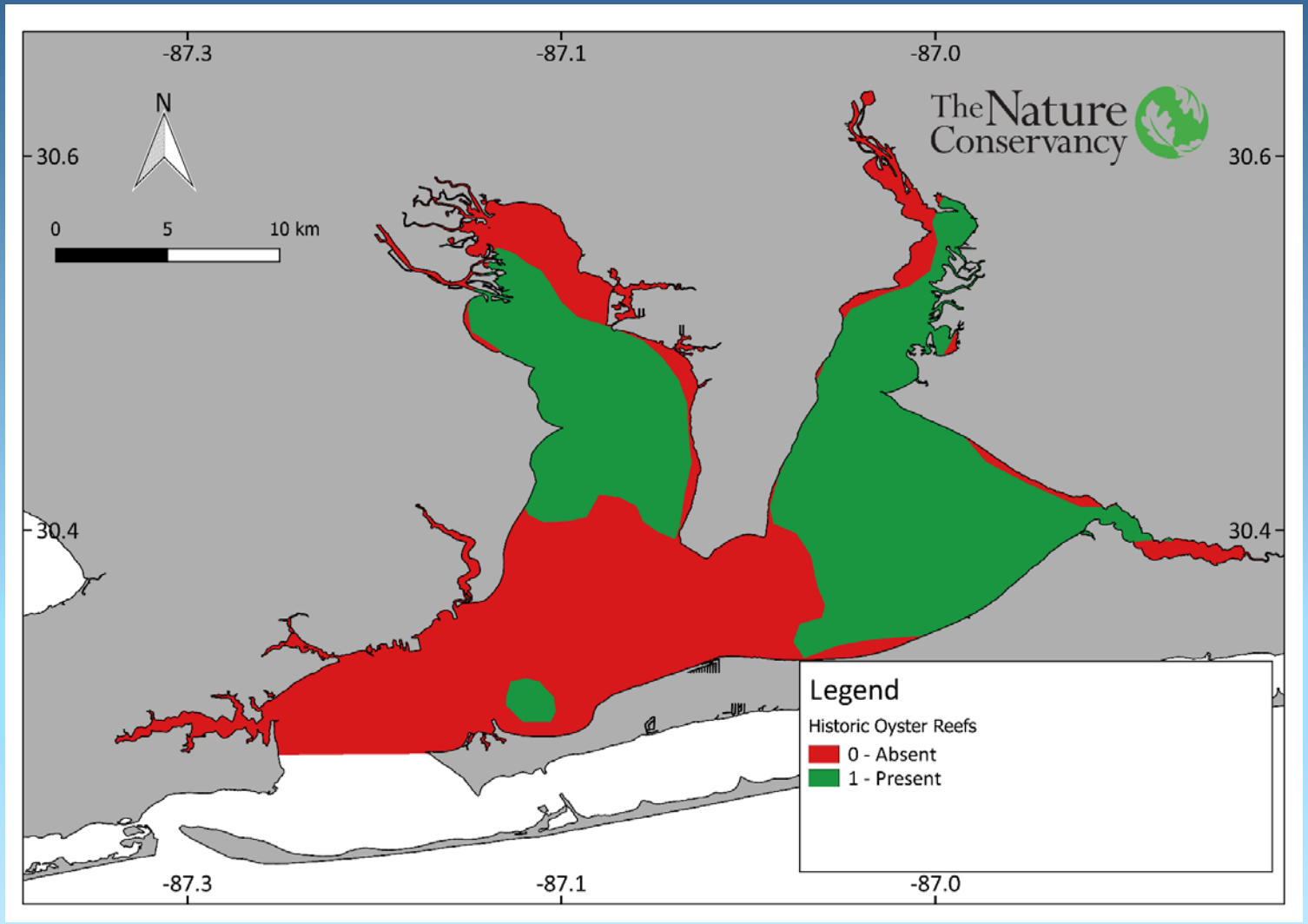
Factors Included

Contemporary Oyster Beds (FWRI)

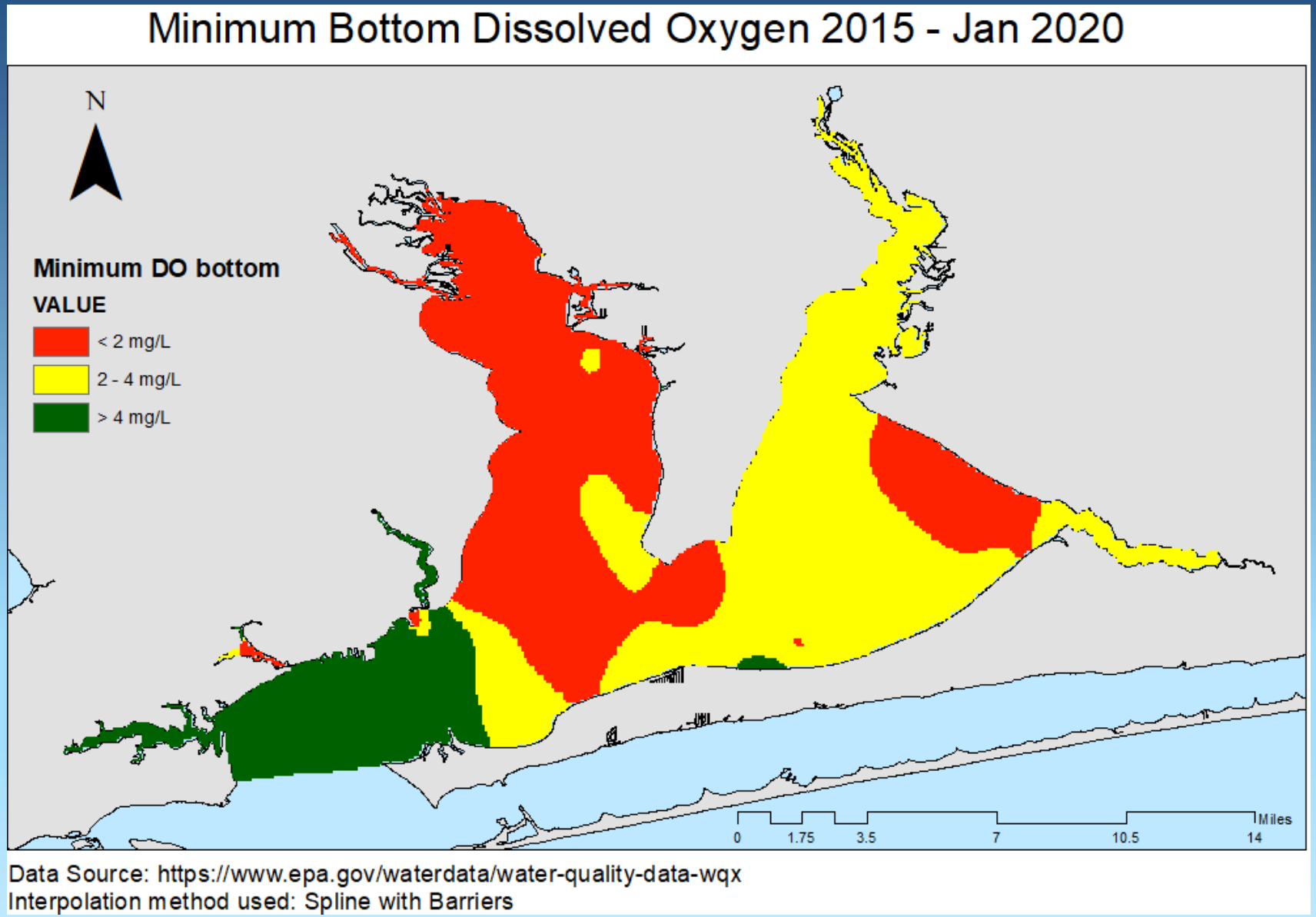


Factors Included

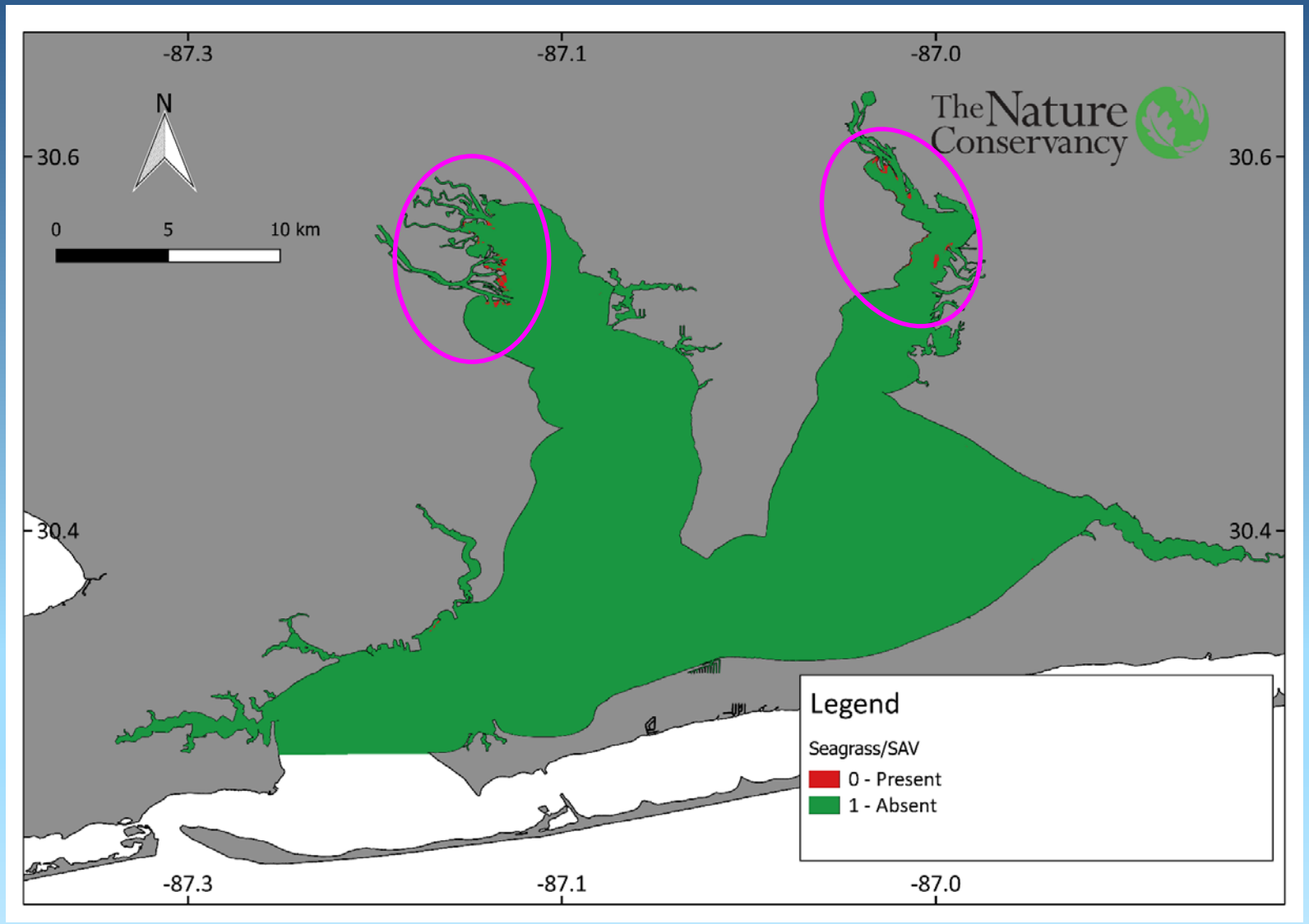
Historic Oyster Beds (1883 – US Fish Commission)



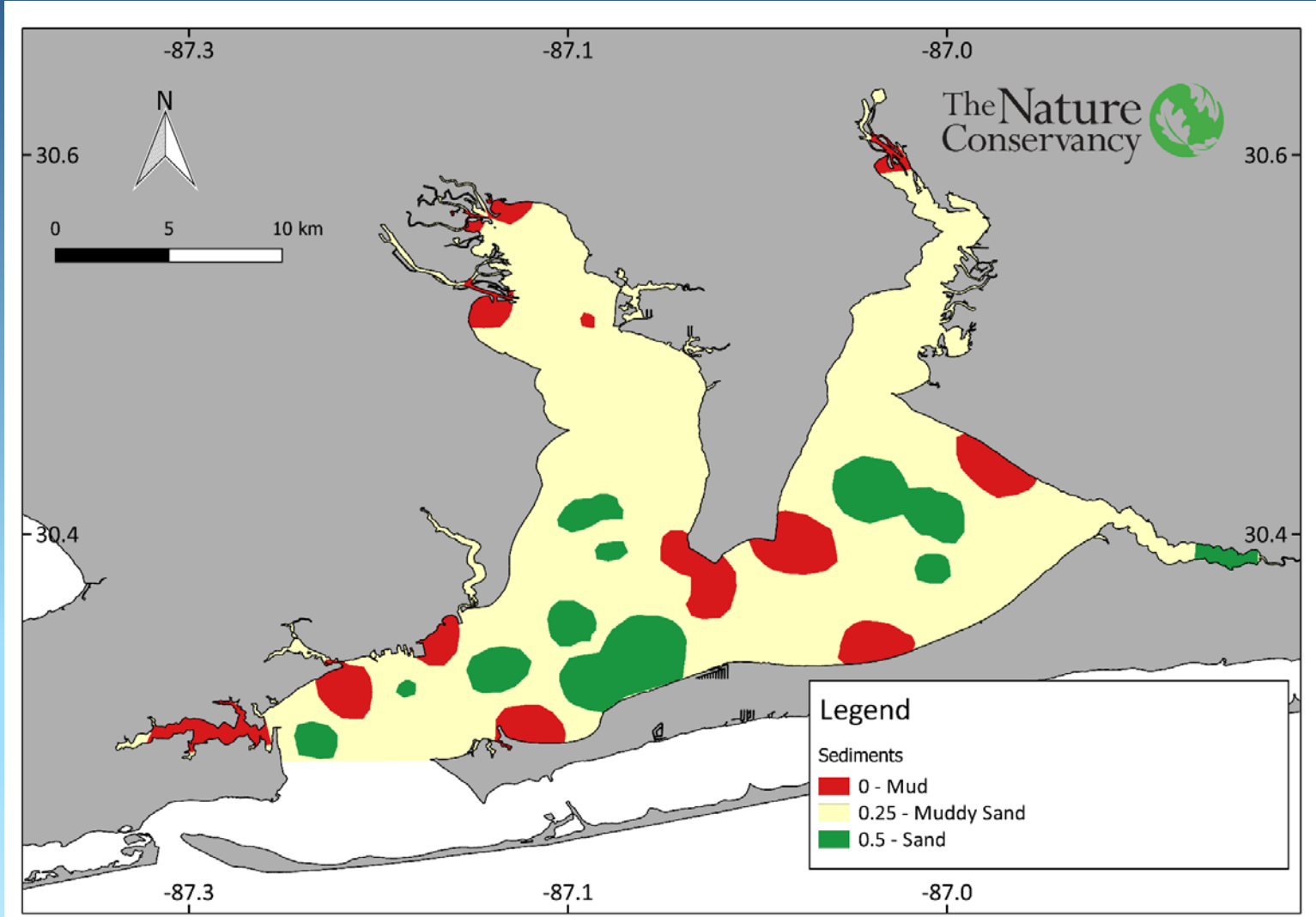
Factors Included



Factors Included
Submerged Aquatic Vegetation (FWRI)

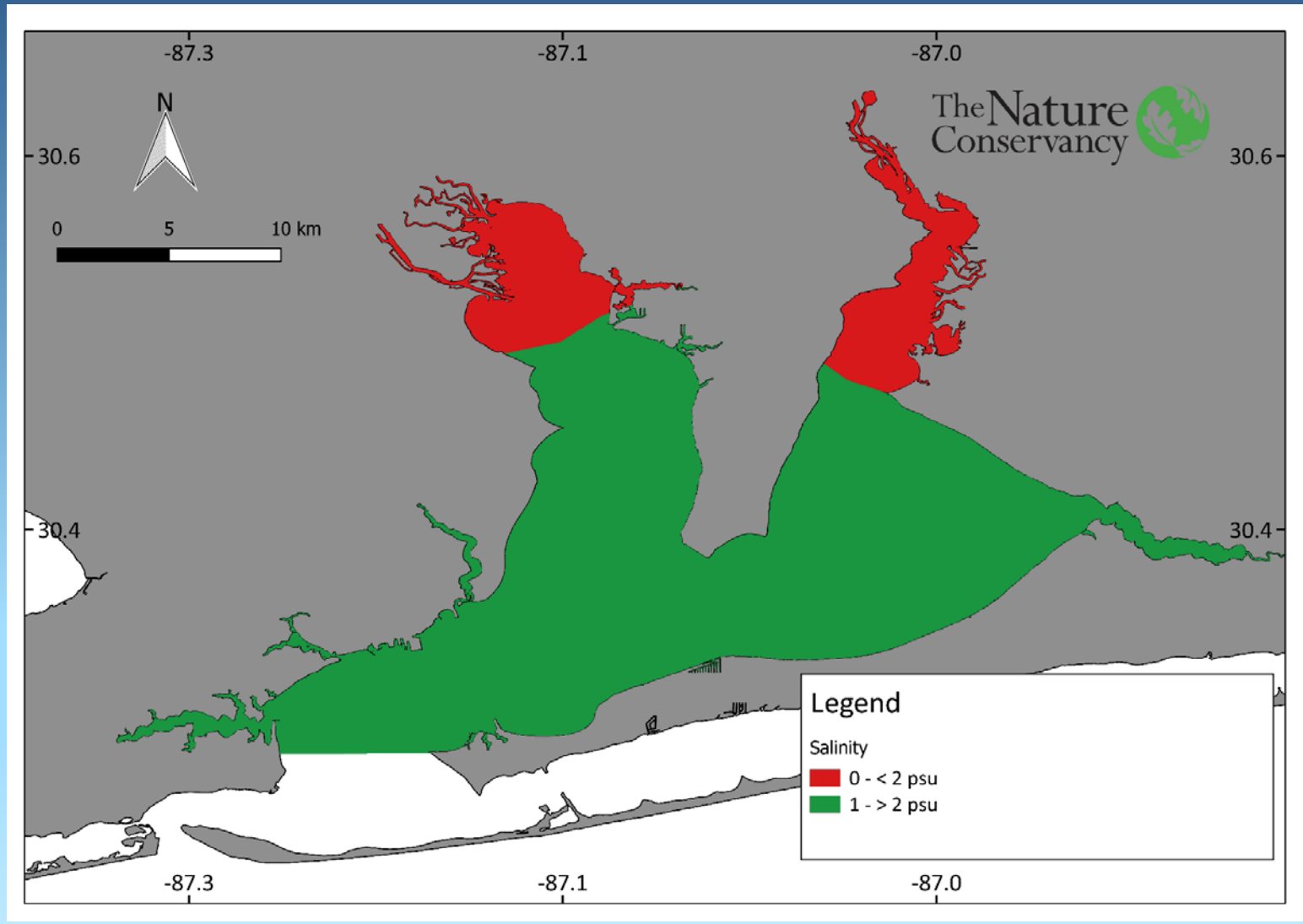


Factors Included
Sediments (McCauley et al. 2005)



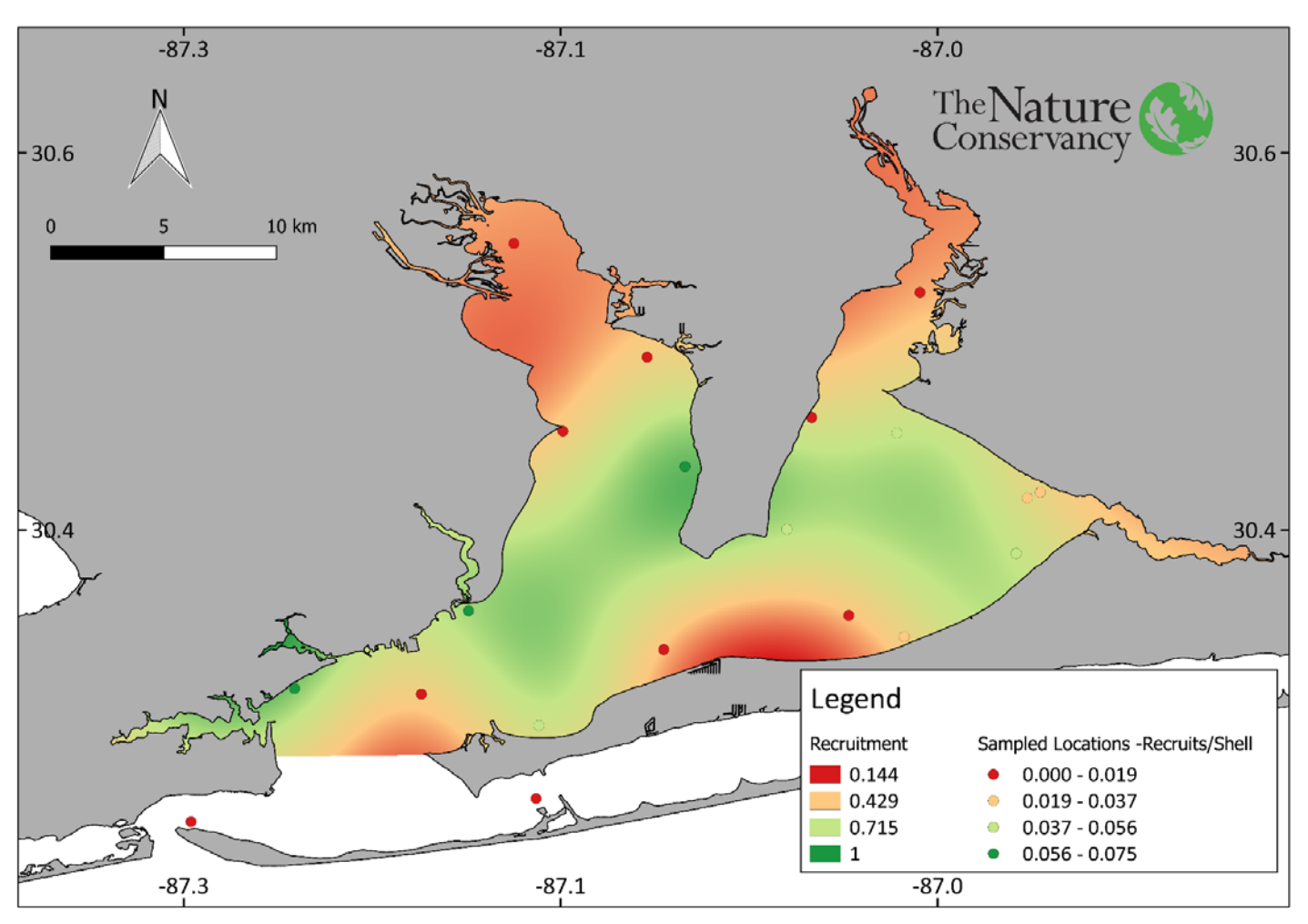
Factors Included

Salinity (spring & summer; McCauley et al. 2005)



Factors Included

Larval Recruitment (Arnold et al. 2017)



HSM (revised May 2020)
Biological, chemical, physical

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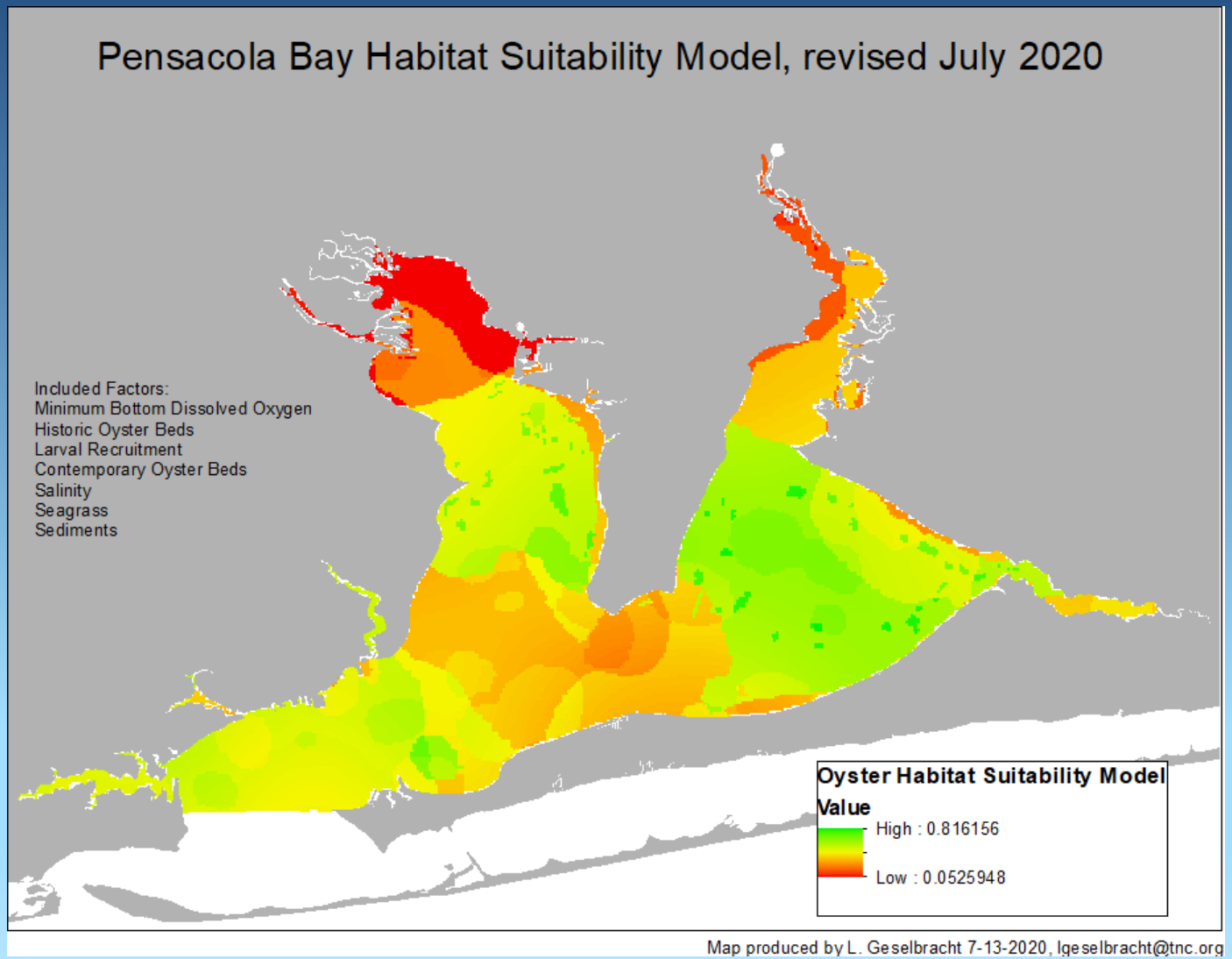
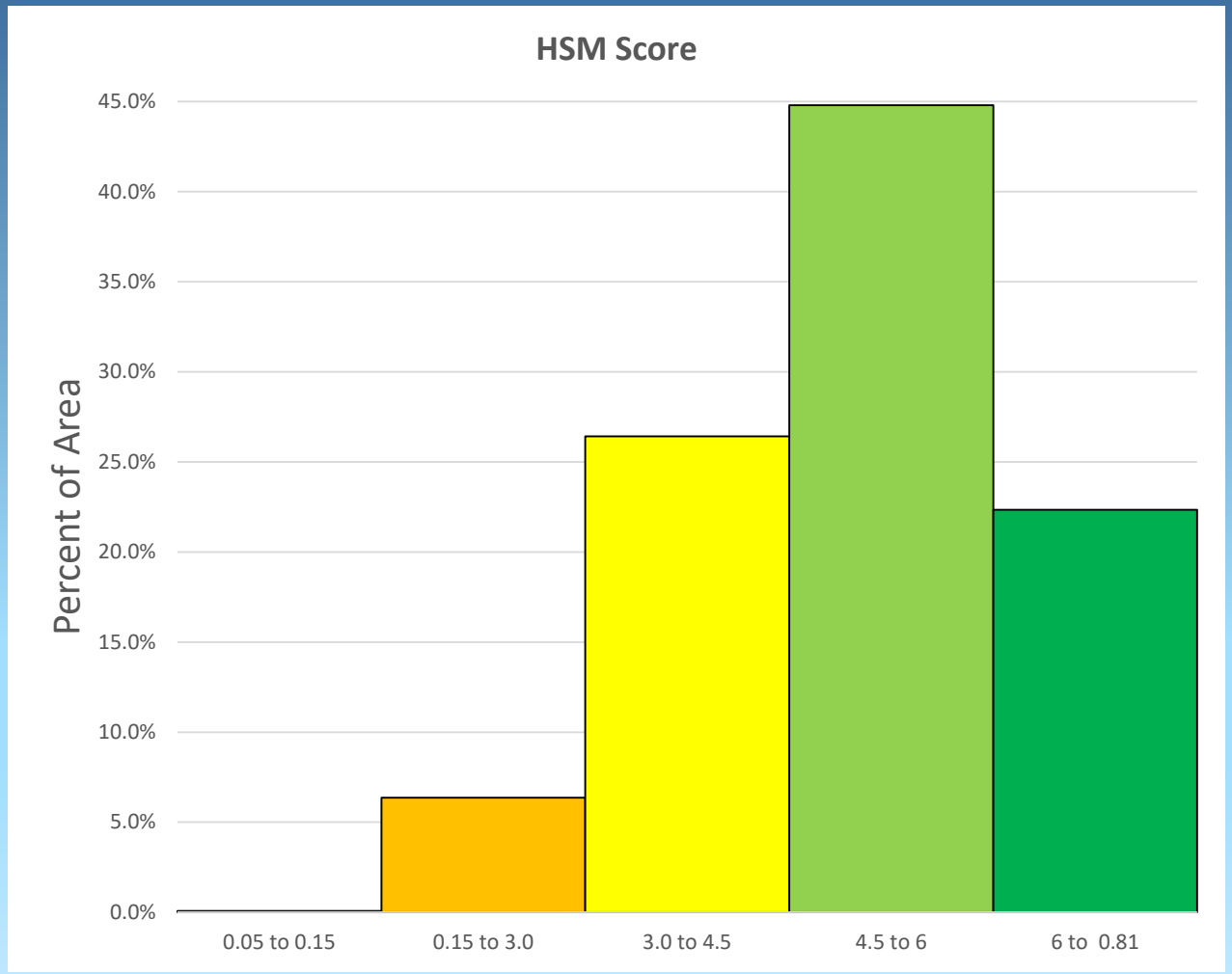


Final Score Calculation: (Component1 + Component2 + … + Component7…)/Maximum Score

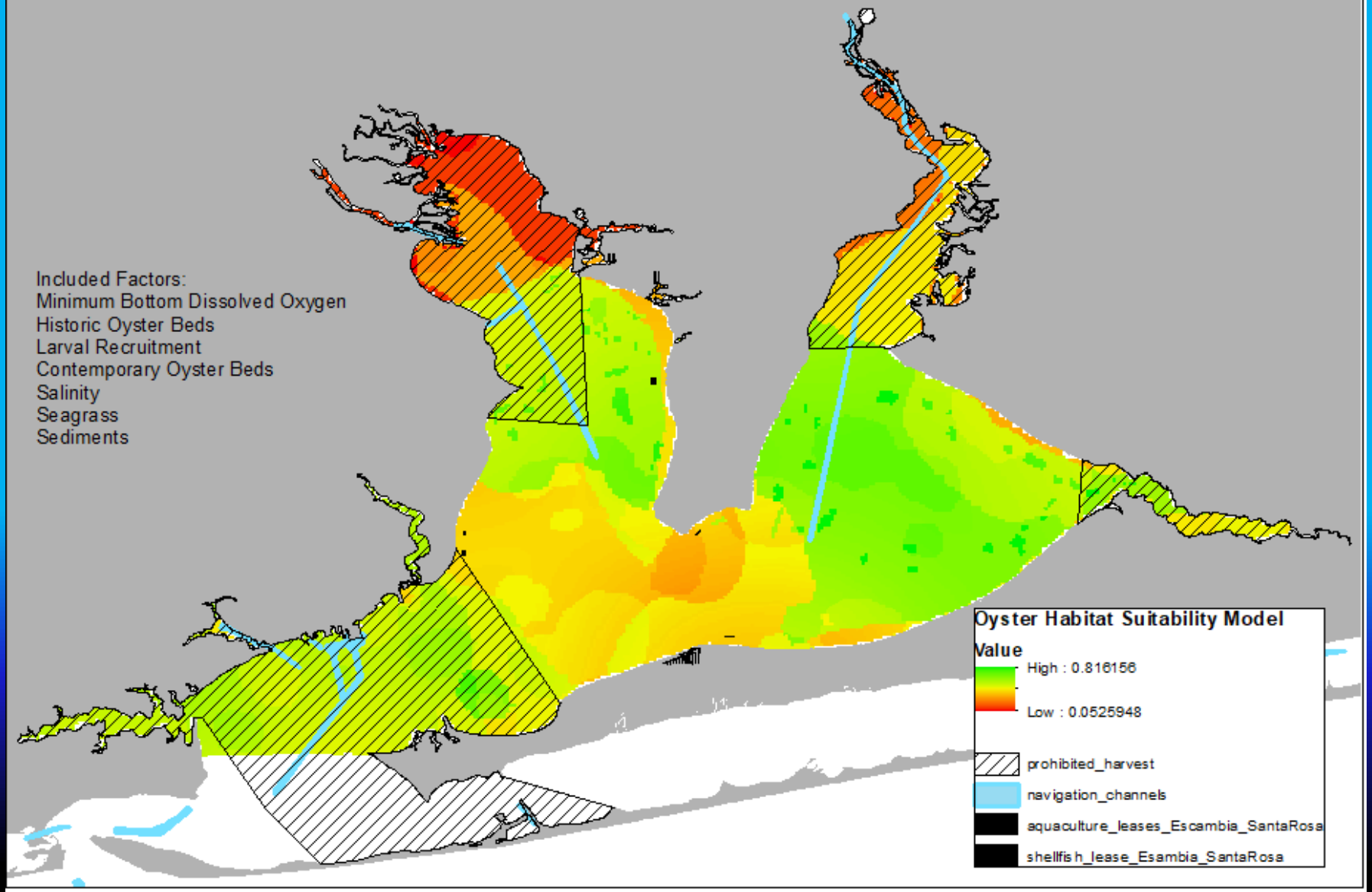
Final HSM

HSM Final – Stats



Max Score	Percent of Area
0.15	0.1%
0.3	6.4%
0.45	26.4%
0.6	44.8%
0.81	22.3%

Pensacola Bay Habitat Suitability Model, revised July 2020 with avoidances and other considerations



Map produced by L. Geselbracht 7-13-2020, lgeselbracht@tnc.org

Summary

- Plenty of area to consider for restoration, fishing enhancement and aquaculture.
- Bottom mapping of contemporary reef areas and lower Blackwater Bay and East River areas will soon be underway that will refine these findings.
- Each bay system will have a unique set of available and useful data for the HSM.
- Social and economic factors could be included to develop a “restoration” suitability analysis.
- Analysis can be adjusted to focus on areas most suitable for the various types of aquaculture.

Questions?