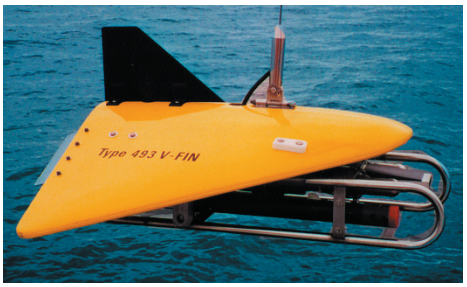
Selected Projects of GLERL's Marine Instrumentation Laboratory

Plankton Survey System

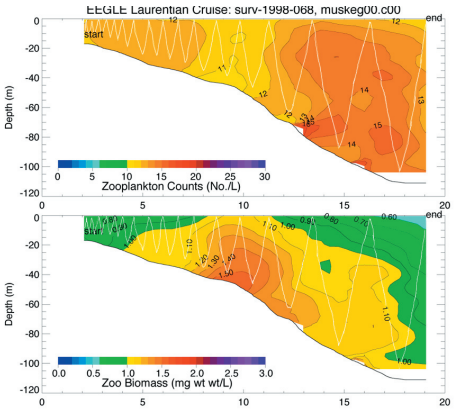
The Plankton Survey System (PSS) was assembled by NOAA's Great Lakes Environmental Research Lab's (GLERL) Marine Instrumentation Lab (MIL) in 1997 to measure distribution and abundance of zooplankton, tiny waterborne crustaceans that serve as a food base for many species of fish. The system measures turbidity, chlorophyll *a*, photosynthetically active radiation (PAR), conductivity, temperature, and zooplankton size and biomass density. The PSS and its onboard instruments have been successfully used on an ongoing basis to survey physical, chemical, and biological conditions before, during, and after Lake Michigan sediment resuspension events as part of the 5-year Episodic Events Great Lakes Experiment (EEGLE) program (http://www.glerl.noaa.gov/eegle/).

The PSS is towed behind a vessel in an up-and-down, or tow-yo fashion that retrieves data in a sinusoidal depth profile. The Optical Plankton Counter (OPC) measures zooplankton size, abundance, and depth distribution, and the fluorometer measures chlorophyll *a*, which provides a measure of abundance of microscopic green plants (algae) that form the foodbase for zooplankton. A PAR sensor measures light in a color band that drives the growth of algae.

The OPC has allowed GLERL scientists to estimate zooplankton biomass over much larger areas in the lakes as opposed to a specific location with net sampling. The graphs on the right display zooplankton counts and biomass estimates over a 25 km distance from shore to a depth of 80 meters. The PSS also indicated that the majority of zooplankton biomass was concentrated around the thermocline, a zone of abrupt water temperature change between warmer overlying water and colder, deeper waters.



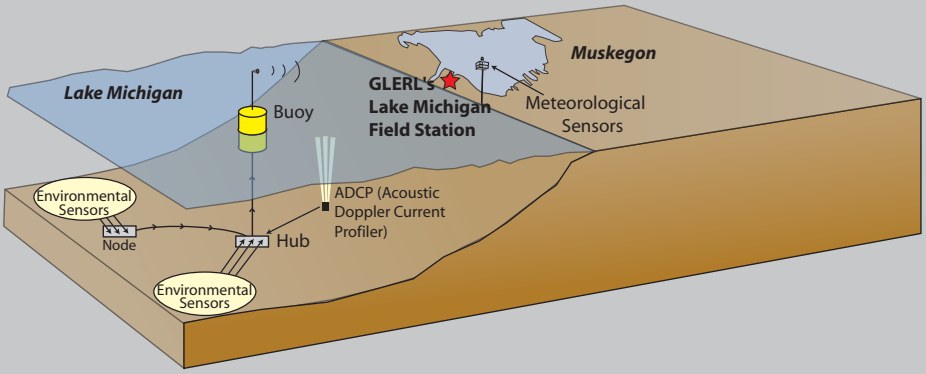
Towed Plankton Survey System (PSS) being lowered into the water.



Sample data graph. Zooplankton count and biomass. Tow path of instrument is shown as white line.

Lake Michigan Wireless Environmental Observatory

GLERL's MIL is developing the first Great Lakes environmental observatory using wireless internet technology at GLERL's Lake Michigan Field Station in Muskegon, MI. When fully developed, the observatory will provide chemical, physical, and biological data to support long-term research on the Great Lakes. These real-time data observations will be available to the scientific and educational community via the internet. This project will put in place the infrastructure needed to simplify sensor deployment and data acquisition for access by scientific researchers, educators, and the public. This is an important contribution to GLERL's leadership in supporting and promoting observation system development among Great Lakes universities and non-governmental organizations.



The environmental observatory consists of an offshore buoy connected to a hub that receives data from various environmental sensors such as an acoustic doppler current profiler. The data are then sent through a wireless link to an onshore receiver connected to the internet.

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Sequential Sediment Sampler

Introduction

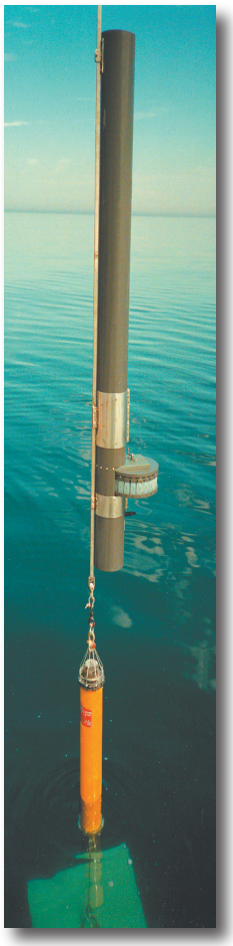
Because fine (clay-sized) sediment particles often bind with nutrients, and harmful contaminants, knowledge of sediment particle suspension, transport and deposition is critical for understanding and predicting ecosystem dynamics and health.

In 1977, GLERL began measuring rates at which waterborne sediment particles settle through the Lake Michigan water column by deploying sediment traps - plastic tubes vertically positioned on anchored cable several meters above the lake bottom. Sediment particles dropping into the tube's opening were funneled into a plastic collection bottle connected to the base of the trap. By retrieving collection bottles from the traps over time (weeks to months) scientists could estimate amounts of sediment deposited per unit area. While traps allowed estimates of sediment deposition over extended lengths of time, they revealed little about how sediment deposition rates might vary on a more frequent (hour-to-hour or day-to-day) basis. This was an important question, because scientists hypothesized that sediment suspension and transport was often driven by short-term episodic events such as storms, that might carry high-volume pulses of sediment to traps in a short period of time. Given the need to look at how sediment deposition might vary over such a short time frame, MIL designed and built the Sequential Sediment Sampler.

The Sampler is deployed with an acoustic release and an anchor, and is retrieved by activating the acoustic release with sound waves from the deck of the ship. It then disengages from the anchor and floats to the surface.

Deployment of a dual sequencing sediment sampler in Lake Michigan.

Design



A motorized, rotating carousel holds 23 sediment collection bottles, controlled by electronics and software. Once the sampler is deployed on an underwater mooring, a gear moves the bottles under the sediment collection funnel at a predetermined rate, allowing scientists to measure sediment deposition sequentially at set intervals of time.

Benefits

GLERL scientists have found the sequential sediment sampler to be extremely useful particularly in detection of the relatively short term flux events that can't be identified with a non-sequential sampler. Overall some 1800 samples have been collected with the sequential sediment sampler with a 90% success rate. The sampler have allowed scientists at GLERL to confirm that much of the particle transport in the lake is associated with episodic events. Currently there are 22 active samplers as well as several others distributed both nationally and internationally.

Retrieval of sampler in Lake Michigan.

For more information on MIL or other GLERL projects, please contact: Information Services, NOAA, Great Lakes Environmental Research Laboratory, 2205 Commonwealth Blvd., Ann Arbor, MI, 734-741-2262 or visit our web site at **www.glerl.noaa.gov**