Ocean Research and Resources Advisory Panel

5-6 June 2006
Consortium for Oceanographic Research and Education
1201 New York Avenue NW, Suite 420
Washington, DC

Subcommittee on Integrated Management of Ocean Resources (SIMOR)

Ocean Research and Resources Advisory Panel – June 5, 2006

Gerhard Kuska & Mary Glackin

Co-Chairs, Subcommittee on Integrated Management of Ocean Resources

ORRAP Discussion Outline

- Update of SIMOR Activities from January 2006
- Next Steps for SIMOR
- SIMOR – ORRAP Opportunities
- Discussion

Subcommittee on Integrated Management of Ocean Resources (SIMOR)

- Includes members from all agencies represented on the Committee on Ocean Policy
- Co-Chairs: Gerhard Kuska (CEQ), Diane Regas (EPA), Chris Kearney (DOI), and Mary Glackin (NOAA)

SIMOR seeks to identify and promote opportunities for collaboration and cooperation among federal agencies and to build partnerships among Federal, State, Tribal and local authorities, the private sector, international partners, and other interested parties.

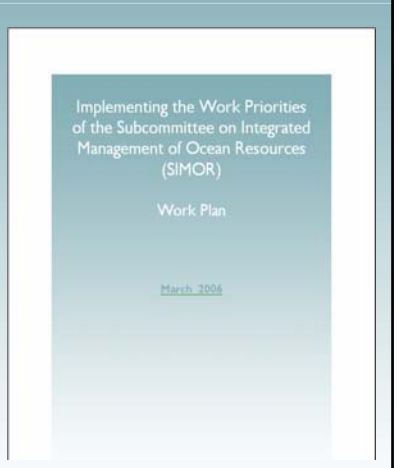
Update of SIMOR Activities from January 2006

- SIMOR Work Plan Approved by ICOSRMI March, 2006
- Work Plan Implementation Underway
- SIMOR Input into the ORPP Development Process
- Active Outreach by SIMOR within Federal Agencies
- Active Outreach by SIMOR outside Federal Agencies

SIMOR Work Plan

- Organized by 4 Priority Areas
  - Support Regional and Local Collaboration
  - Facilitate Use of Ocean Science and Technology in Ocean Resource Mgt
  - Enhance Ocean, Coastal, and Great Lakes Resource Management to Improve Use and Conservation
  - Enhance Ocean Education

  - ➢ Initiates short-term deliverables and long-term efforts
  - ➢ Represents efforts that can be accomplished with existing resources
  - ➢ Additional activities are expected to be identified



Next Steps for SIMOR

- Continued Work Plan Implementation
- Detailed Schedules for Action Item Implementation
- Expansion of Action Item Workgroups
- Formal SIMOR Outreach Presentations
- Town Hall Meetings
- Informal Stakeholder Listening Sessions
- Identify Needed Future Actions

SIMOR – ORRAP Opportunities

- Advice/Input to SIMOR based on "Bridging the Gap"
- Advice to SIMOR on Work Plan Implementation
- Advice to SIMOR on Outreach and Stakeholder Identification
- Identify Potential Future SIMOR Action Items

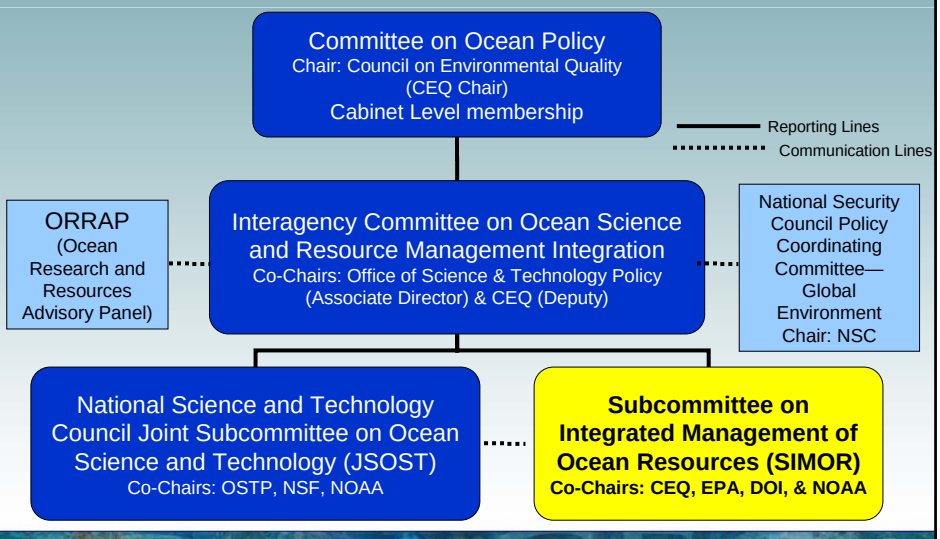
Discussion

More information on the Committee on Ocean Policy Website:

www.ocean.ceq.gov

Backup

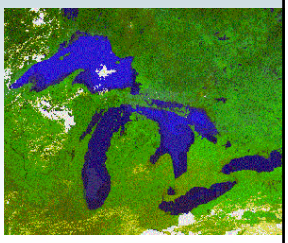
Coordinated Ocean Governance Structure



Highlights of Expected Outcomes (Priority Area 1)

Support Regional & Local Collaboration

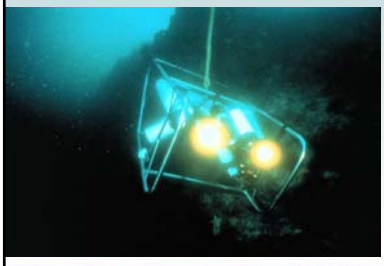
- Increased collaboration in regions across the nation to improve use and conservation of oceans, coasts, and Great Lakes
  - Gulf of Mexico Lessons learned and best practices
  - Great Lakes lessons learned / Clean marina certifications / Best practices for managing dredged material and sediment
  - Support the Northeast Regional Oceans Council initiative
  - Support local communities with the most effective techniques for watershed protection
  - Community workshops on watershed protection
  - Workshops on ecosystem approaches to management
- State decision making supported by Federal ocean economics data
- Improved management of urban estuaries



Highlights of Expected Outcomes (Priority Area 2)

Facilitate Use of Ocean Science and Technology in Ocean Resource Management

- Regionally-networked research plans based on resource mgt priorities
- Federal/State/local collaboration for science to management application
- Integrated ecosystem approach to research with common data standards to support decision making



- Routine sharing of new science from the research community to resource managers
- Use of research results in operations and use of operationally-collected measurements in research

➢ Collaboration with JSOST, and with States through FSTT and additional task teams

Highlights of Expected Outcomes (Priority Area 3)

Enhance Ocean, Coastal, and Great Lakes Resource Management to Improve Use & Conservation

- Improved coordination of programs that seek to make oceans, coasts, and Great Lakes cleaner, healthier, and more productive
  - Comprehensive inventory of interagency activities and areas of interest
  - Efficient and inclusive interagency communications network
  - Readily available and easily utilized data on chemical, pathogenic, and toxin constituents that affect the risks to human health of eating shellfish

- Model for federal-state collaboration to improve water quality programs and reduce the impacts of land-based pollution on coasts

Highlights of Expected Outcomes (Priority Area 4)

Enhance Ocean Education

- Improved coordination of federal programs, in collaboration with JSOST, focused on ocean education and outreach to reflect priorities at the regional, State, and local levels – while maintaining consistency with broad national goals.
  - Ocean Education Implementation Plan
  - Comprehensive inventory of and metrics for current ocean education activities
  - Develop readily available and easily utilized data from ocean and earth observations systems for teachers, students, and the general public
  - Enhance understanding of the status of the current and future ocean workforce and areas for additional efforts
  - Host a high-level ocean education event – Conference on Ocean Literacy

SIMOR Input into the ORPP Development Process

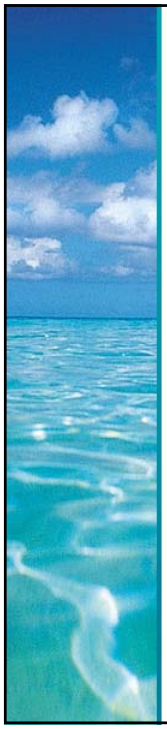
Federal State Task Team

- **Co-Chairs**
  - Peyton Robertson, Deputy Director, NOAA Chesapeake Bay Office
  - Holly Greening, Senior Scientist, Tampa Bay Estuary Program
  - Susan Snow-Cotter, Massachusetts Coastal Zone Management Program
  - (Past co-chair, Deborah Hernandez, formerly Director of Policy and Program Development, South Carolina Office of Ocean and Coastal Resource Management)
- **States**
  - Brian Baird, Assistant Secretary for Resources, Resources Agency of CA
  - Peg Bostwick, 404 Program Coordinator, MI Dept. of Environmental Quality
  - Rick DeVoe, Executive Director, South Carolina Sea Grant Consortium
  - Lisa Sharrard Jones, State Coordinator, Flood Mitigation Programs, SC DNR
  - Denby Lloyd, Director, Alaska Division of Commercial Fisheries
  - Bill Rohring, U.S. Virgin Islands Coastal Zone Management Program
  - Steven Rumrill, South Slough National Estuarine Research Reserve, Oregon

SIMOR Input into the ORPP Development Process

Federal State Task Team (continued)

- **Federal Agencies**
  - Joan Pope, U.S. Army Corps of Engineers
  - Richard Corley, U.S. Department of Transportation, MARAD
  - Stephanie Gambino, Minerals Management Service
  - Gary D. Brewer, Associate Regional Biologist, U.S. Geological Survey
  - Phil Colarusso, EPA New England, Bob Howard, EPA Region 4 [alternate]
  - Paul DiGiacomo, NASA Jet Propulsion Laboratory
  - Sheryl Kunickis, USDA/NRCS
- **Support**
  - Melissa Ladd, NOAA Coastal Services Center
  - Kristine Hiltunen, NOAA Office of Program Planning and Integration



Guiding National Ocean Research Investment: *The Development of the Ocean Research Priorities Plan*

Margaret Leinen - NSF Richard Spinrad – NOAA
Dan Walker - OSTP

National Science and Technology Council
Joint Subcommittee on Ocean Science and Technology (JSOST)

ORRAP Meeting
June 5, 2006

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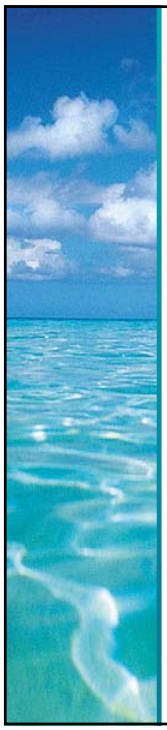

Ocean Research Priorities Plan Development

- Planning Document released for public comment March 27 to May 15, 2006
- Public workshop: April 18-20; Denver, CO
  - ~240 participants, representing 28 states and American Samoa
    - Federal government-39%
    - Academic-34%
    - NGO-12%
    - Private industry-9%
    - State/local government-6%
  - Representation from SIMOR, JSOST, ORRAP

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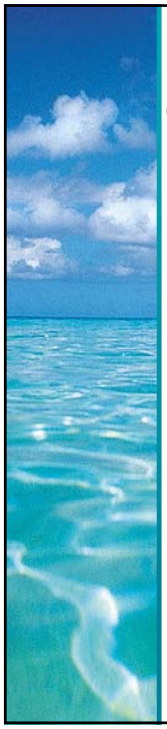

Public Workshop on the Development of the Ocean Research Priorities Plan: *Agenda*

- Emphasis on participant interaction and engagement through multiple, small breakout sessions

Day 1 Plenary: Welcome, Keynote Speakers

Breakouts: Cross-cutting Themes

Day 2 Plenary: Report-outs on Cross- cutting themes

Breakouts: Societal Themes

Day 3 Plenary: Report-outs on societal themes; wrap-up and next steps

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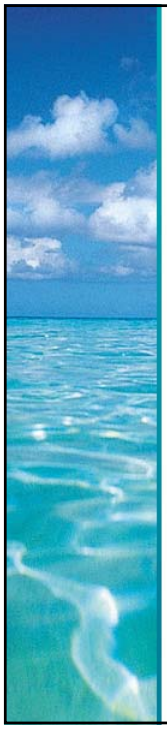

Public Workshop on the Development of the Ocean Research Priorities Plan: *Plenary Speakers*

- Admiral James Watkins, US Navy (ret)
  - Joint Ocean Commission Initiative and former Chair of the U.S. Commission on Ocean Policy.
- Secretary Mike Chrisman-California Resources Agency
  - Oversees policies, activities, and a budget of $4.1 billion and 14,712 employees in 24 departments, commissions, boards and conservancies on conservation, water, fish and game, forestry, parks, energy, coastal, marine and landscape.

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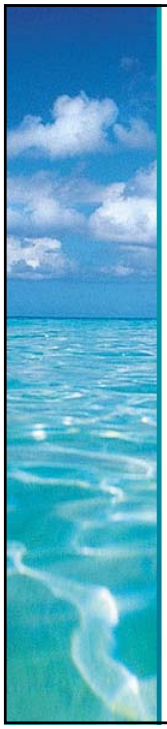

Public Workshop on the Development of the Ocean Research Priorities Plan: *THEMES/Breakout Sessions*

- Societal Themes
  - Enhancing human health
  - Improving ecosystem health
  - Sustaining natural resources
  - Promoting marine operations
  - **The ocean's role in climate variability and change**
  - Mitigating effects of natural hazards
  - Improving quality of life
- Crosscutting Themes
  - Basic understanding of the ocean
  - Expanded ocean education
  - **Research support through ocean observations and infrastructure**

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Charge: Societal Themes

- Identify and prioritize the critical challenges and expected results most important to your theme.
- Identify and prioritize the essential research areas and critical infrastructure/technology that are necessary to address the priority challenges and expected results
- Use the planning document as a **starting point** for discussions focus on the critical research needed to ensure progress toward specified outcomes related to seven selected societal relevant themes
- Consider during your discussion elements within the themes that may be common to other societal themes

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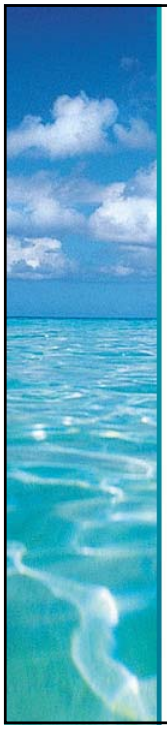
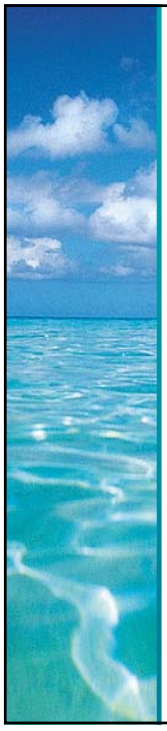


Results: The Ocean and Climate

Challenges:

- Fundamental understanding of ocean circulation and its role in climate, and of sea level rise.
- Understanding the role of chemical cycles in the biosphere in regulating and responding to climate and ocean circulation
- Understanding cross-scale linkages within the Earth system
- Ability to identify potential for abrupt change or "tipping points" (e.g., release of methane, biomass distribution, ecosystem regime shifts).
- Sufficient understanding of Earth system to allow separation of natural and anthropogenic effects on climate, and ocean climate effects on humans.
- *A cross-cutting issue:*
  Conversion of research results to information that will effectively
  - inform/educate the public
  - enable resource managers and policy/decision makers
  - enhance national defense and economic security



Results: The Ocean and Climate

Research Needs:

- Enable a consistent picture of the ocean's role in climate through analysis of paleo and instrumental data.
- Improve understanding of key regional (e.g., polar, tropical, coastal) processes (e.g., ocean circulation, air-sea interaction, convection, water mass formation) on climate variability and change.
- Improve understanding of ocean mixing and turbulence parameterizations.
- Improve understanding of ocean physical, biogeochemical, and air-sea flux processes. Relationship between these. Application to fisheries, ecosystems, and total productivity.
- Identify and monitor 3-D ocean circulation and quantities in key regions that can potentially indicate future abrupt climate changes.

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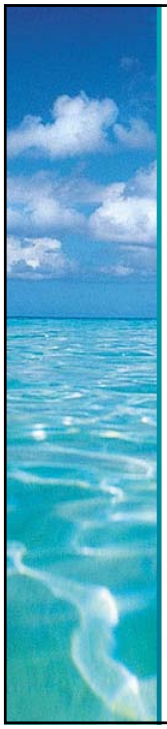

Charge: Crosscutting Themes

- Identify and prioritize the large-scale scientific or technological challenges that need to be addressed to support ocean research overall
- Identify and prioritize the key actions that are necessary to address the priority challenges

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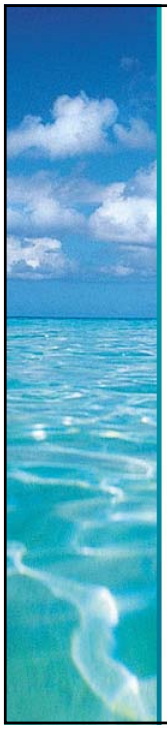

Results: Observations and Infrastructure

Challenges

- Development and sustainability of appropriate and reliable sensors and platforms
- "Cyberinfrastructure" - Data management, data quality, data accessibility, modeling, network security, interoperability available to all stakeholders
- Flexible observing systems
- Research to operations transition

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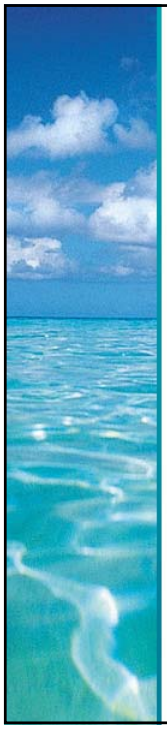

Results: Observations and Infrastructure

Actions

- Coordinated National ocean effort as outlined in the Ocean Commission Report
- Build and maintain strong National fleet
- Ensure sustainability of existing and development of next generation ocean satellite sensing systems
- Implement a robust integrated ocean observing infrastructure that serves National and regional needs
- Foster commercial opportunities for sensors and observing infrastructure

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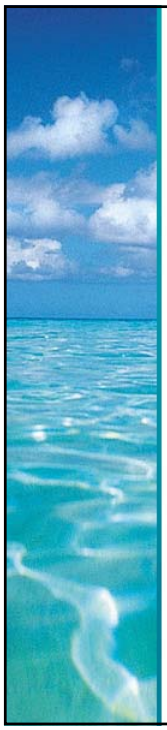

Workshop: *Further Results*

- Suggested additional topics or cross-cutting themes
  - Quality of Life- change from societal to cross-cutting theme or address as an overarching societal theme
  - Human Dimension-social, cultural, economic, and political drivers of human interaction with the ocean
  - Research Translation/Communication-between scientists and managers/decision makers/public
  - Modeling

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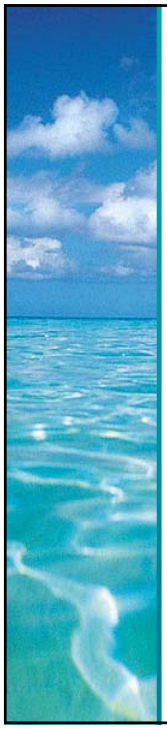

ORPP Development Public Comments

- Nearly 170 pages of public comments received on ORPP Planning Document
- Comments received from 20 organizations and 46 individuals
- Final set of comments posted on web page

http://ocean.ceq.gov/about/sup_jsost_public_comment.html

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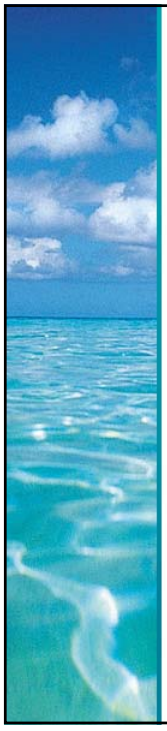

ORPP Development Public Comments

- Specific comments provided for referenced pages and lines in the planning document
- General comments-broad categories
  - Grand challenges/forward thinking
  - Connectivity-disciplines, regions, communities
  - Ecosystem emphasis
  - Human Dimension
  - Research Translation
  - Issues related to implementation
  - Organization/Prioritization

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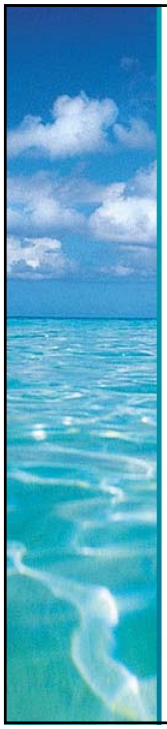

ORPP Construction-Method

- Three tier structure
  - Planning Team to direct comment incorporation and construction of Plan
  - Original theme authors to revise sections
  - JSOST co-chairs to work with Planning Team and Executive Office agencies to ensure coordinated effort
- Planning Team
  - Larry Clark (NSF), Mel Briscoe (ONR), Allen Dearry (NIEHS), John Haines (USGS), Steve Murawski (NOAA), Eric Lindstrom (NASA), Lisa Rom (NSF), Silvia Garzoli (NOAA), Roxanne Nikolaus (NSF), Kristen Koch (NOAA), Sheridan MacAuley (NASA), Kenli Schaaf (JCS)

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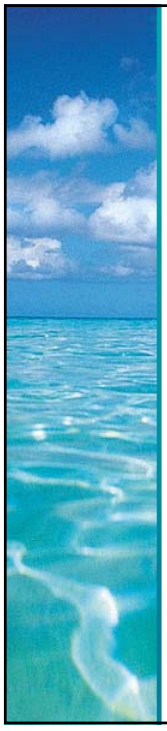

ORPP Timeline-Short-term

- May to early-June
  - Weekly teleconferences with Planning Team
  - Coordination with section authors for revisions
- June 9: JSOST retreat
  - Prioritization, discussion on Plan issues
- June to mid-July
  - JSOST/SIMOR/FSTT/ORRAP review
  - ICOSRMI review
- Mid-late July: Target release of draft Plan

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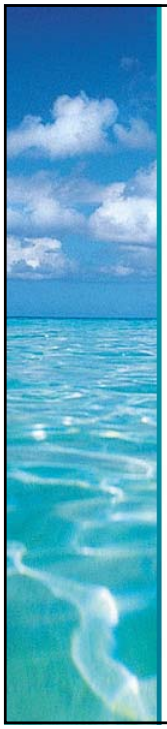

ORPP Timeline-Long-term

- May-July
  - Develop draft Ocean Research Priorities Plan, incorporating workshop input and public comments
- July-October
  - NRC review of plan (3 months)
  - Public comment on draft plan (30 days)
  - Development of Implementation Strategy
- October-December
  - Incorporate NRC and public comments
  - Internal review of 3rd draft
  - Release of final plan

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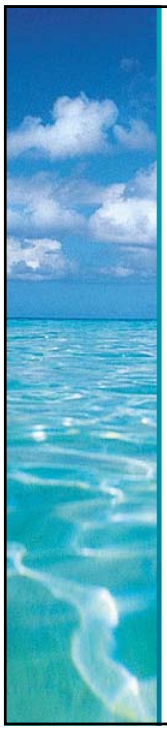

Implementation Strategy

- The Implementation Strategy will…
  - Describe how priorities are turned into plans, programs, and budgets.
  - Describe how agencies will work together.
  - Describe how the Federal government will work with constituents and the broader community.
  - Describe how OSTP, CEQ, and Office of Management and Budget (OMB) will work with agencies to ensure that interagency planning reflects the priorities.
  - Discuss how the ORPP can evolve with time.

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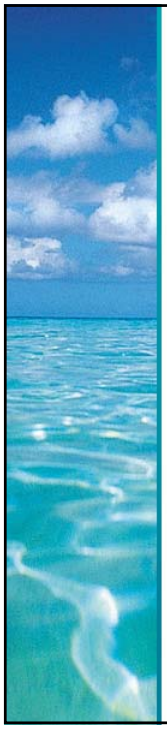

Role of ORRAP

- Participation in the JSOST retreat
  - Chair and Vice-Chair of ORRAP are ex-officio members of JSOST
- Review of draft ORPP during JSOST review in June
- Second Public Comment period during NRC review of draft ORPP
- Review during final JSOST review of the ORPP in late 2006

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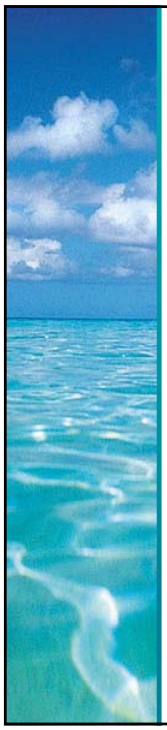

ORPP Outreach

- Notification of release of draft Plan: Federal Register, web postings, e-mails distributions
- Engage/notify communities with limited previous interaction
- Town hall meetings at upcoming conferences
  - Ex. Oceans 2006, California and the World Ocean
- 3-5 potential listening sessions at regional sites
  - Ex. Northeast-WHOI; southeast-RSMAS; California-SIO

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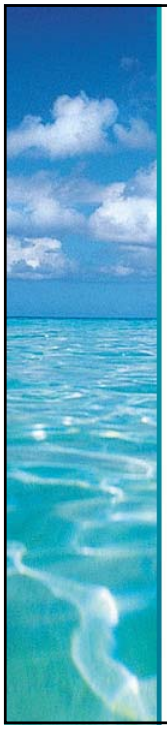

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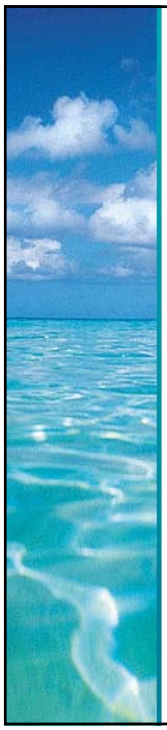

Backup

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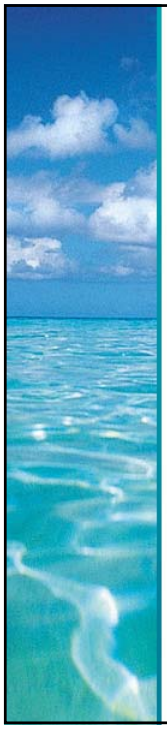

Public Workshop on the Development of the Ocean Research Priorities Plan: *Other Events*

- Town Hall- SIMOR workplan release
- Information session-NRC Decadal Survey on Earth Science and Applications from Space
- JSOST/ NAS Review Committee meeting

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Joint Subcommittee on Ocean Science and Technology

Ocean Research Priorities Plan workshop breakout sessions

Enhancing Our Basic Understanding of the Ocean

Overarching Issues

- Build a strong, vibrant case for the value and excitement of basic science - carefully cast its role in the spectrum from basic to applied.

- The human dimension as both topic and scholarship should be a cross-cutting theme of its own.

Challenges
(4-5 Subgroups)

- Ecosystem dynamics (5)
- Human dimensions, interconnectivity (5)
- Variability, change, anthropogenic (5)
- Create ability to predict (4)

Challenges (1-2 Subgroups)

- Understanding of complex systems (2+)
- Exploration and Discovery (2)
- Oceans as part of Earth System (2)
- Time-space, scaling issues (2)
- Climate (1)
- Lithosphere (1)
- Exchanges across boundaries (1)

Action Items (3-4 Subgroups)

- Advances in Modeling Capabilities (4)
- Connections to fields outside oceans (3)
- Build genomics and related expertise (3)
- Infrastructure for full access to oceans (3)
- Interdisciplinary scholarship, partners (3)
- Data, cyber issues at petascale (3)

Action Items (1-2 Subgroups)

- Trophic dynamics, cascades (2)
- Incorporation of Social Sciences (2)
- Educate about excitement of basic sci (1)
- Build support for basic science (1)
- Build international (1)
- Biodiversity, biogeochemistry topics (1)
- Transfer research to operations/decisions (1)

Ocean Education

Ocean Education is a fundamental theme running throughout the Ocean Research Priorities Draft Plan

•It is an important and essential prerequisite and component of ocean research

•It will help generate support and resources for ocean science

Ocean Education Challenges

- **Communicate the value of ocean resources and Communicate the value of ocean resources and science effectively (4)**
- **Ensure a diverse and qualified workforce (4)**
- **Bridge, address, and capitalize cultural, geographic, languages, values, and practices to reach diverse languages, values, and practices to reach diverse audiences (4)**
- **Improve knowledge of conveyers of ocean information and create an educational continuum that promotes a knowledgeable and ocean-literate literate public (4)**
- **Understand the needs and priorities of end users (**
- **Recognition and acceptance of ocean education and its impact on economic/global competitiveness by the scientific/technology research community and decision-makers (1)**

Ocean Education Actions (1 of 3)

• Establish a nationally coordinated ocean education and public engagement effort (Long term and short term) (4)
• Implement a national ocean education strategy
• Enhance long term information transfer capacity
• Develop an effective infrastructure to support ocean education (
• Convene ocean science communicators to design and implement a communications plan (2)
• **NOW Designate "science translators" for each societal theme to make the science education link and to engage in the development of the final plan and implementation strategy (1)**
• Conduct an inventory and gap analysis of audiences and their needs (NRC?) (3)

Ocean Education Actions (2 of 3)

• Develop a research to education program for all federal agencies (agency priorities, charters, organic acts, mandates) and federally funded activities (e.g. include an federally funded activities (e.g. include an "awards"event to recognize excellence) (3)
• Integrate the ocean into formal education (3)
• Develop cross-curricular material that engenders an appreciation of the oceans,
• Develop ocean science examples to address existing science standards, and
• Include ocean science principles and concepts in national standards

Ocean Education Actions (3 of 3)

- **Create and disseminate quality controlled content in partnerships with diverse content in partnerships with diverse organizations and end users (2)**
- **Identify, promote, and cultivate role models for ocean stewardship and workforce in diverse communities (2)**
- **Create competitive incentives to develop and share training and job placement programs for workforce enhancement (1)**
- **Provide professional/meaningful rewards to scientists for including education and outreach components within research and/or participating in education and outreach efforts (1)**

Observations and Infrastructure

Priorities

- Development and sustainability of appropriate and reliable sensors and platforms
- “Cyberinfrastructure” - Data management, data quality, data accessibility, modeling, network security, interoperability available to all stakeholders
- Flexible observing systems
- Research to operations transition

Actions

- Coordinated National ocean effort as outlined in the Ocean Commission Report
- Build and maintain strong National fleet
- Ensure sustainability of existing and development of next generation ocean satellite sensing systems
- Implement a robust integrated ocean observing infrastructure that serves National and regional needs
- Foster commercial opportunities for sensors and observing infrastructure
- Etc.

Enhancing Human Health

Combined sessions A & B

Consensus Document
of
24 participants

Priority Challenges

- Understand complexity of ocean systems, including characteristics needed to assess human health risks
- Integrate approaches and data across fields
- Foster discovery and development of new marine bio-products
- Monitor, assess, predict, and prevent risks from pathogens, toxins and other chemical contaminants
- Facilitate communication for effective decision-making at all levels
- Conduct integrated epidemiologic studies to assess human health risks and benefits

Priority Expected Results

- OHH research, education, outreach fully institutionalized and enhanced communication network established
- Improved monitoring, surveillance systems, models, databases, and prediction to enhance public health and inform policy and decision-makers
- Rapid discovery and application of ocean bio-products through broad public-private consortia, resulting in improved human health and enhanced private sector returns
- Basic knowledge for sustainable coastal development to minimize adverse environmental impacts on people and animals
- Mechanistic models derived from marine species to improve understanding of human disease
- Improved human nutritional status through consumption of high quality seafood

Priority Research Needs

- Optimize marine bio-product acquisition, characterization, and production using cross-disciplinary methods
- Develop the best tools and methods to assess microbes and chemicals of public health interest
- Integrate ocean data and models with human epidemiologic studies
- Conduct basic science studies to understand mechanisms of oceans and human health interactions and impacts
- Use marine species to develop new mechanistic models of human disease processes and toxicology

Priority Infrastructure Needs

- Develop effective communication and education networks, including platforms for technology transfer
- Develop research standard materials and protocols
- Build interdisciplinary research capacity, including cross-disciplinary training and cross-agency collaborations
- Develop and maintain infrastructure needed to explore questions of public health significance (e.g. platforms, submersibles, & sensors)
- Develop data infrastructure to:
  - integrate human health databases with ocean databases
  - implement a system to provide and disseminate data products
- Provide public health surveillance and rapid response capability

Relationship to Cross-Cutting Themes

- Observations and Infrastructure
  - Sensors of value to human health essential
  - Data management issues reiterated---form, connectivity, temporal
  - Robust observing system, a national fleet, and industry participation
- Enhancing Our Basic Understanding of the Oceans
  - Variability and change, lack of current predictive ability, and species/events of harm to humans
  - interdisciplinary studies on complex ocean issues including HABs, emerging pathology/disease, and potential for intervention
- Ocean Education
  - Interdisciplinary training, team-building exercises, and extensive education activities at all levels in all venues
  - Communication leading to an educated, empowered Public capable of effective decision-making

Key Challenges

- Integrate social and economic sciences with scholarships on the oceans, coasts, Great Lakes and watersheds to improve quality of Life (QoL)
- Understand how decisions within the built environment relate to QoL and ocean quality in the context of different sectors (e.g., transportation, water management, energy, etc.)
- Understand how the ocean currently relates to QoL and build on this knowledge to improve QoL
- Develop a better understanding of what QoL means to divers groups and how it changes through space and time
- Expand and communicate the understanding and identity of the value of oceans to QoL

Expected Results

- The QoL has improved concomitant with improvements in ocean environments and is measurable
- An understanding of the meaning of QoL for different sectors of the population
- A clear understanding of how oceans and their behavior relate to QoL
- Enhanced decision-making mechanisms (science-based) to resolve competing demands on limited resources
- An information infrastructure - data, models, tools, practices - to support decision making
- Detailed set of QoL goals
- A learned approach that enables us to live within our means

Research Needs

- Investigate, monitor, forecast effects of human behavior on ocean systems
- More clearly define QoL metrics across all scales
- Research into development of transfer mechanisms for science-based decision-making; Education, communication, data, information
  - meta analyses to identify strengths & gaps
  - risk perceptions and behaviors
  - population dynamics
- Develop ecosystem and social system models to predict the short- and long-term effects on current & future development & use on oceans, great lakes, and watersheds
- Research into sustainable resource use

Context for Infrastructure and Technology

ASSUMPTIONS:

(A) A comprehensive and evolving interactive sensor robotic network providing (near) real-time 4-D information about the changing condition of the planetary ocean

(B) A broad diversity of economic, social, & population data streams integrated with "A" for research & management and connected to ocean observing network

Infrastructure & Technology

- Common set of information tools
- An education infrastructure that supports interdisciplinary communications related to QoL issues and their link to the oceans
- Interdisciplinary, cross-cutting, human networks of scholars, managers, educators and others to have the skills to lead collaborative networks across the broad range of expertise
- An evaluation toolkit to assess the quality of programs in the context of QoL goals and the level of QoL

The Oceans and Climate

Challenges:

1) Fundamental understanding of ocean circulation and its role in climate, and of sea level rise.
2) Understanding the role of chemical cycles in the bio-sphere in regulating and responding to climate and ocean circulation
3) Understanding cross-scale linkages within the Earth system
4) Ability to identify potential for abrupt change or "tipping points" (e.g., release of methane, biomass distribution, ecosystem regime shifts).
5) Sufficient understanding of Earth system to allow separation of natural and anthropogenic effects on climate, and ocean climate effects on humans.

A cross-cutting issue:

6) Conversion of research results to information that will effectively

- *inform/educate the public*
- *enable resource managers and policy/decision makers*
- *enhance national defense and economic security*

Research Needs:

1) Enable a consistent picture of the ocean's role in climate through analysis of paleo and instrumental data.
2) Improve understanding of key regional (e.g., polar, tropical, coastal) processes (e.g., ocean circulation, air-sea interaction, convection, water mass formation) on climate variability and change.
3) Improve understanding of ocean mixing and turbulence parameterizations.
4) Improve understanding of ocean physical, biogeochemical, and air-sea flux processes. Relationship between these. Application to fisheries, ecosystems, and total productivity.
5) Identify and monitor 3-D ocean circulation and quantities in key regions that can potentially indicate future abrupt climate changes.

Infrastructure and Technology Needs:

1) Global ocean model resolution to sufficient resolution to be useful for physical & biogeochemical processes (~ 1 km scale).
2) Develop an earth systems model linked to the research program (based on community standards).
3) Data assimilation system to link the observations to products for research, forecast, and decision support.
4) Capability to develop climate data records for physical, biological, and biogeochemical data sets.
5) Acquisition of observations necessary to reconstruct past states of the ocean, including the development and refinement of climate proxies.
6) Permanent observing system composed of satellites, in situ sensors, autonomous platforms, ships, drifters, etc. that can continuously evolve to accommodate technological advances and increased knowledge.
7) Industry/academic/government partnerships throughout the entire sensor development, validation and acceptance process.
8) Operate the full observation system by industry/academic/govt partnerships
9) Establish a national technician accreditation program.
10) Mechanisms for sustaining dialogue between resource and decision managers to guide regional efforts and facilitate the application of regional results for social benefit.

Outcomes:

1. **Energy Security**. Improved understanding of the role of carbon cycle in an evolving climate to enable exploration of alternative energy sources for mitigation.

2. **National Security**. Climate predictions and projections of sufficient accuracy & regional specificity to enable strategic and tactical mitigation and adaptation decisions.

3. **Environmental Security**. Skillful climate predictions on seasonal to decadal scales to enable risk reduction with regard to extreme events, effective resource and ecosystem management, and to ensure health and safety

4. **Ocean Literacy.** Increase public appreciation of the oceans' central role in their lives and well-being.

Mitigating the Effects of Natural Hazards

Challenges

- Understand Underlying Processes
- Quality, Quantity, & Uncertainty of Info for RV Assessments and Communications
- Comprehensive Mitigation Plans
- Communicate National Urgency

Expected Outcomes

- Communicate Risk in a Timely Manner
- Increased Capacity to Anticipate & Mitigate
- Enhanced Protection of People & Property
- Market-Based Approaches

Priority Research Needs

- Improved Communication Tools
- Hi-Res Coupled Models & Data Schemes
- Decision Support Tools
- Timely Post-Haz Impact Assessment
- Market Based Approaches

Infrastructure/Tech Needs

- End-to-End Operational Systems
  - Across Watershed-Coastal Interface
- Human Capital
- Enhanced Support for Facilities
- Distributed Access to HPC
- Resilient Materials & Technologies

General Recommendations

- Human Dimension as a New Cross-Cutting Theme
- Mitigation of Coastal Hazards Contributes to Mitigation of Adverse Climate Impacts and Ecosystem and Human Health Concerns

Sustaining Natural Resources

Sustaining Natural Resources

Challenges

- Create a more effective and efficient governance structure that integrates natural resource policies and facilitates interagency collaboration (3)
- Public outreach, engagement, and education to support integrated management outcomes and make responsible decisions (3)
- Develop and Implement Ecosystem Based Management (including Humans) (2)
- Address limited knowledge of species and systems (2)
- Integrate transdisciplinary research and knowledge (2)
- Evaluate the effectiveness of management using decision support tools and employ adaptive management (2)
- Differentiate between natural and anthropogenic change (1)
- Reduce overexplotation of ocean resources and restore habitat (1)

Sustaining Natural Resources

Expected Results

- A public that views information supporting management as accurate, credible, and unbiased, becomes more fully engaged in the decision process, and is supportive of the outcomes (3)
- Improved natural and social scientific assessments including analysis of risk, tradeoffs and benefits of policy alternatives supporting adaptive approaches to management (3)
- Effective and efficient governance structures that facilitate collaborative decision making and timely response (3)
- Predictable and sustainable natural resource yields through effective management and enhancement (2)

Sustaining Natural Resources

Research Needs

- Assessment and monitoring of the abundance, distribution, and diversity of natural resources and human use patterns (3)
- Enhanced modeling, prediction and forecasting incorporating multiple living and non-living resources and human activities (3)
- Understanding the cumulative impacts of human activities (2)
- Integrated research to support geographically specific management (2)
- Support for emerging technologies including energy development and new products (2)
- Address basic data needs including gaps in current information (2)
- Earth systems/interface between oceans with atmosphere and watersheds (1)

Sustaining Natural Resources

Infrastructural and Technology Needs

- Well trained, educated, and diverse work force (3)
- Adequate support for fixed and mobile platforms (labs, ships) to support research and monitoring (3)
- Adequate support for remote sensing technologies including tracking of mobile organisms, and new sensor development (3)
- Infomatics support (e.g., information storage, security, processing, integration and communication) (3)
- Development of marine genomic tools (1)

Sustaining Natural Resources

Potential New Cross-Cuts

- Human Dimensions Research and Information
- Ecosystem Management
- Modeling

FOR US, IT'S PERSONAL!

IT'S UP TO US TO BRING THE OCEAN TO OTHERS!

Improving Ecosystem *Health*

Challenges, Expected Results, Research Needs, and Infrastructure & Technology Needs

Sessions A-C

Disclaimer: Inaccurate representation of the session participants' ideas is the presentor's failure

Challenges to Improving Ecosystem Health

- Understanding structure and functioning of marine ecosystems where natural & anthropogenic factors alter physical, chemical, biological, geological, and ecological processes that shape these systems. This includes investigating ecosystem productivity, diversity, and complexity as a function of within-system interactions (atmosphere, mixed layer, deeps, bottom) as well as forcing from systems outside (linkages between watersheds, estuaries, coastal and ocean systems) (3)
- Characterizing and predicting ecosystem status and change: limited information (e.g., long-term time series) to determine the properties and processes that govern stability and resilience as well as physical, biological, and human(2) forces that drive ecosystem dynamics over various temporal and spatial scales (3)
- Increasing capacity for *exploration & discovery (2)* of marine ecosystems to identify ecosystem products and services to enhance human life and provide goods and services (3)
- Determining and predicting individual and cumulative effects (multiple stressors) of human activities on ecosystem function and diversity, including humans as part of the ecosystem (3)
- Improving management and governance efforts across jurisdictional boundaries that includes socio-economic values and activities with natural factors to maintain health and sustainability of ecosystems. This requires improving abilities to communicate understandable information, educating receivers of the information, and addressing potential public health/economic concerns (CROSS-CUTTING THEMES) (2-3)
- Promoting CROSS-CUTTING education, awareness, and stewardship regarding ecosystem health, threats, structure, and function to enable effective ecosystem-based management (1)

Expected Results

- **Overarching Result: Human activities that are informed by scientific understanding that ensures the effective management and sustained productivity and diversity of marine ecosystems (3)**
- Through collected data, key ecosystem baseline conditions, parameters, processes, and meaningful, measurable indicators of marine ecosystem status/condition will be identified at appropriate scales (3)
- Enhanced modeling capacities (e.g., ecosystem, population, bioaccumulation, etc. models) capable of assessing and predicting ecosystem dynamics and results of potential management strategies will result, leading to improved understanding, decision-making, ecosystem health, future minimization of adverse impacts on ecosystems, lower threats to human health, and a suite of socio-economic benefits (3)
- Effective transfer of scientific information will occur to facilitate stewardship and managed use of marine ecosystems (3)
- Usable products that integrate and synthesize available physical, chemical, geological, biological, socio-economic, and human use data for specific time periods and geographic areas will result (3)
- An integrated scientific observation and monitoring strategy at the spatial and temporal scales needed to assess indicators of marine ecosystem health will be produced (2)
- Methods and technologies will be identified for enhancing and restoring ecosystem health (1)
- **New (WOW!) discoveries will abound (1)**

Research Needs

- **Overarching Need: Improved interdisciplinary research efforts and collaborations, national and international**
- Improve the basic understanding of the components and complexity of marine ecosystems at appropriate scales and their interactions and linkages in order to address the challenges through expanded modeling and prediction (3)
- Identify and develop measurable indicators of ecosystem status that can be used to guide research and restoration/enhancement strategies (2-3)
- Identify and characterize key ecosystem issues and threats to ecosystem status (e.g., climate change/regime shifts, thresholds/tipping points, contaminants and excess nutrients, hypoxia, diseases/pathogens, and invasive species) including the cumulative and relative effects of multiple stressors and distinguishing natural and anthropogenic signals (3)
- Identify and understand the role of biodiversity in maintaining and improving ecosystem health (3)
- Investigate and quantify, where possible, economic and social drivers (e.g., market and non-market resource valuation, land use, water use) in conjunction with natural processes that impact ecosystem health (3)

Infrastructural & Technological Needs

- Improvements in information technology and infrastructure will be essential to ensure that data assimilation, analysis, and modeling tools are available for standardized biological, socio-economic, and ecosystem data (3)
- The continued development and implementation of a CROSS-CUTTING integrated observing system (satellites, ships, platforms, buoys, AUVs, shore labs, etc.) is a key component for assessing physical, chemical, biological, and ecological properties of marine ecosystems and ocean exploration over time, as well as assessing human impact on key properties including productivity, diversity, and resilience (3)
- Additional and improved *in situ* and remote sensor capabilities (for use across appropriate spatial and temporal scales) are needed to gather information about the biological and chemical environment (including coastal watersheds, Great Lakes, and all ocean domains), and thereby provide a more complete understanding of ecosystem status and dynamics (3)
- Improved capabilities in modeling, forecasting, dissemination, and integration of results through research, industry partnerships, etc. are needed that will effectively inform (*distribution of useful, understandable information*) and assist management decisions and serve as the core for education strategies at international, federal, state, tribal, and local levels (3)
- Increasing capital investment in multiple areas, such as traditional taxonomy, science teachers, environmental managers, and science translators (1-2)
- A new, cross-jurisdictional governance entity to bring together and coordinate the ecosystem approach to ocean and coastal research and management (1)

Supporting and Improving Marine Operations

Challenges for Marine Operations

Consensus:

Provide forecast, real-time, and historical marine environmental data on a global basis

Minimize negative impacts on ocean ecosystems (e.g. pollution, noise, ship strikes, introduction of invasive species, etc)

Improve the efficiency, operations, and maintenance of new and existing harbors and ports

Unique:

Develop maritime domain awareness (e.g. historical, real-time, and forecasts of ship data, meteorological and oceanographic variables, and living marine resources)

Coordinate and foster communication between industry, government, and academic entities

Pro-actively plan for the restoration of MOPS after natural, accidental, or terrorism-related disruptions

Ensure and improve safety and efficiency of all marine operations

Expected Results for Marine Operations

Consensus:

Comprehensive awareness of the maritime environment gained from expanded gathering, sharing, and coordination of information

Increased security protection, safer and higher-efficiency MOPS, and improved environmental protection

Increased capacity of ports to meet the demands of domestic and international trade in an environmentally-sustainable manner

Improved understanding of how MOPS affects the marine ecosystem; and the integration of that knowledge into decision-making

Unique:

Reduction of negative economic and human impacts arising from disruptions

Breakdown of stovepipes between government, industry, and academia

Research Needs for Marine Operations

Consensus:

Improve our ability to characterize and forecast METOC conditions worldwide using high-resolution models that assimilate real-time data

Impact of MOPS on ecosystems and development of mitigation strategies

Improve sediment transport models to establish rapid, efficient and environmentally-sustainable dredging operations

Unique:

Develop a comprehensive ocean acoustics observation program

Social and economic implications of climate change to MOPS

Infrastructure and Technological Needs for Marine Operations

Consensus:

Advanced sensor and technology development (autonomous, persistent)

Tools to simulate "What If" scenarios to determine the impact on MOPS

Unique:

Expand the national complement of oceanographic research vessels, satellites, autonomous underwater vehicles and unmanned aerial vehicles

Rapid assessment methods of detecting marine contaminants/pollutants and harmful non-indigenous species

Expand the use of high-frequency radars along the coast to monitor, record and present real-time current data in near-shore environments

Long-term observing systems that are transportable and relocatable; that collect data anywhere on the globe as needed

OBIS User Needs Assessment

Duke University and
Alfred P. Sloan Foundation

March, 2006

Prepared for:

Dr. Patrick Halpin
Chair, OBIS Technical Committee &
Director, Geospatial Analysis Program
Nicholas School of the Environment and Earth Sciences
Duke University
Durham, North Carolina, USA

Prepared by:

Environmental Systems Research Institute, Inc. (ESRI)
8620 Westwood Center Drive
Vienna, Virginia 22182
(703) 506-9515

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Executive Summary

The Ocean Biogeographic Information System (OBIS) is a web-based provider of geospatial information on marine species publicly available at http://www.iobis.org/Welcome.htm. OBIS is structured as a federation of organizations and individuals that share a vision to make marine biogeographic data readily available. As a first step towards the evolution of OBIS into a self sufficient central marine species data repository, the organizations and individuals that support OBIS sought to determine whether OBIS has value beyond the scientific and academic communities that are currently served.

Through a series of interviews with commercial entities, governmental organizations, and nonprofit organizations, several information products requiring marine species data to support business practices were identified. The information products rely on marine species data, but also rely on habitat data and data describing prevailing conditions such as water temperatures and dissolved oxygen levels. Specific requirements for marine species data were highlighted, such as the availability of abundance data and of data indicating distribution patterns, migration patterns, and temporal patterns, the need for standardized data and metadata, and the need for high-quality, complete, and accurate datasets.

Through the interviews, it became evident that OBIS may have potential as a source of data for the creation of information products required by governmental agencies, nonprofits, and the commercial sector, but the findings indicate that there a number of considerations for OBIS in moving towards self sufficiency. The findings revolve around various themes: data issues, data exchange / security issues, usability, mapping, and willingness to participate. It is recommended that additional review steps be performed: a data review, a user interface review, a technical architecture assessment, and a business model analysis. These review steps will allow supporters of OBIS to begin weighing the costs of moving towards a model of self sufficiency that meets the needs of existing and potential users against the benefits.

The user needs and information products described in the OBIS Needs Assessment report provide a starting point for performing the review steps.

I. Introduction

Many scientists who regularly study marine species either as academics, government regulators, or private consultants have a need for a centralized, spatially referenced data repository. Some researchers studying a particular area in depth want to know when new data has been collected to update their own repository. Other researchers who have a broader domain want a cost effective alternative to find reliable species data. For a central data repository to be successful in either case, the system must have sufficient metadata and collection standards; must actively seek new datasets to harvest; must be easy to search either by spatial or attribute queries; and must be reasonably priced. This study, commissioned by the Sloan Foundation, incorporates interviews of researchers in order to identify the information products most useful to their business practices and help guide efforts to develop a self sufficient central marine species data repository.

The Ocean Biogeographic Information System (OBIS) is the information component of the Census of Marine Life (CoML), a growing network of researchers in more than 45 nations engaged in a 10-year initiative to assess and explain the diversity, distribution, and abundance of life in the oceans - past, present, and future. OBIS is a web-based provider of global geospatial information on marine species and provides access to a variety of species-level and habitat-level databases. OBIS was built in the late 1990's, primarily for use by the scientific and academic communities. The website is available at http://www.iobis.org/Welcome.htm.

OBIS is structured as a federation of organizations and individuals that share a vision to make marine biogeographic data readily available. OBIS is managed by an International Committee with significant contribution from the Management Committee, Technical Committee, and Editorial Board. The Alfred P. Sloan Foundation is one of the sponsors that provide funding in support of OBIS. The Sloan Foundation, in conjunction with the OBIS Technical Committee, sought to validate that OBIS has value outside its immediate and intended users and contracted with ESRI to perform a User Needs Assessment for OBIS. The Sloan Foundation and the OBIS Technical Committee recognized that performing a User Needs Assessment will aid OBIS is a first step in the evolution of OBIS into a useful, self-sufficient service for the academic and science communities and other sectors.

II. Background

OBIS aims to provide users with access to a data portal of biological, physical, and chemical oceanographic data from multiple sources. OBIS allows users to search on the Common Name or Scientific name of a species and returns a global map depicting locations of the species. The user can then select from a pre-defined list of regions to narrow the geographic extent. Advanced search options are also available that allow the user to query by genus, species, geographic extent defined by latitude and longitude, date, depth, and data source and return a map showing locations of species. OBIS also provides additional textual information about marine species.

The OBIS community has identified several potential uses of the existing data portal – revealing spatial/temporal patterns, generating new hypotheses about the global marine ecosystem, and guiding future field expeditions. OBIS has encountered several challenges relating to data management, scientific cooperation and organization, and developing innovative approaches to data analysis in the effort to provide open access to geospatial marine data.

There are other marine species database initiatives similar and relevant for OBIS. They include databases from:

- NOAA
- State Government
- Fishbase
- County environmental agencies
- Consulting firms
- Universities
- National gridded databases in the public domain
- World Conservation Monitoring Shop
- Bailey's ecoregion system through the US Forest Service
- NatureServe
- EPA's Enviro-Mapper
- USGS
- IHS Energy
- Non-profits
- Minerals Management Service
- Southeast Monitoring and Assessment Program - http://www.seamap.org/
- SeaMap through Duke University - http://seamap.env.duke.edu/

Other current initiatives similar to OBIS and that may have relevance are the State of Maine's needs assessment for marine GIS, IOOS, NBII, and the Arc Marine Data Model.

The State of Maine Department of Marine Resources released an RFP in November, 2005. The RFP states: "The Maine Department of Marine Resources (DMR) is seeking proposals to conduct a marine Geographic Information System (GIS) needs assessment to explore, document and suggest solutions for multi-stakeholder marine GIS needs. The project will entail communicating with state and federal agencies, NGO contacts and academics that use a marine GIS in order to document marine GIS needs in Maine including data access, analysis, creation and interoperability." Proposals were due December 7, 2005.

The Integrated Ocean Observance System (IOOS) is a federally funded initiative to make all sensors work together within the ocean system. Currently, there are regional associations that collect data. IOOS is also addressing the need for the standardization of data collected by sensors. While IOOS collects different types of data than those provided through OBIS, there may be some overlap, and users of OBIS data potentially also have a need for data collected through IOOS.

Another initiative of note is NBII (www.nbii.org). NBII describes itself as "a broad, collaborative program to provide increased access to data and information on the nation's biological resources. The NBII links diverse, high-quality biological databases, information products, and analytical tools maintained by NBII partners and other contributors in government agencies, academic institutions, non-government organizations, and private industry. NBII partners and collaborators also work on new standards, tools, and technologies that make it easier to find, integrate, and apply biological resources information. Resource managers, scientists, educators, and the general public use the NBII to answer a wide range of questions related to the management, use, or conservation of this nation's biological resources."

Members of the marine community working with GIS have also come together to engage in building an industry-specific GIS data model for ArcGIS. More information about this effort is

available at http://dusk2.geo.orst.edu/djl/arcgis/about.html, where the goal of this initiative is described as "to provide more accurate representations of location and spatial extent, along with a means for conducting more complex spatial analyses of marine and coastal data, by capturing the behavior of real-world objects in a geodatabase."

These initiatives and databases are noteworthy in that they may share common goals with OBIS and may have encountered similar challenges in achieving those goals.

III. Methodology

The primary objective of the User Needs Assessment is to identify information products that are useful beyond the science and academic communities. ESRI worked with the Sloan Foundation and the OBIS Technical Committee to identify several broad sectors that would have a potential need for marine species data in a geospatial data format then selected interviewees from within those sectors. The sectors included: government, commercial, non-profit, and academic. Within each of those sectors, ESRI identified potential interview candidates with a direct or indirect need for marine species data that had some experience using spatially referenced data.

Government Sector

Interviewees within the government sector were chosen to be representative of state and federal government agencies working on coastal issues. The interviewees did not include a local government, as state bodies typically are the regulating authority for environmental issues. Still, the state agencies interviewed were able to provide some insight as to how local governments might use marine species data, although the need for this type of data is limited at that level. Interviewees in the government sector included the following:

Charles Armbruster, Regional Restoration Planning Program Manager
State of Louisiana Office of the Governor
Oil Spill Coordinator's Office
http://www.gov.state.la.us/index.cfm?md=pagebuilder&tmp=home&cpID=32
charles.armbruster@la.gov

The mission of the Louisiana Oil Spill Coordinator's Office is to provide innovative leadership and coordination in oil spill prevention, planning, response, and natural resource damage assessment for the State of Louisiana. In his role with the Governor's Office for the State of Louisiana, Mr. Armbruster is responsible for coordinating restoration efforts after an oil spill, and has a background in coastal geomorphology.

Mike Street, Biologist
State of North Carolina
Department of Environment and Natural Resources, Division of Marine Fisheries
http://www.ncfisheries.net/index.htm
Mike.Street@ncmail.net

The North Carolina Division of Marine Fisheries (DMF) is responsible for the stewardship of the state's marine and estuarine resources. DMF is comprised of nine sections that collectively carry out this mandate. DMF enacts policies to protect marine species and is responsible for the enforcement of resource protection policy. Mr. Street has more than 40 years of experience working with fish and habitat.

Jeff Ardron, Scientific Advisor for Marine Protected Areas
German Federal Agency for Nature Conservation
Marine and Coastal Nature Conservation Unit
jeff.ardron@bfn-vilm.de

The German Federal Agency for Nature Conservation, Marine and Coastal Nature Conservation Unit is focused on planning measures to protect species and habitat. Mr. Ardron's emphasis is on the impact of commercial and recreational fishing within the northeast Atlantic and the OSPAR fishing grounds (established through a multi-country accord). Mr. Ardron is also involved with the Pacific Marine Analysis and Research Association (PacMARA), a nonprofit group of researchers focusing on ecosystem based management in British Columbia.

Stephen Weisberg
Southern California Coastal Water Research Project
http://www.sccwrp.org/
stevew@sccwrp.org

The Southern California Coastal Water Research Project (SCCWRP) is a joint powers agency; government agencies joined together to meet a common goal of protecting the Southern California marine environment. SCCWRP consists of a group of 35 researchers; mostly biologists and chemists with advanced academic degrees. SCCWRP focuses on water quality management in California and works with the State on the adoption of new measuring techniques and new technologies.

Rosalind Cohen, Data Management Liaison
National Office for Integrated and Sustained Ocean Observations (Ocean US)
www.ocean.us
rosalind.e.cohen@noaa.gov

Ocean US was created by the National Oceanographic Partnership Program to coordinate the development of an operational and integrated and sustained ocean observing system (IOOS). Areas of focus include marine operations, climate variability, national security, sustainable resource management, marine ecosystems, natural hazards, and public health. As the Data Management Liaison, Ms. Cohen oversees tasks relating to metadata, data transport and access, and data archival.

Rob Dollison
Geospatial One-Stop (GOS) Project Office
USGS
www.geodata.gov
rdollison@usgs.gov

The Geospatial One-Stop initiative provides standards and models for the geospatial framework data content, provides an interactive index to geospatial data holdings, initiates interaction between Federal, state, and local agencies about existing and planned spatial data collections; and provides an online access point to geospatial data. Mr. Dollison's role is to provide support to the GOS initiative and coordinate with users of geospatial data to promote data sharing. While Mr. Dollison is not a direct consumer of marine species data, Mr. Dollison did identify several agencies that may have a potential need for the data:

- National Biological Survey (a network of universities that has their own database)

- National Biological Information Infrastructure at www.nbii.gov and partners of NBII
- Geospatial One-Stop and the www.geodata.gov portal
- The Bureau of Indian Affairs, (a potential interest pertaining to tribal fisheries in Alaska).
- US Fish and Wildlife Survey
- USGS; (a potential interest from marine and coastal groups and mineral rights groups)
- The Environmental Protection Agency
- The Department of Interior
- The Army Corp of Engineers
- States and local governments with coastline and their constituents
- Oil and energy companies

Commercial Sector

Interviewees within the commercial sector generally had ties to the oil industry. There are likely other commercial entities that have a potential need for marine species data, but the oil industry was identified as having a major need for the data as a result of both regulatory and public relations drivers. The interviewees were representative of commercial entities that all have different roles within the oil industries including a major oil company, a company that does contract work for oil companies, and a company that generally works for governmental agencies regulating the oil industry. Interviewees in the commercial sector included the following:

David Millar, Vice-President of Coastal Mapping and LIDAR
Fugro Pelagos, Inc. – San Diego Office
http://www.fugro-pelagos.com/
dmillar@fugro.com

With 250 offices worldwide, Fugro Pelagos specializes in offshore survey and mapping service. Fugro Pelagos integrates technologies such as multibeam bathymetry, multibeam backscatter "snippets" imagery, LiDAR bathymetry, and GIS. Offshore survey services include marine services (such as oceanographic, geological and geophysical investigations supporting geologic hazards evaluations), environmental studies and EEZ UNCLOS mapping.

Located in San Diego, Mr. Millar is currently a senior manager with the company and has significant GIS experience. The San Diego office does seabed mapping and its primary role is to produce the base data for those that develop and use marine species data. However, some of the other offices do collect marine species data to support environmental investigations for route surveys and other projects.

Eoin Howlett, CEO
Applied Sciences Associates, Inc.
http://www.appsci.com/
ehowlett@appsci.com

Applied Science Associates (ASA) specializes in the development and application of computer tools to investigate marine and freshwater environments. ASA's work focuses on environment and human interaction within that environment with the use of computer models to simulate physical, chemical, and biological processes. In addition, ASA integrates GIS with environmental data monitoring and modeling. Mr. Howlett has over 10 years of experience in international project management specializing in GIS and computer user interface development and integration. Mr. Howlett is product manager for OILMAP, a PC-based oil spill response system, which has been applied to regions throughout the world. He has been involved in

applying this software for oil spill analysis and oil spill contingency studies internationally. He also has extensive experience in industry and government sponsored spill drill exercises, as well as actual spill events.

Some of ASA's typical clients include NOAA, the US Navy, and the US Department of Defense. Generally, ASA does not work with the oil industry. When spills occur, ASA typically performs work for the governing body. Project examples applicable to this study include assessing the impact of oil spills on marine mammals and performing work for NOAA on marine mammal avoidance (marine traffic studies).

Brian Boulmay
Shell Exploration and Production
http://www.shell.com/home/Framework?siteId=eandp-en
brian.boulmay@shell.com

Shell Exploration and Production is engaged in the activities associated with acquiring, exploring, developing and producing oil and gas resources. To support these activities, Shell performs numerous studies that rely on marine species data. Types of studies include impact assessments, biodiversity monitoring, and environmental monitoring. Studies performed in the United States are generally regulatory driven, but Shell opts to perform the same studies in any country where work is performed regardless of whether the country has less stringent regulatory requirements.

Mr. Boulmay currently leads the GIS team in the Exploration and Production, but previously worked in the Environmental Section and has experience with soil and groundwater studies. While Mr. Boulmay is currently involved with exploration and production activities, he is also familiar with other activities that are centered on distributing oil products to consumers.

Non-Profit Organizations

There are several non-profit agencies operating on different scales and in support of different missions that have identified a need for geospatial marine species data. However, many of the non-profits are not currently using GIS technology or geospatial data. For this investigation interviewees were selected that had some familiarity with GIS technology. The non-profit organizations interviewed include:

Sue Wolinsky, Wildlife Biologist
Wildlife Habitat Council
http://www.wildlifehc.org/about/index.cfm
swolinsky@wildlifehc.org

The Wildlife Habitat Council (WHC) is a nonprofit, non-lobbying 501(c)(3) group of corporations, conservation organizations, and individuals dedicated to restoring and enhancing wildlife habitat. Created in 1988, WHC helps large landowners, particularly corporations, manage their unused lands in an ecologically sensitive manner for the benefit of wildlife. More than 2 million acres in 48 states, Puerto Rico, and 16 other countries are managed for wildlife through WHC-assisted projects.

Ms. Wolinsky is a wildlife biologist with WHC who works with corporate partners along the east coast of the United States. WHC generally works with terrestrial species data, as most of the corporate partners are located inland, but WHC does periodically have a need for marine species

data for corporations with coastline property. Two such corporate sites include a nuclear power plant in New Jersey and a site in the Bahamas.

Deidre Sullivan
Marine Advanced Technology Education Center
http://www.marinetech.org/home.php
dsullivan@mpc.edu

The Marine Advanced Technology Education Center (MATE) is a nonprofit organization located on the campus of Monterey Peninsula College and funded through the National Science Foundation. MATE sets out to identify the technical skills and abilities needed for various marine related occupations by collecting information from employers and works with partners to promote marine technology education and workforce development. Examples of career fields that require marine technology include the oil and gas industry, sea floor surveying, and nautical archaeology. MATE Partners include more than 30 community colleges, 15-20 universities, and hundreds of high schools.

Ms. Sullivan supports MATE in several capacities. In addition to teaching students on campus, Ms. Sullivan is the curriculum and industry manager who provides GIS and marine technology instruction to other faculty.

Aaron Hopkins, Research Assistant
Marine Environmental Research Institute
http://www.meriresearch.org/
ahopkins@meriresearch.org

The Marine Environmental Research Institute (MERI®) is a nonprofit charitable organization dedicated to scientific research and education on the impacts of pollution on marine life, and to protecting the health and biodiversity of the marine environment for future generations. MERI® works to accomplish its goals through multidisciplinary ecotoxicological research, research dissemination, environmental education, and international programs. Through its program initiatives, MERI® seeks to address the problems of pollution of the ocean environment, unsustainable coastal development, species and habitat degradation, and environmental emergencies (toxic spills, releases) affecting marine life. As a research assistant, Mr. Hopkins primarily studies toxin levels in marine mammals and fish.

*Mr. Hopkins chose not to participate in a phone interview, but did review the OBIS website and provided feedback through email.

Academic Institutions

Although academic institutions are currently the primary contributors and consumers of data through OBIS, it is beneficial to have an understanding of how the academic community is currently using OBIS. The interviewee was selected based on a recommendation from the OBIS Technical Committee.

Chris Rowe
University of Maryland Center for Environmental Science
http://www.umces.edu/
rowe@cbl.umces.edu

The University of Maryland Center for Environmental Science (UMCES) is one of 13 constituent institutions of the University System of Maryland. The Center's research and science application activities emphasize the Chesapeake Bay and its watershed, but its reach extends nationally and world-wide. Research areas include the sustainable development of marine resources. Dr. Rowe is an associate professor with the University of Maryland. His emphasis is mainly on research, but he also teaches graduate level courses.

Interviews

Prior to the phone interview, each interviewee was provided with a link to the OBIS site at http://www.iobis.org/Welcome.htm and informed of the objective of the study. All interviewees were presented with the following standard set of questions during the telephone interviews, but were asked to elaborate on specific points or information products as appropriate:

- What is your organization's mission?
- For what do you and your organization require marine species data or studies?
- What is your current source of the marine species data that your organization requires?
- How frequently do you use the marine species data or studies you require?
- What, if any, are the regulatory drivers that require you to use marine species data?
- Are there specific datasets that are most important to your work (please list them)?
- How is understanding the geographic extents and locational accuracy of the marine species data or studies important to you?
- What features of a marine species database would make the system worthwhile for you to financially support it?

At the conclusion of the interview we verified with the interviewee that the information provided could be used for this study and proposed ways for the interviewee to track the progress of the study's results.

Interviews Declined

ESRI requested interviews with several other organizations, but interviews were either declined or no response was received to the request for an interview. These organizations include:

Marine Conservation Biology Institute (MCBI)
http://www.mcbi.org/
Non-Profit

Center for Marine Conservation (Ocean Conservancy)
http://www.oceanconservancy.org/site/PageServer?pagename=home
Non-Profit

Chevron
http://www.chevron.com/
Commercial

El Paso Energy
http://www.elpaso.com/
Commercial

Atlantic States Marine Fisheries Commission
http://www.asmfc.org/
Government

IV. Information Product Descriptions

A major objective of the interview process was to compile a set of marine species information products that end users need to support their day-to-day business practices. Information products may take the form of maps, reports, graphs, lists, or any combination thereof. The information product descriptions typically include the following:

- List of specific types of data required.
- Description of how the information product and supporting data are used to support business practices.
- List of data sources currently used.
- An approximation of the current level of effort required to create the information product.
- An approximation of frequency of use of the information product.
- List of other benefits the product may provide to the user.

The following information product descriptions specifically related to marine species information were developed from information uncovered in the interviews.

1. Marine species data used to assess the effects of an oil spill in support of an NRDA

State governments oversee cleanup of thousands of oil spills annually; and while the larger spills receive public attention, there are significantly more spills that do not. For example, the State of Louisiana receives 3500-4500 spill notifications annually. Of those spills, approximately 60% are oil spills. Under the Oil Pollution Act of 1993, a Natural Resource Damage Assessment (NRDA) is required when an oil spill occurs. One estimate of the NRDA is the number of marine species injuries as a result of the spill (typically measured as the number of kilograms of biomass of fish destroyed). The parties responsible for the oil spill are required to compensate the government for the investigation and mitigation of the environmental effects of the spill.

Marine species data required to complete an NRDA need to be collected using a standardized method or protocol. Traditionally, scientists determine abundances of marine species by counting the number of injured or killed organisms within the spill then applying a multiplier across the affected area. Since this method relies on visual confirmation, the multiplier can produce inaccurate estimates of the extents of the injuries. Supplemental marine species data may help in calibrating the model used for approximating the total number of a species injured or killed as a result of a spill. To be most useful, data should include abundance information (species counts) along with metadata explaining the collection methods and time periods of the data. Increasingly, models that estimate marine species abundance based on habitats are being used in oil spill injury assessments. For example, if the marine species injured as a result of an oil spill feed on seagrass, then the amount of seagrass to be replanted as part of the restoration project needs to be determined. Therefore, habitat descriptions are becoming as valuable as marine species observations.

In addition to studying the initial effects of the spill, migration patterns of marine species found in close proximity to a spill area are also important in preparing the NRDA. A species may not be impacted at the time of the spill, but if the species will be migrating into the spill area the injuries

to the species will be factored into the NRDA. Specific types of species data of interest include major bird colonies, endangered species, manatees, and pelican rookeries.

Currently, NOAA or State databases are used in preparation of an NRDA in conjunction with information collected through field studies to assess the impact of the spill. OBIS data may provide another source of marine species data in preparing a NRDA, especially since marine species information is one of the State's least archived datasets. There may be willingness to pay for data required to prepare the NRDA provided that the data is complete, reliable, current, and well documented. Costs to prepare an NRDA, including data collection costs, are typically passed to the responsible party.

2. Marine species data used to determine most appropriate response to an oil spill

When an oil spill first occurs, marine species data may help determine the course of action to combat the spill. During a spill event, the trajectory of a spill is modeled based on prevailing winds, currents, and other conditions to determine where the oil is most likely to go. The Coast Guard will determine the most appropriate response to the spill based on the projected trajectory; in some cases oil is permitted to dilute and the trajectory is not altered, but in other cases the oil may be diverted to a specific area to allow for faster cleanup or to reduce the liability of the responsible party. In one example, oil was diverted into a harbor area despite the presence of a marina rather than out to sea. The rationale was that it would cost less for the responsible party to compensate boat owners for damage than to allow marine species or sensitive habitats in the projected path to be impacted.

Data describing the marine species present, the abundance of the species, and the migratory paths of those species are most useful in helping to determine the response to a spill. Typically, the same NOAA or State databases used to prepare an NRDA are also used for determining response.

3. Marine species data used for pre-spill planning and post-spill analysis

Both the government and commercial sector use marine species data for pre-spill planning and for post-spill analysis. The preparation of the NRDA and response to an oil spill both require access to marine species data during the spill event, however, there is also a need for data before and after spill events occur. As part of pre-spill planning exercises, governmental agencies and the commercial sector perform analyses of past spill events.

Governmental agencies perform pre-spill planning exercises to mitigate hazards, improve response during a spill event, and minimize the extent of injury to marine species that are potentially impacted by spills. Governmental agencies will generally use their own internal databases of marine species that have been compiled through years of research, but may also consult outside sources as needed.

In addition, the commercial sector performs similar studies to assess areas that may be prone to spills and to identify at-risk species in those areas. Performing these studies prior to spill events allows spill responders to be better prepared during a spill event, which could reduce costs associated with compensating the public for the spill and restoration.

For both pre-spill planning and post-spill analysis, the government and commercial sectors are interested in data indicating the presence of marine species, abundance, and migration patterns of marine species. In addition, habitat data may be useful as governmental agencies and the commercial sector need to identify risks to habitat that could be damaged as a result of a spill.

Protection of the habitat that supports marine species is equally as important to protecting the species themselves. Generally complete, detailed data sets are needed for specific geographic extents, and users of data are looking for data sets that can be compared to establish changes over time. Data about prevailing conditions (weather, water temperatures, and chemical levels) is also useful.

4. Marine species data to help enforce coastal habitat protection policy

Governmental agencies are responsible for issuing permits to allow for various types of activities or disturbances along coastlines or in waterways. The permitting process involves performing an assessment of the impact of the activity on the surrounding habitat. Types of activities requiring permits include habitat alteration, drilling, dredging, construction (e.g. rigs), boat ramps, channelization, barrier island restoration, etc. For these types of studies, governmental agencies commonly take a habitat approach (e.g. looking at impact on a seagrass bed habitat) rather than focusing specifically on how the activity will impact marine species abundance. The habitat approach allows the governmental agencies to assess how all species that may be found in a habitat are impacted. There is a standard list of approximately 60-80 habitat types, and permitting agencies generally collect and search for data by habitat rather than single species.

Studies conducted for permitting purposes rely on large-scale, complete datasets within a geographic extent specified by the permitting agency. The users of the data need to be able to specify a geographic extent and identify samples in that area (bottom type, whether it is an altered environment, species present, etc).

An example of the use of marine species data for permitting might involve an application filed with the US Army Corps of Engineers for dredging in coastal waters. As part of the permit review process, the Corps will consult with the National Marine Fisheries Service to determine if there will be adverse impacts to Essential Fish Habitat (EFH) in compliance with the Magnuson-Stevens Marine Fishery Conservation and Management Act. This act was amended in 1996 to include provisions conserving and enhancing EFH. The act requires federal agencies to consult with the National Marine Fisheries Service regarding actions that they fund, authorize, or undertake that could adversely affect EFH. In addition, the National Marine Fisheries Service is required to provide conservation recommendations to federal and state agencies regarding any actions they may take that would adversely impact EFH. More information is available at http://www.fakr.noaa.gov/habitat/efh.htm.

There are several other governmental agencies that issue a variety of permits relating to marine species. NOAA issues permits through http://www.nmfs.noaa.gov/pr/permits/types.htm#mmpa. Other agencies include the US Fish and Wildlife Service, the National Marine Fisheries Service, and State agencies.

5. Marine species data to support marine species protection policy

Governmental agencies are responsible for enacting policies to protect marine species from numerous types of hazards. As noted previously, disturbances to habitat resulting from construction or other activities and pollution are potential threats. Other species may be threatened by the recreational and commercial over-fishing. To enact policies to protect marine species from over-fishing, governing agencies need species data, along with time of year, size of catch, and prevailing conditions at the collection site such as water temperature, dissolved oxygen level, and size distribution. To accurately assess the marine species population, it would be

helpful to determine if the same individual member of the species is counted numerous times or if different members of the species are counted.

To conserve species, government agencies develop and enforce fishing regulations. For recreational fishing, governments will impose regulations on the number of a species that can be caught, the time of year species can be caught, and minimum size that can be kept. Government agencies will use the marine species data to delineate spawning areas, which often includes both estuarine and ocean catch numbers.

Interviewees indicated that they typically use their own internal databases as a primary source, but are interested in data collected by other groups or agencies and marine species counts from other areas along the coastline. Data quality and completeness of data is a principal concern.

6. Marine species data to plan and support rescue operations

While governmental agencies and other groups work to enact and promote policies to protect marine species, there are also organizations that use marine species data in support of marine species rescue operations. One example is the rescue of salmon in the Carmel River in California. The river is intermittent, and each year salmon are rescued when the river dries up. Organizations coordinating the rescue effort compare counts of salmon rescued with other factors, such as the amount of water pumped out through wells, water usage, and rainfall totals to determine impacts on marine species and relationships between these factors.

The data required to support rescue operations is generally collected through field studies, but abundance and species distribution data can be helpful in estimating the counts and distribution of species to be rescued, planning for rescue efforts, and determining the resources needed to support the effort.

7. Marine mammal data to assess impact from vessels and marine traffic

Contractors for NOAA and independent researchers are increasingly performing studies to assess the impact that marine traffic has on marine species, particularly marine mammals. Recent projects have included work with sanctuaries in Cape Cod and a study of the impact of ship strikes on whales. Studies of this nature generally rely on ship surveys and notes from fishermen in addition to internal marine species databases. Researchers need to be able to identify the number of sightings per square mile, but it is also helpful to be able to identify whether the same individual mammal is sited numerous times within a specific geographic extent or whether there are sightings of several different members of the species.

Researchers performing these types of studies indicated that they did not use the OBIS interface to support findings, but they did use the related SeaMap interface at http://seamap.env.duke.edu/ (SeaMap harvests data made available through OBIS).

8. Marine species data used to support cable and pipeline development

Cable and pipeline route surveys are often performed using an integrated desktop study approach prior to beginning work in the water. These surveys are frequently performed for cable and pipeline routes in foreign waters. While these surveys primarily include bathymetry and seafloor imagery to analyze the seafloor, they also at times include areas of marine resource exploitation, fishing zones, sensitive habitat areas, oceanographic data, meteorological information seasonal impact factors, and related permitting issues.

Surveys are performed to collect marine species data to determine species present and abundance. This data is then used to evaluate potential cable and pipeline route options with species impact being one criteria. Generally cable and pipeline route surveys are conducted using internal data archives and field surveys; external source of data are not relied upon. However, there is some potential for OBIS to be used as a supplemental source for data to substantiate findings.

9. Marine species data used to support conservation public relations

Non-profit organizations use marine species data in a variety of ways to support conservation efforts. In one example, the Wildlife Habitat Council (WHC) prepares biological assessments for partner corporations once a corporation has initiated work with WHC. The biological assessments describe how the corporation can improve and preserve habitat on and around the properties owned by the corporation. WHC uses a more habitat-driven than species-driven approach, but species distribution is factored into a biological assessment. Species abundance is not of specific concern for preparation of the studies. While most of the corporate properties require terrestrial data, there are a few properties that do require access to marine data. Biological assessments will also identify any potential problems with invasive species.

WHC presents biological assessments with a series of recommendations to partner corporations. By following the recommendations, partner corporations can participate in a certification program. WHC is not concerned with regulations (partner corporations must be in compliance with all regulations to participate). Generally corporations opt to participate to improve public relations. Certified participants are able to post signs on their property and WHC will issue press releases advertising a corporation's participation in the program.

WHC can bill a partner corporation for specific data needed to repair biological assessments, but WHC will look for data available at no charge first. WHC does rely primarily on external data sources such as NatureServe and EPA's EnviroMapper.

10. Marine species data used for pollution studies

Governmental agencies and non-profit organizations use marine species data in geospatial format in conducting studies pertaining to the effects of pollution on marine species. A primary focus is on the toxin levels in marine mammals and fish. Interviewees indicated that while OBIS provides information on distribution and abundance of a species, they were unable to locate data providing supporting information needed for pollution studies. Supporting information might include gender and age distribution within the population to help determine migration patterns and breeding areas. Also, it would be helpful to note the activity or behavior of marine mammals and other species when applicable. For pollution studies it is important to identify the areas where species are feeding to determine sources of toxins in the diet. Knowing that a sub-population with high levels of a certain toxin tends to feed in one specific geographic area may lead researchers to a point source of pollution "upstream" from those feeding grounds. The information gathered during pollution studies of this nature is then used to enact policies to reduce or prevent pollution in an attempt to protect and conserve marine species.

Interviewees interested in marine species data to support pollution studies need to be able to identify specific geographic areas of interest and need to be able to compare data collected using like methods over time to assess changes in populations or pollution levels. In addition, interviewees expressed an interest in being able to execute searches and plot data based on the cruise or data of observation to more readily identify seasonal trends in species distribution.

11. Marine species data used for Environmental Impact Assessments

As part of Exploration and Production activities, oil companies will perform environmental impact assessments to assess how activities affect the environment. Benchmark studies are performed prior to the construction of coastline facilities to document baseline conditions before the oil company initiates work in the area. Coastline facilities include pipelines, rigs, boats, etc. Similar studies are performed around lasting structures on a regular basis to assess how the coastline facility is impacting the environment. When facilities are removed or projects are terminated, studies continue to be performed. The objective is to demonstrate and certify zero environmental impact as a result of the facility.

Although oil companies have differing business approaches to environmental issues, oil companies are increasingly recognizing the benefits and cost savings of performing environmental studies and enacting (and at times promoting) protection and conservation measures. The environmental measures not only result in fewer fines from regulatory agencies, but improve the public perception of oil companies. Furthermore, some oil companies opt to perform the more stringent assessments in any country in which they construct coastline facilities although environmental regulations vary.

Oil companies collect marine species data through various methods. They may take advantage of publicly available data sources, perform field studies, or hire consulting firms or universities to collect data. Oil companies are interested in the marine species present, abundance, and other factors such as water temperatures, chemical levels, and the ocean floor. OBIS may prove useful to oil companies seeking marine species data for specific geographic extents, and there may be willingness on the part of oil companies to share data that is collected as part of their studies.

12. Marine species information for Social Impact Assessments

In addition to Environmental Impact Assessments, various organizations may use marine species data for Social Impact Assessments to determine how communities in the proximity of coastline oil facilities or other types of development may be impacted. As an example, a tribal organization may perform a study of a village near a site along the coast where a rig will be constructed. Through surveys of the community, it is discovered that the village relies on fishing for sustenance and any impacts to the fish population will be detrimental to the village's ability to feed its population. Marine species data that describes the distribution and abundance of species, in addition to prevailing conditions and habitat, is useful for the Social Impact Assessment. The tribal organization may then use the results of the study to develop plans to help sustain the needed food source or devise compensatory measures.

V. Findings

Interviewees identified several common themes through the discussion of information products needed by the commercial, government, and non-profit sectors. The themes were centered on familiarity with OBIS, data issues, data sharing and security, OBIS usability and available functionality, OBIS self-sustainability, and other available data sources or initiatives.

Familiarity with OBIS

The majority of the interviewee candidates were not familiar with OBIS, its mission, or the OBIS portal. Several interviewees indicated they had performed fairly exhaustive Internet searches to

find potential sources of marine species data, and OBIS did not come up in their searches. In general, interviewees felt OBIS should be better publicized and easier to find.

Data Completeness

Interviewees tended to concur that there is a significant amount of data available through OBIS, but also expressed concerns about the completeness and quality of the data. OBIS is useful in supporting intended purposes of describing global and regional patterns of diversity in the oceans and providing a basis for investigating global diversity, but interviewees indicated that OBIS may not be able to meet their needs for complete datasets within very specific geographic areas of interest. Users need to identify all species present within a specific geographic extent. Several interviewees indicated that the industry is trending away from using species abundance data for environmental assessments. Instead, habitat data and data describing prevailing conditions within a geographic extent can be used to more accurately model abundance. Users need to be able to determine the habitat associated with certain species and species associated with specific habitats.

Data Quality

Another issue for some of the interviewees is their understanding of the quality and the limitations of the existing data available through OBIS. One interviewee searched on a type of herring and found that the data indicated the herring was located in a geographic location where it is not known to be. Anomalies in the data such as these made some interviewees hesitant to consider OBIS as a potential source. At minimum, interviewees are looking for metadata describing these types of anomalies. The textual information and disclaimers about the data on the website that identifies some of the known limitations of the data is useful, but specific information about the quality of the data displayed for each search is needed.

Data Standards

Several interviewees echoed the need for a consistent, established fisheries database, but also felt that a standard distributed data model for marine species data is critical to data sharing. Interviewees indicated that a data model for marine species data needs to accommodate several aspects of marine species data in addition to distribution and abundance. The data model also needs to consider temporal changes, migration patterns, and habitat and needs to differentiate between observations of the same animal as it traverses ocean waters versus sightings of different members of the species. In addition to the standards needed for storing and representing the data, there is a need for standardized methods of collection to ensure consistency and the ability to compare data from different studies over time. While each entity collecting data may have a consistent set of collection or sampling methods for sampling, there is a lack of consistency across various sectors and entities compiling and using the data.

Metadata

In addition to the need for standardized data, interviewees also need access to complete, standardized metadata for any dataset used to support business practices. Interviewees indicated that metadata should describe the collection methods used as well as more common entities such as the purpose, data owner, publication date, and use and access limitations.

Data Sharing / Security Issues

While many of the interviewees recognize the importance of data sharing and are interested in a standardized marine species database, there is also reluctance on the part of some agencies to share data without the ability to control access to the data. Some of the reluctance is a concern that data will be used inappropriately, but there is also competition to publish findings based on data collected before another individual or group publishes the findings. Governmental agencies acknowledge that their data is public and do make it available, but they do reserve the right to negotiate how the data is used by those that acquire it. Interviewees indicated they are more willing to share data they collect if they have some control over who accesses it and how it is used.

Willingness to Contribute

There is some willingness on the part of users of marine species data to pay for the data. Most interviewees have internal databases that serve as their primary data sources and meet most of their data needs. If data of the same quality, completeness, and relevance were available through an external source, users may give consideration to paying for that data, as it could be more cost-effective than collecting data and maintaining internal databases. Interviewees that are willing to pay for data indicated that the data must have value above and beyond what can be obtained through other publicly available sources (data be must be complete and accurate). There is a higher level of expectation of the data quality and level of standardization when there is a charge for data.

Interviewees discussed several models regarding data exchange. Generally, users are most supportive of a model that allows for entities that contribute data to access data at no charge or for a nominal fee. Entities that access or extract data without contributing could be charged a higher fee. Another potential option would involve corporate sponsorship of OBIS by corporations that access data.

Interviewees did highlight other models that they feel are less effective. Some commercial data providers make data available on a state by state basis. Because study areas may be relatively small but still cross state boundaries, this approach gives users less flexibility in acquiring data and leads to higher costs for data consumers. Another model was recently employed by IHS Energy and the United Nations Environment Programme World Conservation Monitoring Centre. Some interviewees expressed frustration at data delivery partnerships such as these, as data that they considered to be in the public domain is now being distributed at cost by IHS.

Usability

The general consensus among interviewees was that the current OBIS interface is difficult to use and provides limited search capabilities. Interviewees commented that the data they are interested in may be available through the portal, but either the search tools needed are not available or there is not enough information given for the user to know how to access the data. Users want more flexibility in performing searches, such as the ability to search by habitat type, by date of collection, by collection method, or by data collector, as examples. Interviewees did find it useful to be able to search by both common name and scientific name, but felt that the search engine needed to be a little more forgiving in terms of typographical errors or misspellings. Users did feel that the information provided on how to cite OBIS is useful.

Interviewees provided little feedback regarding the performance of the site. When developing web applications, ESRI generally finds users have a tolerance of one map per second.

Mapping

In addition to the search capabilities, users expressed interest in more mapping functionality. Mapping functionality employed on other web mapping sites that ESRI has developed include the ability to change symbols, to turn off and on data layers, and to define geographic extents through coordinates or pan and zoom tools. Interviewees were not clear as to what dots and boxes on the current map represent.

In addition, data export tools or web services would be of benefit. For example, ArcIMS provides a data extract service that allows users to download an extract of the dataset based on the geographic extents of the map frame.

Databases and Initiatives

Interviewees indicated that they use several of the data sources identified in Section III. There may be some potential for providers of these data resources to share data through OBIS or for OBIS to tie into other initiatives such as NBII or IOOS.

Interviewees also provided some insight as to the reasons that other sources of information might be used over OBIS. Interviewees that accessed other datasets were either not aware of the OBIS site or found that the other sites were easier to use and extract data from. An example given is SeaMap, a publicly available database of marine mammals, turtles, and birds in US coastal waters and accesses many of the same data sources as accessed by OBIS. Although interviewees indicated that the data available through SeaMap is not exhaustive and cannot be used as a composite data source, the data available through SeaMap proved to be valuable for specific projects.

VI. Recommendations

The Sloan Foundation and OBIS Technical Committee recognized that a User Needs Assessment is an essential step in the system design process for an information portal such as OBIS. Based on the existing OBIS portal and the findings of the User Needs Assessment, ESRI recommends that the Sloan Foundation and OBIS Technical Committee perform a series of review steps. The reviews include a data review, interface design review, technical architecture review, and a business model review.

Data Review

ESRI recommends that the Sloan Foundation and OBIS Technical Committee perform a review of the existing data available through the OBIS portal to assess whether the data meets the needs of existing and potential users. Questions to address include:

- Is the data sufficiently complete to meet user needs?
- Are key datasets missing that can be made available through OBIS?
- Is supplemental information from existing studies that may be useful available?
- Is data sufficiently accurate to meet user needs?
- If data errors are noted, can they be corrected?
- Is the data sufficiently current to meet user needs?
- Is there more recent data available?
- Are there older datasets available that allow data to be compared over time?

In addition to a review of the data, ESRI recommends that the corresponding metadata be reviewed as well. The metadata should provide existing and potential users with sufficient information to determine whether specific datasets are current, accurate, and complete enough to be used for a specific study or purpose. Metadata should highlight known anomalies in the data and describe collection methods. OBIS has already reviewed Federal Geographic Data Committee (FGDC), Global Charge Master Directory (GCMD), and other metadata standards to compile a metadata standard for OBIS that is available through the OBIS portal. ESRI recommends that the metadata standard and metadata records for data be easier to locate from the OBIS Welcome page.

Generally, there are two types of metadata standards: content standards and format standards. ESRI recommends that OBIS consider both. The presentation format of metadata should be considered for the readability for the general audience, but also for similarity to other existing presentation formats that users of geospatial data may already be familiar with (e.g. ISO, FGDC classic). Typically, ESRI recommends that an existing metadata format be used rather than creating a new format, as use of an existing standard metadata format can better enable metadata to be made available through metadata clearinghouses and made searchable.

In moving towards making OBIS metadata searchable, ESRI recommends that OBIS consider the metadata publication requirements of portals such as Geospatial One Stop (GOS). GOS is available at www.geodata.gov and is an example of a geographic information system portal that serves as a public gateway for improving access to geospatial information. Metadata can be published via geodata.gov in three ways: publishing metadata to a metadata distribution server (clearinghouse) from which geodata.gov can harvest, upload of XML formatted data, or creation of metadata using the geodata.gov metadata publication tool. More information is available at http://www.geo-one-stop.gov/metadata/CreatePublishMeta.pdf. XML format metadata records

are one of the most portable, as they can be frequently be read by clearinghouses and are generally interchangeable with other metadata formats.

The current OBIS metadata standard contains the content that interviewees indicated would be required to assess the usefulness of data for specific purposes, however, OBIS will need to consider how to ensure metadata records are in compliance with the content standard. One option is limit the ability of data providers to post data without a metadata review being completed first. Some limitations of this approach we have found are that resources are needed to perform the metadata review and enforcement of the metadata standard may discourage data providers that have not completed metadata from posting data. A metadata review should not only address whether all required inputs are populated, but whether there is sufficient information included with each input. Interviewees were particularly concerned with data collection methods; the samples provided through the OBIS portal only provide limited information about the collection methods. ESRI recommends that metadata records include very specific information about the collection methods: the sampling method, sampling area and interval, duration of sampling period, etc. Additionally, OBIS may want to focus on educating and working with potential data providers to complete their metadata.

Implementation of a metadata content standard will help to address concerns centering around data quality and data completeness. A significant number of the interviewees expressed concerns that the quality of the data is either unknown or not to the level required. As noted above, interviewees were interested in descriptions of data collection methods and data review (quality control) processes to assess data quality. Interviewees expressed a desire to know what review processes data posted to OBIS had undergone. For example, the group SCAMIT in Southern California works to make sure taxonomies and nomenclatures are used consistently – an indication that a dataset available through OBIS had gone through review by SCAMIT or a similar group could alleviate some concerns about data quality. ESRI recommends that OBIS consider the need for review of data by oversight committees as applicable. Another option includes building quality assurance applications that can check data during the load process; suspect data can be marked or changed depending on the agreements established with the data source provider.

Interface Design Review

ESRI recommends that the Sloan Foundation and OBIS Technical Committee conduct a design review of the OBIS interface to assess whether OBIS provides existing and potential users with the access needed to information. Questions to consider include:

- Does the interface provide users with all of the search capabilities that are needed?
- What types of data queries are needed?
- What types of spatial queries are required?
- Does the interface provide users with all of the navigational tools that are needed?
- Does the interface provide users with all of the mapping capabilities that are needed to produce specific map outputs?
- Are appropriate cartographic standards applied to the map output?
- Is the interface easy to use?
- Does the performance of OBIS fall within a level tolerated by users?

Although a complete assessment is beyond the scope of this study, ESRI offers some general suggestions on the user interface. Recommendations include:

- Provide users with a link, tab, or button to a set of instructions as to how to navigate the site on the Welcome page. One option is to include this as a tab, button, or link for new users. Information provided for new users should include an explanation of the various types of queries that can be performed and the different mapper options (e.g. C Squares, KGS, etc.).

- Consider providing map tips or a legend to assist users with knowing what the dots and boxes on a returned map represent.

- Provide users with all search capabilities on one page.

- Return a map to a user with fewer steps. Currently, several clicks are required to get to a map (e.g. currently a search is executed on species name, then user chooses from a list of returned results, a map window is opened and the user may need to navigate or choose the desired area of interest).

- Consider providing users with the ability to download data in geospatial format so that the data can be used with desktop GIS applications. When considering this option, OBIS will want to evaluate whether restrictions should be placed on this capability. Certain datasets may be suitable for viewing through the OBIS portal, but the data owner may not want the data distributed in geospatial format.

- Present the list of data sources currently at the bottom of the search results screen on a separate page, in a dropdown list, or a table to make this information easier to read.

- Provide the ability to search on several species and return a map showing those species (e.g. all species of turtles).

- Make the New Search option on the search results page easier to find. Options include changing the font or moving the feature to the top of the page.

Technical Architecture Recommendations

ESRI recommends that the Sloan Foundation and OBIS Technical Committee further explore portal technology as the technical solution for OBIS. A GIS portal is a single point of access to spatial information, regardless of the location, format, or structure of the data source. A successful portal connects desktop users with disparate data holdings and applications. Portal technology is an appropriate technical solution for OBIS, as OBIS can function as the gateway to disparate data holdings rather than storing all of the data. For instance, datasets provided by other organizations can be consumed and fused into one application with little intrusion to those organizations. Portal technology allows for wide scale data sharing with essentially unrestricted access, but the sensitive nature of certain data sets may require a level of security to be applied. For more information about GIS portal technology, consult the attached GIS Portal Technology white paper.

The Sloan Foundation and OBIS Technical Committee may want to consider performing a technical architecture assessment to ensure an appropriate system design for portal technology and a solution that will meet user needs. More information on system architecture design strategies is available at http://www.esri.com/library/whitepapers/pdfs/sysdesig.pdf.

Business Model Analysis

While the data review, interface review, and technical architecture assessment are all important steps, ESRI recommends that the Sloan Foundation and OBIS Technical Committee perform an overarching business model analysis. The business model analysis should set out to answer some important questions that can help determine how to proceed with the other reviews and assessments. The business model analysis will need to consider who the intended users of OBIS should be based on the specific needs and information products highlighted as part of this study. A cost-benefit analysis is an important component of the business model analysis, as it can help determine whether the costs associated with performing reviews will be outweighed by the benefits. Additionally, the costs associated with addressing data issues, modifying the interface, and implementing the technical architecture needed to support users must also be considered.

To perform the business model analysis, ESRI recommends that the Sloan Foundation and OBIS Technical Committee develop a pilot project for a limited geographic extent. The pilot project should focus on getting organizations at all levels that collect data within the geographic extent to share data through OBIS: Federal, State, and local government, the commercial sector, non-profit agencies, and academic institutions. A pilot project can serve as a proof of concept to demonstrate the benefits that OBIS can provide when an increasing number of data sets are provided through OBIS. There are many collectors of data that would be relevant for OBIS, but often times there is no perceived need among those data collectors to share data – a pilot project can help promote the need for data sharing. The pilot project can also serve to demonstrate that the process of sharing data can be simple and relatively quick.

ESRI also recommends that OBIS pursue relationships with potential data providers and groups that have developed other marine species database initiatives. As noted in the Technical Architecture recommendations, GIS portal technology such as ESRI's Portal Toolkit can provide a non-intrusive way to facilitate data exchange among groups that are interested in and willing to share data, as map services from various organizations can be consumed and fused for presentation to an end user.

Additionally, ESRI recommends that OBIS consider approaches for publicizing OBIS as part of the business model analysis. Marketing approaches might include providing links from other marine species organization sites, advertising at conferences, or participating in the Geospatial One Stop initiative.

There is potential for OBIS to evolve and move towards a model of self-sufficiency, but there are a number of data and design considerations that must be accounted for in the review process and any ensuing design and implementation steps. The need for marine species data will likely continue to increase, as the ocean is one of the least explored areas on Earth today. However, as exploration continues and the need for marine species data broadens, OBIS will need to consider the requirements of the expanded users of the data in order to implement and support a self-sufficient, useful service.

NATIONAL WATER QUALITY MONITORING COUNCIL

Working Together for Clean Water

The National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries

Ocean Research and Resources Advisory Panel

June 6, 2006

Presentation Outline

- Review history of the project
- Recap the design process
- Overview of the report's content
- Discuss next Steps

Background

The Oceans Act of 2000

- **Created U.S. Commission on Ocean Policy**
- **To focus on:**
  - **Protection of life and property**
  - **Stewardship of resources**
  - **Protection of environment and pollution prevention**
  - **Enhancement of marine commerce**
  - **Closer cooperation among government agencies**

Chapter 15: Recommendations for "Creating a National Monitoring Network"

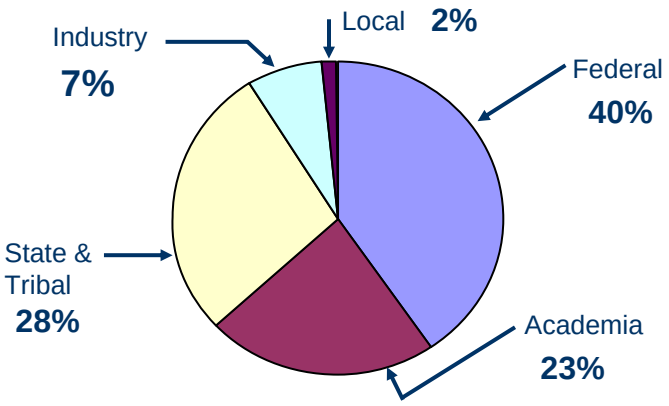
- 15-1: Develop a national monitoring network that coordinates and expands existing efforts, including monitoring of atmospheric deposition.
- 15-2: Ensure that the national monitoring network includes adequate coverage in both coastal areas and the upland areas that affect them, and ... linked to the IOOS.
- 15-3: Ensure that the monitoring network has clear goals, specific core variables and an apporpriate sampling framework.

Advisory Committee on Water Information (ACWI) Charged with Network Design

- Charge from Council on Environmental Quality (CEQ) and National Science and Technology Council (NSTC) formally accepted in February, 2005
- ACWI delegated responsibility to National Water Quality Monitoring Council (NWQMC)
- Progress reports to ACWI and NSTC Subcommittee on Water Availability and Quality during 2005
- Report presented to ACWI in January, 2006 and formally accepted in April, 2006
- Report presented to CEQ and NSTC in April, 2006

80 Participants in the National Water Quality Network Design

Participant Affiliation



Design Features

- Clear objectives
- A Network linked to IOOS
- A monitoring Network that recognizes linkages among resource compartments
- Builds on existing programs
- Flexibility over time
- Includes
  - Data management system that provides accessible data
  - Metadata
  - Quality assurance

Structure of the Design

- Nine Resource compartments

A Continuum of Observations
- Estuaries
- Nearshore
- Offshore and EEZ
- Great Lakes
- Coastal Beaches
- Wetlands

With Flow and Flux from:
- Rivers
- Atmosphere
- Groundwater

Structure of the Design

- Fixed station and probabilistic designs
- Stations identified
- Parameters and sampling frequencies specified
- Provisions for
  - Data comparability
  - Data management & access

Constituent Categories

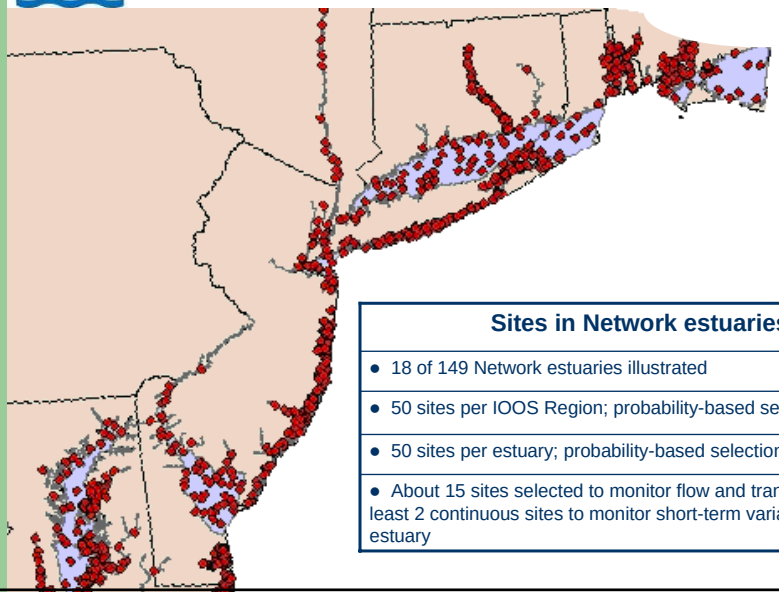
- **Physical:** Flow magnitude and direction, physical habitat, sediments
- **Chemical:**
  - Inorganic: Water-quality characteristics, major ions, nutrients, metals and metalloids
  - Organic: Bulk organics, volatile organic compounds, pesticides, halogenated hydrocarbons, polycyclic aromatic hydrocarbons, contaminants with new and emerging concerns
- **Biological:** Diversity, toxicity

Network Design Summary

Network Design Summary

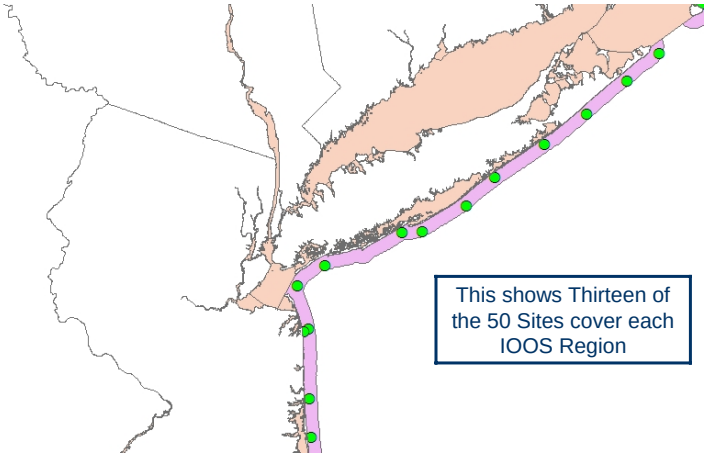
Resource component	Purpose	Reporting unit	Number of sites per reporting unit	Total number of sites	Site Selection	Sample frequency	Sample interval
Estuaries	Condition of US estuaries	National & IOOS regions	50 per IOOS region	500 sites sampled per year	Probability-based design that will assure geographic coverage	Once per year	5 years (repeat year 1 sites in year 6)
	Condition of individual estuaries	Individual estuary	50 sites per estuary except for very small estuaries	1500 sampled per year (50 sites X 30 estuaries sampled per year)	Probability-based design that will assure geographic coverage	Monthly for physical and chemical conditions in water column; Once per year for biological characterization and sediment quality	5 years (repeat year 1 estuaries in year 6)
	Transport through estuaries	Individual estuary	15 sites per estuary	2235 (15 sites X 149 estuaries)	Distributed along salinity gradient from major river mouth to seaward outlet	Monthly for physical and chemical conditions in water column	On going
	Short-term variability	Individual estuary	2 per estuary	298 (these sites are subset of sites used for transport)	At two ends of salinity gradient	Continuous monitoring	Continuous

Monitoring Estuaries



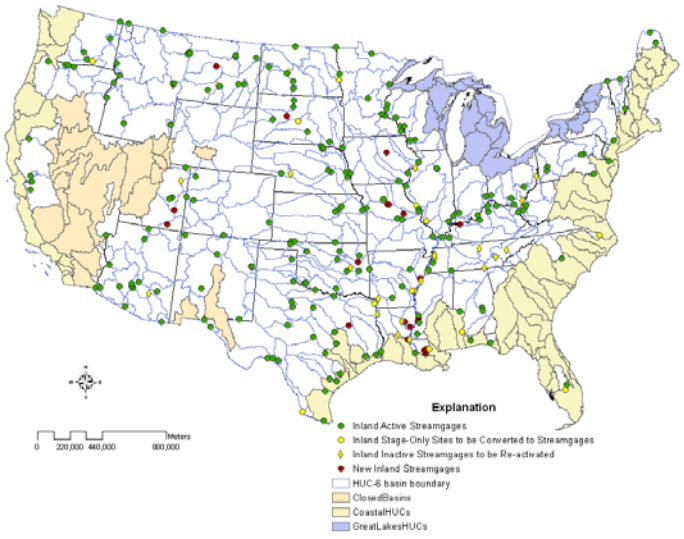
Sites in Network estuaries
• 18 of 149 Network estuaries illustrated
• 50 sites per IOOS Region; probability-based selection
• 50 sites per estuary; probability-based selection
• About 15 sites selected to monitor flow and transport with at least 2 continuous sites to monitor short-term variability in each estuary

Monitoring Near Shore



This shows Thirteen of the 50 Sites cover each IOOS Region

Monitoring Large Rivers



Coordination With IOOS

- Design proposes to involve the IOOS ***Regional Associations*** in managing a part of the proposed monitoring
- Design has a data management plan that is consistent with the IOOS Data Plan
- Design relies on IOOS plans for monitoring the Offshore compartment

A Network of Networks

- National network at specified spatial and temporal density
- The Network will rely on existing efforts to the extent possible
- Federal backbone can be augmented with state and local data that are network compliant
- Additions and enhancements can be accommodated

A Network of Networks

(continued)

- Conditions and trends identified at national scale
- State and local agencies continue to be responsible for detailed problem identification and source tracking

Metrics to Track Network Implementation

- Finalize design to determine the “whole”
- Complete the inventory to determine what portion is on-going
- Example: Streamgages
  - Need 258 sites at downstream point of Hydrologic Unit Code 6 (HUC-6) basins
  - 222 streamgages in place

  METRIC: 86% of total needed are in place

Network Data Management

- Design places major emphasis on storage and access
  - Built on ACWI’s Water Quality Data Elements for content, metadata
  - Assumes USGS and EPA data warehouses
  - Assumes web services will be the data exchange mechanism

Products

- Accessible data
- Quality assurance and quality control plans
- Periodic summary reports
- Examples of use of Network data and information in scientific literature and in resource management

Management Questions

- What is the condition of the Nation's waters?
- Where, how, and why are water quality conditions changing over time?
- Are strategies to protect water quality working?
- Are we meeting water quality goals and standards?

Network Presentations

- Council on Environmental Quality
- National Science and Technology Policy: SWAQ, and JSOST
- Subcommittee on Integrated Management of Ocean Resources
- U.S. Geo Group on Earth Observations (June)
- Coastal Coordinating Committee & Coastal States Organization (June)

Network Presentations

- National Water Quality Monitoring Conference
  - May 8-11, 2006
  - Approximately 900 attendees from Federal, Tribal, and State agencies, academia, private sector, volunteer monitoring community
  - Plenary presentations
  - 4 special sessions with open dialogue

Next Steps

- Discuss the details and advantages of the Network with groups that may become partners in its implementation
- Appoint agency staff to coordinate implementation of pilots
- Identify and negotiate pilot studies
  - Further develop selected details of the Design
  - Conduct expanded inventory of ongoing monitoring that might meet Network requirements
- Further develop metrics to track progress in Network implementation
- Identify resources

Briefing for ORRAP
June 6, 2006 on
NOAA Oceans and Human Health Initiative
and
Workshop on Assessing Public Health Risks: Coastal Observations for Decision Making

Juli M. Trtanj
Director, NOAA Oceans and Human Health Initiative

A Very Brief OHHI History

•Authorized by Congress in 2003

•Scoping Workshop-CORE, 2003

•The **Oceans and Human Health Act of 2004** Authorizes the Secretary of Commerce "to establish an **Oceans and Human Health Initiative** to coordinate and implement research and activities of NOAA related to the role of the oceans, the coasts, and the Great Lakes in human health."

•**OHHI Funding History:** The OHHA authorizes funding levels through FY08 for a total of $60 million

FY06 appropriation of $5 million, (FY05-$18 million, FY04-$10 million, FY03-$8 million)

NOAA OHHI Program Elements

The OHHA establishes **programmatic requirements** for the OHHI:

- Centralized program and research coordination (OHHI Program Office)
- National Advisory Panel
- *One or more NOAA National Centers of Excellence (3)*
- *Extramural Research grants (26)**
- *Traineeships-pre- and post-doctoral programs**
- *Distinguished Scholars (2)**
- Public Information and Outreach
- Annual Report to Congress
- Part of an Interagency OHH Program
  - *requires at least 50% of OHHI funds to external grants, distinguished scholars, and traineeships

A Mission within A Mission…

NOAA's Mission: **To understand and predict changes in the Earth's environment, and conserve and manage coastal and marine resources to meet our nation's economic, social, and environmental needs.**

Ecosystem Goal: Healthy and productive coastal and marine ecosystems that benefit society, and a well-informed public that acts as a steward of coastal and marine ecosystems

OHHI Draft Mission: Understand and predict the connections between the condition of oceans, coasts, Great Lakes and human health to provide information focused on reducing risks to public health.

NOAA OHHI Scientific Goals

1) Supporting an ecosystems approach to understanding causal relationships between humans, ocean processes, marine ecosystem health, and human health outcomes;

2) developing tools and methods to identify, monitor, predict, and ultimately reduce or prevent ocean-related public health risks;

3) identifying emerging human health risks from ocean and coastal waters;

4) Promoting the ecologically sound discovery of marine organisms and bioactive agents for human health benefit; and

5) Providing useful information for public health and natural resource decision makers

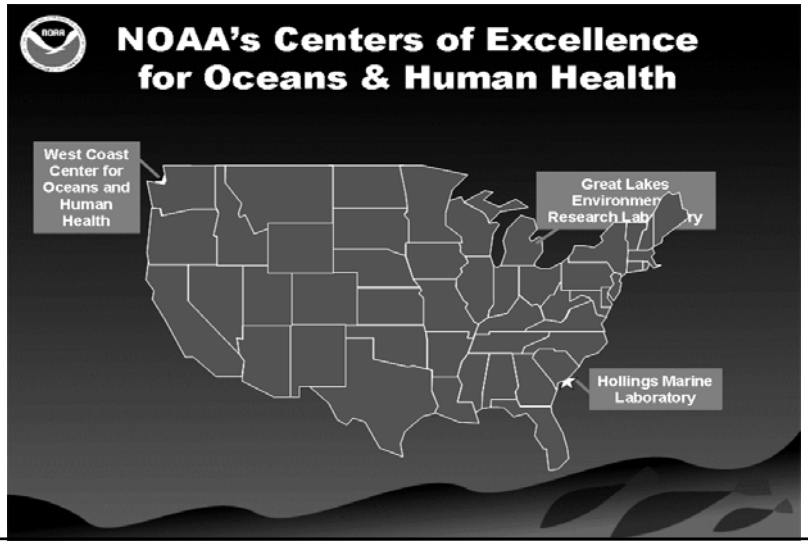
This will be accomplished through close partnership with other agencies, academia, and the public health community, with the goal of providing useful environmental information, predictive tools, and monitoring capacity for public health and natural resource decision makers.

NOAA OHHI Scientific Scope

- **Pathogens**
- **Marine Toxins**
- **Chemical Pollutants**
- **Marine Pharmaceuticals and Natural Products**

- ***Multiple Ecosystem Stressors (ie. climate)***
- ***Sentinel Species and Habitats***

- **Public Information**
- **Outreach**
- **Education**
- **Data Management**



OHHI External Grants

- **OHH Act requires 50% of funds to go to external efforts**
- **FY04: 104 proposals received, 17 grants awarded ($6.8 million)**
- **FY05: 121 proposals reviewed, 9 new projects funded ($5.0 million + $1.8 continuing projects)**
- **FY06: FRN not expected due to budget cuts**
- **Designed to build partnership with non-federal sector and build cadre of interdisciplinary ocean and health scientists**
- **Designed to fill targeted research gaps or exploratory areas best suited to hypothesis driven short time cycle research**
- **Link to Centers not required for proposal, informal link for mutual scientific benefit**

Distinguished Scholars

- **Dr. Rita Colwell, Distinguished University Professor Emerita, University of Maryland**
- **Dr. Philip Roberts, Professor, Georgia Institute of Technology**

Public Information and Outreach

- ***Assessing Public Health Risks: Coastal Observations for Decision Making-Jan. 23-25, 2006***
- **Coordination with Sea Grant (also required by OHHA)- initial consultations underway**
- **ASLO/AGU/TOS February 2006**
- **AAAS February 2006**
- **Estuarine Research Federation, Oct. 2005**
- **OCEANS 2005**
- **Molluscan Shellfish Safety Conference,, Aug. 2005**
- **Connecting the Gulf Coast and Human Health, May 2005**
- **Much activity at the Centers**

Assessing Public Health Risks: Coastal Observations for Decision Making

St. Pete, Florida, January 23-25, 2006
Goals:

1) Identify decision processes and critical information gaps that could be filled by the IOOS focused on reducing health risks from:

a) microbial pathogens
b) marine biotoxins and harmful algal blooms
c) emerging coastal public health threats

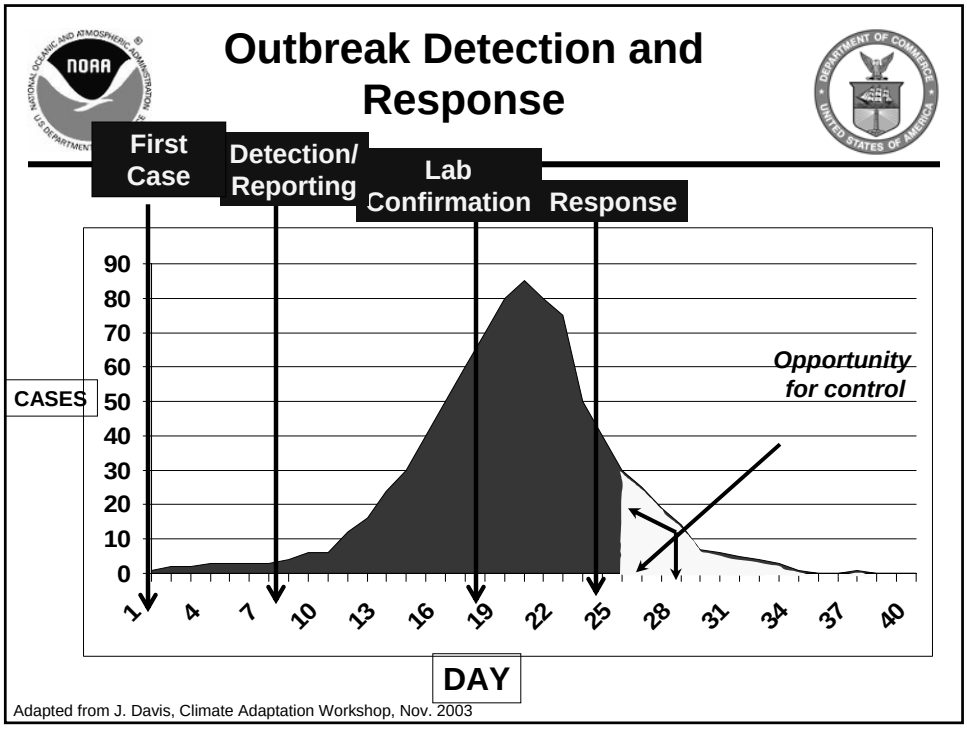
2) Identify coastal water quality information needed—for closure, advisory, and use of predictive models or monitoring

3) Prioritize data and information parameters necessary for above

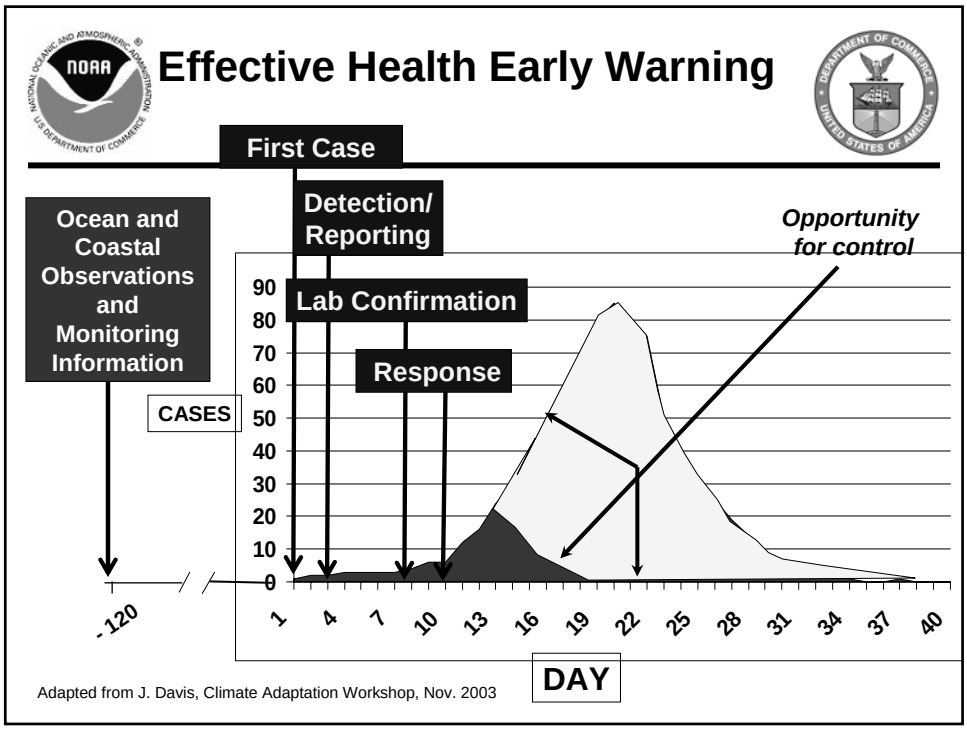
4) Establish mechanisms for continued dialogue and communication to maintain the involvement of this community (managers, public health officials, and oceanographers) in the effort to ensure the timely flow of accurate, integrated and sustained ocean and coastal data and information for public health benefit.

Assessing Public Health Risks: Coastal Observations for Decision Making

- **Meeting and Steering Committee Chaired by Dr. Rita Colwell**
- **80 invited participants**
  - **Beach managers**
  - **Public health officials—Federal, State and Local**
  - **Shellfish managers**
  - **Scientists**
  - **IOOS regional associations**
  - **Data Managers**
  - **Modelers**
  - **Satellite and Remote Sensing experts**
- **Opening talk by Dr. Warren Washington**
- **Supported by: NOAA, EPA, NSF, NASA, USGS, NIEHS, Ocean.US**
- **Used by Ocean.US for implementation plan, agencies for planning and funding**



Adapted from J. Davis, Climate Adaptation Workshop, Nov. 2003



Adapted from J. Davis, Climate Adaptation Workshop, Nov. 2003

Assessing Public Health Risks: Coastal Observations for Decision Making: Break Outs

- **Identify public health decisions that could be improved by an ocean observing system**
- **Design an Ocean Observing System to support public health decisions**
- **Determine next steps needed to build an ocean observing system to support public health decisions, including:**
  - **Research needs**
  - **Information delivery**
  - **Data management**

Assessing Public Health Risks: Coastal Observations for Decision Making: Preliminary Findings

- **Develop a Blue Print for an Integrated Ocean Observing System that supports Public Health Decision Making**
- **Preliminary findings:**
  - **Importance and difficulty of obtaining epidemiological data temporally and spatially compatible with ocean and coastal obs which is essential for identifying the locations and extent of human health problems as well as tracking their sources.**
  - **Need for sustained observations of weather, coastal currents, water quality, of shellfish populations in order to develop numerical models that can reliably predict the movement and fate of waterborne pathogens and harmful algal blooms.**
  - **Need for a sustained regional or local communication between communities**
  - **Potential for pilot projects**

Assessing Public Health Risks: Coastal Observations for Decision Making: Preliminary Findings

- **an Integrated Ocean Observing System is needed** to improve the ability of decision-makers to manage and mitigate public health threats more effectively
- **Improve the reliability of epidemiological data linking exposure to illness** - collect temporally and spatially compatible data linking physical, biological, and health data
- **Increase the accuracy and timeliness of estimates of the concentration and distribution** of waterborne pathogens, toxic algae, and their toxins. Identify more accurate indicators of risk and improve measurement techniques to reduce the time between sample collection and the availability of results. Molecular, optical, and hybrid methods should be considered.
- Make more inshore measurements and **measure indicators of and/or the concentration of waterborne pathogens, toxic algae and their toxins, at the same times and sites** as measurements of environmental parameters that determine the survival rates and distributions of waterborne pathogens and toxic algae.
- **Make environmental observations** (e.g., vector winds, temperature, salinity, waves, and currents) **on time and space scales relevant** to the population dynamics of waterborne pathogens and harmful algae by deploying adaptive sensing platforms near HAB hot spots and nutrient sources, combined sewer outfalls, and other point- and non-point contamination sources as appropriate

Assessing Public Health Risks: Coastal Observations for Decision Making: Preliminary Findings

- **Implement national standards and protocols** for measurements, data management and communications, and modeling
- **Specify chemical, physical, and biological data requirements** for predicting the development of HABs and their trajectories
- Develop and validate **coupled physical-pathogen transport** models for nowcasting risks and forecasting changes in risks with known accuracy
- Develop and improve near-shore circulation models that link land-based inputs and near-shore processes with better offshore boundary conditions. **Incorporate pathogen and algal biology into these models.**
- Provide the data and information needed to **quantify relationships** between changes in land use and land-based inputs to coastal waters and changes in public health risks
- Develop methods for **real-time, in situ detection** measurements of microbial indicators or pathogens for more accurate and timely warnings and advisories for closing and opening beaches and shellfish beds

Assessing Public Health Risks: Coastal Observations for Decision Making: Preliminary Findings

- A **new paradigm** of coordination among public health and environmental protection officials, living resource and coastal zone managers, and oceanographers and coastal hydrologists to develop an IOOS that meets their collective needs
- More effective use of the internet and other electronic media to transmit relevant data to public health officials so that they can **issue timely warnings**
- In addition to promoting stronger national stakeholder coordination, **use IOOS Regional Associations** to help identify needs, entrain users, and guide the integration of public health requirements into the IOOS. Increase participation by coastal managers, public health practitioners, and stakeholders responsible for beach and shellfish management in the Regional Associations.
- Include IOOS and other physical scientists in **traditional health communities and meetings**

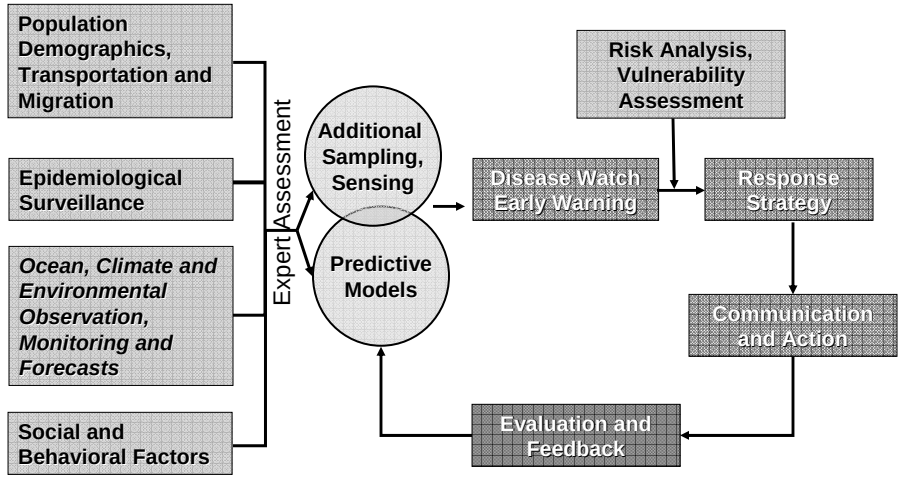
Assessing Public Health Risks: Coastal Observations for Decision Making: Next Steps

- Final Report and Executive Summary in review
- Integrate findings into IOOS implementation plan
- Use findings to direct agency research and funding
- Pilot Projects
- Use findings during development of Interagency Oceans and Human Health Program Implementation plan (JSOST)

Other Interagency Oceans and Human Health Activities

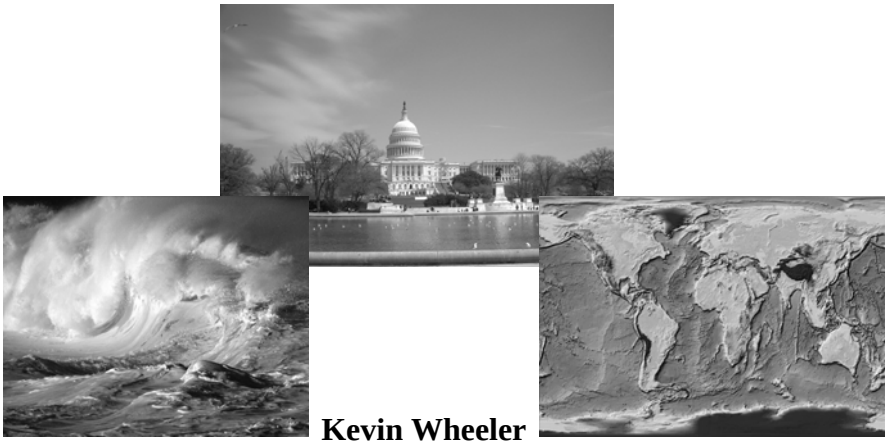
- OHHI All-PI meeting-January 18-20, 2006—Second in planning
- AGU/ASLO/TOS Oceans and Human Health Session
- NSF/NIEHS and NOAA Second Annual Meeting-April 24-25, 2006—Third in planning
- JSOST Interagency Working Group on Harmful Algal Blooms, Hypoxia and Human Health (IWG-4H)
  - Interagency OHH Implementation Plan
  - Annual Report

Components of a Health Early Warning System



Davis, J., Trtanj, J., Dees. W, AMCA Nov. 2004

LEGISLATIVE UPDATE



Kevin Wheeler
Director of External Affairs

June is Ocean Month

4-10 **National Oceans Week**
Presidential Proclamation highlights:
IOOS, Ocean Education, Deep Oceans Research, NOAA, Aquaculture, Marine Mammals, Over-fishing

6-7 **Conference on Ocean Literacy (COOL)**

7 **House Science Markup of NOAA Organic Act**

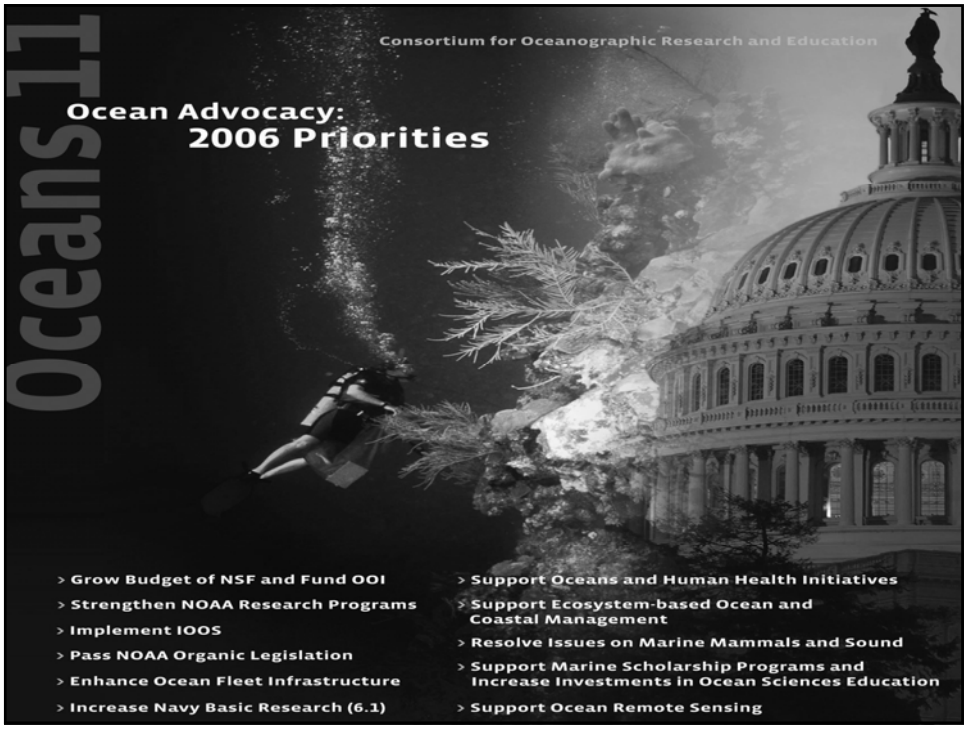
8 **World Oceans Day**

8 **Senate Commerce Hearing on Offshore Aquaculture**

13-14 **Capitol Hill Oceans Week (CHOW)**

13 **JOCI Top Ten List**

14 **Senate Commerce Hearing on State of the Oceans**



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CORE Coalitions

- **Friends of NOAA**

- **IOOS Coalition**

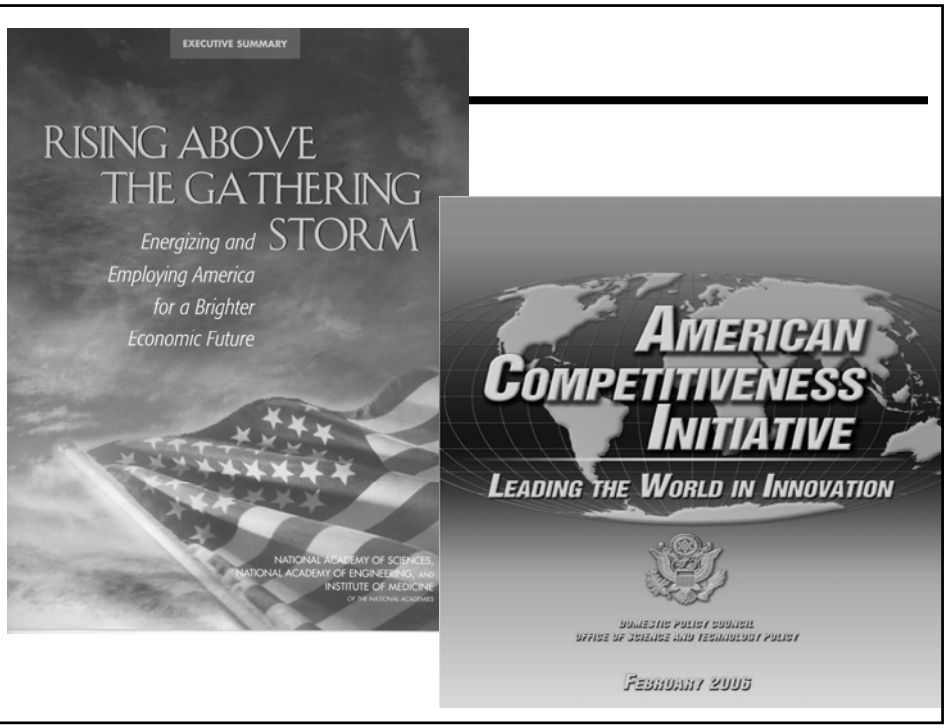
- **Coalition for National Science Foundation Funding**
- **Innovation and Competitiveness Coalition**
- **Coalition for National Security Research**

Status of Ocean Legislation

- **Marine Debris Research Prevention and Reduction Act**
  - Passed Senate
  - Reported out of Resources – Still in Transportation & Infrastructure
- **Tsunami Preparedness Act**
  - Passed Senate
  - Reported out of House Science Committee, Still in Resources
- **National Ocean Exploration Program Act**
  - Passed Senate
  - House Resources Fisheries Sub. Held Hearing, Pending Science Hearing
- **Coral Reef Conservation Act**
  - Passed Senate
  - Referred to House Resources Committee

Status of Ocean Legislation Cont.

- **Ocean and Coastal Observing System Act**
  - Passed Senate
  - Several bills in House referred to Resources Committee
- **Ballast Water Management Act**
  - Placed on Senate Calendar
- **Magnuson-Stevens Reauthorization**
  - Placed on Senate Calendar
  - Competing Bills in Resources (Pombo vs. Gilchrest)
- **Coastal Zone Enhancement Act**
  - Placed on Senate Calendar



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Comparison of Research Funding Provisions in Innovation Initiatives

SENATE PACE ACTS

- **10% Annual increases over 7 years for:**
  - **DoD 6.1**
  - **NSF**
  - **NIST**
  - **DoE Office of Science**

ACI Initiative

- **Doubles budgets over 10 years for:**
  - **NSF**
  - **NIST**
  - **DoE Office of Science**
- **8% increase in DoD research for FY07**

Ocean Research Budget Outlook

Agency	FY2005	FY2006	FY2007 req
NSF	**5,481**	**5,581**	**6,020 (+7.8%)**
Geosciences	697	703	745
MREFC	165	191	240
NOAA	**3,906**	**3,850**	**3,681 (-4.4%)**
OAR	404	370	338
NOS	669	590	394
NASA	**16,070**	**16,623**	**16,792 (+1%)**
Science& Expl	9,335	9,721	10,524
Navy 6.1	**478**	**475**	**456 (-4%)**

FY2007

302-b Allocations (BA in billions)	FY 2006 Enacted	FY 2007 President's Request	Subcom. Allocation	% change from '06 enacted level
Science, State, Justice, & Commerce	**$57.208**	**$59.727**	**$59.836**	**+4.6%**

Appropriation Schedule

- **Subcommittee Markup – week of June 12**
- **Full Committee Markup – week of June 19**
- **Full House Consideration – week of June 26**
- **Senate Consideration – July**

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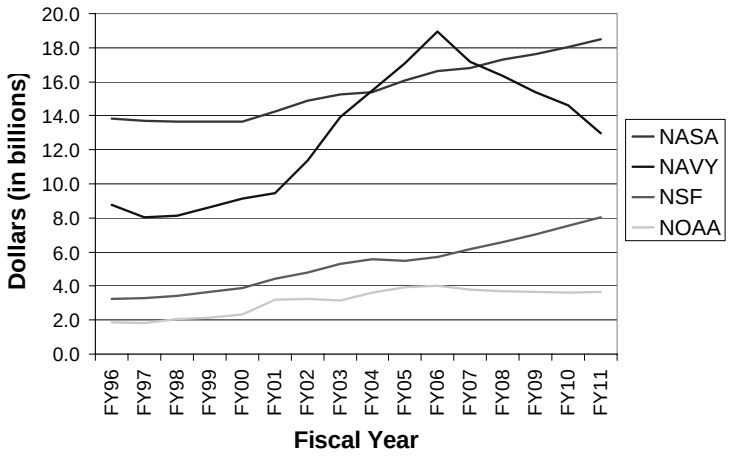
OMB Budget Projections



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The End

USNC Biodiversity Workshop

Approaches for Researching the Roles of Marine and Coastal Biodiversity in Maintaining Ecosystem Services

September 11-13, 2006
Latham Hotel, Washington, DC

Objective:
To improve understanding of marine and coastal biodiversity and the application of this knowledge to support sustainable and adaptive ecosystem-based management of living and nonliving resources.

Workshop Topics

1. How does biodiversity at genetic, species, and community levels contribute to ecosystem function, resilience, or adaptability and what are likely consequences of loss of biodiversity in marine systems?

2. How might increased knowledge of biodiversity at all levels be used to improve management of marine systems over the next decade? That is, what can we conclude, infer, or reasonably anticipate about the functional roles and values of biodiversity, and what do we know, what do we not know, and what do we need to know in order to inform robust ecosystem-based management approaches to marine resources?

3. What pragmatic but revealing metrics of biodiversity and/or ecosystem function should be considered for inclusion in ocean observing and assessment systems o provide continuing information flow for enhanced ecosystem-based management approaches? [e.g. keystone species, proxies, indices, genetic barcode analysis, etc.]

Broader Impacts

- Forging cross-disciplinary, cross-initiative, and cross-agency partnerships to elucidate the role marine biodiversity plays in ecosystem structure and function
- Facilitating the sharing of information among regional, national and international research initiatives addressing the affects of marine biodiversity change on ecosystems
- Identifying priority areas for new research
- Informing monitoring programs and observing systems of effective and pragmatic measures of biodiversity
- Stimulating research opportunities and graduate training
- Stimulating biosensor development and improved data management
- Advancing marine science and approaches to marine ecosystem-based management through lessons from the terrestrial experience
- Helping to identify community-driven research priorities and next-steps related to the JSOST Ocean Research Priorities Plan themes on Improving Ecosystem Health, Sustaining Natural Resources, and Enhancing Human Health

USNC Biodiversity Workshop

Meeting Co-Chairs

Dr. Lewis Incze (Bioscience Research Institute, University of Southern Maine)
Dr. Jo-Ann Leong, Director and Professor, Hawai'i Institute of Marine Biology, University of Hawai'i)
Dr. Paul Sandifer (Senior Scientist, Coastal Ecology, NOAA/NOS)

Additional Steering Committee Members:

Dr. Michael Fogarty (Woods Hole Oceanographic Institute)
Dr. Ben Halpern (University of California, Santa Barbara)
Dr. Steven Palumbi (Hopkins Marine Station, Stanford University)

Sponsored By:

For more information please contact Michael Feldman (mfeldman@coreocean.org)