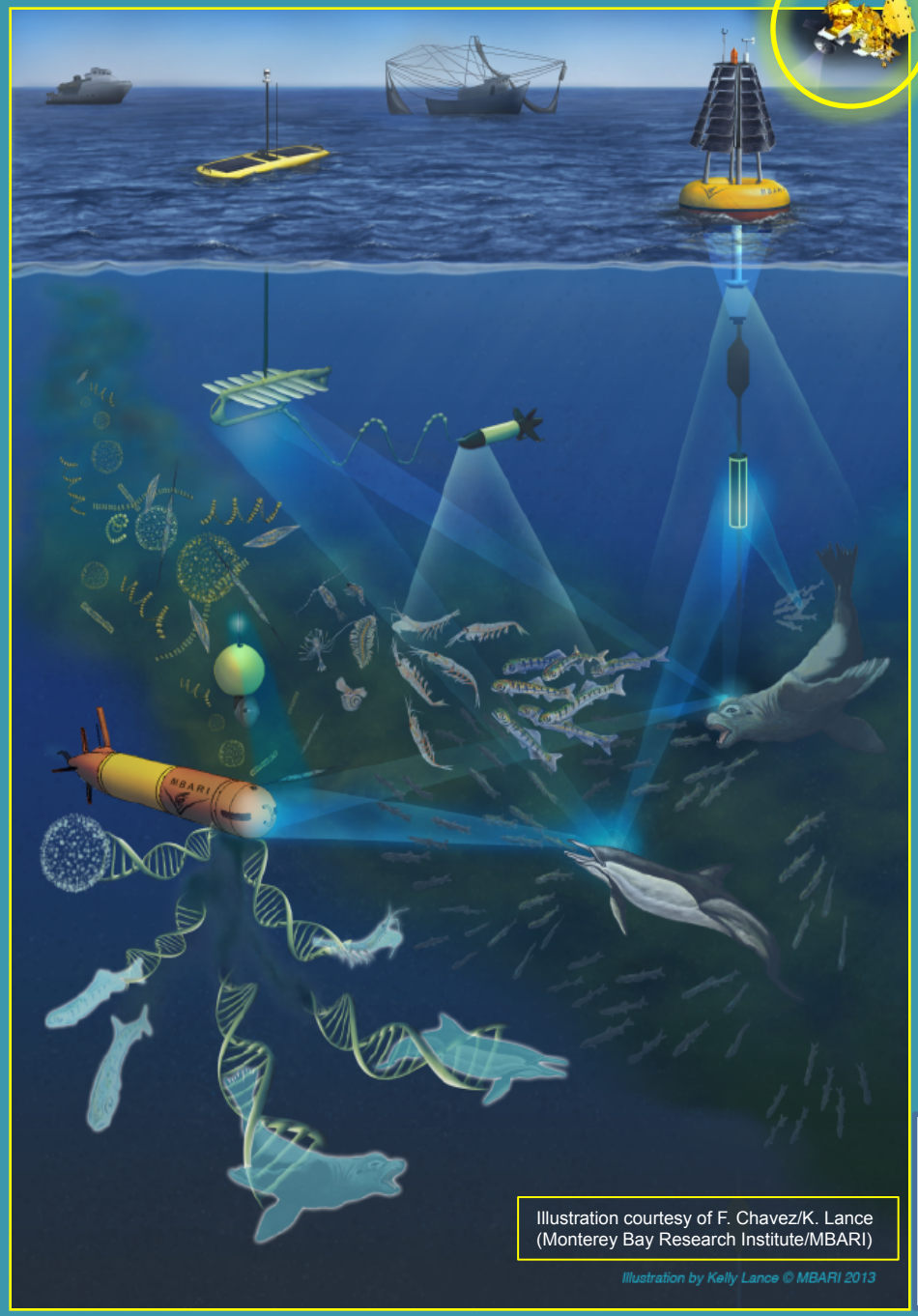

Illustration courtesy of F. Chavez/K. Lance
(Monterey Bay Research Institute/MBARI)

Illustration by Kelly Lance © MBARI 2013

NASA

NOAA

NOPP National Oceanographic Partnership Program

NATIONAL MARINE SANCTUARIES

MBON

Marine Biodiversity Observation Network

…from microbes to whales

MBARI

USF UNIVERSITY OF SOUTH FLORIDA COLLEGE OF MARINE SCIENCE

WOODS HOLE OCEANOGRAPHIC INSTITUTION 1930

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

NATIONAL MARINE SANCTUARIES

NOAA FISHERIES

OBIS OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

GOOS

GEO BON

IOOS | Integrated Ocean Observing System

Why measure biodiversity?

MBON
Marine Biodiversity Observation Network

Biodiversity benefits:

- ecosystem function & resilience,
- chemical cycles,
- human health (food, materials, chemicals, recreation)

Life in the Sea

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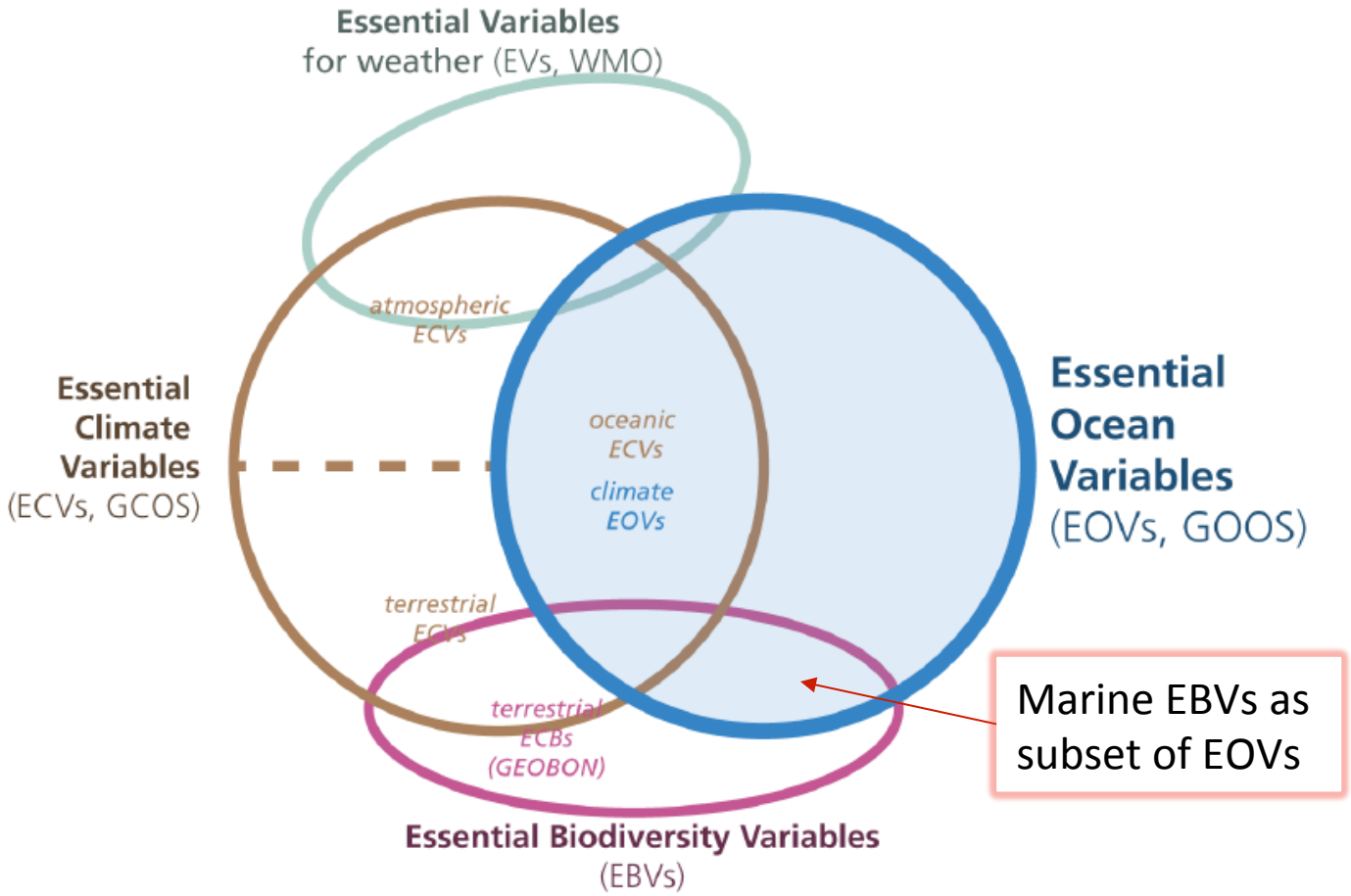
Marine Biodiversity Observation Network

Biodiversity: the variety of life and habitats

- -number of species,
- -abundance and biomass,
- -interactions (organisms & environment),
- -variability of habitat

These 'Essential Biodiversity Variables'
are really basic, but are very difficult to make

Essential Variables: EOV and EBV



- GOOS: GOOS panels (EOV)
- Group on Earth Observations (GEO): GEOBON – MBON
- National / academic programs

Need to be linked, and enabled to measure life

MBON
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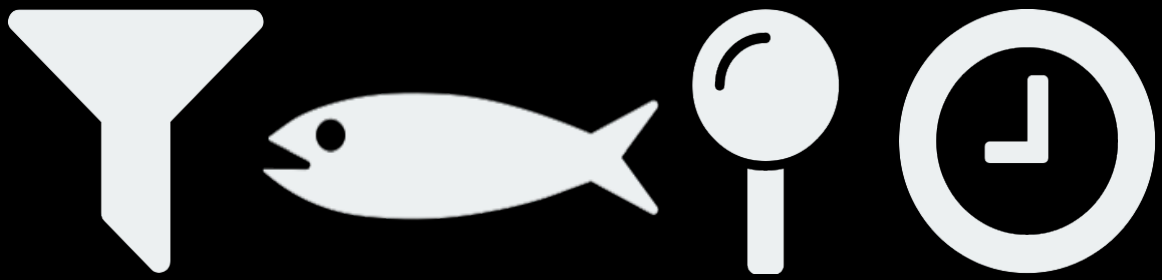
A collaborative NETWORK that links

Databases Datasets

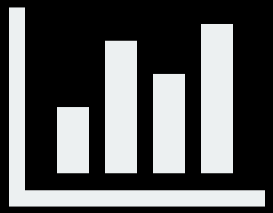


Filters: Taxa Space Time

To produce:

Maps

Abundance



Trends

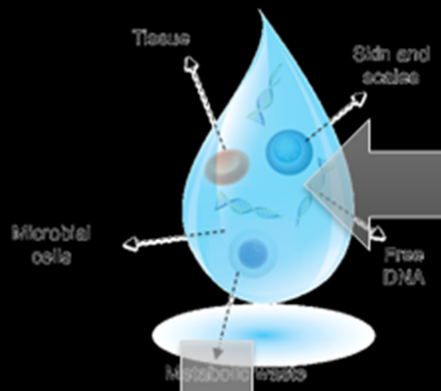
Sanctuaries MBON demonstration priority:

→US National Marine Sanctuary Condition Reports

National Marine Sanctuaries

Environmental Data Integration

eDNA testing

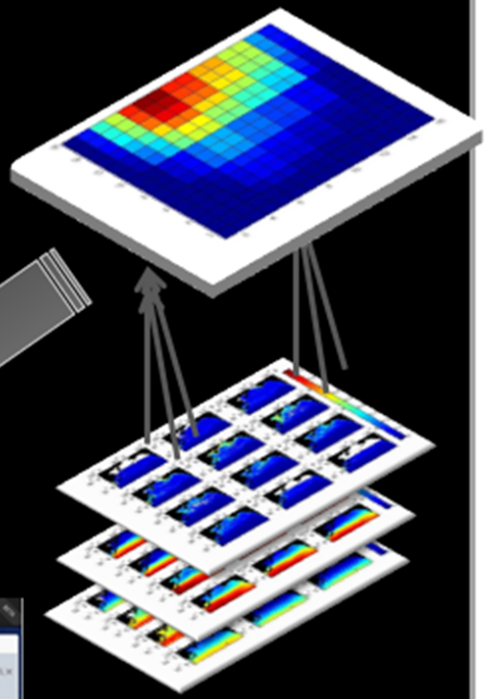


Case Studies

- Integration of 20y+ environmental and biological datasets
- In situ data collection

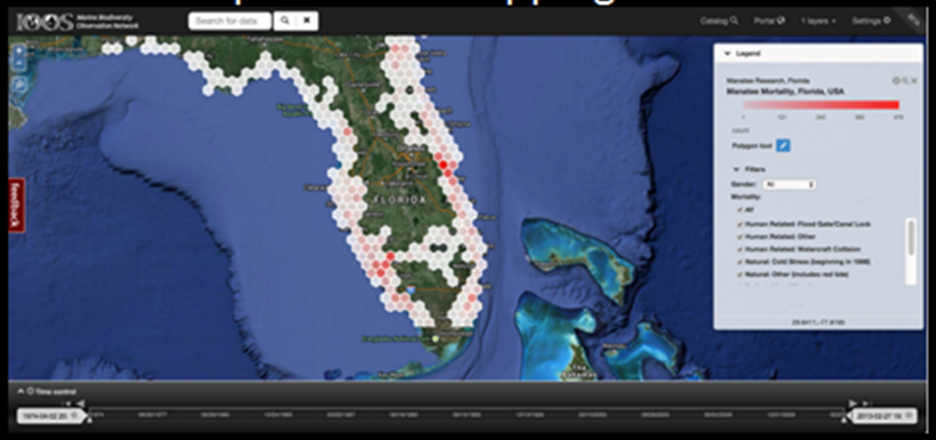
- E&O
- Socio-economics
- Ecosystem Valuation

Ecological Marine Units Satellite Seascapes

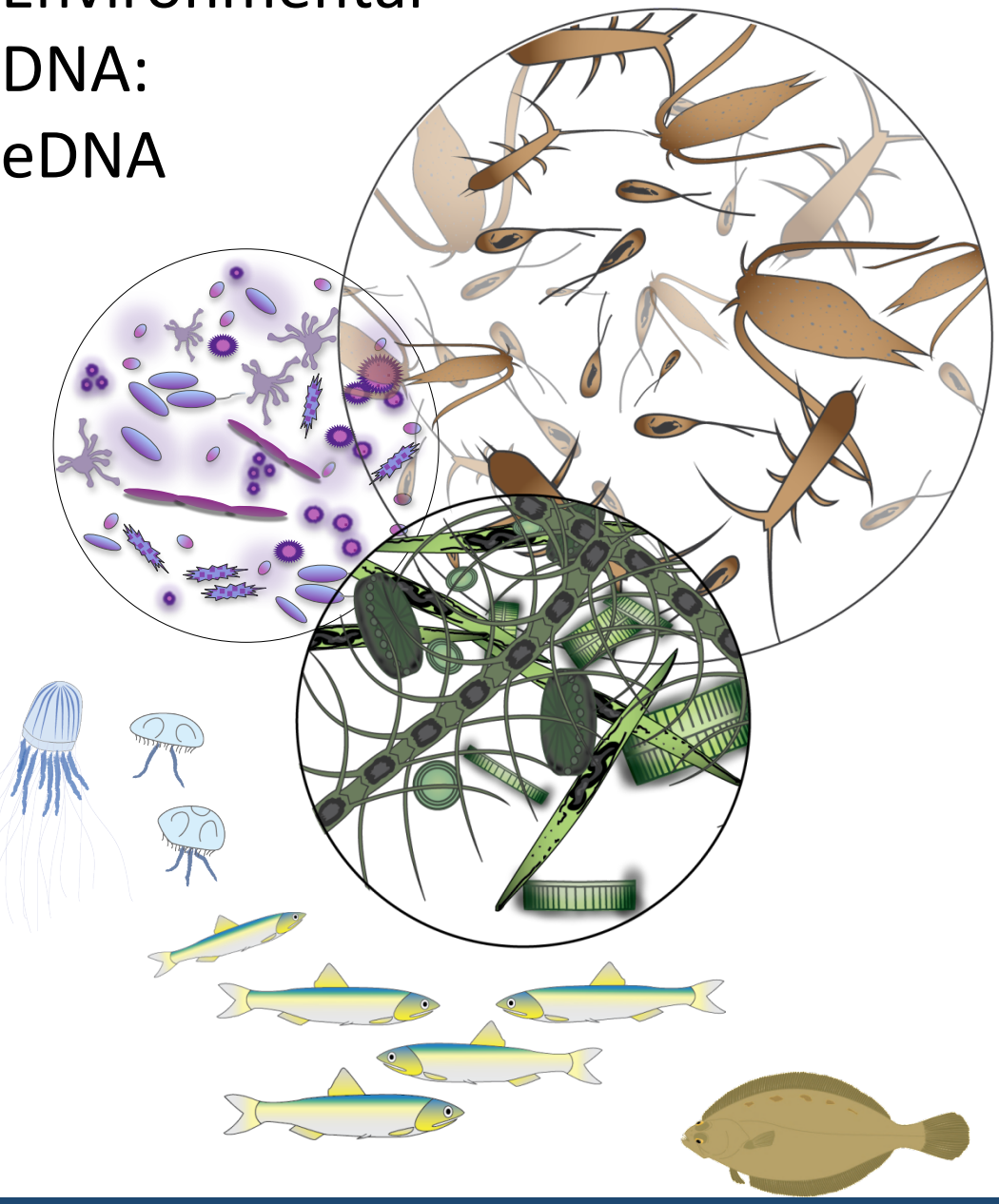


Autonomous eDNA sensor

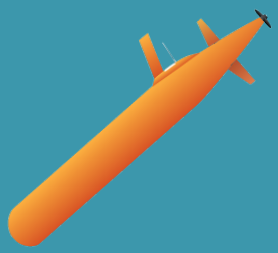
MBON data portal and mapping tool



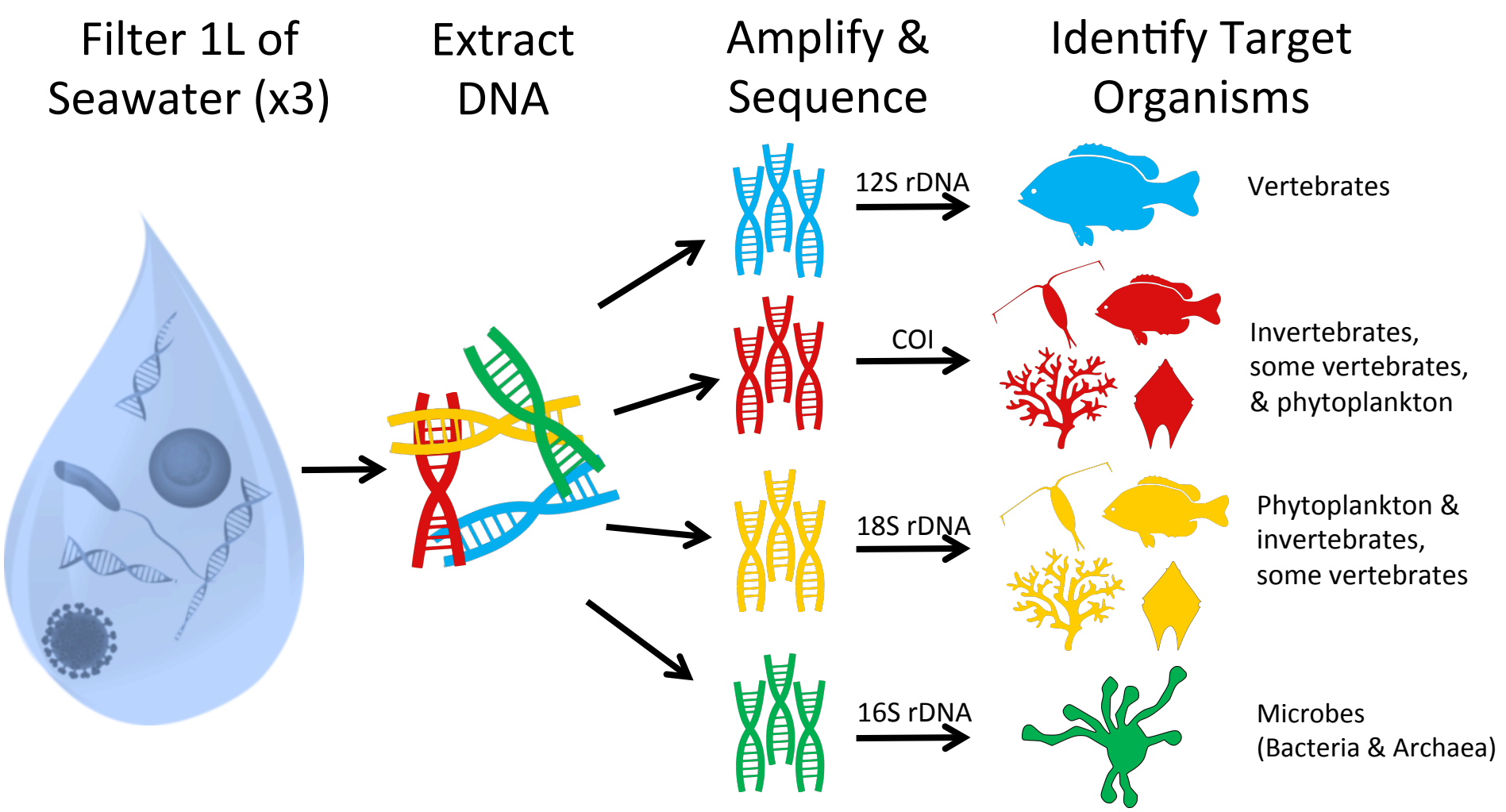
Environmental DNA: eDNA



eDNA allows detection of diverse groups using many platforms

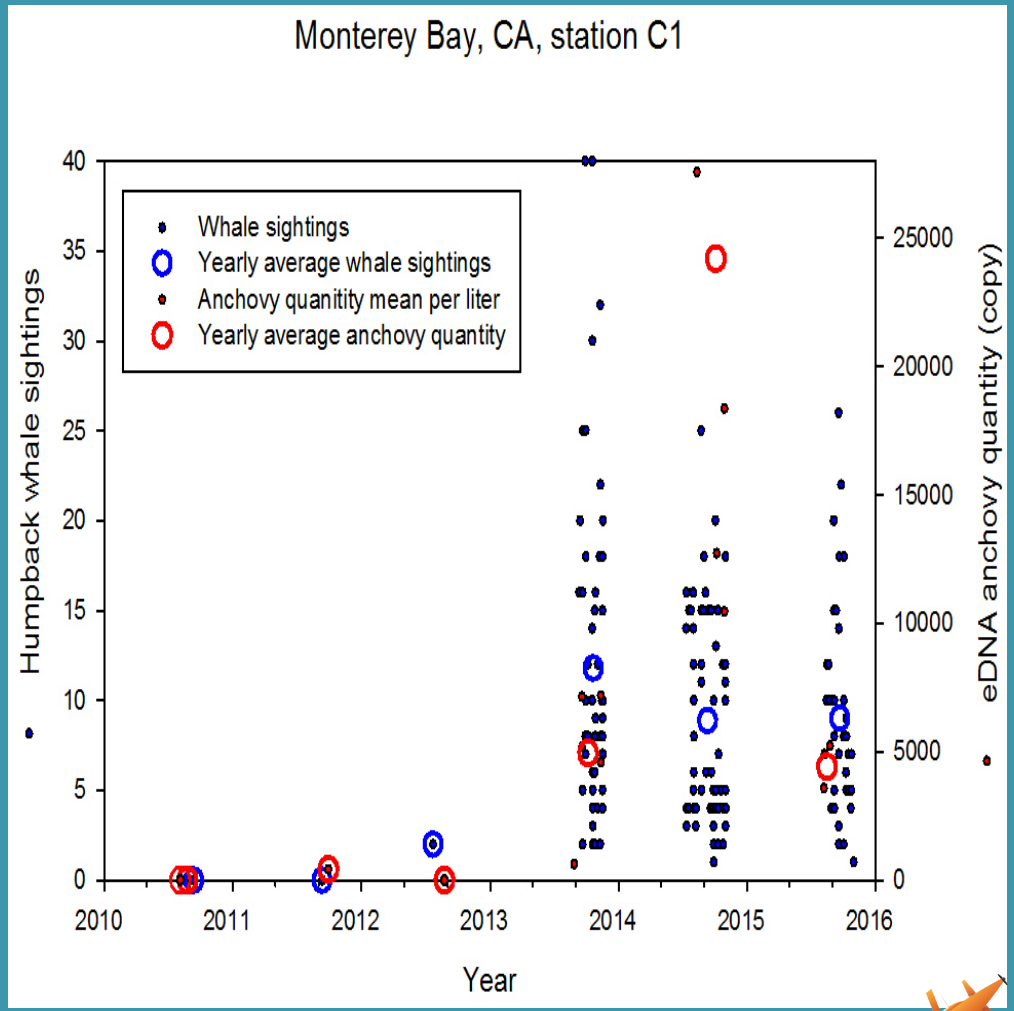


Milestone: MBON Standard Protocol



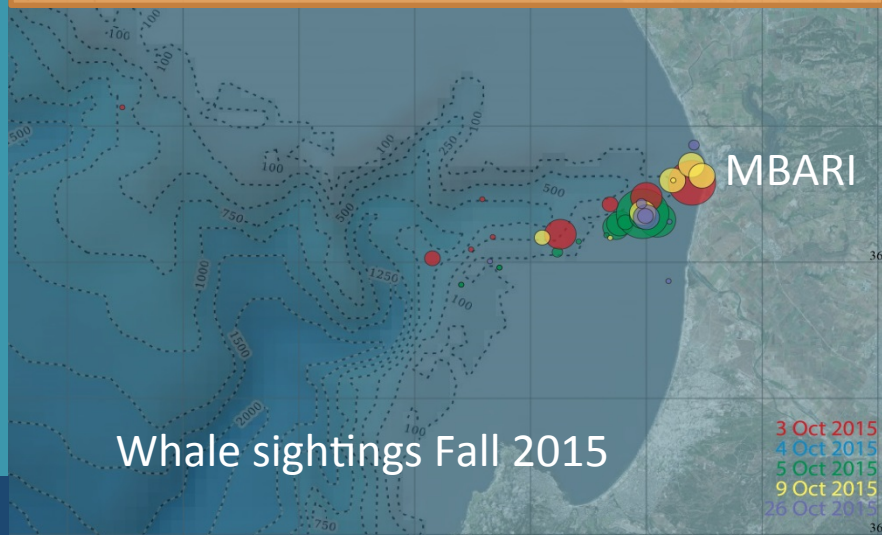
Djurhuus et al., in review

eDNA detected increased anchovy abundance



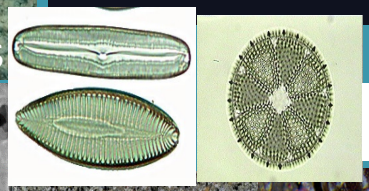
In field trials 3G ESP successfully picked up anchovy eDNA

Preserved samples allow construction of long time series

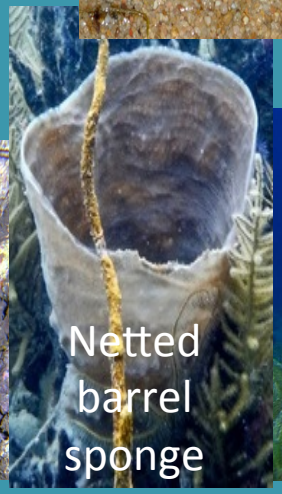


Sanctuaries MBON eDNA Team: FWRI, MBARI, Stanford, & USF

eDNA Recovers a Wealth of Biodiversity from the Florida Keys NMS

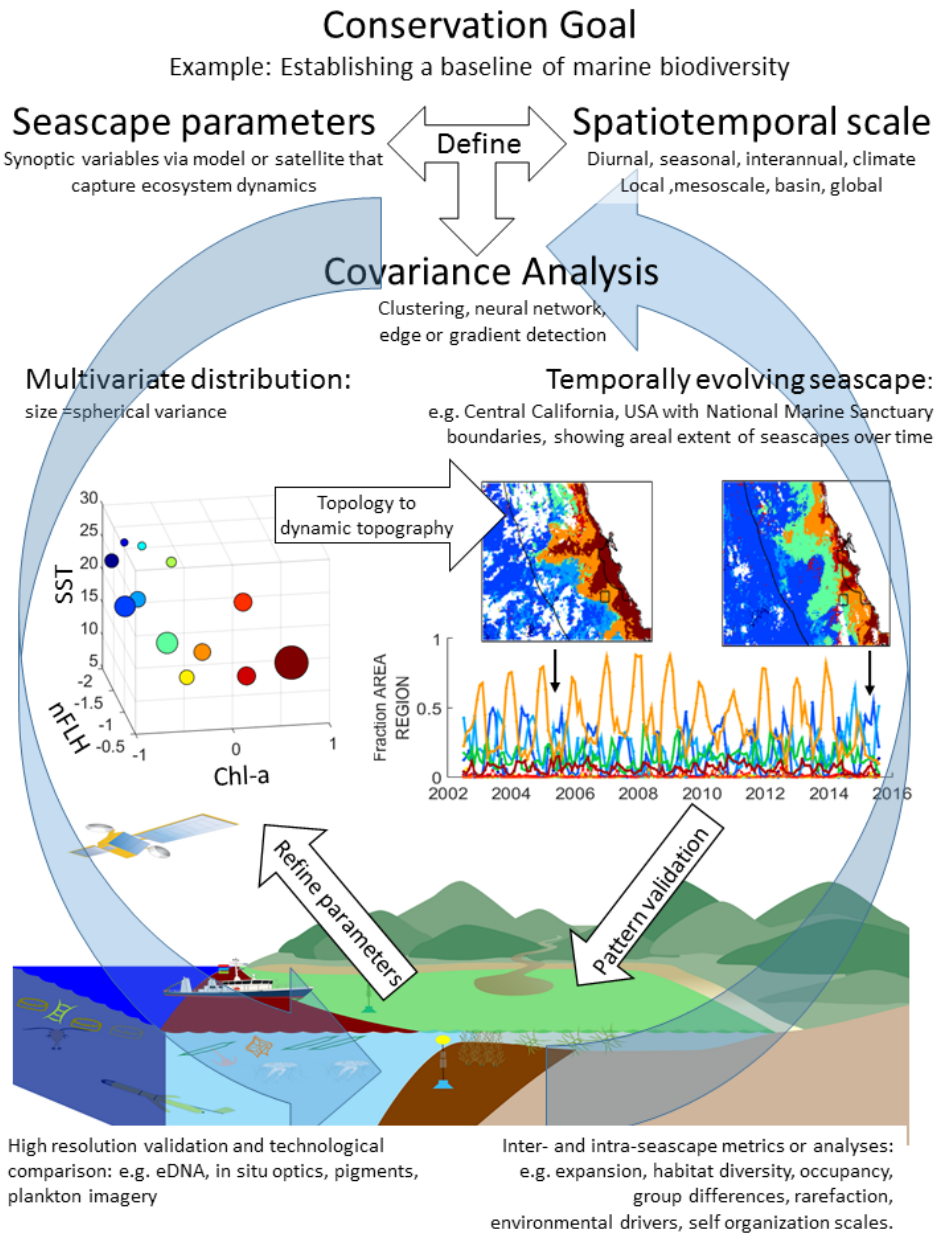


Diatoms



MBON and seascapes

- Dynamic biogeographic framework
- Ecosystem comparison
- Indicators and metrics
- Cruise planning, feature tracking
- Seasonal and Interannual dynamics



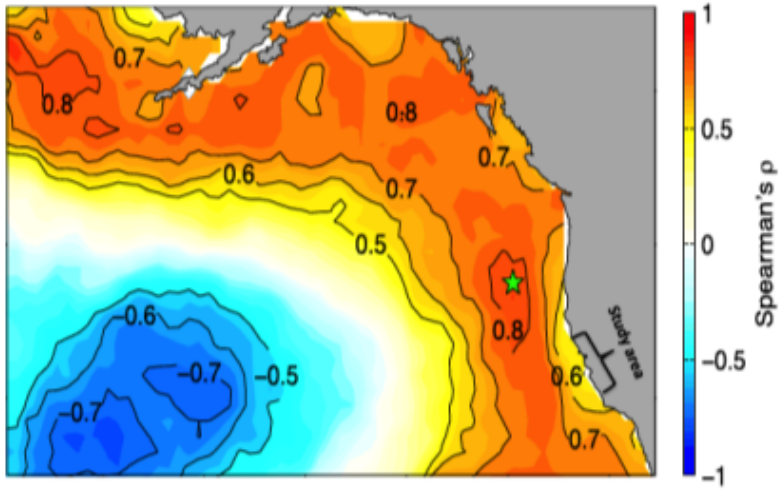
Central California pelagic forage fish and Eastern Pacific climate

Forage fish: food for larger predators (fish, seabirds, marine mammals)

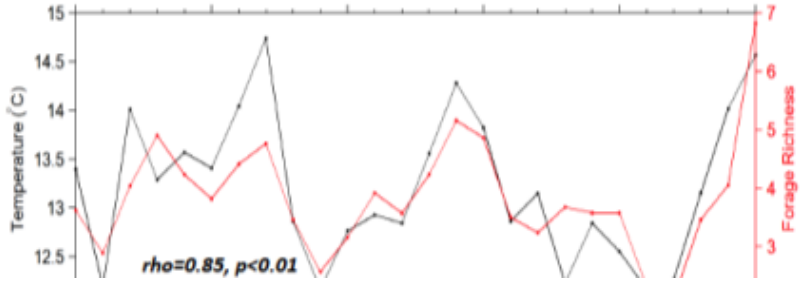
May-June SST & Forage Richness

Figure 7

High SST = High Forage Richness

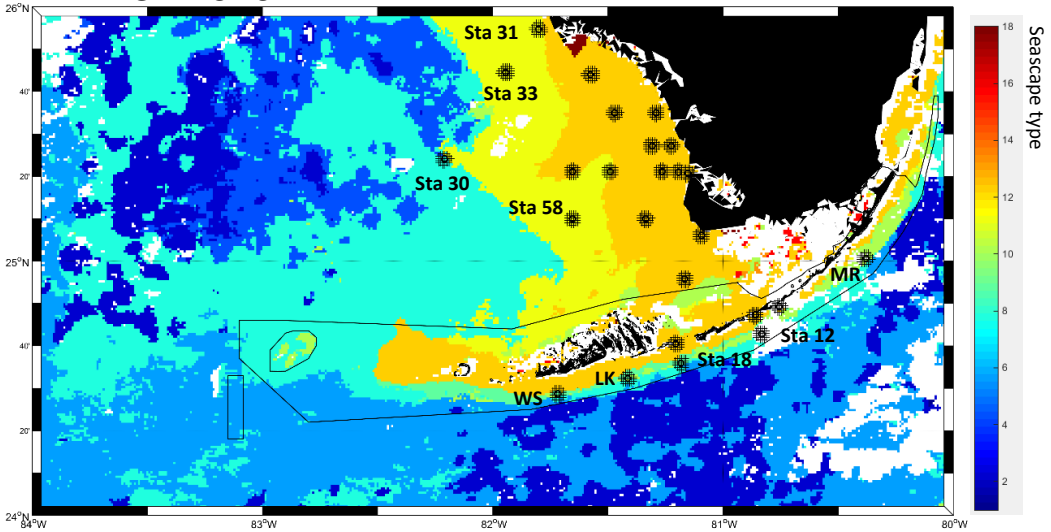


High PDO = High Forage Richness



Seascape validation in south Florida waters

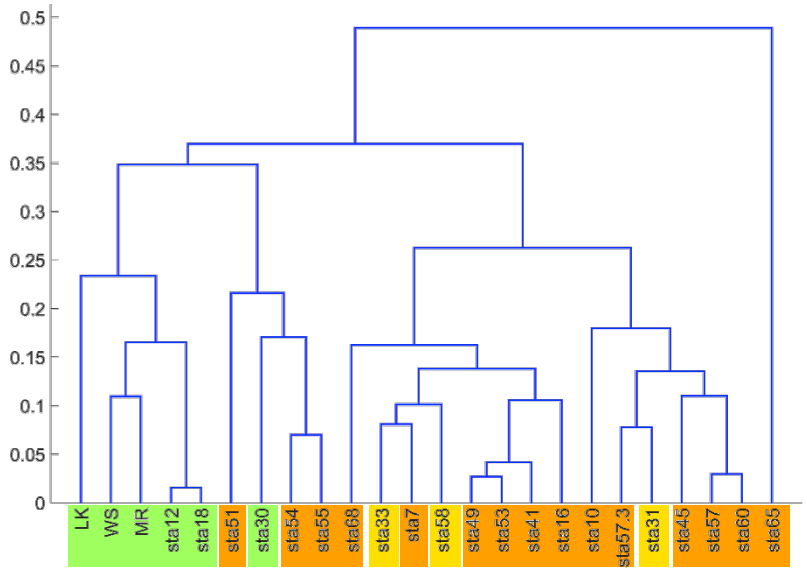
MARCH 2016



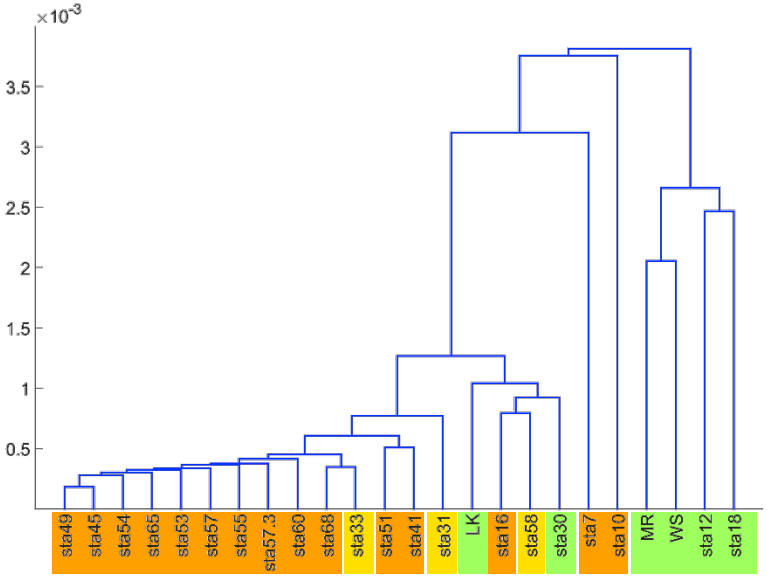
<u>Seascape validation:</u>

Seascapes show distinct phytoplankton communities

Phytoplankton pigments (HPLC)



Phytoplankton absorption spectra (a_{phy})



Seascape type

10

12

13

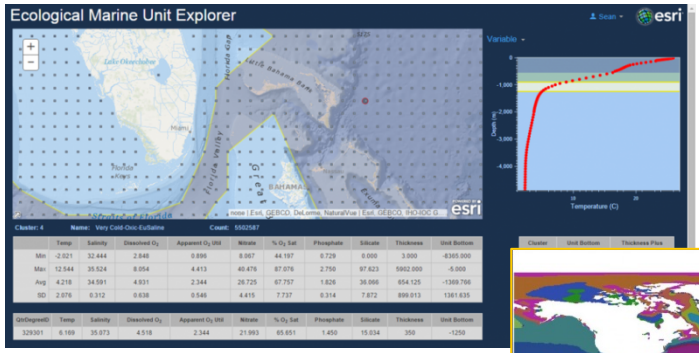
Regional to Global Seascapes

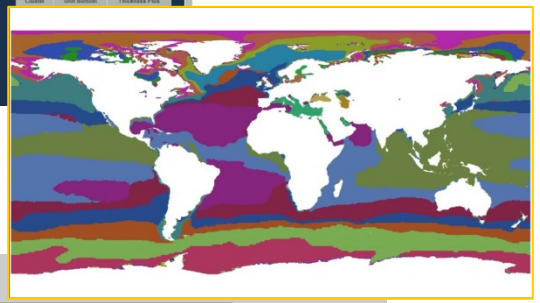
In progress/Next steps:

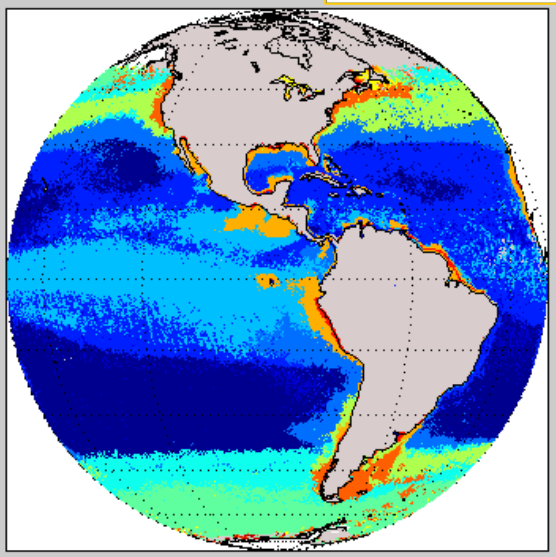
- Refine science questions
- Automate data flow between NASA, USF, WHOI, IOOS DMAC / Axiom
- COVERAGE: CEOS Ocean Variables Enabling Research and Applications for GEO
- Algorithms: HAB, acidification
- GEOBON and broader links:

➢ Link Seascapes and Ecological Marine Units/EMU (USGS/esri)

➢ Other partners/internationally







Surface ocean EMU

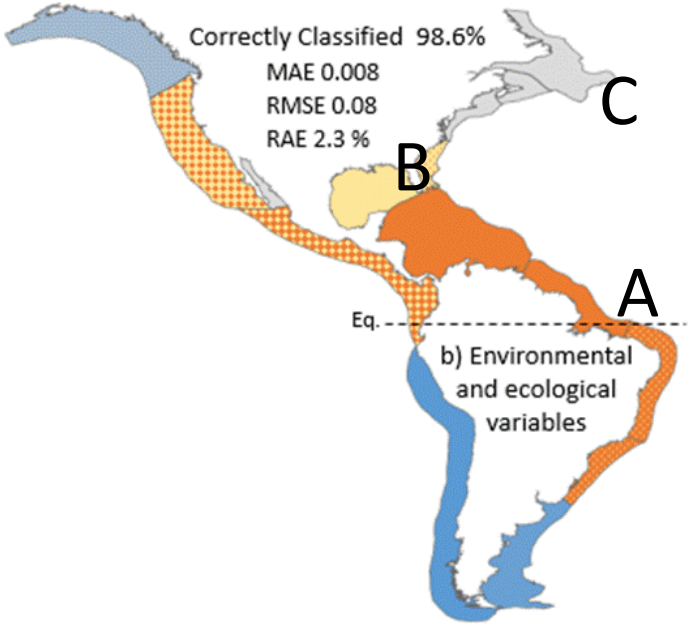
Surface ocean Seascapes

Example: diversity of fisheries and satellite seascapes in Large Marine Ecosystems (LME) of the Americas

Results:

Three megaregions

Between 1982 and 2010, seven LMEs diversified their fisheries



Muller-Karger et al., 2017. Megaregions Among the Large Marine Ecosystems of the Americas. Environmental Development. http://dx.doi.org/10.1016/j.envdev.2017.01.005.

MBON
Marine Biodiversity Observation Network

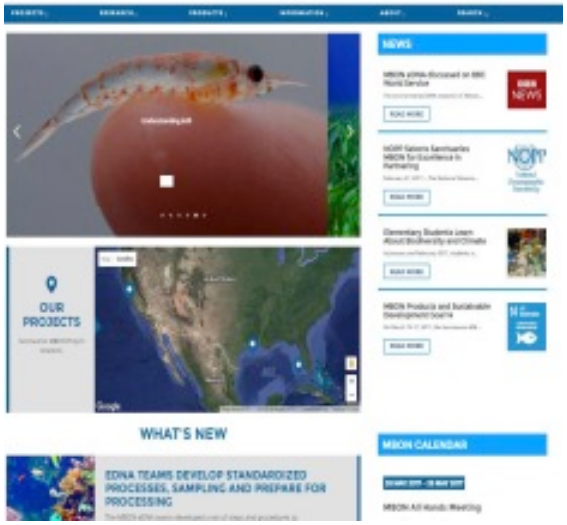
Communications & Outreach

CJ Reynolds, Jennifer Brown, Chris Simoniello, Mitch Roffer

Engage users and support Products

- Quarterly Updates,
- Short videos,
- Pod casts,
- Sanctuaries MBON website,
- User oriented webinars and tutorials

Coming soon: Sanctuaries.marinebon.org



CENTER FOR OCEAN SOLUTIONS

eDNA Video

MBON

Societal Relevance

SUSTAINABLE DEVELOPMENT GOAL 14

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

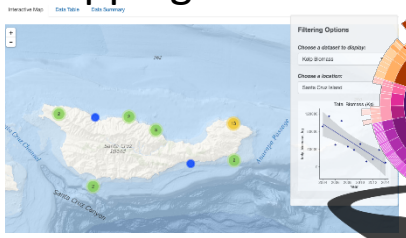
10 targets that require scientific information and capacity building on biodiversity

BLUE PLANET Oceans and Society

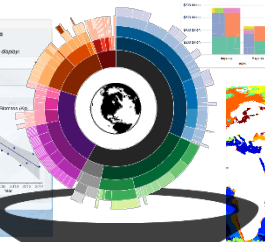
MBON Marine Biodiversity Observation Network

SDG14 Interactive web-based tool

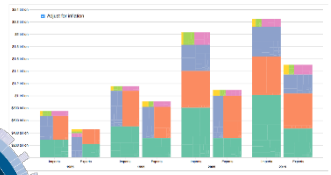
Mapping tools



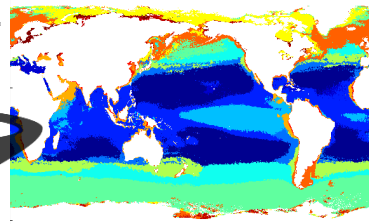
Taxa



Time series



Satellite seascapes



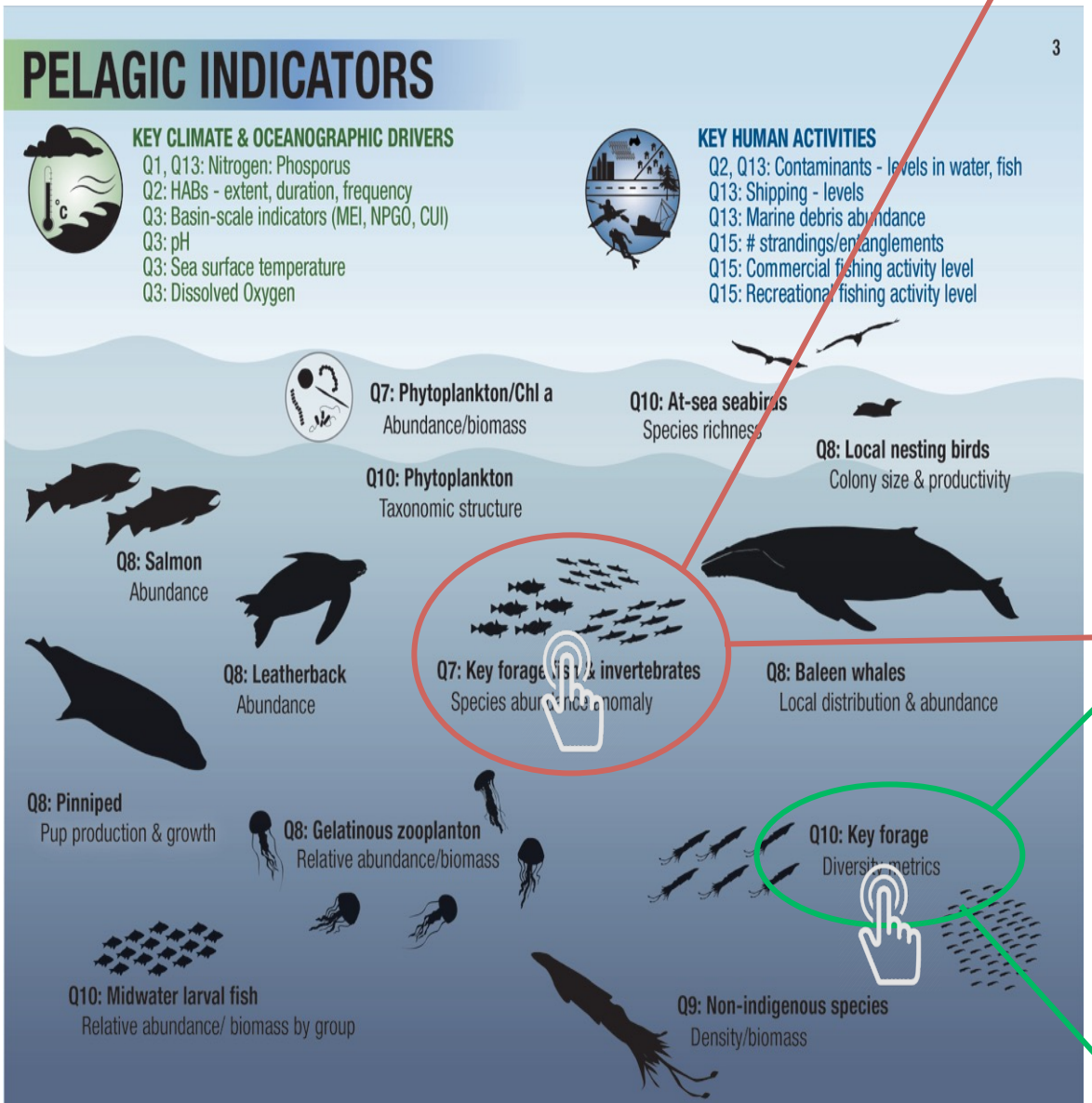
USGEO

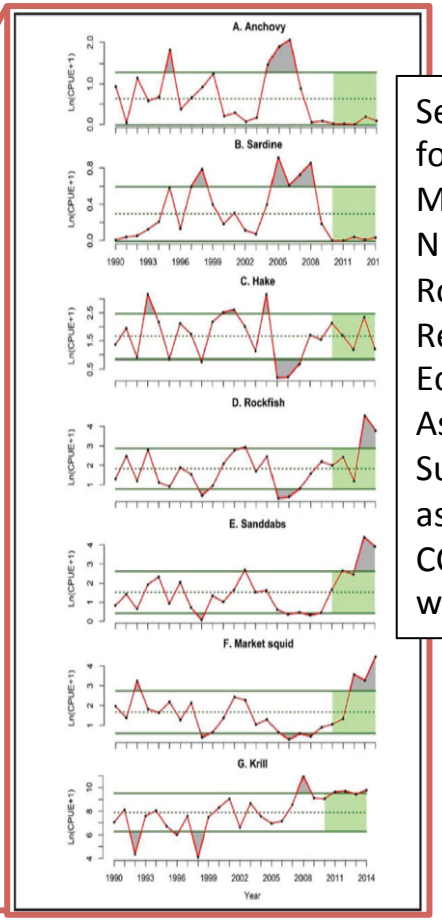
Support

14 LIFE BELOW WATER

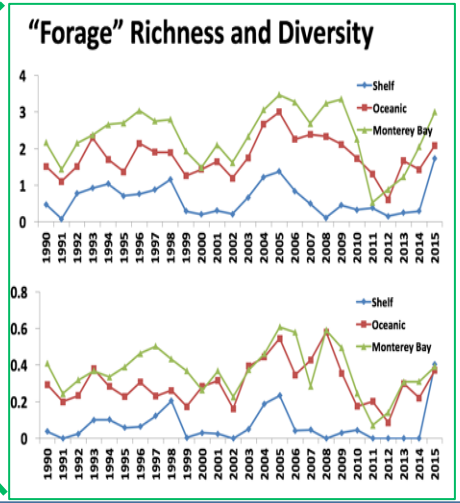
SUSTAINABLE DEVELOPMENT GOALS

Infographics: Conceptual Models for *Status and Trends* Products





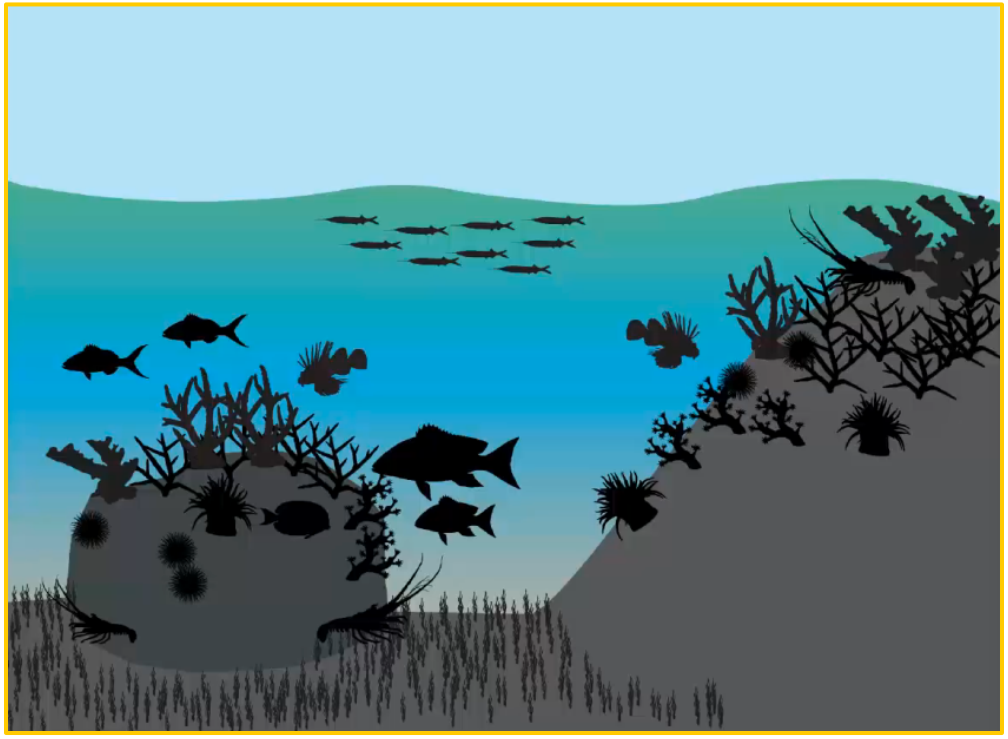
Seven key pelagic forage groups for MBNMS from NMFS-SWFSC Rockfish Recruitment and Ecosystem Assessment Surveys as reported on CCIEA indicator website



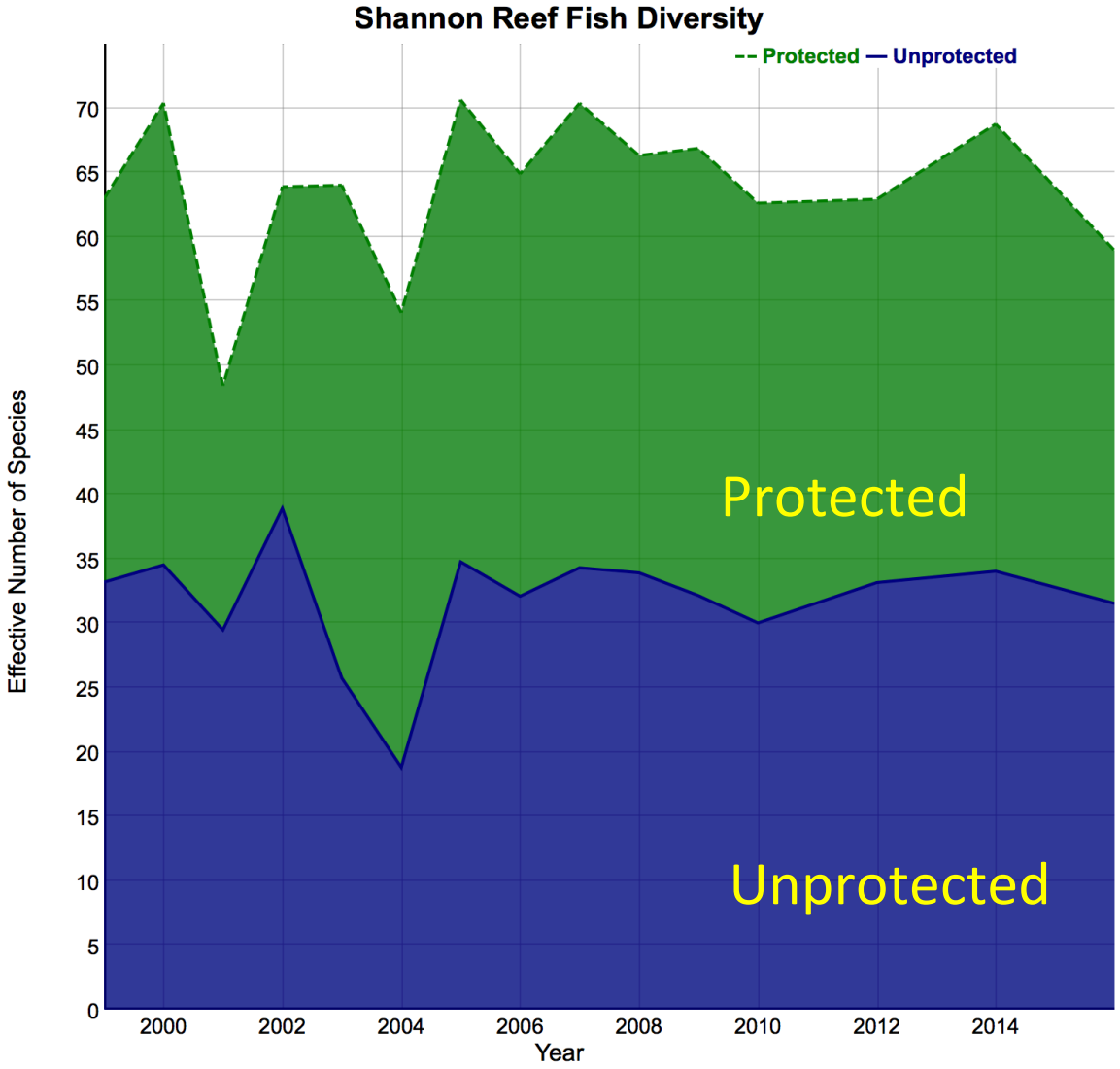
(Santora et al. in review)

Florida Keys Coral Reef Ecosystem (*Infographic* approach)

1. Reef fish biodiversity
2. Trophic Groups (13)
3. Trophic level (4)
4. Exploited reef fish (9)
5. Stony corals
6. Sea fans
7. Sponges
8. Caribbean spiny lobster
9. Queen conch
10. Sea turtles
11. Black sea urchin



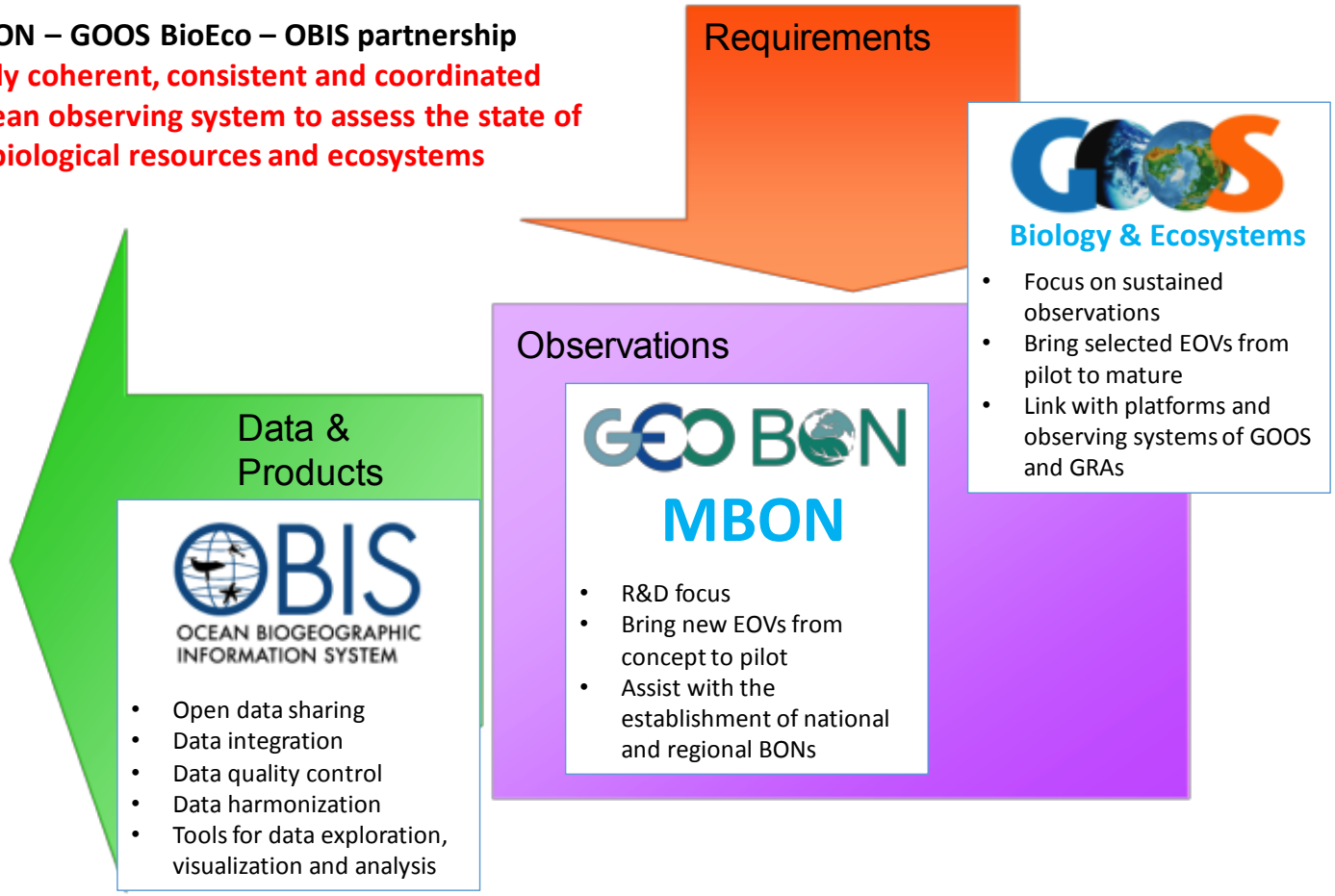
Florida Keys National Marine Sanctuary Reef Fish Diversity



A Global Collaboration: OBIS + GOOS (IOC) and MBON

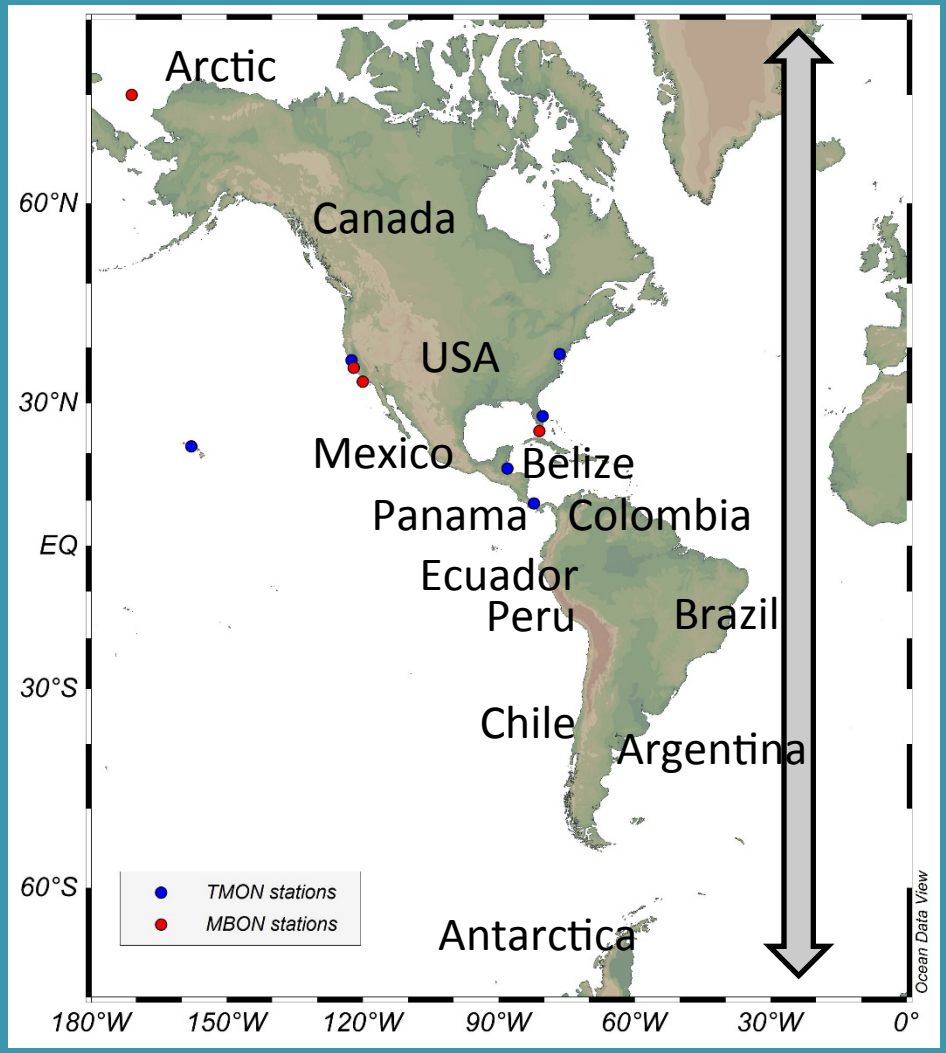
GEO BON/MBON – GOOS BioEco – OBIS partnership

Building a globally coherent, consistent and coordinated sustained global ocean observing system to assess the state of the ocean's biological resources and ecosystems



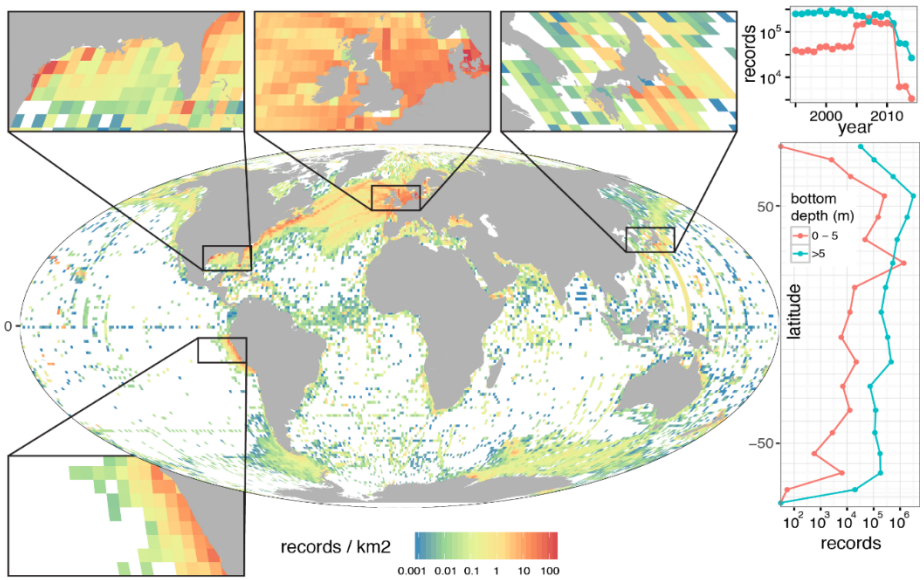
e.g.: http://iobis.org/2016/12/15/goosgeobonobis/

Pole-to-Pole MBON of the Americas

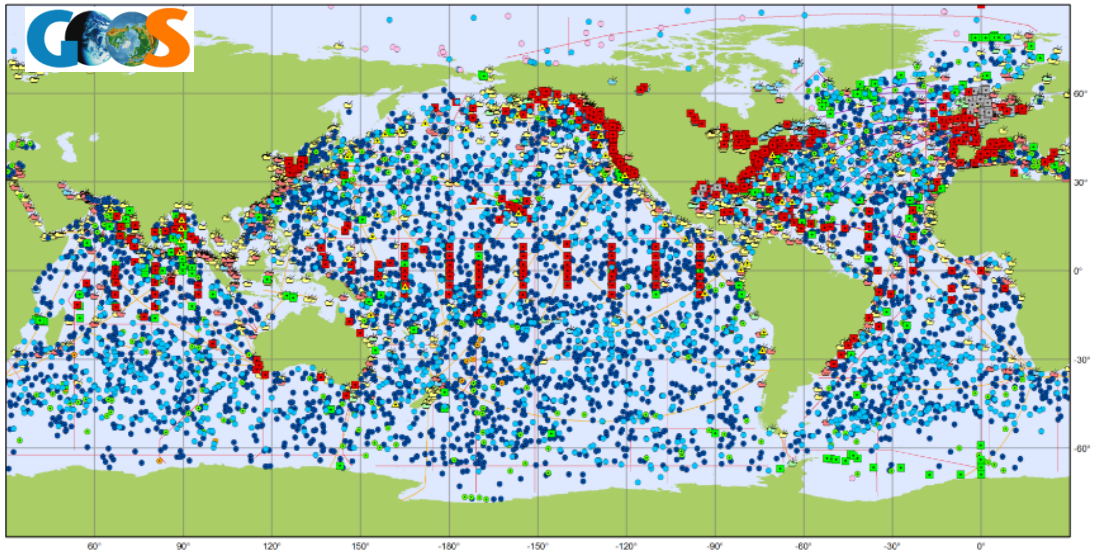


- GEO Plenary, Mexico (2015)
- Convention of Biological Diversity (Montreal, Apr 24, 2016)
- GEO BON Open Science Meeting (Leipzig, Jul 4-6,2016)
- Pole-to-Pole in the Americas Workshop (Puerto Morelos, Mexico, Sep 26-30, 2016)
- GEO-XIII Plenary (St Petersburg, Russia, Nov 9-10, 2016)
- Animal Telemetry Netw. – Mar,Aug'17
- Blue Planet – May 2017
- AmeriGEOSS –Jul 2017 Costa Rica
- OBIS, GOOS Workshops
- GEO Plenary-Oct 2017
- etc.

Co-chairs linking Africa, Europe, Asia-Pacific



Present to Future



MBON

Marine Biodiversity Observation Network

GOAL:

Increase observations of marine life building on GOOS, OBIS, and other networks:

- MarineGEO/Tennenbaum
- UNEP WCMC
- Americas (AmeriGEOSS)
- EuBON
- AsiaPacific
- Coral/GCRMN
- Africa
- CAFF (Arctic)
- National programs
- etc.

13 Hands-on STEM Lessons:

Elementary, Middle, High

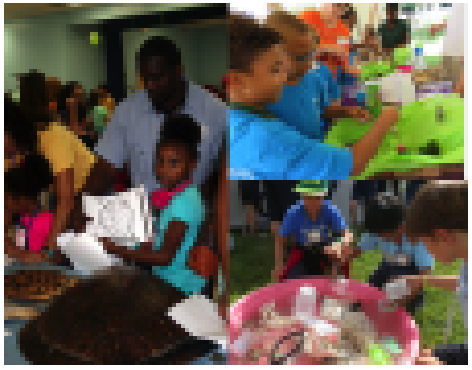
Standards cross-referenced

Science Festivals (4 annual)

Professional development

of educators

Outreach to minorities



Santuaries MBON Co-Investigators:
-Frank Muller-Karger (carib@usf.edu)
-Francisco Chavez (chfr@mbari.org)

The US Sanctuaries MBON Team

GEO BON MBON co-chairs:
-Frank Muller-Karger (carib@usf.edu)
-Isabel Sousa Pinto (ispinto@ciimar.up.pt)
-Mark Costello (m.costello@auckland.ac.nz)

MBON
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