

# Collecting Winter Data on U.S. Coast Guard Icebreakers

PAGES 105–106

Winter research and monitoring of ice-bound rivers, lakes, and coastal seas to date has usually involved seagoing civilian scientists leading survey efforts. However, because of poor weather conditions and a lack of safe research platforms, scientists collecting data during winter face some difficult and often insurmountable problems. To solve these problems and to further research and environmental monitoring goals, new partnerships can be formed through integrating efforts of the U.S. Coast Guard (USCG) with citizen science initiatives.

USCG and a research group at Ohio's Bowling Green State University are entering the third year of such a partnership, in which icebreaking operations in Lake Erie using USCG Cutter *Neah Bay* support volunteer data collection. With two additional USCG vessels joining the program this winter season, the partnership serves as a timely and useful model for worldwide environmental research and monitoring through citizen science and government collaboration.

## *Icebreaking for Commerce and Research*

Coast Guard icebreaking is an important winter operation supporting maritime commerce and flood control in inland and coastal waters. The North American Great Lakes, for instance, have a dedicated fleet of eight USCG and two Canadian Coast Guard icebreaking vessels. The Baltic Sea, as another example, had at least 40 state-owned or state-leased icebreaking vessels operating during the 2009–2010 winter season (<http://portal.liikennevirasto.fi/sivu/www/baltice/>). Icebreaking operations are critical in rivers, lakes, and coastal seas where the demand for commercial ship traffic exists.

Scientists have long recognized that icebreakers travel areas of significant human activity and economic value, evidenced by the fact that they are needed to support such activity and commerce. Thus, it is also important to monitor water quality, habitat degradation, and pollution related to human activity and industry in these areas.

Operations by coast guards have a long history of association with scientific research and monitoring, including on ice-bound waters. In North America the Canadian Coast Guard, with its Icebreaking Program [*Canadian Coast Guard*, 1999], is charged with the operation of a federal civilian fleet of 18 icebreakers and has supported science missions from the high Arctic [*Cressey*, 2011] to the Great Lakes [*Twiss et al.*, 2012]. Likewise, USCG has long been involved in oceanographic research [*Capelotti*, 1996], a mandate prescribed

in Title 14 of U.S. Code, Section 94, which states that the Coast Guard “shall conduct such oceanographic research, use such equipment or instruments, and collect and analyze such oceanographic data, in cooperation with other agencies of the Government, or not, as may be in the national interest.” Through a partnership with the National Science Foundation, USCG operates three polar class icebreakers in Arctic and Antarctic waters and has additionally supported winter research efforts in the Great Lakes [*Nghiem and Leshkevich*, 2007].

However, logistical considerations often prevent researchers from embedding on USCG vessels during icebreaking operations. Citizen science programs involving USCG personnel offer an alternative approach. The U.S. Environmental Protection Agency's (EPA) National Directory of Volunteer Monitoring Programs (<http://yosemite.epa.gov/water/volmon.nsf/Home?readform>) lists more than a thousand programs operating within the United States alone. With well-defined sampling procedures and good quality-assurance practices, citizen science programs that partner with USCG collect credible and defensible scientific data for research, monitoring, and policy efforts.

## *Monitoring Lake Erie*

USCG service personnel are dedicated and motivated citizen stakeholders living and working in the marine and freshwater regions where they serve. Thus, they are well suited to citizen science initiatives that

seek to learn more about the environment in which they live. The recent collaboration between USCG and Bowling Green State University to monitor Lake Erie exemplified this—USCG service personnel were eager to learn how to collect the data needed for winter environmental monitoring.

The collaboration has provided chemical and biological data on the ecosystem in winter that otherwise would have been very challenging to collect [*McKay et al.*, 2011]. During winter 2010–2011 the monitoring effort included synoptic sampling of the surface waters of Lake Erie conducted during normal operations of *Neah Bay* from November to March (Figure 1). When the mission permitted, water samples were collected at hourly intervals while under way to provide a spatial and temporal survey for algal biomass (as chlorophyll *a*), dissolved and particulate nutrients, and other physicochemical parameters. This will allow researchers to evaluate winter primary production in the lake and assess its effect on the formation of an expansive dead zone that recurs in Lake Erie's central basin each summer [*Hawley et al.*, 2006].

These data were collected using the citizen science mechanism of the Ohio Credible Data Program, which provides a means to standardize and streamline surface water monitoring performed by nongovernmental groups (see <http://www.epa.state.oh.us/Default.aspx?tabid=4566>). As a result, not only are the data useful for research into the winter limnology of the North American Great Lakes but they also meet the requirements for use for regulatory applications, including the setting of water quality standards and evaluating the attainment of those standards. Thus, collaboration between Bowling Green State University and USCG is not only furthering the

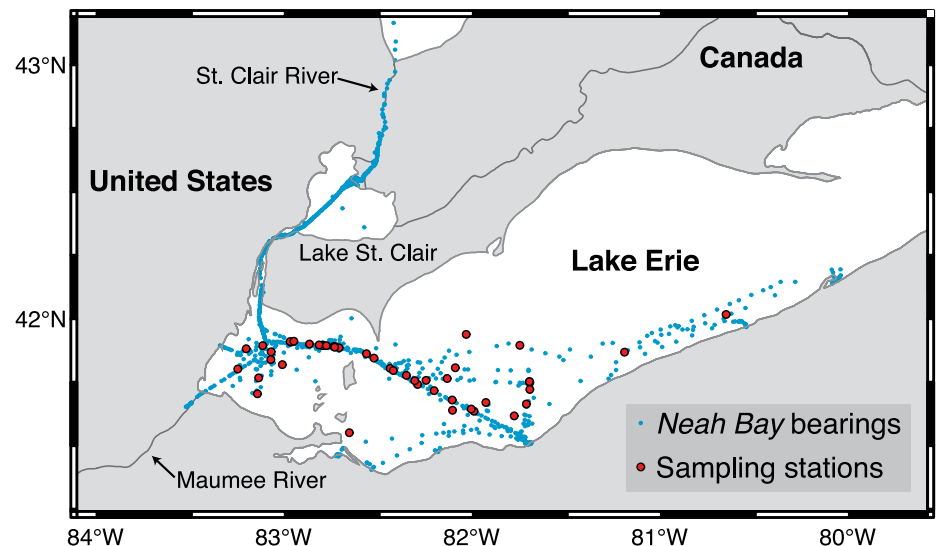


Fig. 1. Winter season 2010–2011 navigation tracks of U.S. Coast Guard (USCG) Cutter *Neah Bay* (blue) demonstrate monitoring potential in Lake Erie by partnering with USCG. Sampling was conducted at 48 sites (red) between November and March. The Ninth Coast Guard District is home to eight icebreaking cutters whose operations cover the five Great Lakes and the St. Lawrence Seaway, offering further opportunities to conduct monitoring.

university's research but is also providing the Ohio EPA with new data on the water quality of an important body of water during a virtually unstudied seasonal period.

*A Repeatable Model for Partnerships  
Between Government and Academia*

The combination of icebreaking operations and a citizen science environmental monitoring program has been invaluable for work studying the winter limnology of the Laurentian Great Lakes. But more important, this model of enlisting the Coast Guard or other groups with specialized equipment and all-weather access could be replicable in other regions. Whether enlisted personnel or commissioned officers, the personnel on board icebreakers and other vessels are citizen stakeholders who place great value on the waterways on which they work, and these citizens offer an untapped resource for collecting high-quality and, until now, scarce information on nearshore environments.

*Acknowledgments*

We thank the crew of *Neah Bay*, who ably carried out the sampling program, and Dan Glomski and Jeff Reynolds of the Ohio EPA Division of Surface Water, who facilitated our participation in the Ohio Credible Data Program. This project was funded in part through the Lake Erie Protection Fund.

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