

GSA DATA REPOSITORY 2009167

“A Lacustrine Carbonate Record of Holocene Seasonality and Climate”

DERBY LAKE LIMNOLOGY

Data from Derby Lake collected during sediment coring operations in 1999 and 2001 (Figure DR-1) in part document the chemical, biological, and physical properties of the lake. The epilimnion (0-10 m water depth) shows elevated temperatures indicating thermal stratification, as well as elevated levels of dissolved oxygen and pH, consistent with seasonal photosynthesis. The epilimnion also exhibits reduced concentrations of calcium, consistent with uptake related to calcite precipitation driven by photosynthesis and warm temperatures. The hypolimnion (10-27 m water depth) exhibits decreased temperature, pH, and dissolved oxygen, while elevated concentrations of calcium there reflect calcite dissolution driven by organic matter respiration and reduced temperatures.

These data demonstrate that Derby Lake is typical of many temperate, thermally-stratified, ‘hardwater’ inland lakes in Michigan. Although long-term monitoring of the lake was not within the scope of our study, many lakes in similar hydroclimatic settings have been intensively studied in recent decades. Wetzel (2001) illustrates many limnological concepts using long-term datasets from similar inland Michigan lakes, which are commonly dimictic, seasonally stratified, eutrophic, and ice covered from December through March. A series of studies in the 1980s used inland Michigan lakes as freshwater carbonate laboratories (e.g. Murphy and Wilkinson, 1980; Dustin et al., 1986). Derby Lake shares many of the key elements of these ‘marl lakes’, including hard water (surface alkalinity of 2.49 meq/kg in 2001), and ample amounts of carbonate parent material in local glacial tills.

DETECTING LOW CARBONATE EVENTS (LCE)

An approximate but objective count of low carbonate events (LCE) may be obtained by identifying intervals where the sample-to-sample change in carbonate abundance is less than - 5%. The resulting tally is then checked against the data and a visual inspection of the core to remove intervals that represent double counts within prolonged periods of low abundance, and add intervals where very short duration events are either muted or not represented by the coarse sampling interval. Visual inspection of the core aides in the latter process because low carbonate horizons are readily identified by their darker color.

FIGURE CAPTIONS

Figure DR1: Limnological data from Derby Lake, Michigan.

REFERENCES CITED

- Dustin, N.M., Wilkinson, B.H., and Owen, R.M., 1986, Littlefield Lake, Michigan: Carbonate budget of Holocene sedimentation in a temperate-region lacustrine system: *Limnology and Oceanography*, v. 31, p. 1301-1311.
- Murphy, D.H., and Wilkinson, B.H., 1980, Carbonate deposition and facies distribution in a central Michigan marl lake: *Sedimentology*, v. 27, p. 123-135.
- Wetzel, R.G., 2001, *Limnology: Lake and river ecosystems*: San Diego, Academic Press, 1006 p.

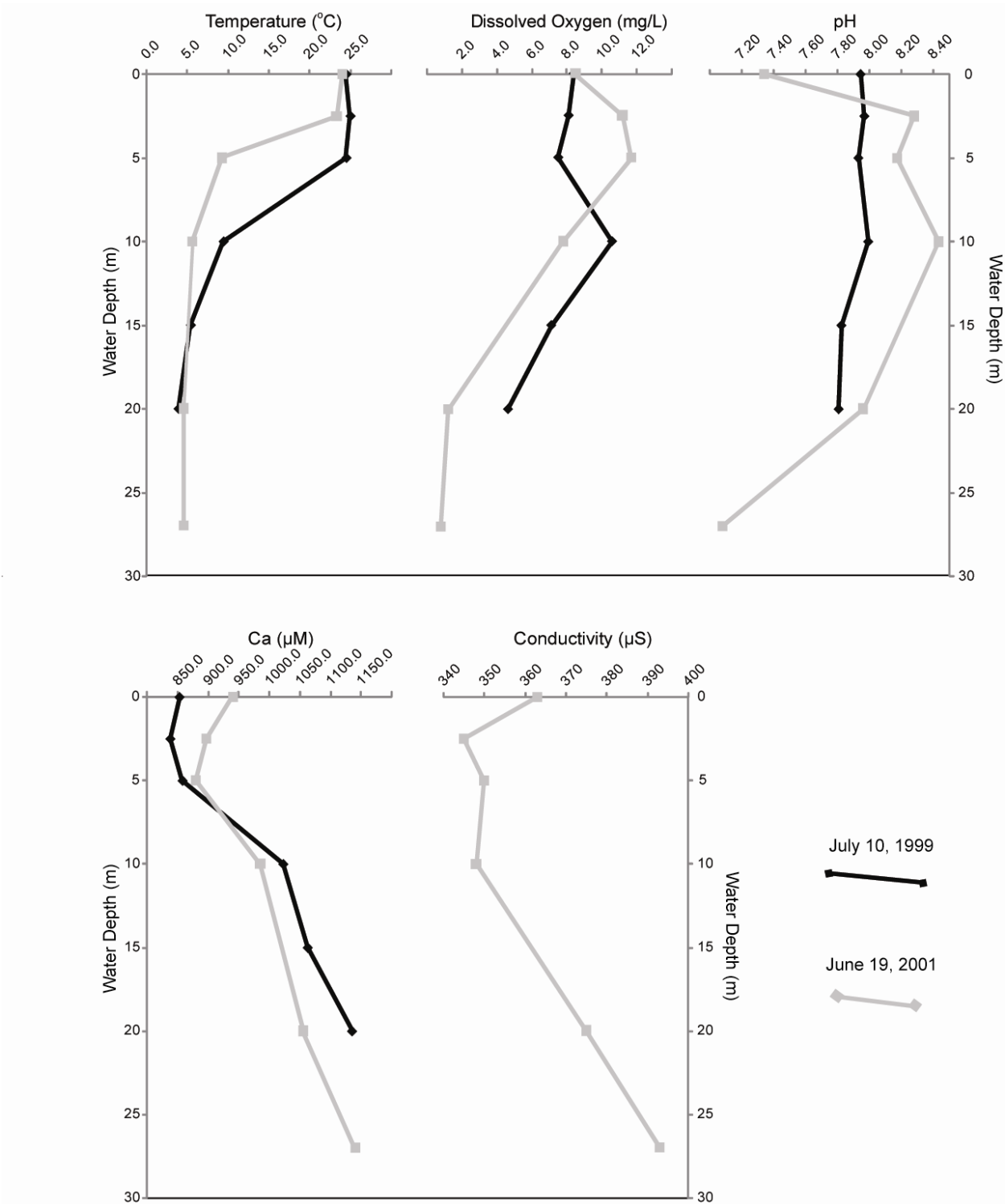


Figure DR1