PAW PAW LAKE TROPHIC STATE

Progressive Companies / Water Resources Group

KEY PARAMETERS INFLUENCING LAKE PRODUCTIVITY

Phosphorus is the key nutrient driving aquatic plant and algae growth, and excess amounts can accelerate natural lake aging, or "eutrophication." When bottom waters contain oxygen, phosphorus generally remains bound to sediments. When deep-water oxygen is depleted, as commonly occurs in summer when lakes stratify by temperature and temporarily stop mixing, sediments release phosphorus back into the water, often becoming a significant internal source. Typically, lakes with phosphorus levels above 20 parts per billion (ppb) support abundant plant and algae growth. Algal quantity can be estimated by measuring chlorophyll-*a*, with concentrations over 6 ppb indicating elevated algal production. Water clarity is measured with a round, black and white disk called a Secchi disk. Aquatic plants can usually grow to about twice the Secchi depth. Generally, increased phosphorus, whether from external inputs or internal sediment release, drives higher chlorophyll-*a* and reduces water clarity.

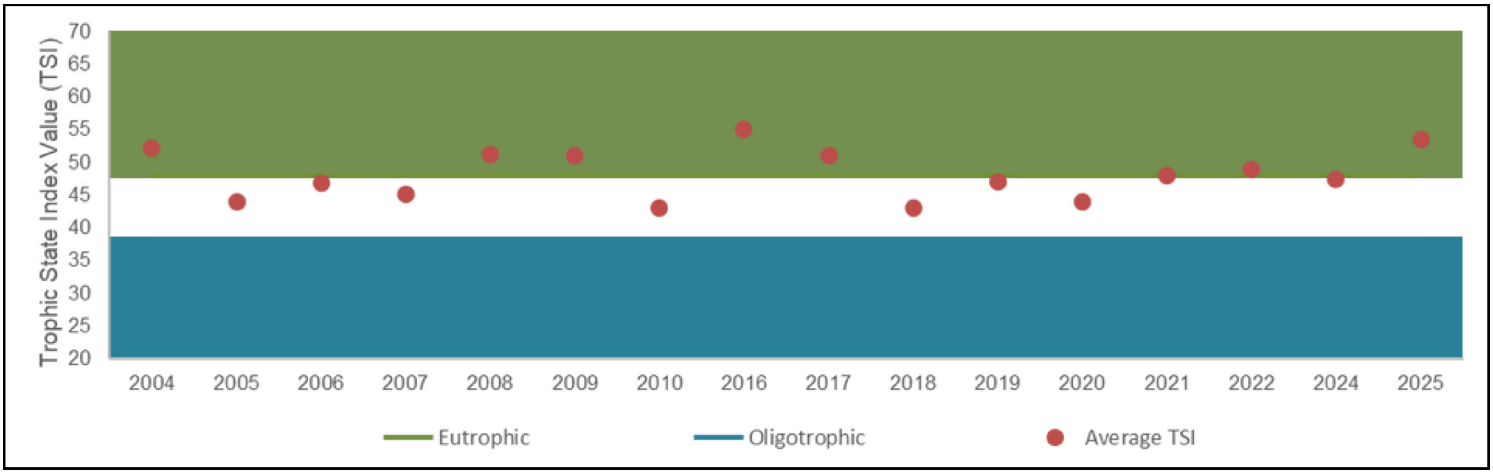
DETERMINING TROPHIC STATE

Carlson's Trophic State Index (TSI) was developed from mathematical relationships that allowed phosphorus, chlorophyll-*a*, and Secchi transparency readings to be converted to a numerical scale from 0 to 100, with increasing numbers indicating more productive lakes. TSI scores allow lakes to be classified as oligotrophic, mesotrophic, or eutrophic. Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes often maintain sufficient dissolved oxygen in the cool, deep water during late summer to support cold-water fish such as trout and whitefish. By contrast, eutrophic lakes are often shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen during the summer. Therefore, these lakes primarily support warmwater fish such as bass and panfish. Lakes that fall between these two extremes are called mesotrophic lakes. The table below provides a summary of lake classification criteria and shows how the TSI can be used to rate the trophic state of Michigan lakes.

LAKE CLASSIFICATION CRITERIA

Lake Classification	Michigan TSI Value	Total Phosphorus (ppb)	Chlorophyll-*a* (ppb)	Secchi Transparency (feet)
Oligotrophic	Less than 38	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	38 to 48	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 48	Greater than 20	Greater than 6.0	Less than 7.5

Historical data collected by Water Quality Investigators[1] and Spicer Group[2], along with recent measurements collected by Progressive Companies, were compiled to evaluate long-term trophic state trends in Paw Paw Lake. Average TSI values derived from spring phosphorus and summer chlorophyll-*a* and Secchi transparency data collected between 2004 and 2025 are shown in the graph below. Based on these metrics, Paw Paw Lake can be classified as meso-eutrophic, exhibiting characteristics of both mesotrophic and eutrophic lake systems. Although average phosphorus, chlorophyll-*a*, and water transparency vary from year to year, the long-term data place the lake near the boundary between mesotrophic and eutrophic conditions.



[1] Fusilier, W. E. (2010, November). Big Paw Paw Lake: 2004-2010 water quality studies. Water Quality Investigators.
[2] Spicer Group. (2023, March 1). 2022 summary of water quality results, Paw Paw Lake.

PROGRESSIVE COMPANIES