Research Vessel *Lake Guardian* Returns to Port After a Successful Field Season

(Left) Lake Guardian docked in Sault Ste. Marie, Michigan for Public Tours. (Right) GLNPO Director Chris Korleski and Dr. Alexander Karatayev of Buffalo State College process a bottom sediment sample collected during the Cooperative Science and Monitoring Initiative for Lake Ontario.

(October XX, 2018) In early October, the research vessel *Lake Guardian* returned to its home port in Milwaukee, Wisconsin, after a busy field season of offshore surveillance on all five Great Lakes. Among other activities, the *Guardian* monitored the low-oxygen "dead zone" in Lake Erie, hosted teacher trainings and public tours, and conducted several intensive studies of Lake Ontario.

The U.S. Environmental Protection Agency's Great Lakes National Program Office (GLNPO) monitors offshore water quality of the Great Lakes to track restoration progress and identify emerging water quality concerns. Comprehensive water quality surveys are conducted in all five Great Lakes in both the spring, when the water is cold and well-mixed, and in the summer, when the surface waters are warmer and the lakes are stratified and more biologically active. The Spring Survey began soon after ice-break up and measured nutrients and other water quality parameters, as well as plankton and zooplankton populations living in the water. The Summer Survey began later in August and sampled benthos (organisms living in the bottom sediments) in addition to water quality, phytoplankton, and zooplankton. Several university researchers also used the *Lake Guardian* as a sampling platform during these surveys to support their Great Lakes investigations.

Throughout the field season, GLNPO also monitored bottom water oxygen levels at ten locations in the central basin of Lake Erie. This sampling is done throughout the summer season to measure the impacts of excess nutrients on the Lake Erie ecosystem. A "dead zone" can form when large amounts of sinking algae from blooms is consumed by bacteria at the bottom of the lake, which uses up the available oxygen in the water.

In between these monitoring programs, a group of 15 educators from throughout the Great Lakes basin had the unique opportunity to participate in the annual *Shipboard Science Workshop*. This educator program is a long-running partnership between GLNPO and Sea Grant's *Center for Great Lakes Literacy* which promotes Great Lakes sciences in education. Educators assist with collecting samples and conducting a small research project on the *Guardian*. In the following school year, they bring Great Lakes science back to their classrooms and share their experience with their teaching colleagues.

In addition, GLNPO and Sea Grant conducted 10 live video broadcasts with classrooms around the Great Lakes basin while the *Guardian* was actively conducting field work. These calls gave over 300 students an opportunity to understand why and how we monitor the recovery of the Great Lakes, see sampling in action, ask questions of the scientists and crew, and get a glimpse of what a career in the sciences might be like.

2018 was the year of the *Cooperative Science and Monitoring Initiative* (CSMI) for Lake Ontario. CSMI is a joint United States and Canadian effort to provide environmental managers with needed information on each Great Lake. (The focus of CSMI rotates between the five Great Lakes on a five-year cycle). The work on Lake Ontario was designed to assess the transfer of nutrients and energy in the foodweb and the resulting changes in species abundance and community structures. Approximately 24 stations were sampled at four different times over the summer for nutrients, bacteria and ciliates, zooplankton, and larval fish. In September, underwater video and grab samples of bottom sediments were collected at over 80 stations to determine the abundance of benthic (bottom-dwelling) species. Researchers paid special attention to the invertebrate species *Diporeia*, a small shrimp-like creature that was once the cornerstone of the Lake Ontario food chain, and the invasive Quagga mussels, which have replaced *Diporeia* as the dominant benthic species in Lake Ontario.

The *Lake Guardian* is often working 24 hours a day for several days in a row. Even though it was a busy field year, EPA was able to offer a few free public tours of the vessel during times when the boat was docked, including events in Detroit and Sault St. Marie, Michigan and Rochester, New York. The tours include a safety overview, tour of the ship, and a discussion of sampling and analytical equipment. It is a unique opportunity to visit the largest Great Lakes research vessel and learn how scientists monitor the health of the Lakes.

Before making its way back to its home port of Milwaukee, Wisconsin, the *Guardian* conducted the last survey of the year - a final assessment of oxygen levels in the central basin of Lake Erie. Now that the ship is home for the winter, work has already begun on getting the Lake *Guardian* ready for next spring and another busy field season on the ever-changing Great Lakes.