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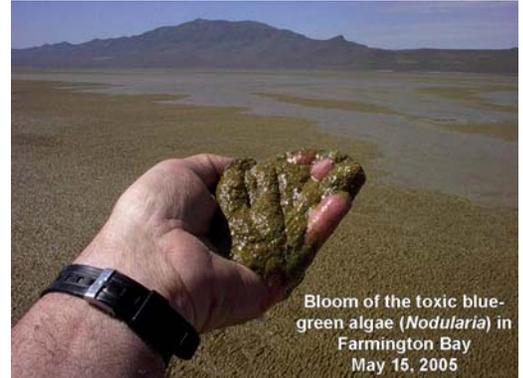


Great Salt Lake Advisory Council

Nutrient Loading and Eutrophication in the Great Salt Lake

Wayne Wurtsbaugh, Utah State University
November 20, 2008

The Problem—Like many large cities that border lakes and rivers, greater metropolitan Salt Lake City discharges significant loads of nutrients and other wastes into the Great Salt Lake. The lake receives high concentrations of phosphorus and nitrogen wastes from sewage treatment plants that serve over 1 million people in the greater metropolitan area. To a lesser extent, non-point sources also contribute to the problem. These nutrients enter the shallow Farmington Bay, promoting extensive blooms of algae (eutrophication). The automobile causeway and Antelope Island not only help contain the heavy nutrient load, but they also keep the bay water fresher than the open Great Salt Lake, and this allows the proliferation of hazardous forms of algae like the *Nodularia* shown in the photo. Nutrient and algal levels in Farmington Bay are 20 times the critical level for a eutrophic classification and higher than in any other lake in the State. Problems linked to the eutrophication of Farmington Bay include:



- *Anoxia*. Decomposition of the dying algae causes the *loss of oxygen (anoxia)* from the water at night, and sometimes for periods of several days. *This limits the organisms that can survive in the bay.*
- *Toxic blue-green algae (cyanobacteria)* that proliferate in Farmington Bay are hazardous to wildlife and humans. The concentrations of these toxins sometimes exceed World Health Organization guidelines by over 10-fold. Outflows of the cyanobacteria from Farmington Bay can cause rashes on swimmers in nearby Bridger Bay on Antelope Island. Researchers elsewhere have documented bird die-offs due to cyanobacterial blooms that are only a fraction of what are encountered in Farmington Bay.
- *Lake stink*. The anoxia allows highly toxic hydrogen sulfide gas to be generated and produces “*lake stink*” when high winds release the gas into the air. Surveys of residents and sampling of lake sediments suggest that Farmington Bay is a primary cause of lake stink. This problem likely reduces recreational use of the Great Salt Lake.
- *Eutrophication in Gilbert Bay*. Nutrients and excess algae are exported from Farmington Bay into Gilbert Bay. The increased loading of nutrients there contribute to anoxia and hydrogen sulfide generation in its deep waters. However, under the current loading, brine shrimp may benefit from increased levels of algae to feed on.

With 2–3 fold population growth expected within 50 years, eutrophication in all of the bays of the Great Salt Lake will increase. Higher loading will exacerbate problems in Farmington Bay and may cause similar problems in Gilbert Bay.

Funding—Limited funding for research on eutrophication has come from the Tides Foundation, Utah Forestry, Fire and State Lands, Central Davis Sewer District, the Division of Water Quality, and Utah State University.

Project partners—Analyses of eutrophication have been done by Wayne Wurtsbaugh and students at Utah State Univ. Work on the impact of eutrophication in Farmington Bay on Gilbert Bay was done in collaboration with David Naftz at the US Geological Survey. The Division of Wildlife Resources has assisted in studies of the impacts of cyanobacteria on birds. The Division of Water Quality (Theron Miller) has focused their analyses of eutrophication on impounded wetlands bordering Farmington Bay.

What can be done?—Although more work is needed prior to implementing management decisions, there are several possible solutions to reduce the impact of excessive nutrients on the lake:

- *Breaching the automobile causeway* would allow higher salinity water to flow into Farmington Bay. This would limit the abundance of the toxic cyanobacteria, and would also allow brine shrimp to grow in the bay.
- *Diversion of the Salt Lake City Sewage Canal and the wastewater outfalls from Davis County treatment plants* into the much larger Gilbert Bay would decrease impacts on the shallow and enclosed Farmington Bay. This, however, might simply transfer the problem from one area of the lake to another.
- *Flushing Farmington Bay with freshwater* from the Jordan River during spring runoff would help remove nutrients from the bay. Currently, high flows during the spring are diverted via the Goggin Drain into Gilbert Bay.
- *Tertiary treatment of sewage wastes* could be implemented to remove phosphorus and/or nitrogen before waters are discharged to the lake. Although expensive, this approach has been adopted by many major cities in the U.S. that border lakes, rivers, and estuaries.