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FUTURE DIRECTIONS: ENHANCING AND SUSTAINING A MARINE WATER QUALITY MONITORING NETWORK

This chapter presents information about making a marine monitoring program sustainable in the long run, with an emphasis on the experience and explorations of the MYSound project in this area. Section 7.1 places the issue of sustainability for a specific program in the context of international, national, and local initiatives. Section 7.2 describes actions that MYSound is taking to enhance and expand its network, with an emphasis on the concept of “distributed stewardship.” Section 7.3 focuses on future opportunities and initiatives that MYSound and other monitoring programs can consider to sustain this work into the future.

7.1 CHALLENGES AND OPPORTUNITIES FOR THE MYSOUND PROJECT

Establishing the MYSound network is a significant accomplishment, but maintaining and expanding it over time will be even more challenging. Sustainability is important for several reasons. First, implementing a regional, ecosystem-wide real-time monitoring network contributes to the national strategy and approach, described below, of providing longer term, multi-parameter environmental monitoring data. Second, the development of MYSound and other such monitoring programs represents a significant up-front investment of money and effort. This investment includes not only equipment, which is readily replaceable, but also expertise, experience, cooperation, and project visibility and momentum, which are not easily rebuilt. Finally, if the monitoring network becomes inactive due to lack of funding, a continuity gap in the data would occur, limiting the value of the data obtained before and after this monitoring gap.

EPA’s EMPACT program provided the primary funding to initiate the MYSound project. This program-specific funding, while substantial, had a finite lifetime as EPA moves on to address other problems and issues. This is typical of most federally funded monitoring efforts (except for compliance monitoring, where the costs are borne largely by the municipalities and companies being monitored). The challenge in sustaining the MYSound effort is to develop a more diverse funding base by integrating the MYSound monitoring effort with other initiatives, and expanding the range of data and information disseminated to serve a wider group of users. It is hoped that these users can support the operation and maintenance of the network through direct funding and in-kind logistics support. Partnerships and leveraging of resources will be the key to success.

Coincidentally, a number of international and national initiatives are calling for partnerships in establishing and maintaining coastal marine monitoring networks like the MYSound network. On the international level, the world oceanographic community is moving steadily forward in implementing the concept of the Global Ocean Observing System (GOOS). GOOS is a global ocean monitoring network that acquires and disseminates data in near real time to support:

- Weather forecasts and climate predictions.
- Now-casting (providing information on current conditions) and forecasting for safe marine operations, mitigation of natural hazards, and national security.
- The detection and prediction of effects of human activities and climate change on marine ecosystems and living resources.

The system will assimilate data from in situ sensors mounted on a wide range of platforms (towed instrument packages, fixed moorings, drifters, autonomous underwater vehicles [AUVs] and remotely operated vehicles [ROVs]) and from aircraft and satellite remote sensors that transmit data in real time. Advanced data assimilation and modeling techniques will be used to analyze and synthesize the data into decision-making tools to support marine operations, environmental management, and basic research. It is envisioned that the coastal components of GOOS (C-GOOS) will be similar to MYSound in function and configuration. GOOS hopes to build on existing programs, including MYSound, to develop the global system.

On a national scale, enhanced long-term coastal monitoring efforts are called for in the Coastal Research and Monitoring Strategy developed under the Clean Water Action Plan (CWAP). In implementing this monitoring scheme the CWAP Coastal Strategy calls for expansion and enhancement of monitoring efforts by:

- Coordinating coastal monitoring and research activities to provide useful information on which to base coastal management decisions.
- Expanding federal coastal programs to focus on urgent issues (e.g. harmful algal blooms, shellfish mortality, habitat restoration).
- Building and expanding partnerships among federal, state, tribal, local, and business stakeholders to achieve clean water and public health goals in the coastal zone.

It should be noted that the Clean Water Action Plan stresses the importance of adopting a watershed approach in setting priorities and taking action to clean up rivers, lakes, and coastal waters. The plan also calls for collaborative effort on the part of government, industry and the public at large in sustaining water quality.

In addition to international and national programs, local monitoring efforts are expanding rapidly under the auspices of municipalities, colleges and universities, and volunteer water quality monitoring efforts sponsored by regional and local environmental NGOs. These efforts provide additional data on site-specific environmental trends and can be integrated into federal data sets if appropriate QA/QC protocols are followed. In addition, these local efforts represent a powerful constituency for the broader-scale federal and state monitoring programs.

Crucial to achieving long-term sustainability within the MYSound project will be achieving consistency with the longer term goals, objectives, and strategies of GOOS and the Clean Water Action Plan, and integrating with other marine environmental monitoring efforts on a national, regional, watershed, and local basis.

7.2 CURRENT ACTIONS TO EXPAND AND ENHANCE THE MYSOUND NETWORK

In 2001 and 2002, the MYSound project investigated the addition of several additional stations to the inshore portion of the MYSound network under the “distributed stewardship” concept. Under this concept, members of the MYSound project team at the University of Connecticut (UConn) will hand off the day-to-day maintenance of the inshore stations to the local partners (or in some cases a coalition of partners), while still maintaining the MYSound Web site and the offshore (mid-Sound) stations. The consensus of the MYSound partners was that they were amenable to the concept if funding were available to provide the basic inshore station equipment (buoy [if needed]), sensors, data processor, telemetry package, modem, etc.) as currently in place in Hempstead Harbor, Bridgeport Harbor, and the Thames River.

The MYSound team prepared several proposals outlining this concept and submitted them to the Long Island Sound Study Management Committee and the EMPACT program for consideration in 2001. In the fall of 2001 the project was able to acquire funding under the EMPACT Integration/Networking program.

In addition, the project was able to acquire some additional funding under the Long Island Sound Study to support the Web site and maintain the current offshore stations. This meant that while the future of MYSound had been uncertain in June 2001, the network now could be maintained and even expanded under the “distributed stewardship” concept in 2002 and 2003, as described in more detail in Section 7.2.2.

7.2.1 ENHANCEMENT OF THE OFFSHORE NETWORK TO SUPPORT ENVIRONMENTAL MANAGEMENT AND MARITIME OPERATIONS PLANNING

By the end of 2002, MYSound will have three oceanographic and two meteorological stations operational along the axis of the Sound with data displayed on the MYSound Web site. The oceanographic monitoring stations will be operating at the eastern Corps of Engineers dredged material disposal site off New London, at the midpoint of the Sound near New Haven (Central LIS station), and in the western Sound near Greenwich. Oceanographic parameters measured will be temperature, salinity, dissolved oxygen, and current speed and direction. A chlorophyll *a* and nutrient sensor may be added to one or more stations. The meteorological stations will be established on a Central Offshore LIS station in the vicinity of New Haven and in the Eastern Sound at New London Ledge Light. Meteorological parameters will include air temperature, humidity, barometric pressure, and wind speed and direction. At the Central LIS station, wave height will be measured as well. The temperature, salinity, dissolved oxygen, and nutrient data will be useful in interpreting long-term changes and trends in the Sound’s water quality through correlation with Sound-wide water quality surveys conducted by EPA, Connecticut DEP, and New York DEC under the Long Island Sound Study.

7.2.2 EXPANSION OF THE INSHORE NETWORK AND INTEGRATION WITH WATERSHED, RIVER, AND HARBOR MONITORING EFFORTS

To increase outside involvement and expand the number of stations that can be supported, the project has developed and is testing the concept of “distributed stewardship” of the inshore stations. The MYSound project team will assemble and deploy the station, or facilitate the assembly and deployment of the station by a local agency or organization, but then that agency or organization (or a coalition of several agencies/organizations) will operate and maintain the station. The local entity will also be responsible for water quality sampling, possibly through a local municipal or volunteer water quality sampling program (such as those sponsored by Save the Sound, Inc.). The data telemetry links will be installed and maintained by the MYSound project team so that the data can be made available in real time on the MYSound Web site. The project team would also provide technical consultation and data interpretation support. The incorporation of the Hempstead Harbor station into the network was MYSound’s first attempt at distributed stewardship of a monitoring station and proved successful.

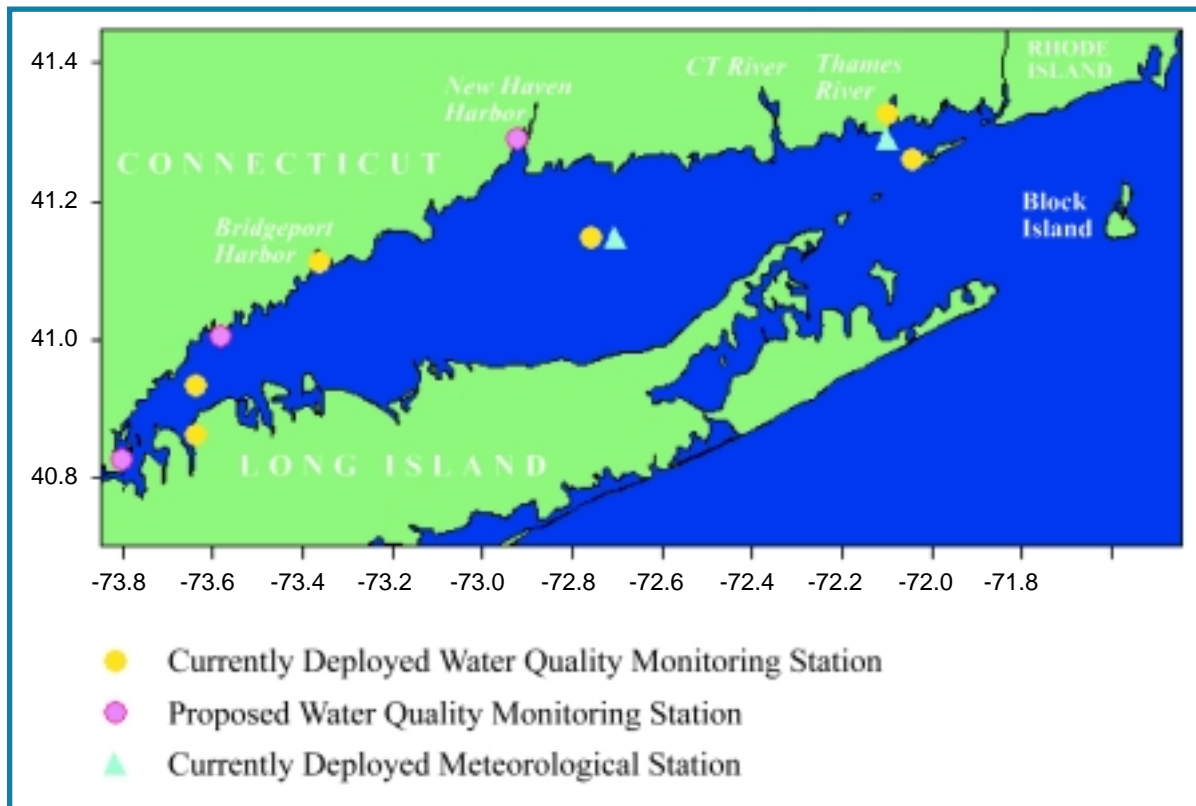
By the end of 2002, five “distributed stewardship” monitoring stations will be up and running along the Connecticut shoreline and on the coast of Long Island:

- New London Harbor (Thames River), already deployed.
- Bridgeport Harbor, already deployed.
- Hempstead Harbor, already deployed but currently offline due to a collision by a barge.
- Norwalk Harbor (Norwalk River), scheduled for deployment in fall 2002.
- New Haven Harbor, scheduled for deployment in spring 2003.

Having additional inshore stations in the various rivers, estuaries, and harbors throughout the Sound will provide valuable information on overall water quality status and trends, but also provide information on local water quality useful to municipalities, researchers, and NGOs on a site-specific basis. In the future, it would also be useful to establish monitoring stations further upstream in the major watersheds monitored within the MYSound project to document the watershed contributions to pollutants in the Sound.

Figure 7.1 shows the comprehensive array of water quality, oceanographic and meteorological monitoring stations throughout the Sound anticipated by the end of December 2002. Having these stations in place will set the stage for longer term development of the network as described in Section 7.3.

FIGURE 7.1 MAP SHOWING THE LOCATION OF MYSOUND MONITORING STATIONS ANTICIPATED BY DECEMBER 2002



7.3 LONGER TERM OPPORTUNITIES TO EXPAND AND ENHANCE THE MYSOUND NETWORK

MYSound is actively pursuing several opportunities to collaborate with other organizations and agencies to expand and enhance the monitoring network. One such opportunity involves the NOAA Physical Oceanographic Real-Time System (PORTS) project (http://co-ops.nos.noaa.gov/d_ports.html). The wind and water quality data acquired at the MYSound meteorological and oceanographic stations are of direct value to the maritime transportation industry, fishing vessels, and recreational boaters. In this regard, the MYSound offshore stations are similar in function to the stations deployed through PORTS, which also gather and disseminate, in real time, current, wind, and tide data in a number of port areas around the country. NOAA has established a PORTS Station in New Haven, which measures wind speed and direction and tide level. An excellent opportunity for integrating the MYSound and PORTS projects lies in cross-linking all of the MYSound offshore monitoring stations with the NOAA PORTS Web site to form a combined data source for Long Island Sound. It would also be desirable to establish wave sensors at the

offshore MYSound sites to be available for commercial vessels, fishing boats, and recreational boaters. (A wave sensor and meteorological sensors are being added to the sensor array for the Central LIS Offshore station near New Haven; they may eventually be added to other stations if funding becomes available.) Access to these data could be obtained through the MYSound Web site, the NOAA PORTS site, or a dial-up telephone number.

MYSound is investigating collaboration with NOAA in expanding and supporting the offshore network. Such collaboration has already been initiated, in that NOAA provided the buoy hull for the Central Offshore LIS station. The meteorological and oceanographic data from the Central Offshore LIS buoy will be shared with NOAA. MYSound also has collaborated with NOAA in developing funding proposals for the MYSound project's offshore component.

The offshore oceanographic and meteorological data could also be used in hydrodynamic models to produce now-casts and forecasts of the current regime in the Sound for planning maritime transportation and predicting the transport of pollutants in the Sound. Several models are available (at UConn and elsewhere) that could be adapted to this application. Current vector maps could be provided over the Internet on the MYSound home page and could be downloaded by environmental managers and maritime users.

Satellite and aircraft remote sensing images of Long Island Sound are an additional data source that could be integrated with the MYSound real-time monitoring data. Remote sensing imagery can often help in explaining the scope and causes of phenomena that are detected in the real-time time series. They also facilitate visualization of circulation patterns and water property changes in the Sound on a seasonal basis.

If the "distributed stewardship" concept proves viable in the long term, it is likely that other local governments, educational institutions, and NGOs will seek to establish monitoring stations in their own estuaries, rivers, and harbors. Other collaborative inshore station and upstream watershed monitoring station possibilities include:

- A station in the Housatonic River Estuary at Milford Point in collaboration with the Connecticut Coastal Audubon Center and the Housatonic Valley Association.
- An upstream station in the Housatonic River Watershed in collaboration with Connecticut DEP, U.S. Geological Survey (USGS), and the Housatonic Valley Association.
- Two stations in the Connecticut River (an estuary station near Essex and an upstream station just below Hartford) in collaboration with the Connecticut River Museum, Connecticut DEP, and USGS.
- A station in the upper Thames River at Norwich in collaboration with Connecticut DEP, USGS, and the Thames River Basin Partnership.
- A station in the Pawcatuck River estuary in collaboration with the Connecticut DEP and Pawcatuck Watershed Partnership.
- Additional stations along the north coast of Long Island in collaboration with New York DEC, State University of New York (SUNY), municipalities, and local New York environmental NGOs.

The initial monitoring station deployments under MYSound focused on establishing static stations that would record environmental parameters at a specific location over a long period of time (one or more years). However, there are times when intensive real-time sampling may be required to provide supporting data for a specific research project or investigate the cause of a specific environmental problem (e.g. a Harmful Algal Bloom [HAB] or lobster die-off as experienced in LIS over the past year). To support this application, it would be ideal to have one or more monitoring stations that could be equipped with a tailored suite of sensors and rapidly deployed to provide the required data. An automated water sampling system could be included in the station for QA/QC. These "roving stations" could be deployed on several days' notice and remain on scene for

a period of several days to several months. Because of their changing location, they would have to be operated and maintained by UConn. MYSound is exploring this option with EPA, Connecticut DEP, New York DEC, and university researchers interested in conducting studies around the Sound.

An important aspect of the MYSound project is providing a venue and test platforms for new water quality sensors and monitoring systems. As the system matures, MYSound will actively seek opportunities for the stations to serve as a sensor test-bed. MYSound will pursue this in collaboration with EPA and the Office of Naval Research (ONR), their research laboratories, and EPA's Environmental Technology Verification (ETV) Program, a government-industry consortium designed to test and verify the performance of new water monitoring technologies. A program will be investigated whereby prototype sensors would be solicited for testing. These sensors would be screened and pre-tested by EPA, ONR, and the ETV consortium as appropriate. Sensors and systems deemed to be applicable to coastal monitoring, and judged to be fully operational, would be tested in the field on MYSound stations. Federal funding will be sought to cover the cost of testing so that there is added incentive for sensor development companies to participate in the program.

Another important component of the MYSound project from its outset has been education and public outreach. MYSound will seek to expand this component by linking its efforts with those of other academic institutions and public outreach organizations. The project will work with the Bridgeport Regional Vocational Aquaculture School, the Sound School, and Project Oceanology to expand and refine the educational material available on the MYSound Web site. The project will also investigate the possibility of establishing a Long Island Sound topics lecture series that could be accessed through the Web site, as well as developing hands-on tutorials and exercises that use MYSound's real-time data to explain and demonstrate oceanographic and meteorological concepts.

MYSound also plans to intensify its efforts to network with other coastal marine environmental monitoring efforts in the Northeast and around the country and tie into the rapidly forming C-GOOS initiative. MYSound anticipates developing a proposal for an expanded MYSound network under the National Ocean Partnership Program or other major federal coastal monitoring programs. This effort will serve as a prototype for a large estuarine GOOS coastal monitoring component. MYSound plans to formulate this proposal as a joint effort with NOAA and EPA, Connecticut DEP and New York DEC, SUNY at Stonybrook, and several environmental NGOs around the Sound. Ultimately, the goal is to implement a comprehensive Long Island Sound Estuarine Observing System similar to the system established in Chesapeake Bay, and currently under development in the Gulf of Maine.

Finally, MYSound recognizes that to sustain and enhance the project, marketing and proposal writing are as important as equipment maintenance, data dissemination, and QA/QC. MYSound approaches project outreach and development as focused and continuous efforts, not just collateral activities undertaken at the end of each fiscal year. Communications and outreach material are kept up to date and disseminated to potential funding organizations. Pre-proposals and white papers on the project are prepared in advance so that they can be quickly modified and submitted as a proposal if a funding opportunity is identified.

Sustaining a Marine Water Quality Monitoring Network: Key Points and Lessons Learned

- Sustainability is often a critical issue with regional or local marine environmental monitoring programs, since most programs are initiated with federal funding that provides support for one to five years. After that, the programs must become self-sustaining on a regional or local basis.
- The challenge in sustaining the MYSound effort is to develop a stable, ongoing source (or sources) of funding and in-kind support. To this end, MYSound is working to craft a strategic plan which it can promulgate to other agencies and organizations that may be interested in and capable of providing support; facilitate the development of partnerships to strengthen the project; and coordinate the development of a Sustainability Master Plan and specific proposals to obtain future support.
- Partnering with other agencies, institutions, and private organizations is the key to success. Partnering brings in fresh ideas and perspectives to the project, increases access to potential funding, and often provides in-kind support that can drastically reduce the need for direct annual funding. Potential MYSound partnerships that can broaden and strengthen the project include tying offshore stations to NOAA PORTS and expanding monitoring into watersheds in collaboration with upstream stakeholders. MYSound has found partnership opportunities through such activities as attending workshops and conferences and becoming involved in the programs of potential partners.
- Distributed stewardship provides the most promising approach in sustaining the local inshore and harbor stations. Through this approach, the MYSound project team at UConn will hand off the day-to-day maintenance of the inshore stations to the local partners (or in some cases a coalition of partners), while UConn maintains the MYSound Web site and the offshore (mid-Sound) stations. In addition, partners will seek their own maintenance funding from local stakeholders.
- The key to acquiring funding is maintaining a constant awareness of funding opportunities that may become available. This requires constant networking with potential funding agencies and organizations and being persistent in following up on funding leads. Rather than trying to fund the project under one large grant, it is often more feasible and expedient to define the project in several components and seek funding for each separately. This may require modifying the focus of the project somewhat, but this will not detract from the project as long as the overall goals are being met.
- Marketing and proposal writing are as important as equipment maintenance, data dissemination, and QA/QC. Project outreach and development must be focused and continuous, and not just collateral activities undertaken at the end of each fiscal year. Communications and outreach material must be kept up to date and disseminated to potential funding organizations. Pre-proposals and white papers on the project should be prepared in advance so that they can be quickly modified and submitted as a proposal if a funding opportunity is identified.