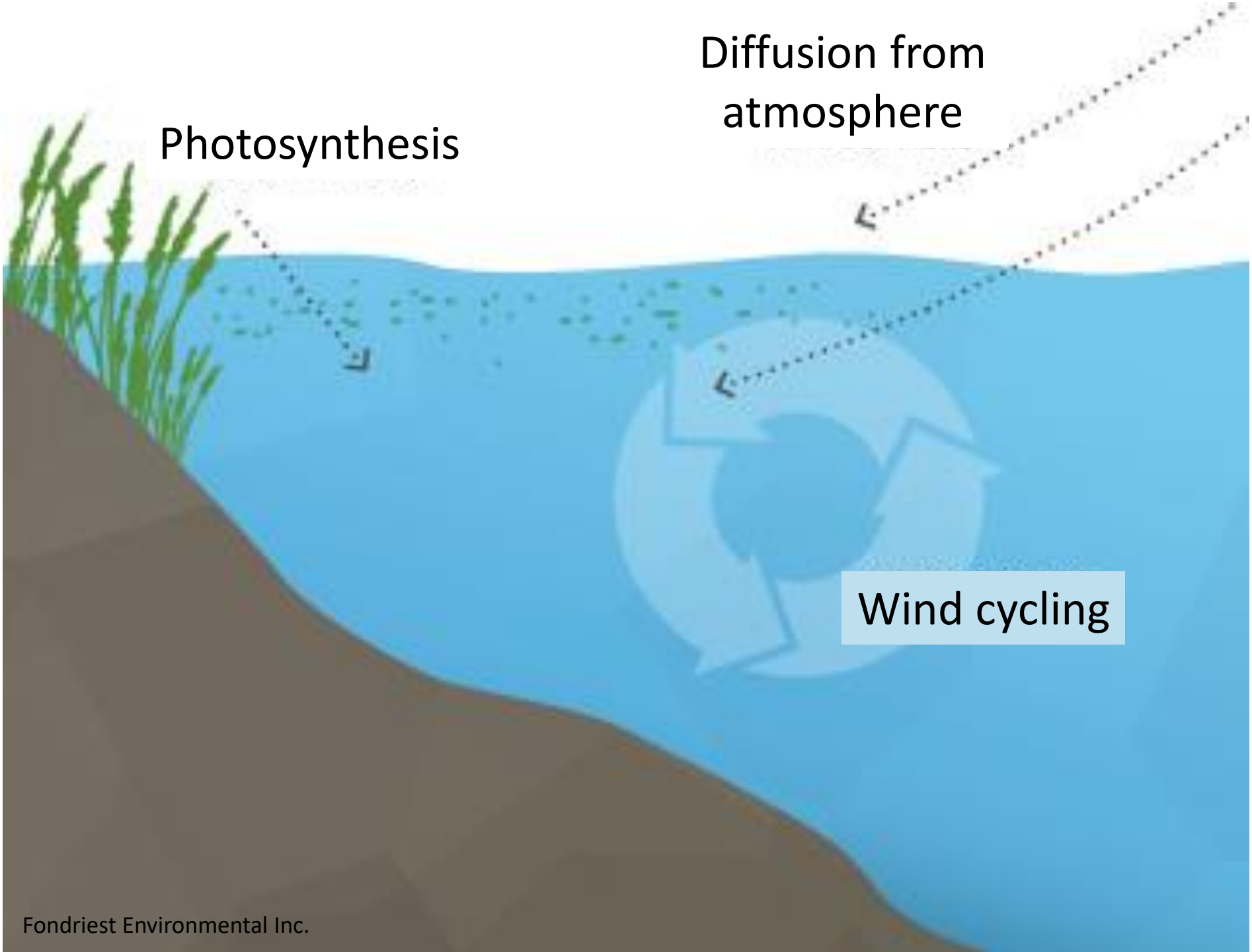
Monitoring Dissolved Oxygen in Lakes

Katie Hein

WDNR



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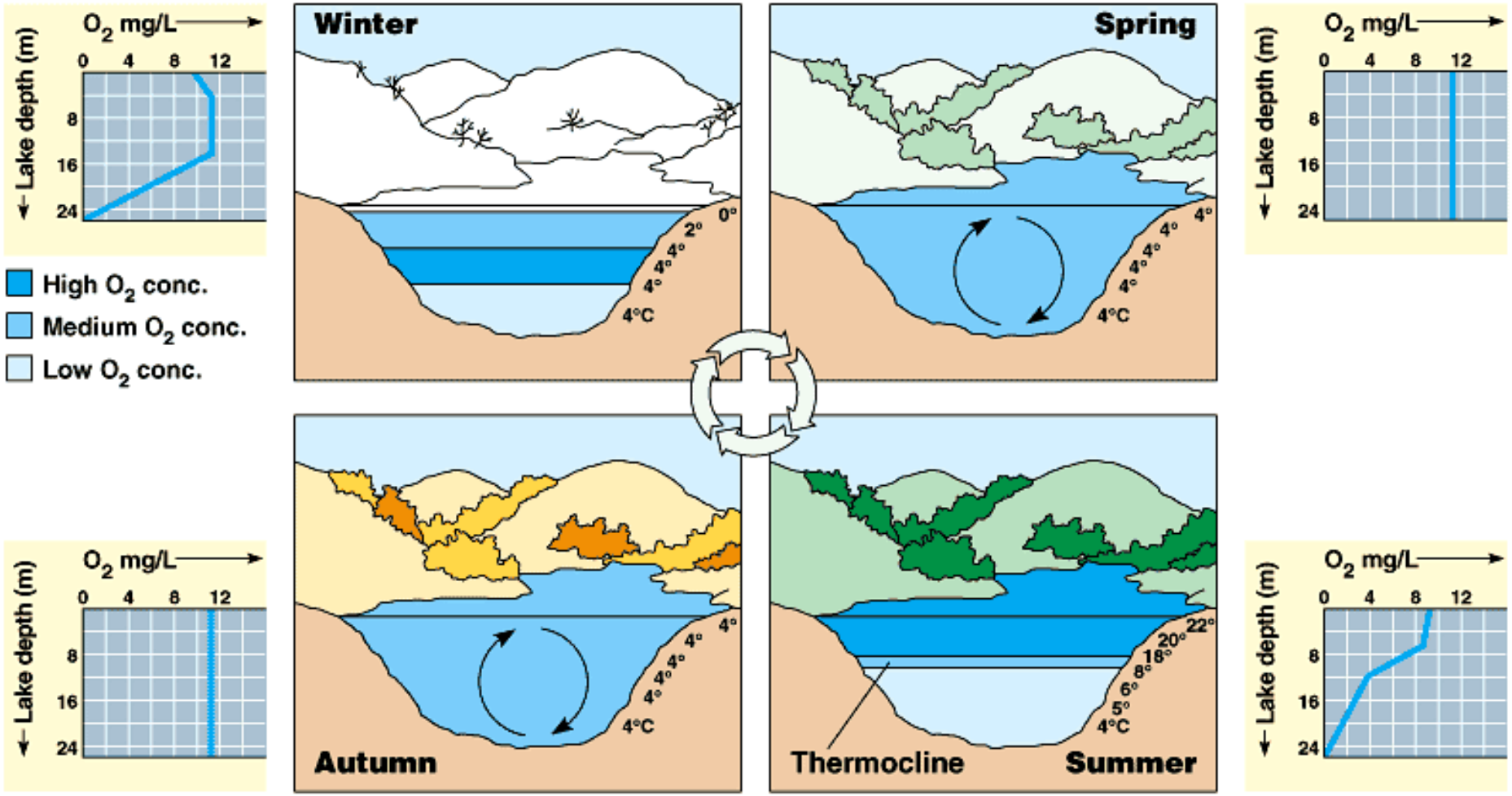
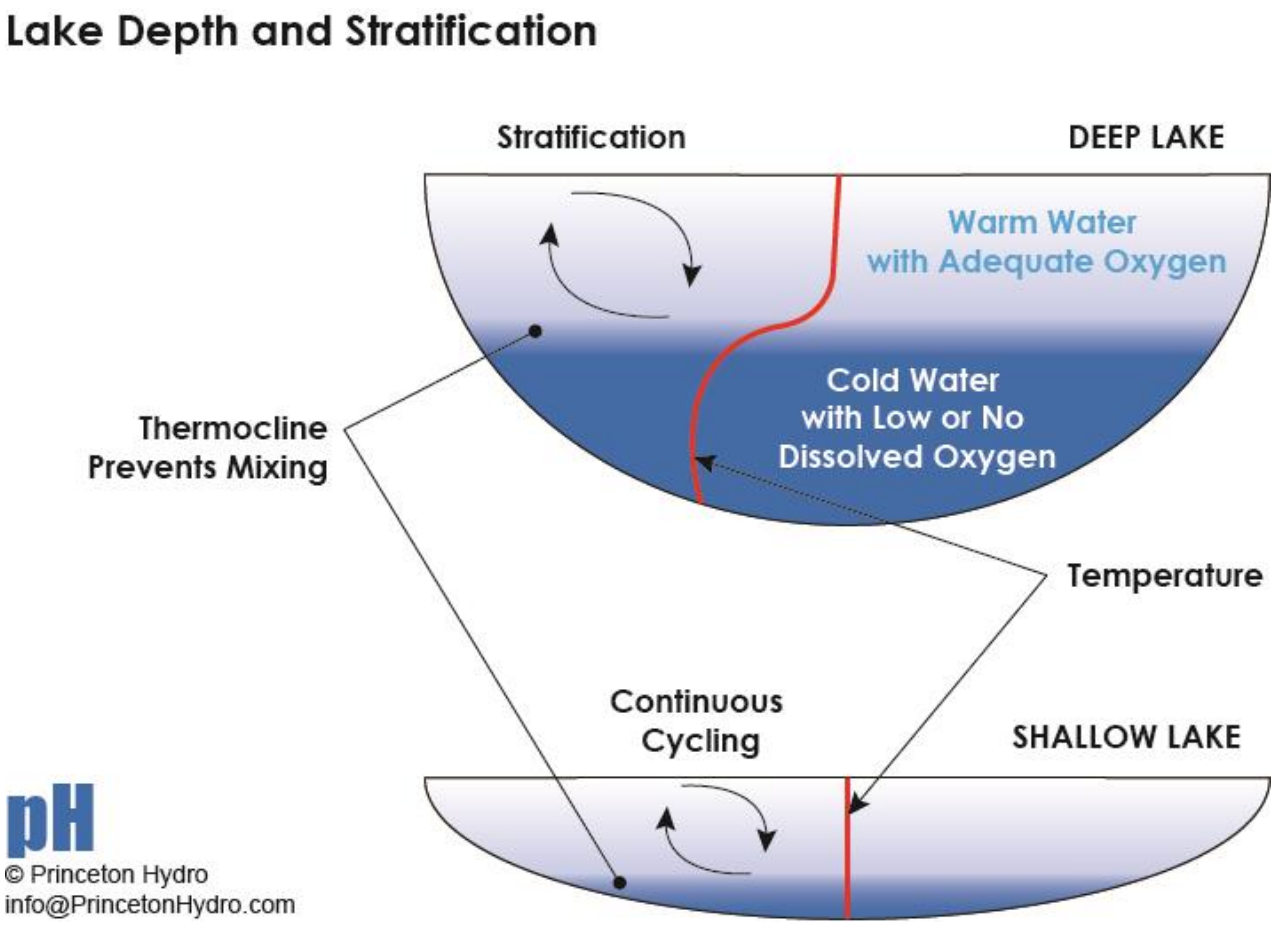
Lake Stratification by Season

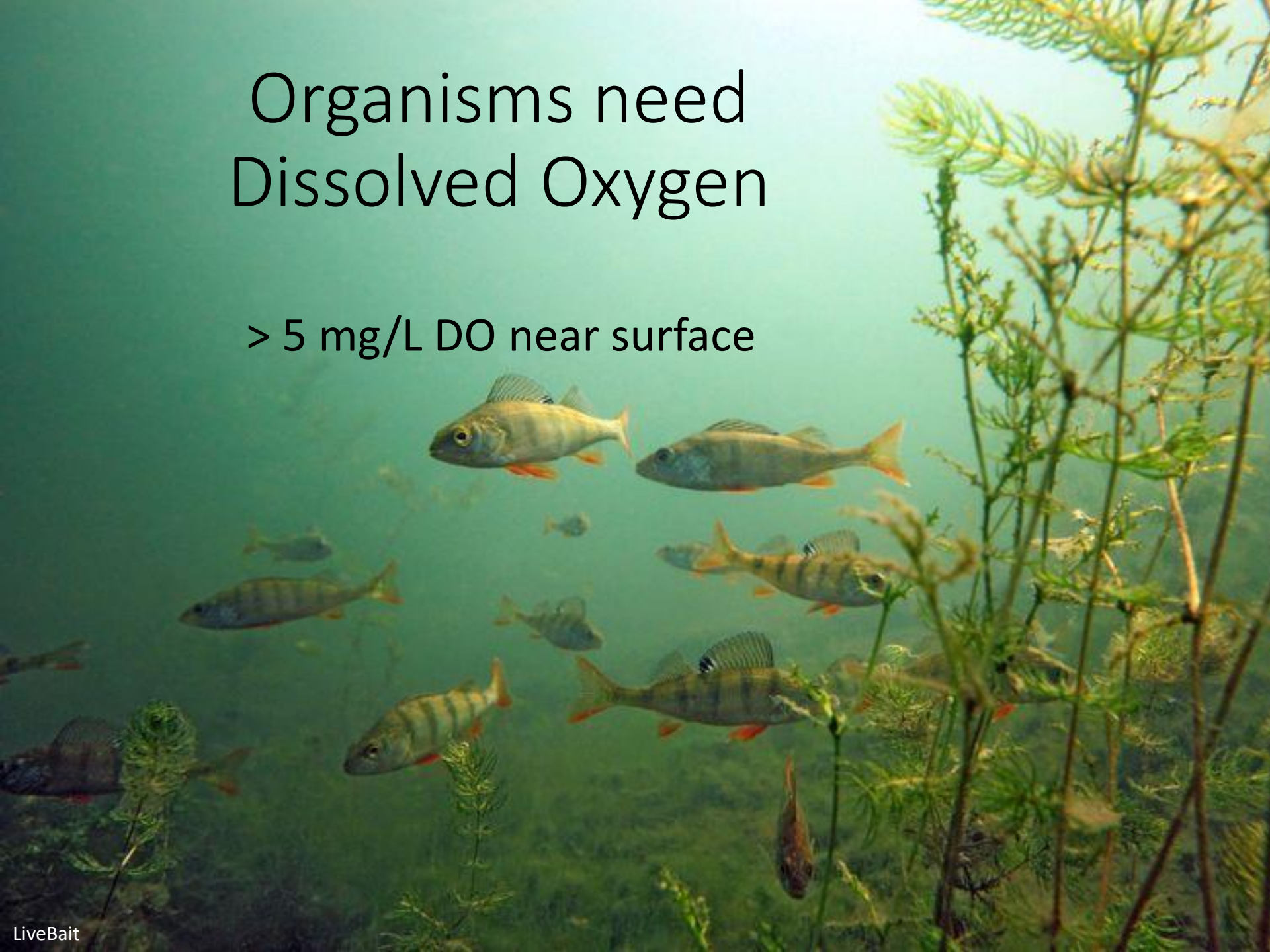


Lake Stratification by Depth



Organisms need Dissolved Oxygen

> 5 mg/L DO near surface



LiveBait

Coldwater fish need oxygenated cold water

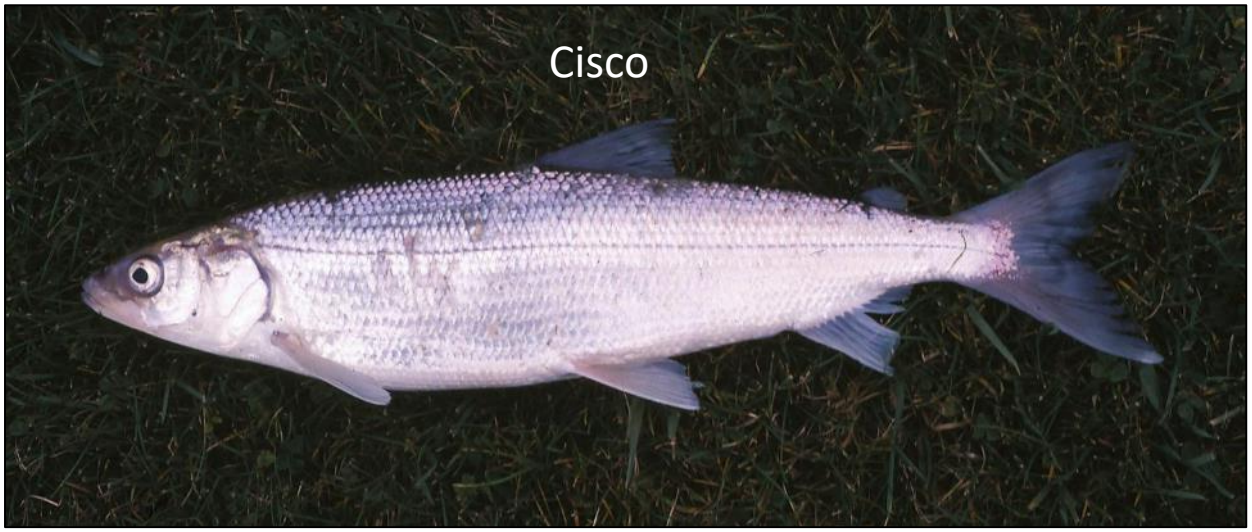
Dissolved Oxygen > 3 mg/l

Water Temperatures

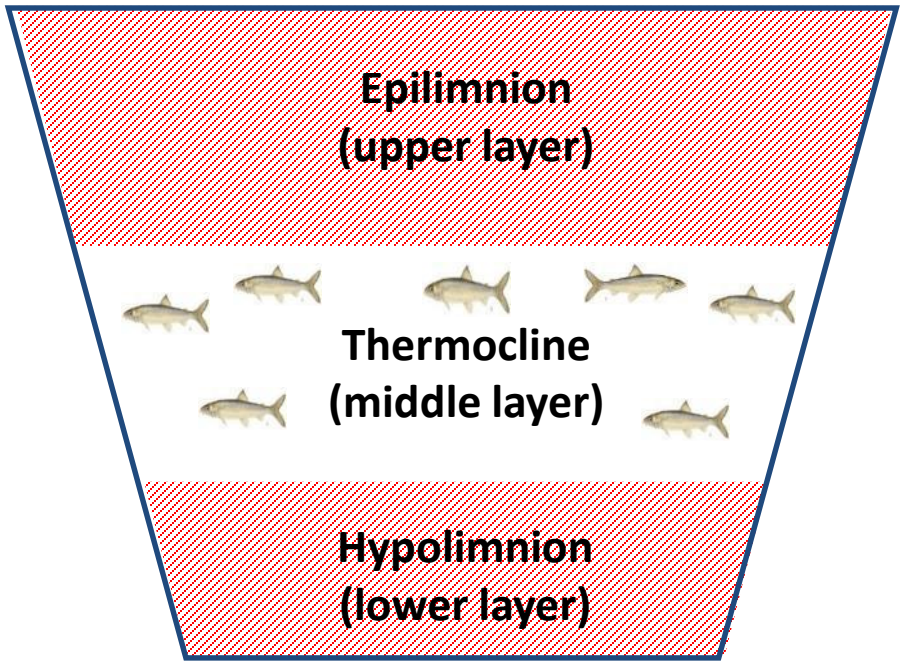
< 73°F Cisco and Brook, Brown, and Rainbow Trout;

< 66°F Lake Whitefish;

< 57°F Lake Trout



Coldwater fish need oxygenated cold water



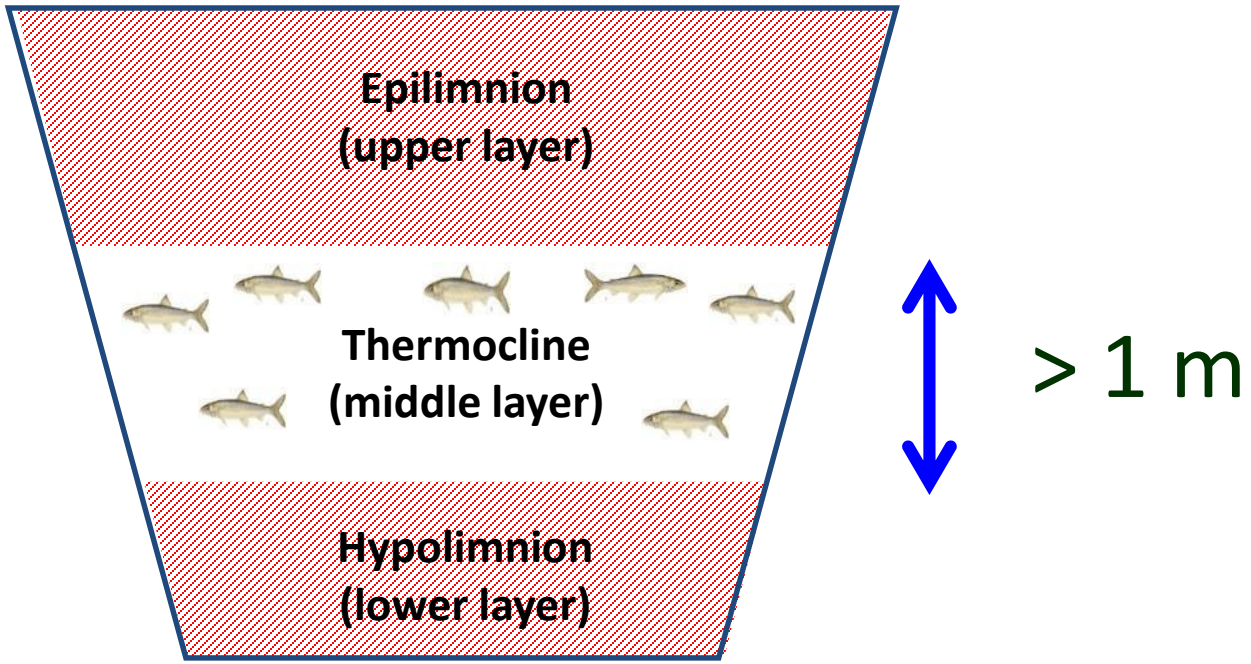
Plenty of oxygen
But TOO WARM

Cool enough
Sufficient oxygen*

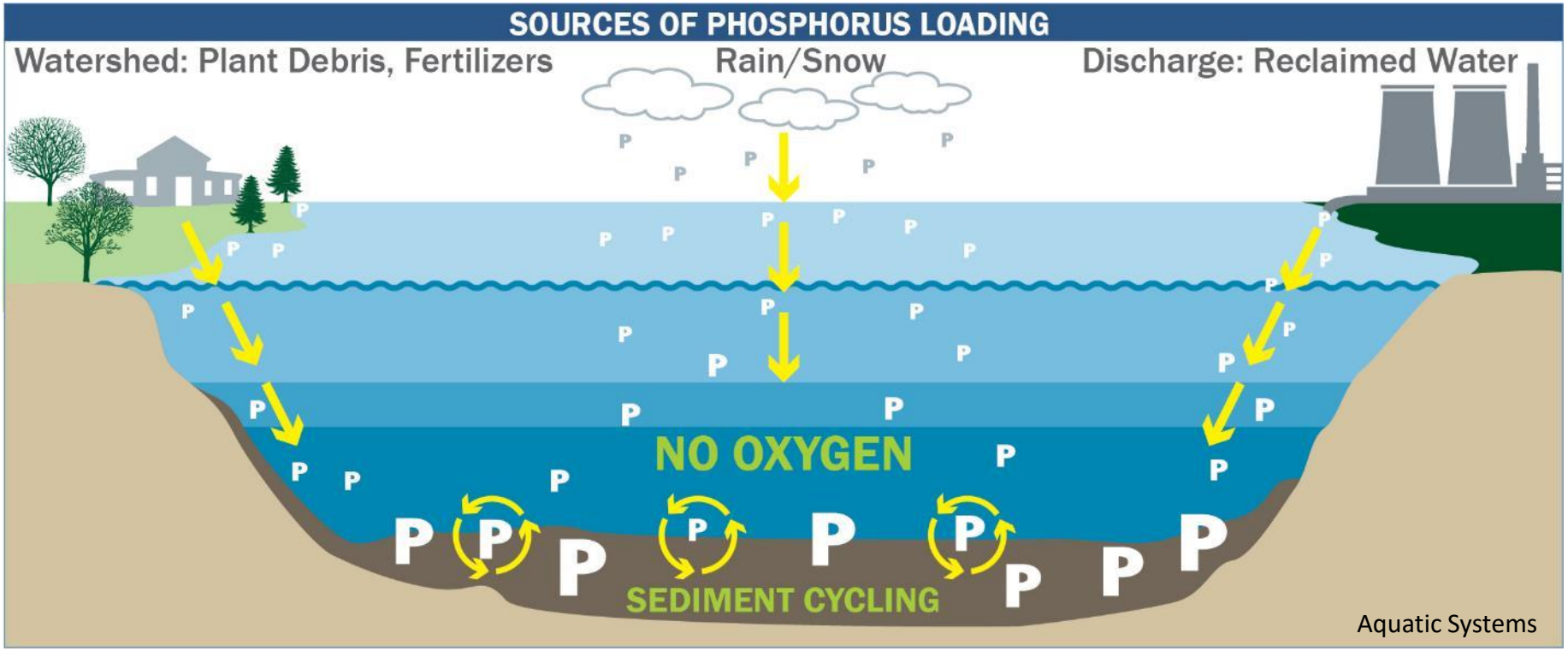
Nice and cold
But NO OXYGEN

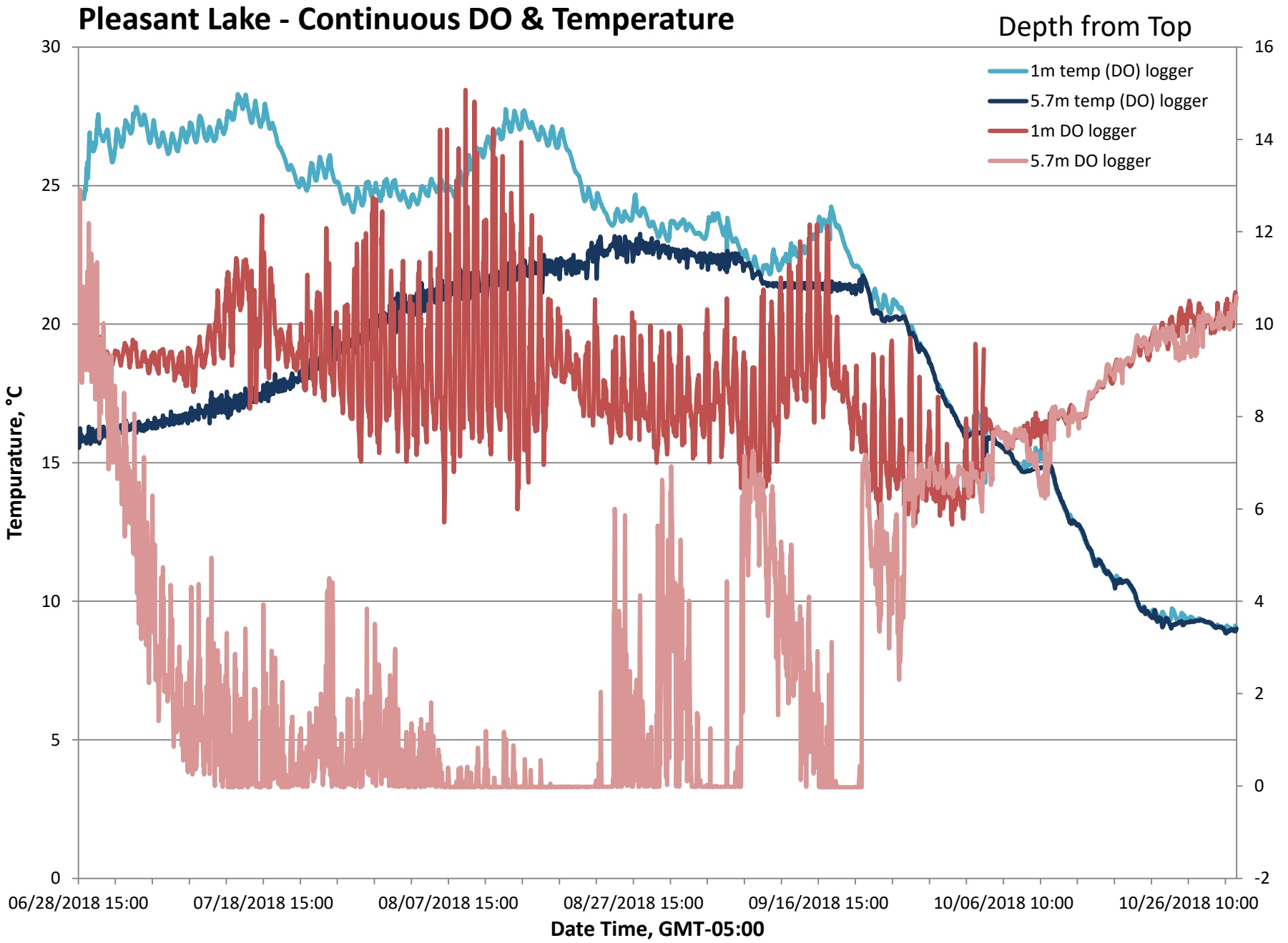
** If summer gets longer or if eutrophication occurs, Thermocline (middle layer) may run out of oxygen, resulting in fish kill*

Coldwater fish need oxygenated cold water

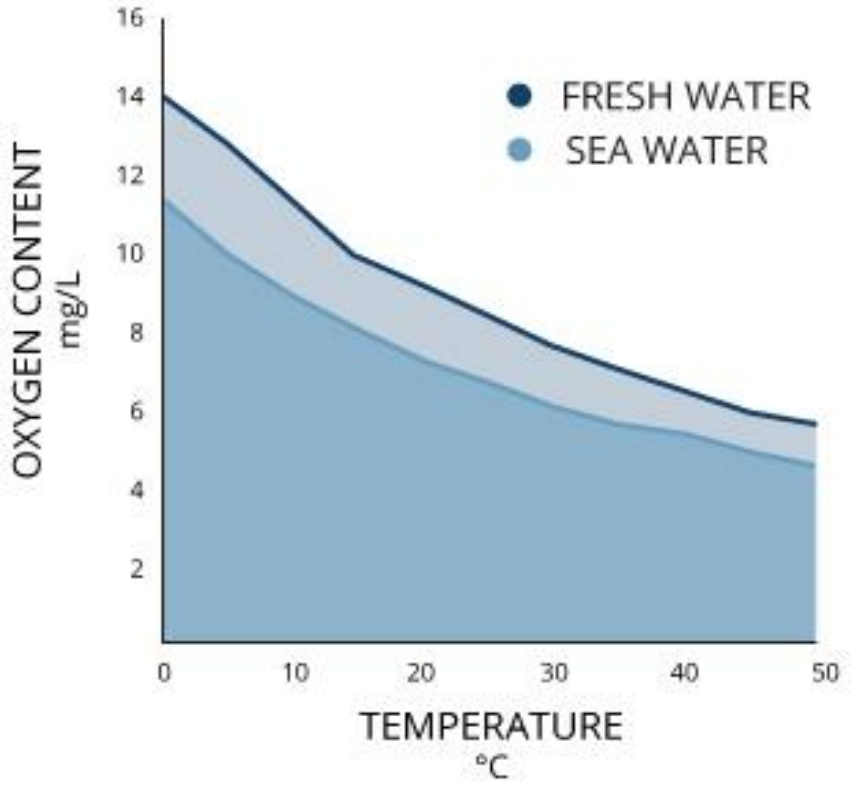


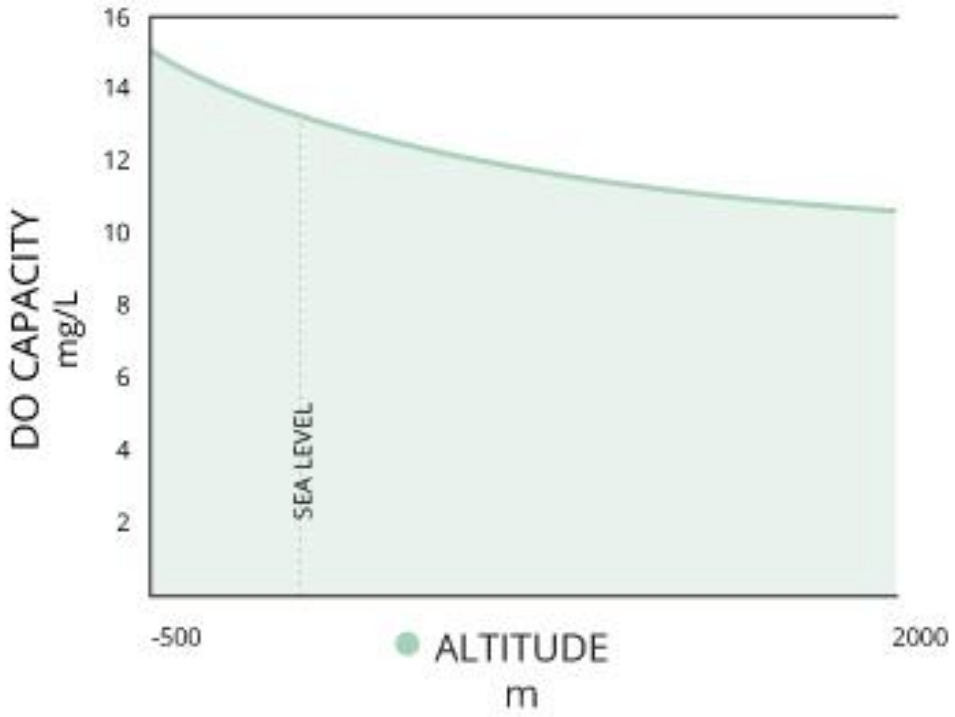
Oxygen influences the phosphorus cycle




Pleasant Lake - Continuous DO & Temperature
Depth from Top
1m temp (DO) logger
5.7m temp (DO) logger
1m DO logger
5.7m DO logger
Tempurature, °C
DO conc, mg/L
Date Time, GMT-05:00
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
-2
06/28/2018 15:00
07/18/2018 15:00
08/07/2018 15:00
08/27/2018 15:00
09/16/2018 15:00
10/06/2018 10:00
10/26/2018 10:00

Dissolved Oxygen Solubility Depends on Temperature, Salinity, & Pressure





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How to measure DO

Winkler Titration

Multiparameter Meter

Two Types of DO Meters

Optical (ODO)

Polarographic or Galvanic

Many Models

- Refer to your user manual
- Call company for technical support

Multiparameter Meters Require Maintenance and Calibration

Tender Loving Care

Keep it clean!

- Rinse with tap water after use
- Clean optical with moist lens cleaning tissue
- Never use solvents
- Maintain clean and greased O-rings
- Maintain clean and dry sensor ports

Short-term storage (< 30 days)

- Store in calibration cup with small amount of water (don't cover sensors)

- Long-term storage
  - Remove batteries
  - Store optical (ODO) sensor in calibration cup filled with distilled water
  - Store polarographic or galvanic sensor in calibration cup – dry or wet

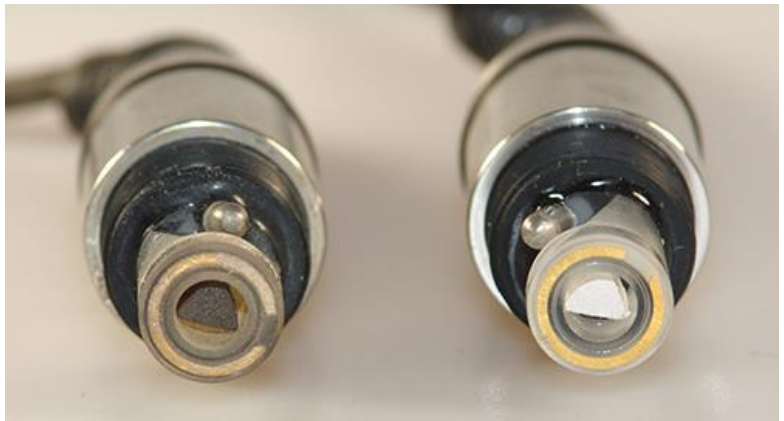
Replace Parts

Optical

- Inspect sensor cap for scratches in paint/dye layer
- Replace cap every 1-2 years

Polarographic

- Replace membranes and solution ~1-2 months or if bubbles present or deposits of dried electrolyte visible
- Sand tarnished metal
- Sensor lasts ~5 yrs



Calibrate EVERY day you use it!

Calibration supplies

- Multiparameter meter
- Distilled or tap water
- Sponge
- Calibration log
- Pencil
- Elevation
- Barometric pressure correction table

Water-saturated air (100%) DO Calibration

1. Turn on meter – warm up for ~10 minutes
2. Visually inspect sensor
3. Ensure temperature readings are accurate
4. Correct for barometric pressure
5. Ensure settings are for freshwater
6. Moisten sponge in calibration chamber
7. Place sensor in calibration chamber with small amount of water or damp sponge
8. Calibrate to 100% saturation
9. Accept calibration when stable
10. Check for drift – meter should read ± 1% (optical) or 2% (polarographic) of calibration value ~ 10 min later

Barometric Pressure – calibration procedure depends on model

1. meter measures barometric pressure directly
2. you enter the elevation – make sure to use proper units (ft or m)
3. you enter the barometric pressure
   - do NOT enter barometric pressure from weather station
   - you must UNCORRECT for sea level based on your altitude

Uncorrecting Barometric Pressure

Elevation in Madison is 873 ft

Barometric pressure = 29.84 inches

Uncorrected BP = 29.84 * 0.971

= 28.97

~ 29.84 - 0.9

Altitude (feet)	Multiplication Factor*	Subtraction Factor** (mm)	(in)
550	0.981	15.0	0.6
600	0.979	16.3	0.6
650	0.978	17.8	0.7
700	0.976	19.1	0.8
750	0.974	20.3	0.8
800	0.973	21.8	0.9
850	0.971	23.1	0.9
900	0.969	24.4	1.0

Keep a Calibration Record

- Serial number
- Your name
- Date/Time
- Warmup time (minutes)
- Temperature
- Instrument BP
- Uncorrected BP
- D.O. pre-cal
- D.O. post-cal
- D.O. from solubility chart
- Drift check (D.O. 10 min later)

Track in SWIMS

- Record model of meter
- Record whether you calibrated the meter for DO that day


Thanks to Jim Klosiewski