The Marine Biodiversity Observation Network (MBON): Ties to DMAC

IOOS-RA DMAC Meeting

June 3, 2016

Silver Spring, MD

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MBON Evolution

- 2000-2010: Census of Marine Life
- **May 2010: NOPP workshop "Attaining an Operational Marine Biodiversity Observation Network (BON)"**
- May 2013: BioScience, "Envisioning a marine biodiversity observation network" (Duffy et al.)
- August 2013: NOPP call for MBON proposals
- June 2014: Oceanography, "A framework for a marine biodiversity observing network within changing continental shelf seascapes." (Muller-Karger et al.)
- **Fall 2014 – MBON demo projects launched**
- Fall 2015 – MBON "Pole to Pole" announced at Group on Earth Observations (GEO) Plenary, Mexico City
- **November 2015, Dr. Sullivan to GEO: "MBON underpins the concept of environmental intelligence."**
- Spring 2016 – MBON established as a GEO BON Thematic Node

2010 MBON Workshop Outcomes

Key conclusion: BON will fill knowledge gaps and inform decisions, is possible with existing technology, is "critically useful" for establishing long-term species status and trends

Recommendation #7: "Initiate an integrated marine BON demonstration project soon."

Demo projects should:

- Integrate existing programs and methodologies with new approaches
- Address multiple scales - microbes to whales, instants to centuries, in situ to satellite.
- Consider sampling needs (automated processing, species identification, informatics), and
- Meet community data management requirements and make data accessible.

MBON Vision

MBON partners are building a network to observe marine life – how it's changing and how that affects us.

- Significant investments have been made in ocean observing (primarily physical/biogeochemical)…
- … but there has been no systematic, integrated effort to observe life in the sea.
- Our vision is a long-term, multi-sector (federal, academic, NGO, etc.) partnership.

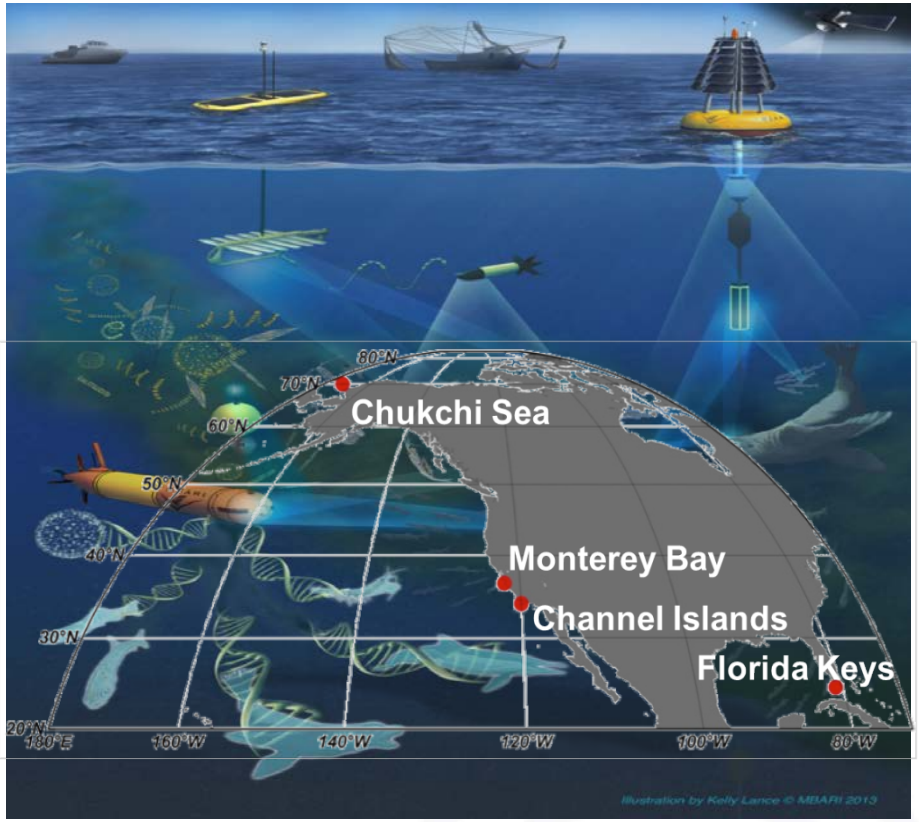
U.S. MBON Demonstration Projects

Interagency support:

- $15M from NASA, NOAA (IOOS and OER), and BOEM – FY14-18
- In-kind from USGS on DMAC, ecological mapping units

Demo projects are working together to:

- Increase efficiencies and fill gaps in biodiversity monitoring
- Integrate biological and environmental obs; remote sensing with in situ
- Develop methods for automated biological sampling
- Lead global development of marine biodiversity indicators and variables
- **Address questions about DMAC for biological and biodiversity data in the context of ocean observing**
- **Create and MBON portal**
- Develop a sustainable U.S. MBON



Credit: MBARI

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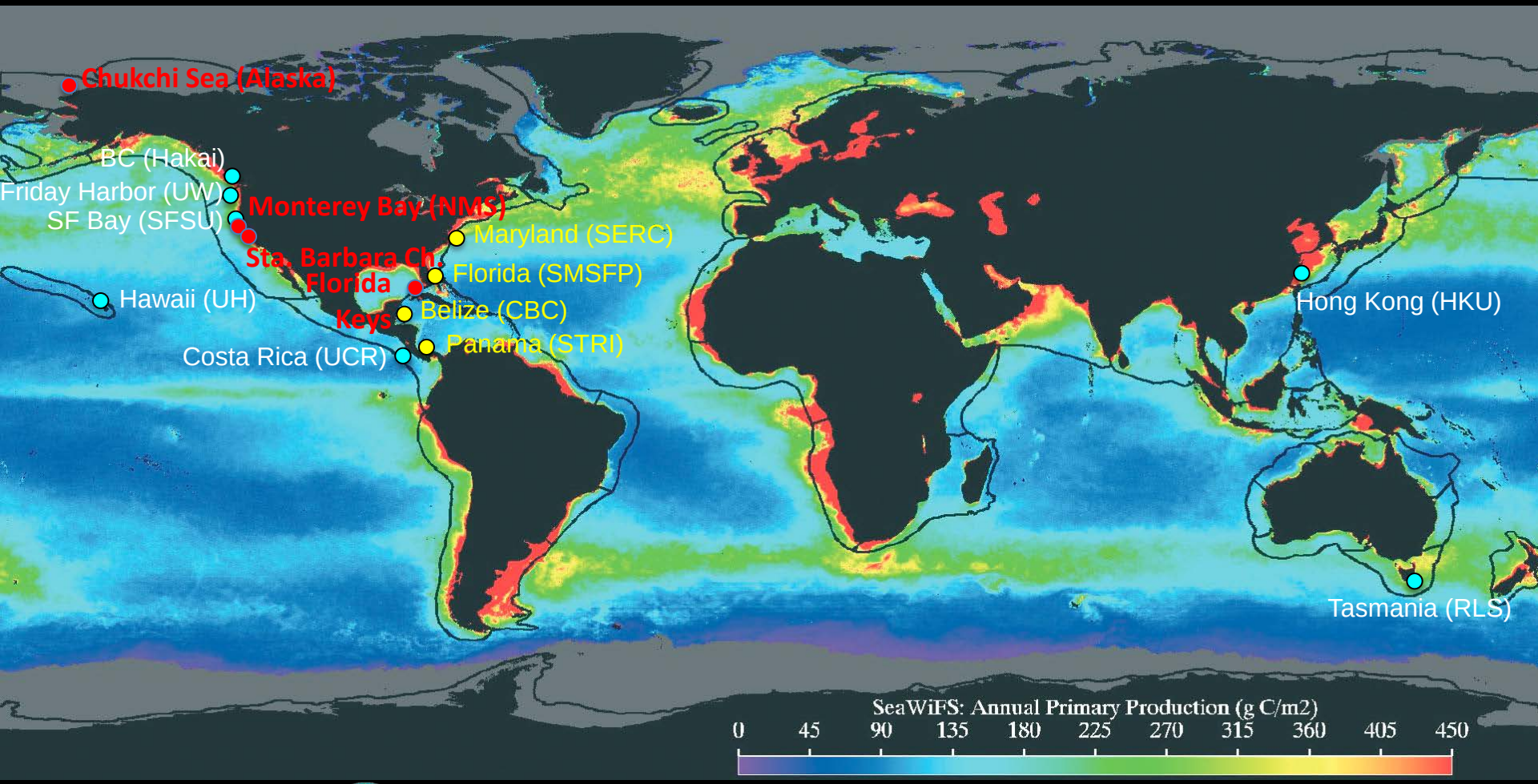
Current MBON Collaborations



NASA NOAA Smithsonian BOEM Bureau of Ocean Energy Management

A True Network: Cross-MBON Integration

The 3 U.S. MBON demo projects and and Smithsonian's Tennenbaum Marine Observatories Network are working together on :

- Data management, MBON portal development
- eDNA methods and data handling
- "Seascapes" development
  - Inter-disciplinary approach based on landscape ecology; merges ecology, geography, and ocean dynamics to observe species embedded in a dynamic seascape, where boundaries, extent, and location of features change with time
- Outreach and communications
- Other issues by request

MBON Pieces

Measurements
Observations, EBVs, species, environment, function

- National/State surveys, Protected areas, Harvests/landings, Remote Sensing, Research expeditions, Autonomous vehicles, Advanced technologies (acoustics, video, etc.)

Information system
Standards, Integration, Archives

- MBON is: Online, easily accessible, real-time, open access; Spatially-oriented; Graphs, charts, status and trends; Integrated species, habitat, economic data

Analysis tools
Indices, Statistics, Seascapes, Indicators

Products
Stakeholder requirements, Tools

- Time series, Indices, Indicators (e.g. ocean health, pteropods for Ocean Acidification, sardines/anchovies, krill, Spatial distributions, Forecasts, Seascapes

MBON Data

- Species and abundance
  - Phytoplankton, zooplankton, fish, corals, invertebrates, marine mammals, microbes, sea birds, sea turtles, and submerged aquatic vegetation (benthic and pelagic)
- Biological vital rates
  - including but not limited to production, recruitment, mortality, fecundity, growth, feeding rates , and microbial activity)
- Nekton diet
  - Diets of fish, sea birds, sea turtles, and marine mammals); and
- Environmental DNA
  - MBON projects are evaluating methods for collecting and analyzing water samples and proof of concept for eDNA in an MBON

MBON and IOOS Biological Core Variables

IOOS Biological Core Variables	Sanctuaries BON	AMBON	SBC BON
Fish species/abundance	yes	yes	yes
Phytoplankton species/abundance	yes	yes	yes
Zooplankton species/abundance	yes	yes	yes
Coral species/abundance	yes	yes (soft corals)	yes
Invertebrate species/abundance	yes	yes	yes
Marine mammal species/abundance	yes	yes	yes
Microbial species/abundance/activity	yes	yes	yes
Sea birds species/abundance	yes	yes	yes
Sea turtles species/abundance	yes	n/a	
Submerged aquatic vegetation species/abundance	yes	too deep	yes
Biological vital rates (includes production, recruitment, mortality, fecundity, growth, feeding rates, microbial activity, etc.)	yes	maybe	
Nekton diet (diets of fish, sea birds, sea turtles, and marine mammals)	yes		
Sound	no	yes	yes

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Our Collective Challenge

- The MBON demos are working with all IOOS biological data variables -- grappling with questions that IOOS has such as:
  - How to handle standards for bio data
  - How to integrate across large bio data collection efforts
  - How data should flow from data collection to RAs, IOOS catalog, OBIS, etc.
  - Best options for data accessibility and visualization
  - Integrating across diverse biological monitoring activities
  - Integrating biological with environmental data
- We can learn from the MBON DMAC process to help IOOS meet its biological data objectives
- What are CeNCOOS, GCOOS and AOOS learning from the process?
- How might we bring additional RAs to the table?

Thank you!

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