Mini Report Proposal

Stephen Powers

1. Title

Examining the relationship between Secchi depth and dissolved organic carbon concentration in naturally formed lakes

2. Research question(s)

What is the mathematical form of relationship between Secchi depth and dissolved organic carbon? In what ways does the mathematical form vary among lake types?

3. Hypothesis(es) or prediction(s)

i. There is a general negative relationship between Secchi depth and dissolved organic carbon concentration in lakes.

4. Rationale

Dissolved organic carbon concentration varies widely among lakes, influencing water clarity. Secchi depth provides an important measure of water clarity. Lakes with higher dissolved organic carbon concentration are expected to be more visibly stained, decreasing water clarity and Secchi depth. Other factors such as chlorophyll concentration and turbidity may confound the potential relationship between Secchi depth and dissolved organic carbon. When we consider naturally formed lakes with turbidity less than 10 NTU, effects of chlorophyll and turbidity on Secchi depth are not large, providing an opportunity to isolate and test the mathematical relationship between Secchi depth and dissolved organic carbon concentration.

5. Selected References

Hansen AM, Kraus TEC, Pellerin BA, Fleck JA, Downing BD, Bergamaschi BA. 2016. Optical properties of dissolved organic matter (DOM): Effects of biological and photolytic degradation. Limnology and Oceanography 61:1015–32. https://onlinelibrary.wiley.com/doi/abs/10.1002/lno.10270.

Jassby AD, Goldman CR, Reuter JE, Richards RC. 1999. Origins and scale dependence of temporal variability in the transparency of Lake Tahoe, California–Nevada. Limnology and Oceanography 44:282–94. https://onlinelibrary.wiley.com/doi/abs/10.4319/lo.1999.44.2.0282. Last accessed 12/06/2025

Rose KC, Winslow LA, Read JS, Hansen GJA. 2016. Climate-induced warming of lakes can be either amplified or suppressed by trends in water clarity. Limnology and Oceanography Letters 1:44–53. https://onlinelibrary.wiley.com/doi/abs/10.1002/lol2.10027.

Rubin HJ, Lutz DA, Steele BG, Cottingham KL, Weathers KC, Ducey MJ, Palace M, Johnson KM, Chipman JW. 2021. Remote sensing of lake water clarity: performance and transferability of both historical algorithms and machine learning. Remote Sensing 13:1434. https://www.mdpi.com/2072-4292/13/8/1434.

Senar OE, Bergström A-K, Trick CG, Grimm NB, Hessen DO, Karlsson J, Kidd KA, Kritzberg E, McKnight DM, Freeman EC, Creed IF, Andersson A, Ask J, Berggren M, Cherif M, Giesler R, Hotchkiss ER, Kortelainen P, Palta MM, Vrede T, Weyhenmeyer GA. 2018. Global change-driven effects on dissolved organic matter composition: Implications for food

webs of northern lakes. Global Change Biology 24:3692–714. https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14129

Williamson CE, Morris DP, Pace ML, Olson OG. 1999. Dissolved organic carbon and nutrients as regulators of lake ecosystems: Resurrection of a more integrated paradigm. Limnology and Oceanography 44:795–803. https://onlinelibrary.wiley.com/doi/abs/10.4319/lo.1999.44.3_part_2.0795.