NOAA Great Lakes Environmental Research Laboratory
2012 Strategic Plan

Appendix B: Responses to 2010 External Lab Review Recommendations

GLERL Responses to 2010 Lab Review Recommendations

A review of the National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory (NOAA-GLERL) was conducted on 16-18 November, 2010 in Ann Arbor, Michigan. Review panel members included:

- Captain Bob Houtman, National Science Foundation, Chair
- Dr. Robert Beardsley, Woods Hole Oceanographic Institution
- Dr. G. Ross Heath, University of Washington
- Dr. Thomas Johnson, University of Minnesota, Duluth
- Dr. David Lodge, University of Notre Dame
- Dr. Shirley Pomponi, Harbor Branch Oceanographic Institution, Florida Atlantic University
- Dr. Steven Ramberg, Pennsylvania State University, Applied Research Laboratory

Following the review, the panel submitted a report outlining 15 recommendations for improving research and operations at GLERL. In general, reviewers recognized the highly skilled and talented workforce at the laboratory and its dedication to the GLERL mission. The review panel noted that GLERL is poised to serve as a leader in major advancements in NOAA mission-critical areas, but recognized that staffing and funding levels currently constrain the possibilities of GLERL research.

The laboratory's 2012 Strategic Plan was developed in response to a recommendation by the review panel to develop "a cohesive strategic plan for the entire lab so the vision and future goals become clear and appropriate metrics can be developed to determine progress and inform management decisions." Other Panel recommendations are addressed throughout the strategic plan. This document includes responses to each recommendation and is intended to serve as an appendix to the strategic plan.

1. **Develop bold, integrated, strategic plans with 1, 5, and 10 year milestones for individual research areas and GLERL as a whole**

   The 2012 Strategic Plan outline the bold new vision for the laboratory. Short-term milestones and long-term goals are included in the plan and in the logic models in Appendix C.

2. **Address staff issues through targeted additions in mission critical areas**

   GLERL recognizes the need for targeted staff additions to carry out its new mission and vision. The Implementation Strategy (Section 3) of the 2012 Strategic Plan lists priority additions in mission-critical areas that will help meet specific science objectives.

3. **Increase collaboration with the Cooperative Institute for Limnology and Ecosystems Research (CILER), U.S. Geological Survey (USGS), and industry (through the Small Business Innovation Research program) to maximize funding and fiscal efficiency**

   Laboratory managers and senior scientists actively participated in development of the new CILER strategic plan in 2011, and serve as key members of the CILER Executive Board, Management Council, and the new CILER Council of Fellows. GLERL has supported the CILER director in strengthening the involvement of institutions beyond the University of Michigan in CILER, and facilitated a face-to-face meeting in the summer of 2011 between CILER and University of Michigan administrators and the NOAA Administrator, Dr. Jane Lubchenco, that resulted in commitments that significantly strengthen the

NOAA-CILER partnership. Collaboration with CILER is vital to many GLERL science priorities; for example, GLERL's nutrient measurement and cycling needs are efficiently handled by a CILER colleague.

GLERL built on our relationship with USGS in several ways in 2011, including informal meetings and exchange of information between GLERL and USGS laboratory and regional managers in Ann Arbor, as well as with other USGS representatives from groups including the Coastal and Marine Geology Program laboratory in Massachusetts. GLERL scientists strengthened or developed new collaborations with USGS scientists, including a Coordinated Science and Monitoring Initiative (CSMI) in Lake Huron that began in April 2012, and ongoing work with the USGS Center for Integrated Data Analysis in Wisconsin.

GLERL interaction with the private sector has included close work with LimnoTech on the Great Lakes Observing System (GLOS) Design Report, released in June 2011, and additional GLOS-related work since then. GLERL management initiated collaboration with faculty from the University of Michigan's Ross School of Business that will lead to an economic impact analysis of the laboratory and its research, planned as an M.S. project to begin in 2012. Cooperative partnerships continue to develop with Nortek, Fondriest Environmental, and SeaLandAire that have helped advance real-time observation technology in the Great Lakes region and at GLERL. GLERL's work to convert vessels to biofuel has expanded to over 500 vessels, including a national feasibility study in 2011 by the U.S. Army Corps of Engineer s that included GLERL participation.

The laboratory will continue to build on its strong partnerships as a strategic and essential way of leveraging its base support and accomplishing its mission in the Great Lakes and beyond.

4. Upgrade laboratory equipment and computing resources

Excellent progress has been made since the review. To improve capabilities and efficiency, GLERL purchased the following equipment:

- A top-of-the line Leica inverted microscope and image analysis system with capabilities for fluorescent, phase, brightfield, and DIC optics. This microscope will advance our phytoplankton work, particularly with harmful algal bloom cyanobacteria such as Microcystis
- A digitally imaging flow cytometer (FlowCam) for automatically counting and measuring phytoplankton and other seston in the 3 μm to 1 mm range
- A new nutrient autoanalyzer system, which will increase sample output by a factor of three compared to the old system
- A refrigerated centrifuge that can spin down liter quantities of algae and seston

A process was developed to prioritize capital equipment purchases, and priorities for the next several fiscal years have been selected by branch chiefs. Computing resources will be upgraded to support the modeling and forecasting objectives of GLERL through the Integrated Physical and Ecological Modeling and Forecasting branch.

5. Strategically expand observation and research to other Great Lakes as they fit into mission goals

Long-term goals of the Observing Systems and Advanced Technology branch include year-round, under-ice observations on all five Great Lakes. The Ecosystem Dynamics branch is leveraging the externally-

funded Lake Huron CSMI program, as well as base funds, to establish a seasonal long-term research program on Lake Huron much like our program on Lake Michigan. Lake Huron is the least studied of all the Great Lakes and faces many of the same stressors as Lake Michigan and the other lakes.

6. **Develop observing systems for year round and extreme environment application**

   Long-term goals of the Observing Systems and Advanced Technology branch include year-round, under-ice observations on all five Great Lakes. See the milestones in the 2012 Strategic Plan Science Strategy for more details.

7. **Develop detailed design/construction/maintenance plans for current systems and for future expansion plans**

   Existing design/build documentation will be augmented with operations and maintenance procedures with technology transition in mind.

8. **Plan for publication in Science or Nature every few years to boost disserved recognition**

   As the laboratory hires new staff (both principal investigator and technical) and refreshes its laboratory and research equipment, this goal will become a reality. Papers on modeling and forecasting are currently being targeted for these high-profile publications. Observing systems research and development is currently underway with these journals in mind.

9. **Develop and implement adaptive sampling programs that integrate new statistical sampling designs and new technologies**

   New technologies and equipment prioritized for purchase in the near term will enable the Ecosystem Dynamics group to address this recommendation. For example, GLERL will purchase a Multiple Opening-Closing Net with Environmental Sensing System that will improve pelagic food web sampling.

10. **Develop a more comprehensive conceptual and methodological approach to the food web that can reasonably be expected to detect the presence and impact of new species**

    This research need is a primary driver for the development of an Integrated Ecological Modeling Framework, described in further detail in the Integrated Physical and Ecological Modeling and Forecasting branch section in the Science Strategy of the 2012 Strategic Plan.

11. **Expand and develop research in mission critical areas such as biogeochemistry, food web dynamics, and integrated bio-physical and ecosystem modeling**

    The addition of strategic staff, as outlined in the Implementation Strategy of the Strategic Plan, will allow us to return to our position as leaders in this area. This research need is also a primary driver for the development of an Integrated Ecological Modeling Framework. A critical impediment to progress in the area of food web dynamics is the need for updated shipboard sampling gear, which is prioritized under the capital equipment prioritization process.

12. **Better communication is necessary within and between the theme programs on the development and implementation of mission goals**

    This recommendation has been a major focus of lab management and branch chiefs since the reorganization of GLERL. All decisions on science are now made in conjunction with all branches during the annual project planning process. The integrated Science Strategy in the 2012 Strategic Plan outlines how the three science branches will work individually and collectively to fulfill GLERL's mission and meet

specific science goals. Science goals in the 2012 Strategic Plan were developed with participation from all science branches.

13. Attention to the progress of Jorg Imerger and Jason Antenucci of CWR at the University of Western Australia in terms of coupling biogeochemical and physical models

GLERL scientists interact with CWR scientists at international conferences such as the International Society of Limnology and Physical Processes in Natural Waters. GLERL is currently exploring the possibility of exchanging seminars with this group.

14. Continue to develop the increasingly important connection to NOAA's National Ocean Service (including the Coast Survey Development Laboratory and Center for Operational Oceanographic Products and Services (CO-OPS))

Connections with the U.S. Integrated Ocean Observing System, the National Data Buoy Center, and CO-OPS are established and are being developed. GLERL management met with NOS leadership in Ann Arbor and at NOAA headquarters in 2011 to build on this relationship, and successfully advocated for establishment of a permanent position in Ann Arbor for an NOS-National Centers for Coastal Ocean Science scientist with the regional Ecosystems Research Branch. GLERL management, the GLERL hydrology research group, and those associated with the GLOS design project have had ongoing interaction with CO-OPS, including participation in workshops and other activities. GLERL will continue to build on the partnership with NOS, particularly with the Line Office's research programs.

15. Continue to develop and communicate complex model forecast results and uncertainty in critical areas related to human health and safety

The focus of GLERL's bold new vision is to deliver ecosystem forecasts in critical areas including harmful algal blooms, hypoxia, water quality, and food web dynamics. An example of current work in this area is a study using Bayesian statistical models to quantify uncertainty in fecal indicator bacteria measurements, which was completed in FY2011 and will be incorporated into forecast models in FY2012.

GLERL's Integrated Physical and Ecological Modeling and Forecasting branch continues to seek ways to effectively communicate uncertainty in model forecasts, in partnership with others, including U.S. EPA program managers, USGS scientists, researchers at the National Weather Service, Sea Grant program managers and grantees, and the GLERL Information Services branch.