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Research and Data Collection in Support of Spatial Fisheries Management in Atlantic HMS Fisheries

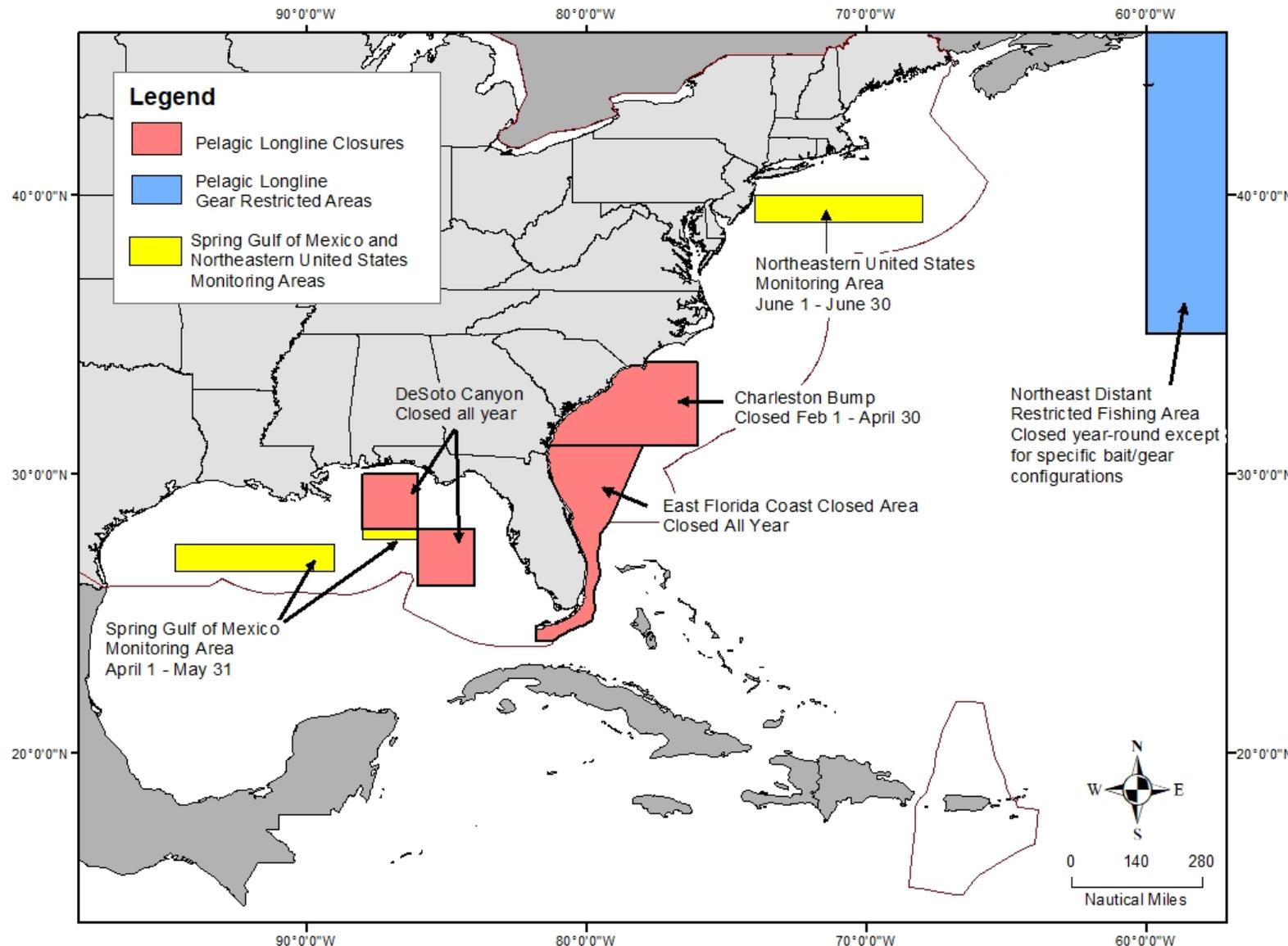
**Fall HMS AP Meeting
September 2020**

Purpose

Goal: To evaluate the effectiveness of existing spatial management as appropriate on an ongoing basis

Spatial data supports:

- Closed area analyses
- Essential fish habitat (EFH) designations
- Ecosystem-based fisheries management (EBFM)
- Climate change adaptation and resilience



Retrospective and Updates

- Issues and Options paper published on May 16, 2019.
 - <https://www.fisheries.noaa.gov/action/research-and-data-collection-support-spatial-fisheries-management>
 - Included 7 options to collect data and perform research in closed areas
 - Presented to the AP on May 22, 2019
 - Public comment period May 16, 2019 - July 31, 2019
 - 4 public hearings
- Currently considering public comments and options in anticipation of a proposed rule
- Exploring additional methods to evaluate species occurrence in closed areas...HMS-PRiSM

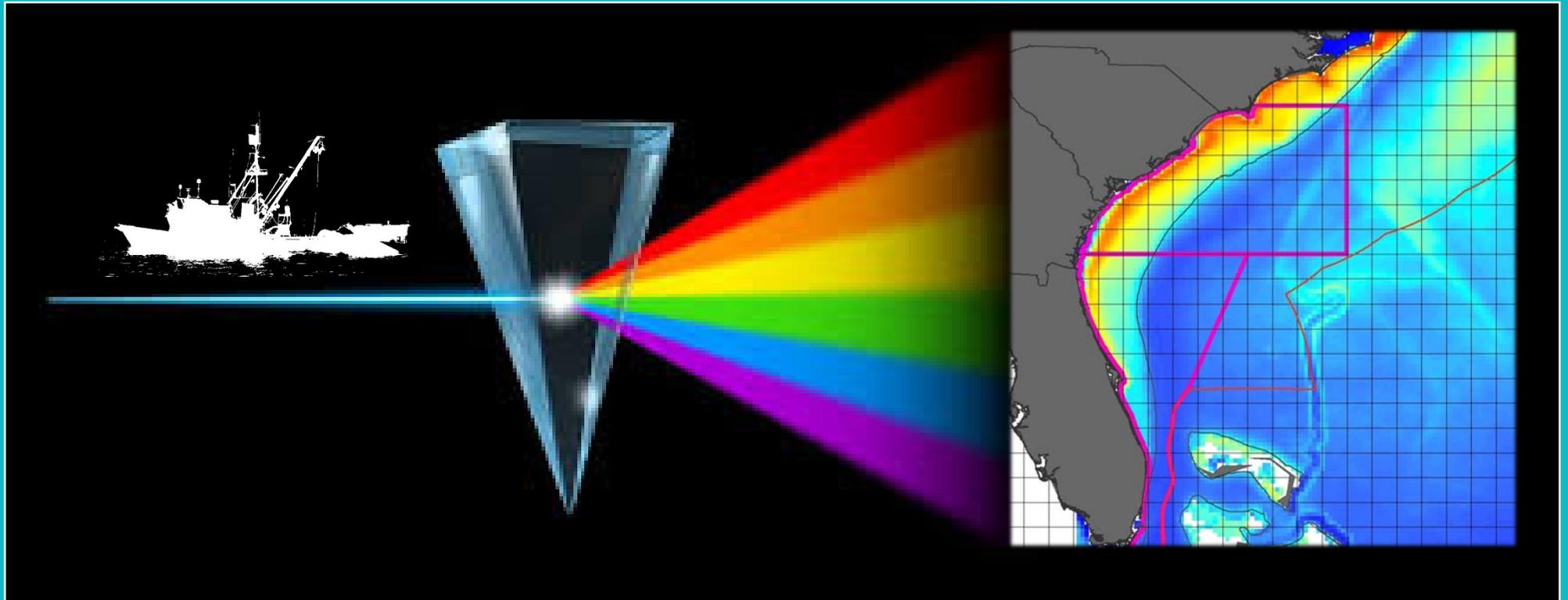


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Highly Migratory Species PRedictive Spatial Modeling (HMS-PRiSM)



Species Distribution Model (SDM) 101

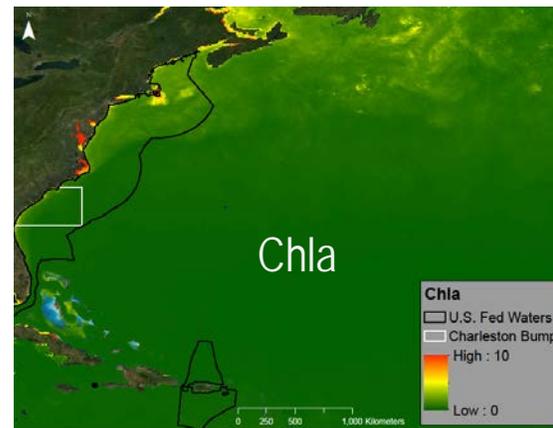
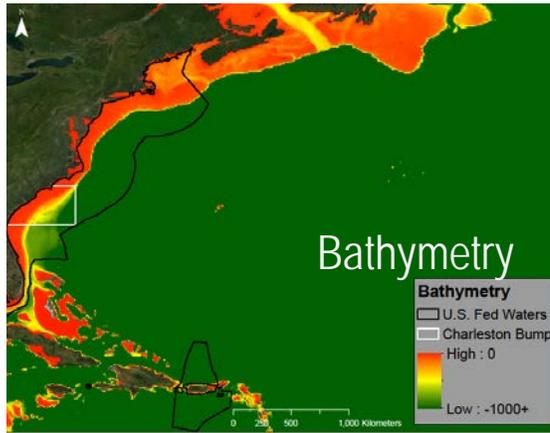
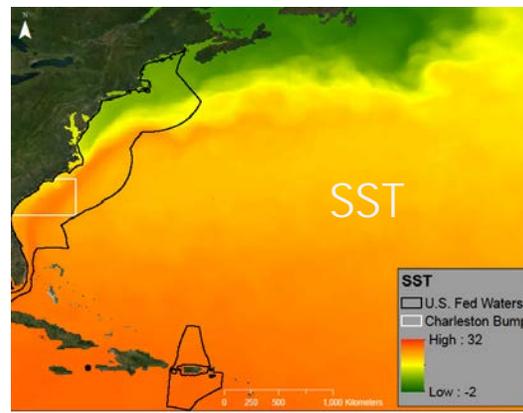
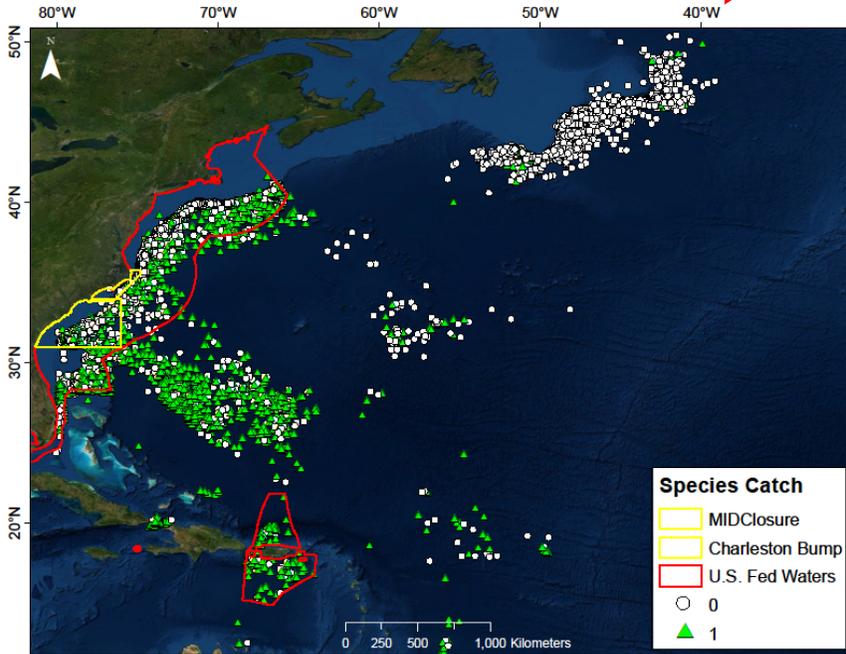
Use relationship between species presence/absence or abundance and the environment to identify areas of good to poor habitat for species



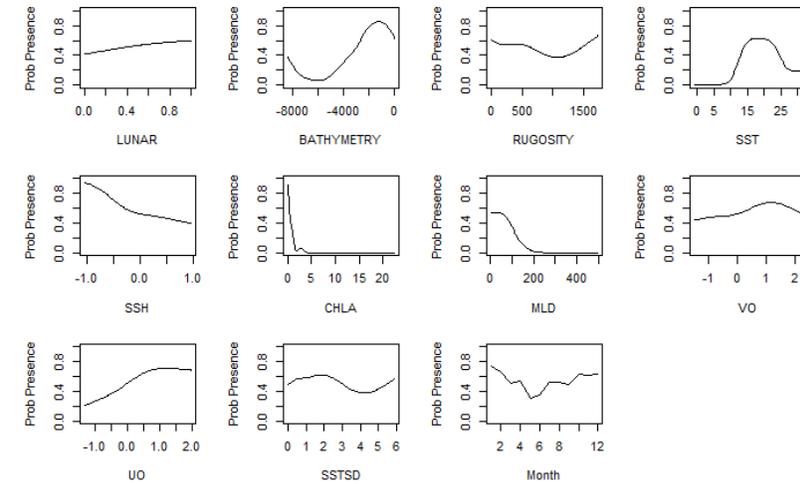
1) Match environmental variables to presence/absence data

2) Run model

Species A - Presence/Absence Data



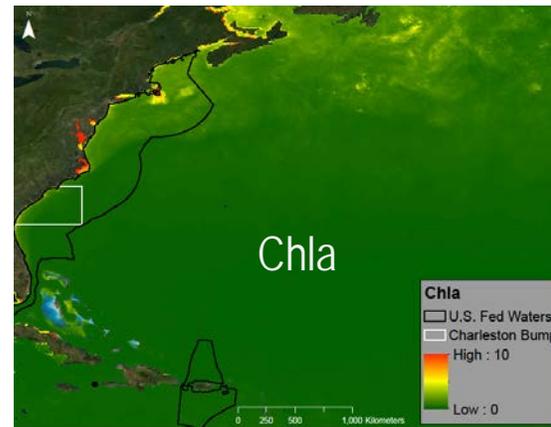
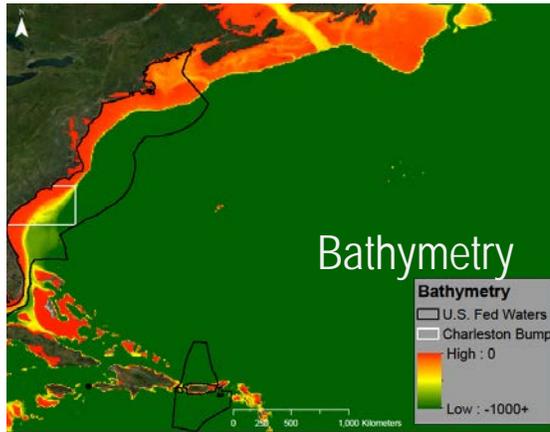
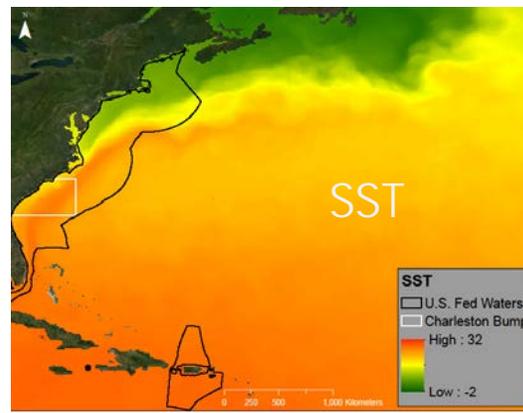
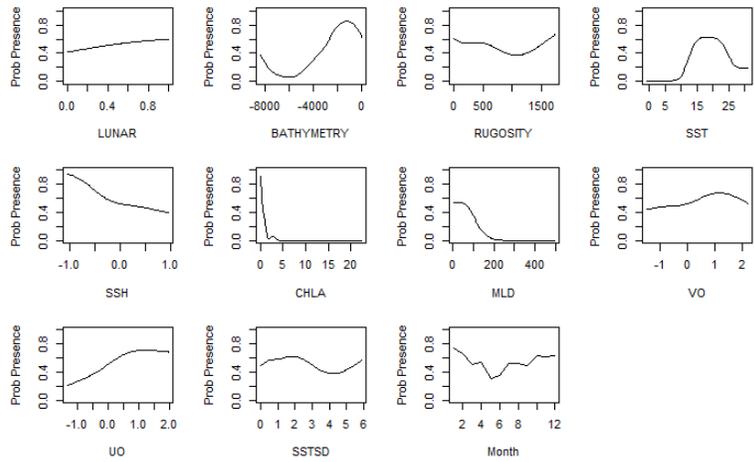
Species A - Model Output



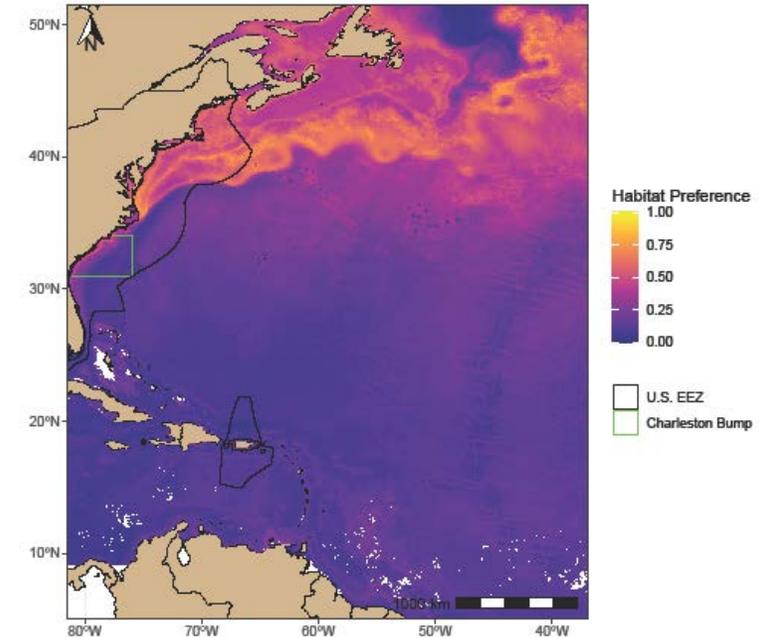
3) Extract environmental variables for a given time period we want to predict over

4) Apply model to environmental data

Species A - Model Output



Species A - Probability of Presence Map for May



SDM 101

Use relationship between species presence/absence or abundance and the environment to identify areas of good to poor habitat for species

Current Uses

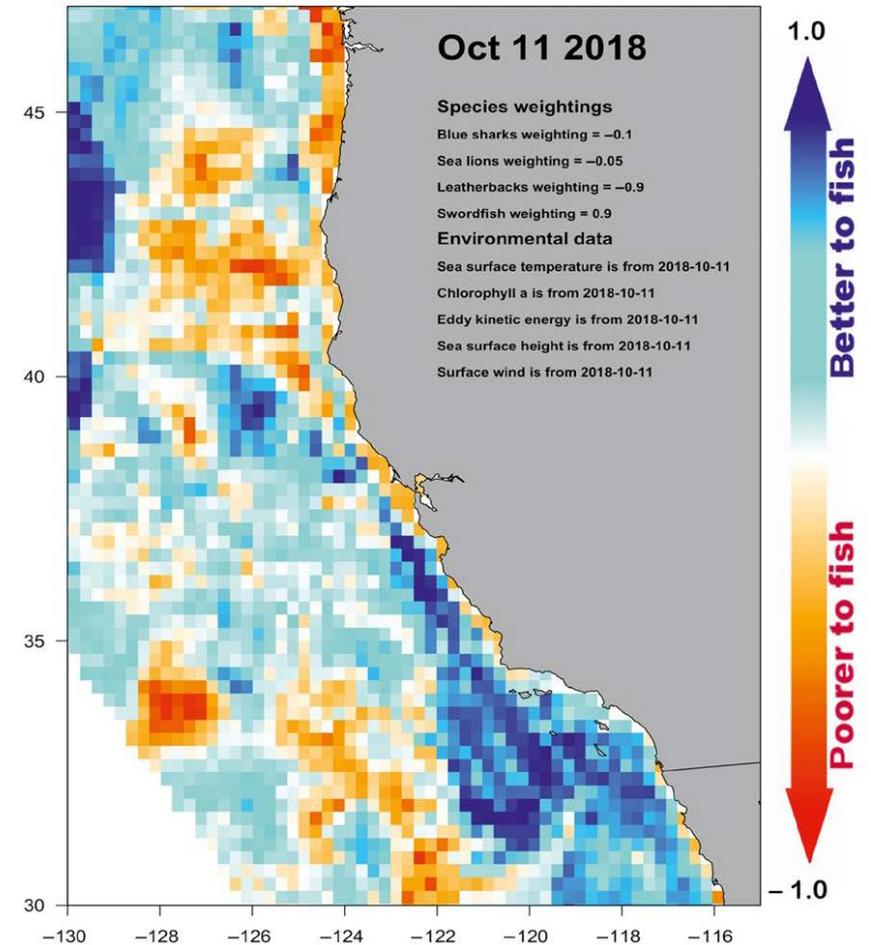
- Has been used to help fisheries avoid bycatch
- Used to project impacts of climate change
- Gives management the ability to act more dynamically in space and time
 - (e.g., nowcasts and seasonal forecasts)



EcoCast Example

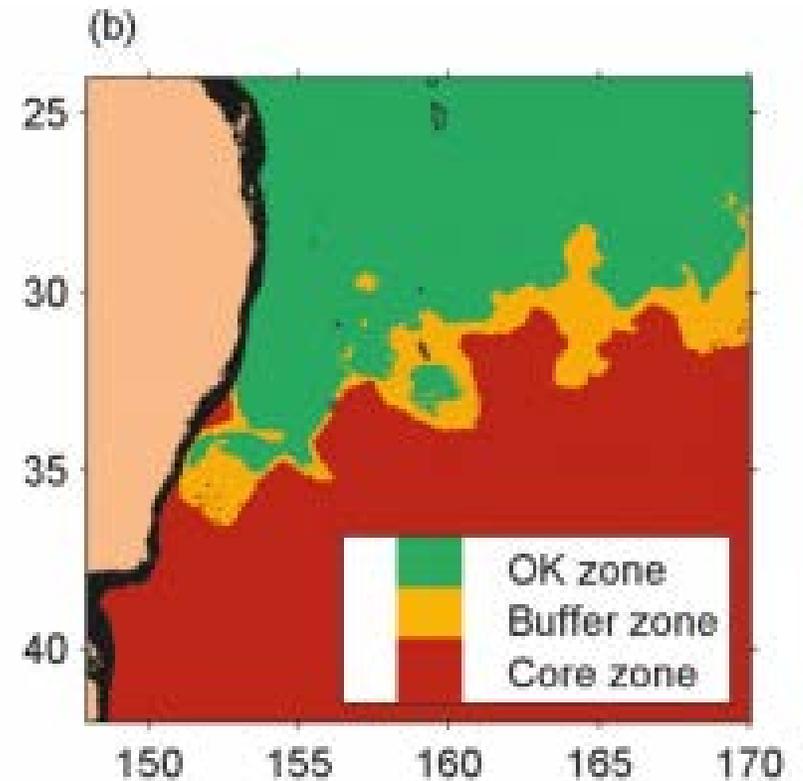


- Created habitat models for swordfish and typical bycatch species in drift gillnet fishery (e.g., leatherback turtles, blue shark, sea lion)
- Find ideal location where swordfish catch is maximized and bycatch is minimized
- Output daily maps for fishermen to use



Bluefin Tuna Australian Multispecies Longline

- Created 3 zones from habitat model: Core (80% of time), Buffer (15% of time), OK (5% of time)
- Given to managers every two weeks
- Access to zones dictated by level of observer coverage or quota they are holding
- Also provide managers with 3-4 months forecast of 3 zones so that managers can let fishermen know of potential future restrictions



HMS PRISM

- **Observer Data from Pelagic Longline (Atlantic only)**
 - **Target or IBQ Species:** Swordfish, Yellowfin Tuna, Bigeye Tuna, Bluefin Tuna
 - **Bycatch Species:** Blue Marlin, White Marlin/Spearfish Group, Billfish Group, Mako Shark, Dusky Shark, Leatherback Sea Turtle, Loggerhead Sea Turtle
- **Predictor Variables:** Bathymetry, Rugosity (bumpiness of bottom), SST, Sea surface height (proxy for fronts), Chlorophyll A, Mixed Layer Depth, Vertical Current Velocity, Horizontal Current Velocity, SST Standard Deviation (proxy for fronts), Lunar Illumination, Hook Configuration, Bait Type, Set Time, Maximum Set Depth
 - Products from publicly accessible datasets
 - Matched to all observer data based on time and location



HMS PRISM

- **Model Framework:** Generalized Additive Model (GAM) using presence/absence data
- **Predictions:** Predict over mean historical (2016-2018) conditions each month
- Use same approach for other locations and fisheries
 - (e.g., Gulf of Mexico and bottom longline)

Intended Use

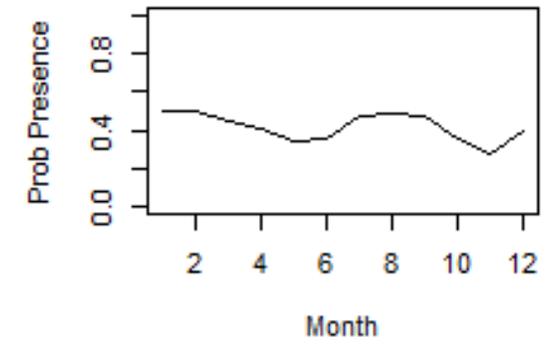
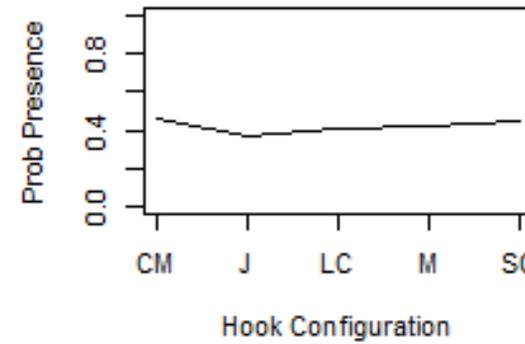
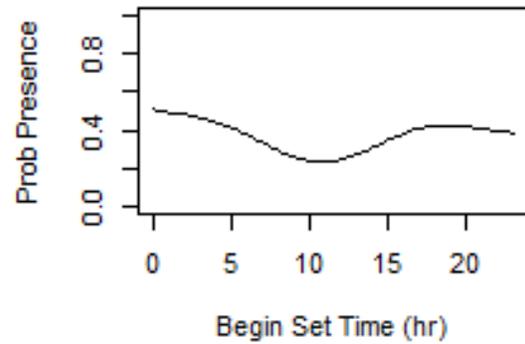
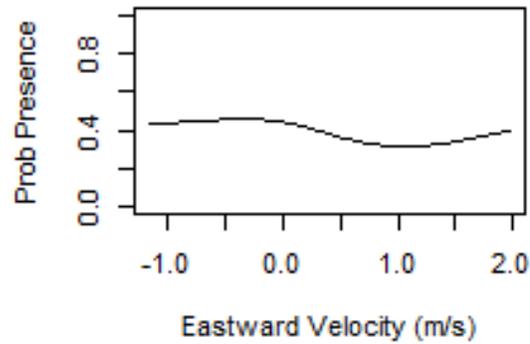
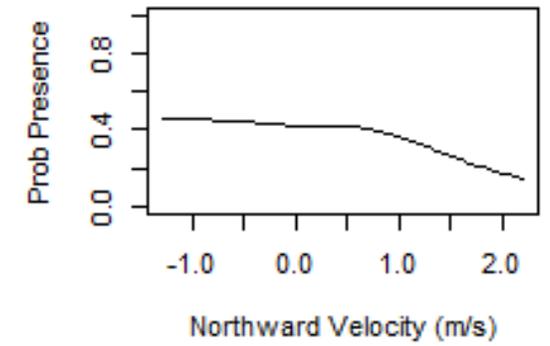
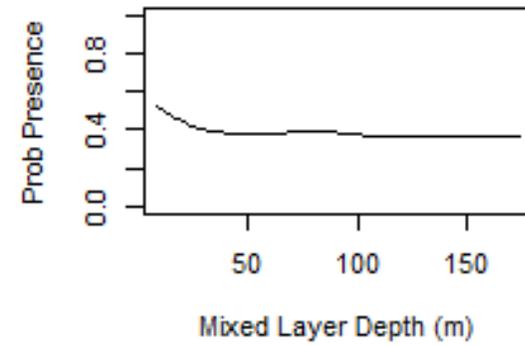
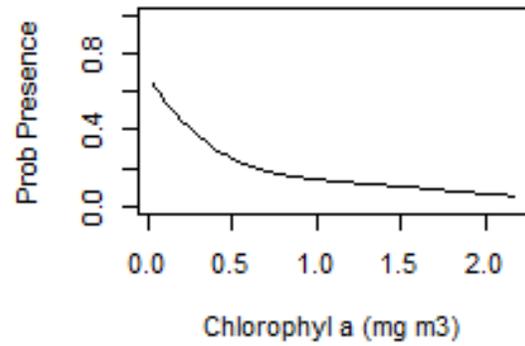
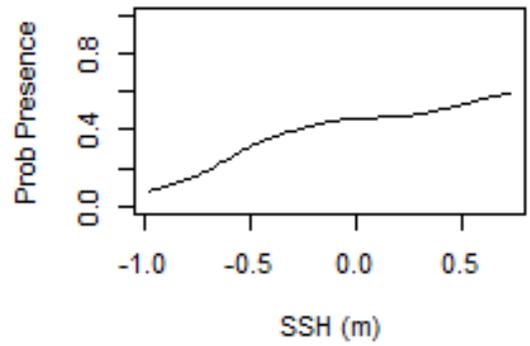
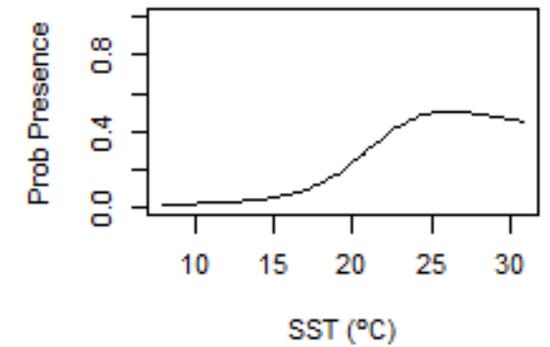
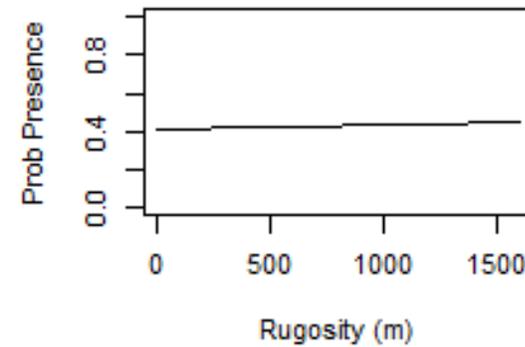
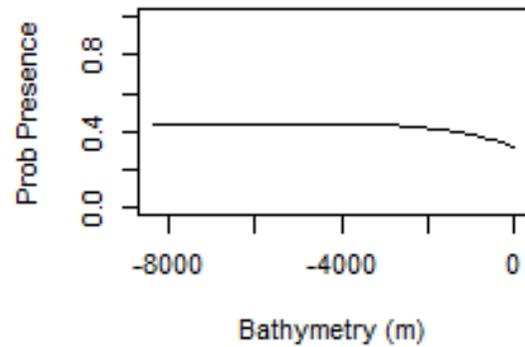
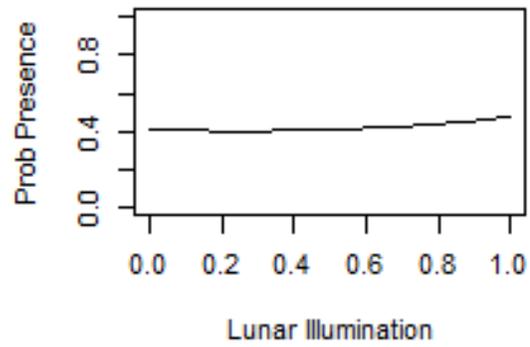
This modeling tool may be a useful component of closed area analysis and evaluating effectiveness of spatial management approaches

All results in the following figures are preliminary



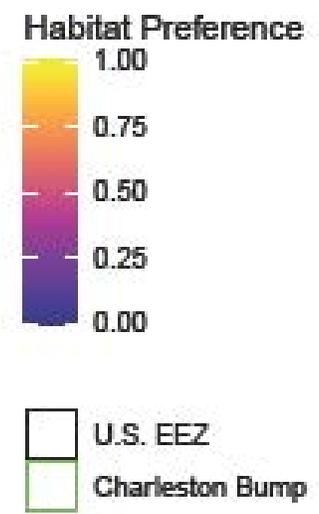
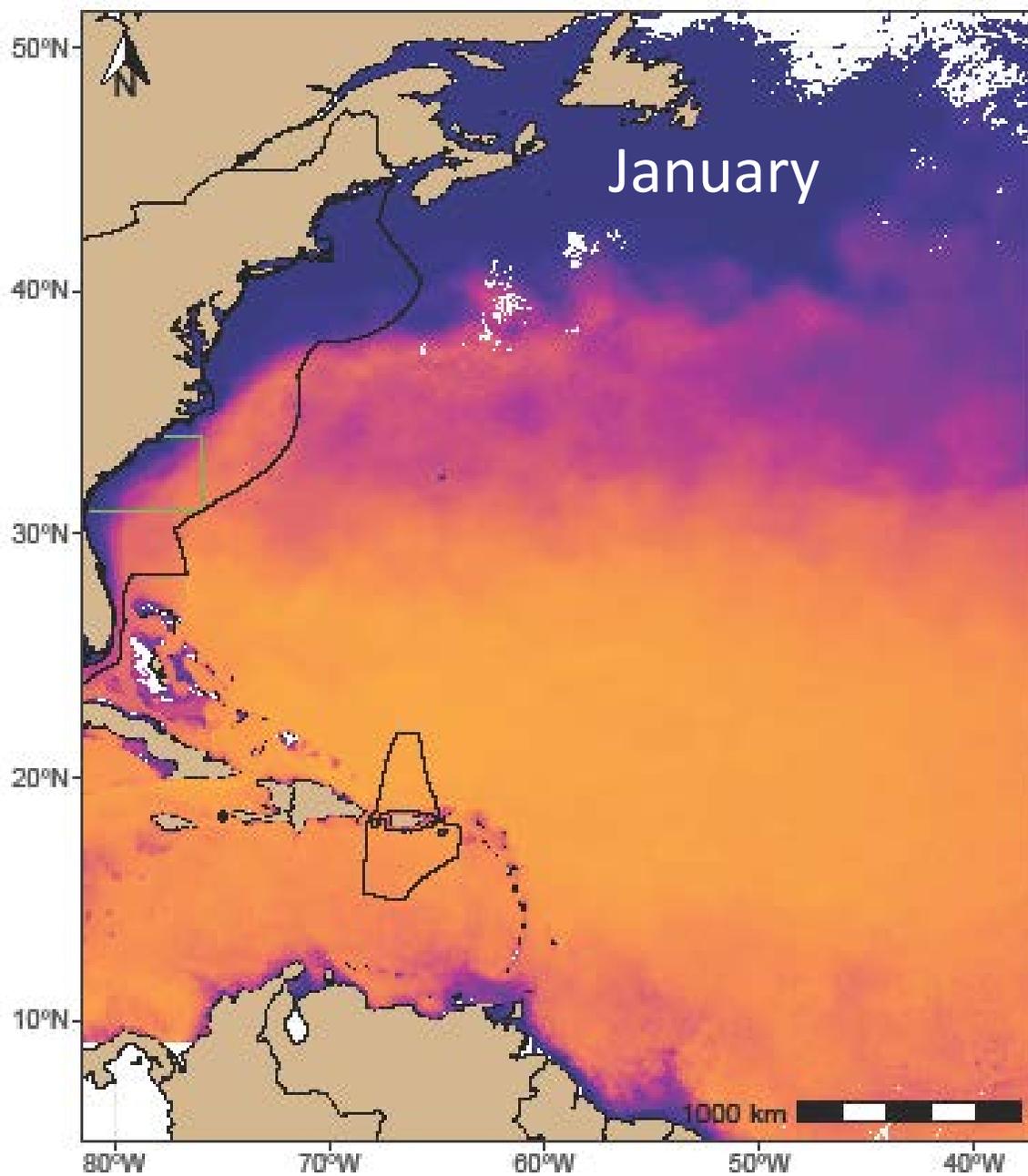
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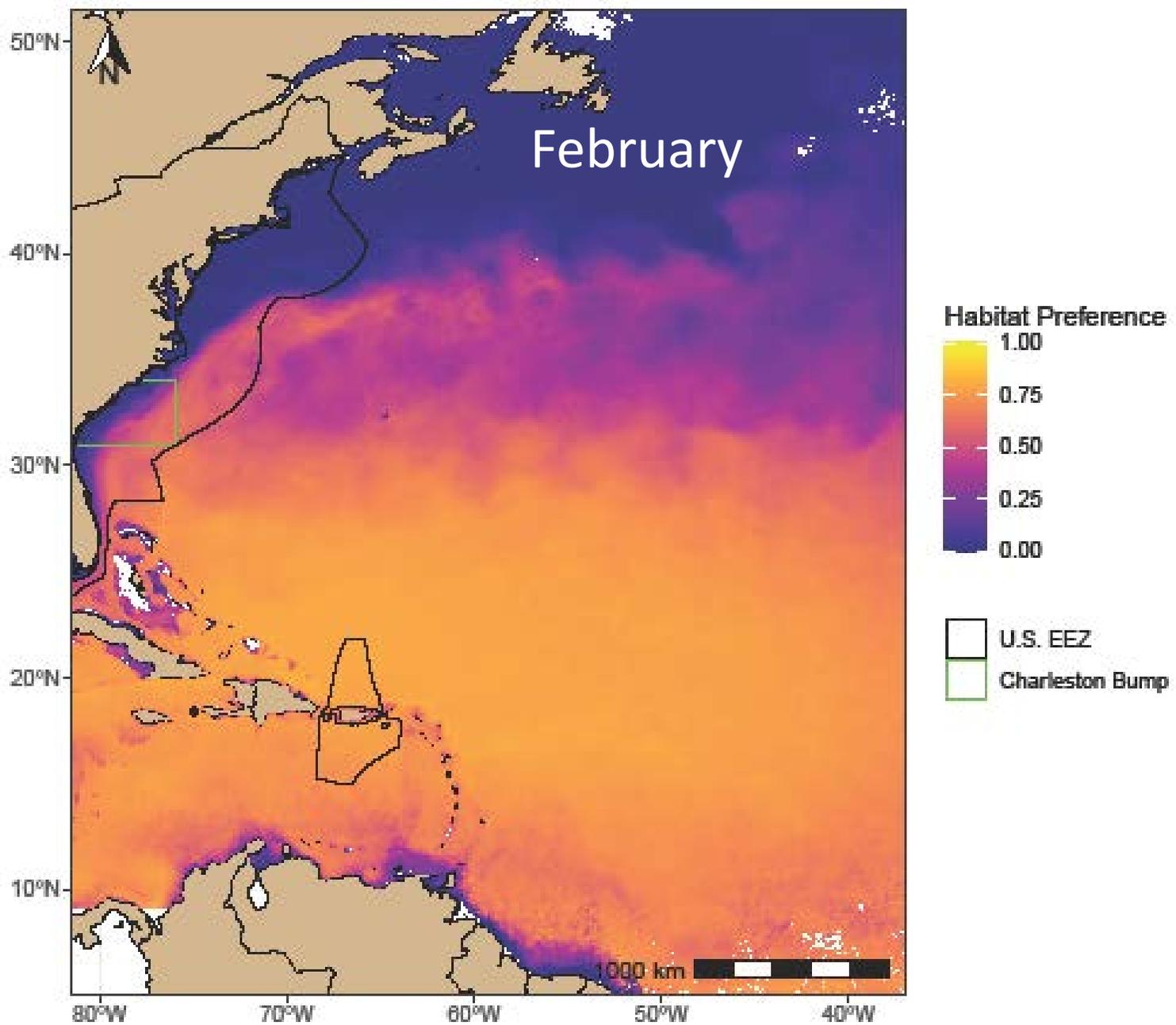
All Billfish Species Distributions

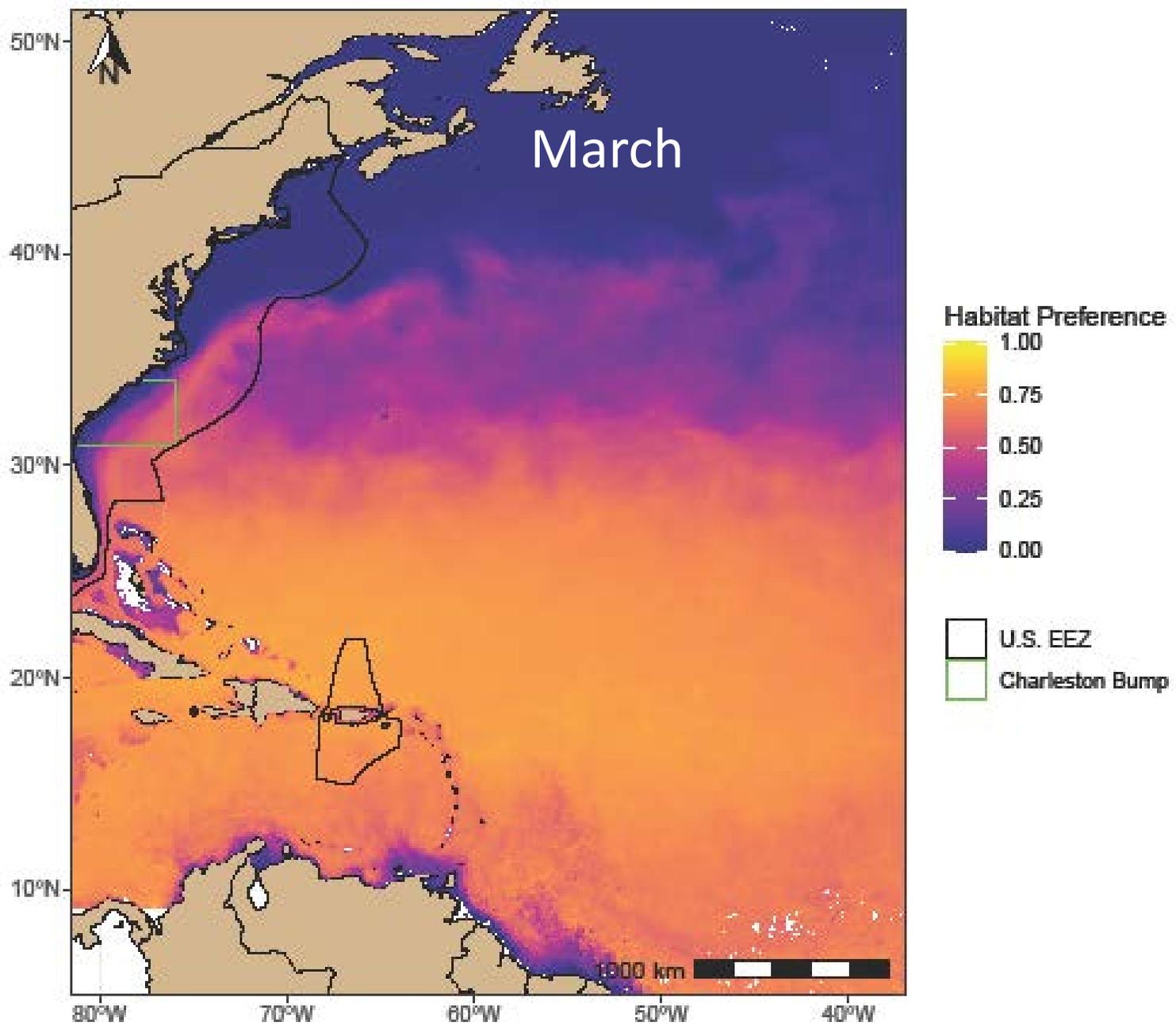


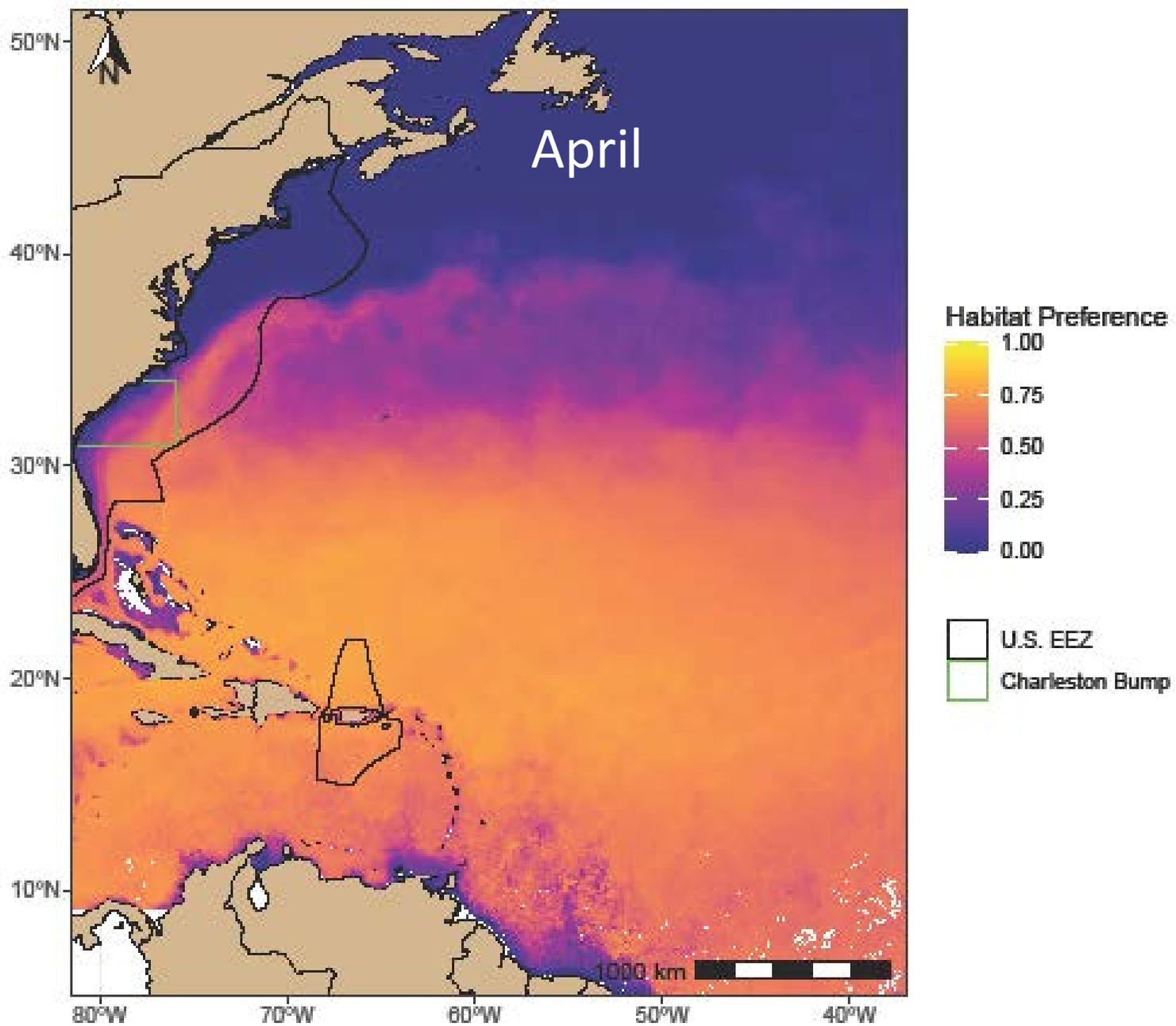
Positive Catch: 40% - Model Validated



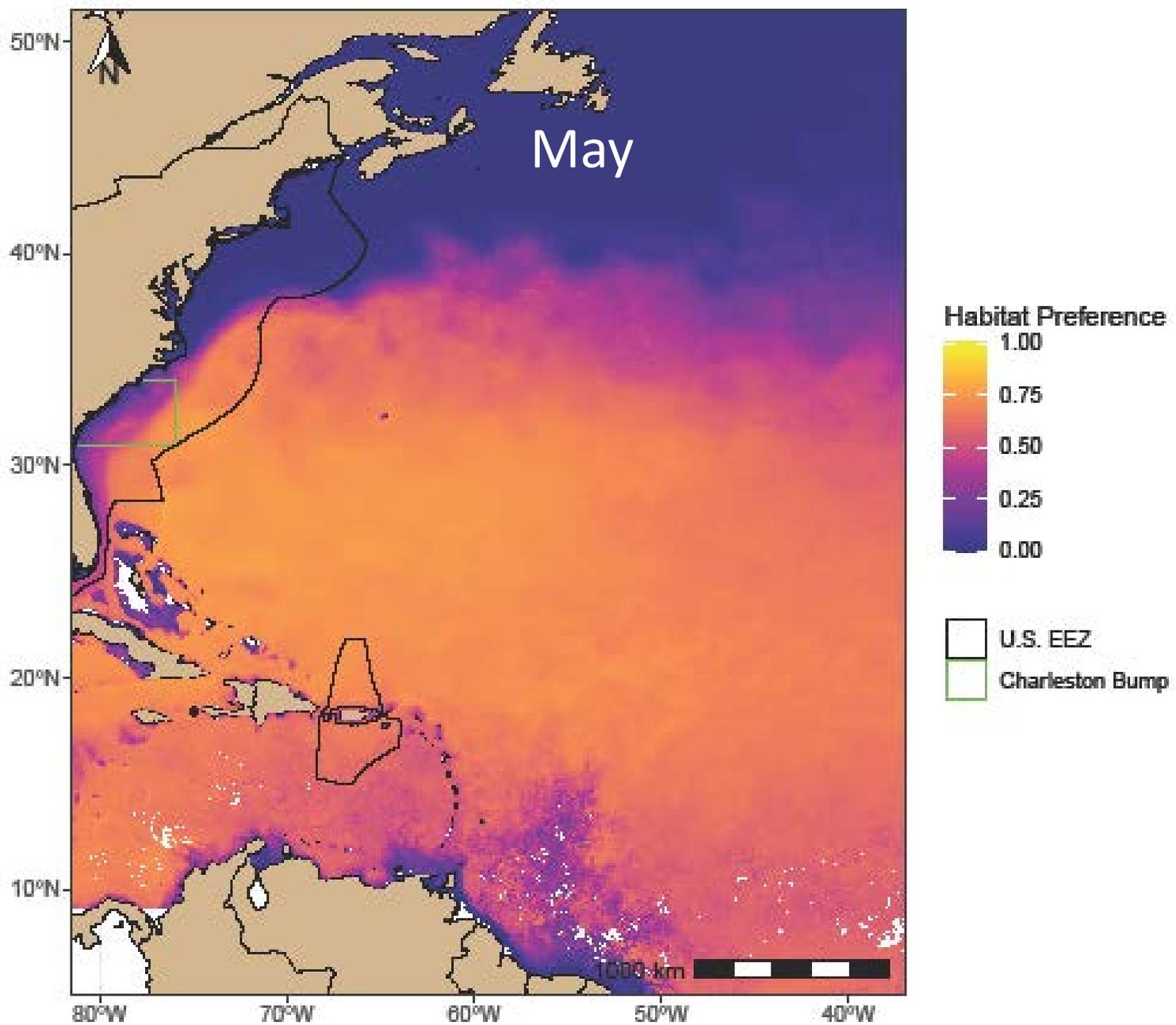


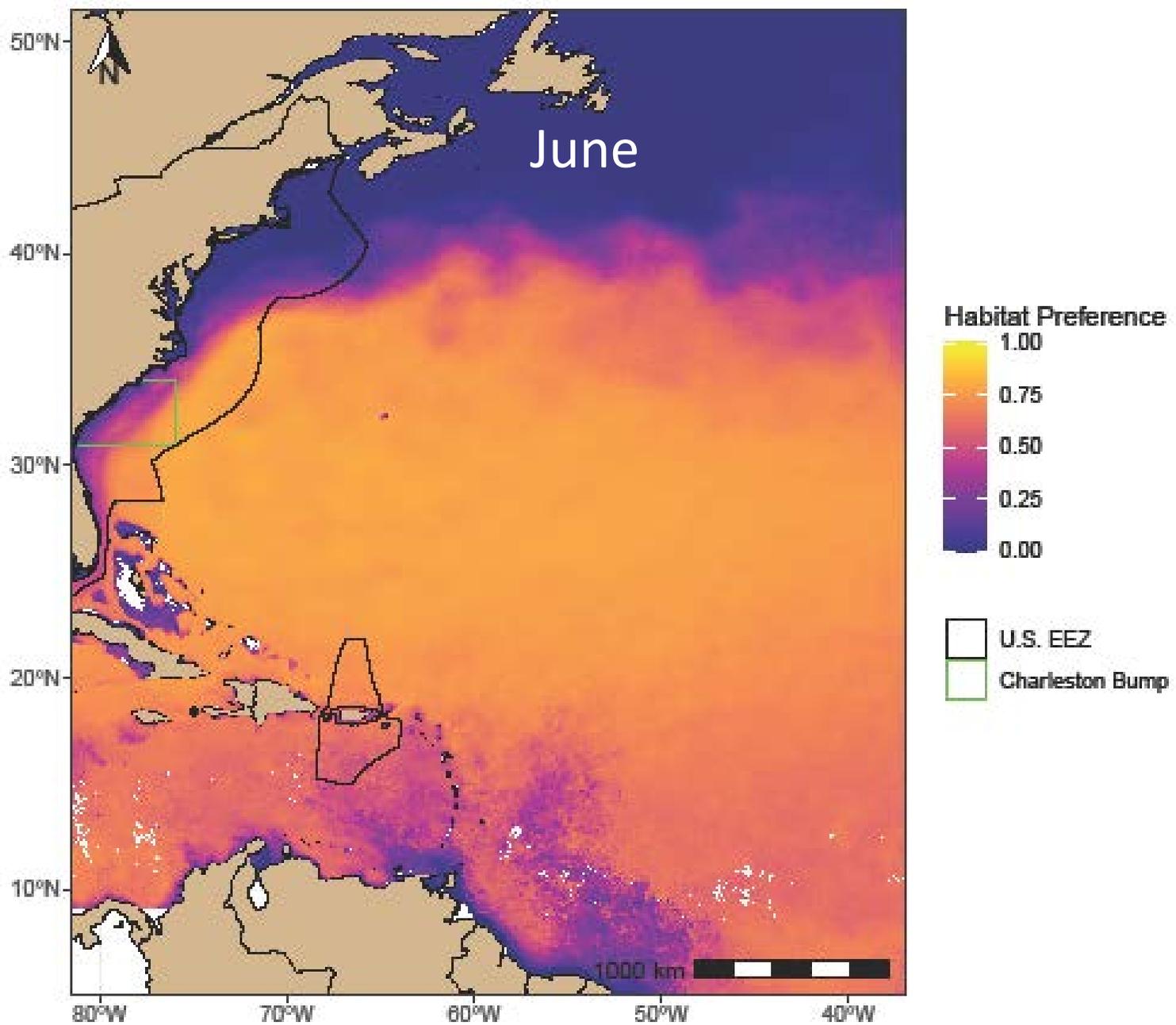


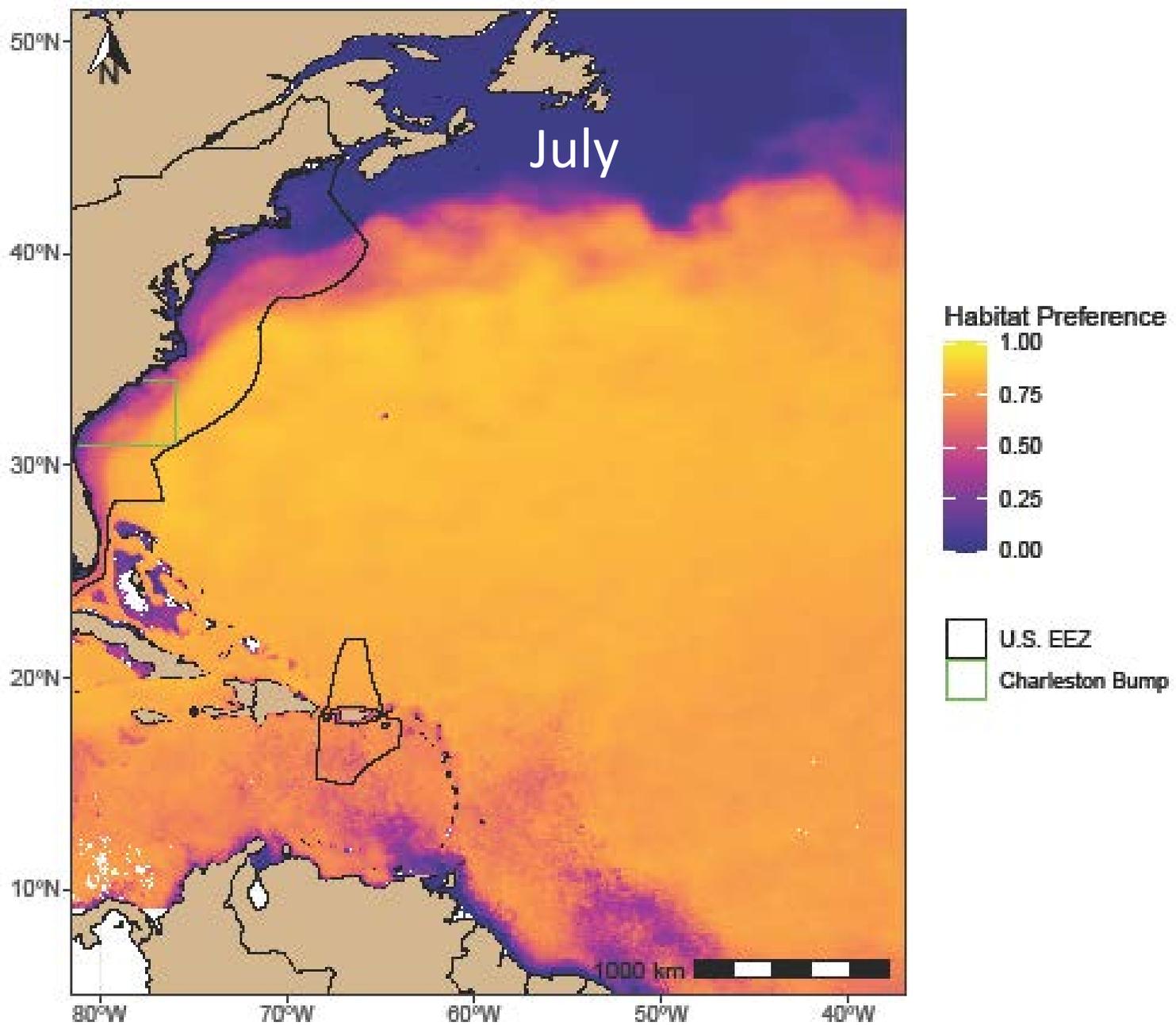




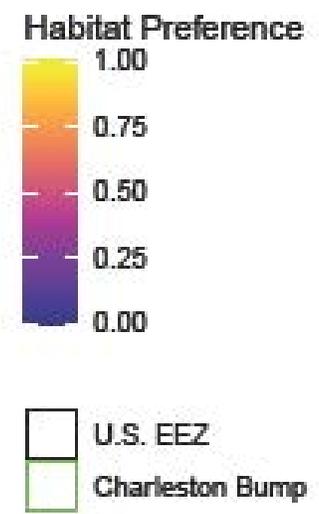
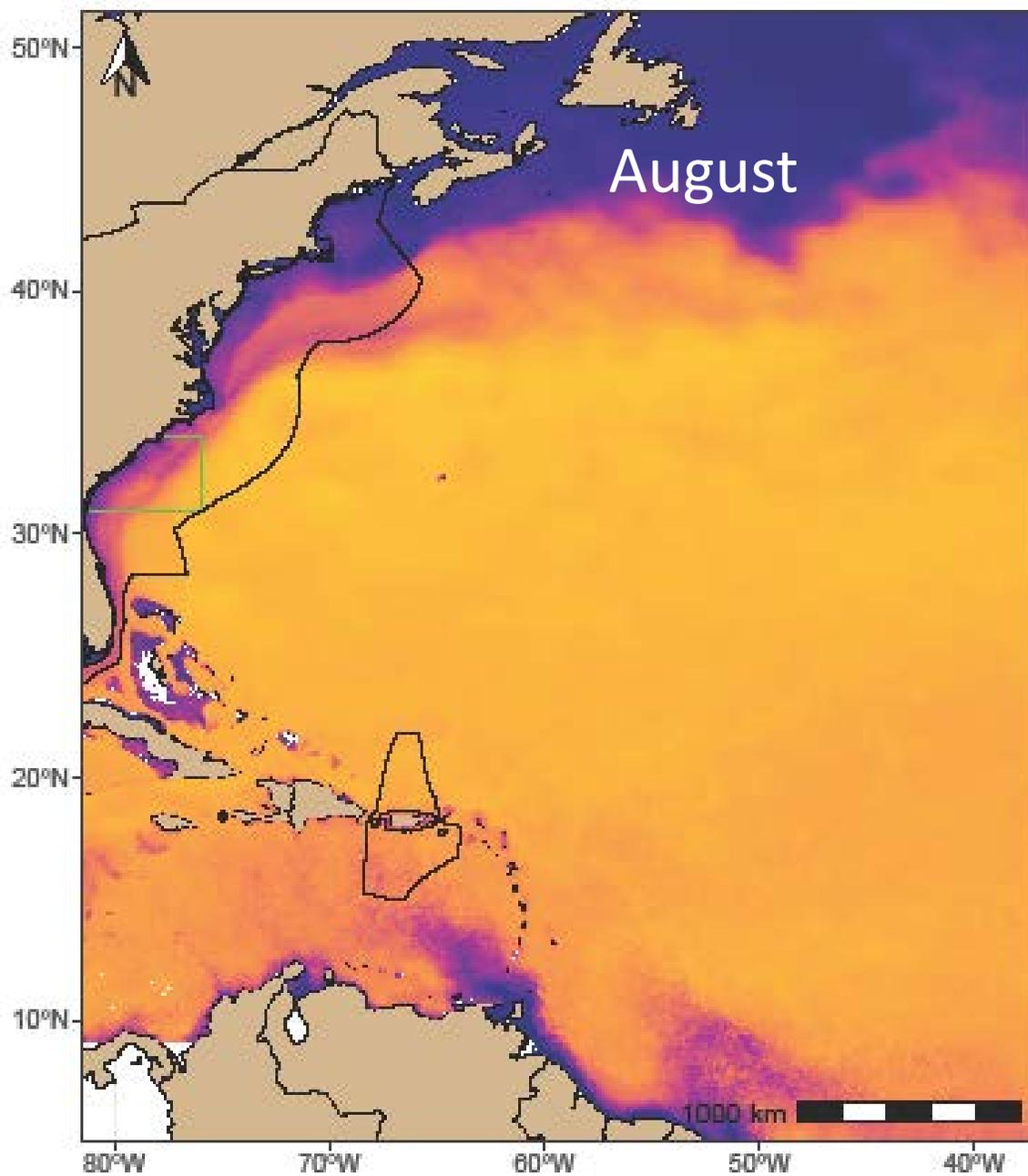
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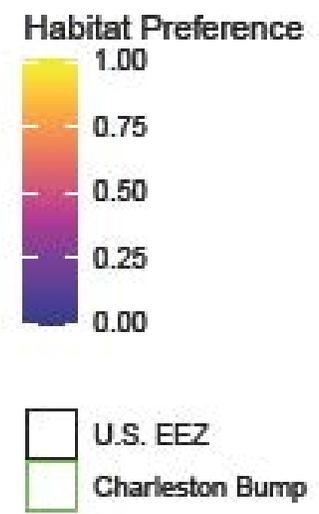
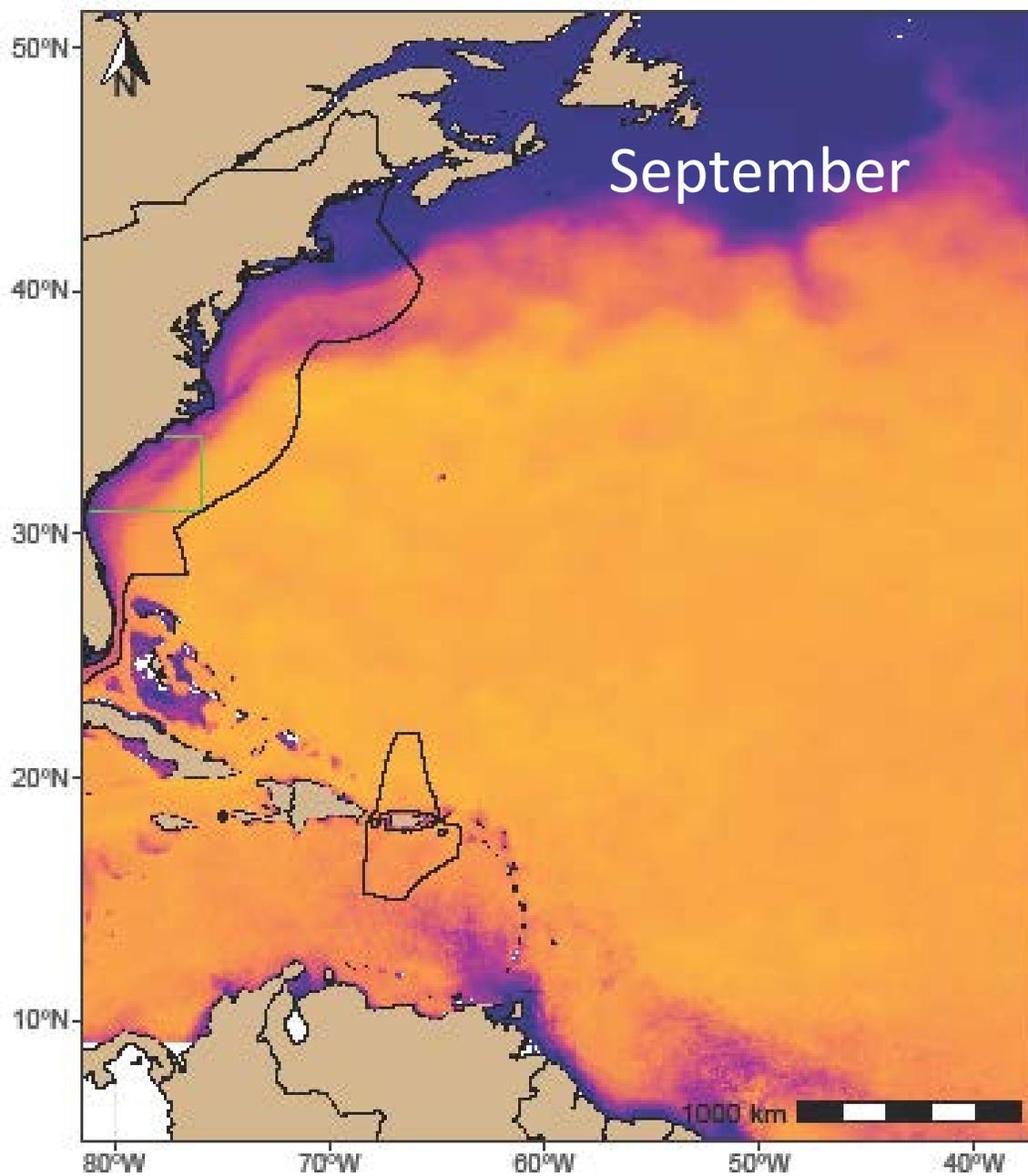


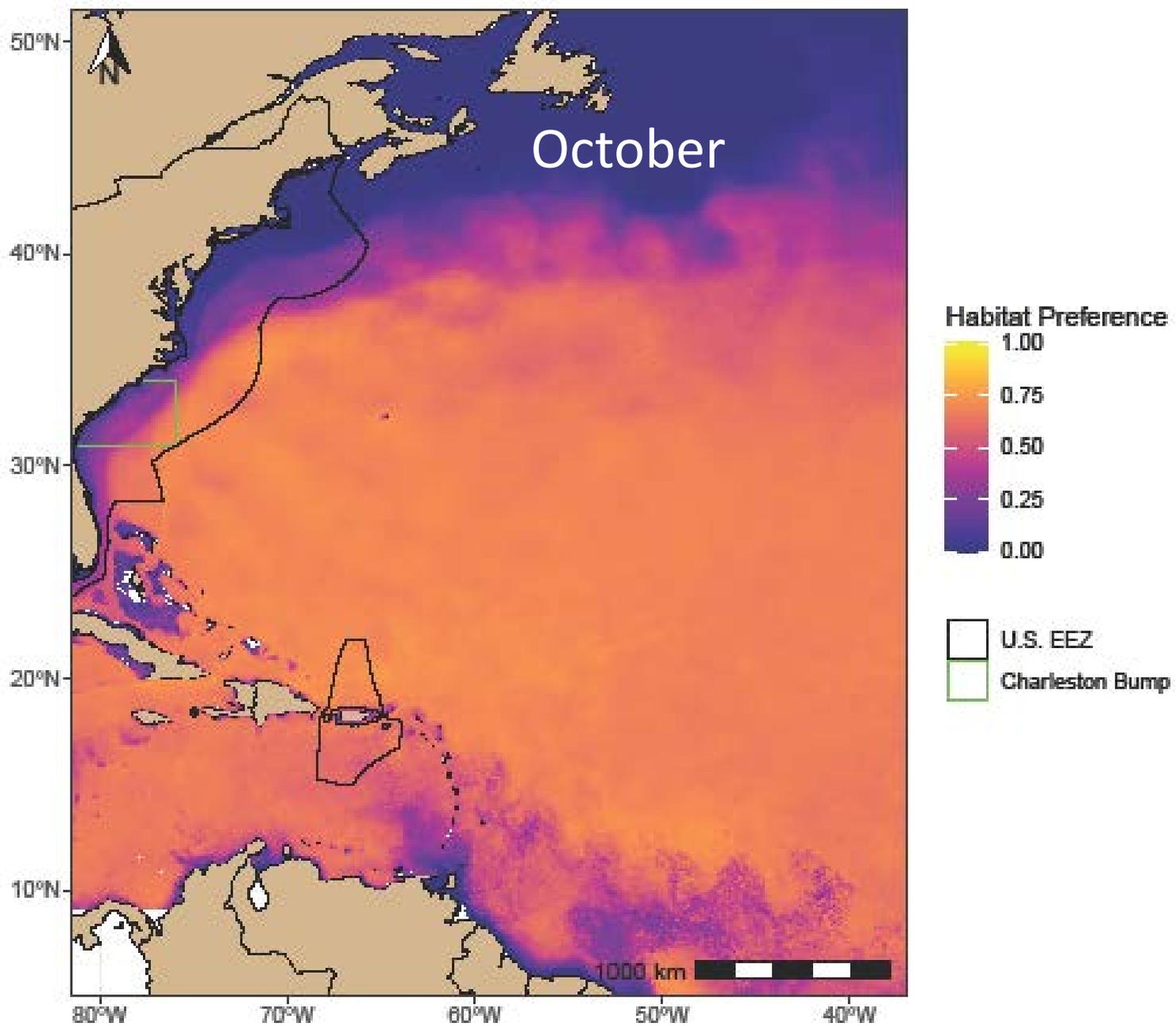


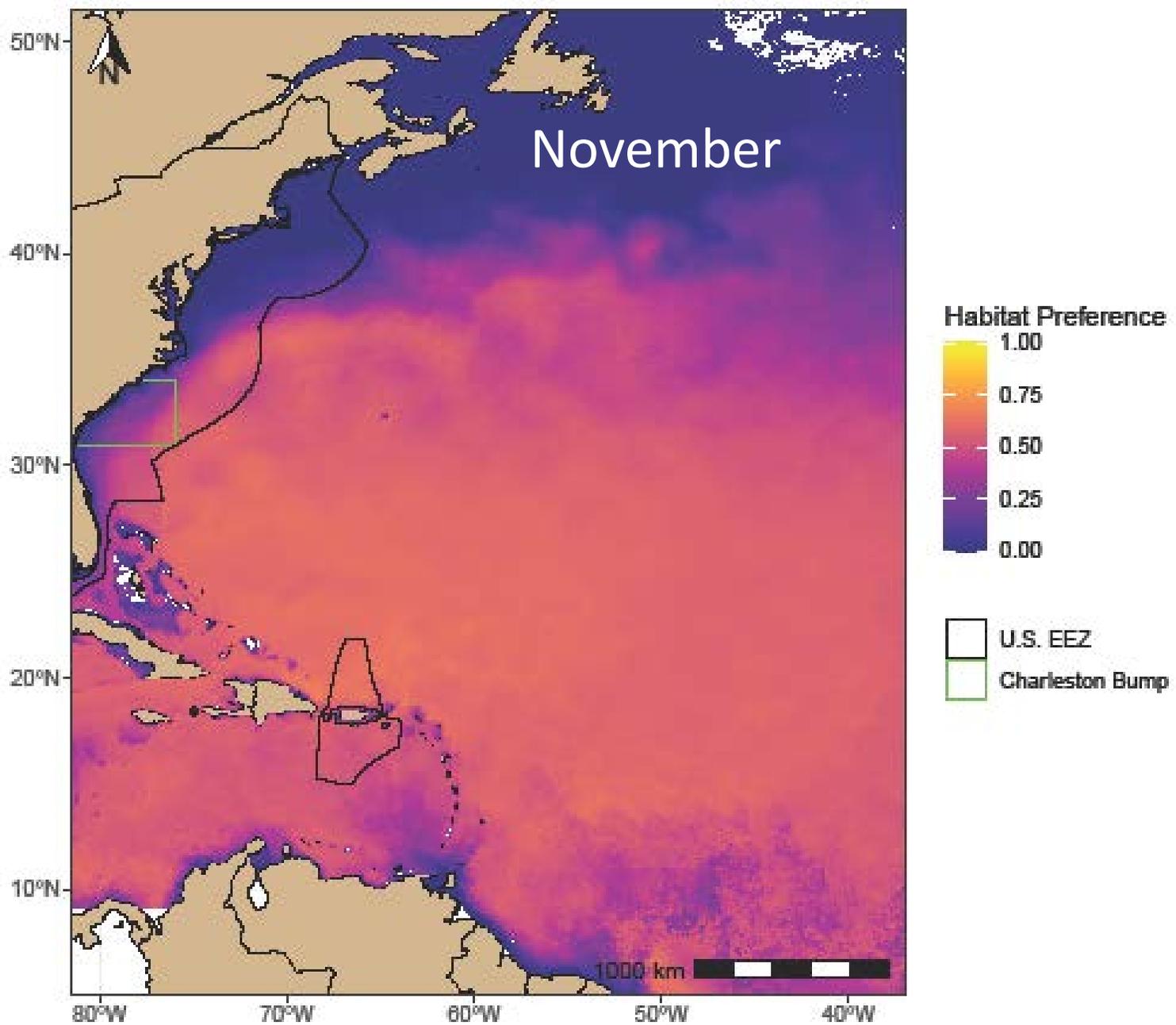


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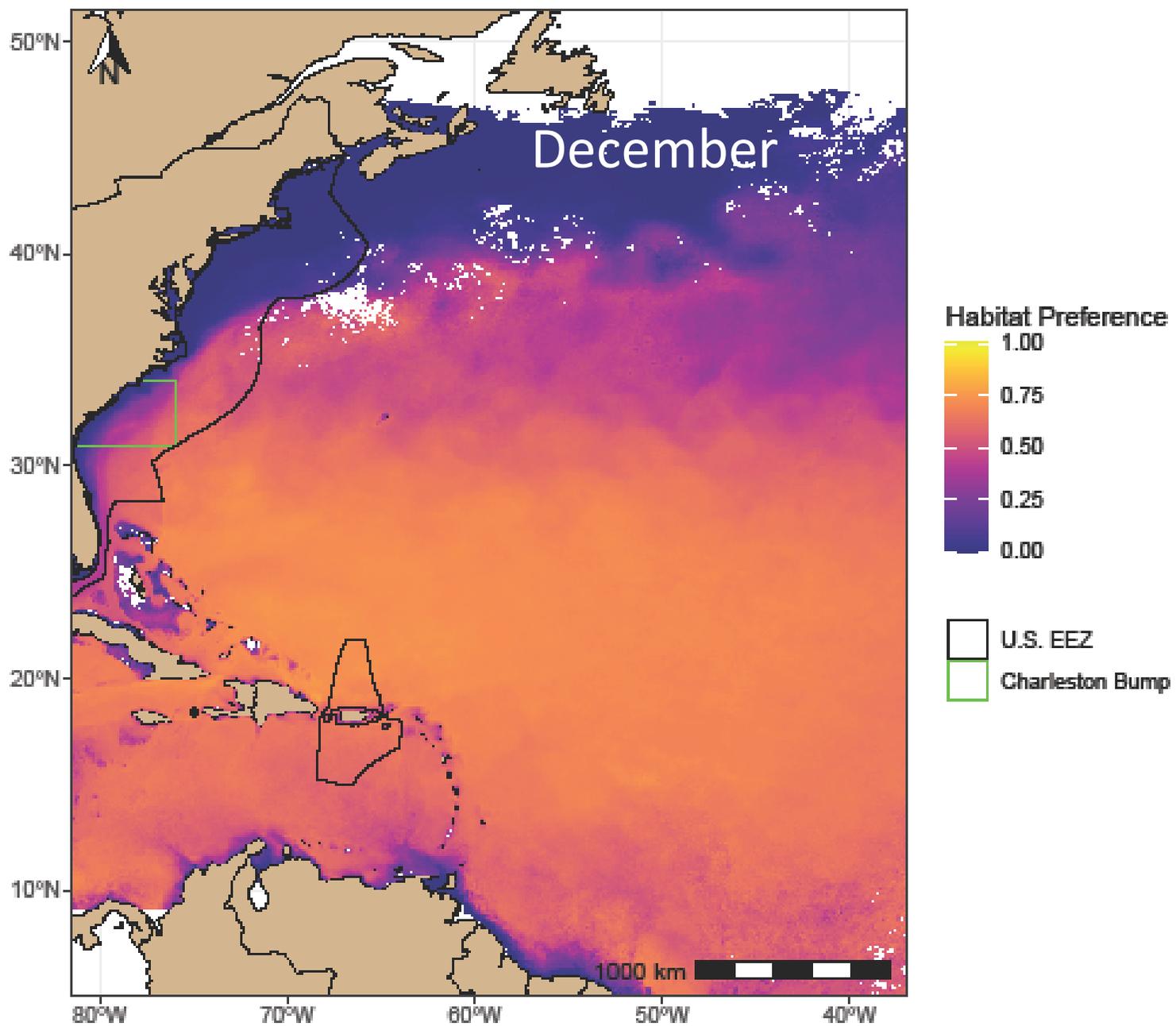






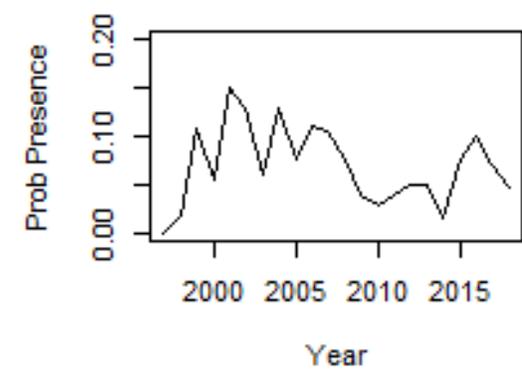
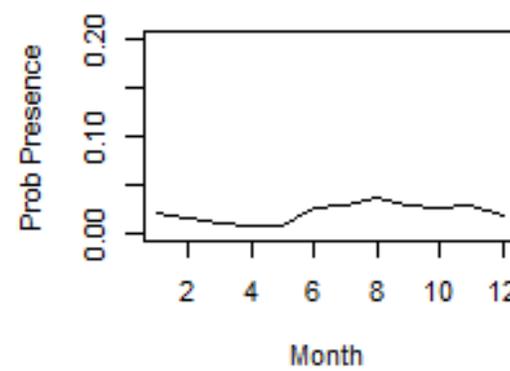
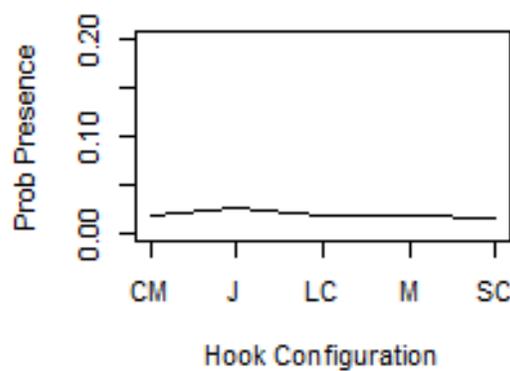
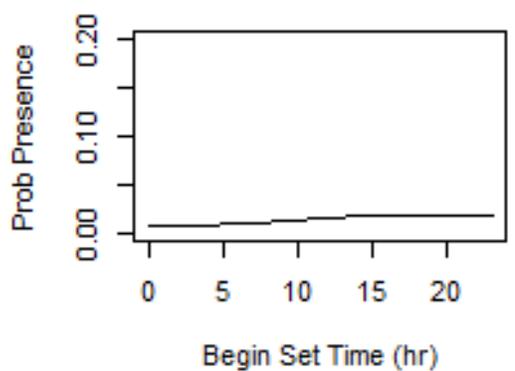
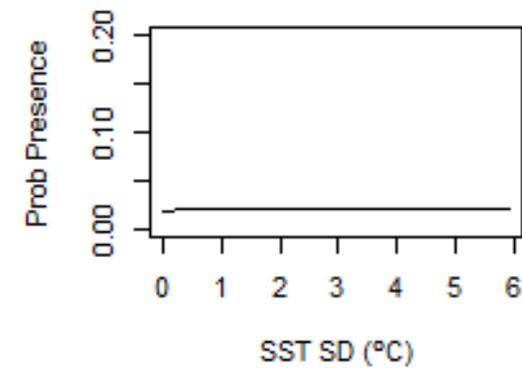
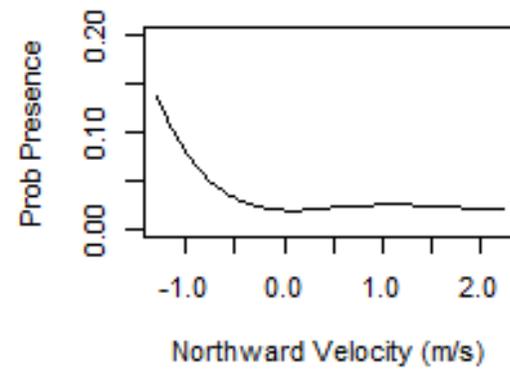
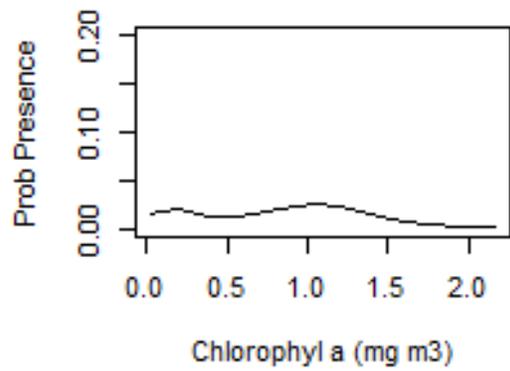
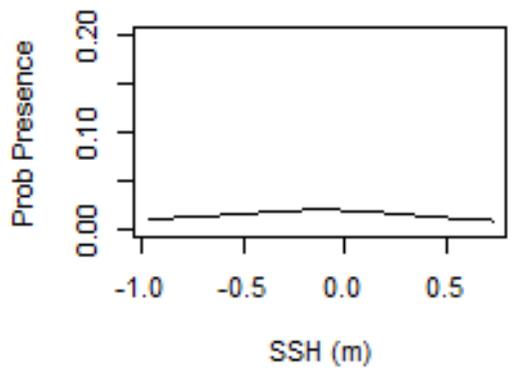
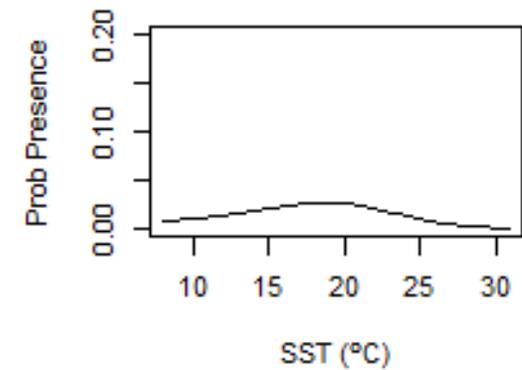
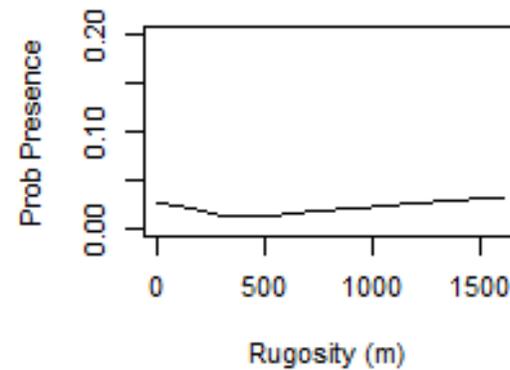
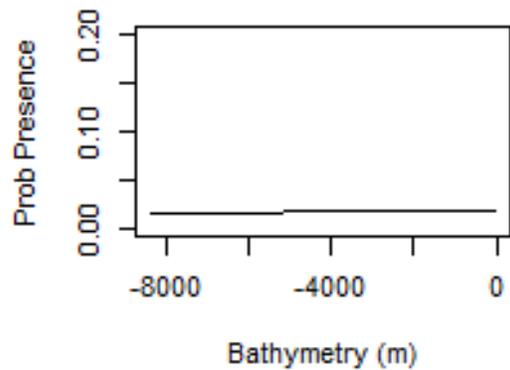
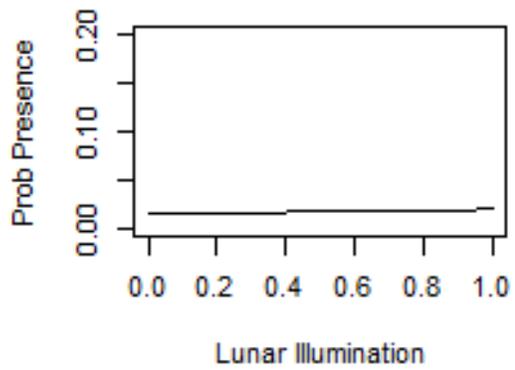


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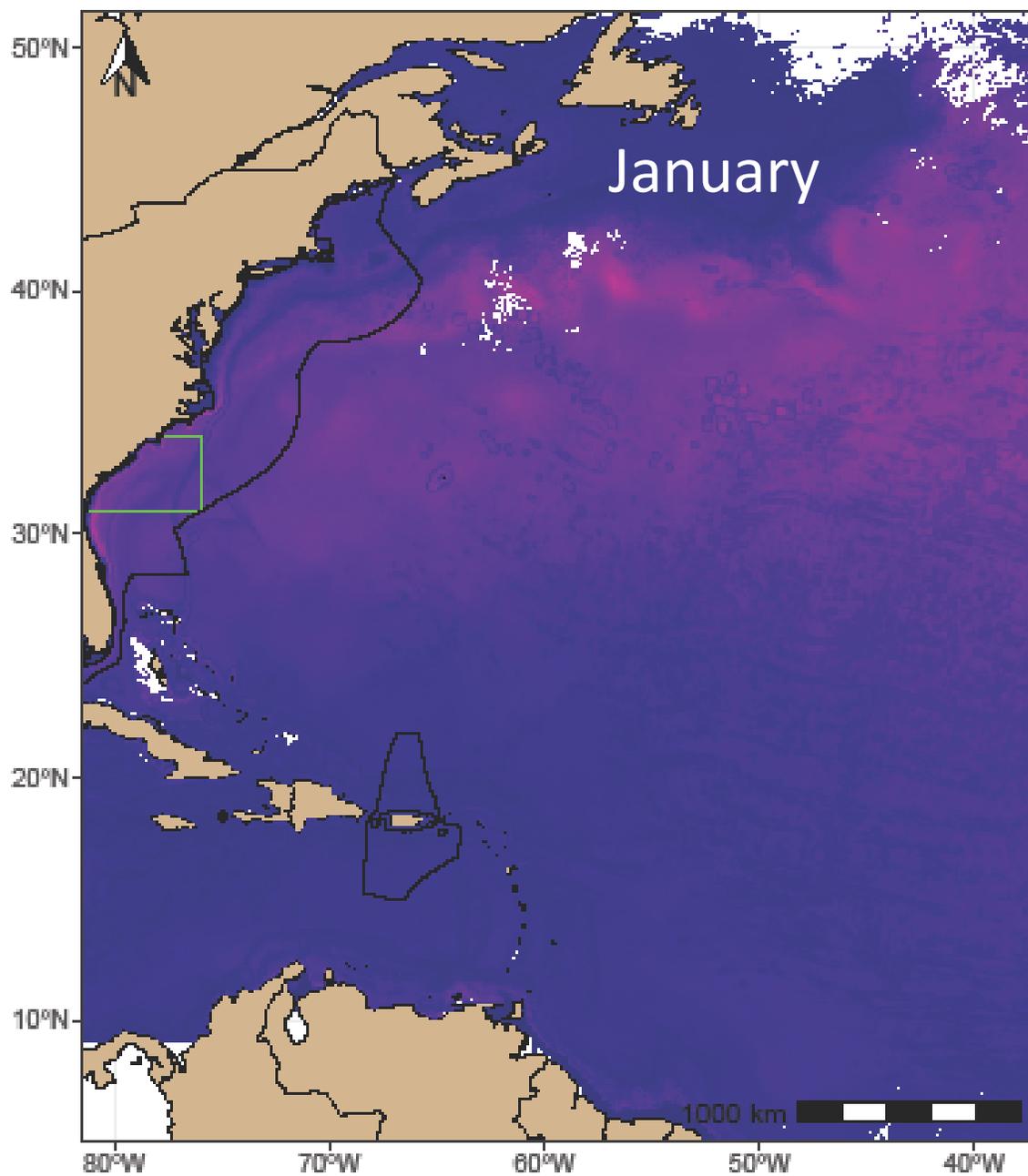
Leatherback Sea Turtle Distributions



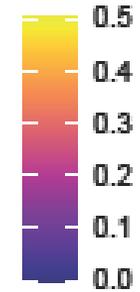


Positive Catch: 6% - Model Validated 



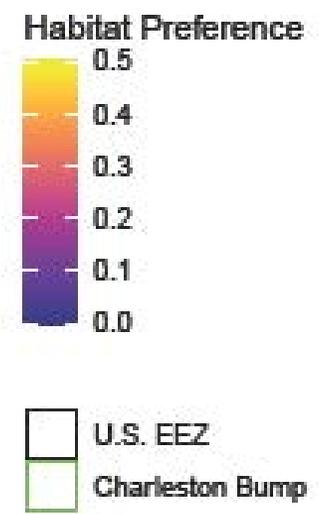
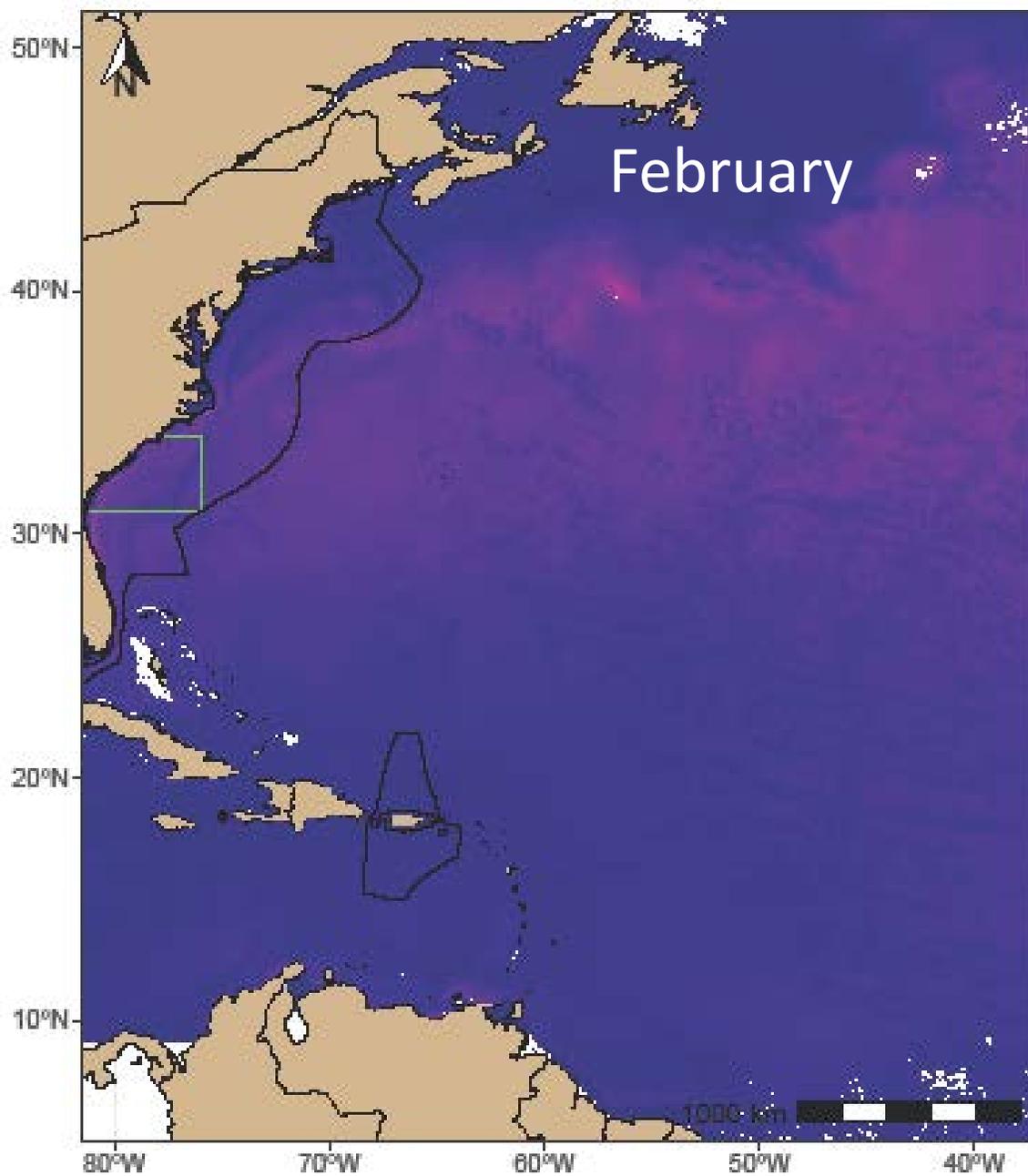


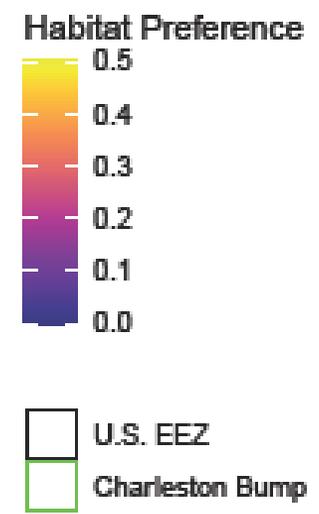
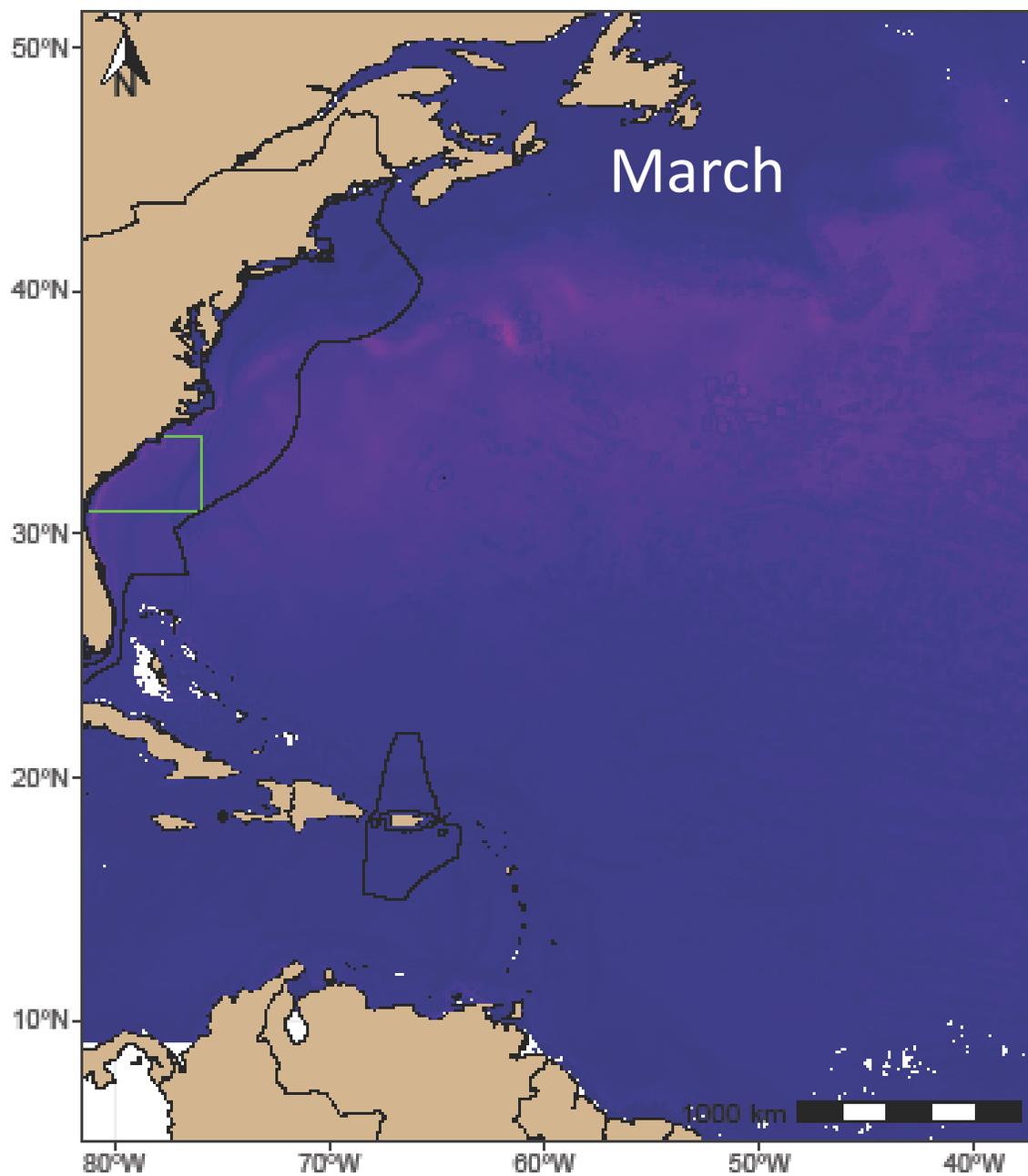
Habitat Preference

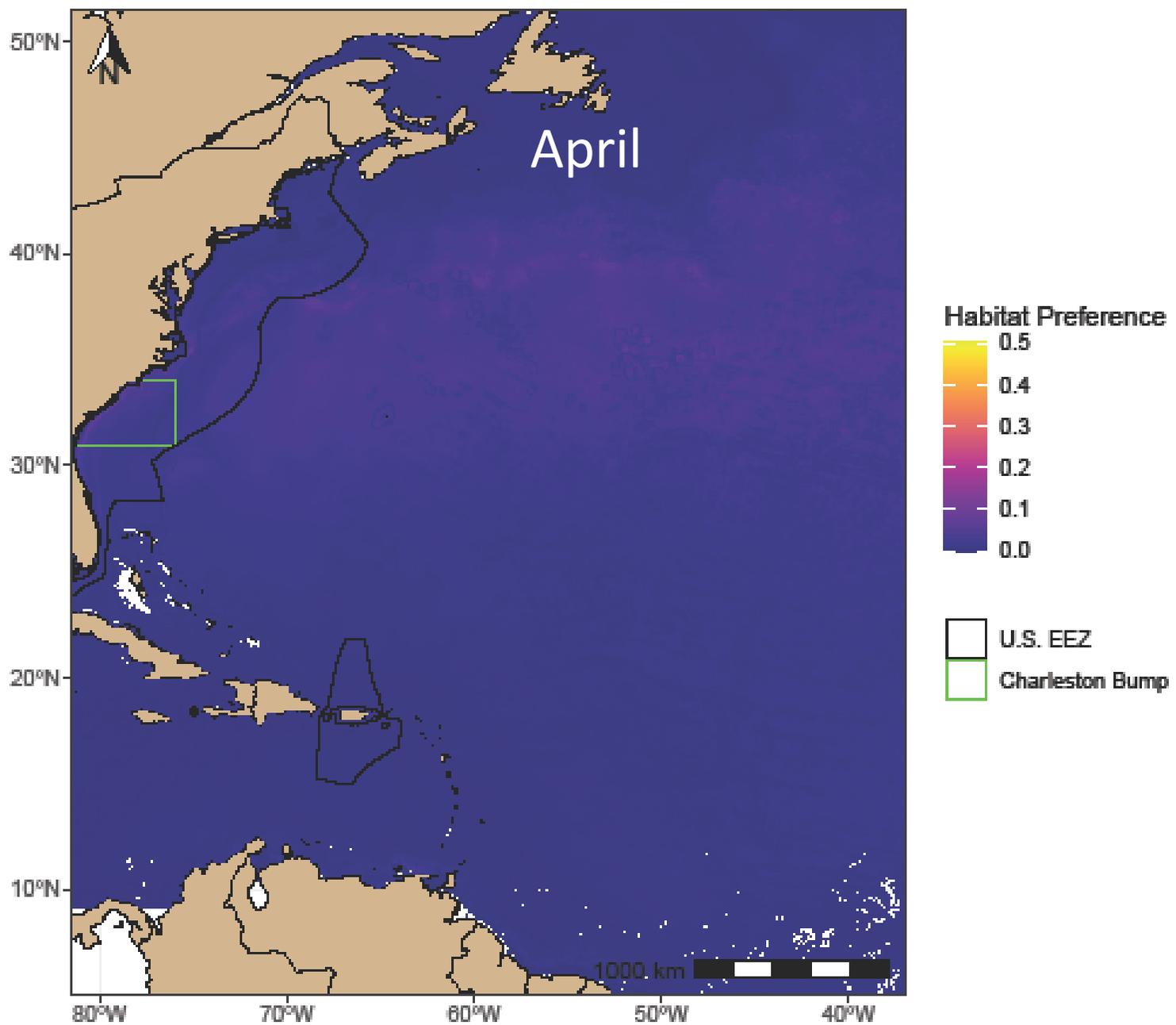


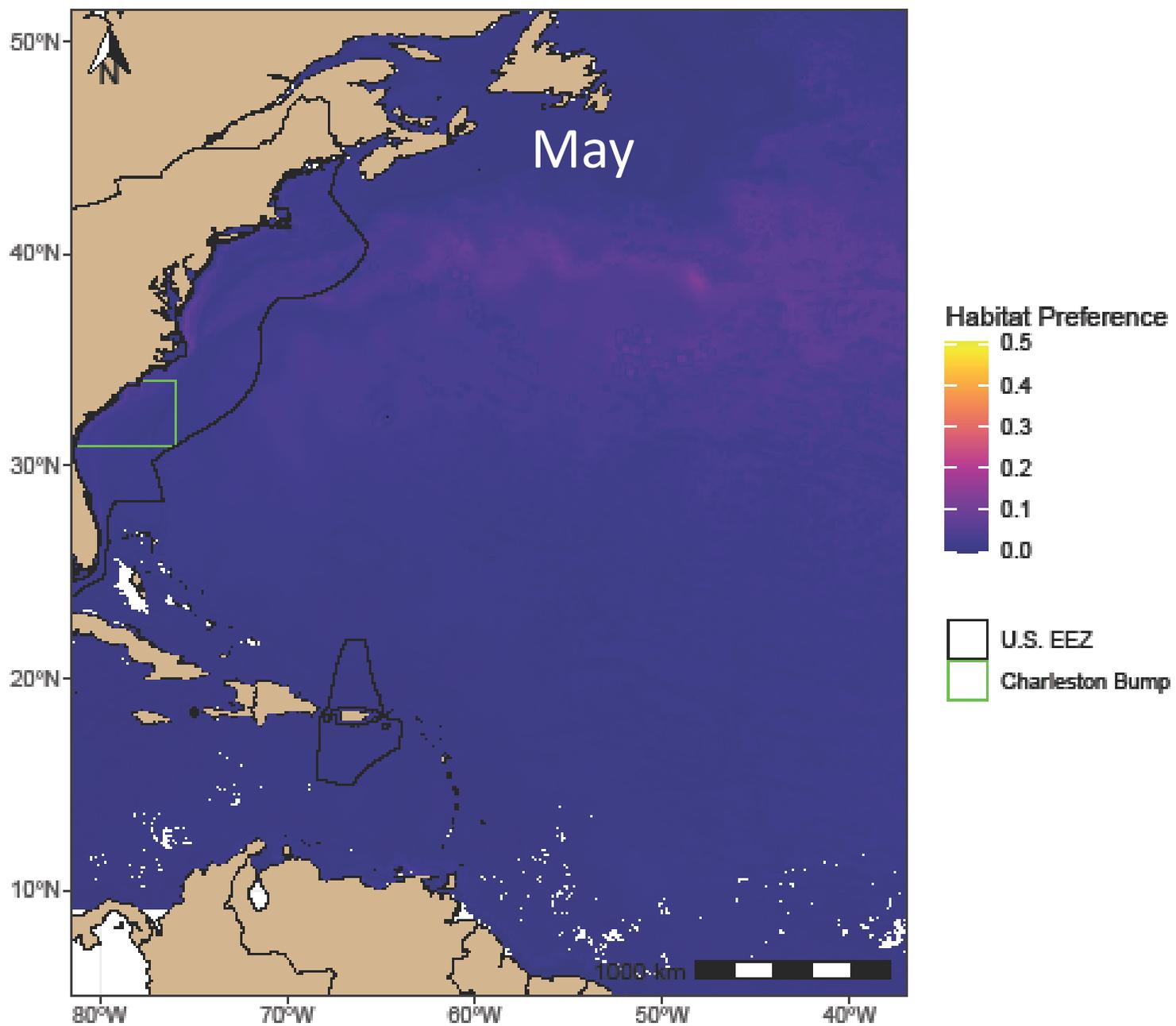
-  U.S. EEZ
-  Charleston Bump

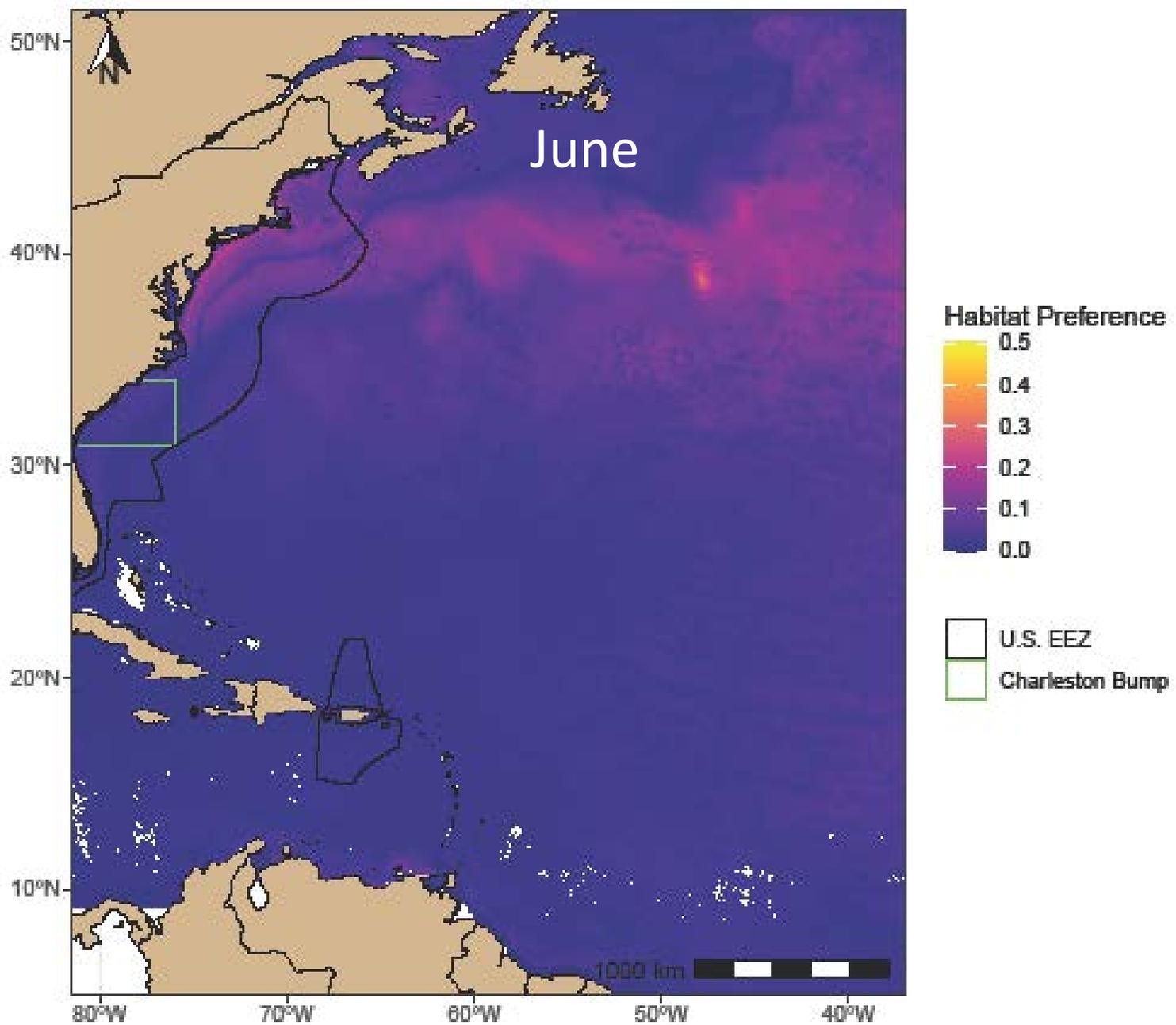


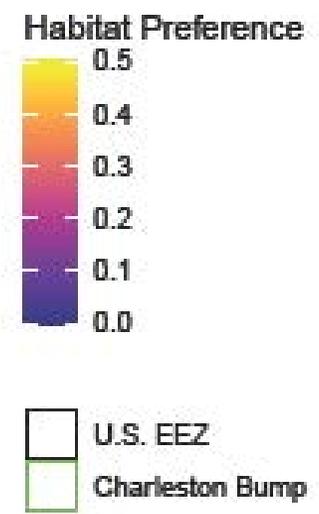
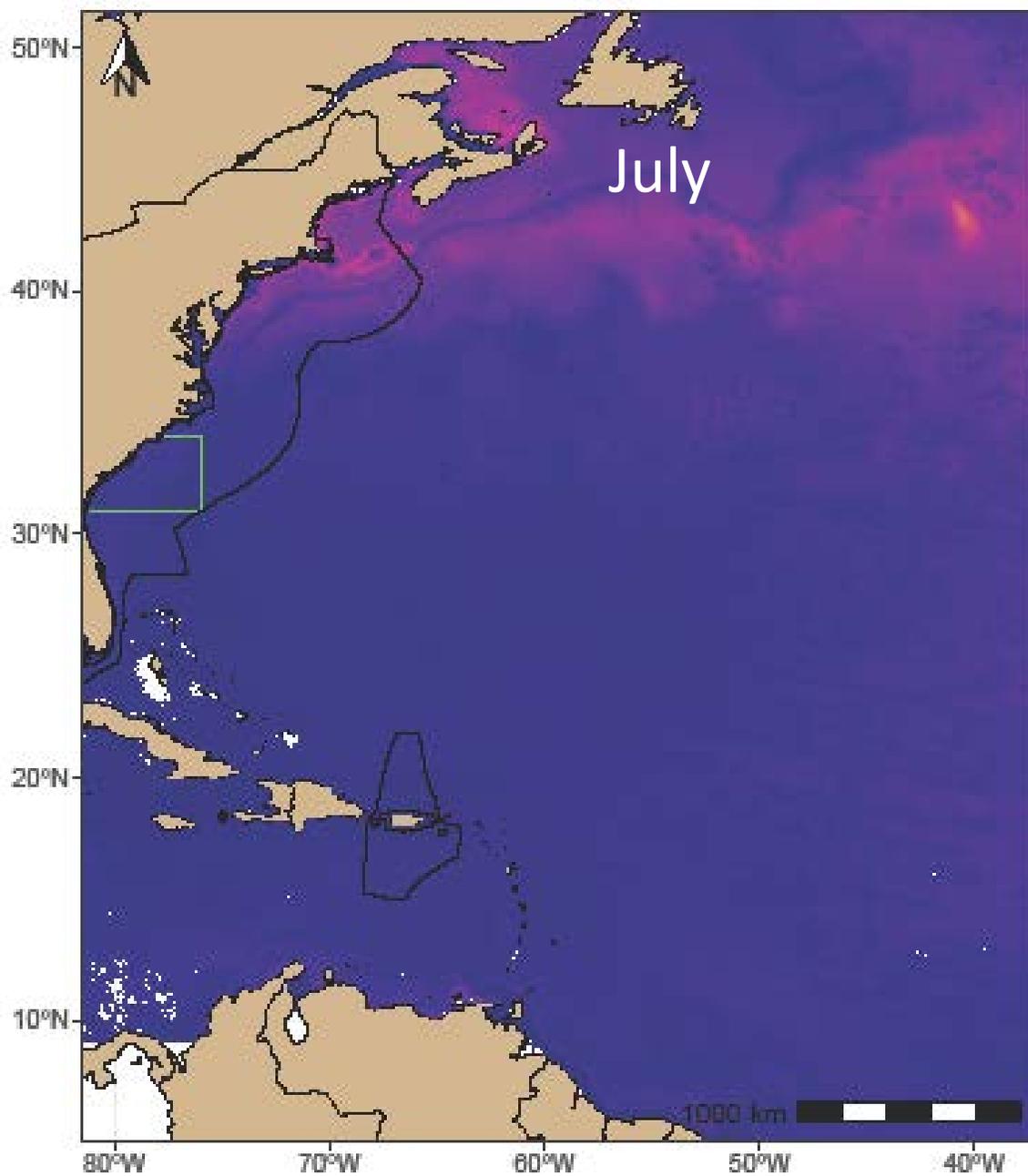


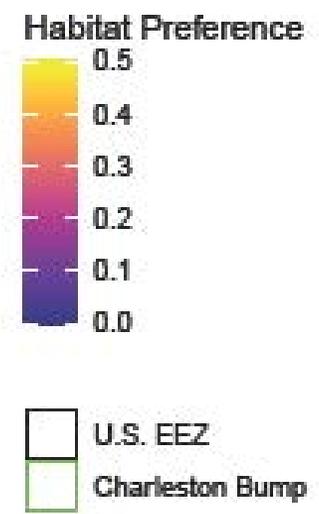
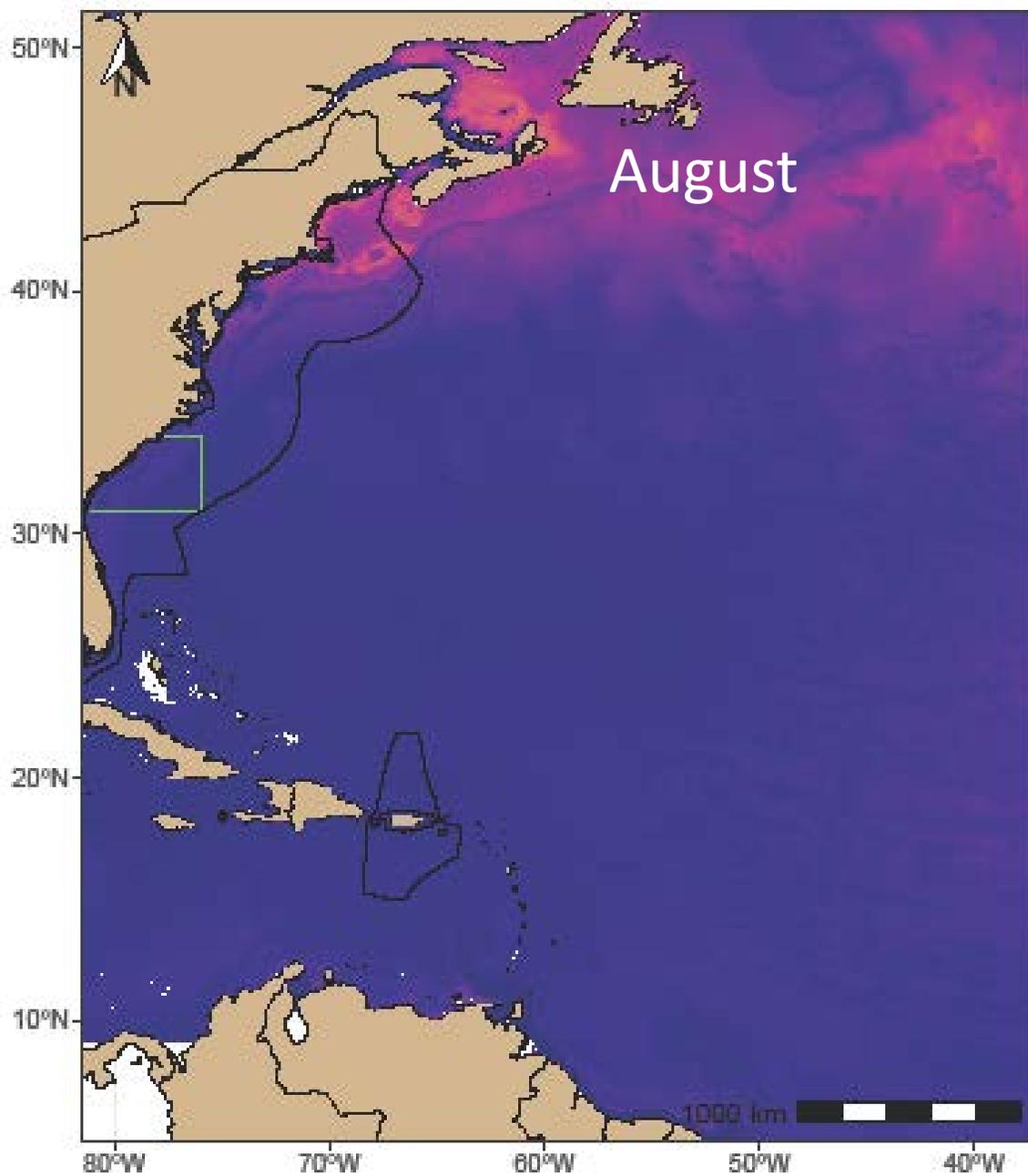


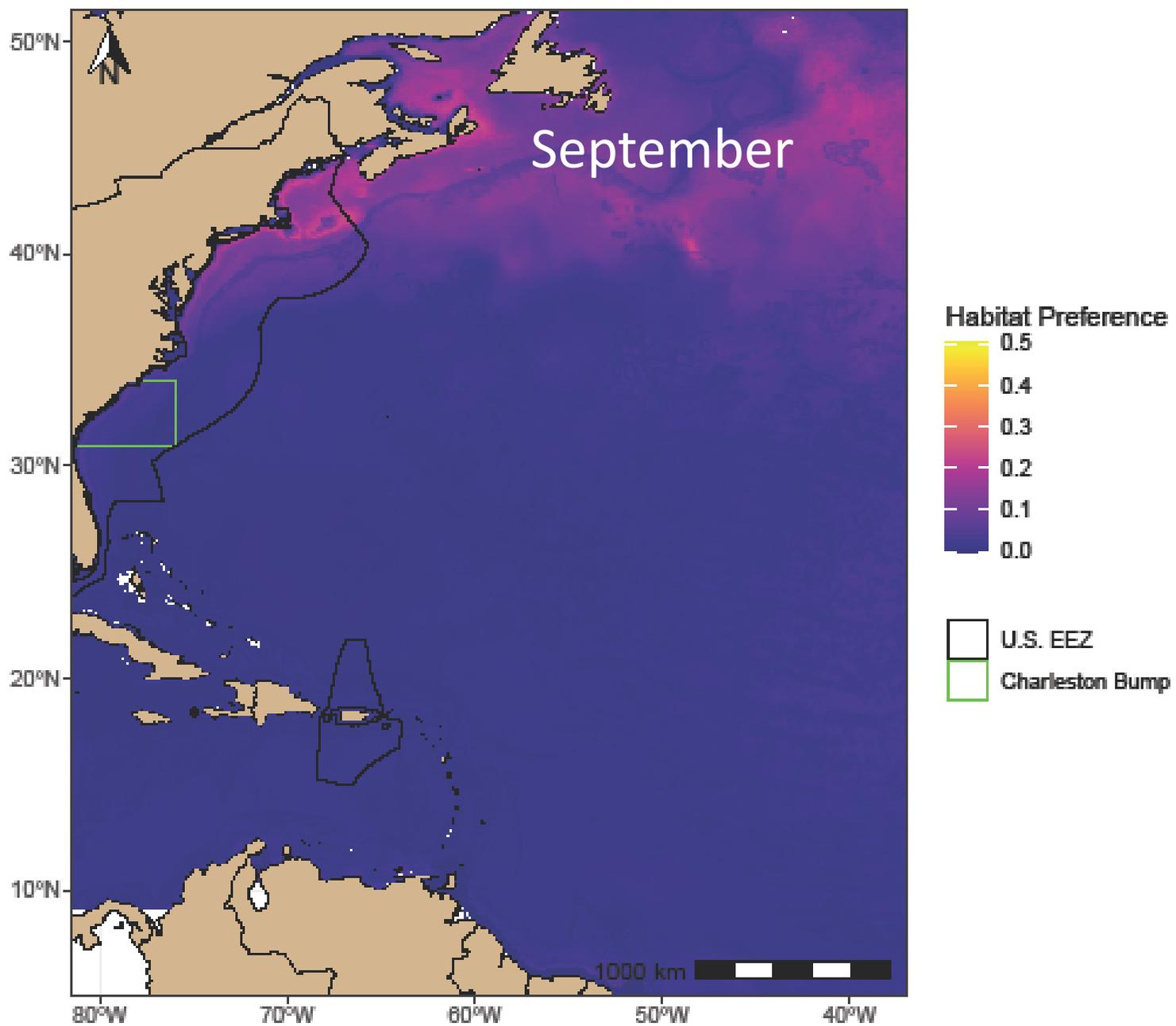


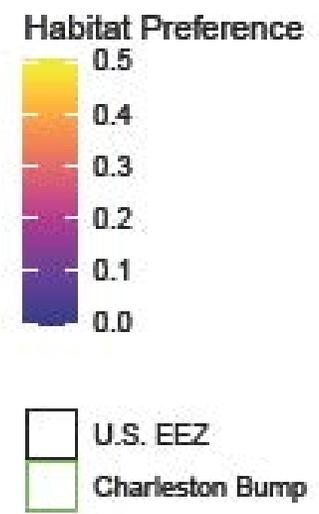
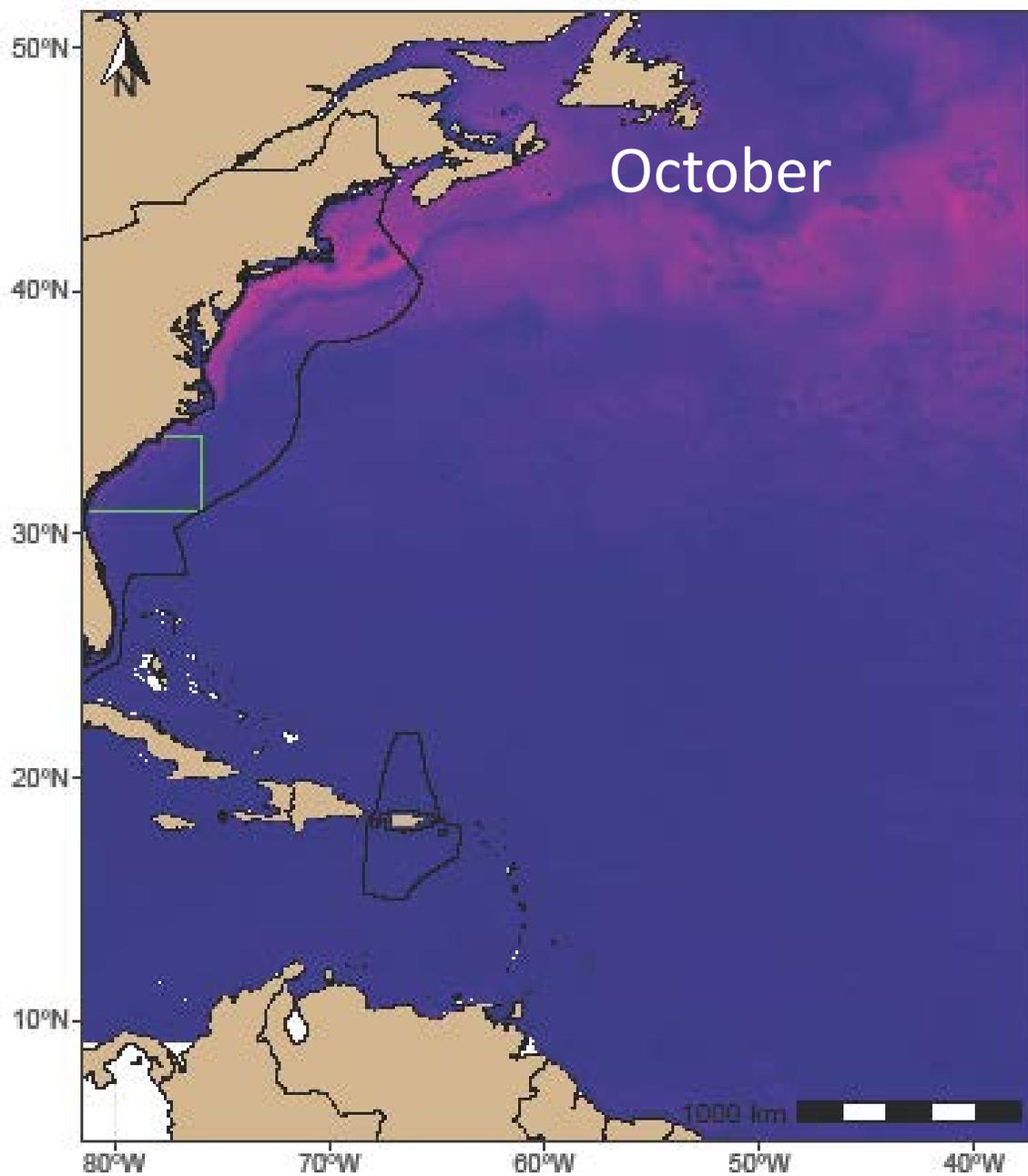


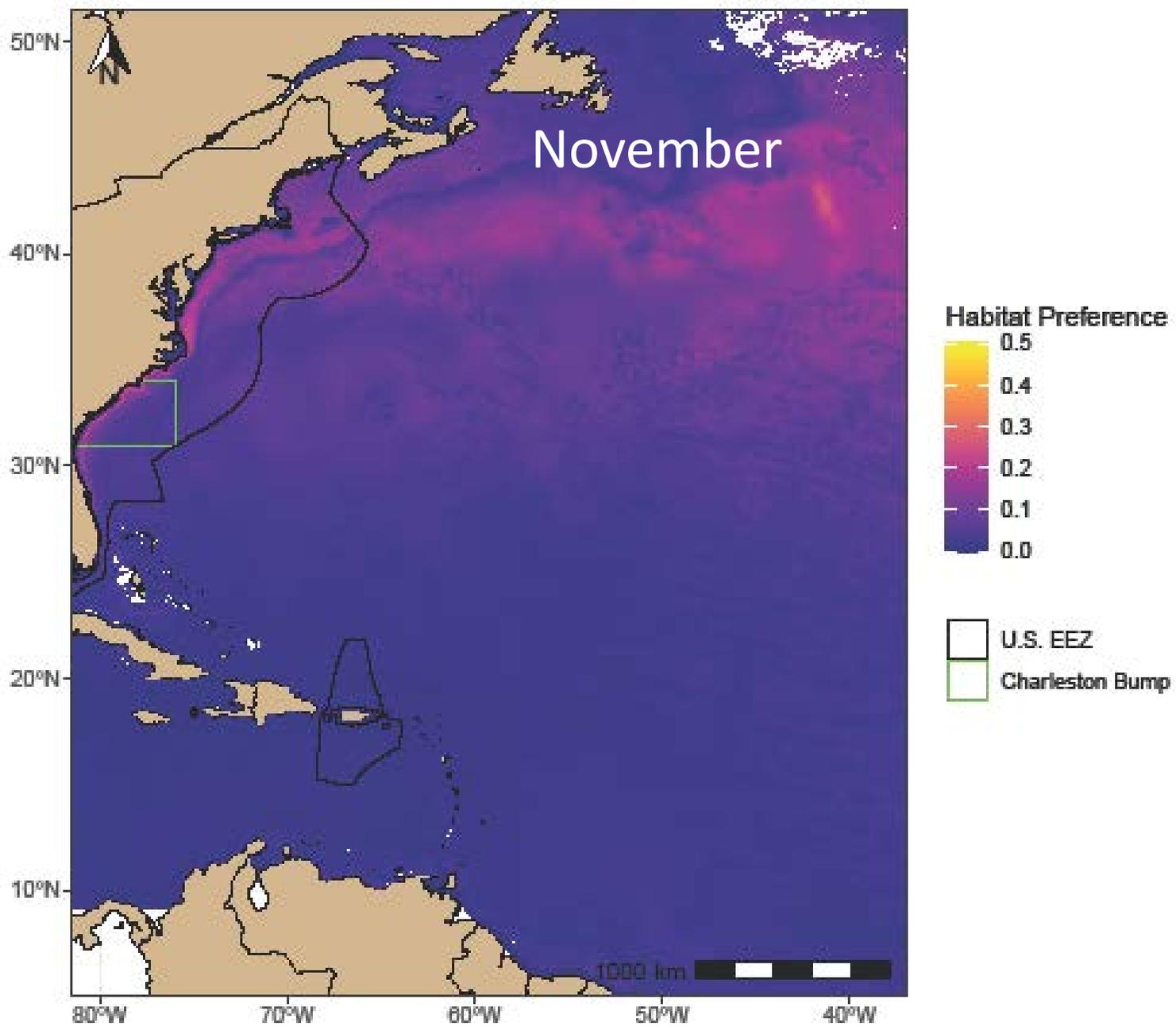


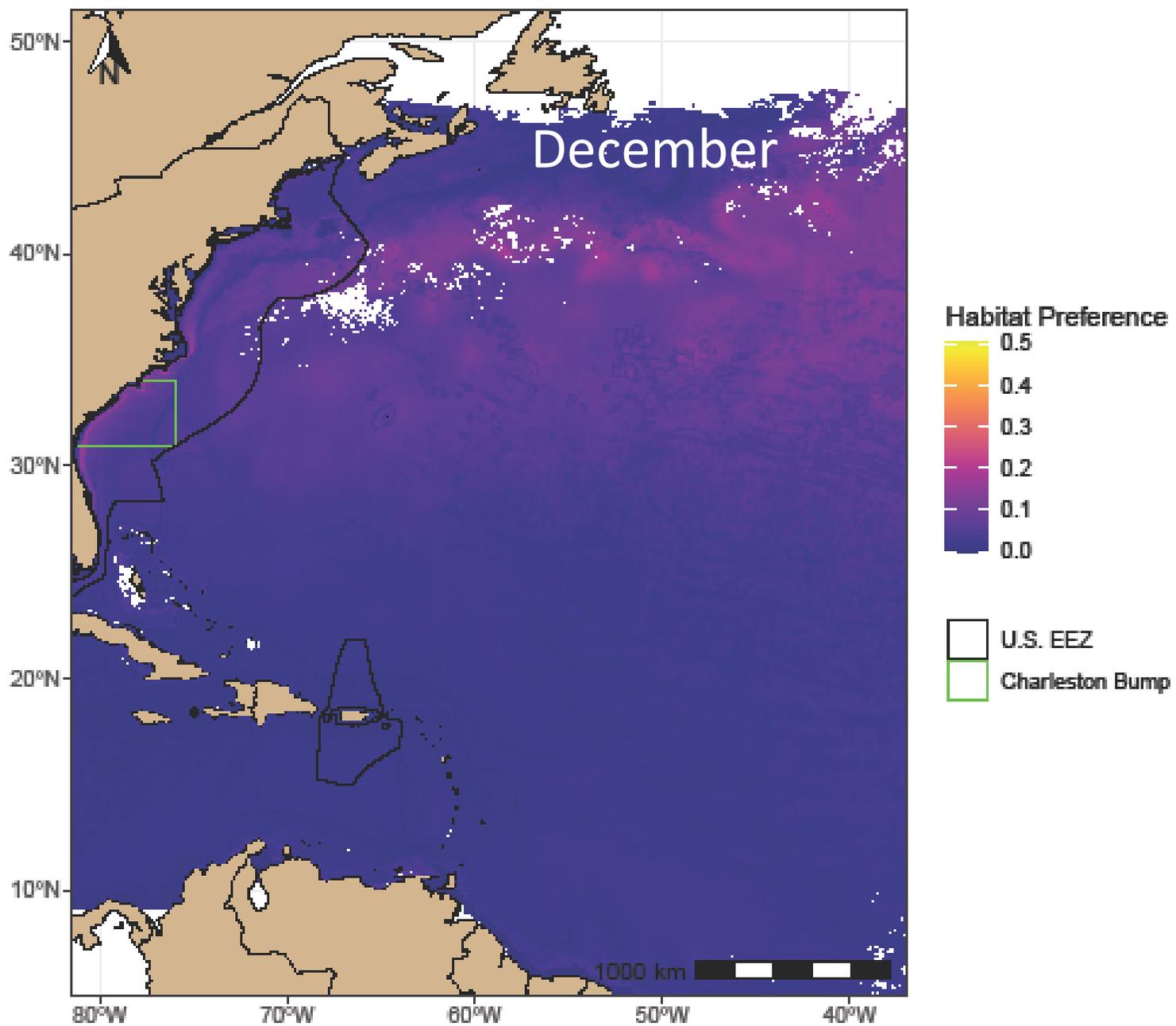












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Assess Closed Areas

Does the location/size/timing of a closed area protect bycatch species' core habitat?



Mako Shark



Leatherback
Sea Turtle



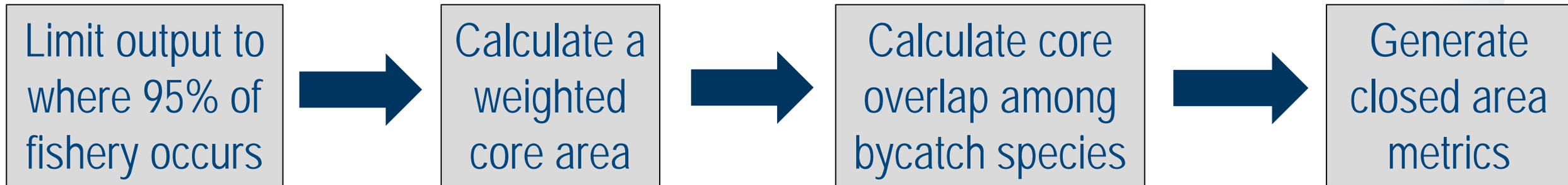
Loggerhead
Sea Turtle



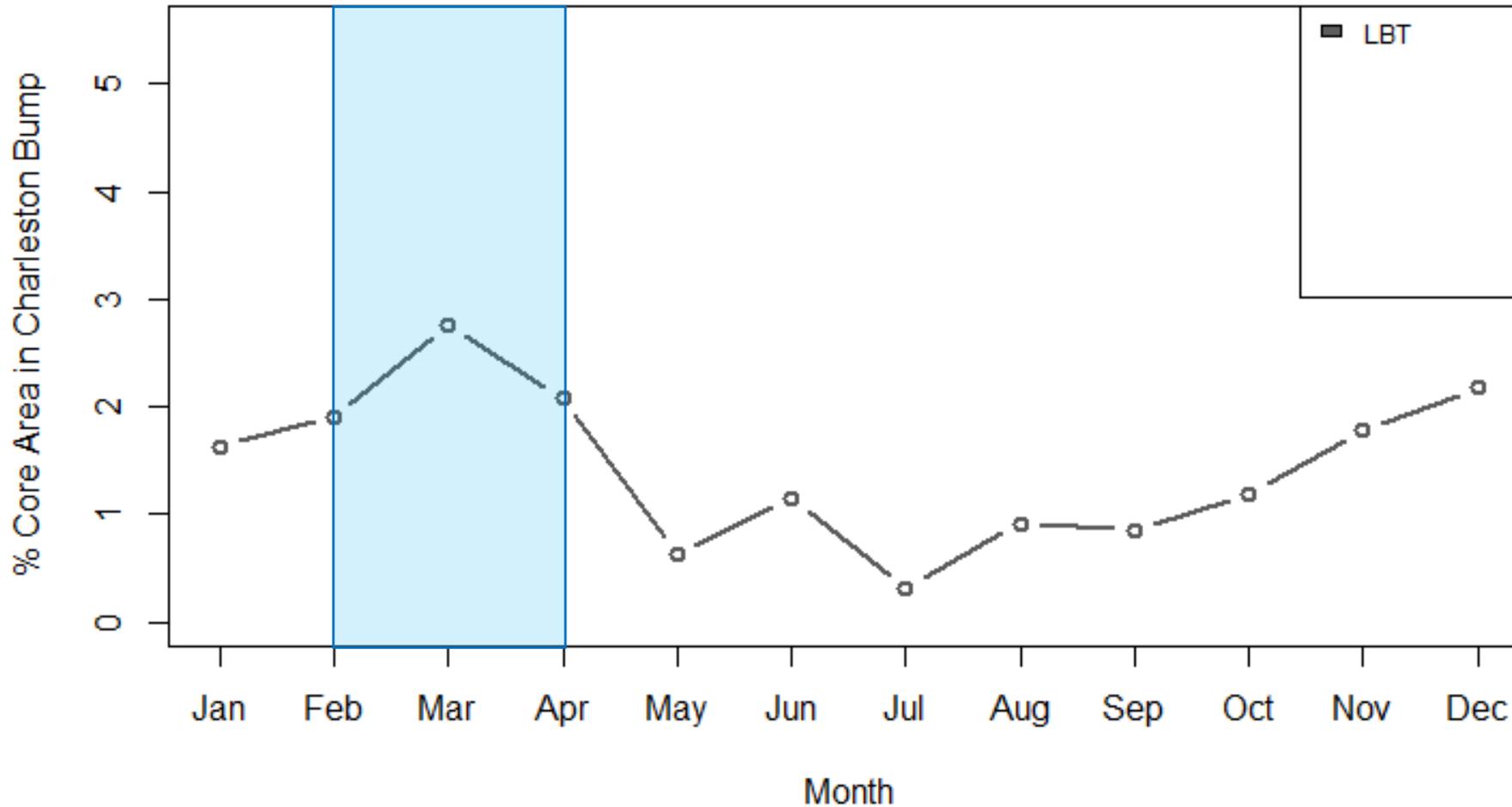
Billfish Species

Assess Closed Areas

Does the location/size/timing of a closed area protect bycatch species' core habitat?



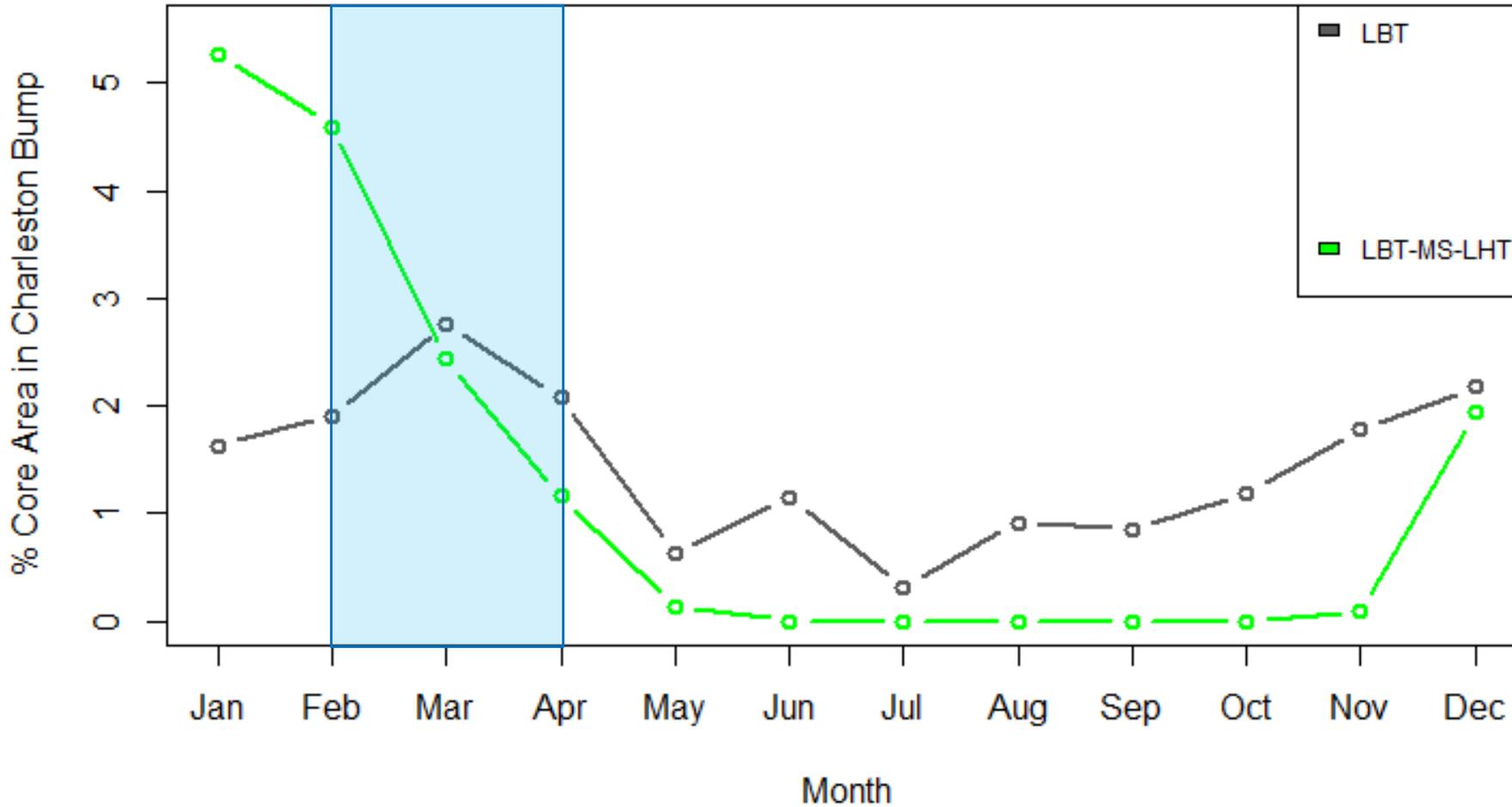
% Core Area in Charleston Bump



BIL = Billfish Species; LHT = Loggerhead Turtle
MS = Mako Shark; LBT = Leatherback Turtle



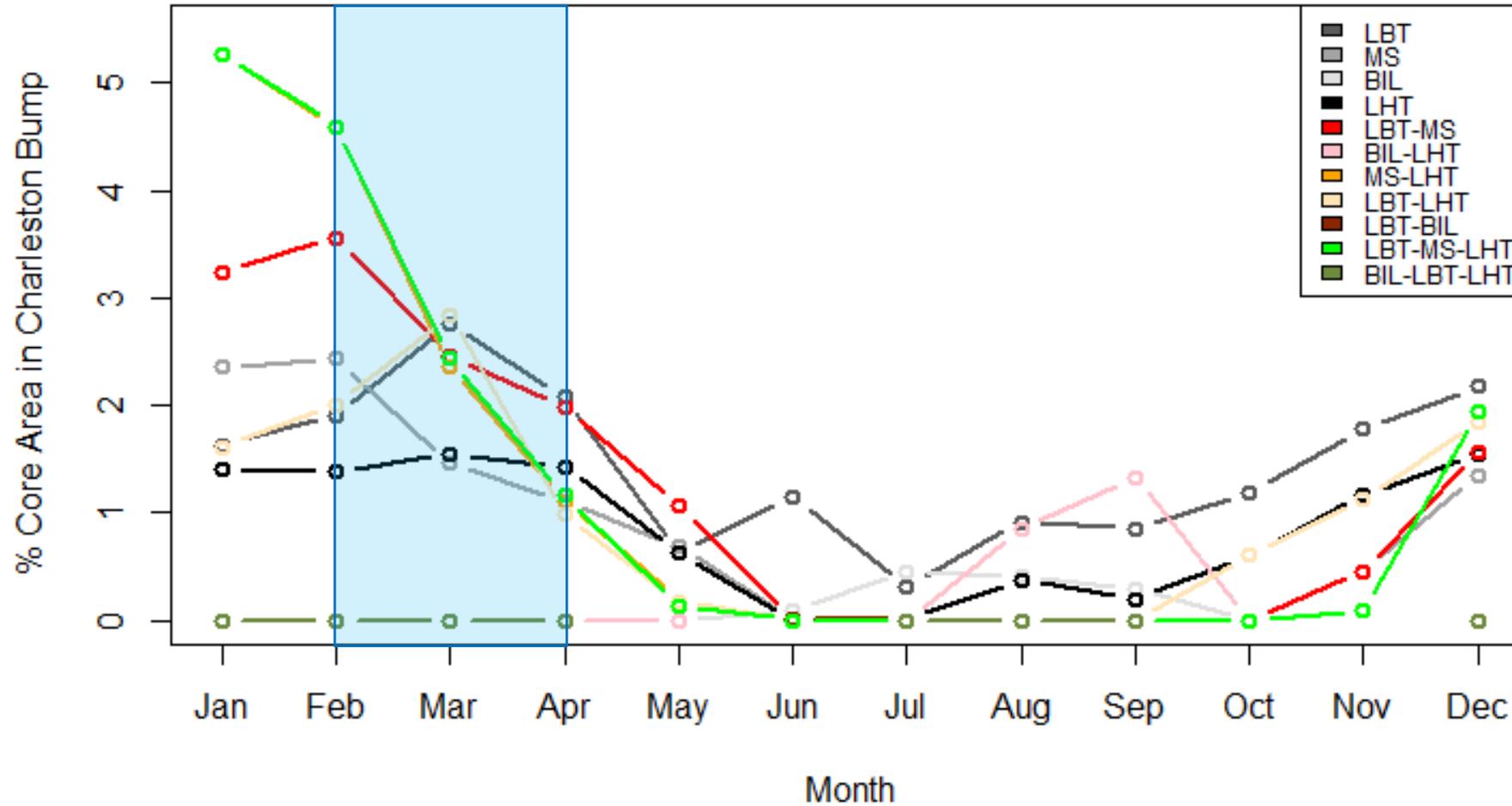
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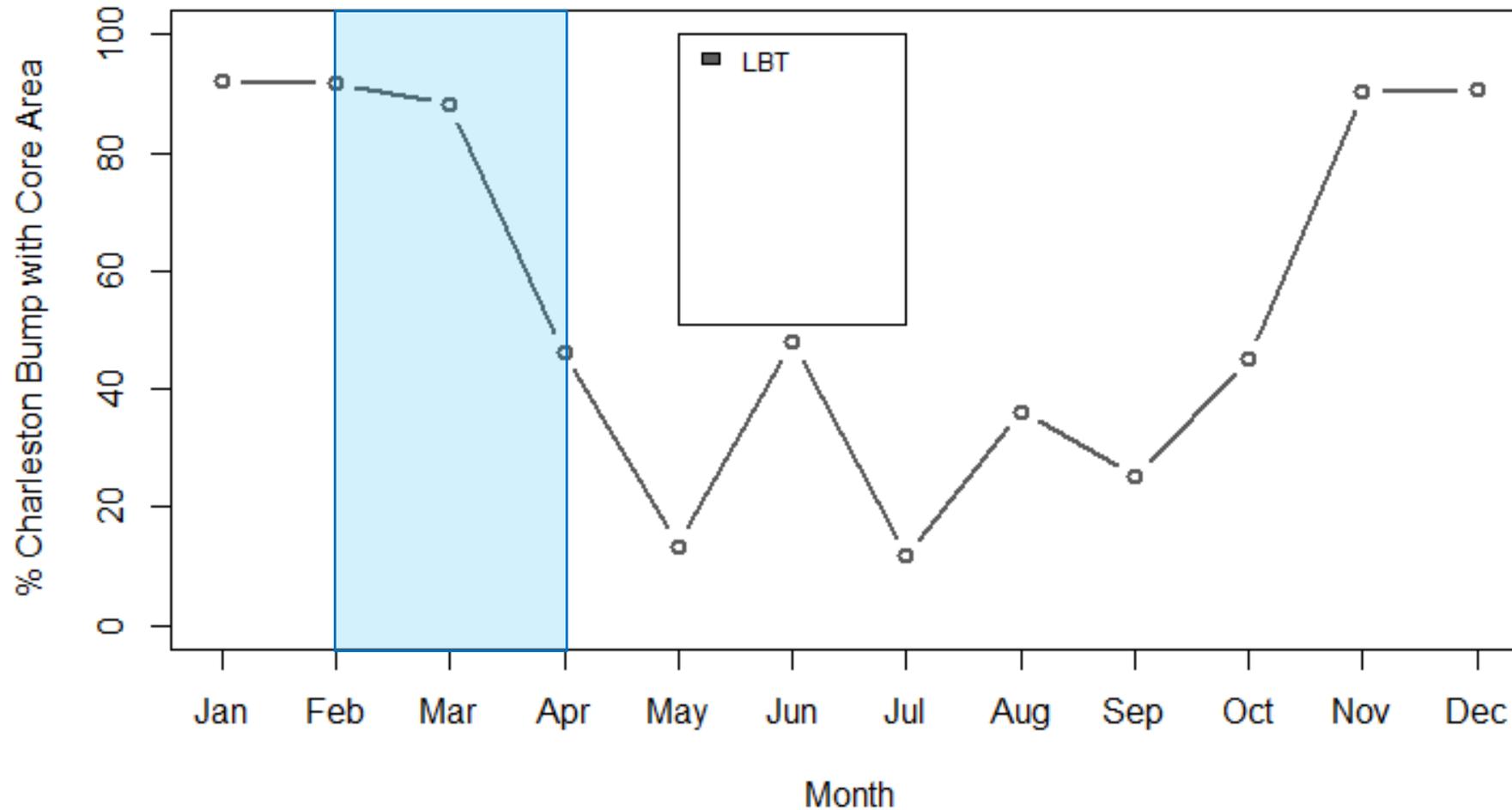


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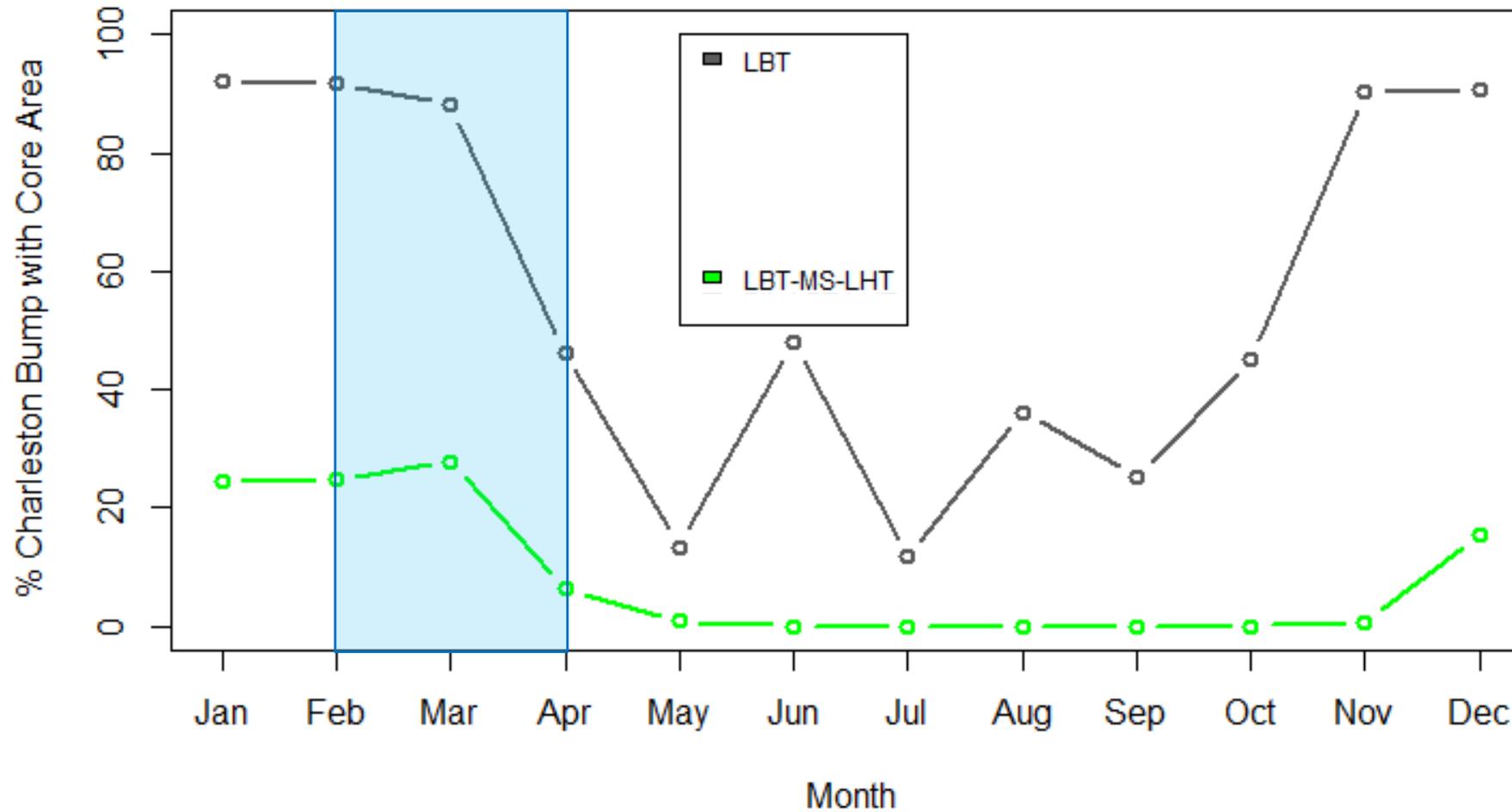
% Charleston Bump with Core Area



BIL = Billfish Species; LHT = Loggerhead Turtle
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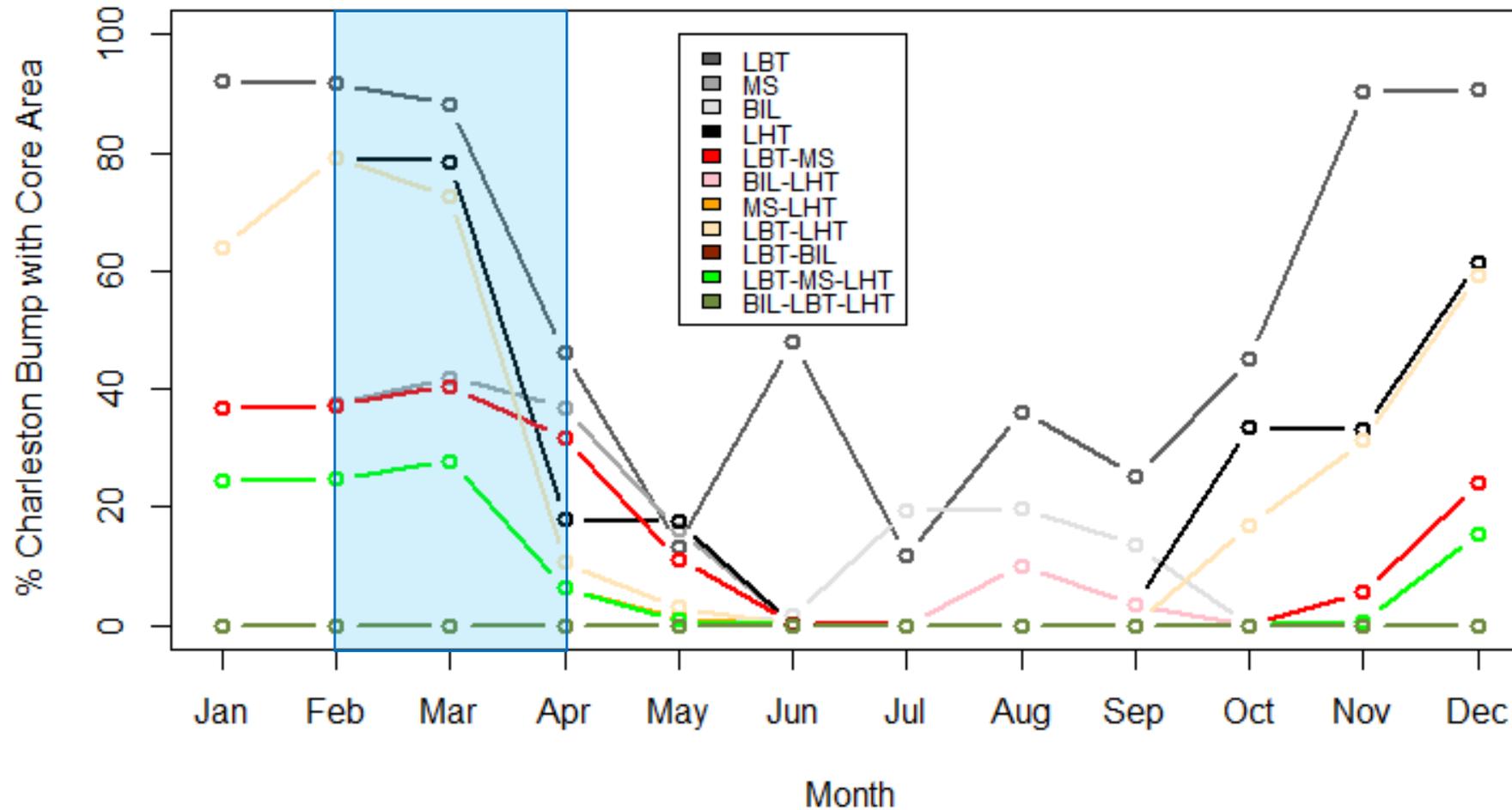


% Charleston Bump with Core Area



BIL = Billfish Species; LHT = Loggerhead Turtle
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% Charleston Bump with Core Area

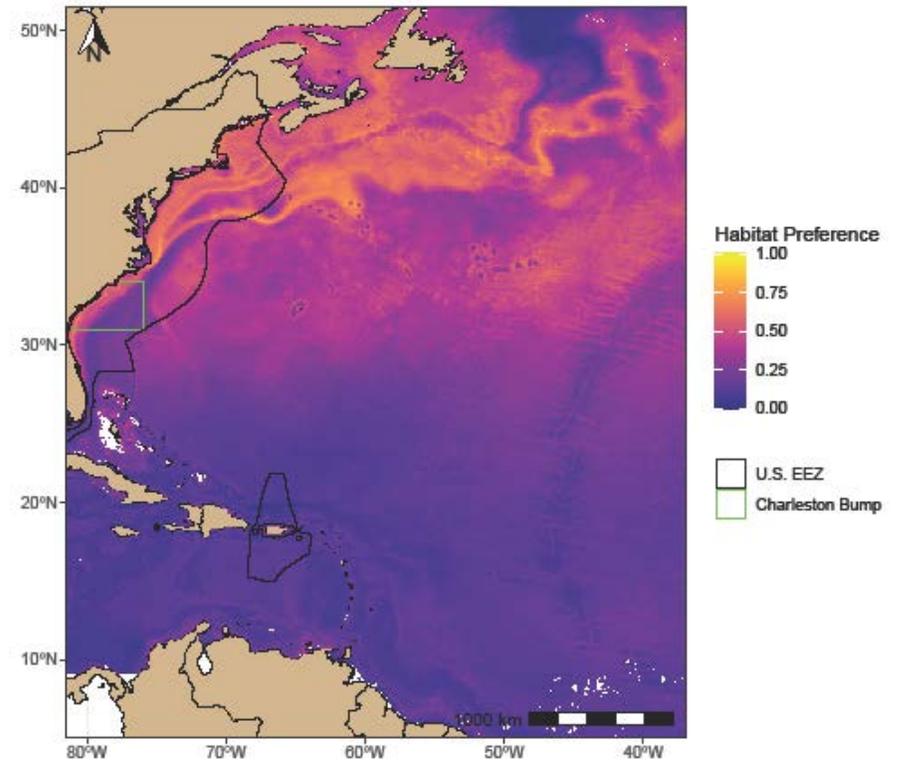


BIL = Billfish Species; LHT = Loggerhead Turtle
 MS = Mako Shark; LBT = Leatherback Turtle



Other Potential Uses for PRiSM

- Optimize target catch and reduce bycatch
- Determine specific species' hotspots
- Help in EFH designations



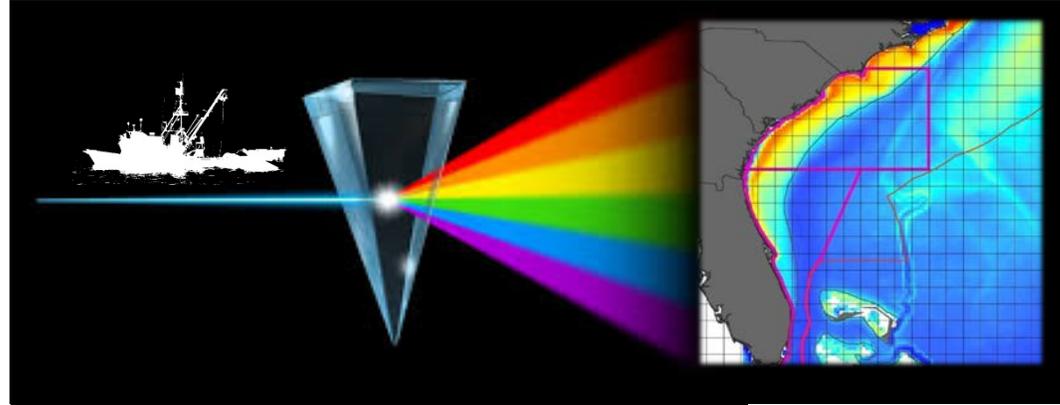
Next Steps

- HMS Predictive Spatial Modeling (PRiSM) Project: ONGOING
 - Formal review of modeling methodology expected early 2021
 - Addition of data and areas
- Research and Data Collection in Support of Spatial Fisheries Management in Atlantic HMS Fisheries
 - Proposed Rule and DEIS:
 - Expected Release mid to late 2021
 - Final Rule and FEIS:
 - Expected Release 2022



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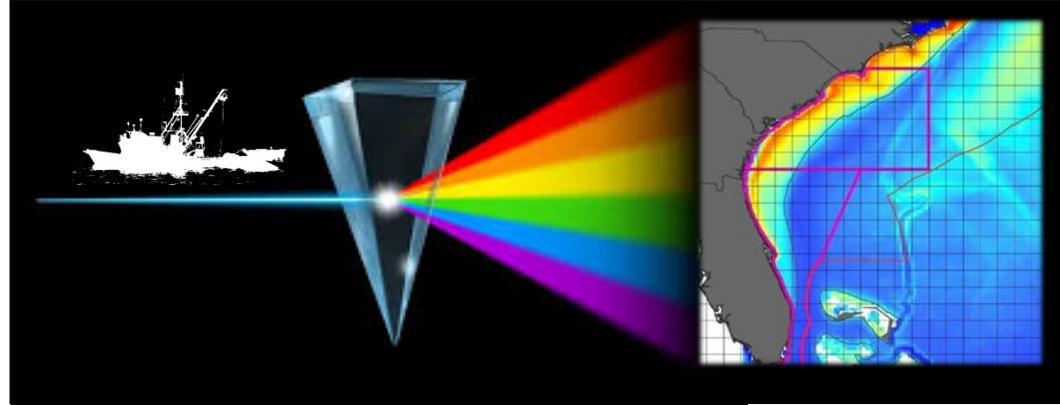
Point of Contact

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Questions/Comments/Ideas?

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Questions

1. Do you feel like a modeling approach like this is useful in assessing closed areas?
2. Are there any other species you think we should focus on?
3. Are there any other environmental variables we should consider?