

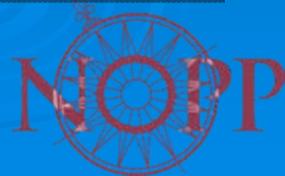
A National Marine Biodiversity Observing Network to Inform Ecosystem Based Management and Science

Dr. Reginald Beach, Senior Scientist

National Oceanic and Atmospheric Administration, Office of Oceanic and Atmospheric Research, Office of Exploration and Research



PICES Conference
29 October 2010, Portland, Oregon



Attaining Operational Marine* Biodiversity Observations

A Workshop to Determine the Status of Current Abilities and Scope Future Solutions

Joint Subcommittee on Ocean Science & Technology's Interagency
Working Group on Ocean Partnerships

Federal Agency Interests in Biodiversity
From Baseline Inventories & Science to Application

It is clear that biodiversity is a topic that is too large for any one U.S. agency to take-on by itself. To preserve marine biodiversity, the U.S. should expand upon what is known in the domestic and international marine science community regarding biodiversity and build upon existing agency strengths and mandates through new partnerships, approaches and science.

To address these challenges, an ad hoc group of federal representatives are holding quarterly meetings . The group strives to identify common ground, plan future steps and initiate partnership activities.



Attaining Operational Marine Biodiversity Observations
24-27 May 2010, Washington, DC



Federal Sponsors

- Woody Turner NASA / Biodiversity
- Eric Lindstrom NASA / PO
- Bob Gisiner MMC
- Sally Valdes MMS
- Jim Eckman ONR / NOPP
- Mike Weise ONR
- Gabrielle Canonico NOAA / NOS / IOOS
- Paul Ticco NOAA / NOS/ NMS
- Eric Breuer NOAA / NMFS / S&T
- Reggie Beach NOAA / OAR / OER
- Scott Snyder NSF / DEB
- Dave Garrison NSF / OCE
- Chris Meyer SMITHSONIAN INSTITUTION

Steering Committee

- Linda Amaral-Zettler Marine Biological Laboratory (Co-Chair)
- Kendra Daly University of South Florida
- J. Emmett Duffy Virginia Institute of Marine Science (Co-Chair)
- Daphne Fautin University of Kansas
- Gustav Paulay University of Florida (Co-Chair)
- Alex Rogers Zoological Society of London
- Tatiana Rynearson University of Rhode Island
- Heidi Sosik Woods Hole Oceanographic Institution
- John (Jay) Stachowicz University of California-Davis

A Federal Agency Perspective on the Need for Coordinated Observations of Biodiversity

- Several agencies have responsibility for managing and conserving elements of marine, coastal and lacustrine biodiversity.
- Managing aquatic biodiversity can serve as a proxy for managing a number of other important ecosystem services (e.g., Palumbi et al. 2009).
- Properly managing biodiversity and reducing our negative impacts upon it requires observation systems to monitor the condition of biodiversity over time.
- To monitor biodiversity effectively, we must do so at all levels: ecosystems (habitats), species and populations, and genes (molecular).
- There are a number of biodiversity-relevant observation systems in place today across the USG but they are not coordinated and thus far less effective than they might be. There are also many gaps in terms of the breadth of biodiversity observations needed.



Attaining Operational Marine Biodiversity Observations
24-27 May 2010, Washington, DC



A Federal Agency Perspective on the Need for Coordinated Observations of Biodiversity

- Federal agencies now realize the imperative for integration—a coordinated and interagency strategic approach to observations of elements of aquatic biodiversity.
- It's only been within the last few years that many of the tools and methods required to observe biodiversity at multiple scales have become available—and working across spatial and temporal scales is crucial (using tools from microsattellites to satellites orbiting the Earth)!
- Observation systems devoted to the physical aspects of aquatic systems have much to teach us and are a good start but a biological observation network will require us to develop some new approaches.
- We cannot monitor every species and ecosystem, in every location, using every technique, at all times of the year. We have to make some choices. We need your help in focusing our efforts.
- We need information to evaluate trends and help predict future distributions and abundances in order to manage our activities in a ways that protect of biodiversity and associated ecosystem services.
- Given the threats to biodiversity and ecosystem services, we have no time to lose.



Attaining Operational Marine Biodiversity Observations
24-27 May 2010, Washington, DC



Why is Biodiversity Important?

Biodiversity increases productivity and stability of marine ecosystems

Plant Diversity

Resource Use
Primary production
Animal production

Increase in
high diversity
community

+ 17%
+ 79%
+ 80%

Number of
Experiments

5
3
14

Animal Diversity

Resource Use
Animal Production
Nutrient Cycling
Stability

+ 37%
+ 78%
+ 5%
+ 15%

5
6
9
8

Analysis of 32 published studies that manipulated diversity (through early 2005):



Worm et al. 2006, Science

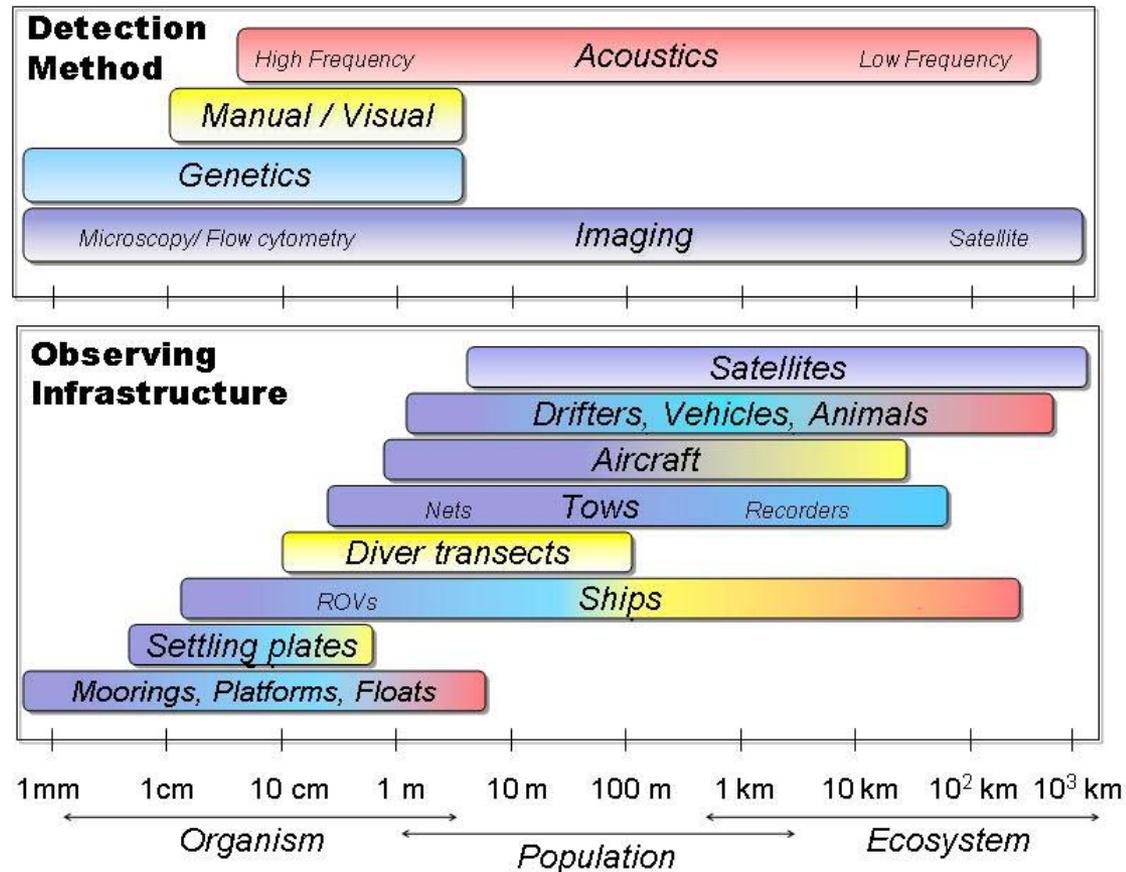
Attaining Operational Marine Biodiversity Observations Workshop

- The three day workshop, organized by the National Oceanographic Partnership Program Office, convened in Washington, DC in May 2010.
- Seven federal sponsors (NOAA, NASA, MMC, ONR, NSF, BOEMRE, and SI) funded the workshop.
- 7 of the 9 steering committee members and over 35 marine experts attended.
- The purpose was to develop recommendations for implementing a national marine biodiversity observing network (BON).
- Discussions focused on challenges and opportunities by habitat, taxa, existing and future methodologies and BON case studies.

Output from Marine BON Workshop

- Draft Synthesis Report organized by:
 - Executive Summary and Introduction
 - Workshop Structure and Outcomes
 - 7 Recommendations
 - 4 case studies (Deep sea, Continental shelves, Nearshore regions / Great Lakes, and Coral reefs)
- Additional highlights of report:
 - Existing methods diagram illustrating diversity at multiple levels and across taxa and temporal scales
 - Top issues for a marine BON to address
 - Transformative approaches section to implementing a marine BON
- Report available for review and comment on www.nopp.org/forum until November 2010 and we seek additional input on recommendations from PICES and NCSE conferences.
- Final report expected in January 2011.

Existing Methods to Measure Biodiversity



T. Ryneason

Figure 3. Aquatic biodiversity can be assessed over a range of spatial scales from millimeters to thousands of km using a combination of detection methods (top panel) and observing infrastructure (bottom panel). Some observing infrastructures can accommodate multiple detection methods, indicated here by different colors: e.g. ships can accommodate all four detection methods whereas satellites use only imaging methods. The relevant spatial scales refer to the range of a single unit and single sortie for each instrument type.

BON Recommendations 1 & 2

- **Recommendation 1: *Coordinate biodiversity sampling across taxa, habitats, hierarchical levels, and methods.***

Certain preferred sampling and observing components of marine biodiversity should serve as the standard for integrated marine biodiversity observation programs.

- **Recommendation 2: *Maximize compatibility of BON with legacy data.***

Sampling schemes for a marine BON should include A) designing sampling schemes that, where possible, produce data that can be meaningfully compared with historical data, and B) investment in rescuing historical marine biodiversity data by digitizing and organizing them into user-friendly electronic formats that are made publicly available.

BON Recommendations 3 & 4

- **Recommendation 3: *Establish one or more Biodiversity Observation Headquarters to coordinate sample processing, including taxonomic identifications, data management, and training.***

Sustained long-term support for a central BON processing facility, including the personnel to process large volumes of samples and observations and the requisite information technology infrastructure, must be developed.

- **Recommendation 4: *Synthesize and make accessible marine taxonomic resources.***

Organizing and synthesizing taxonomic resources would greatly enhance capacity for a biodiversity inventory, speeding identification of organisms sampled and observed.

BON Recommendations 5 & 6

- **Recommendation 5: *Initiate an integrated marine BON demonstration project as soon as possible.***

Proving the concept of an end-to-end observation program—from intraspecific variation through species to remotely sensed habitat level diversity—at a specific site as a demonstration project is a first step to initiating an integrated marine BON.

- **Recommendation 6: *Invest in developing new approaches for automated sample processing.***

Systems should be developed to automate sample processing and organize biodiversity observations to eliminate the bottleneck of copious observation samples and images.



BON Recommendation 7

- **Recommendation 7: *Modernize and enhance the nation's physical infrastructure for marine exploration.***

The US fleet of vehicles capable of working at depths greater than 4500 m was judged inadequate to achieve a basic assessment of deep-sea biodiversity; an expanded fleet of ROVs and AUVs is needed.



Photo credit: WHOI

Conclusions

- The formation of a national marine BON is possible with existing technology.
- An operational BON would fill knowledge gaps and provide a sound basis for informing scientific, government, industry and public decisions.
- The BON must integrate observations across the hierarchical levels of biodiversity, from intraspecific genetic variation through species and functional groups to remotely sensed habitat-level diversity.
- Sampling approaches must be linked across scales of space and time.

BON Pilot Study & Census of Marine Life (CoML)

- A pilot project in a specific region, most likely a nearshore region, could provide an example of what technologies and infrastructure could be utilized to implement a comprehensive marine BON.
- Information on biodiversity hotspots from CoML projects could also help identify an ideal pilot project area.
- Recommendation 2 highlights the need to make the BON compatible with legacy data, and CoML data will be critical to incorporate into the BON.

Photo credit:
Kevin Raskoff, ArcOD



We Want Your Input!

- Using the time left in this session, we would like your input and impressions on the seven recommendations and any comments on implementing a national marine BON.
- Please visit www.nopp.org/forum before 19 November 2010 to review the full draft report and appendices and provide input.
- E-mail comments to: NOPPO@OCEANLEADERSHIP.ORG
- SUBJECT: BON Report
- Questions?
Please contact:
reginald.beach@noaa.gov or
hgoodwin@oceanleadership.org



Photo credit: NOAA