Seagrass Non-Cryptic Fish Assemblage Across the Florida Keys National Marine Sanctuary Seascape

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Based at FIU, our team of ecologists, geneticists, and conservationists are making a difference for sharks, rays, and reef fish around the world.

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FISHSCAPE PROJECT QUESTION:

How much seagrass is necessary to support reef fish foraging?

P.I: Alastair Harborne

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

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SFCCESU

This project is funded through the South Florida-Caribbean Cooperative Ecosystems Studies Unit

Multi-scale approach

FISHSCAPE integrates multiple approaches:

- Seascape mapping
- Acoustic telemetry to track fish movements
- Laboratory experiments measuring energetic costs
- Mesocosm Experiment On Mesopredatory fish Foraging Efficiency
- Stable Isotope Analyses and Mesopredators diet
- **Foraging fishes and Predators/Prey assessment with Baited Remote Underwater Video Stations-BRUVS**






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Non- cryptic Fish Community Assemblage With Baited Remote Underwater Video Systems- BRUVS

Objective:

To characterize fish assemblage patterns across different seagrass habitats at three distinct regions within the FKNMS, examining how seascape variables influence the non-cryptic fish assemblage.

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Methods- Baited Remote Underwater Video Stations- BRUVS

- Non-invasive. Camera mounted on a frame with a bait arm extending one meter from the camera
- The bait cage at the end contains standardized bait to attract fish into the camera's field of view

Key advantages of BRUVS:

- Records species missed by visual census/trawling (Mesopredators and Upper predators)
- Captures rare species occurrences
- Documents natural behavior
- Allows abundance quantification

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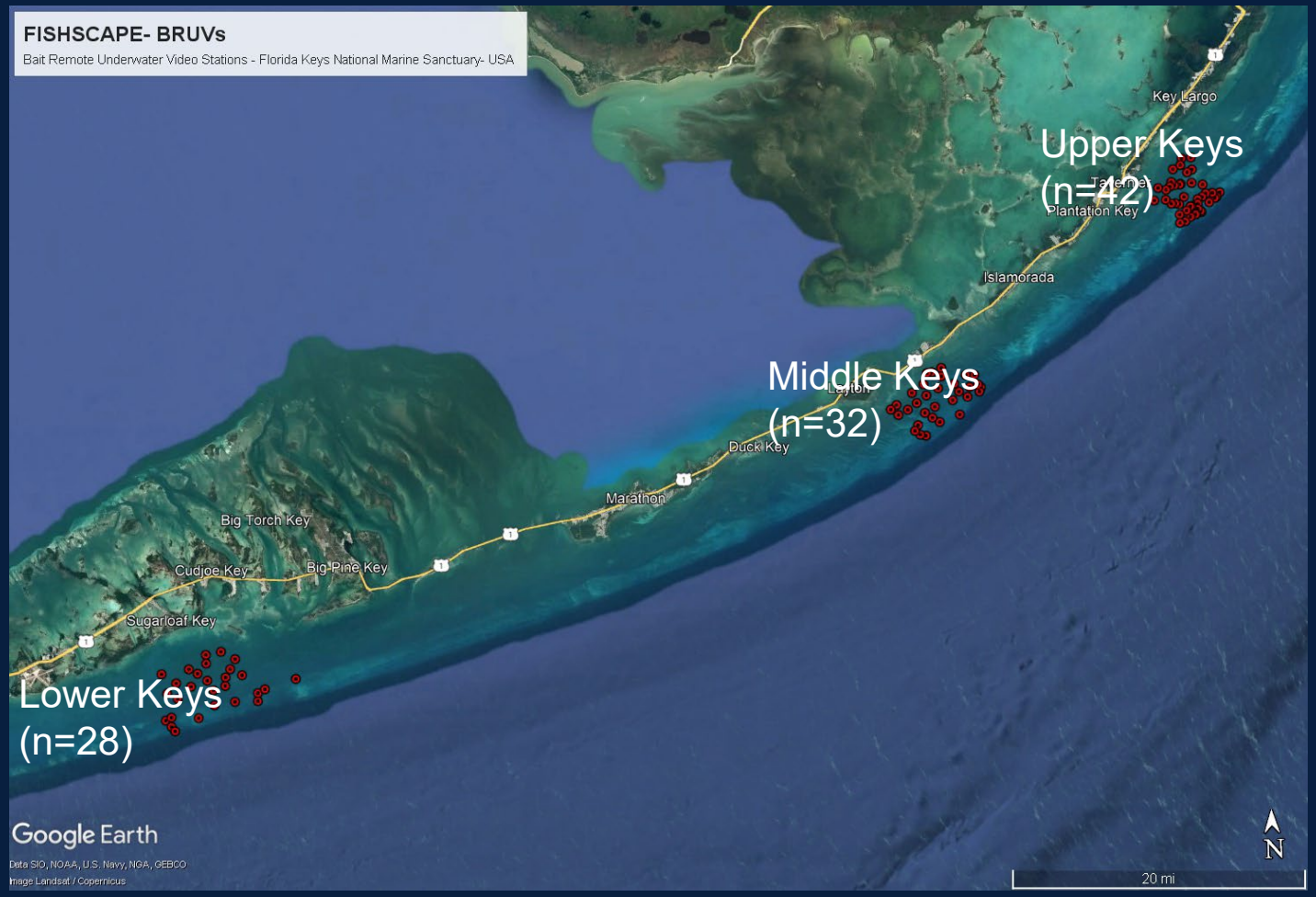
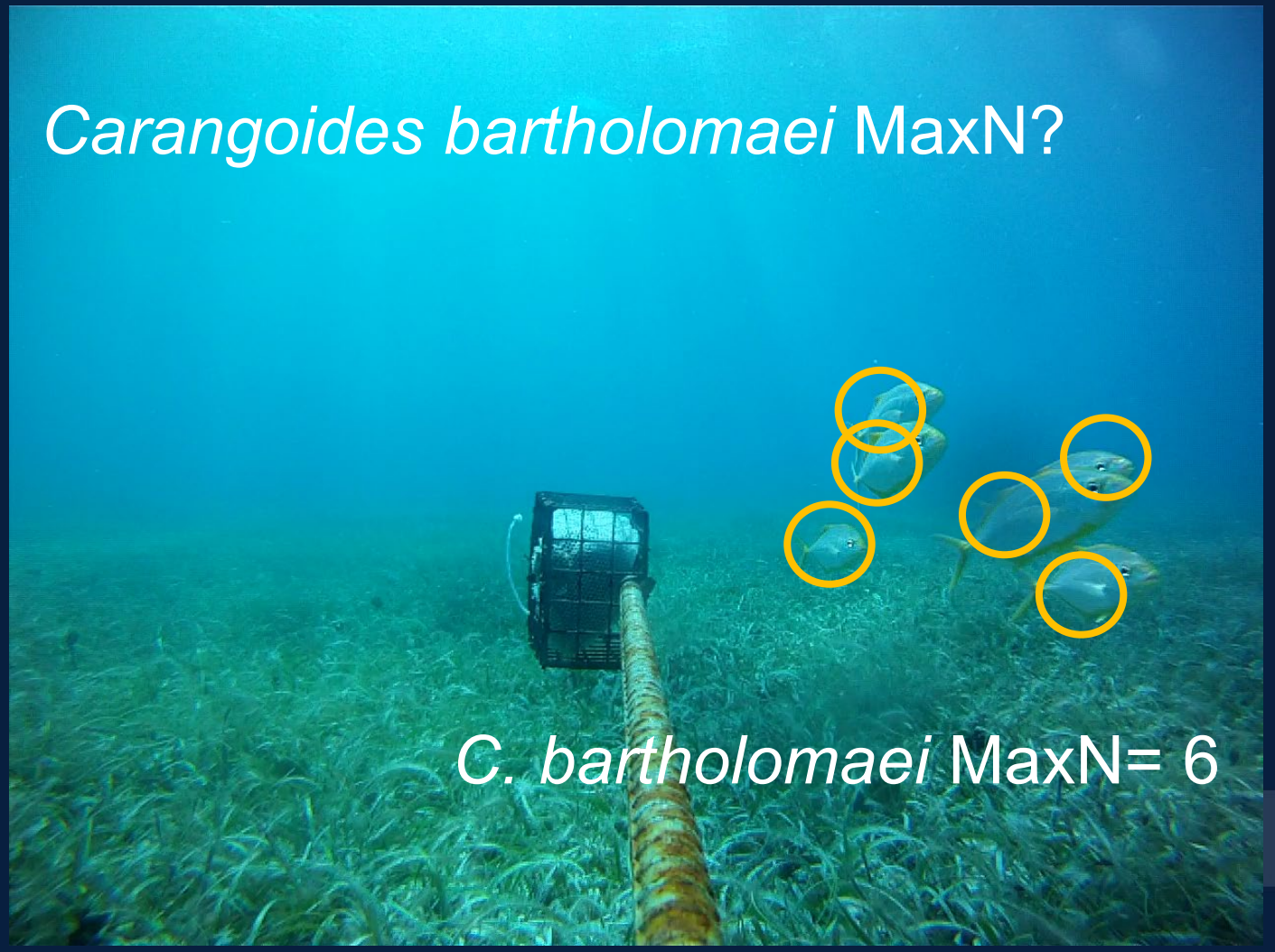
Baited Remote Underwater Video Stations



102 BRUVS were deployed in mornings in sites at different seagrass continuity, distances to shore and reefs.

- Units were placed at least 500 meters apart to ensure independent sampling
- Each frame recorded >170 minutes = > 290 hours.

MaxN (Cappo et al., 2003)



The maximum number of individuals of a species visible in a single video frame.

This conservative measure avoids double-counting individuals and provides reliable data for my analyses.

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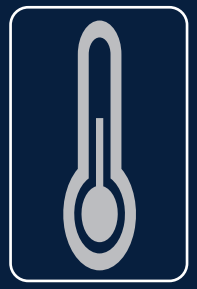
Environmental and Seascape variables

Depth



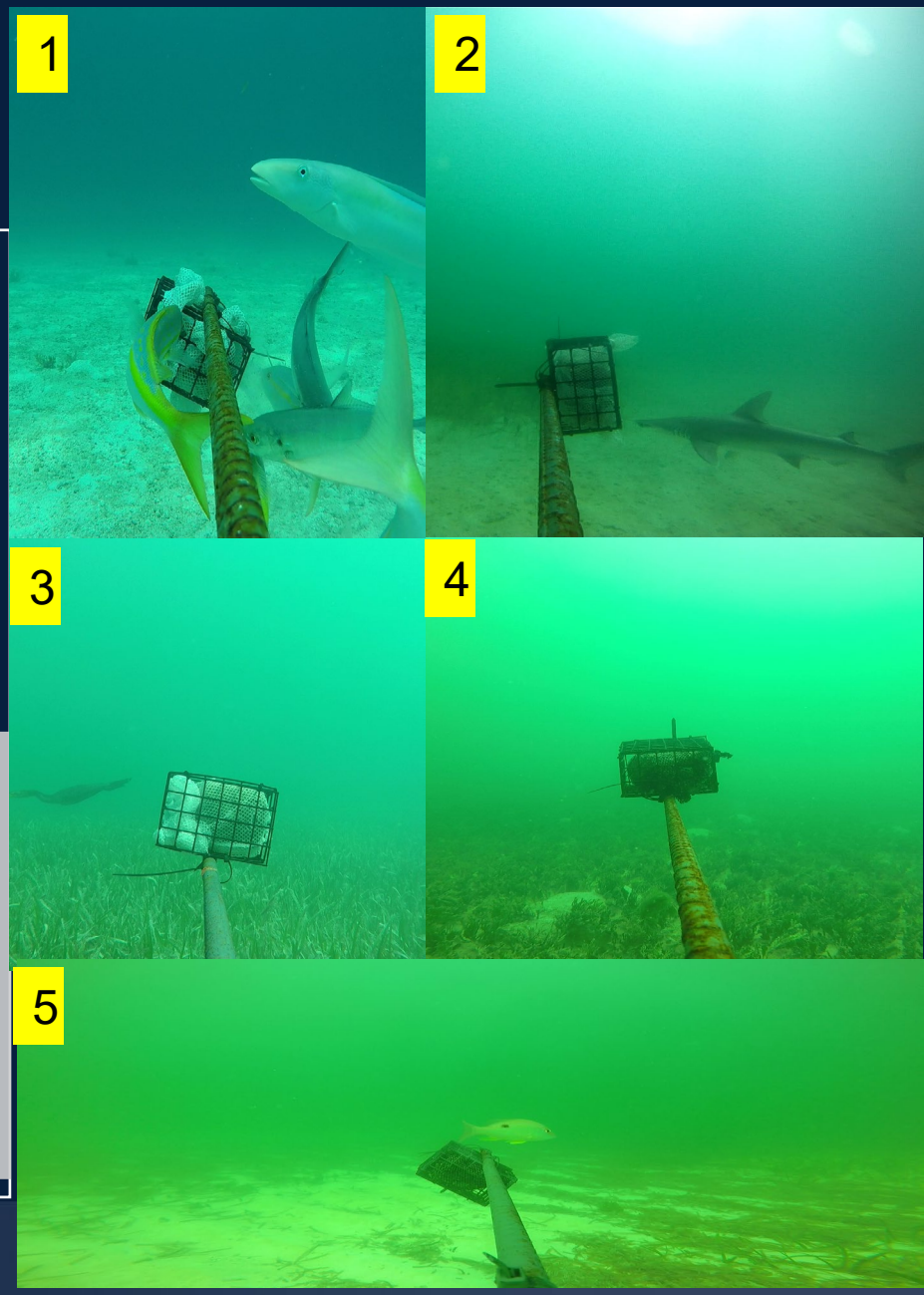
Temperature

Turbidity (5 levels scale)

Turbidity

5-point qualitative scale based on water color and visibility in the video frames.

1. Very clear (deep blue water with excellent visibility)	**2**. Clear (blue to blue-teal water with good visibility)	**3.** Moderate turbidity (blue-green. Moderate visibility)	**4**. Turbid (Green water with reduced visibility)	**5**. Very turbid (intense green water with poor visibility)



Environmental and Seascape variables

Depth

Temperature

Turbidity (5 levels scale)

Gravity Index- Fishing pressure

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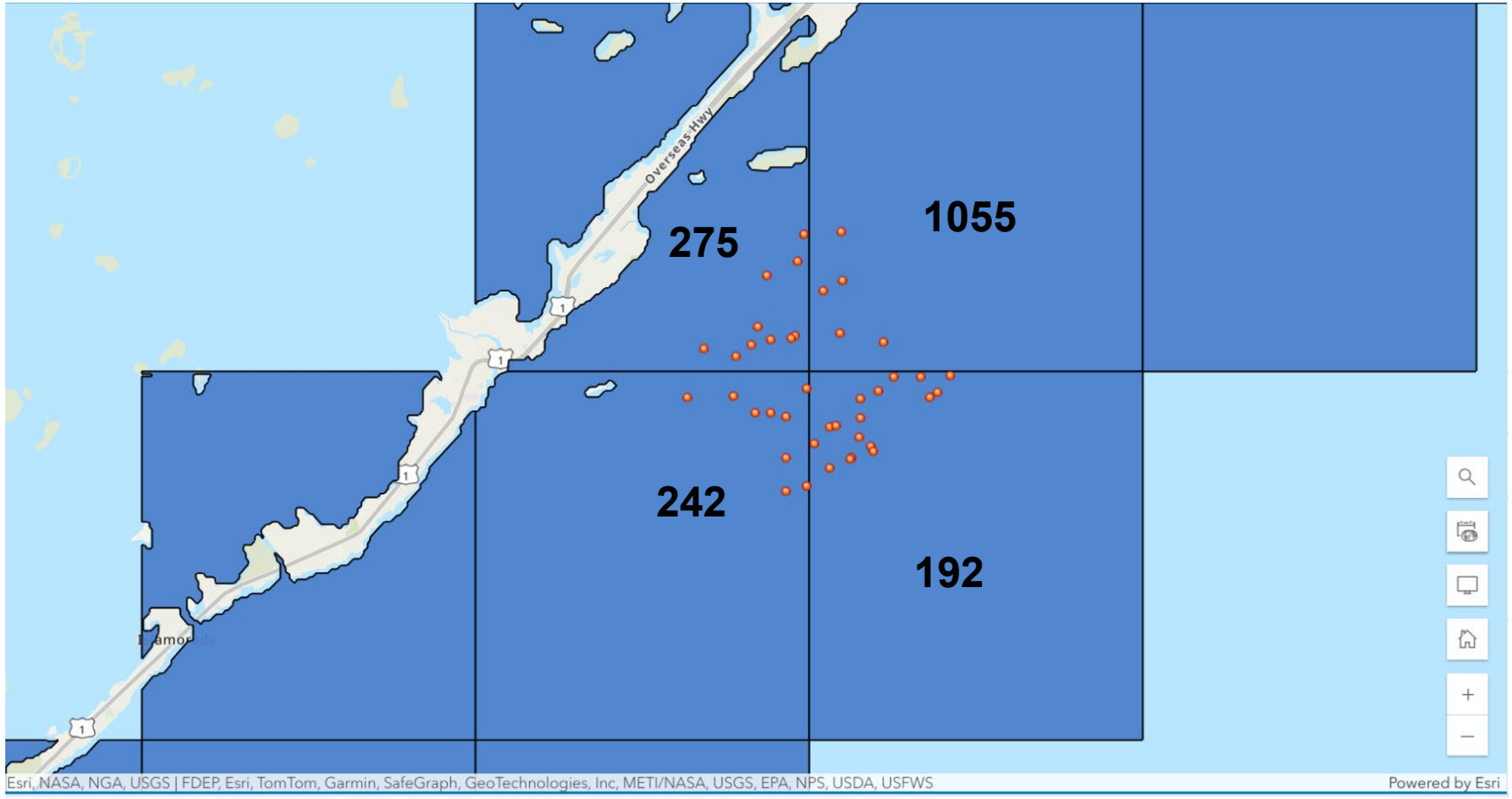
Gravity Index (Cinner et al., 2018)

Human interactions with a reef are a function of the population of a place divided by the squared time it takes to travel to the reefs



Environmental and Seascape variables

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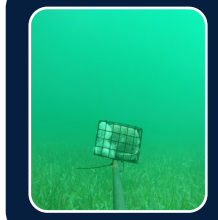
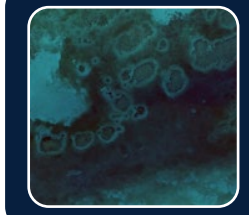
Temperature



Turbidity (5 levels scale)

Gravity Index-Fishing pressure (Cinner et al., 2018)

Distance to Shore



Distance to reefs

Reef connectivity (Buffers of 100m, 250m , 500m)

Seagrass continuity (Florida's Unified Reef Map)

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Continuous/Discontinuos Seagrass

Fish Assemblage Analysis

Diversity Metrics

- Alpha diversity
- Species accumulation curves and richness estimation

Boosted Regression Trees (BRT)

Quantified relative influence (%) for each predictor in Species abundances and diversity

Multivariate Analysis (dbRDA)

Distance-based Redundancy Analysis with Bray-Curtis to identify which factors drive regional differences

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Results

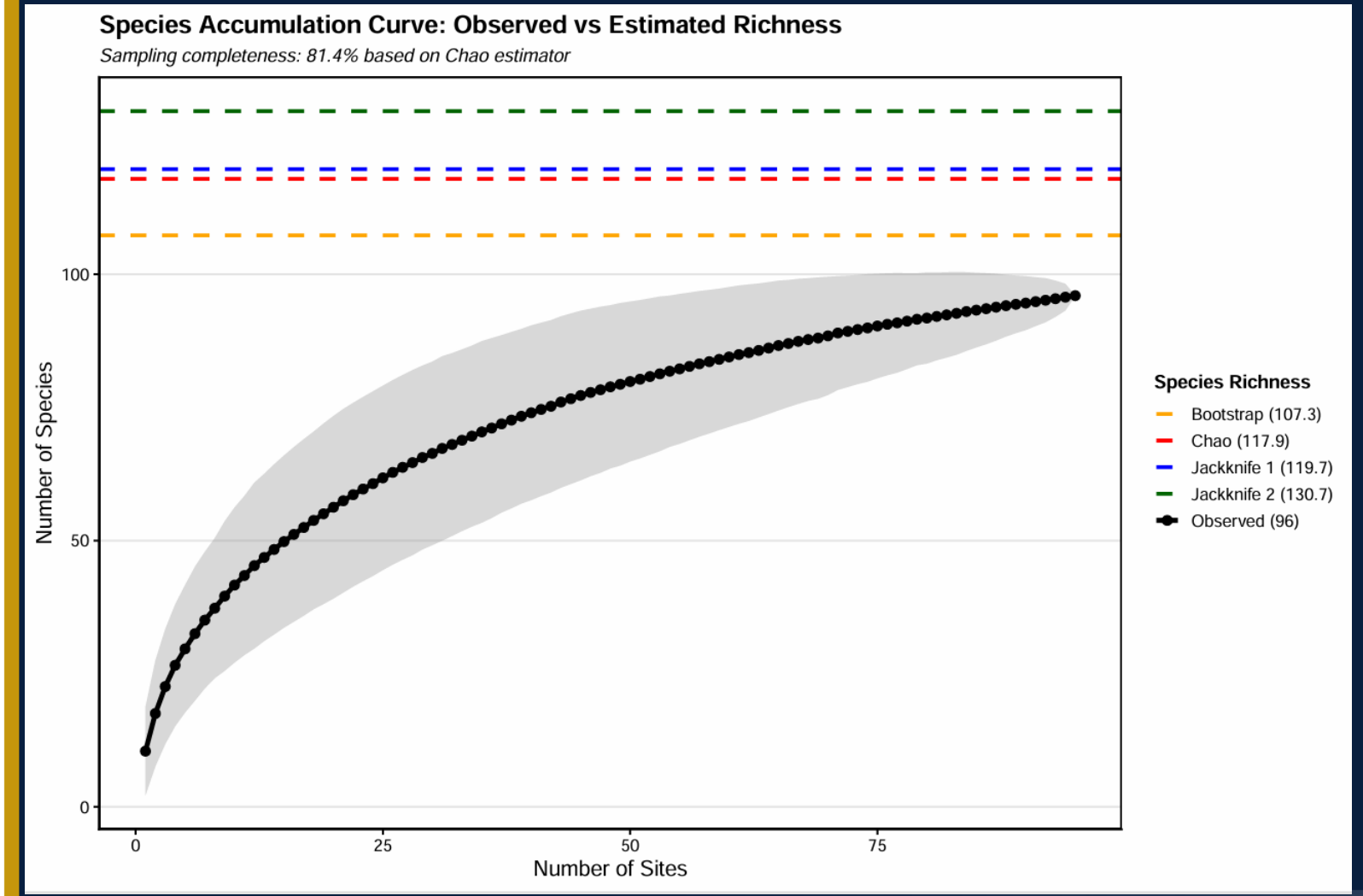

Figure 1: Species accumulation curve

- 95 Non-cryptic fish species across FKNMS seagrass habitats
- Species estimation is 120 species
- BRUVS + Visual Census (by FIU Seagrass Ecosystems Research Lab) = 174 species

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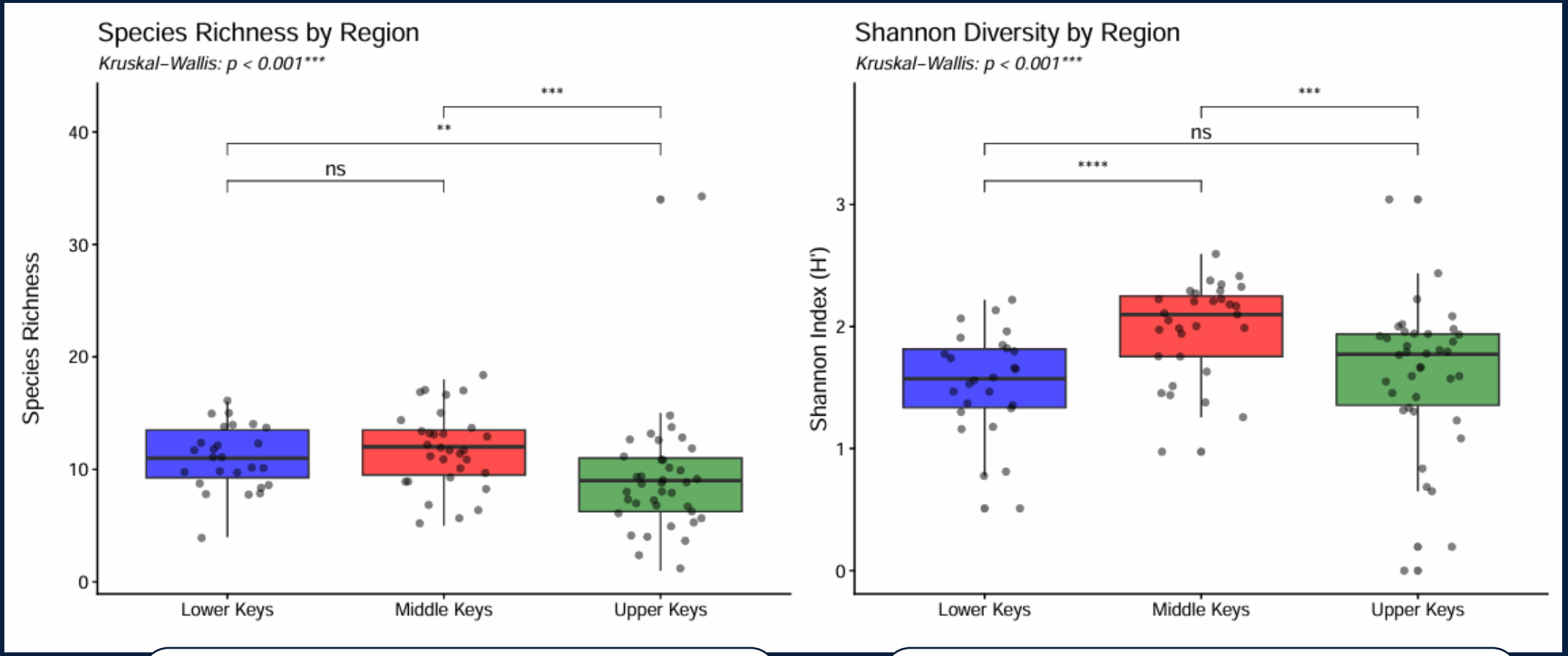
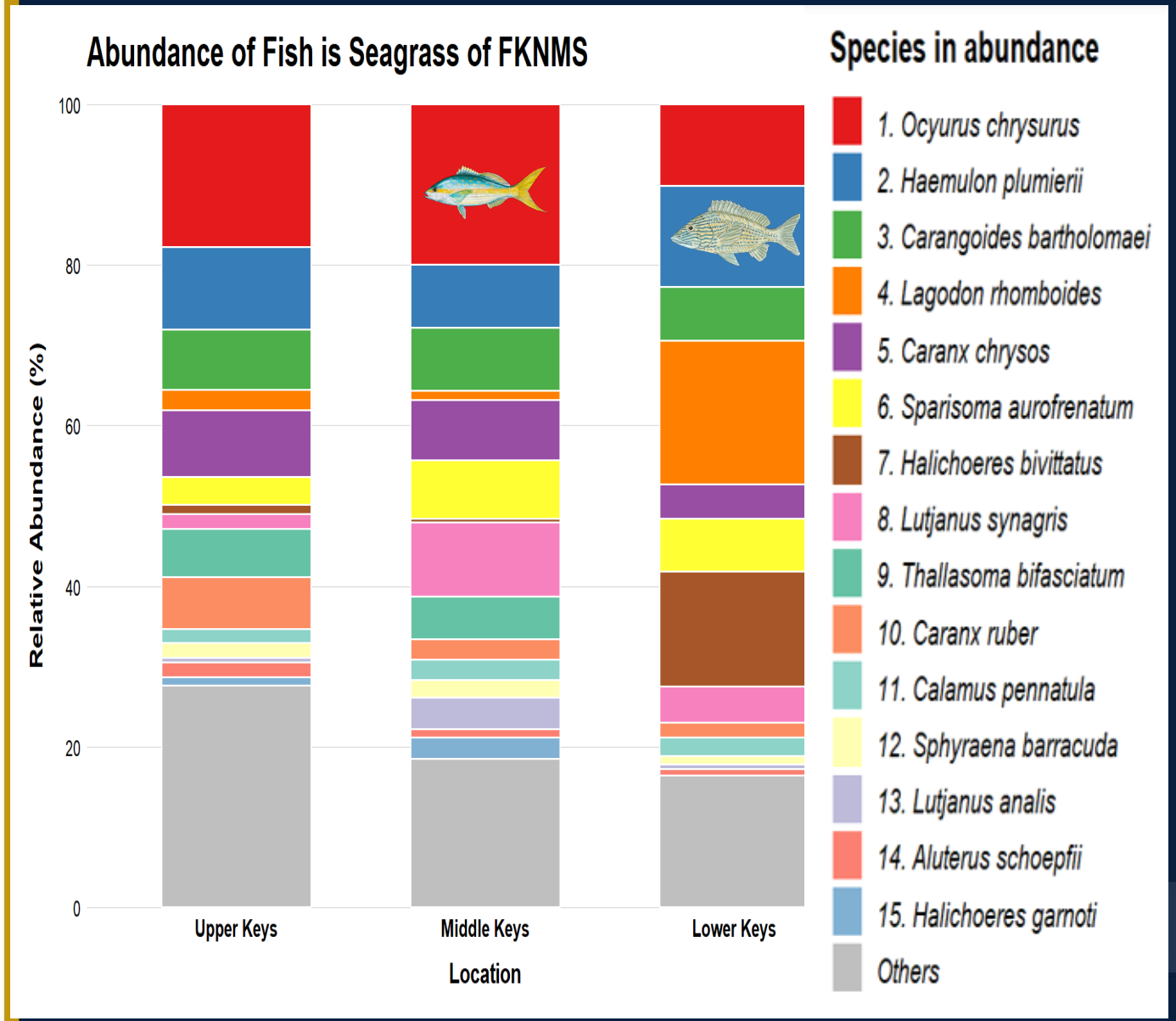
Diversity Patterns by location



Upper Keys show significantly lower **species richness** (~9 species) compared to Lower Keys and Middle Keys (~12-13 species, $p < 0.001$)

Middle Keys exhibit the highest **diversity (~2.1 H')** with significant differences among regions ($p < 0.001$)

Top dominant species across regions



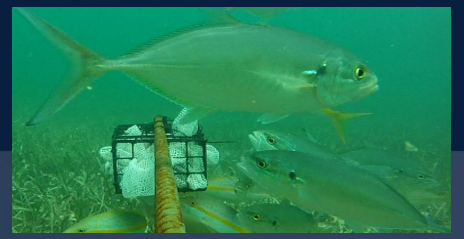
1. Yellowtail Snapper- Highest abundance

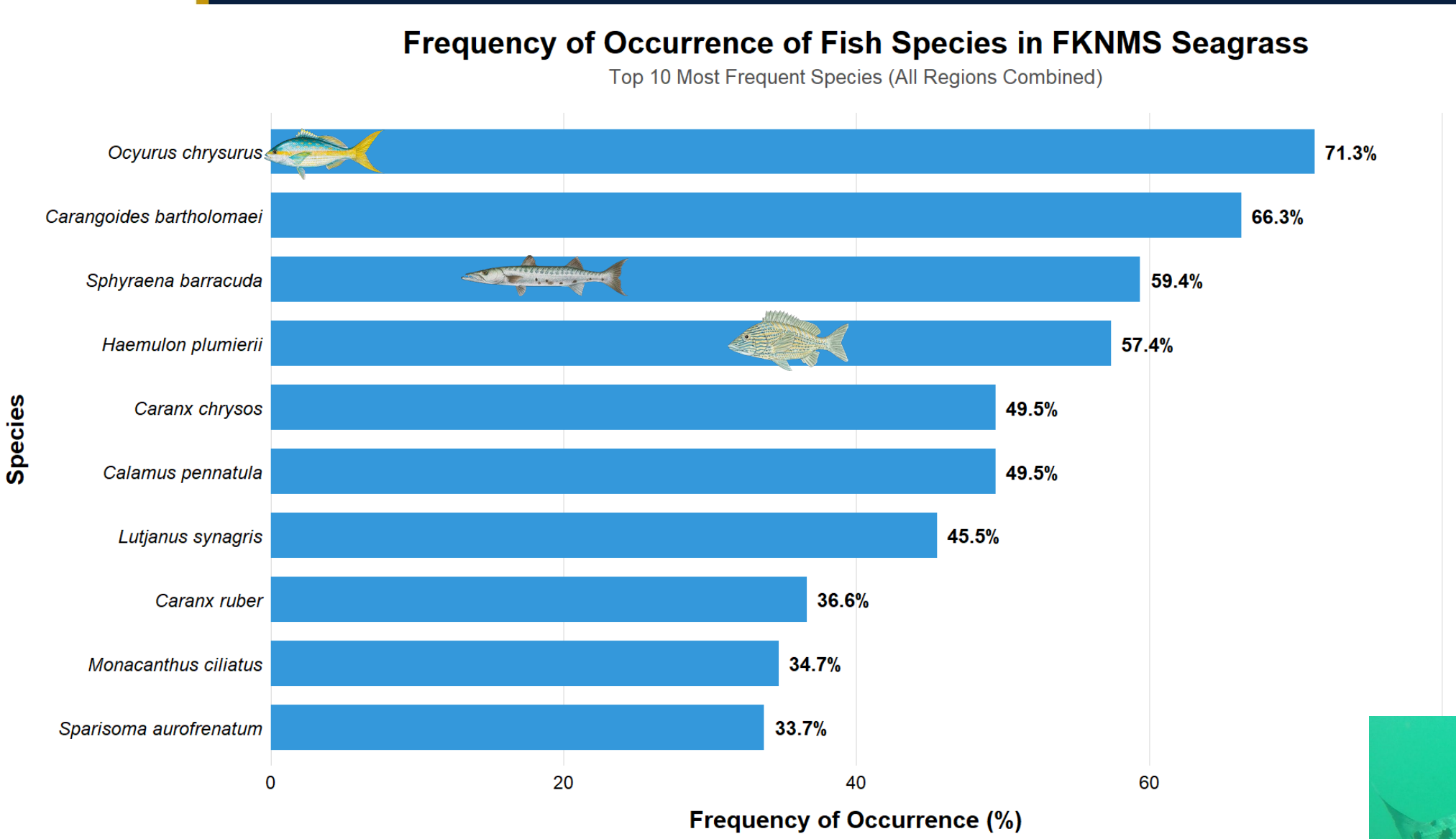
2. White Grunt

3. Yellow Jack

4. Pinfish - Dominant in Lower Keys (~30%).

5. Blue Runner





The Yellowtail Snapper, our most frequently observed species, shows high occurrence rates across all regions

Sphyraena barracuda was the most common predator (60% Frequency of Occurrence)

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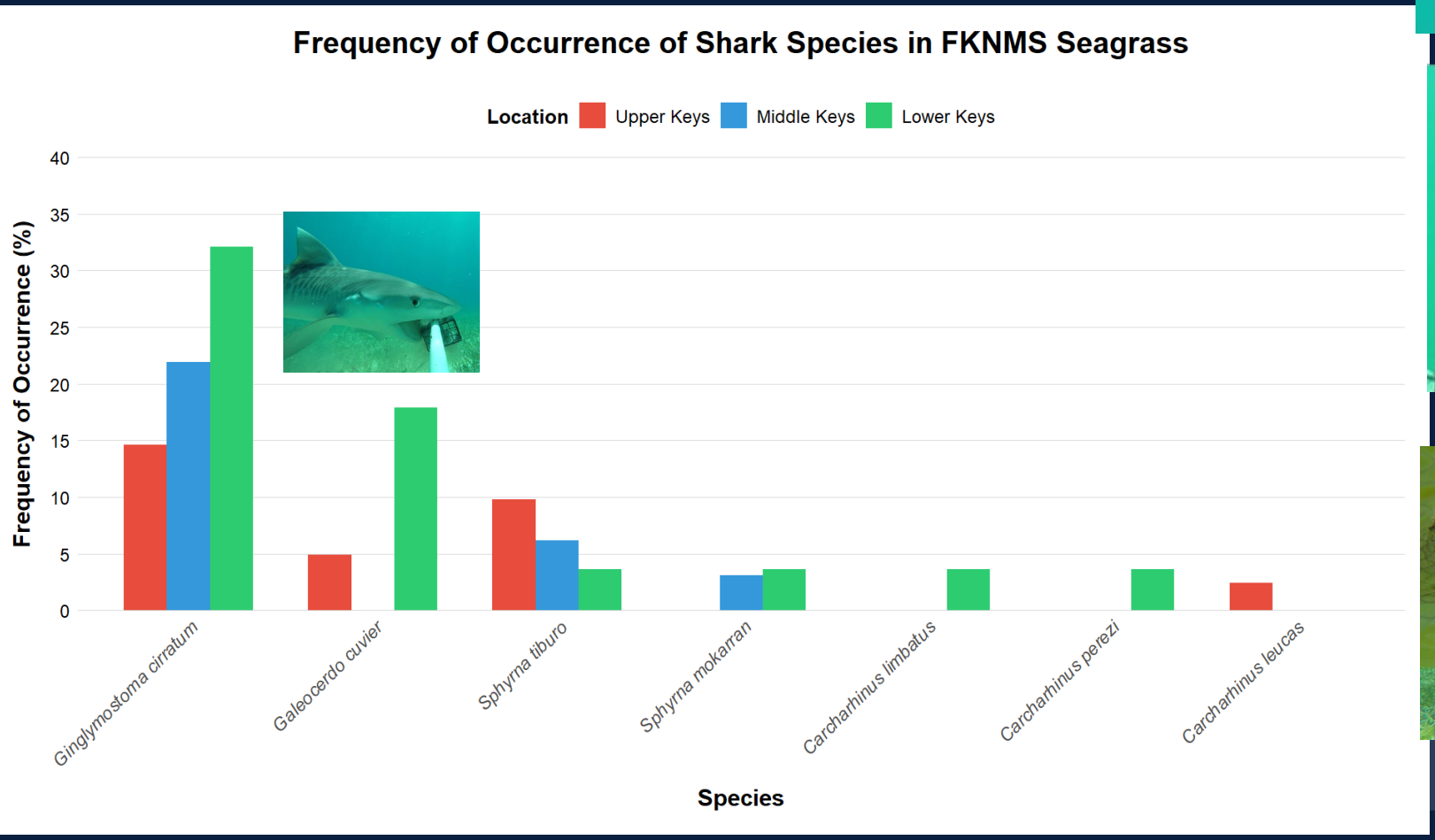
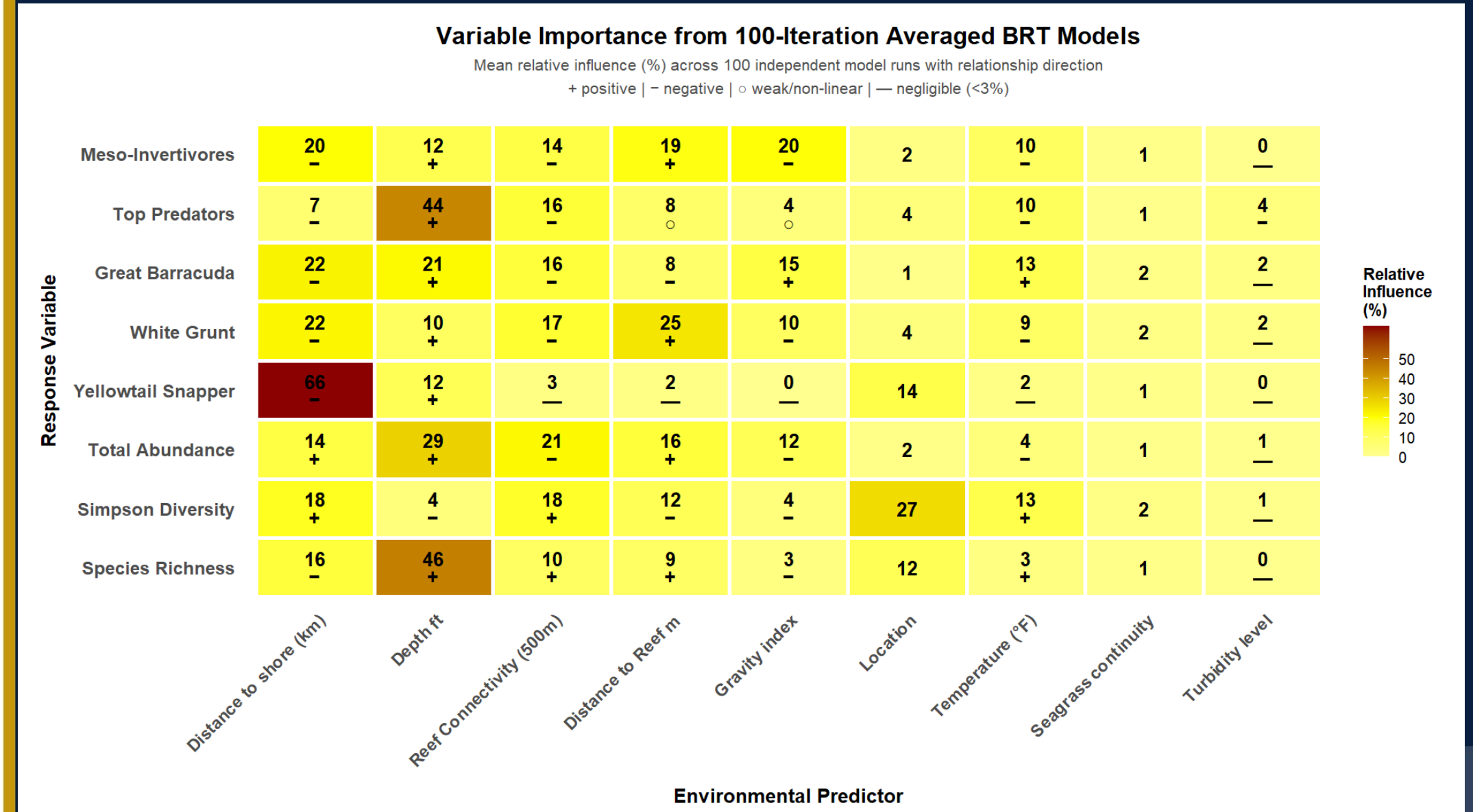
Other predators and rare species

- 7 Shark species: Bull shark, Nurse shark, Blacktip shark, Caribbean Reef Shark, Great Hammerhead Shark, Bonnethead Shark, Tiger Shark.
- Other Species: Cormorants, Turtles, Dolphins



Boosted Regressions Trees results:



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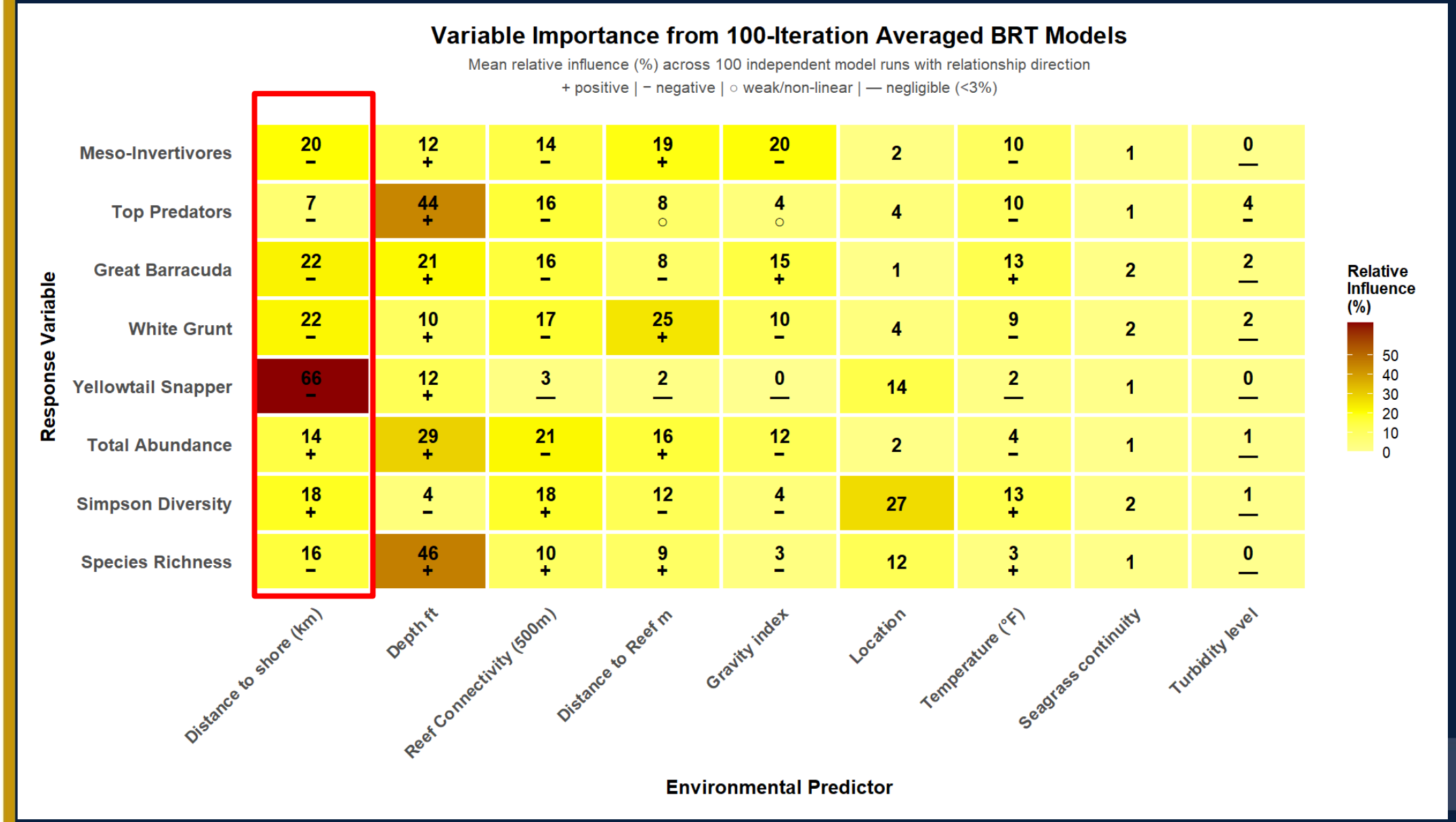
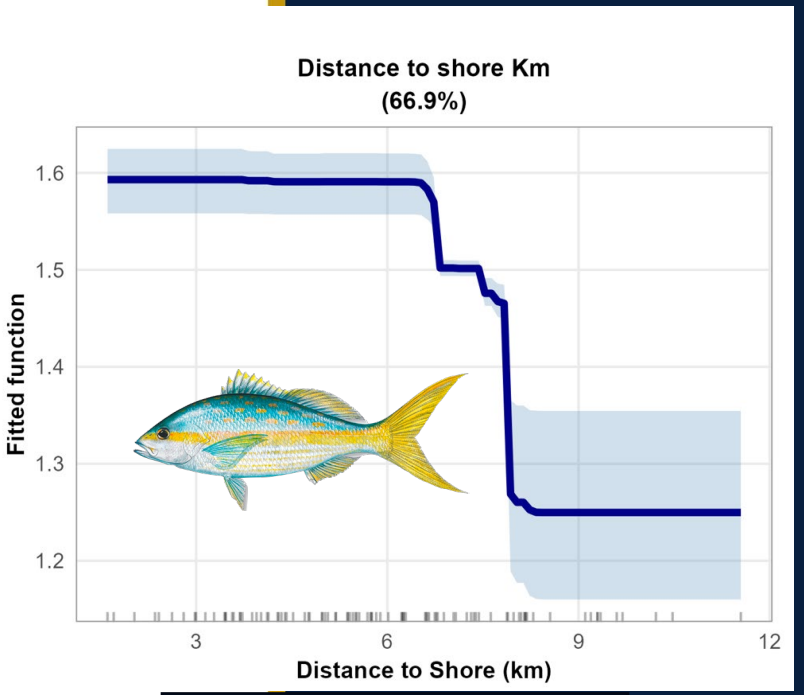
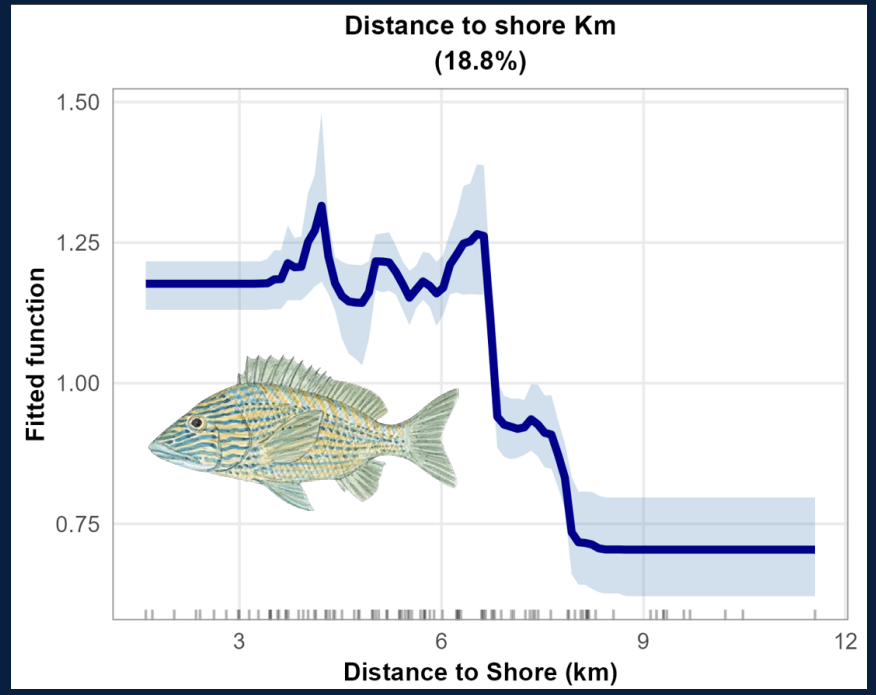


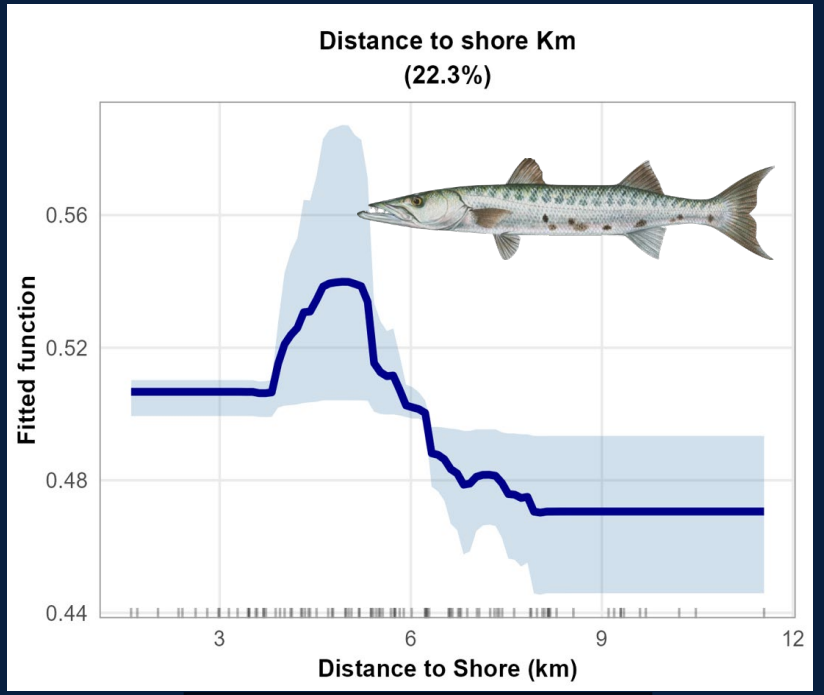
Distance to shore relationships with the most important species



Yellowtail Snapper



White Grunt



Great Barracuda

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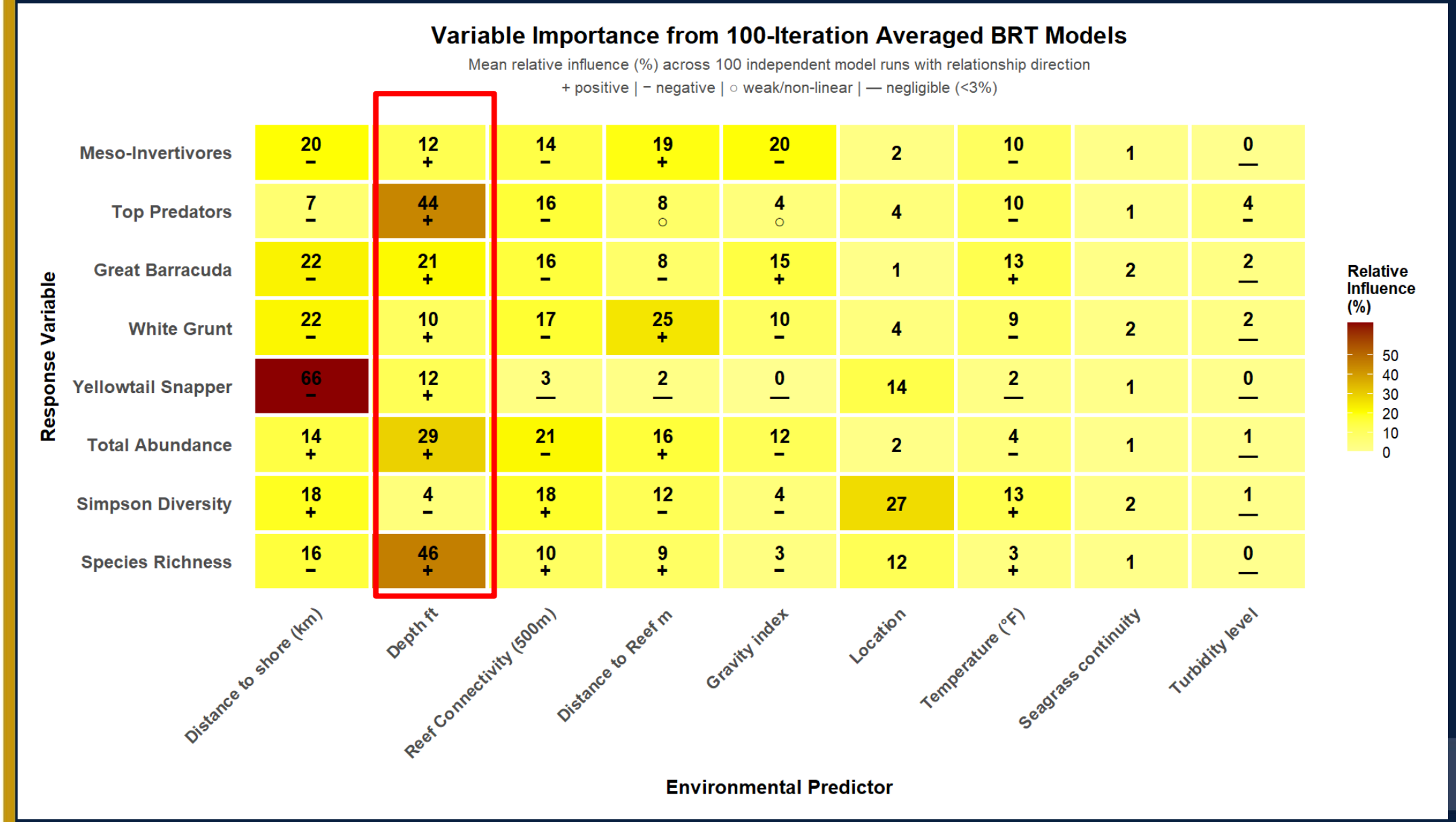
Boosted Regressions Trees results:



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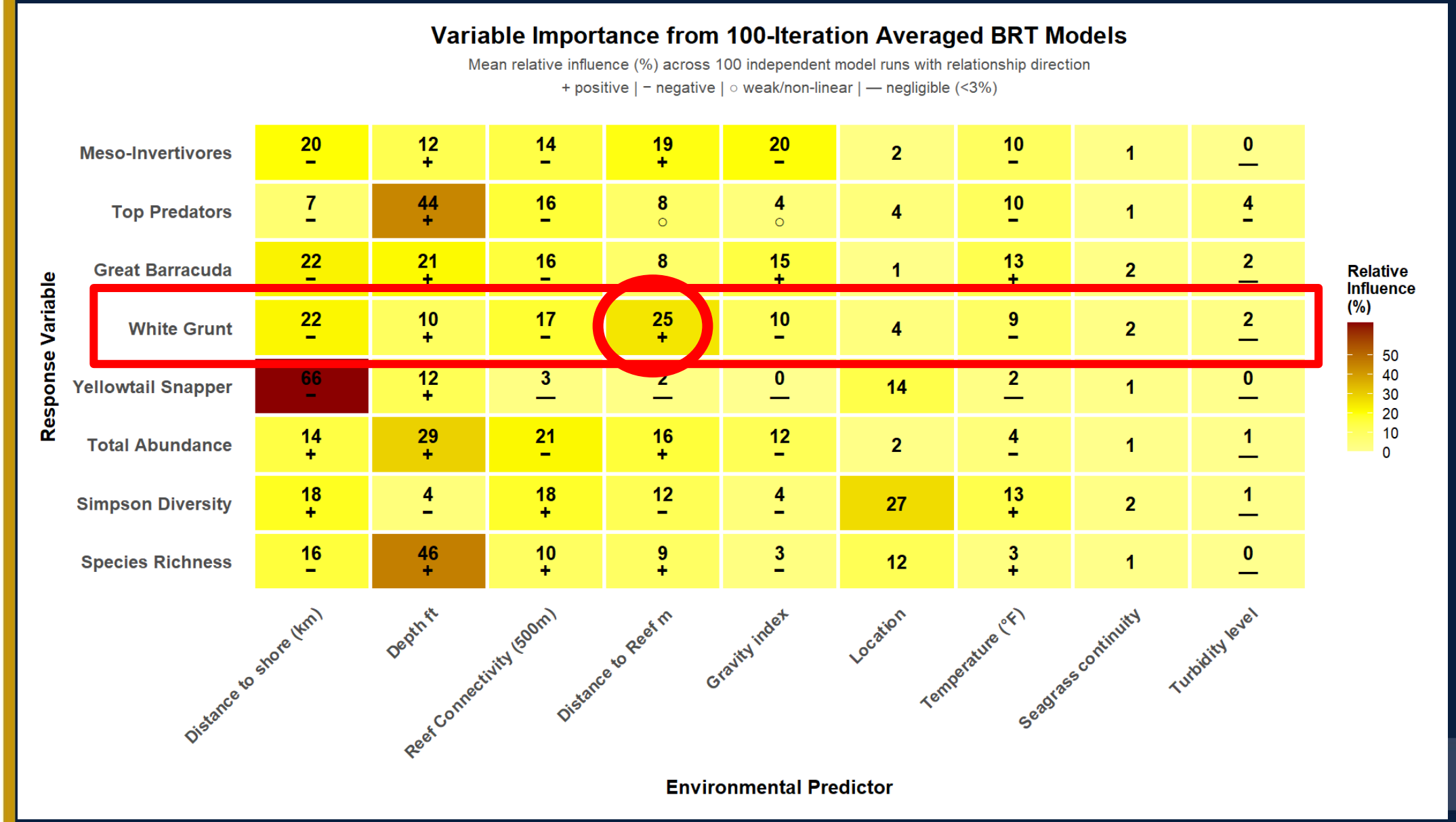
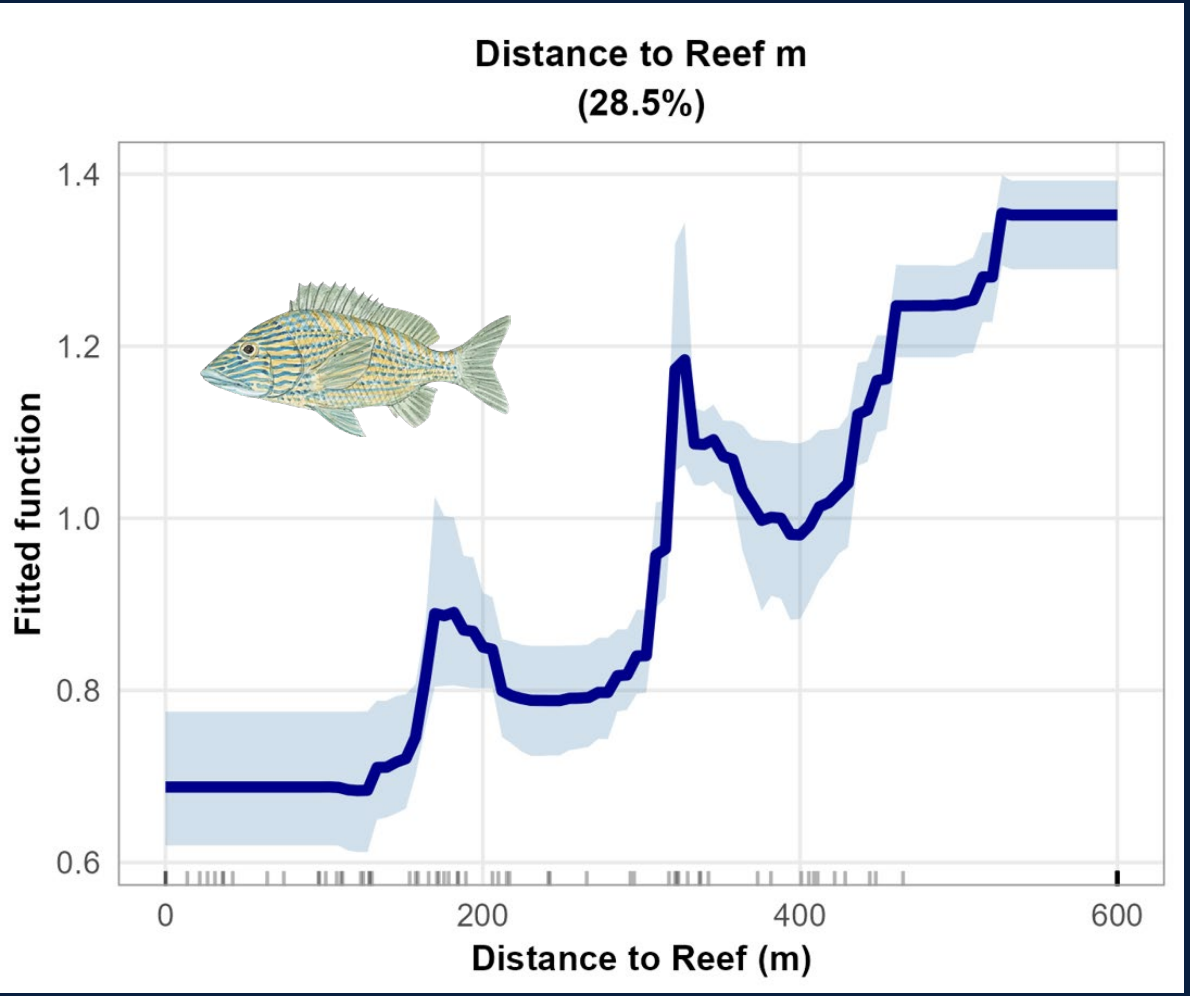
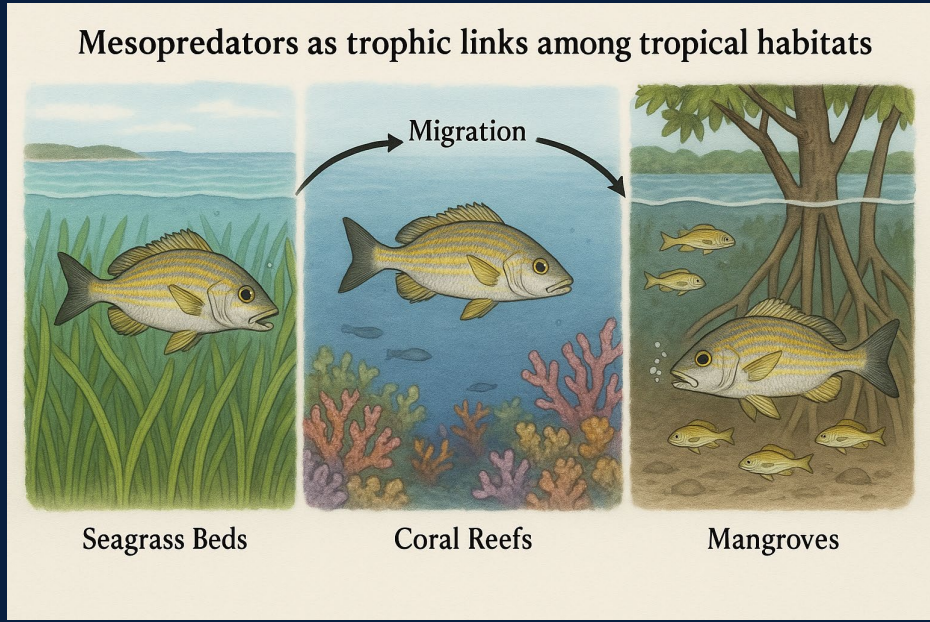


Distance to reef the most important for White Grunt





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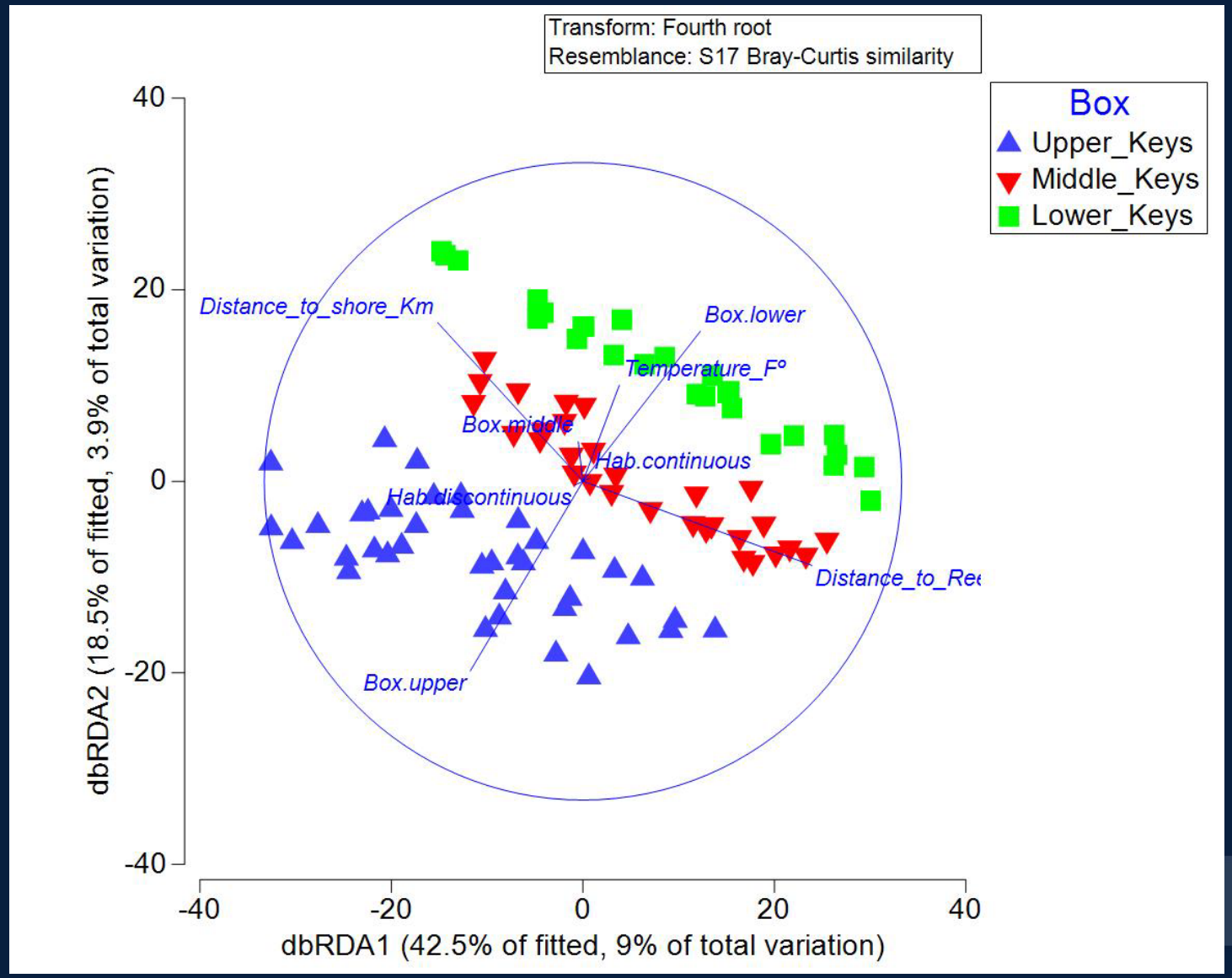
Distance-based Redundancy Analysis (dbRDA)



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Take home message:

1. Seagrass habitats across FKNMS support 95 non-cryptic fish species (~174 including cryptic with visual census)

High diversity!

2. Distance to shore influence mesopredators abundance

White Grunt (*Haemulon plumierii*)

Family **Haemulidae**.

It is a **nocturnal forager** on benthic invertebrates and fish occupying **reef habitats** during the day and **seagrass** at night.

This species holds **economic importance**.

Yellowtail Snapper (*Ocyurus chrysurus*)

Family **Lutjanidae**

It exhibits a more **mobile feeding strategy**

Considered an **economically valuable species.**

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Acknowledgments

- **FISHSCAPE project collaborators**
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- **TFEL Lab members**
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FULBRIGHT Colombia

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