

Presence, Abundance, and Distribution of Common Invasive and Non-Native Species in the Florida Keys National Marine Sanctuary

UNIVERSITY OF MIAMI

ROSENSTIEL SCHOOL of
MARINE, ATMOSPHERIC
& EARTH SCIENCE



David Ganz¹, Chris Langdon¹, Harrison M. Albert^{1,2}
dbg1043@miami.edu

¹University of Miami Rosenstiel School of Marine, Atmospheric, & Earth Science

²NOAA Florida Keys National Marine Sanctuary

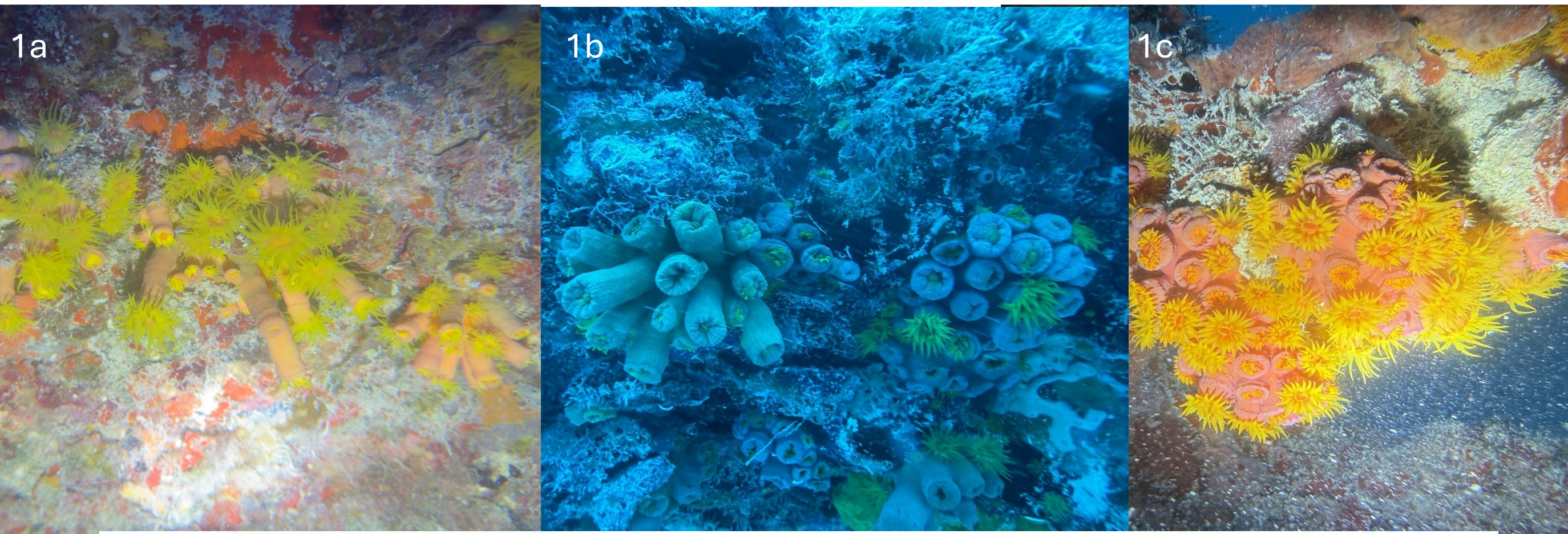


Introduction

- Florida is known to have a well-established range of native biodiversity, with South Florida having the highest EAS (established alien species) richness values in the world.¹
- Alien species, or those species that are not naturally found in a particular geographic area, are either classified as non-native or invasive based on their impact on their introduced ecosystem.
- Invasive species notoriously play a deleterious role, outcompeting native species, and possibly fueling native displacement rates.²
- Non-native species are introduced species that may not necessarily cause harm to native species by occupying unutilized niches in the ecosystem.³
- This research is part of an ongoing study that focuses on documenting the potential occurrence and abundance (or absence) of seven (7) non-native and invasive species in the NOAA Florida Keys National Marine Sanctuary (FKNMS) including:
 - Two (2) stony coral species: *Tubastraea coccinea* and *Tubastraea faulkneri*,
 - Two (2) soft coral species: *Unomia stolonifera* and *Xenia umbellata*,
 - Two (2) bony fish: *Pterois miles* and *Pterois volitans*, and
 - One (1) species of seagrass: *Halophila stipulacea*.

Methods

- Traditional scuba methods were used to survey each site.
- The site was canvassed as much as possible within safe recreational diving limits (primarily utilizing an ascending grid search pattern).
- If an alien species was observed, identification was made to the species level if possible, and depth, abundance, and an estimate of reproductive fecundity (i.e., juvenile vs. adult for *Pterois spp.*) were noted. Additional information about observable behavior or surrounding habitat complexity was also recorded.
- Dive site names and/or GPS coordinates were recorded for each site post-dive.
- Sites were categorized by depth (i.e., deep [>60ft], moderate [30-59ft], shallow [<30ft]) and type (i.e., reef or wreck).
- Data was analyzed in Microsoft Excel using conditional probability to determine the likelihood of locating any of the noted species in a given depth.



	Indian: <i>Pterois miles</i>	Pacific: <i>Pterois volitans</i>
Dorsal Fin Rays	10	11
Anal Fin Rays	6	7
Pectoral Fin Size	Shorter	Longer
Spot Size	Smaller	Larger
Geographic Range	Africa – Indonesia	Indonesia – W Pacific

Schultz, 1986

Fig 1. 3 images of *Tubastraea spp.* and an ID guide for *Pterois spp.* Fig 1a-1c images were taken on October 2025 at the USNS Vandenberg in Key West, FL. Fig 1a. *T. faulkneri*. Fig 1b. *T. faulkneri* (left) side-by-side with *T. coccinea* (right). Fig 1c. *T. coccinea*. Fig 1d. Meristic differences of *Pterois spp.* (Schultz, 1986).

Literature Cited

¹Dawson, W., Moser, D., van Kleunen, M. et al. Global hotspots and correlates of alien species richness across taxonomic groups. <https://doi.org/10.1038/s41559-017-0186>

²H.A. Mooney, & E.E. Cleland, The evolutionary impact of invasive species. <https://doi.org/10.2307/1444950>

³Boltovskoy D, Sylvester F, Paolucci EM. Invasive species denialism: Sorting out facts, beliefs, and definitions. <https://doi.org/10.1002/ece3.4588>

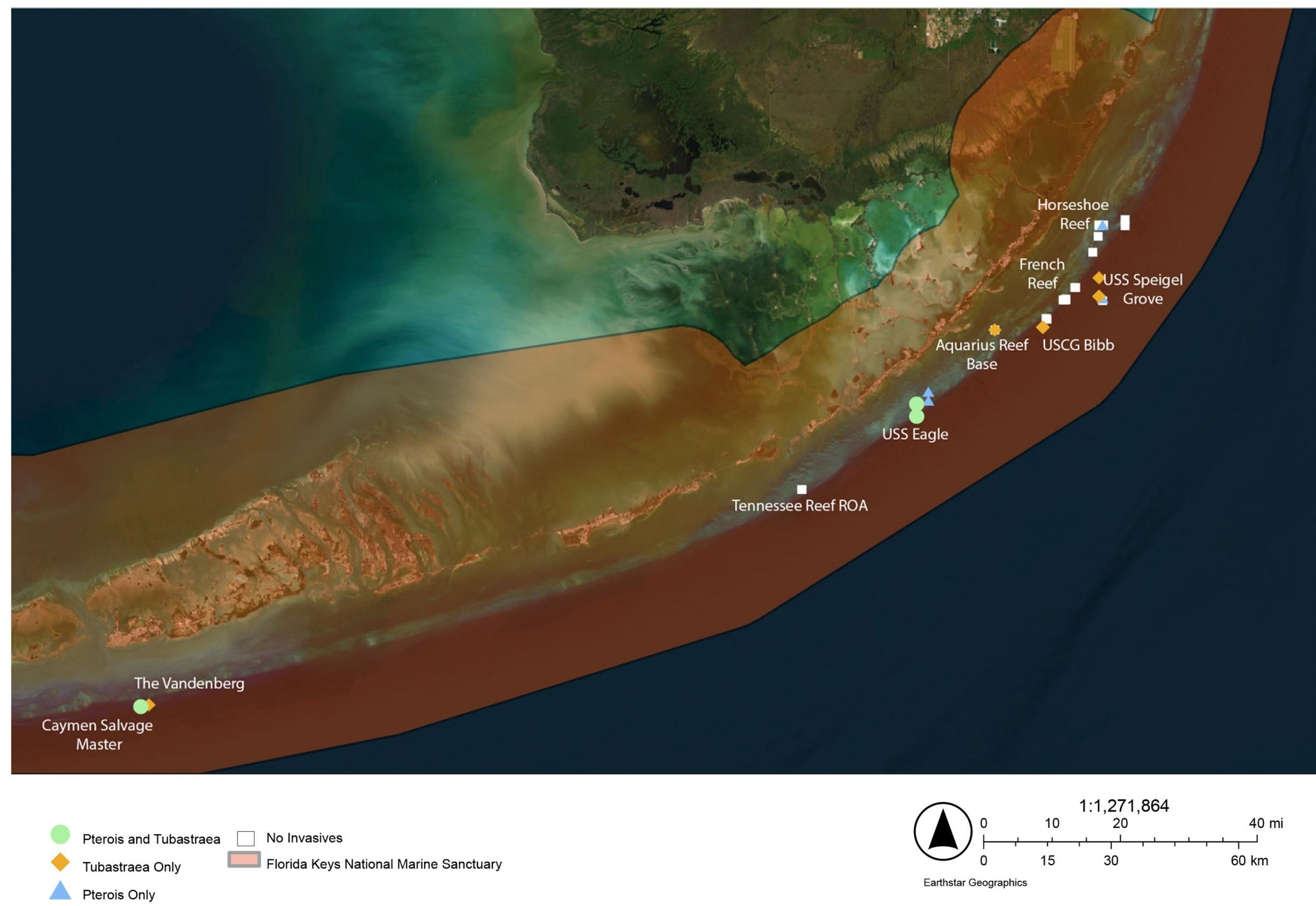
⁴Schultz, E. T. (1986). *Pterois volitans* and *Pterois miles*: Two Valid Species. <https://doi.org/10.2307/1444950>

⁵Ruiz-Allais, Juan & Benayahu, Yehuda & Lasso-Alcalá, Oscar. (2021). The invasive octocoral *Unomia stolonifera* (Alcyonacea, Xeniidae) is dominating the benthos in the Southeastern Caribbean Sea. <https://doi.org/10.5281/zenodo.4784709>

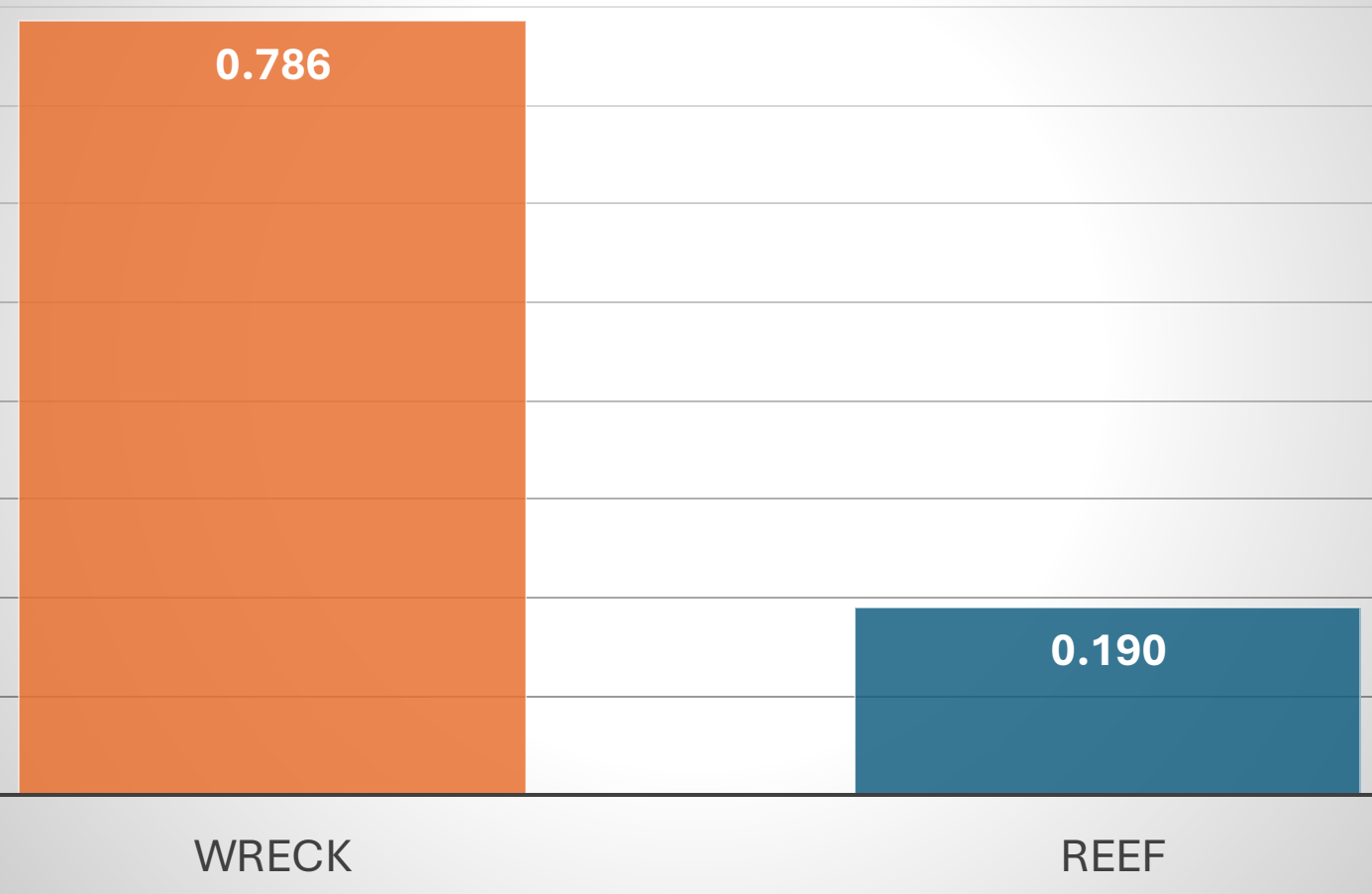
⁶Lages, Bruno & Fleury, Beatriz & Menegola, Carla & Creed, Joel. Change in tropical rocky shore communities due to an alien coral invasion. <https://doi.org/10.3354/meps09290>

Results

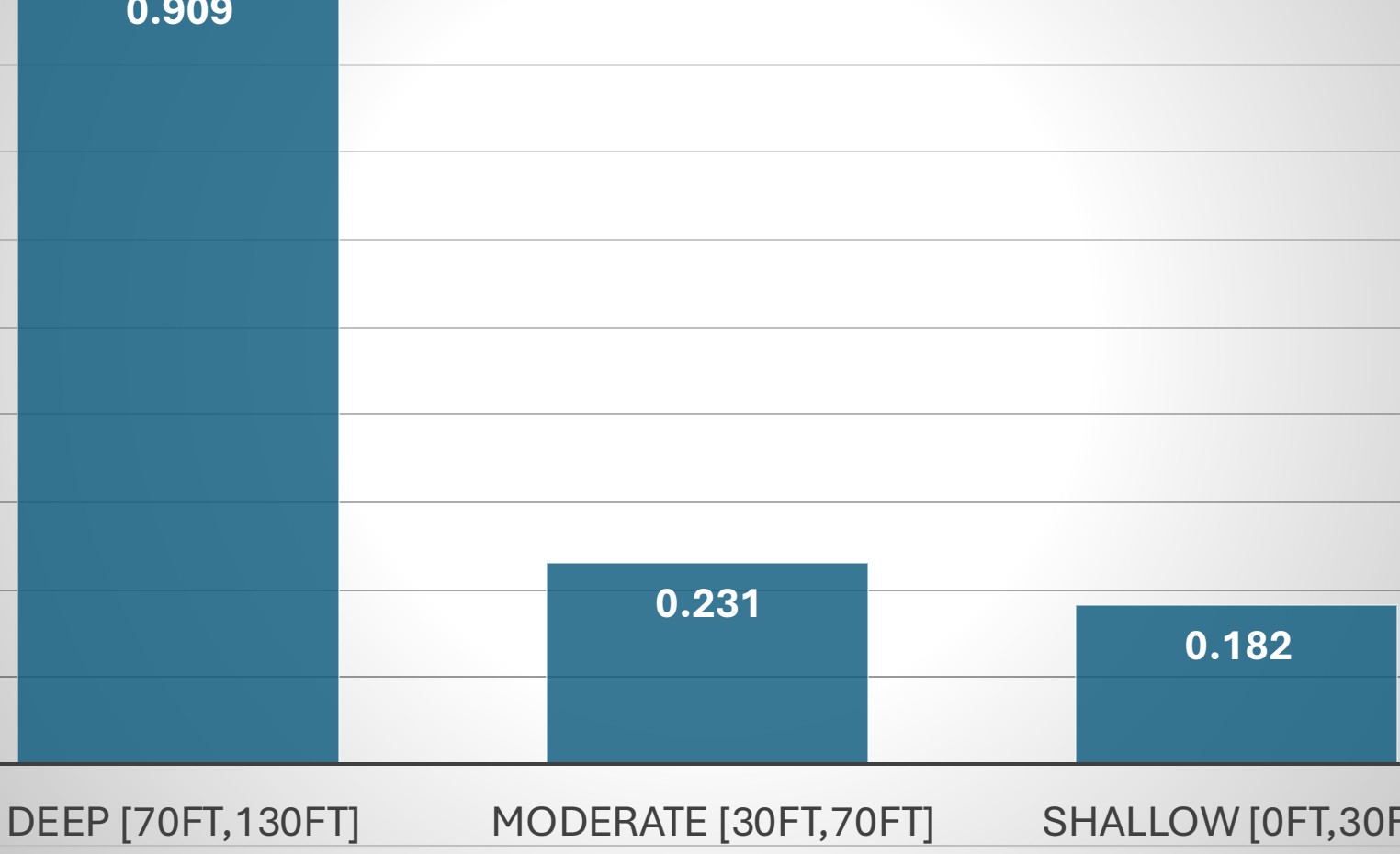
Invasive Species Survey Dive Site Map



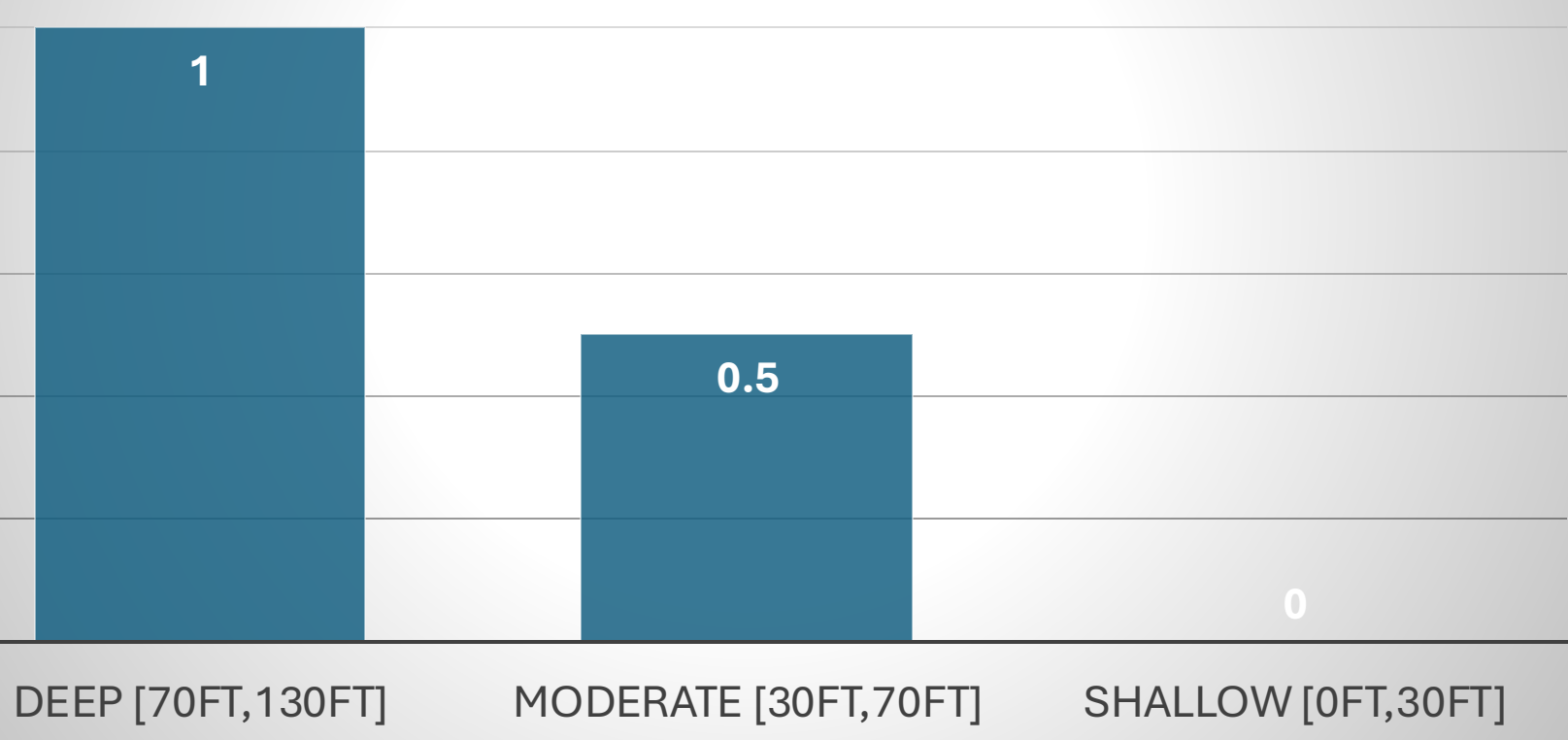
Conditional Probability of Invasive Presence Given Site Type



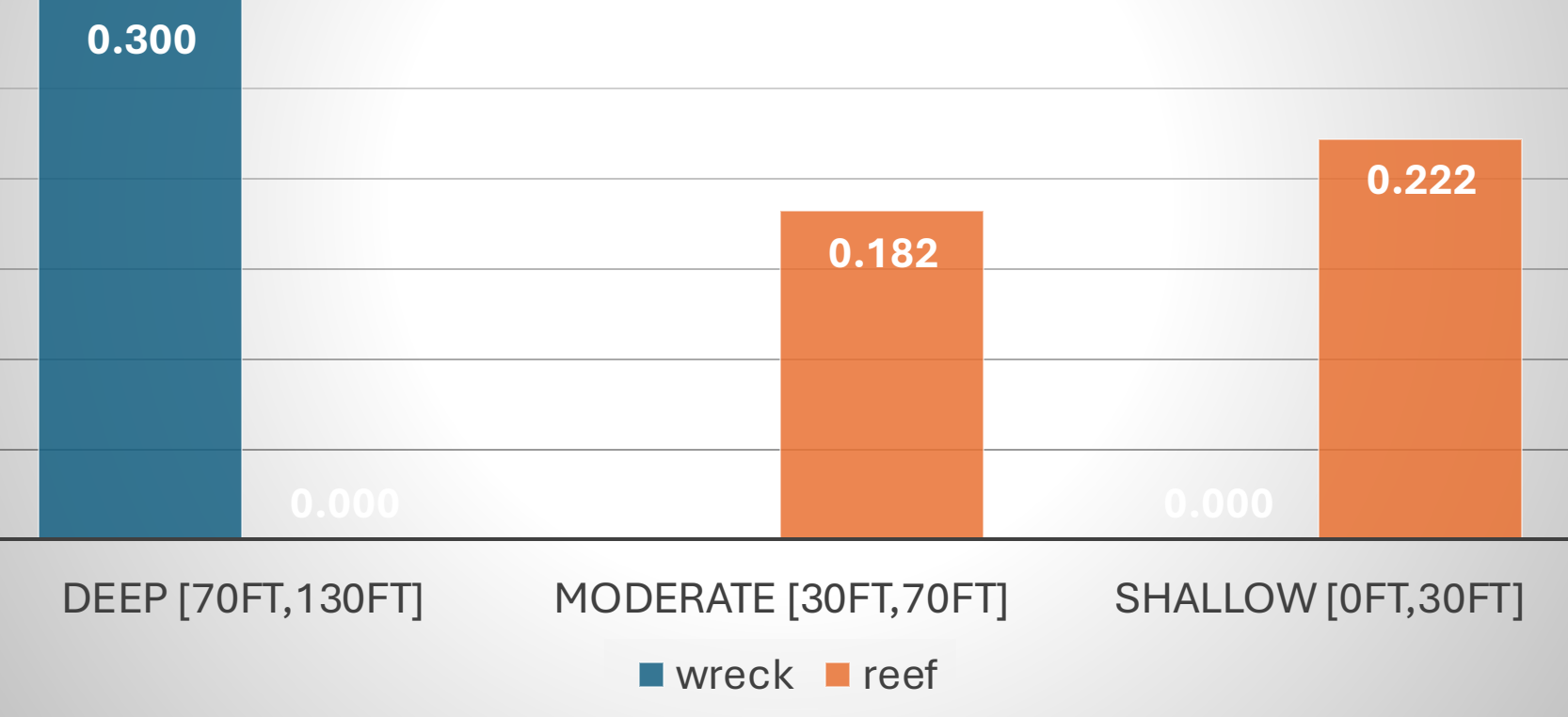
Conditional Probability of Invasive Presence Given Depth



Conditional Probability of *Tubastraea spp.* Given Depth and Wreck



Conditional Probability of *Pterois spp.* Given Depth and Site Type



Conclusion

- From analyzing the data collected, this research presents the conditional probability of the noted species to be found on similar types of substrates and associated depths within FKNMS.
- Wreck sites (especially deep wrecks >60ft) show a significantly higher presence of alien species.
- No *Unomia*, *Xenia*, or *Halophila* were noted on any dives within the sanctuary. This is an incredibly positive finding as these species can overrun native ecosystems.⁵
- Pterois spp.* had a fairly mottled and distributed presence by geography, depth, and site.
- Tubastraea spp.* were found on all deep wreck sites and one (1) moderate depth site (Aquarius Reef Base – 60ft) but were not geographically limited.
- Additional dives need to be conducted at sites with varying depth ranges, particularly in the Middle and Lower Keys as these geographic regions were under-surveyed in this study due to logistics.
- Future research needs to be conducted within FKNMS in order to understand the effect *Tubastraea spp.* has on the native benthic species of artificial substrates. In other parts of the world, *Tubastraea spp.* has been known to affect the benthic ecosystems they inhabit, such as increasing native biodiversity of the area.⁶ Additional research is needed to understand if the species have similar impacts in FKNMS.
- Overall, the data from this study provides a baseline assessment of common invasive and non-native species observed within FKNMS and also serves as a conditional prediction tool for researchers to use who are interested in locating these species at similar sites within FKNMS.

Acknowledgements

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