

IDEA: Land/Ocean Biogeochemical Observatory (LOBO) for Nitrogen and Carbon Cycling (ECS 0308070)

Understanding long-term change in the marine environment requires sustained observations. Current technology limits most chemical and biological data collection to the times that researchers are present to obtain samples. High frequency and episodic events are often not sampled. Autonomous sensors free scientists from many of these limitations. The Land/Ocean Biogeochemical Observatory, developed at the Monterey Bay Aquarium Research Institute, is a wireless chemical and biological sensor network that enables autonomous observing. The LOBO system combines novel chemical sensors that have months-long endurance with robust platforms and software. The system was designed to provide a completely integrated system from sensors and platforms to data delivery and visualization on the Internet. This enables long-term observing of coastal ecosystems and greatly lowers technical barriers that inhibit adoption of this technology.

After 3 years of development and operation in the Elkhorn Slough National Estuarine Research Reserve on the central California coast, the LOBO technology was licensed to Satlantic, Inc. This makes the system available to the greater community. In addition to the NSF-funded LOBO network in Elkhorn Slough, four additional LOBO networks from Satlantic have already been deployed in Nova Scotia, Oregon, Florida and California. These four systems have been funded by private foundations and individuals or commercial entities concerned with observing the coastal environment. The lowering of technical barriers has greatly expanded participation in ocean observing. The LOBO network will serve as the backbone for a North American ocean observing system that provides an unprecedented record of changing coastal processes.

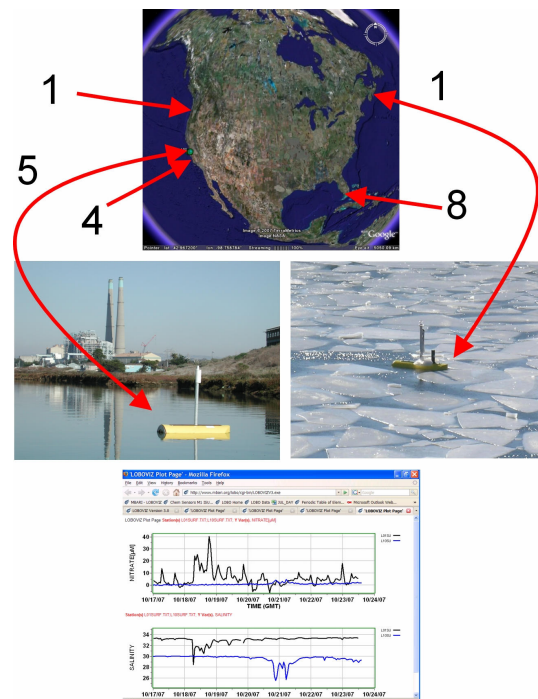


Figure Legend.

Top. Location of LOBO observing systems. Number of observing nodes in each system is indicated by the numeral. Left, LOBO L03 node in Elkhorn Slough, California monitors a watershed dominated by agriculture. Right, LOBO L10 node, shown in pancake ice flows during February in Northeast Arm, Halifax, Nova Scotia, monitors an urban environment. Bottom, nitrate concentration and salinity (www.mbari.org/lobo) observed during small rain events in late October, 2007 at the L01 node in Elkhorn Slough (black line) and L10 in Halifax (blue line). The freshwater inputs are similar in both systems, as shown by the salinity change recorded in the lower panel. However, the nitrate concentration change (upper panel) in the watershed dominated by agriculture is much higher, per unit salinity decrease, than in the urban system. Such observations provide a context for scientific understanding and for assessing the efficacy of management actions.

• Why is this research outcome notable and/or important, and how does it address the strategic outcome goal(s) as described in the [NSF Strategic Plan 2006-2011](#)?

The LOBO system contributes directly to the outcome goals of *Discovery*, *Learning* and *Research Infrastructure*. The LOBO system provides a new class of *Research Infrastructure* for observing coastal processes that is now being used for both *Discovery* and for *Learning*. For example, Adams and Matsumoto (2007) have written an article describing applications of the LOBO system in high school classrooms.

Adams, L.G., and G.I. Matsumoto. 2007. Investigating Coastal Processes and Nitrate Levels in the Elkhorn Slough Using Real-Time Data. *Oceanography* 20(1):200-204.

• Does this highlight represent transformative research?

Yes. The LOBO system enables transformative research by providing a new *Research Infrastructure* that allows observations of the coastal environment to be made on space and time scales that were previously unattainable.

• Does this highlight represent Broadening Participation?

Yes. By lowering the technological barriers to autonomous observing we have allowed a much broader group to begin ocean observations. This includes private foundations, regulatory agencies and interested individuals.

Are there any existing or potential societal benefits, including benefits to the U.S. economy, of this research of which you are aware?

Yes. The observing system enables greatly improved management of coastal ecosystems by providing high quality data. It will allow the effects of regulatory activities to be assessed directly in many cases.