

SWEET OR SALTY, QUALITY COUNTS: SEA GRANT PRIORITIZES CLEAN WATER

By Sharon Moen, Minnesota Sea Grant

Beluga whales living in the St. Lawrence Estuary can be so contaminated that they qualify as hazardous waste. The endangered population also exhibits the highest known rate of cancer in any wild mammal species, one that's comparable to the rate among human adults in the United States.

Sea Grant-funded researchers at the Woods Hole Oceanographic Institution (WHOI) have studied genes that affect the susceptibility of belugas to toxins to understand whether the population's condition reflects the chemical soup in which they dwell. Pollutants from industry, agriculture, and urban development in the entire Great Lakes Basin funnel through the St. Lawrence, along with pollutants from far off places that fall from the sky (a circumstance known as atmospheric deposition). The researchers found that belugas have a high-sensitivity version of a specific gene that responds to polychlorinated biphenyls (PCBs), suggesting that these chemicals may be particularly troublesome in cetaceans like whales.

"Certain contaminants appear to be causing noticeable biochemical effects in many organs of belugas and other marine animals," said Mark Hahn, a senior scientist at WHOI with research interests in toxicology. "Our work has revealed that some marine animals, including belugas, may be especially sensitive to these chemicals, whereas others, such as certain seabirds, may be more resistant. My hope is that as we

clarify how exposure to compounds like PCBs and endocrine disrupting chemicals affect organs and individuals, we can begin to ask questions about the risk that contaminants pose at the population level. That's the ultimate goal."

The quality of the water in the Great Lakes—sometimes dubbed "North America's Sweetwater Seas" or the "Fourth Coast of the United States"—concerns the National Oceanic and Atmospheric Administration, particularly through its regional network of university-based Sea Grant programs. The federal and state partnerships that fuel Sea Grant programs in coastal states around the nation were designed to support research, outreach, and education that improve the economic and environmental prosperity of the nation's coastal regions. By state, by region, and as a national network, 32 Sea Grant programs work toward sustaining the nation's water quality and supply.

Superior waters

"Lake Superior sets the bar for water quality in fresh surface waters," said Jeff Gunderson, the director of the University of Minnesota Sea Grant Program, which operates less than five miles from the westernmost edge of the Great Lakes. "Sea Grant helps to ensure that Lake Superior's reputation is not only warranted, but sustained. To do this we stay vigilant and proactive about educating community leaders and emerging





scientists, funding aquatic research, working with industries, and exchanging ideas with residents.”

Aside from contributing to the way coastal communities manage stormwater runoff, development, and water quality, Minnesota Sea Grant has conducted seminal research on bacteria that triggers beach closures, chemicals that disrupt the normal production of hormones, and toxins such as PCBs and toxaphene. In fact, Time Magazine (2006) recognized that the work of Minnesota Sea Grant researcher Michael Sadowsky would redefine how *E. coli*, a bacteria used for indicating fecal contamination, is used in water quality monitoring. They wrote:

Sadowsky and his fellow researchers have found a way to tease out stretches of marker DNA that indicate whether the bacteria came from human or nonhuman sources. With cities and states across the country spending billions on new water-quality systems, the impact of Sadowsky's work could be huge.

Other Sea Grant offices conduct a similar suite of research, outreach and educational activities to ensure sustainable water supplies and high water quality. For instance, Sea Grant extension professionals have cooperated with the Miller Brewing Company to improve the waters near Milwaukee beaches and have helped city officials plan how Chicago's 8.7 million people will continue to have a safe drinking water supply. Whether in South Carolina or Southern California, Sea Grant has improved peoples' understanding of groundwater and surface water relationships in such a profound way that some are taking considerable pains to install new septic systems, raingardens, and water retention ponds. To sustain their water quality and supplies, residents, businesses, and communities are willing to commit the time, money, and sweat required for such water management projects.

Back from the dead

Even though it is still bedeviled by episodes of waterfowl botulism and “dead zone” areas where oxygen is scarce, Lake Erie can be touted as one of the world's most powerful environmental success stories. Jeff Reutter, the director of the Ohio Sea Grant Program and Stone Laboratory, tells it this way:

Lake Erie was in rough shape 40 years ago. One of its tributaries, the Cuyahoga River caught on fire (1969). Erie itself was called a “dead lake” due to high

contaminant levels and its excessive phosphorous loads. As well as an embarrassment, Lake Erie became a national joke. “I heard Lake Erie is the place fish go to die,” quipped Johnny Carson on late night television (1976).

In response to Lake Erie and the generally deteriorating water quality of the country, the United States government created the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency, and passed the Federal Water Pollution Control Amendments of 1972 (commonly known as the Clean Water Act). Lake Erie responded dramatically to the ensuing limits put on phosphorous inputs. Through the efforts of many entities, including Sea Grant, the lake went from “dead” to “the walleye capital of the world” with more pounds of fish being harvested from Lake Erie than the other four lakes combined.

In addition to funding investigations regarding Lake Erie, Sea Grant helps to coordinate research in the United States and Canada that will solve a troubling increase in phosphorus levels and harmful algal blooms, among other challenges. The Binational Executive Committee recently tapped Sea Grant's outreach capabilities to aid agencies in communicating information about Lake Erie's current situation to managers, decision makers, and the public.

Creating cleaner waters

If the people, communities, and industries around Lake Erie can cooperate to improve water quality, Sea Grant knows it is possible to inspire the same synergy within the Chesapeake Bay and the Gulf of Mexico. They, too, are on the receiving end of stormwater runoff laced with pollutants from multiple and vast agriculture and urban centers. The influx of excess nutrients leads to excess algal production and low levels of oxygen in the water. Fisheries, boating, and tourism—not to mention waterfront real estate—are multi-million-dollar activities jeopardized by deteriorating water quality. Sea Grant staff and researchers put considerable effort into complex water quality challenges that lead to dead zones and harmful algae blooms using the national program's trademark approach:

- Improve scientific understanding.
- Support integrated management decisions that reflect science.
- Create an informed citizenry.

The approach was fully implemented in response to Section 303d of the Clean Water Act. This act requires states to develop

Total Maximum Daily Loads (TMDLs) for waters impaired by pollutants. The objectivity and finesse required to calculate TMDLs—the amount of a pollutant that a waterbody can receive and still meet water quality standards—inspired the EPA, state agencies, and watershed districts to recruit Sea Grant staff to facilitate dialogues and conduct surveys, reviews, and public education. The TMDL process and Sea Grant’s non-advocacy, non-partisan, science-based reputation helped to generate plans that substantially reduce suspended solids, nutrient enrichment, and bacteria inputs to waterbodies. The EPA lauded projects to which Sea Grant contributed as outstanding examples of TMDL planning, processes, and public outreach.

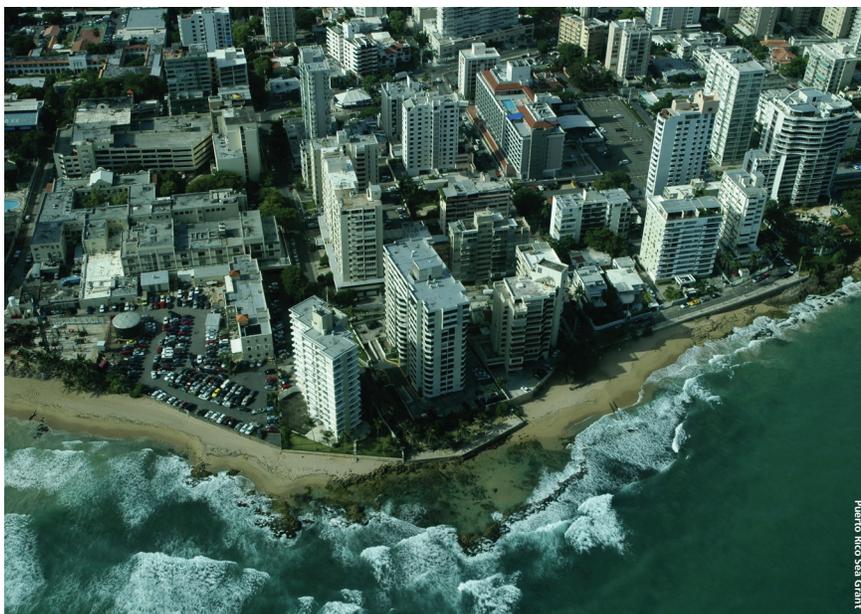


Photo: Rios Sea Grant

Also, Sea Grant trains citizen scientists of all ages to conserve the quality of their water. People have reported making sustained behavioral changes to improve water quality after their children studied Sea Grant’s watershed curriculum, and after participating in Sea Grant’s watershed programs and projects. By providing city governments with science-based regional scenarios regarding climatic change and tools to evaluate the tight association between land use and water quality, Sea Grant staff adds rigor to decision-making and furthers the goals of community economic and ecologic sustainability.

Sea Grant-funded researchers are creating new technologies for removing harmful algae toxins from drinking water as well as studying the causes for dead zones. They’re working to understand how water seeps into the ocean through submarine groundwater discharge and how this affects water quality around coasts, corals, and shellfish beds. Communities have become better at enhancing, conserving, and managing their water quality and supplies because of Sea Grant-funded water flow modeling and septic system research.

We all live downstream

Beyond clarifying the correlation between septic systems and seawater quality, Sea Grant has reduced chemical pollutants in waterways by organizing pharmaceutical collection events and a first-ever buy-back program for human drugs that may cause

problems when discharged into aquatic environments. To rid the nation’s coasts of non-biodegradable plastics, Sea Grant organizes the retrieval of derelict fishing gear and monofilament fishing line from beaches, and arranges for the recycling of shrink-wrap from boating facilities. Millions of pounds of beach litter have been properly disposed or recycled through Sea Grant’s efforts.

As safe and sustainable water supplies become scarcer and therefore more precious, as is predicted in the next century, NOAA Sea Grant’s devoted pursuit of excellent water quality is not only heartening, but also economically essential. The St. Lawrence River belugas, those cancer-ridden sea canaries at the mouth of the Great Lakes Seaway, may be oblivious to the causes of their undoing, but they and other coastal creatures (including humans) don’t need to be undone. Each year, Sea Grant’s dedicated researchers produce new insights into ways to improve, manage, and protect water supplies. Echoing these science-based insights, Sea Grant’s

passionate extension professionals work to make sure research results are accessible to those people who most need and want them. Sweet or salty, water is essential to your life and keeping that water clean is essential to NOAA Sea Grant.

For more information on the ways that NOAA Sea Grant ensures safe and sustainable water supplies, go to the national network’s Web site at: www.seagrants.noaa.gov ❖

