

NJDEP

Bureau of Freshwater & Biological Monitoring

Ambient Lake Monitoring Network



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Water Monitoring and Standards



NJDEP

Ambient Lake Monitoring Network

Topics Covered

- **Network Design**
- **Parameters analyzed**
- **Overview of Assessments and Results**
- **Statewide Status**



Network Design

- Renewed in 2005, designed to provide the water quality data necessary to assess the ecological health of the State's lentic water resource and assess support of aquatic life use.
- Probabilistically-based using EPA's Generalized Random Tessellation Stratified (GRTS) survey design, equalized over all Omernik Level III Ecoregions.
- The target population: all NJ lakes(1,100), man-made or natural, wholly or partially within NJ's political boundaries, except water supply reservoirs.
- A lake is further defined as a permanent body of water of at least two (2) hectares in size, and a depth of approximately one meter at the deepest point measured.

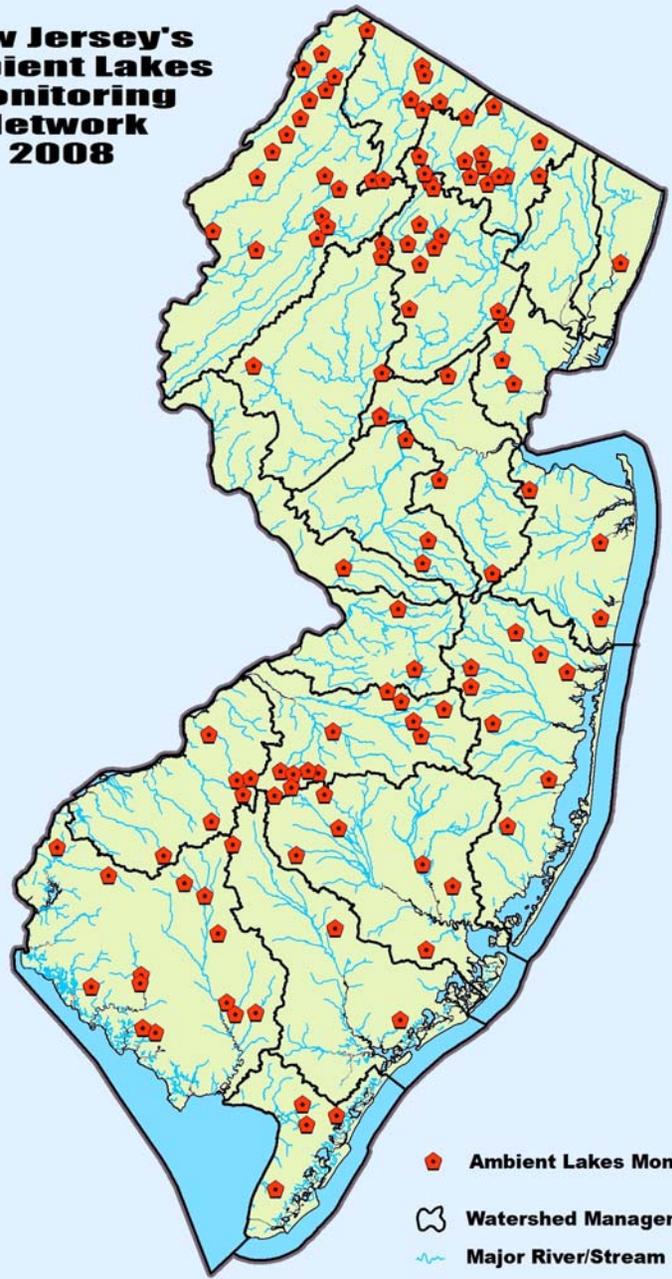


Network Design

- 200 lakes in Network.
- 40 lakes (Panel) sampled per year.
- Sampling Frequency: each lake sampled 3 times during the year.
(Spring, Summer, and Fall).
- As many as 3 in-lake stations and outlets sampled at each lake.
- Each lake re-visited every five years.



**New Jersey's
Ambient Lakes
Monitoring
Network
2008**



- ◆ Ambient Lakes Monitoring Site
- ⊞ Watershed Management Area
- ~ Major River/Stream



Sample Parameters

- ✓ Total Phosphorus
- ✓ Total Kjeldahl Nitrogen
- ✓ Nitrite+Nitrate Nitrogen
- ✓ Ammonia Nitrogen
- ✓ Secchi depths
- ✓ Chlorophyll "a"
- ✓ Dissolved Oxygen
- ✓ Temperature
- ✓ Specific Conductance
- ✓ pH
- ✓ Alkalinity
- ✓ Hardness
- ✓ Turbidity



Trophic Status Assessment



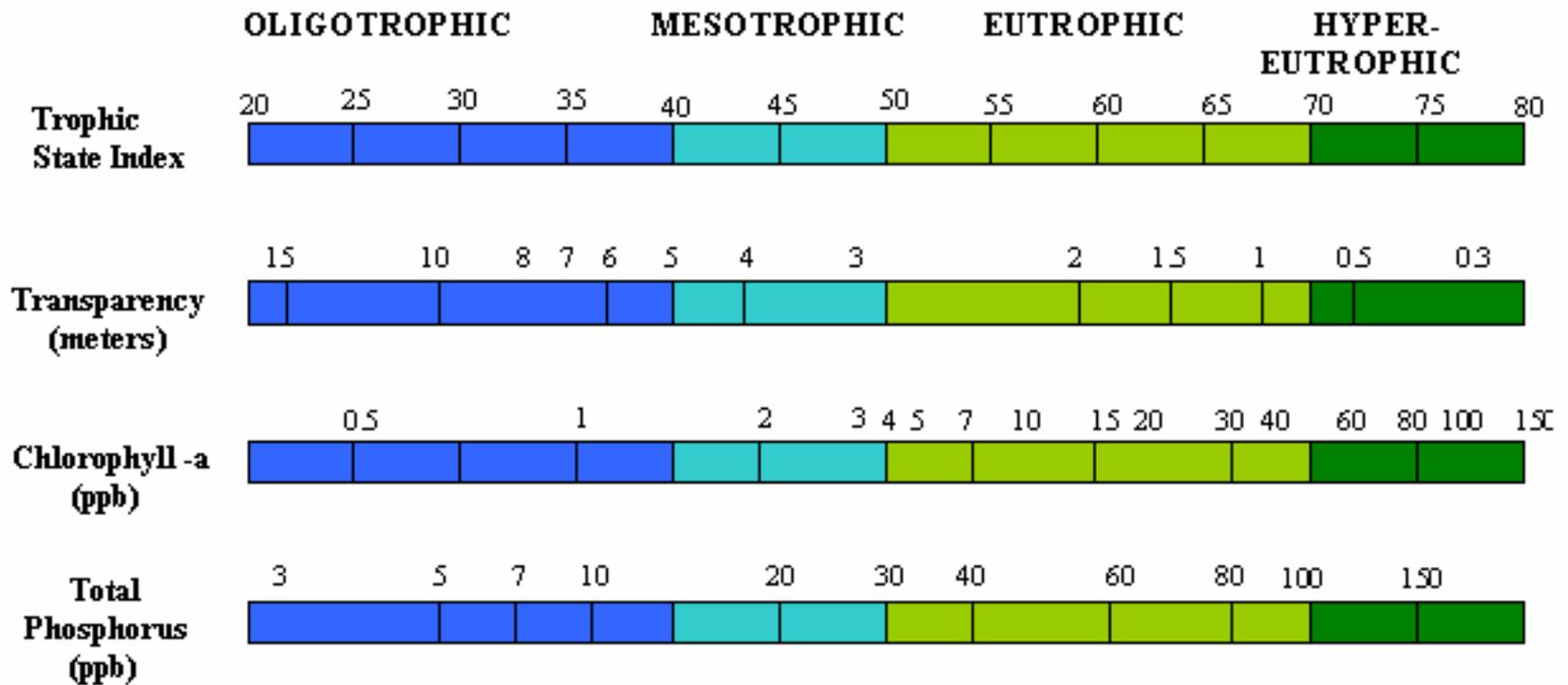
Trophic Status Assessment

- Lakes are frequently divided into two (2) types: oligotrophic and eutrophic. These two types represent the extreme ends of a lake aging (eutrophication) continuum.
- Cultural eutrophication can rush oligotrophic lakes into the eutrophic conditions in a matter of a human generation or two.



Trophic Status Assessment

Carlson's Trophic State Index (TSI)



Trophic Status Assessment

- TSI can be calculated for *any* of the parameters measured.
- Strong agreement between the results of the three TSI parameters within each lake station.
- For the purpose of assessing New Jersey Lakes: final TSI result for each in-lake station is the mean of TSI's for each parameter.



Trophic Status Assessment

TSI parameters converted to
standard units*

- Total Phosphorus

$$(TSIP) = 14.12 \ln(TP) + 4.15$$

- Chlorophyll "a"

$$(TSIC) = 9.81 \ln(\text{Chl } \underline{a}) + 30.6$$

- Secchi Disk

$$(TSIS) = 60 - 14.41 \ln(SD)$$

*Minnesota Lake Water Quality Assessment



TSI Converted Values

■ **Oligotrophic. 0 to 40.**

Lakes have low nutrient levels, are usually deep, and have high oxygen levels in the bottom waters. These lakes have very few algal blooms.

■ **Mesotrophic. 41-50.**

Lakes are in the "middle" of the trophic scale. They have increasing amounts of nutrients and slightly lower amounts of dissolved oxygen. There are temporary algae and aquatic plant problems.

■ **Eutrophic. 51-70.**

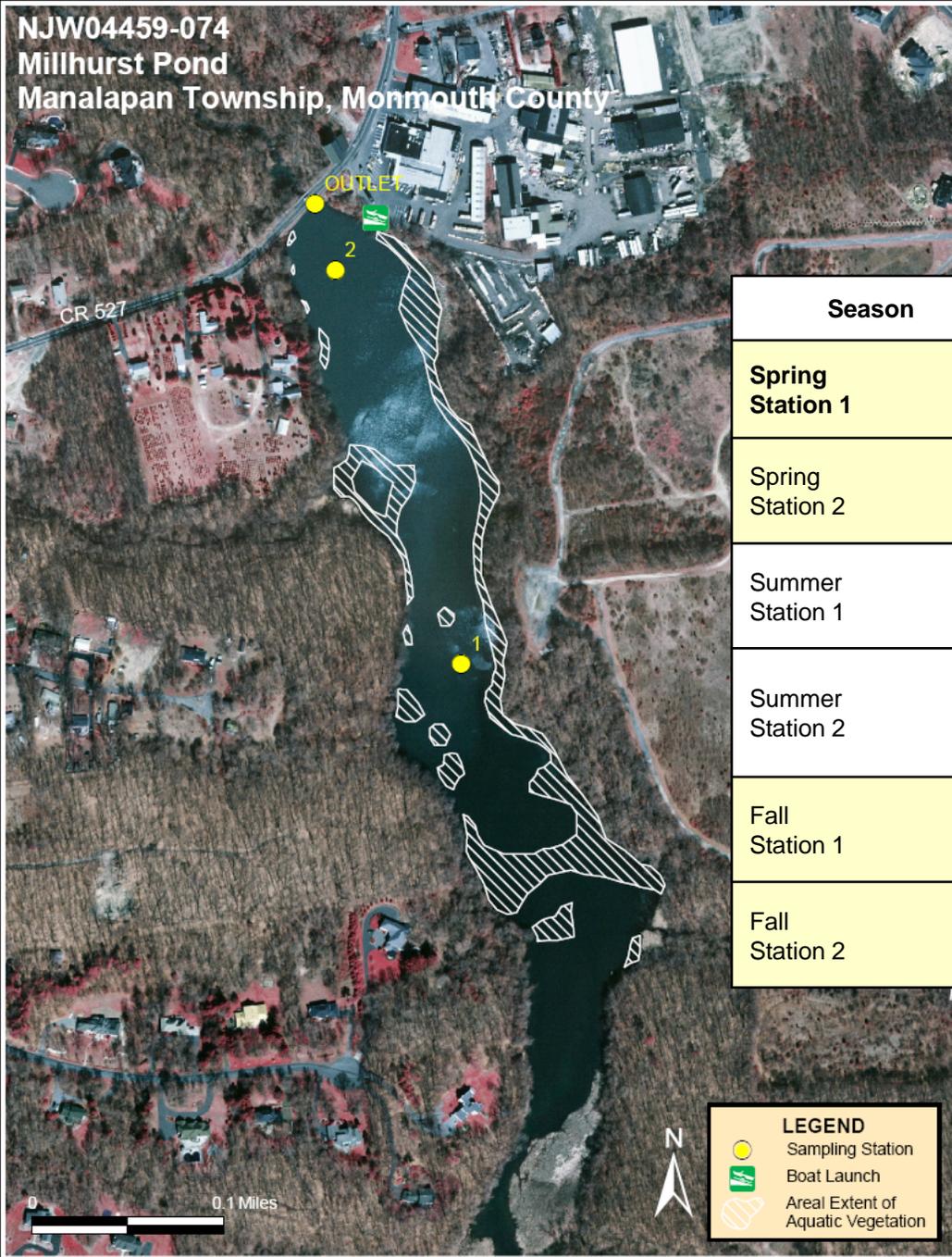
Lakes are nutrient rich. They are usually shallow, "green" lakes that have limited oxygen levels in the bottom waters. They have persistent algae and aquatic plant problems.

■ **Hypereutrophic. >70.**

Lakes are very green and have little or no oxygen in the bottom layers. There are extreme algae and aquatic plant problems.



NJW04459-074
 Millhurst Pond
 Manalapan Township, Monmouth County



Season	TSIP	TSIC	TSIS	TSI
Spring Station 1	51.13	48.81	B	49.97 Mesotrophic
Spring Station 2	54.13	55.84	61.52	57.16 Eutrophic
Summer Station 1	60.27	48.18	B	54.22 Eutrophic
Summer Station 2	44.13	46.19	58.63	49.65 Mesotrophic
Fall Station 1	60.85	53.57	69.99	61.47 Eutrophic
Fall Station 2	57.34	49.55	58.63	55.17 Eutrophic

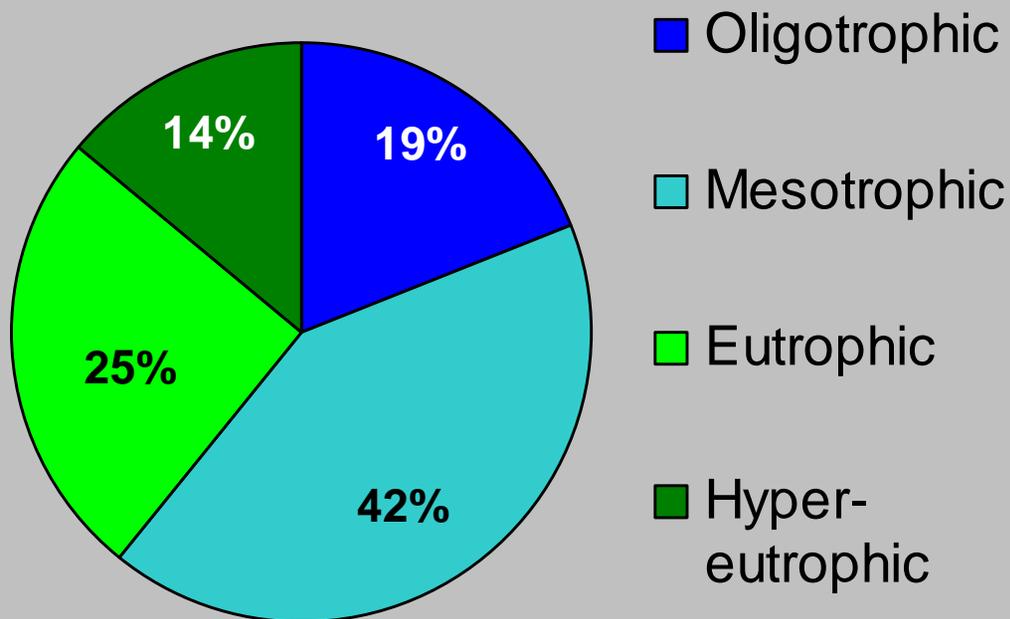
LEGEND

- Sampling Station
- Boat Launch
- Areal Extent of Aquatic Vegetation



Statewide Lake Trophic Status To Date

Trophic Status of Panel 1 & 2 Lakes



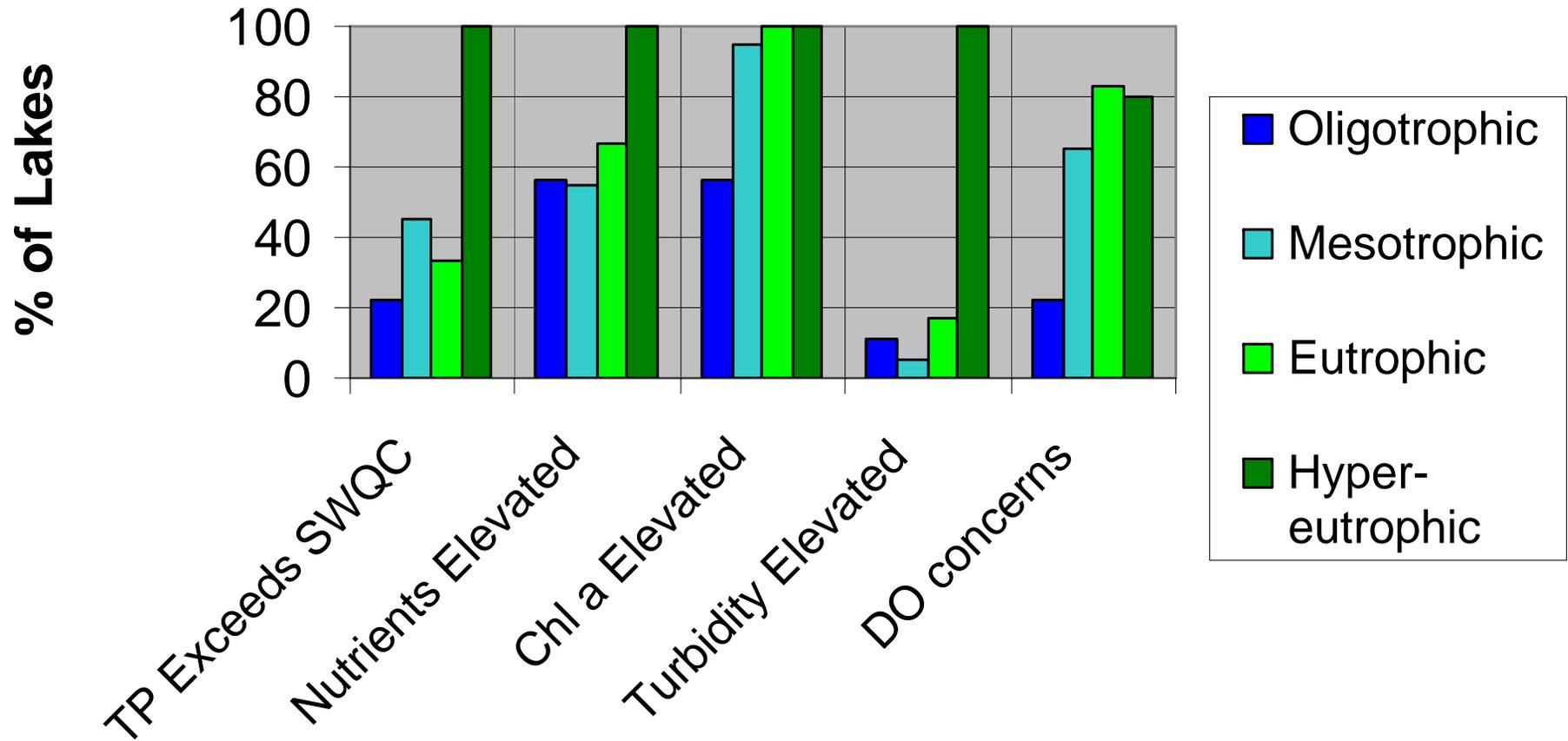
The percentage of lakes is defined as lakes exhibiting a particular trophic state at any time during the three sampling seasons.



Physical/ Chemical Results Summary



Chemical Results Summary



Total Phosphorus (TP)

- Lakes exceeding the SWQC (0.05mg/l) for TP in two separate visits are listed as non-support of aquatic life use.
- When TP levels were elevated, algae concentrations as measured by Chlorophyll "a", were also elevated. When these individual TSI parameters (TP and Chlorophyll "a") are approximately equal, it can be inferred that TP limits the algae growth.
- Seasonal variation; TP higher in summer.



Other Nutrients

- 38% of lakes, sampled all 3 seasons, exhibited a seasonal fluctuation in Nitrite + Nitrate Nitrogen which correlated to the seasonal fluctuation in the lake's trophic state.
- Nitrite + Nitrate Nitrogen was elevated in the spring, decreased significantly in the summer, then rose again in the fall.
- In most of these lakes, an oligotrophic or mesotrophic state was present in the spring, eutrophic in the summer, and many went back to an oligotrophic or mesotrophic state in the fall.



Other Significant Parameters

- Supersaturated Dissolved oxygen (greater than 100% saturation) corresponded with high Chlorophyll a.
- DO < 4.0 mg/l measured in two separate visits is listed as non-support of aquatic life use.
- Turbidity also showed a strong correlation to a lake's trophic state.



Potential Stressors/ Further Studies

- Storm water outfalls. Total Nitrite + Nitrate, Total Phosphorus, turbidity, were more apt to be elevated when outfall pipes were present.
- Atmospheric precipitation and fallout from urban contaminants.
- Heavy fertilization in agricultural regions, the phosphorus content of precipitation is much higher during the active growing (summer) season.
- Release of sediment bound phosphorus due to changes in sediment-water interface.



NJ Statewide Status Summary

- All lakes exhibited degrees of eutrophication depending on the season and/ or area of the lake sampled. Accordingly, this data demonstrates that NJ lakes are in, or accelerating towards, an entirely eutrophic state.
- Total Phosphorus, Nitrite + Nitrate Nitrogen , and Chl a have best correlation to trophic state.
- Definitive statewide assessment of New Jersey's lakes cannot be performed until data for the entire network of 200 lakes is collected.



- **Additional information on the Ambient Lakes Monitoring Program can be obtained from WM&S' Bureau of Freshwater & Biological Monitoring by calling 609-292-0427 or visiting its website at:**
www.state.nj.us/dep/wms/bfbm.

