Building Environmental Intelligence

2013-2014 Global Seminar Series: Panel 2

Case Studies:

Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)
Water Quality Program Director, Upper Mississippi River Basin Association (UMRBA)
Moreton Bay Ecosystem Health Monitoring Plan, Australia
Great Barrier Reef, Australia

January 10, 2014

Event Webpage:
http://www.chesapeakebay.net/calendar/event/21275

Overview:

The Scientific, Technical Assessment, and Reporting Team is hosting a Global Seminar Series to gain insights on unique and innovative approaches to monitoring, including but not limited to: network design, funding, interactions with stakeholders, technology, and analysis techniques. This case studies are monitoring networks from across the United States, Australia, and Ireland. The insights gathered during this Global Seminar Series will inform the next steps of Building Environmental Intelligence, leading the future of water quality monitoring in the Chesapeake Bay. The presenter was asked the following questions:

- What are the objectives of the monitoring network(s) and supporting network design?
- What is the operational model of how the sample collection, lab analysis, and data management are conducted?
- What is the business model of how the network is funded?
- What is the governance structure of the restoration effort and how do they oversee the monitoring program?
- List the three biggest successes and challenges in sustaining the network(s).

Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)

Presenter: Dr. Gerhard Kuska, Executive Director, Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS)

Link to: Presentation

Case Study Location: 9 states of the Mid-Atlantic United States

Case Studies Monitoring Priorities:

- Inform Decision Making
- Provide support for measuring restoration progress
- Fisheries
- Toxics and Emerging Contaminants/ Public Health Risks
- Climate Change
- Improving safety and efficiency of maritime operations
- Using a variety of platforms and leveraging the capabilities and expertise of a variety of partners to work toward an end-to-end system that focuses on societal challenges and opportunities. Doing science but supporter of research & development.
- Inundation driven by tropical storms and northeasters

Challenges in Sustaining Monitoring:

- Connecting with end users / stakeholders and leveraging allied groups' contacts
- Marketing MARACOOS brand / getting necessary coverage in media and the community
- Overcoming misinformation/misperceptions about MARACOOS and IOOS past (i.e. MARACOOS is sometimes viewed incorrectly as a competitor. MARACOOS seeks funding for the partners; and views everyone in the Mid-Atlantic, who carries out observing/modeling efforts, as a partner).

Innovative Operations of Monitoring Networks/ Technology:

- User-driven system and approach, three subsystems
    - Observing Systems
    - Data Management and Communication
    - Modeling and Analysis Systems
    - Monitoring Program Core Elements: Acidity, Bathymetry, Bottom Character, Colored Dissolved Organic Matter, Contaminants, Dissolved Nutrients, Dissolved Oxygen, Fish Abundance, Fish Species, Heat Flux, Ice Distribution, Ocean Color, Optical Properties, Partial Pressure of CO2, Pathogens, Phytoplankton Species, Salinity, Sea Level, Stream Flow, Surface Currents, Surface Waves, Temperature, Total Suspended Matter, Wind Speed and Direction, Zooplankton Abundance, and Zooplankton Species.

- The traditional Research to Operations (or Application) construct is a two-way street:
    - Research provides information and tools to the operations side, often times providing meaningful products that operations had yet to conceive
    - Operations provide feedback to help drive the research and product development more effectively to address their needs.

        - Found a need to build a more formal approach to providing feedback from the operations side (in this case, from our users and stakeholders) to the research community. MARACOOS has found success with holding stakeholder workshops.

- Continuous Monitoring Technology
    - Weather Tracking
    - High Frequency Radar, CODAR Ocean Sensors, Underwater Gliders, 41 radars from cape to cape including:
        - Long range (lower resolution) 5 MHZ – Search And Rescue Optimal Planning System *SAROPS*
        - Medium range (medium resolution) 13 MHZ – oil/pollution tracking
        - Short range (higher resolution) 25 MHZ – PORTS and near coastal/estuaries

- Ecological Decision Support – Fisheries
    - Develop statistical models using bottom trawl surveys and MARACOOS 3-D data to predict species distribution based on observed or forecasted MARACOOS 3-D fields.

- Chesapeake Inundation Prediction System (CIPS) Partners
    - When thinking about coastal inundation, MARACOOS has recognized the growing need to help communities deal with short term events, like storms and flooding, as well as longer term events, such as sea-level rise. Hurricane impacts. MARACOOS believes in the need to go from the traditional forecast to providing a forecast of the impact through a user-friendly interface.
        - A good example of collaboration within the Chesapeake.
        - MARACOOS has begun discussions with NOAA's National Centers for Environmental Prediction (NCEP), which is a part of the National Weather Service, to collaborate on an end-to-end system, from data collection to end user services that will further bring together the water side with the weather and climate pieces.

Innovative Business Models and Leveraging Resources:

- **User Defined Regional Themes** enhance collaboration across the regions, while maintaining the unique focus that is required by the users in individual regions. So while **funding may come from a particular source for a particular theme, those data can be available to other themes and end user needs**. By leveraging observing data for other purposes, MARACOOS is able to multiply the bang for the buck. Every dollar NOAA provides to MARACOOS partners is matched with funding support from other

sources that benefits the observing system and its capabilities. They believe to have roughly a **7-to-1 annual return on investment**, because of the leveraging that MARACOOS is doing in the following themes:

- Maritime Safety
- Ecological Decision Support
- Water Quality
  - **Example:** Support was provided by MARACOOS to NYC and NJ officials following a massive release of raw sewage into the Hudson River during the peak summer tourist season. MARACOOS partners advised officials on where sewage was likely flowing so that they could make decisions on closing beaches, issuing seafood warnings and water activity advisories, to protect public health, as well as directing tourists and other beachgoers to beaches with no impact from the spill.
- Coastal Inundation
- Offshore Energy
  - **Example:** the East Coast regional associations (NERACOOS, SECOORA, and MARACOOS) are working together to develop a single product group for offshore wind energy, that will benefit from the expertise across the entire eastern seaboard.

- Leverage funding through other federal and non-governmental sources
- NSF Grants, Coordinate joint grant proposals. Draw in new partners to strengthen proposals
- Annual Membership Fees of $500, currently about 70 members
- Data and products are available to all (public) without cost
- Consideration is being given to monetizing the added value products (not the data itself) MARACOOS itself may not be the appropriate entity to 'sell' products

Engaging the Public/ Citizen Science/ Non-traditional Partners:

- MyMARACOOS Fishing Website/Mobile App
  - Extensive outreach activities
  - Customized to meet user needs

How the Monitoring is incorporated into the Governance Structure:

- To balance Operations/Applications with the established Research infrastructure, MARACOOS is developing a User/Stakeholder infrastructure that will oversee and drive product development and refinement. Regional associations are best positioned to serve as the bridge between the research communities (including the federal agencies) and the

stakeholder / operational user community, in order to identify and translate needs that lead toward the development and successful transition of meaningful information products for the user communities.

- Including: A **User Council** comprised of members of the end user / stakeholder community, to serve as the high level link to the user community.
- **Product Groups** also comprised of end users, but also of MARACOOS scientists/developers, which will have more of a thematic and product development focus.
    - There is a critical role for the private sector within Product Groups for their role in product development. MARACOOS believes success is driven by the extent to which the private sector is involved in the creation of products that society needs and is willing to pay for.
- To support the **User Council** and **Product Groups**, MARACOOS has a support structure in place through the **Stakeholder Liaison Service**.
    - The **Stakeholder Liaison Service** (One person traveling 29 cities in 12 months) will focus geographically and thematically. The Liaison will form the bridge between the user communities and MARACOOS scientists and partners.

Water Quality Program Director, Upper Mississippi River Basin Association (UMRBA)

Presenters: Dave Hokanson, Water Quality Program Director, Upper Mississippi River Basin Association (UMRBA)

Links to: Presentation

Case Study Location: Upper Mississippi River Basin, USA

Case Studies Monitoring Priorities:

- Inform decision making and reporting for Clean Water Act
- Aquatic life/ecosystem support
- Support for recreation
- Use for drinking water supply
- Nutrient and sediment loading & impacts
- Links to Gulf Hypoxia
- Recently: there is an emphasis on building a robust data set for the detection of change

Monitoring Program Design:

- Four major designated uses – aquatic life, drinking water, recreation, fish consumption

- Operational staff include 4 permanent staff and 3 project specific staff. State dues and grants/contracts support monitoring activities.
- Selected a UMR-wide probabilistic design:
    - 15 randomly distributed samples in flowing channels (main & side channels) in each of the 13 UMR assessment reaches
    - Includes chemical, physical, fish tissue, biological assemblage, indicator bacteria sampling
    - For assessing aquatic life, fish consumption, & recreation use support
    - Supplemented by fixed stations, targeted sites, and follow-up monitoring:
        - Fixed Stations: For aquatic life, recreation, and drinking water assessments (use existing fixed stations)
        - Targeted Sites: For drinking water (intakes) and recreation use (urban areas) assessments
        - Follow-Up Sampling: As needed for aquatic life and fish consumption uses

    - Additionally, 45 tributary loading network sites. Parameters: field (DO, temp, pH, turbidity, conductivity, Secchi), nutrients (TN, TP, NHx, nitrate/nitrite, dissolved P, chl-a), TSS, TOC, discharge

Challenges in Sustaining Monitoring throughout our Case Studies:

- Funding

Innovative Operations of Monitoring Networks/ Technology:

- Annual monitoring workplans.
- Headed towards a more distributed sample collection model, where many different partners are collecting data (similar to the Chesapeake Bay Program Partnership).
- UMRBC performed a data gap analysis, results available in the presentation slides.
- Data management will most likely be the main function for UMRBC coordination. This is a necessary step for the integration of new, diverse sampling partners.

Innovative Business Models and Leveraging Resources:

- States' self-imposed water quality "assessment" of $17K each ($85K total); plus small portion of states' dues. This is a newly established funding mechanism. UMRBC is currently exploring more funding opportunities.

How the Monitoring is incorporated into the Governance Structure:

- Board provides consideration of recommended monitoring plan/policy resolution.

Moreton Bay Ecosystem Health Monitoring Plan, Australia and Great Barrier Reef, Australia

Presenter: Dr. Simon Costanzo, Moreton Bay Ecosystem Health Monitoring Plan, Australia

Links to: Presentation

Case Study Location: Moreton Bay and Great Barrier Reef, Australia

Case Studies Monitoring Priorities:

- Advise councils and land managers on areas of declining health
- Report on the effects of different land uses
- Evaluate the effectiveness of management actions aimed at improving and protecting aquatic ecosystems
- Communicating how science underpins action

Monitoring Program Design:

Moreton Bay

- Monitoring in freshwater and marine waters, networks operate separately.
- Two teams collect information and preform analysis. The teams are comprised of state government representatives and academics. All monitoring is overseen by a scientific expert panel.
- Freshwater Network:
    - Water Quality (biannually) at 135 sites
    - Nutrient Cycling (biannually) at 135 sites
    - Ecosystem Processes (biannually) at 135 sites
    - Aquatic macroinvertebrates (biannually) at 135 sites
    - Fish (biannually) at 135 sites

- Marine Network:
    - Water Quality (Monthly): 18 estuaries (160 sites), 9 bay regions (94 sites), which equals 13,020 observation points
    - Seagrass Depth Range (biannually) at 15 sites
    - Seagrass Distribution (every 3 years), Bay-wide
    - Nutrient Mixing Plots (biannually)
    - Coral Cover (annually) at 4 sites
    - N mapping (annually) at 253 sites
    - Riparian Assessment (annually) for 740 km

- Novel targeting techniques are used for the monitoring of two major plumes discharged from sewage treatment plants and informing decision makers on the impacts of sewage treatment plant upgrades.
- Mapping seagrass
- Use spatial statistics to evaluate sampling strategy

Great Barrier Reef

- Funded through a Joint commitment of the Australian and Queensland Governments (federal and state)
- Primary focus is diffuse source pollution from broadscale land use (i.e sugar cane crops).
- Pollution cannot be directly attributed to one point of dispersal, such as a pipe or waste outlet.
- As is the Moreton Bay Healthy Waterways Program, monitoring for the Great Barrier Reef is designed for a pressure, state, response framework.

Challenges in Sustaining Monitoring:

- "Report Card Fatigue," the environment does not react o management actions as quickly as report cards are released and therefore the community is getting tired of same monitoring results.
- It is difficult to communicate that it is a success that with increasing population pressures the Bay is maintaining a B grade, which is a success within itself.

Innovative Operations of Monitoring Networks/ Technology:

- Pressure, State, Response framework

Innovative Business Models and Leveraging Resources:

- Moreton Bay has found a sustainable funding model which includes approaches such as:
    - User pays system because prior to the development of this network, data wasn't being pooled anywhere specific.
    - Industries such as utilities, paper, and sugar cane farms were spending money on monitoring based on license conditions and requirements, now resources are being pooled by the Healthy Waterways monitoring the program to perform all the monitoring using a cohesive network.
    - Municipalities charged on a per capita basis
    - Industry charged on per ton N basis as an incentive program
    - In-kind government support
    - Fees and participation written into discharge license conditions

How the Monitoring is incorporated into the Governance Structure:

- Municipalities and State Government responsible for restoration
- The Healthy Waterways Office delivers four key programmatic elements:
    - Science and Innovation
    - Ecosystem Health Monitoring Program
    - Water by Design
    - Communication, Education and Motivation Program