An Analysis of Chloride Concentration, Dissolved Oxygen, and Phosphorus in Angle Pond

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Fig. 1. A satellite image of Angle Pond.
From NHDES Lake Information Mapper

Fig. 2. A photo of Angle Pond in late winter

Angle Pond

Angle Pond is a mesotrophic lake located between Sandown and Hampstead, in New Hampshire, Rockingham County. Angle Pond is 161 acres with a maximum depth of 35 ft and an average depth of 14 ft. (Angle pond site map). Angle Pond is a private lake with no public access, and it is surrounded by homes on all sides (Fig. 1.). All of these homes have septic systems, as Sandown and Hampstead lack sewer. Though it is nice living on a lake or pond, this amount of road frontage can cause problems. It really doesn't take much to make a lake more likely to experience long term salinization. Even an area wherein 1% of the land cover is impervious surfaces will do (Dugan et al., 2017). Salinization is the increase of ionic compounds in freshwater, and up in the Northeast, the most common ion is chloride, mostly derived from road salts.

Chloride in low concentrations in fresh water doesn't pose much issue, but as the concentration rises so does the ecological impact. The effects typically begin to show as the concentration raises to the 100s and 1,000s of mg/L. (Dugan et al., 2017). Those higher levels can affect the composition and function of the various communities in the afflicted body of water. Communities of all scales can be affected, from communities of the smallest phytoplankton and zooplankton to the largest macroinvertebrates and fish. This increased salinity can cause a decline in the abundance and richness of species, which can then further lead to trophic cascades and entirely altered ecosystems and functions. In cases of severe salinization, the chemical differences of the water can cause layers to form and an inability for those layers to mix beyond the chemocline. This stratification can result in an anoxic lower layer and difficulty for nutrients to flow throughout the lake (Dugan et al., 2017).

Sandown, the town surrounding most of Angle Pond, uses roughly 1,500 tons of road salt and 450 cubic yards of sand each winter season. The salt is used at dangerous intersections and in extreme road conditions. The salt and sand are applied as a mixture that is at minimum one part salt and two parts sand. Residents of Sandown have access to sand for their own use via the Highway Department, though salt is not available for residents' use. (Sandown, NH, n.d.).

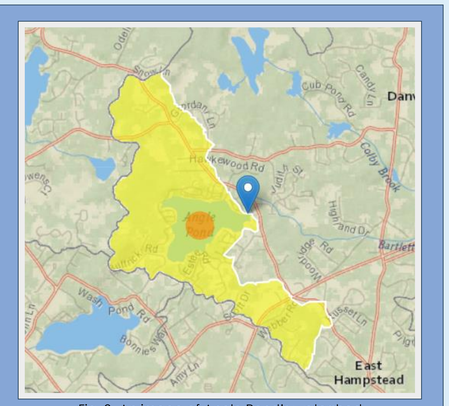

Fig. 3. An image of Angle Pond's watershed.
Image from StreamStats

New Hampshire Water Quality Standards:
860 mg/L is the acute limit of Cl.
230 mg/L is the chronic limit of Cl.
Class A: 75% DO saturation, 6mg/L DO instantaneous. No turbidity passed baseline. Natural pH. Natural phosphorus.
Class B: 75% DO saturation, 5mg/L DO instantaneous. No turbidity 10NTU passed baseline. 6.5 - 8.0 pH. Phosphorus levels don't impede use. (NHDES Lake Trend Report, R-WD-20-08)

Results

Angle Pond is above the 75th percentile for specific conductance and is below the 25th percentile for dissolved oxygen. (NHDES Lake Trend Report, R-WD-20-08)

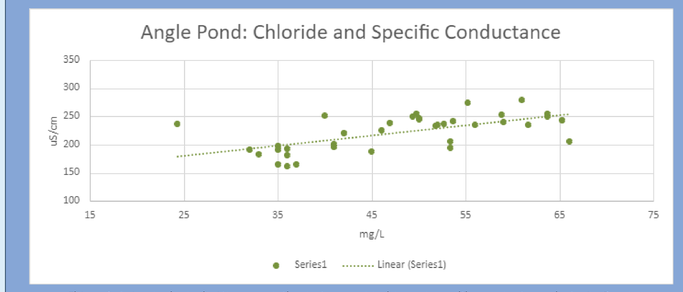

Figure 4. A graph displaying the correlation between chloride and specific conductance in Angle Pond.

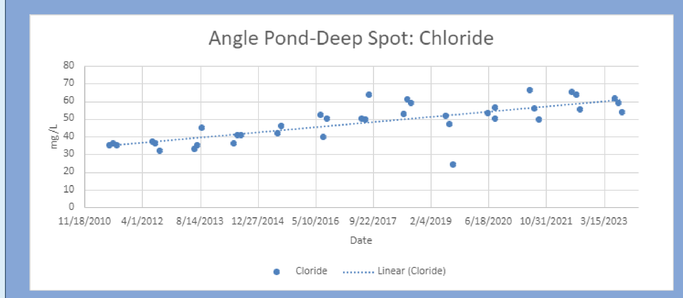

Figure 5. A graph displaying the concentration of chloride in Angle Pond over time.

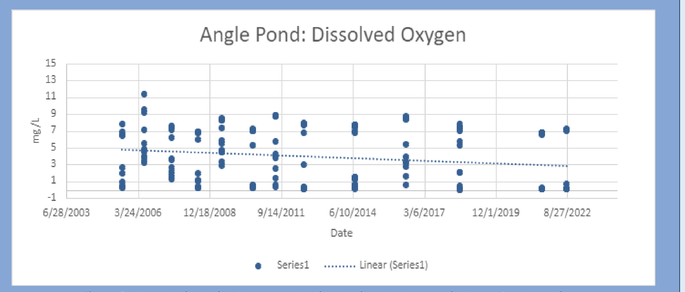

Figure 6. A graph displaying the concentration of dissolved oxygen in Angle Pond over time.

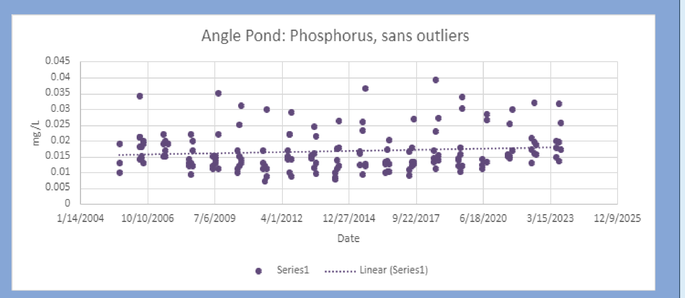

Figure 7. A graph displaying the concentration of phosphorus in Angle Pond over time.

Conclusions

The data provided for this analysis on Angle Pond comes from the Volunteer Lake Assessment Program (VLAP) managed by the New Hampshire Department of Environmental Services (NHDES). As seen in the graphs, Angle Pond has shown an increase in both specific conductance (fig. 9) and chloride (fig. 5) over time. This increase likely originates from road salt in the watershed of Angle Pond. This increase in chloride can cause a number of problems as stated above.

A decreasing trend in dissolved oxygen has been observed (fig. 6). Phosphorus appears to be increasing slightly (fig. 7), and the phosphorus levels of Angle Pond are consistently a bit above the =<12 microgram limit that mesotrophic lakes have and is in the 75th percentile for mesotrophic lakes, and most of the phosphorus appears to originate from organic matter in the benthic sediments under anoxic conditions (Scott et. al, 2020). However, this analysis has not deemed the increase in phosphorus immediately troublesome.

Data provided by the Volunteer Lake Assessment Project (VLAP) overseen by the New Hampshire Department of Environmental Services

References

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