Supplementary Information
Indicator D: Inland Water Quality
State of Casco Bay 6th Edition

References

Hunt, Paul T., Kate McDonald, and Kirsten Ness. 2016. Sebago Lake, Maine and the Water Quality Index: A Method for Subwatershed Protection. LakeLine, 36(3)10-18. North American Lake Management Society. Fall 2016. Available here: <https://www.pwd.org/sites/default/files/hunt.pdf>.

Maine Department of Environmental Protection. 2018. 2016 Integrated Water Quality Monitoring and Assessment Report. Available here: <https://www.maine.gov/dep/water/monitoring/305b/index.html>.

Further Reading

Lake Stewards of Maine. (n.d.). Lakes of Maine. Retrieved from http://lakesofmaine.org/index.html?r=1637622976.

This website contains information about Maine's lakes. Here you can find volunteer opportunities, water quality data, management practices, and resources for different regions of Maine.

Maine Department of Environmental Protection. (n.d.). *GIS maps and other data files*. Retrieved from https://www.maine.gov/dep/gis/datamaps/.

A comprehensive list of maps that can be opened in ArcGIS or Google Earth Pro. These maps include data from the Bureau of Remediation and Waste Management, the Bureaus of Land Resources and Water Quality, and the Bureau of Air Quality.

Sebago Lake Protection. Portland Water District. (2019, August 5). Retrieved from https://www.pwd.org/sebago-lake-protection.

Contains information about Sebago Lake and its watershed. Sebago Lake is the drinking water source for Portland Water District customers, including residents of the City of Portland, and several other towns in the region. PWD monitors the lake and its tributaries and publishes their data here. Their Sebago Lake Monitoring Buoy provides real-time data on temperature, dissolved oxygen, chlorophyll, and water clarity.

Presumpscot Regional Land Trust. (n.d.). *Water Quality Monitoring*. Retrieved from https://www.prlt.org/water.

Through volunteer efforts, Presumpscot Regional Land Trust maintains an online map visualizing water quality trends in the Presumpscot River Watershed from the last 11 years. Data includes E. Coli bacteria and dissolved oxygen levels.

Methods and Data Sources

Biomonitoring data were downloaded from Maine Department of Environmental Protection's (DEP) website. DEP makes certain data available on-line at <https://www.maine.gov/dep/gis/datamaps/>. Among those data, the site exposes GIS data on stream and wetland biomonitoring results via a KML file ("lawb_biomonitoring.kml"), which can be opened in Goggle Earth. CBEP used a series of Python scripts to access and aggregate the data exposed there for further analysis. Detailed descriptions of DEP's data format and our data access methods are provided in the detailed data analysis repository on GitHub (https://github.com/CBEP-SoCB-Details/Access_Biomonitoring).

Maine's 2016 "Integrated Report" was the source for all info on Impaired waters. That was the most recent finalized Maine Integrated Report when we were preparing the State of Casco Bay Report. The Integrated Report documents are available on DEP's website, at https://www.maine.gov/dep/water/monitoring/305b/index.html . Geospatial data relating to the impaired status of Maine inland rivers and streams were provided directly to CBEP by DEP.

DEP aggregates data on lake water quality from volunteer water quality monitors, state agencies and other sources, and posts it on-line. Aggregate data through 2019 are housed as excel files on the website of the Gulf of Maine Council for the Marine Environment, as part of their "Knowledge Base" at https://gulfofmaine.org/public/gulf-of-maine-council-on-the-marine-environment/ Our lake water quality analysis was based on that data source. (The data has apparently not been updated since the 2019 monitoring year. Data and information are accessible on a lake-by-lake basis via the Lakes of Maine website.)

Additional lake monitoring data for Sebago Lake was provided to CBEP directly by the Portland Water District.

Presumpscot River water quality data has been gathered for many years by volunteers. Volunteers worked originally with Presumpscot River Watch, and more recently under the leadership of the Presumpscot Regional Land Trust. Data was provided to CBEP by Presumpscot Regional Land Trust.

Data supporting the sidebar on the Portland Water District's Lake Vulnerability Index were provided to CBEP by the Portland Water District.

Weather and precipitation data for the Portland Jetport was retrieved from NOAA's National Centers for Environmental Information Climate Data Online APIs., specifically via API v2. Information on this API is available here: <https://www.ncdc.noaa.gov/cdo-web/webservices/v2>. Documentation on specific datasets is available at: <https://www.ncdc.noaa.gov/cdo-web/datasets>.

Impervious cover information was based on Maine Department of Inland Fisheries and Wildlife's one meter pixel impervious cover data, based principally on 2007 imagery. CBEP retains copies of the data for the Casco Bay region. Data is publicly available through the Maine Geolibrary. CBEP aggregated that data layer to catchments identified derived from NHD+ V2 data available here: <https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus>.

In general, results presented in the chapter focus on depiction of pattern and variation, using graphical approaches. Water quality data seldom follows simple probability distributions, so we emphasized robust statistical summaries, like medians. Where more detailed analyses were conducted, we relied on

multiple modelling strategies (multivariate linear models, GLMs, and GAMS), complemented by robust or resistant methods that can minimize the impact of data that does not meet assumptions of standard statistical models. Any qualitative conclusions mentioned in the text or in figure legends are based on results of multiple model strategies, to minimize risk of reporting results that are model-dependent.

The most important data analyses results presented here may be those that evaluate long-term trends in water quality at specific locations (e.g., specific lakes). In general, we searched for long-term trends using linear models (to detect trends in typical conditions) or generalized linear models (to test for changes in frequency of violations of water quality criteria). Where appropriate, we used mixed effects models to test for dependencies on possible predictors of water quality (such as site, time of year or temperature). We complemented those analyses using other tools, such as median-based linear models, (Theil-Sen estimators and their elaborations), or resistant correlation methods (Kendall's Tau).

Specifically, the table showing long-term trends in lake water quality is based on median-based linear models, to minimize the effects of outliers.

Access to data and summary of data analysis can be found at https://github.com/CBEP-SoCB. For a full archive of data and all analyses steps head to https://github.com/CBEP-SoCB-Details.