Integrating field marine plankton and satellite seascapes observations: Science products for management in the Southeast Marine Biodiversity Observation Network (MBON)

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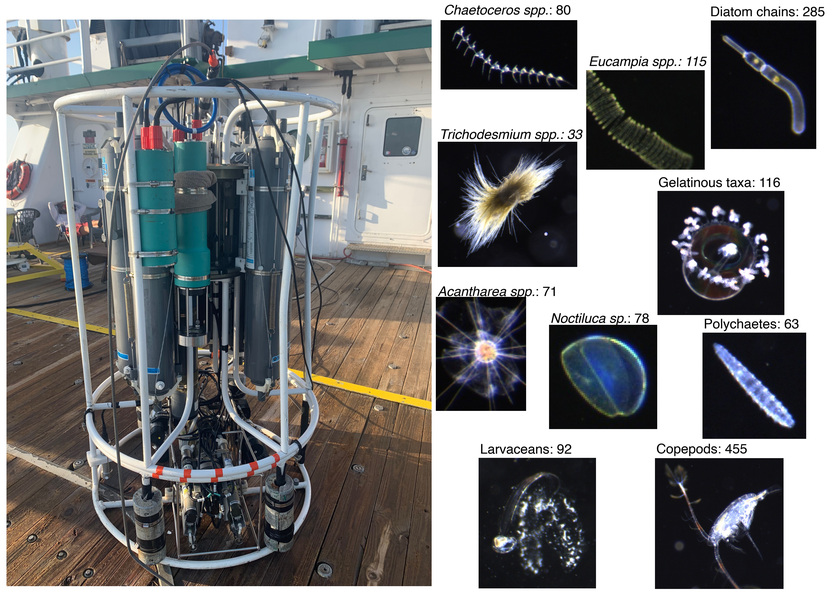
MBON Marine Biodiversity Observation Network

ROSENSTIEL SCHOOL MIAMI COOPERATIVE INSTITUTE for MARINE & ATMOSPHERIC STUDIES

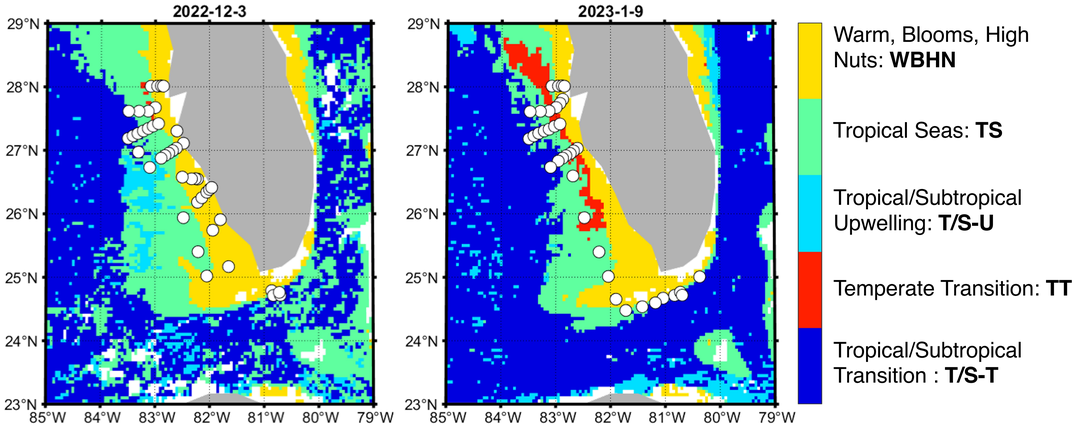
Introduction

- This study merged image-based plankton observations with satellite seascapes records to test whether plankton assemblages show distinct affinities with seascape classes in south Florida waters.
- Three field campaigns aboard the *R/V Walton Smith* (U. Miami) were conducted in December 2022, and January and March 2023.
- A Continuous Particle Imaging and Classification System (CPICS ; Coastal Ocean Vision) mounted on a CTD rosette was used to collect plankton profiles.
- Images collected at 10 frames per second and ~ 4.5 μm per pixel were manually annotated to examine dominant micro-phytoplankton species and zooplankton taxa of sizes between ~ 100 μm and 10 mm.
- Each plankton occurrence was matched to a unique seascape class.



Three cruises: December 3-9, 2022; January 11-17, 2023; March 2-9, 2023.
CTD profiles: 134 / # stations: 66 / manually-annotated images: 1,388

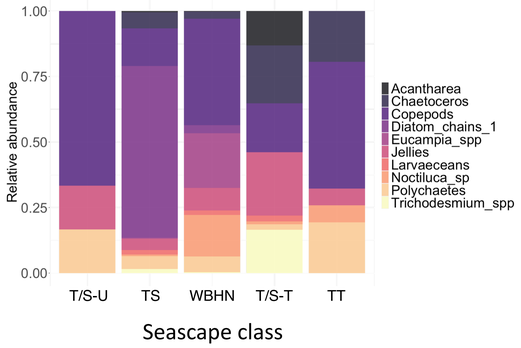
Satellite seascapes

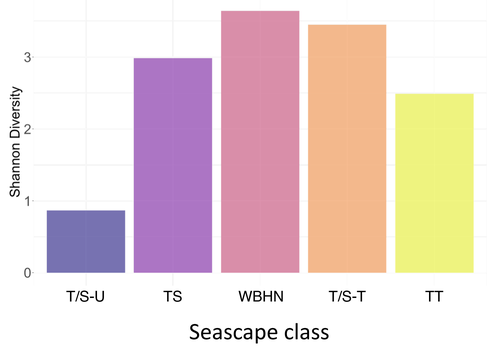


- Satellite seascapes are a deep-learning classification of surface biomes based on remotely-sensed variables of ocean color and physical properties (i.e. Chl-a, CDOM, nFLH, SST, SSS, Absolute Dynamic Topography (ADT), ice cover).
- Maps on the left show 8-day seascape integrations during December 3-10, 2022, and January 9-17, 2023 (white circles = sampled sites).
- The Temperate Transition (TT, in red) seascape covered a broad area along the west Florida shelf during the January cruise.

Plankton communities in sampled seascapes

- TS (light green class on maps above) showed strong dominance of the centric diatom *Eucampia spp.*
- TT observed during the January survey showed strong dominance of polychaetes, copepods, and *Chaetoceros spp.*
- *Trichodesmium spp.*, jellies, and *Acantharea spp.* were strongly represented in the oligotrophic T/S-T seascape.



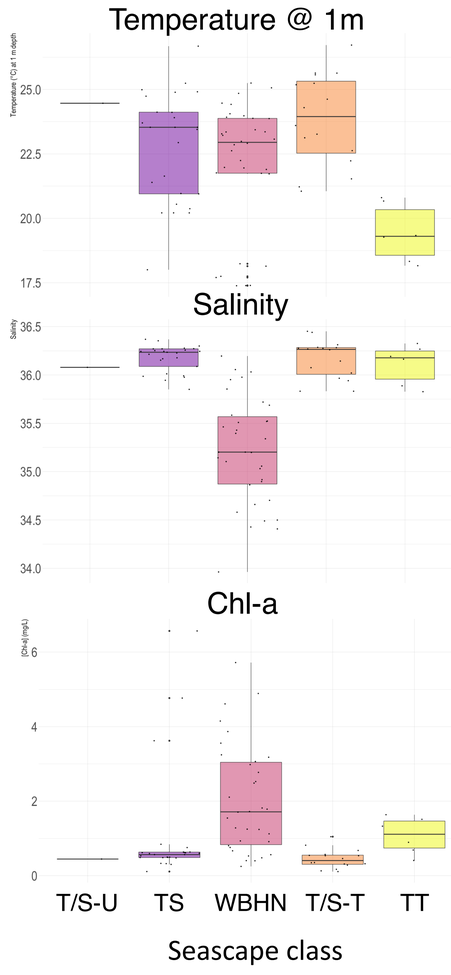


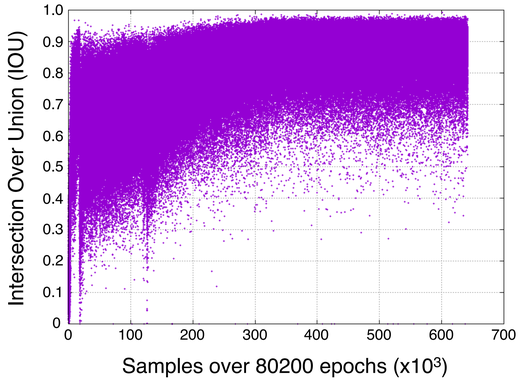
Seascapes hydrography

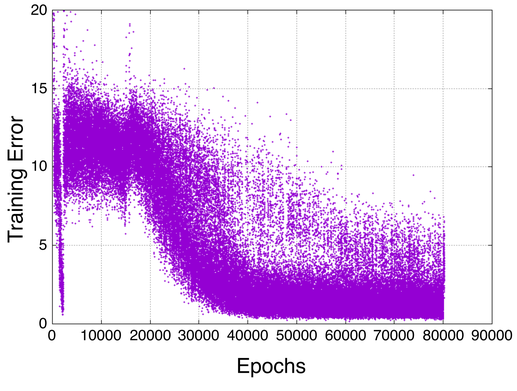
- Sampled seascapes showed distinct hydrographic conditions and phytoplankton biomass levels (as Chl-a concentration).
- The Warm, Blooms, High Nuts (WBHN) and the Tropical Seas (TS) seascapes dominated the surveyed area.
- The WBHN seascape indicates area of lower salinity and coastal runoff influence, and mesotrophic conditions with elevated phytoplankton biomass.
- The Temperate Transition (TT) seascape indicates bloom-conducive habitat.

Automated classification of plankton groups

- A Deep Learning Image Classification Environment (DICE; Coastal Ocean Vision) was used to classify selected plankton groups using a convolutional deep neural network YOLO algorithm.
- Plankton groups used: diatom chains, copepods, *Eucampia spp.*, *Noctiluca sp.*, polychaetes.
- Training: 80% / Validation: 20%
- Improving classifier performance will require enhancing the number of high-quality images in each category to refine training and validation of the YOLO algorithm.







DS: WS_cruises ClassName	True Pos	Correct thresh=.5	Incorrect thresh=.5	Incorrectly Classified
Chains	27%	22/80		
Copepods	23%	21/91	1	Noctiluca(1)
Eucampia	04%	1/23	1	Chains(1)
Totals: 3 classes	22.7%	44/194	2/56 (3.6%)	
Summary: 891 Training Images, 222 Validation Images, 194 objects, Cfg: TS.Subset.1/20221214_2028				

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