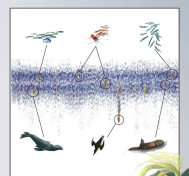
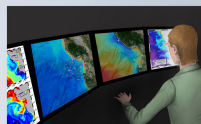
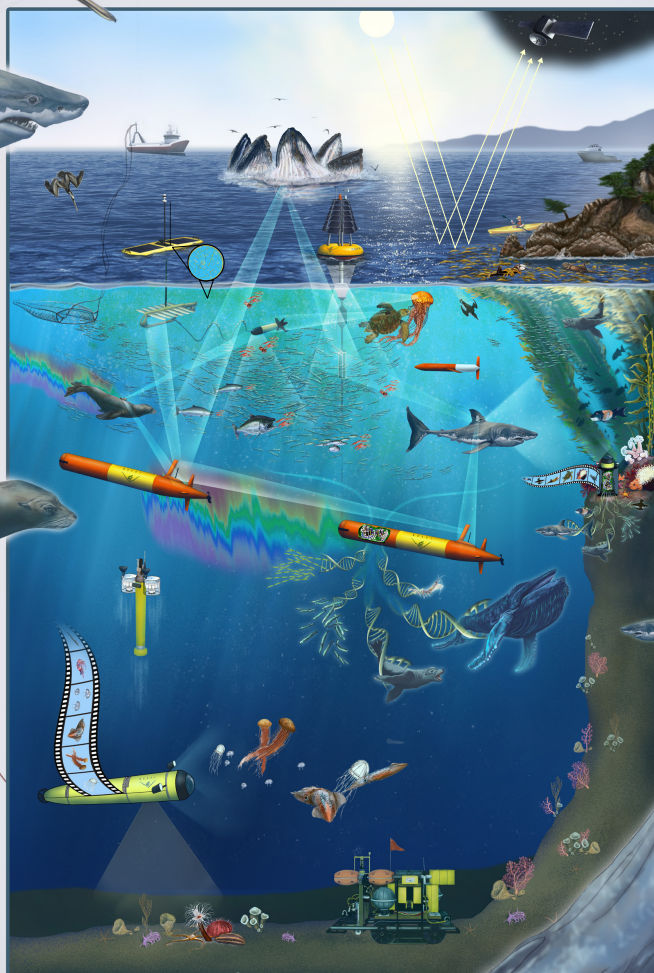


Observing Life in the Sea



Washington, DC
April 2018



MBON

Marine Biodiversity
Observation Network


Sanctuaries MBON

Monterey Bay,
Florida Keys, and
Flower Garden Banks
National Marine Sanctuaries


Principal Investigators:
Frank Muller-Karger (USF)
Francisco Chávez (MBARI)





Science-policy news brief: get involved


[MENU](#) 

nature
International journal of science

 Search

 E-alert

 Submit




 Login

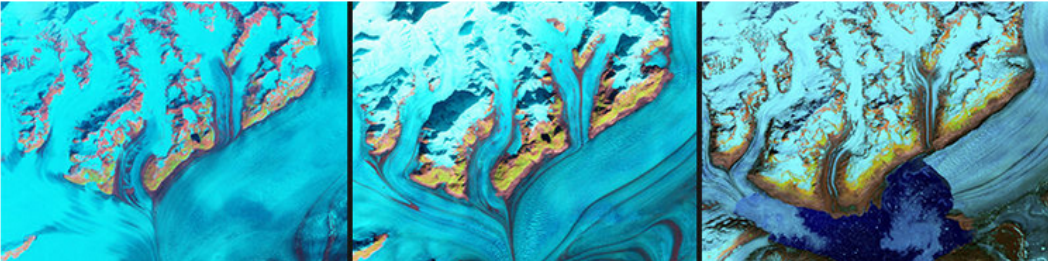
NEWS • 24 APRIL 2018

US government considers charging for popular Earth-observing data

Images from Landsat satellites and agricultural-survey programme are freely available to scientists — but for how long?

Gabriel Popkin



RELATED ARTICLES

Earth-observing companies push for more-advanced science satellites

Landsat 8 to the rescue

Vision

Develop a community of practice...

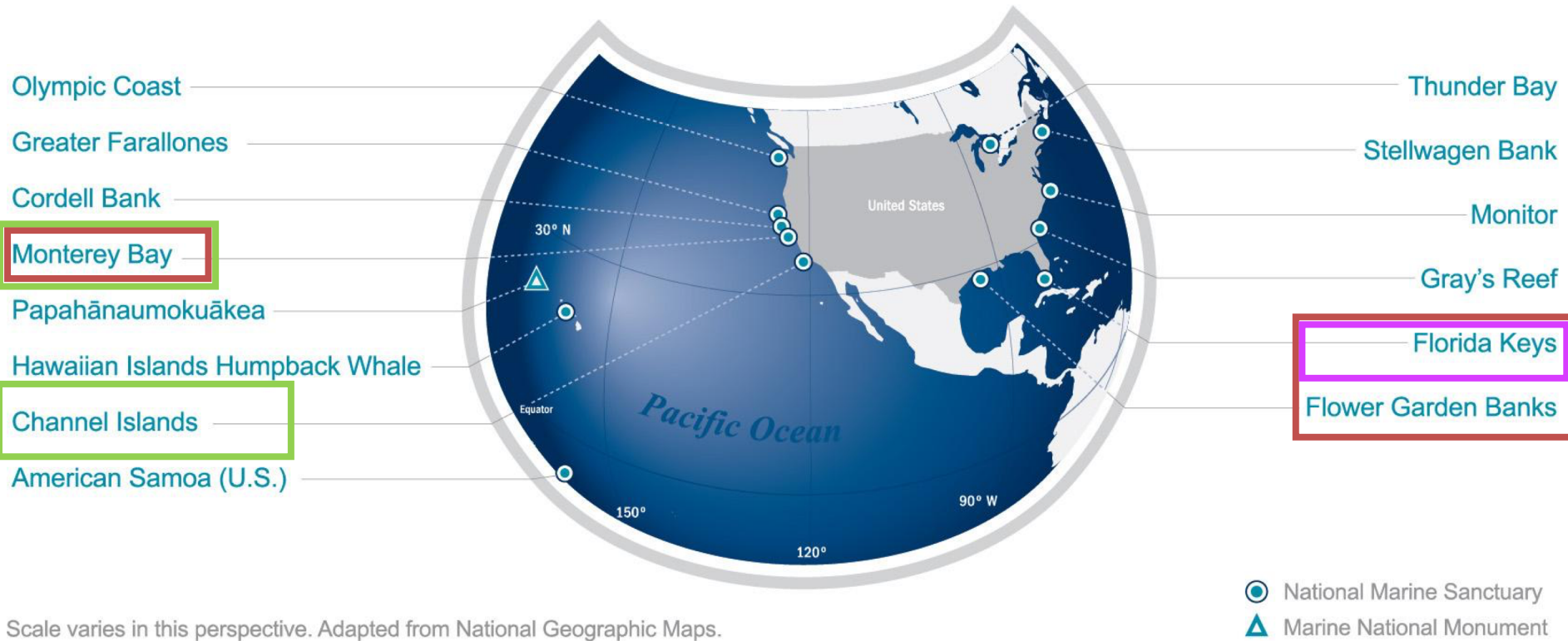
...to understand marine biodiversity
and how it changes over time

...for fundamental ecology studies
and ensure sustainable development

Addressing Sanctuary Needs: data & tools

Sanctuary sites engaged with California Current IEA, MBON demonstration projects and Gulf of Mexico IEA

NATIONAL MARINE SANCTUARY SYSTEM



U.S. MBON PORTAL

Collaboration of IEA with



MBON

Marine Biodiversity Observation Network

Smithsonian MarineGEO Partnership

Our infrastructure is people



- **Vital signs:**
coastal seabed focus
diversity time series
- **Diagnostic tests:**
Coordinated exp'ts
- **Capacity building**



Main activities

- Field data collection
- Identify, obtain other biological data
- New approaches:
 - Seascapes (biogeographic areas from satellite obs.)
 - Environmental DNA (eDNA)
- Adopting and improving data schema for NOAA IOOS operational applications
 - Darwin Core / OBIS
- Development of a global MBON

The Sanctuaries MBON pilot concept

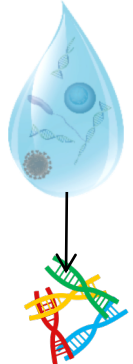
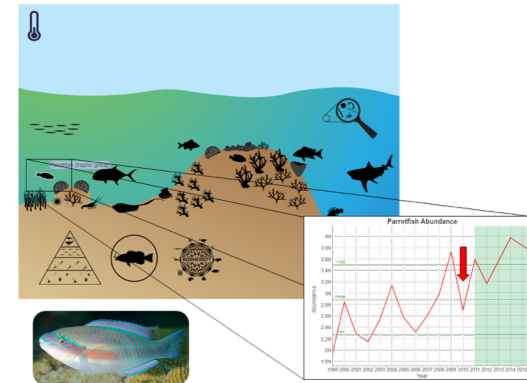
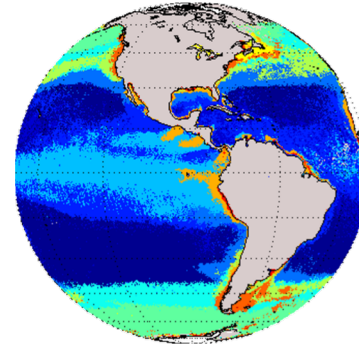


Observations

Seascapes

Data Integration

eDNA



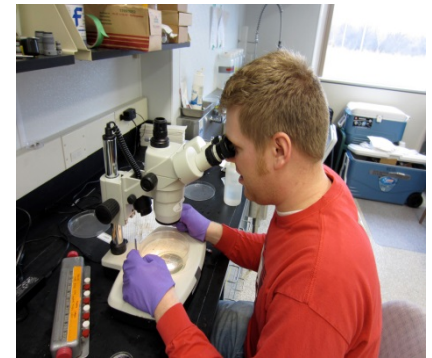
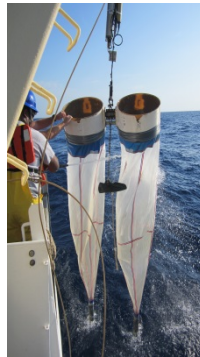
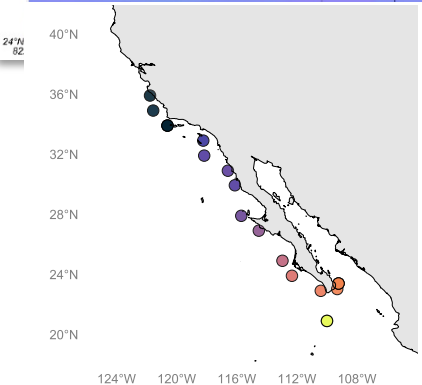
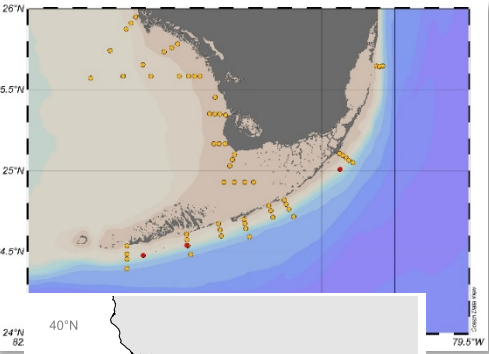
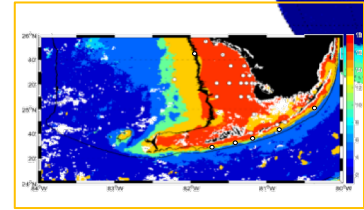
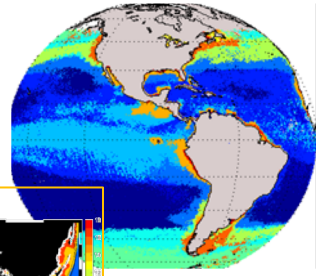
Informs



Ocean literacy



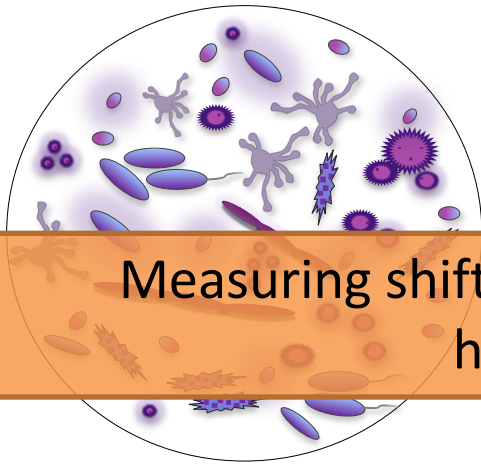
*People are at the core
of our effort*



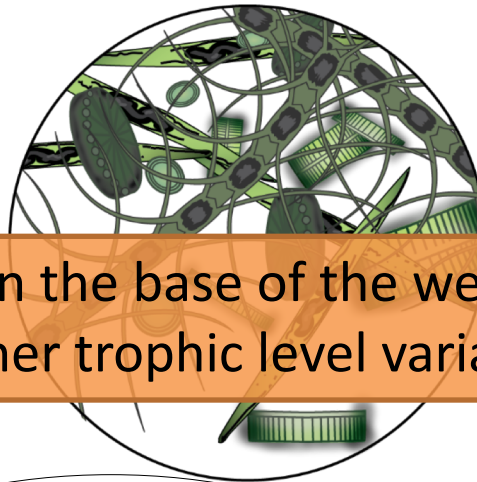
Over 30 expeditions in each FL Keys & MB 2015-2018

eDNA genetic markers give snapshots of biodiversity across various groups that are difficult to capture through other methods

16S rDNA



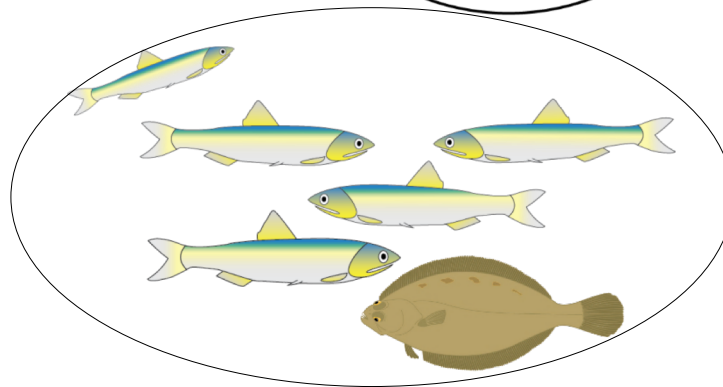
18S rDNA



COI



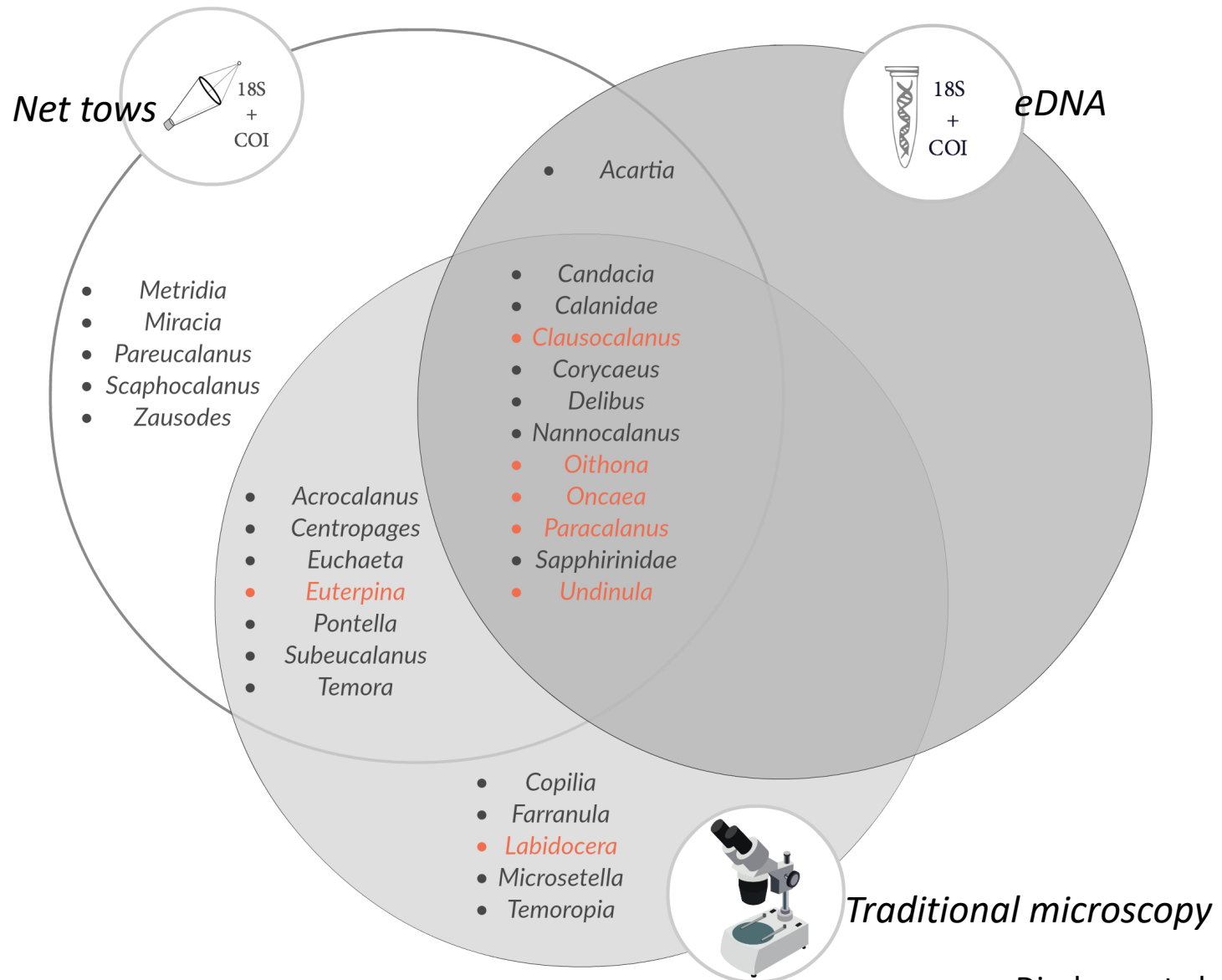
Measuring shifts in the base of the web gives insights into higher trophic level variability



12S rDNA

Each marker is most sensitive towards detecting different groups of organisms

Zooplankton Methods Comparison (Florida)

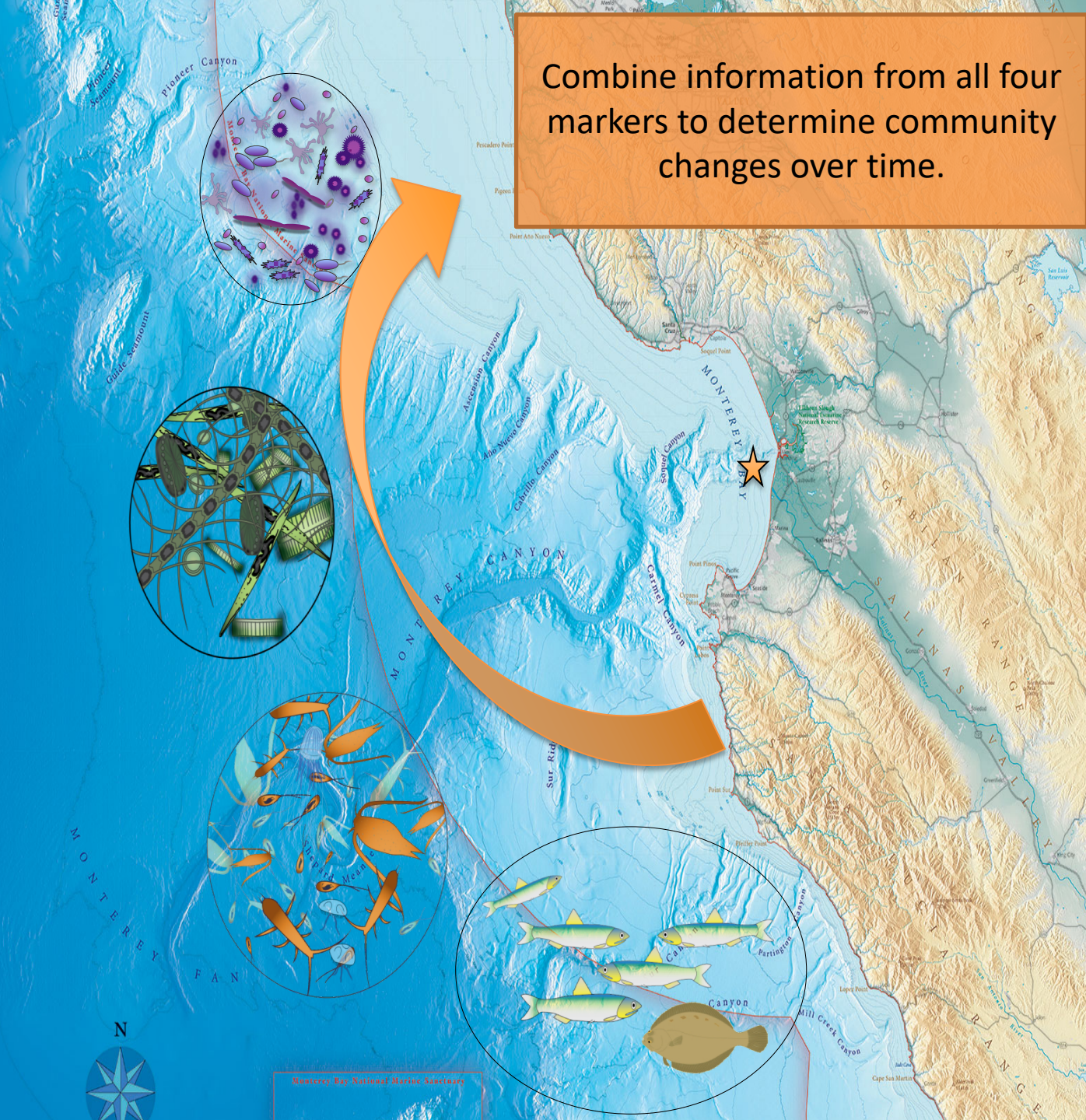


Monterey Bay National Marine Sanctuary:

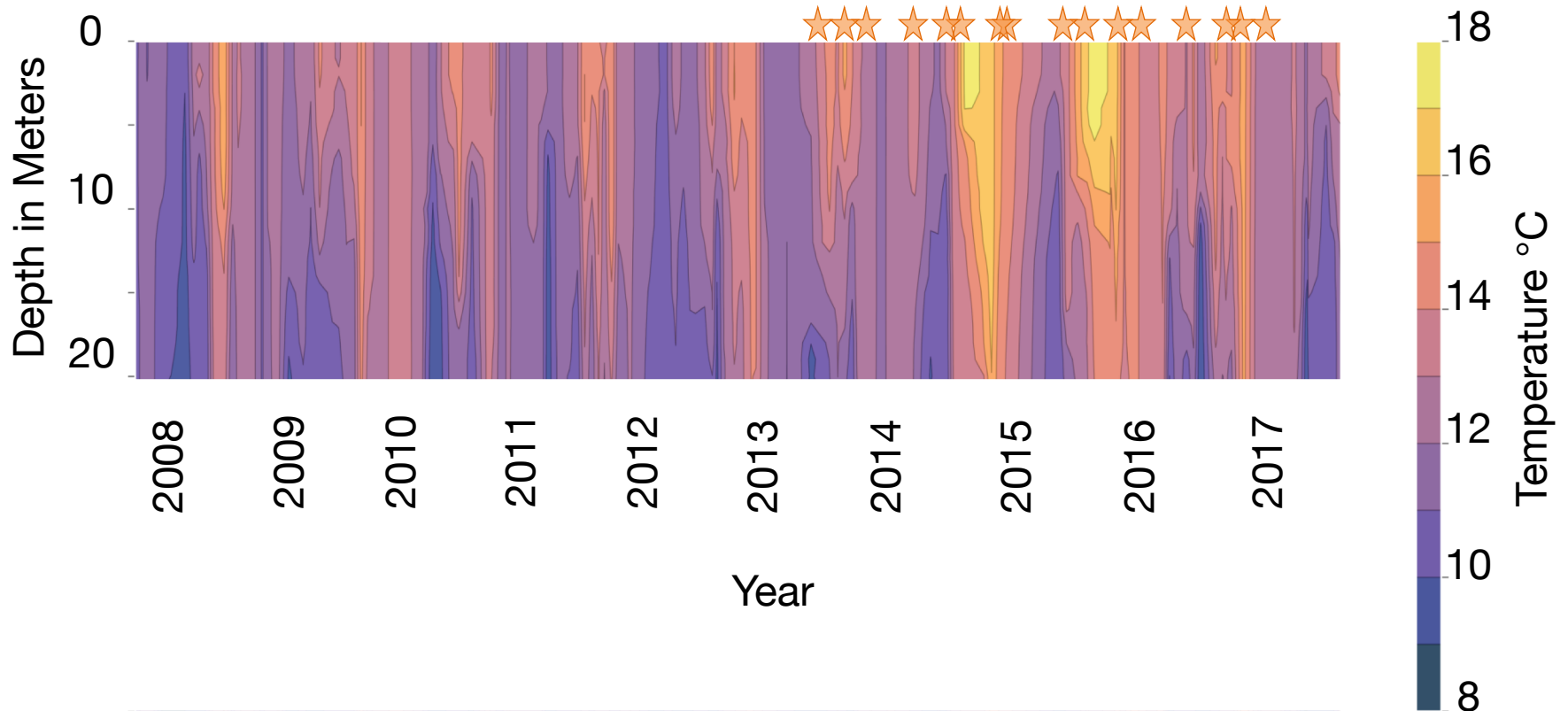
eDNA Monitoring

Combine information from all four markers to determine community changes over time.

- Monthly cruises to stations within Monterey Bay
- Build on long-standing time series

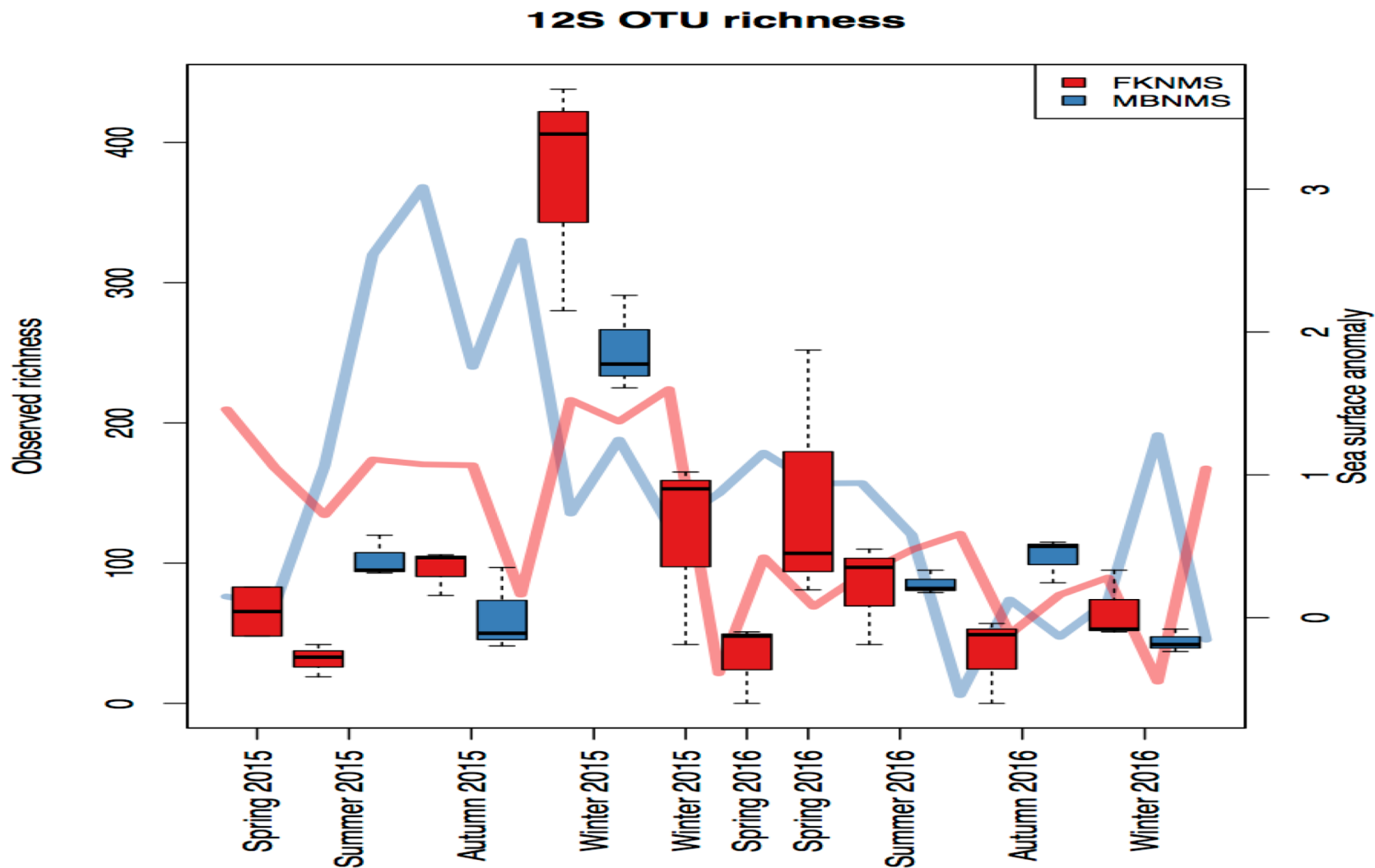


When did we sample?
Samples captured different ocean conditions



Upper water temperature
changes in Monterey Bay

Higher Phytoplankton & Vertebrate diversity seen by eDNA with warmer conditions in FL and MB



Satellite data

NASA MODIS (2000-present)

Daily, monthly, annual, climatology, anomalies:

- Sea Surface Temperature
- Ocean color

Seascapes

- Regional (Gulf of Mexico, US W coast, Arctic Ocean)
- Global

NOAA VIIRS (2011-present)

Daily, monthly, annual, climatology, anomalies:

- Sea Surface Temperature
- Ocean color

Seascapes

- Regional (Gulf of Mexico, US W coast, Arctic Ocean)
- Global

Landsat, Commercial (WorldView 2, 3)

Individual images, mosaics

- Wetland land-cover classification
- Bathymetry
- Coral reef, seagrass

Satellite-derived Seascapes

Kavanaugh (OSU), and all

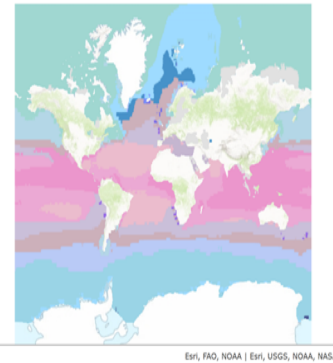
Global classification

Regional downscaling

Ongoing efforts

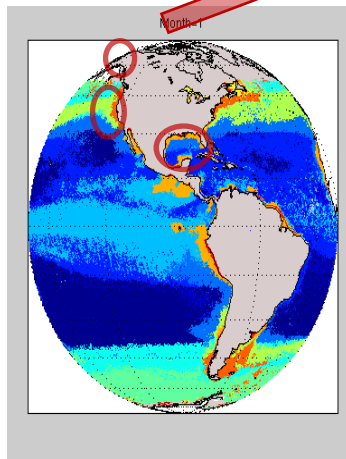
- Global
- EMU intercalibration
- Case Studies:
 - Arctic
 - Temperate
 - Subtropical
- Habitat –species relationships
- Operational
 - NOAA NESDIS
 - NASA COVERAGE

Static+3D

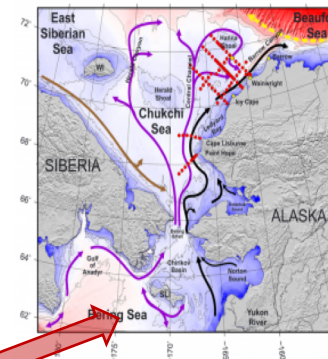


Ecological Marine Units

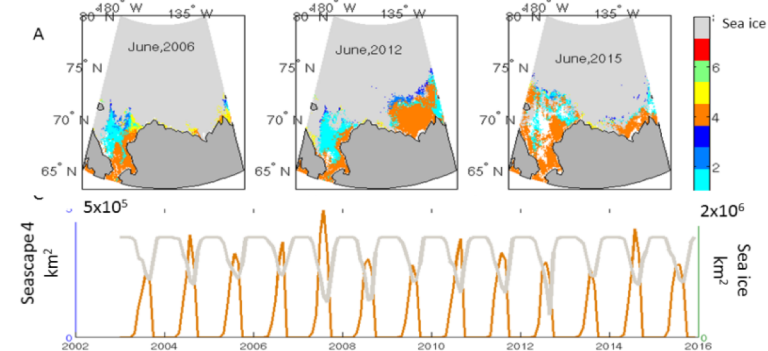
Dynamic+2D



Dynamic Seascapes



Arctic MBON; Distributed Biological Observatory



Dynamic habitat maps

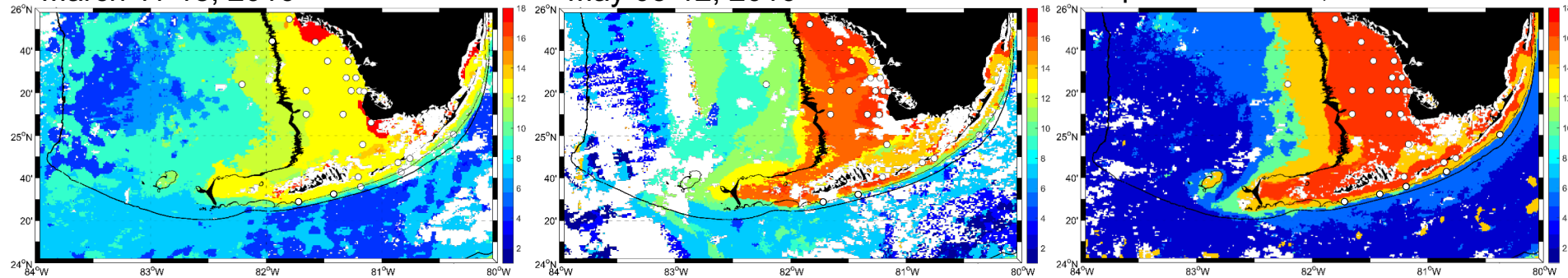
Arctic MBON

Seascape validation: south Florida

March 11-18, 2016

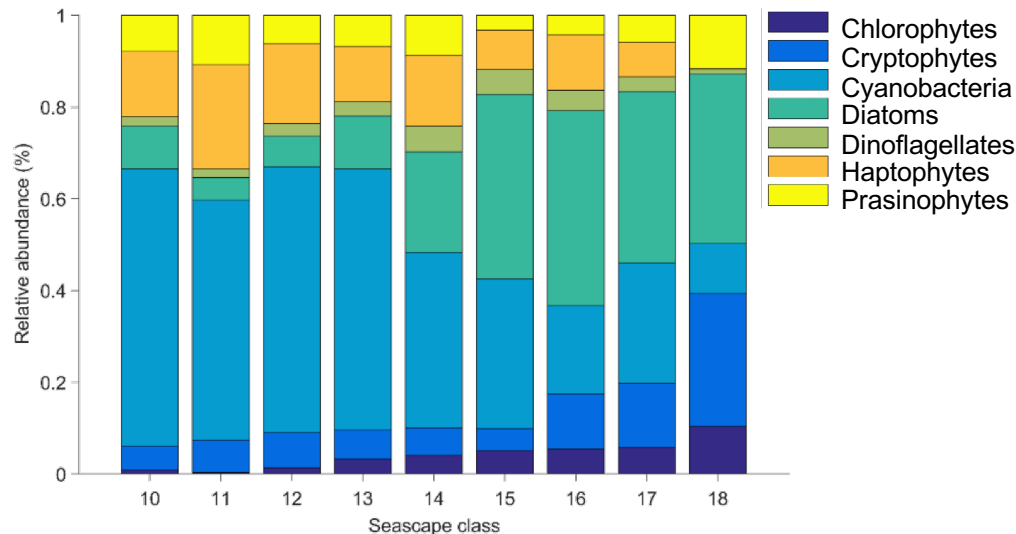
May 05-12, 2016

September 12-19, 2016



Seasonal shifts of
phytoplankton
assemblages

Also validating:
eDNA,
zooplankton

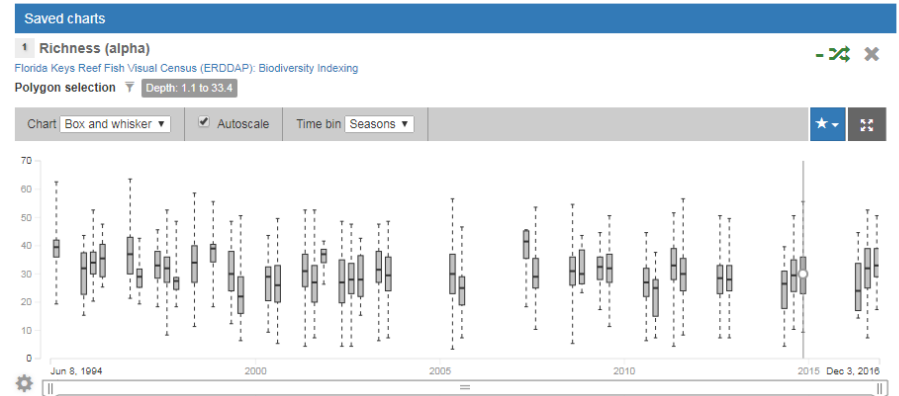
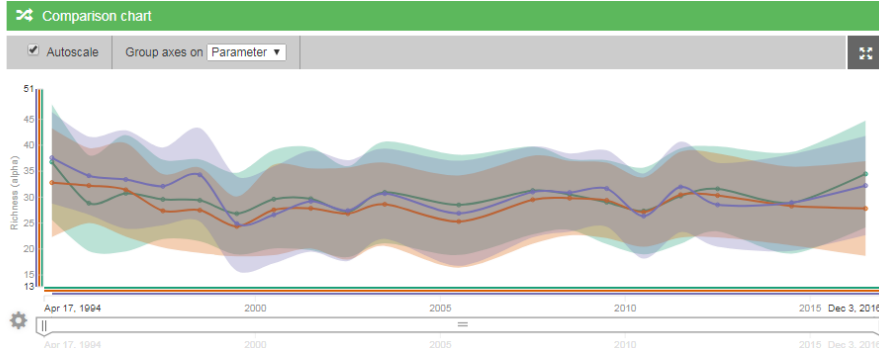
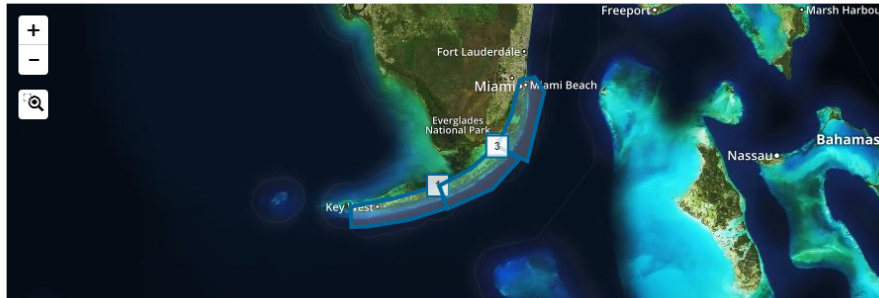


In prep: Dynamic satellite seascapes as predictors of seasonal shifts of phytoplankton assemblages in south Florida waters.
Enrique Montes, Anni Djurhuus, Christopher R. Kelble, Daniel Otis, Frank E. Muller-Karger, and Maria T. Kavanaugh

IOOS Data management: MBON Portal:

★ Florida Keys Reef Fish Visual Census: Species richness in the Upper, Middle, and Lower Key

Species richness is defined as the number of distinct species per sample. These analysis take the average richness values for all samples within the subset (polygon).



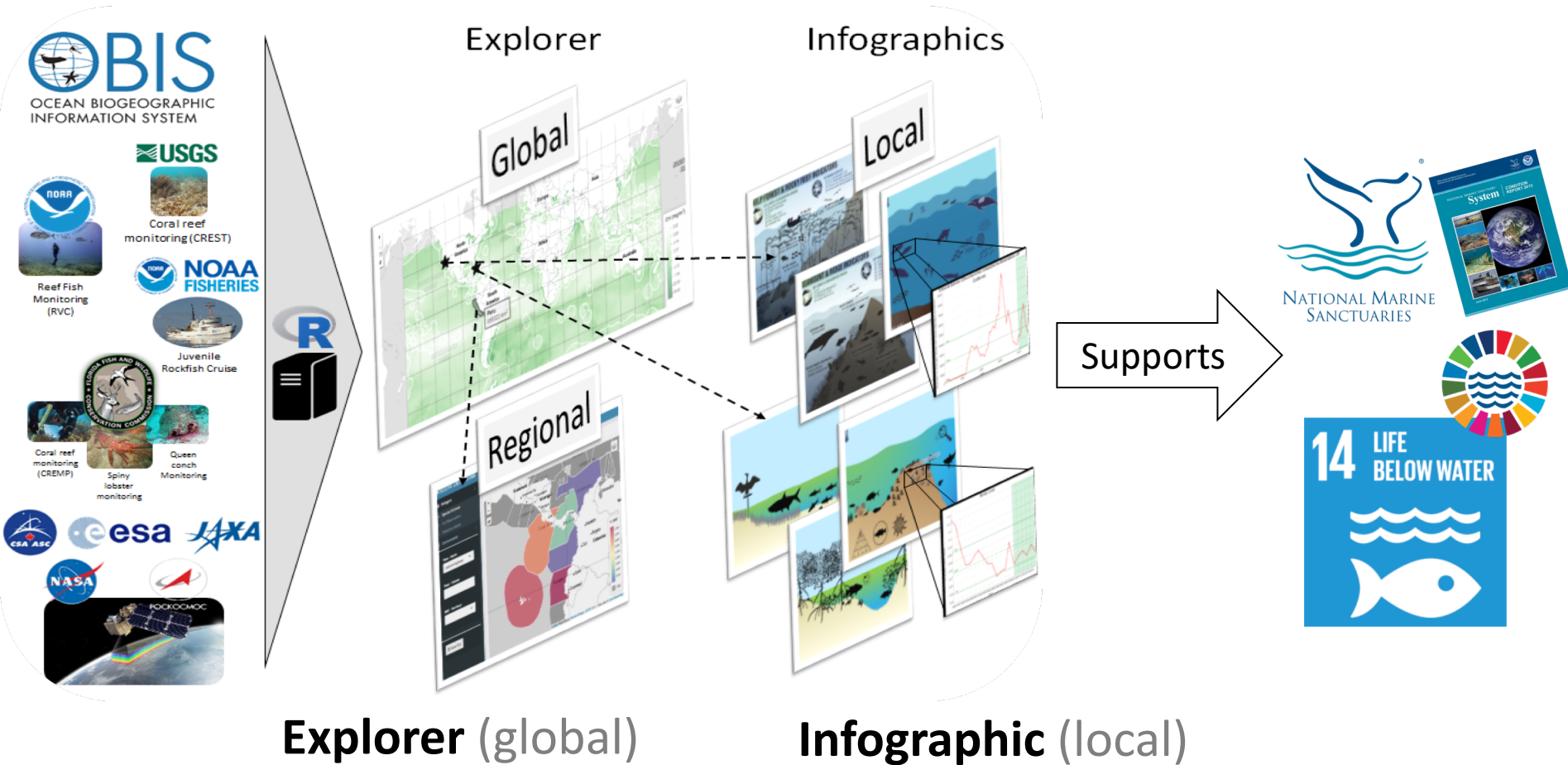
- Beta version is live

<https://mbon.ioos.us/>

Data Integration

MBON Portal: Interactive Tools

for data storytelling



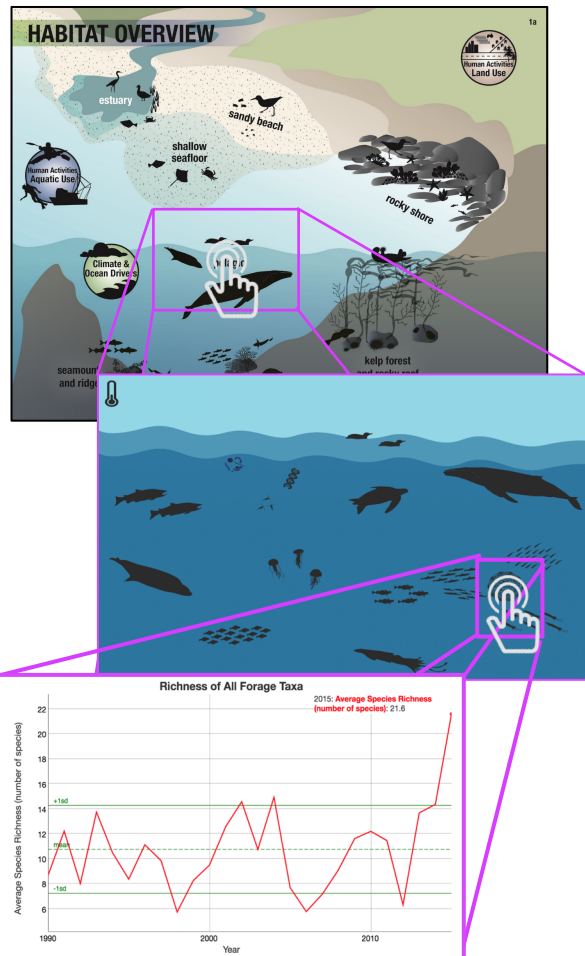
<https://mbon.ioos.us/>

Dynamically updating sanctuary status and trends

Infographics

Audience:

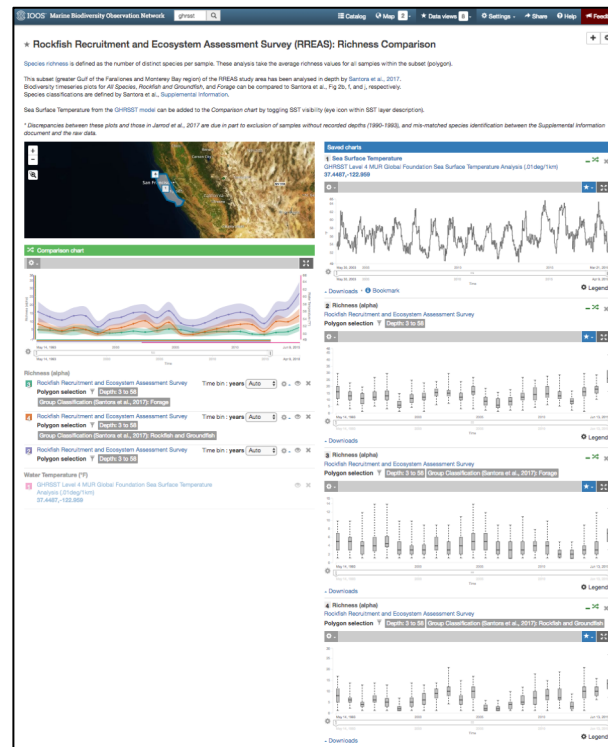
Public, managers, educators



Curated Data Views

Audience:

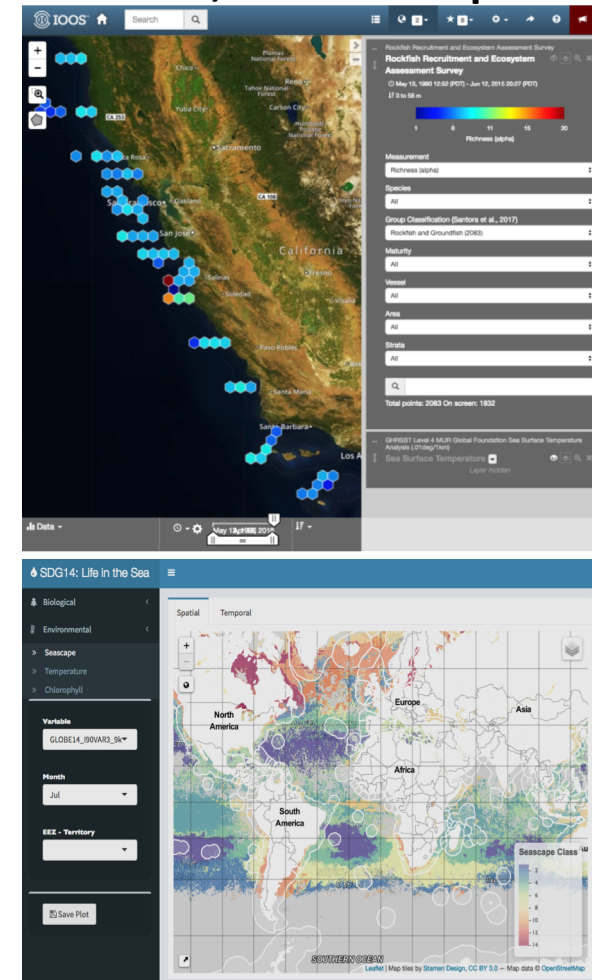
Advisory groups,
researchers, teams



Data portals

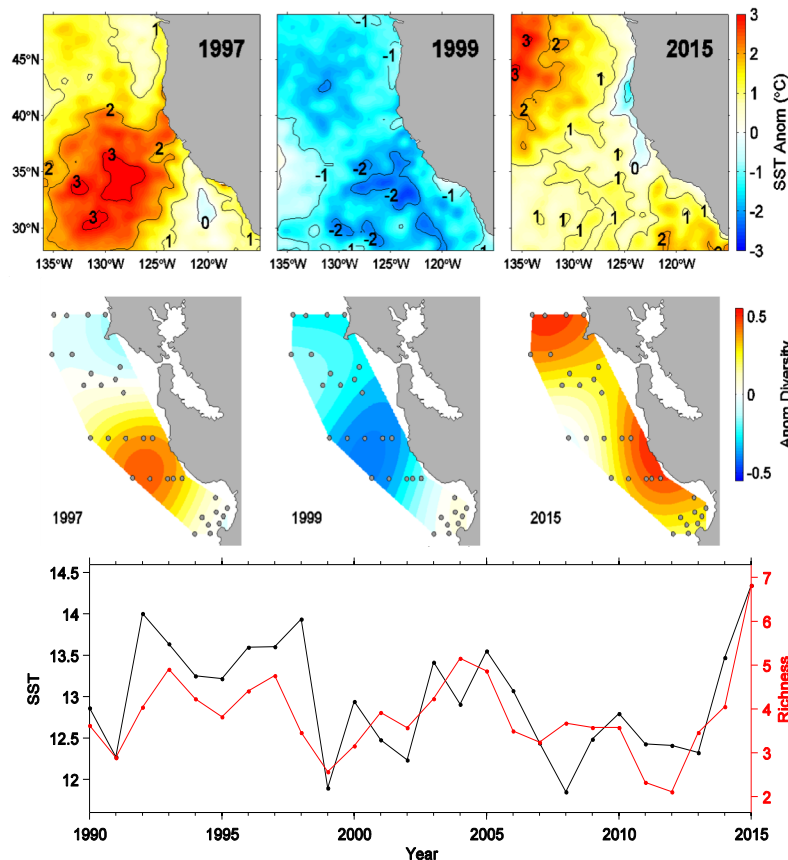
Audience:

Scientists, technical experts



Ocean climate and biodiversity of pelagic fish (forage species)

J.A. Santora, E.L. Hazen, I.D. Schroeder, S.J. Bograd, K.A. Sakuma, J.C. Field (2017)
MEPS Vol 580: 205-220, DOI: 10.10.3354/meps12278

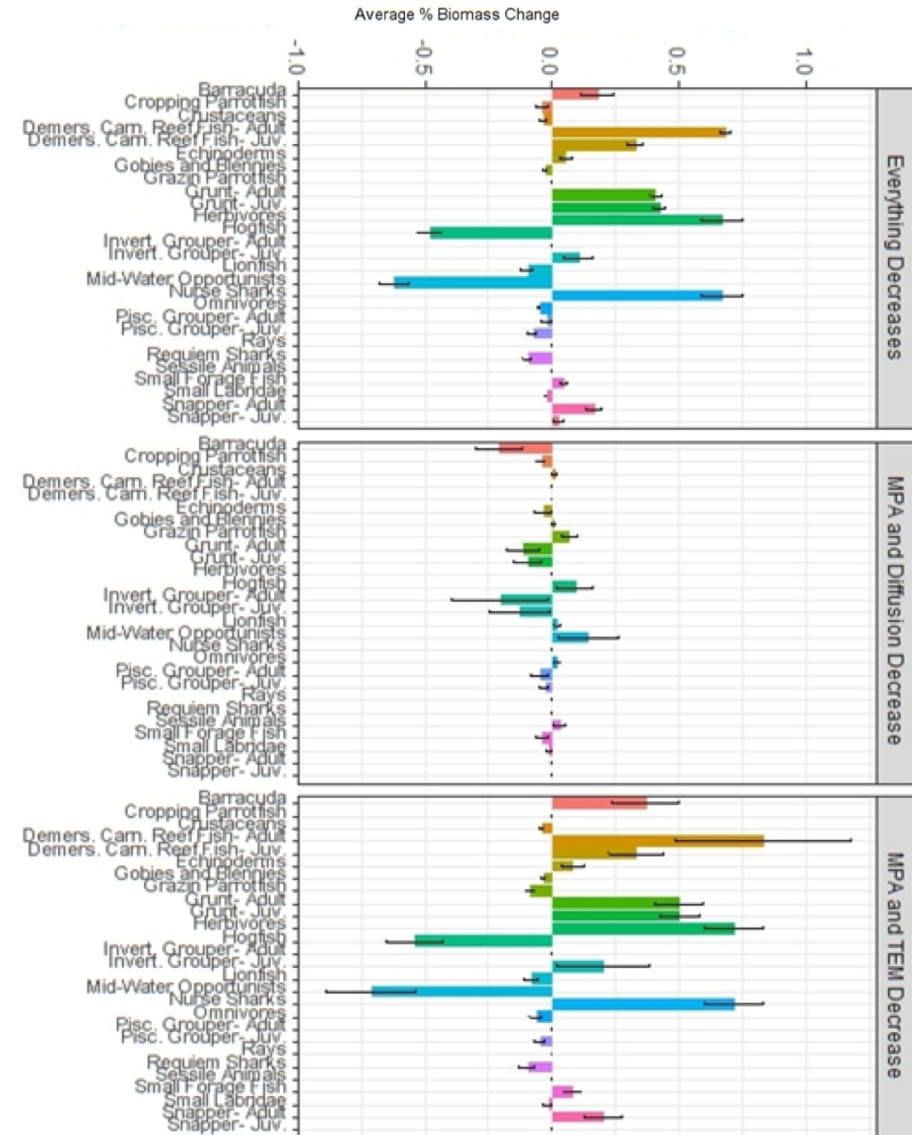


- 1995-97 and 2015 heat waves (ENSO) show high diversity.
- Affects fisheries and coastal water quality.

Ecosystem Modeling: Conservation Planning - Florida Keys



Ecospace Biomass Change 1994-2012 Given MPA Size, Fishing Effort (TEM), and Diffusion (Movement)

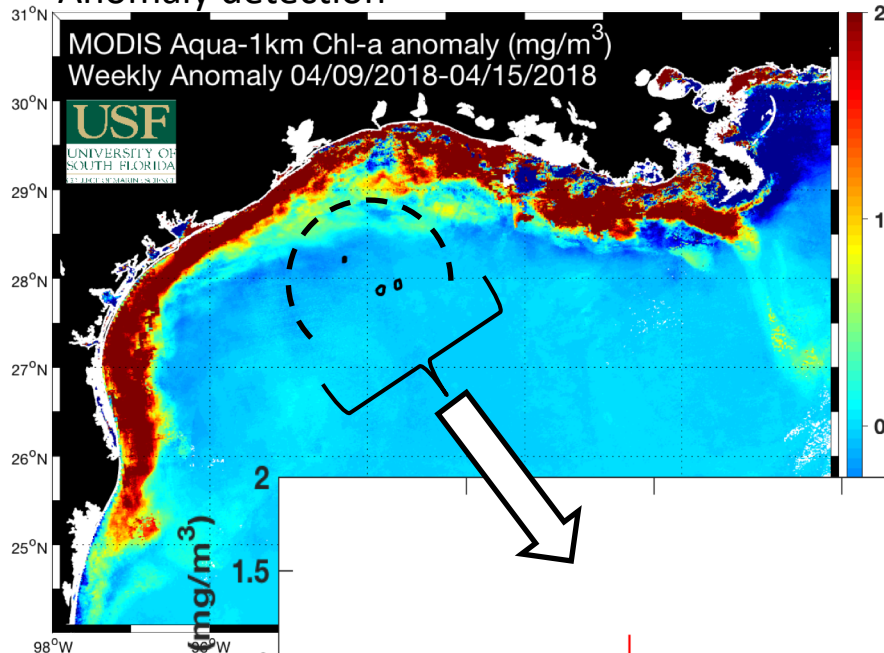


Ecospace scenarios:
Fish biomass variation
with Marine Protected
Area (MPA) size, fishing
effort, and movement

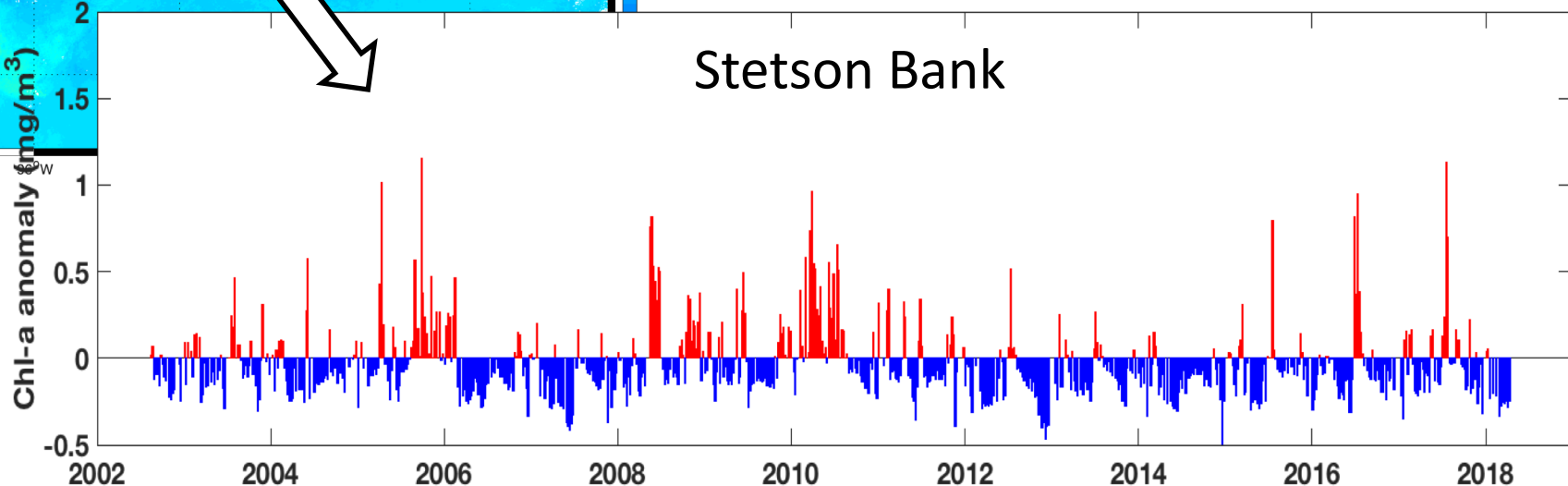
**Fishing effort: larger effect on
biomass than MPA size**

Early warning and alert system for Sanctuaries

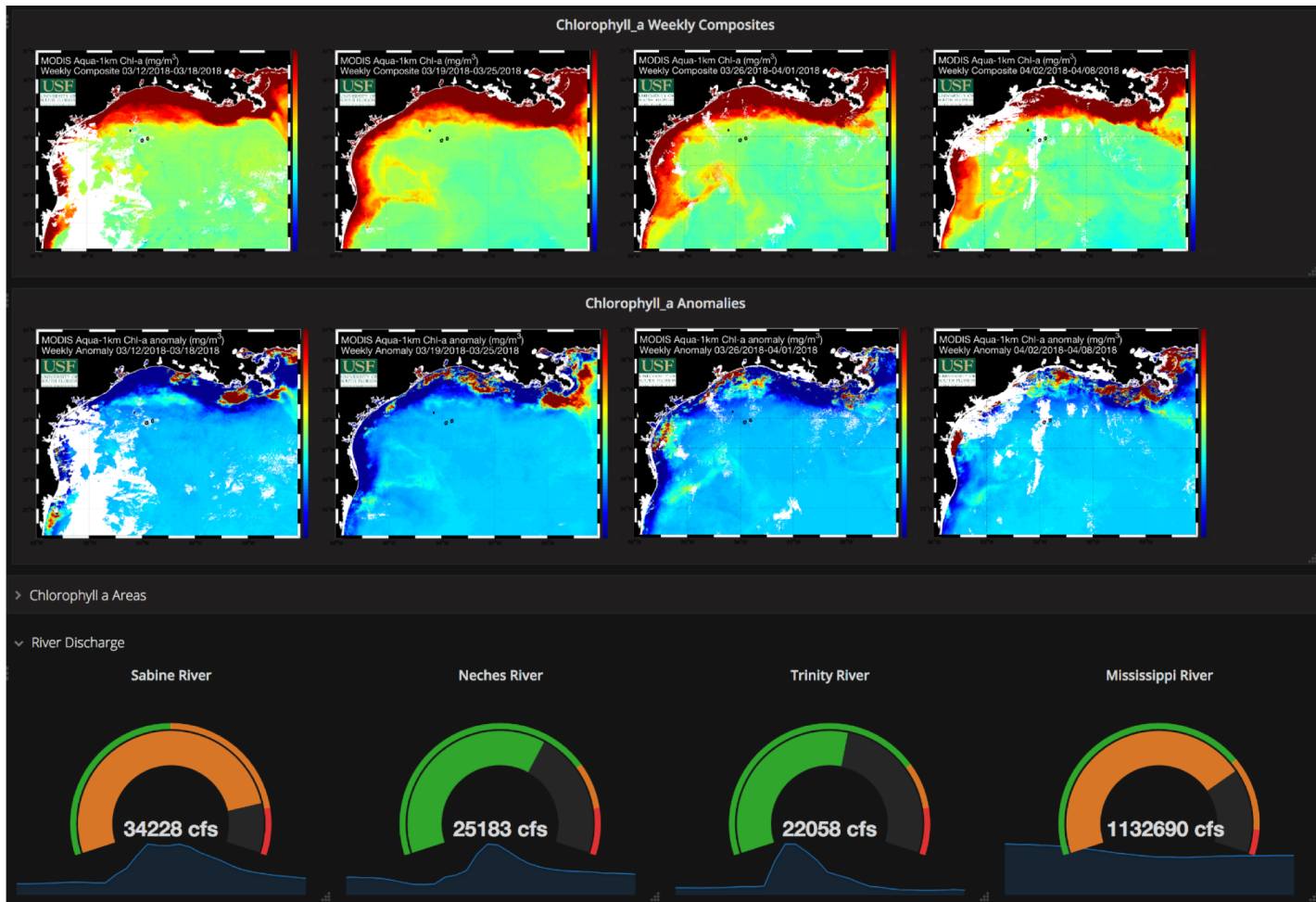
Anomaly detection



- Detection of anomalies in CHL, SST, Turbidity
- FGBNMS, FKNMS, others
- Dashboard and email alerts in real time



Early warning alerts for Sanctuaries



User dashboard for FGBNMS is live.

<https://usf-imars.github.io/img-dash/index.html?date=2018-04-10T19:15:51.513Z>

Florida Youth Outreach

- St. Pete Science Fest Oct. 20-21, 2017
 - 175+ 4th & 5th graders and 800+ “kids of all ages”
 - Activities teach about reef biodiversity, led by Simonello, supported by GCOOS, SECOORA and IMARS
- Stewart Middle Magnet School, Tampa, FL Nov-Dec activities
 - 60 students “lunch and learn” with FMK on remote sensing and biodiversity
 - USF CMS Campus Visit -- 50 students learn about MBON, conduct research with Keys Infographic, interact with AUVs, tour the R/V *Weatherbird*.
 - Featured on [USF Facebook](#), [Twitter](#) and [Hillsborough County School District website](#)
- [USF CMS awareness FMK interview](#)



Students learn how to assess diversity on coral reef transects at Sci Fest



MBON

Marine Biodiversity
Observation Network

Working with and supporting
other US and international
MBON projects



The First U.S. IOOS Biological Data Training Workshop

February 8-9, 2018
Seattle, WA.



MBON / OBIS Portals

Enrolling data

Web services:
Darwin Core /
WoRMS,
rOBIS and ERDDAP

Partnership



OCEAN BIOGEOGRAPHIC
INFORMATION SYSTEM

MBON

INTERNATIONAL
LINKAGES

OBSERVING LIFE IN THE OCEANS FOR SOCIETAL BENEFIT
(- INFORMATION FLOW -)



Global Ocean Observing System



GOOS: ESSENTIAL OCEAN VARIABLES

Focus on EOVS driven by societal needs

- Global implementation -

**GROUP ON
EARTH OBSERVATIONS**

**Biodiversity Observation
Network (BON)**



ESSENTIAL BIODIVERSITY VARIABLES

*Focus on EBVs driven by science questions
and other user needs (policy, societal)*

- National and regional implementation -

MARINE OBSERVATION NETWORK

National — Regional — Global — Thematic

National Governments • Non Government Organizations • Agencies • Institutions • Citizen Science

Data integration and dissemination



+ other national, international data systems

OTHER DATA PROVIDERS AND USERS

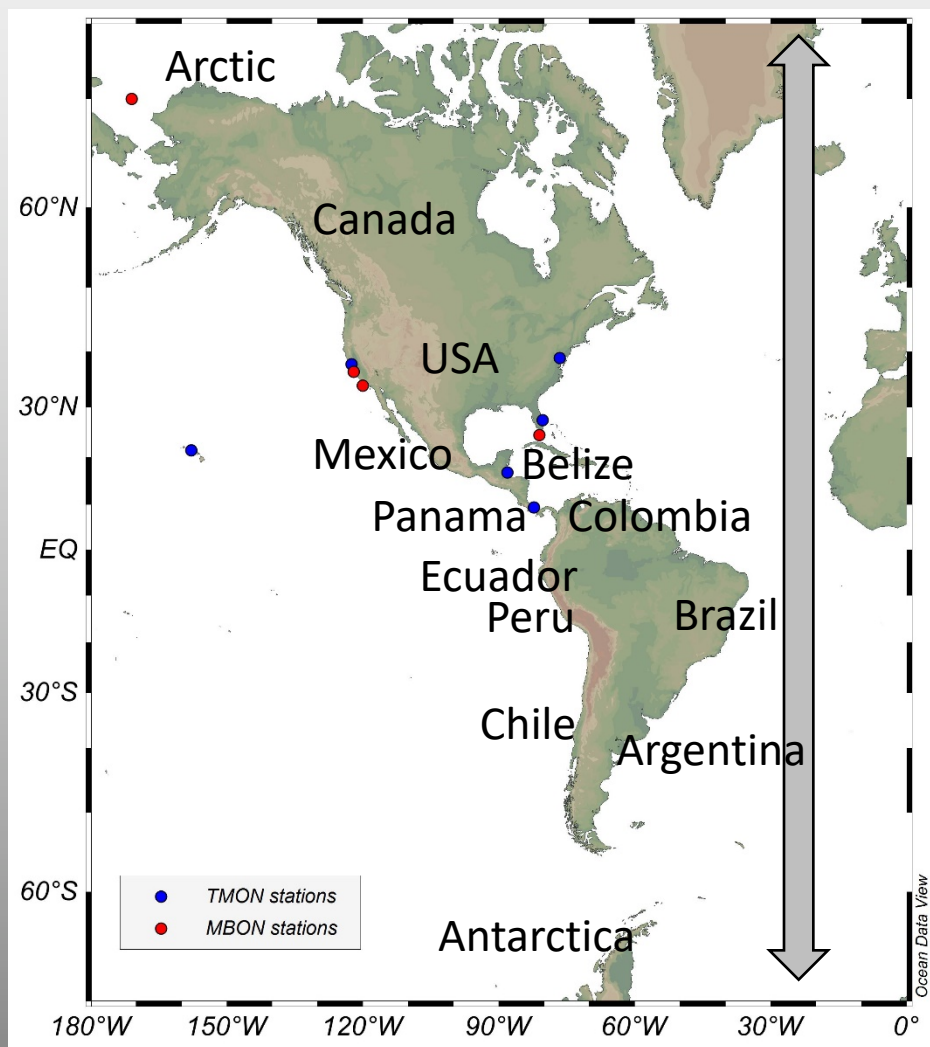
- ✓ National Governments and Organizations
- ✓ International Organizations
- ✓ Non Government Organizations
- ✓ Research Institutions
- ✓ Citizen Scientists



Smithsonian
TMON - MarineGEO



MBON beyond the US: GEO, GOOS, CBD, UN SDG

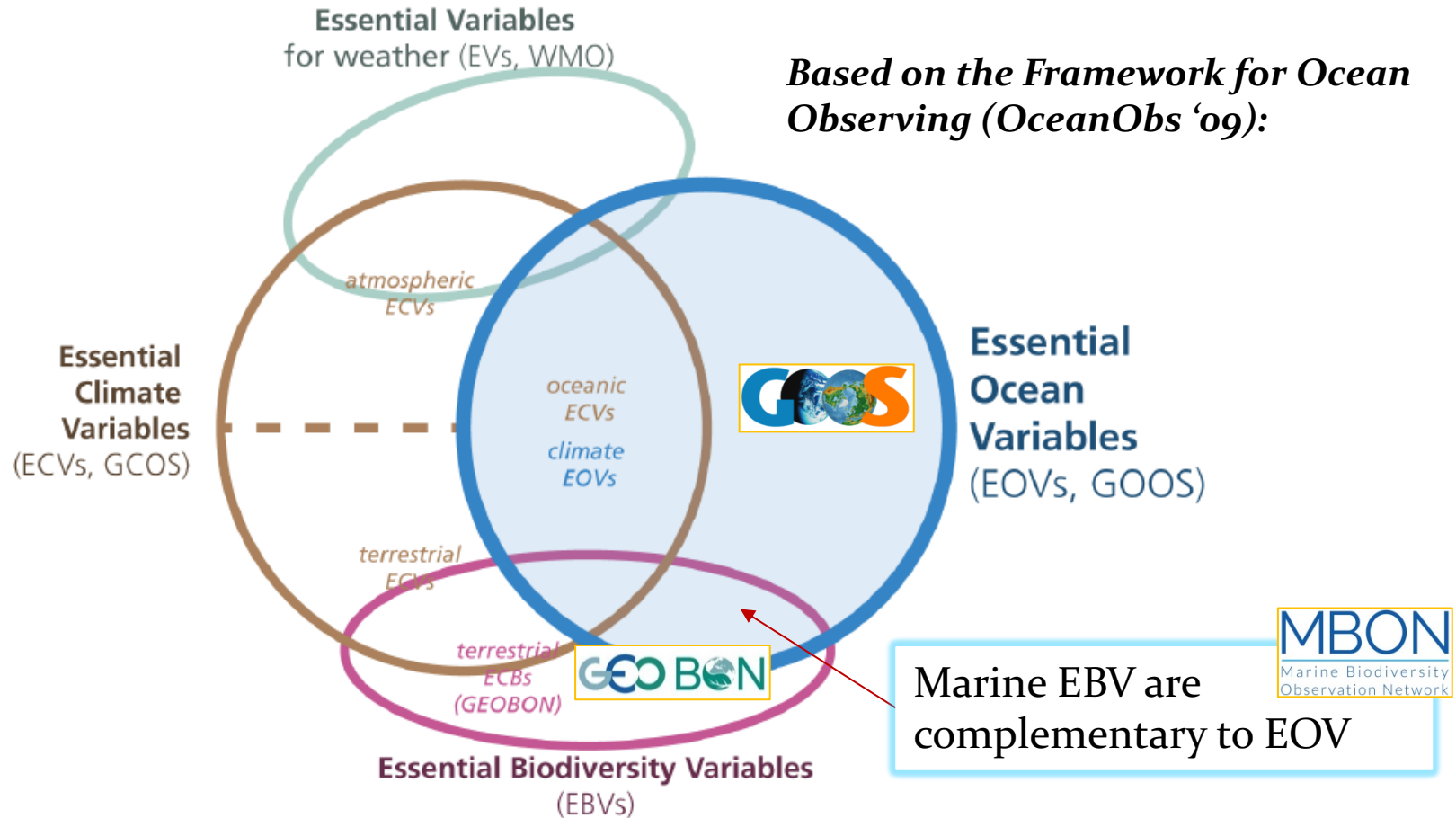


- **Pole-to-Pole MBON pilot**
 - the Americas
- **BON in a Box**
- **UN Sustainable Development Goal 14**

Outreach and planning

- MBON presentation at the GEO Plenary (Washington, DC, 2017)
- Monthly Webinars
- Pole-to-Pole in the Americas Workshop (Brazil, Aug 9-15, 2018)

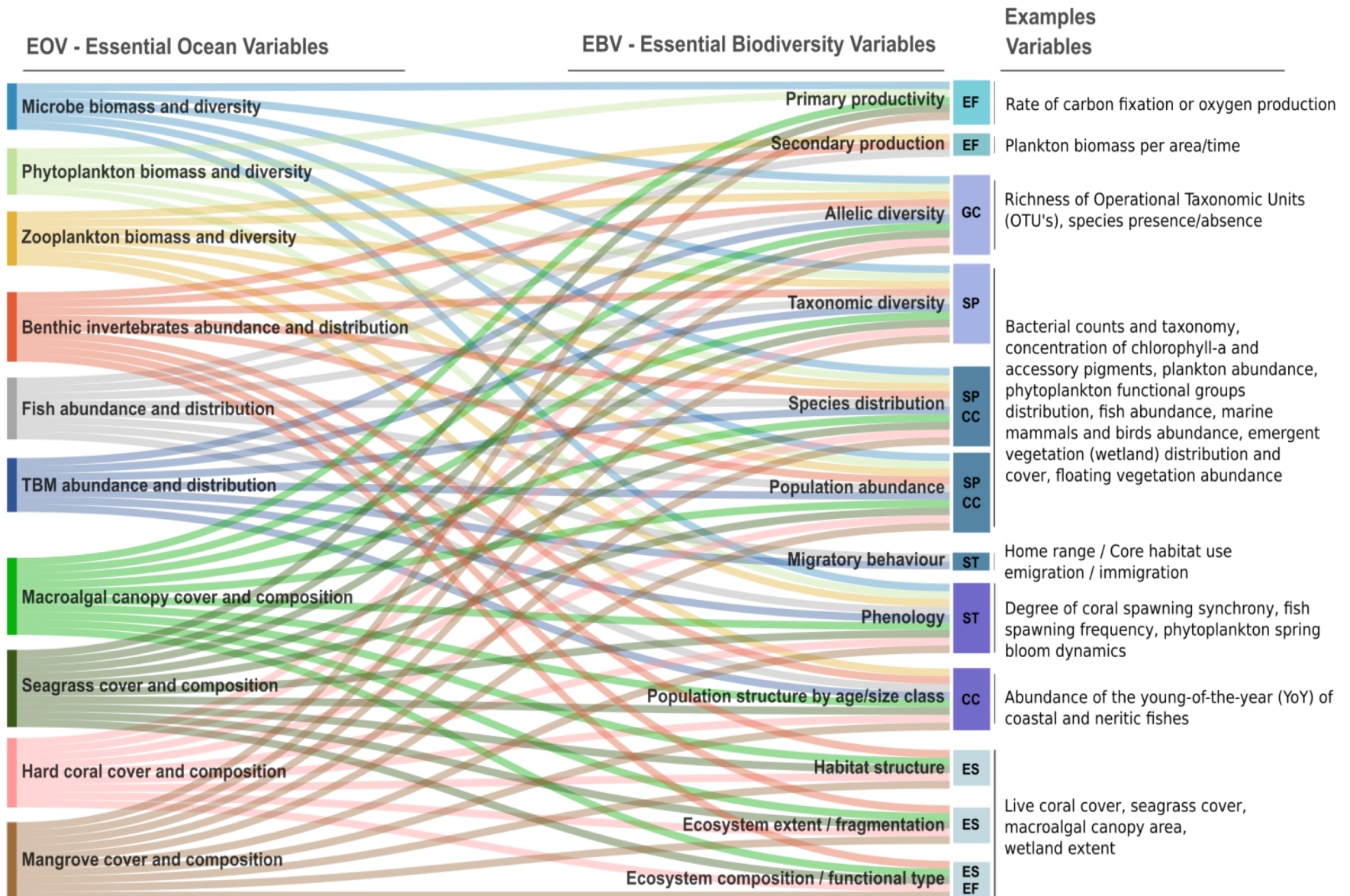
Linking Essential Biodiversity Variables (EBVs) and Essential Ocean Variables (EOVs)



EOVs are central to GOOS strategic planning and implementation

EBVs are central to GEO BON strategic planning and implementation

EBV and EOV are Complementary



MBON beyond the US: – In Progress

- GOOS Bio-Eco Panel and RNC
- OBIS and IOOS – IOOS adopts DarwinCore + training efforts
- MBON Portal development (X-MBON, IOOS)
- Indicator development for SDG14 in progress
- Global 'omics observatories
- WCMB in Montreal on May 17 (prototype to demo to CBD officials)
- GOOS Regional Alliances Meeting, June 12, Santa Marta, Colombia
- SBSTTA in Montreal on July 27 (promote the polished prototype)
- CBD in Egypt November 2018 (unveiling the tool/portal international)
- OceanObs 19
- SCOR P-OBS Working Group: Integration of Plankton-Observing Sensor Systems to Existing Global Sampling
- CMAR corridor: MBON is working with Ecuador, Panama, Colombia and Costa Rica to help define research needs in this EBSA.
- NOAA Ocean Exploration Research

2018-2019 Plans

- Microbes-to-Whales (M2W) eDNA
- Biodiversity indicators for SDG14
- Operational Seascapes data via NOAA NESDIS / CoastWatch
- Early Warning System
- MBON Portal: Infographics/Explorer
- Global MBON (GEO BON MBON, Pole-to-Pole, Marine GEO-TMON/Smithsonian)

MBON

Marine Biodiversity
Observation Network