MBON remote sensing working group
MBON utilizes multiple platforms at multiple scales, advances B/E remote sensing in four ways:

1. Plankton functional type algorithms: composition and size
2. Foundation Species: kelp, coral, seagrass
3. Species Distribution Models
4. Seascape ecology: pelagic habitat

Important pathfinder activities for NASA PACE and SBG
Decadal Phytoplankton Group Dynamics

- Nearly 20 years of cross-channel phytoplankton pigment biomarkers
- Shown are diatom, dinoflagellate, prymnesiophyte, chlorophyte & picophytoplankton groups
- Diatoms dominate, vary seasonally modulated by climate variations
- Dinoflagellates vary on decadal time scales due to advection of southern waters (supported by ROMS)
- Pico/nanos show seasonal succession
- Partnership with Plumes & Blooms

Blooms of different phytoplankton groups have different spectra (from Catlett and Siegel, 2018) Seascapes are dominated by different phytoplankton (diatoms vs cyanobacteria). Microscopy and pigments confirm different communities across seascapes. (Montes et al. 2020; Kavanaugh et al. 2014)
Integrating subsurface plankton distributions, higher trophic levels, connecting theory, and pipelines

- How do phytoplankton CS and PSD translate to zooplankton CS and PSD?
- How do subsurface plankton distributions correlate with their surface seascape?
- Is there a need to incorporate subsurface features into seascape classification?

Deliverable:
- Open access deep learning pipeline (Schmid et al. 2021). Developed for zooplankton images, but easily repurposed for other types of images (e.g., phytoplankton from IFCB, satellite imagery)


End Users: Sanctuaries, NWFSC, IEA
Owners: Cowen, Sponaugle, Schmid, Kavanaugh, Fischer, Moore
Foundation species provide habitat for entire communities

Abundances and Diversity of corals, seagrasses, and kelp
Landsat, Sentinel, and Rrs from in-situ optics
Owners: Bell, Siegel, Muller-Karger
End-users: PACE, SBG Science and Applications

Beyond imaging kelps: physiology and foodweb dynamics!
Predicting food-web structure through physics, primary production, and turnover of primary producers.
Owners: Tom Bell and Bob Miller

- Determine relationships between species abundance and primary production, biogenic structure & physical environment
- Use a novel food web to refine hypothesized community states and identify archetypal indicator species
- Predict and validate spatial patterns of rocky reef biodiversity across the Southern California Bight
Species distribution and Semi-analytical models

End-users: IEA, MBON

Owners: Cimino, Messié, Santora, Schroeder

Next steps: incorporate more assemblage info, multi-species modeling
Effect of climate and events on habitats: Management relevance

Heatwaves and ENSO: productive seascape decreases extent and dominance
Decreases in krill, increased warm water species, compression of forage habitat, increased conflict.

Santora et al., 2020 (Nature Comm), 2021 (Oceanography)
Downscaling next steps

Model solutions with increased classes to highlight regional variability are available for each MBON node. Training during next two XMBON working groups.

Continuity: CoastWatch MODIS to VIIRS in new Aqua Terra Suomi NPP award
End User: MBON Nodes, NMS, NOAA PMEL (OA program)
We continue to refine spatial scales, but we need to integrate additional remote sensing assets, strategic in water assets, and moorings.

Higher resolution measurements will be key for observing change in coastal embayments
Owners: Otis

Seasonal and interannual variability in warmer seascapes from Pacific Loss of pack ice (30-40%). Increase cloud cover (no ocean color, below ice threshold). Solar angle insufficient during shoulder season with increased open periods. CAN WE PLEASE GET LIDAR?? Necessity for in water assets (e.g. CEO Mooring, Danielson).
Owners: Danielson, Grebmeier, Iken, and Kavanaugh
We’re getting the products out there……

- Global Seascapes are distributed through NOAA CoastWatch, R package, R-shiny
- High resolution products will be hosted by IOOS Ras (Dec-March): NANOOS MBON NCC, AOOS- AMBON, Somewhere in Florida

[cwcgom.aoml.noaa.gov/cgom/OceanViewer/#](cwcgom.aoml.noaa.gov/cgom/OceanViewer/#)
cwcgom.aoml.noaa.gov/thredds/SEASCAPE_MONTH.html
marinebon.org/seascapeR/
shiny.marinebon.app/seascapes
Owners: Trinanes, Best, Kavanaugh, Montes, Otis, Muller-Karger
Summary

- MBON remote sensing tracks: plankton groups, foundation species, higher trophic levels (SDMs) and pelagic habitat extent and diversity
- Remote sensing WG members integrates instrumentation (traditional and new technology), models, and ecological time series (context, mechanism, and partnerships). Provides validation, depth information, and increased taxonomic resolution.
- Indices used for marine ecosystem management: National Marine Sanctuaries, fisheries management, Integrated Ecosystem Assessment and global indicators EBVs and EOVs. PACE/SBG Application Readiness. Engage early, listen, and be ready for diverse needs.
- Indices also used for innovative science, and trans-sector science (e.g. academic-agency partnerships with IFCB). Science as stakeholders. How do we continue innovation and PACE/SBG preparation? Focused X-MBON studies across working groups?
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- Pico/nanos show seasonal succession
- Partnership with Plumes & Blooms NASA funded – just reupped for 3 more years!
PnP data hosted on SBC LTER database

Catlett et al. *Progress in Oceanography* [2021]