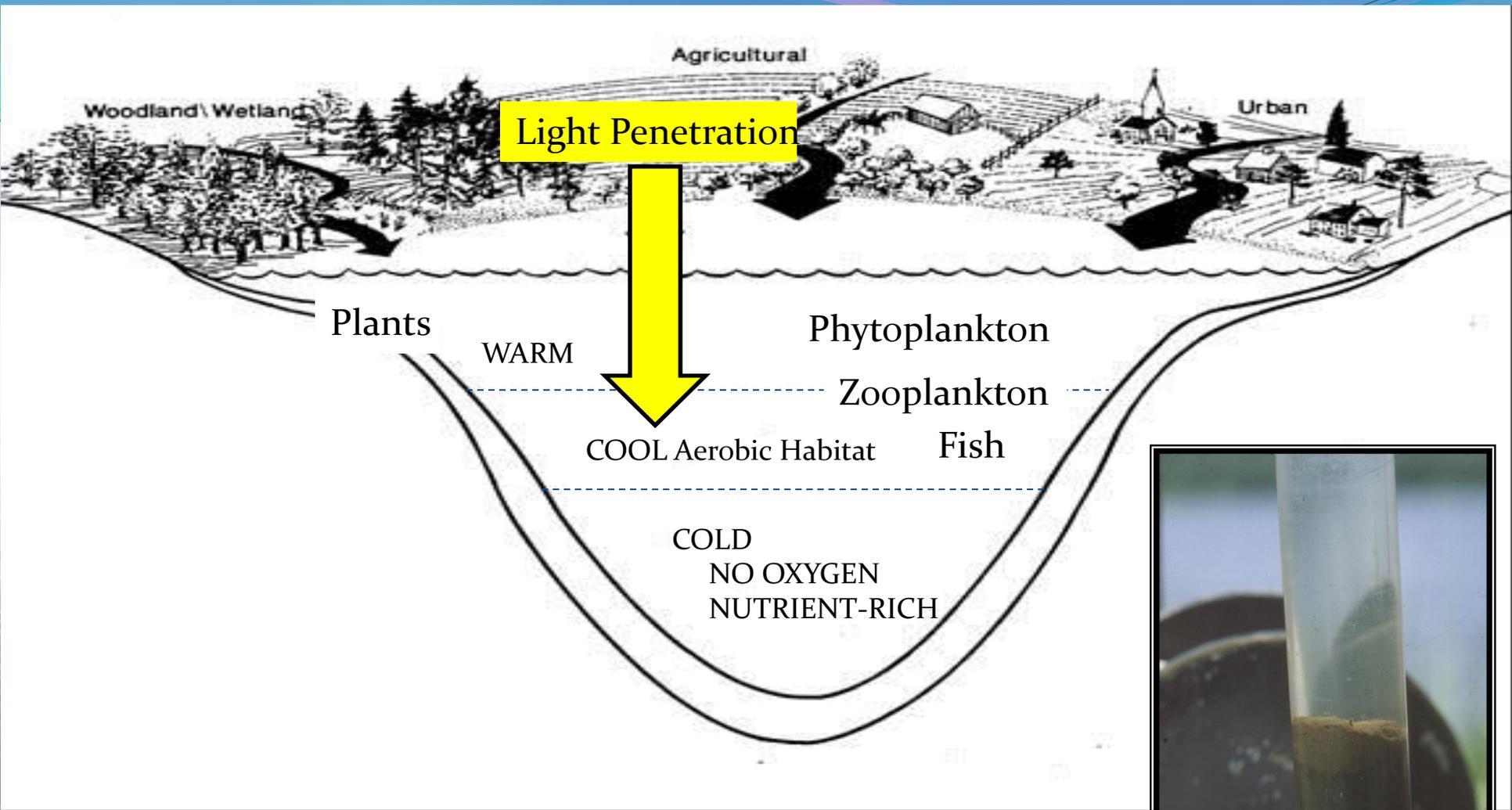


Wangumbaug



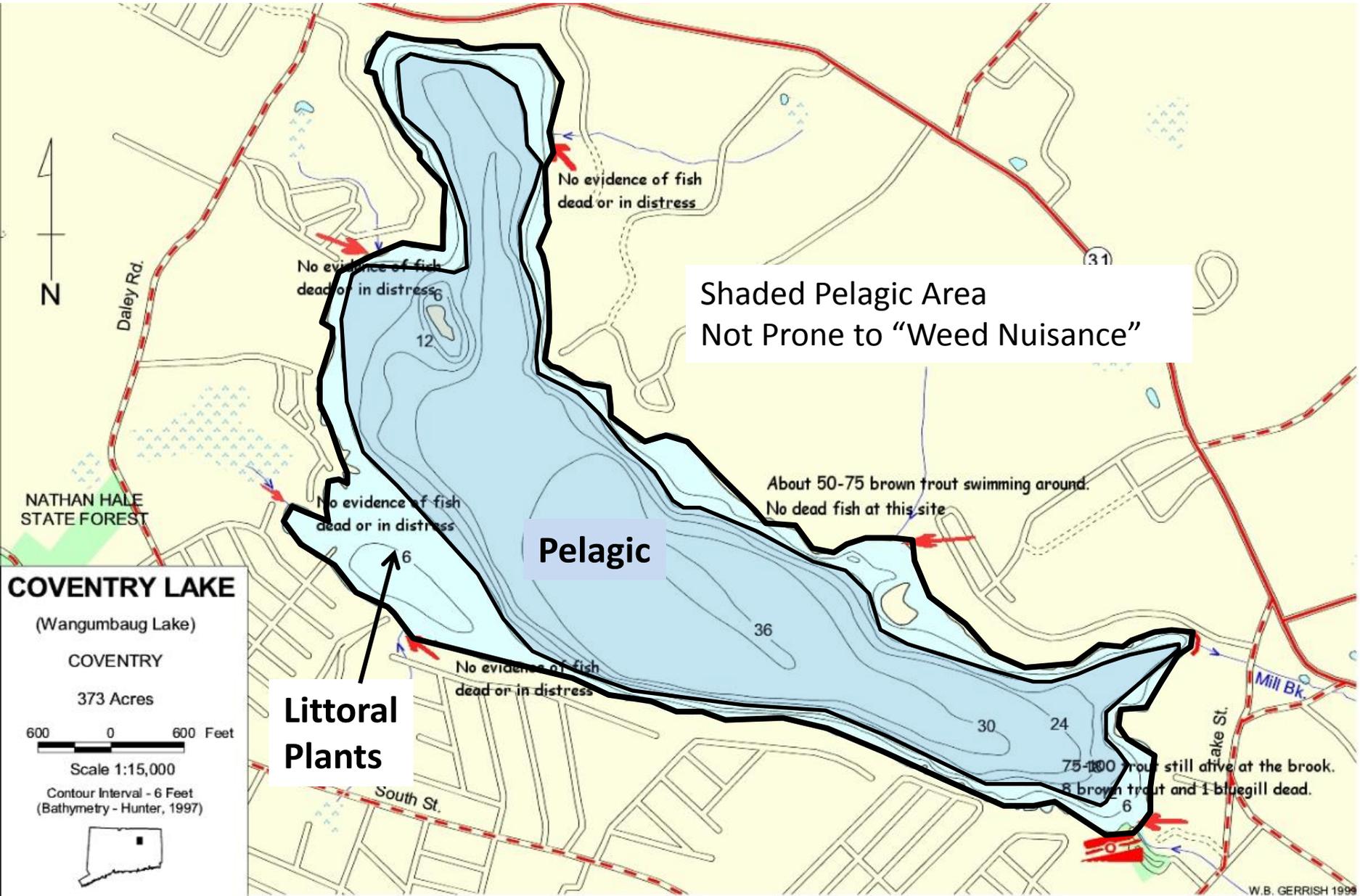
*Robert (Bob) Kortmann, Ph.D.
Ecosystem Consulting Service, Inc.*

www.EcosystemConsulting.com



Nutrient-rich muck in most areas

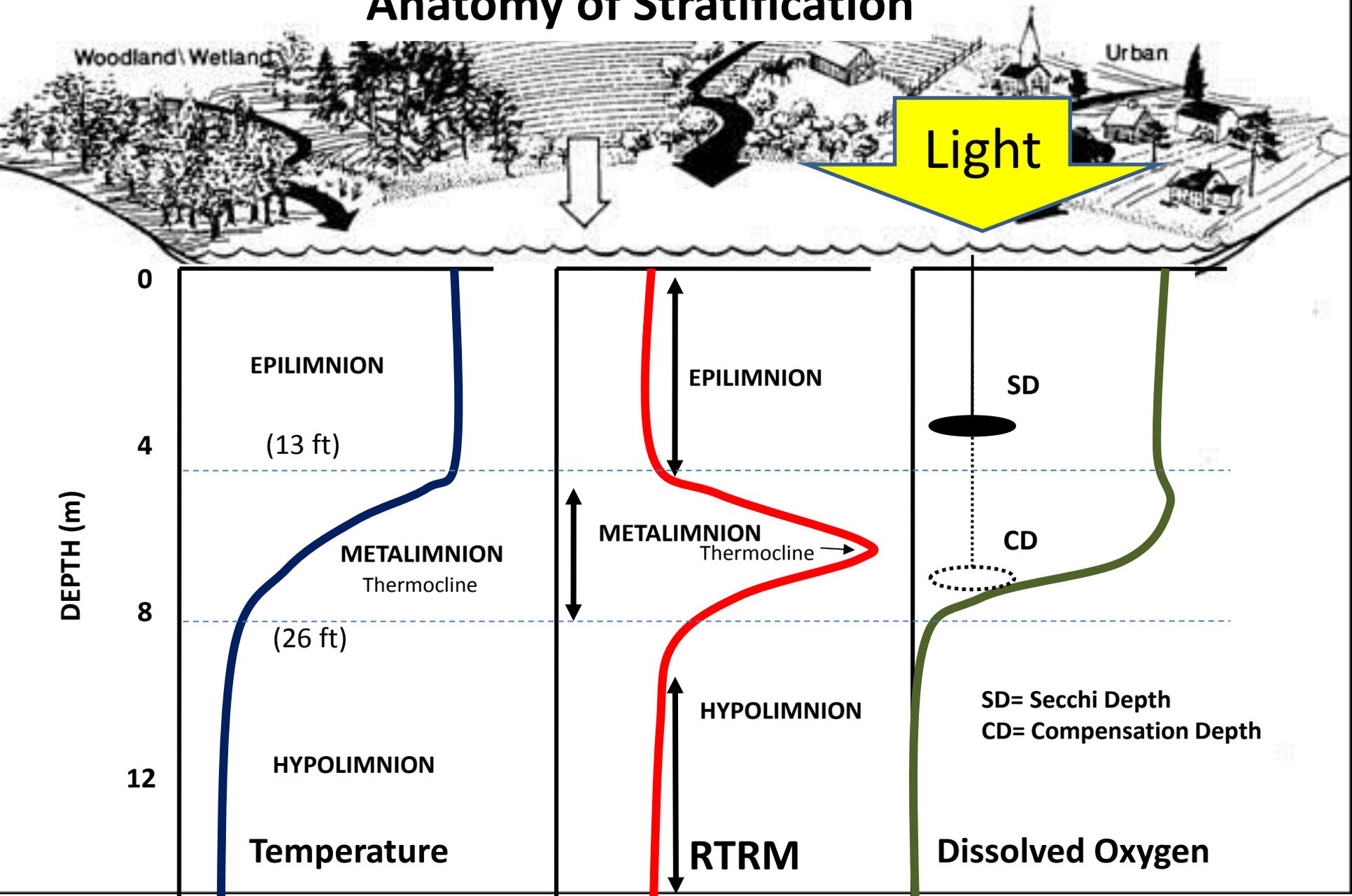




Source: CT DEP Fisheries Unit Notes August 2009

2009 Trout were stressed by Temperature-Oxygen Conditions in August 2009

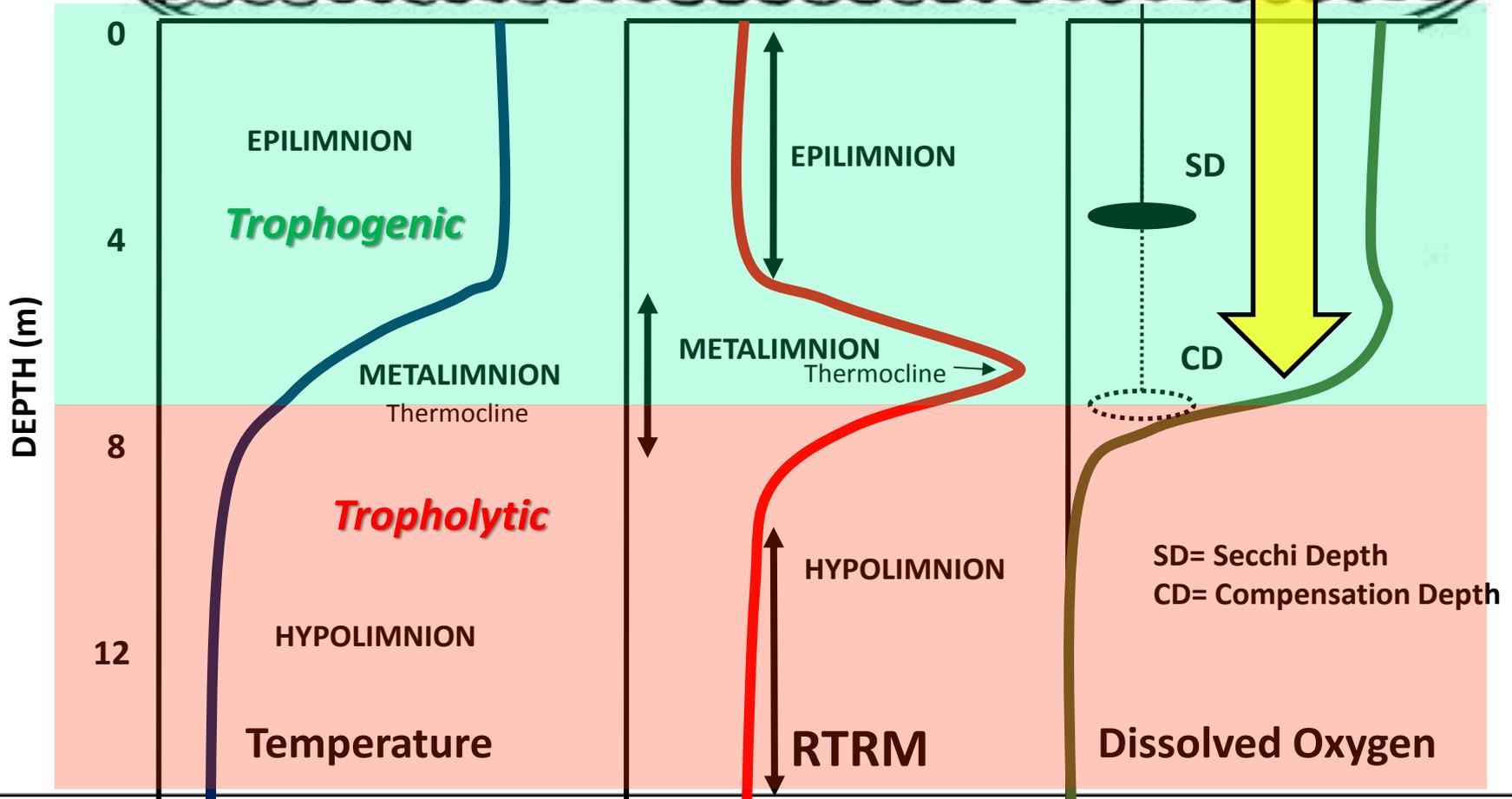
Anatomy of Stratification



Light Penetration Control of Anoxic Boundary

Anatomy of Stratification

Compensation Depth Penetrates the Metalimnion
(i.e. Secchi Disk Depth > ½ the Epilimnion Thickness)

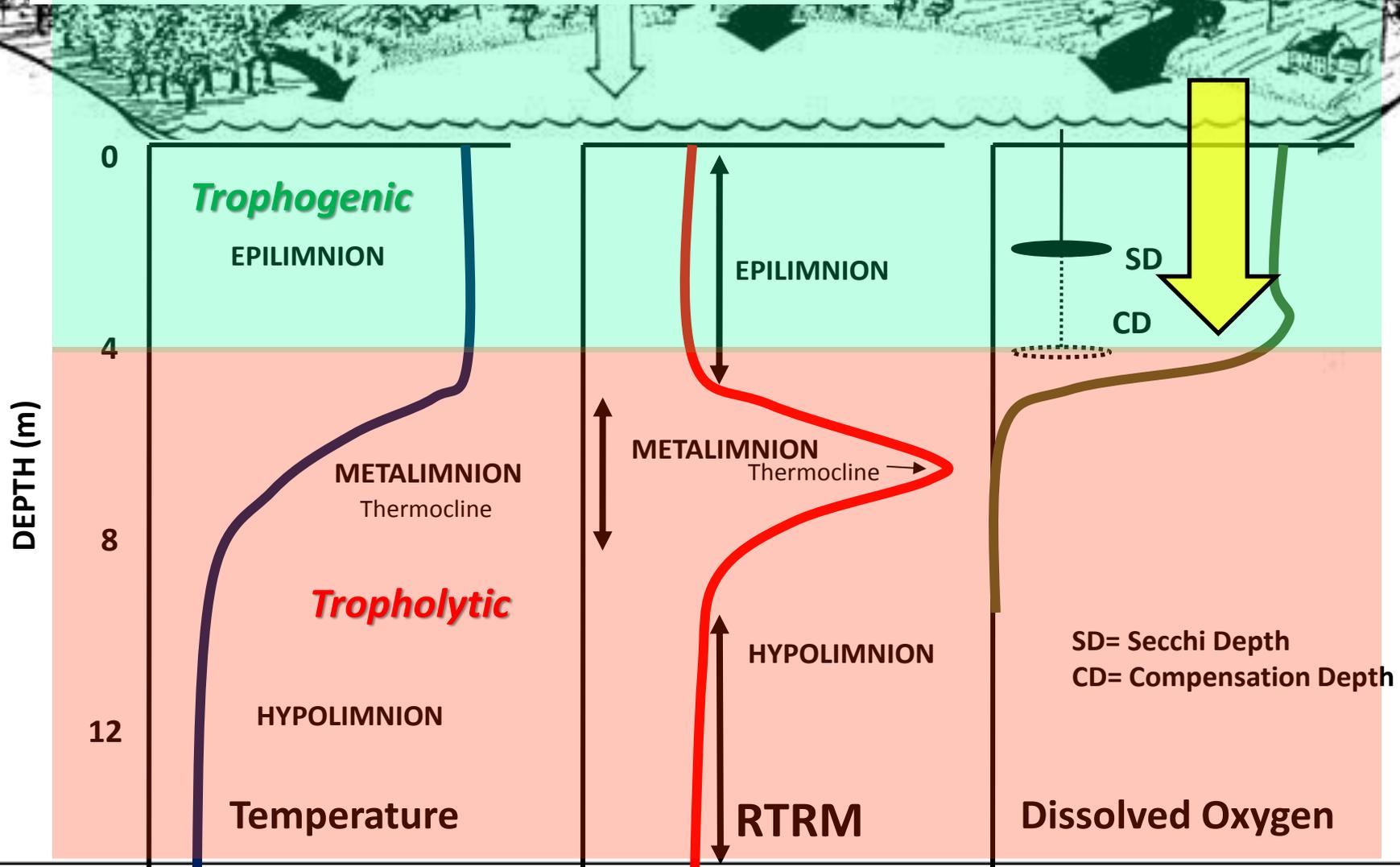


Diffusion Control of Anoxic Boundary

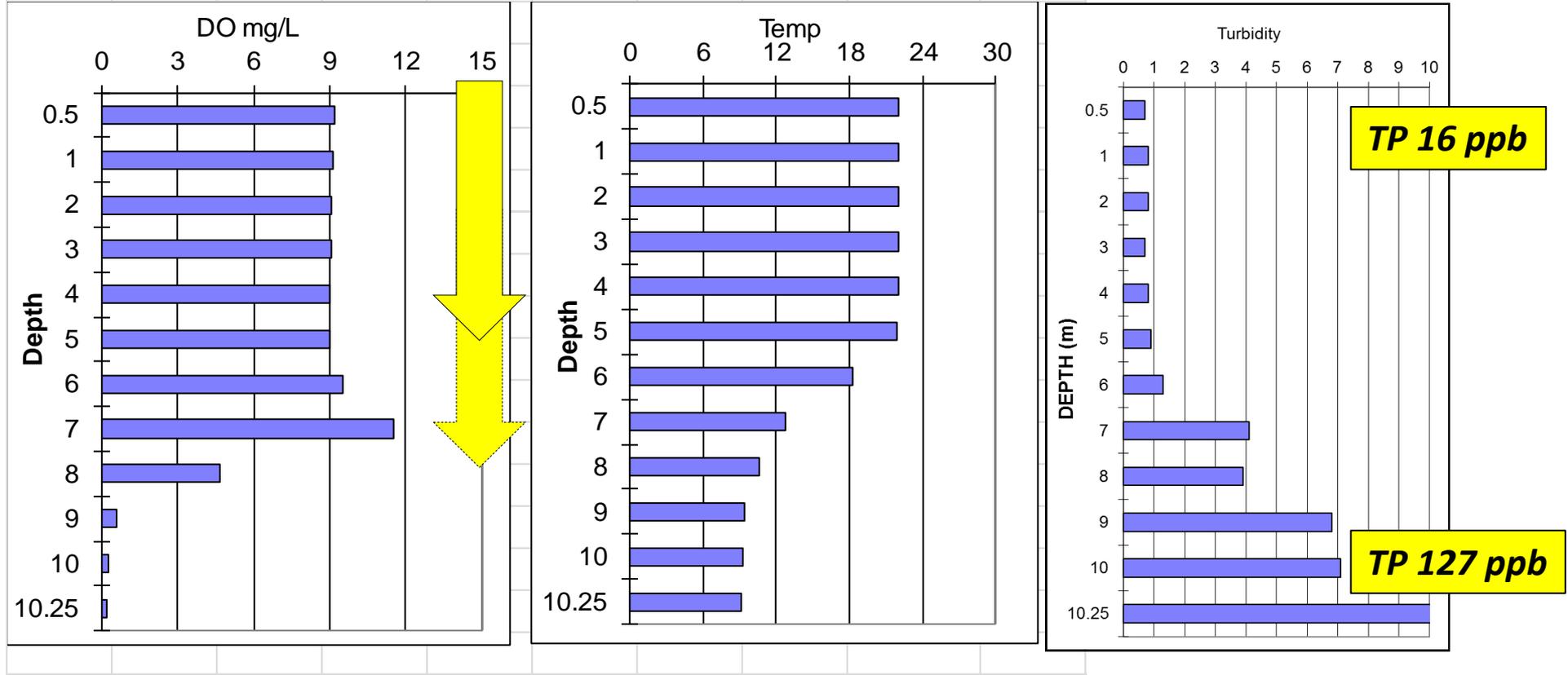
Anatomy of Stratification

Compensation Depth Doesn't Penetrate the Metalimnion
(i.e. Secchi Disk Depth < ½ the Epilimnion Thickness)

**Cyanobacteria
are stimulated**



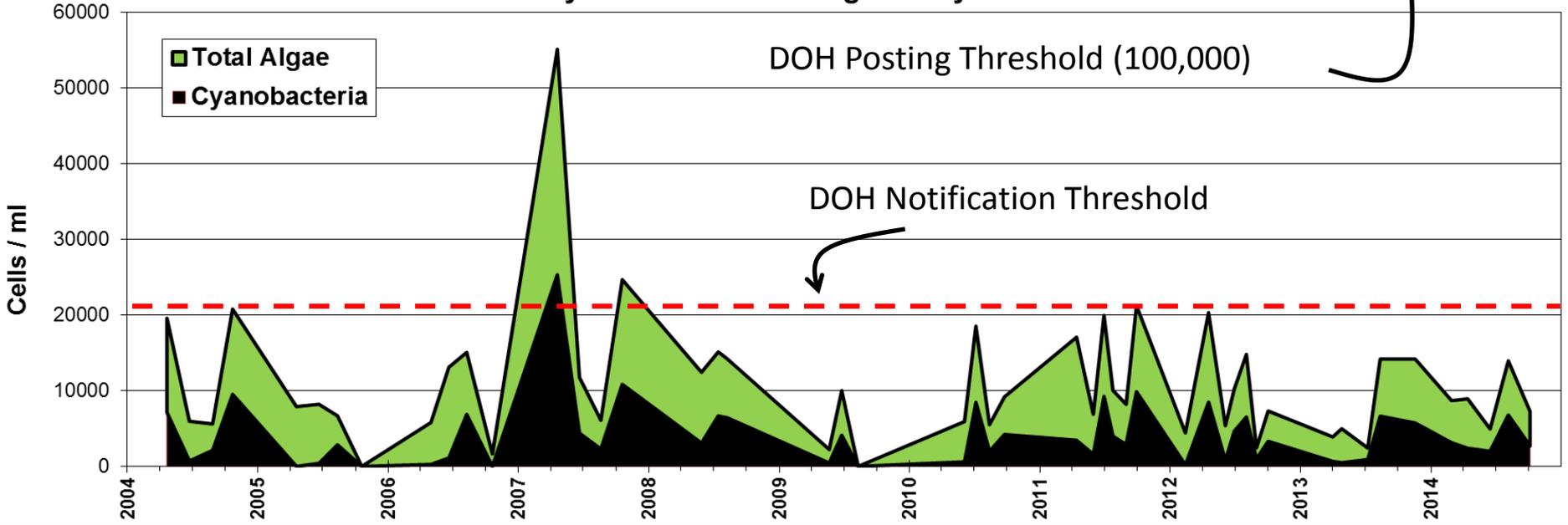
Wangumbaug- June 2015



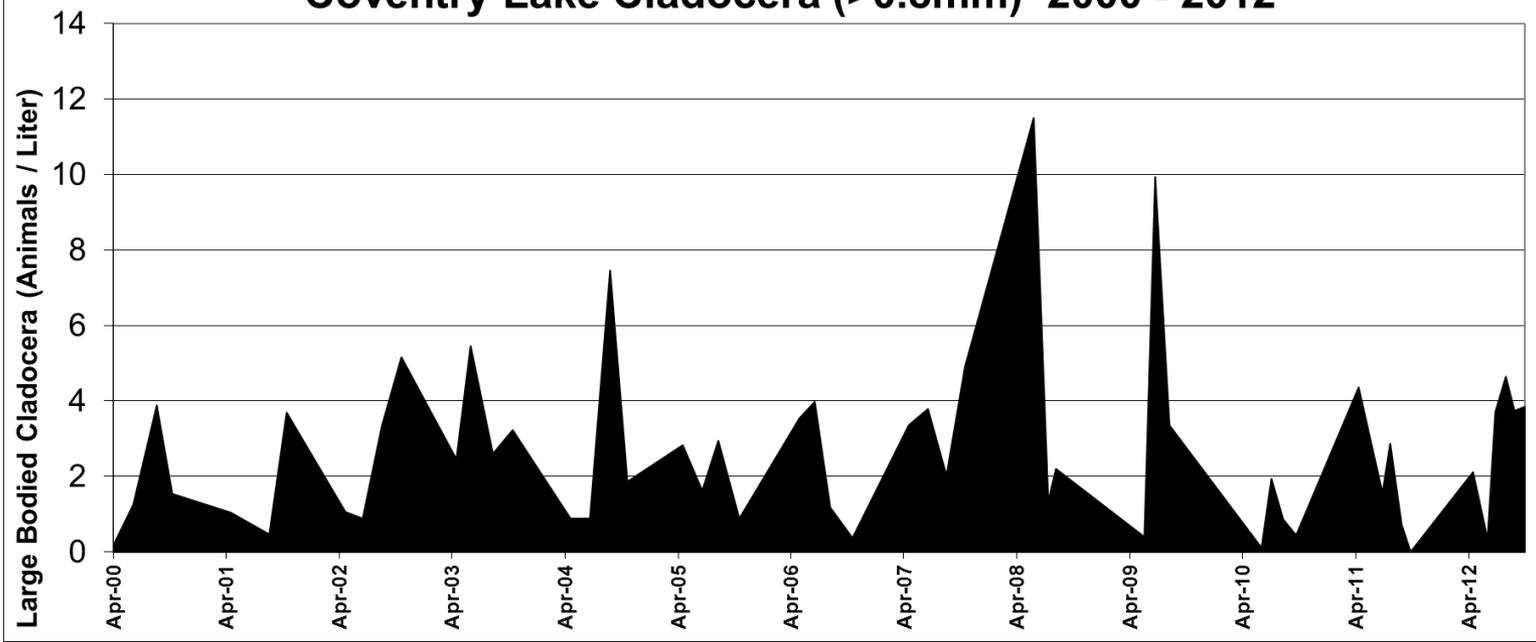
Secchi Disk Transparency = 5m (16.4 ft)

Cyanobacteria become the dominant phytoplankton, but phytoplankton are currently at very low density.

Coventry 2004-2014 Total Algae & Cyanobacteria



Coventry Lake Cladocera (>0.8mm) 2000 - 2012





Littoral Zone

***Manage* to reduce the *nuisance* posed by rooted aquatic vegetation**

***Protect* against new Invasive Species infestation**

(Fanwort, Naiad)

Bottom Weed Barriers

(or floating during early growing season)

Light limitation analogous to garden mulch fabric



- LBB45 actual size is 10' 9" wide by 45' covering an area of 484 sqft.
- \$300.00; \$ 0.62 / sf plus rebar, plus freight, plus installation
- A convenient method of deployment and recovery is needed.

Threats to the Ecological Integrity of Wangumbaug:

- New Infestation by **Invasive Species** such as:
 - **Cabomba, Naiad**, other nuisance macrophytes
 - Zooplanktivorous fish such as the **Alewife**
 - Other Invasives such as Quaga or Zebra Mussel (low risk)
- **Watershed disturbance** that causes a turbid condition that reduces light penetration.
- **Sediment disturbance** that causes a turbid condition that reduces light penetration.
- **Increased Nutrient Loading from the Watershed.**
- **Increased Internal Nutrient Loading**
 - Due to **intensified oxygen loss in deep strata**
 - Due to **perturbation of Thermal Stratification Structure**
 - Due to **Sediment Disturbance and Re-Suspension**



This is what a Cyanobacteria Bloom looks like.



This is what Coventry Lake will look like if :

- Transparency decreases below about 2- 2.5m
- TP Increases above about 25-30 ppb near the surface
- A Turbidity Episode occurs during the growing season

Imagine the Consequences.

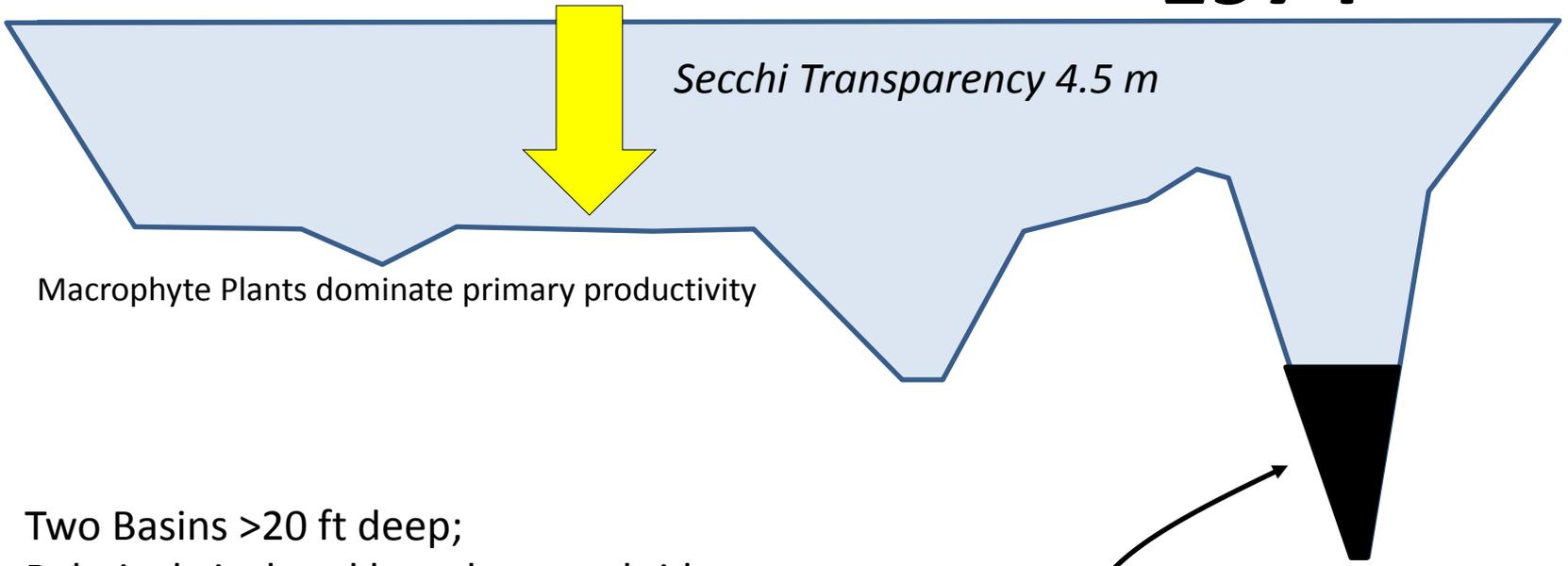
Also mats of Naiad



Lake Pocotopaug

Light Penetration

1974



Macrophyte Plants dominate primary productivity

Two Basins >20 ft deep;
Relatively isolated by submerged ridges.

No Oxygen in 1974

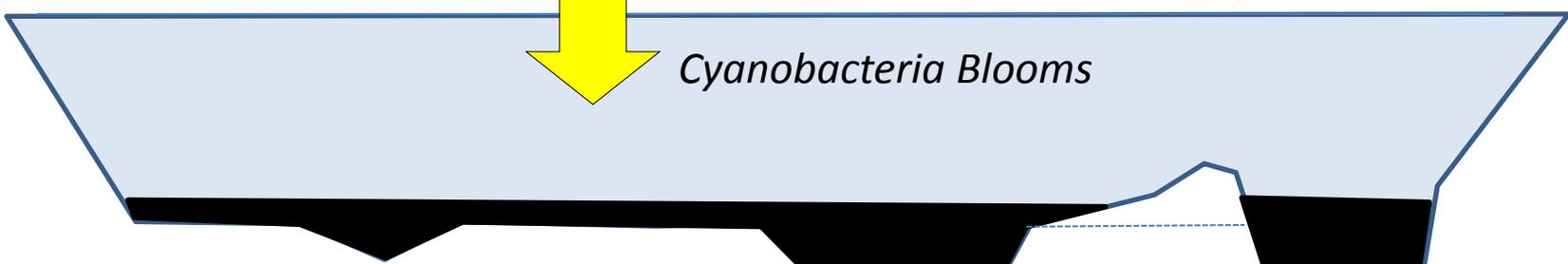
Turbidity episodes due to watershed disturbance during the late 1980s and early 1990s reduced light penetration. Inadequate light for plant growth over more lake bottom area.



Lake Pocotopaug

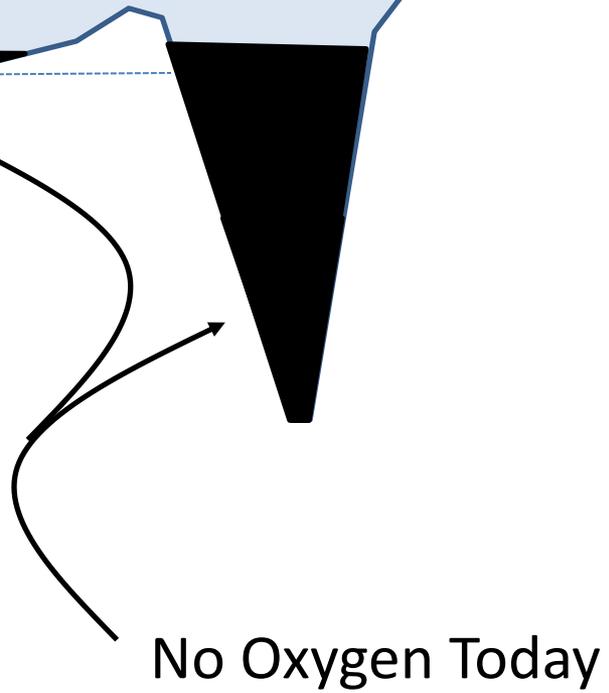
Light Penetration

NOW



Macrophyte vegetation dies due to lack of light penetration...
Phytoplanktonic Cyanobacteria dominate primary productivity

Two Basins >20 ft deep;
Relatively isolated by submerged ridges.



Switching of "Productivity State"
from Plants to Phytoplankton;
Cyanobacteria Blooms

Technical information[[edit](#)] (Source: Wikipedia)

The Flyboard is a bolt on device that is attached to a jet ski and requires proper instructions and safety gear before being able to use the product successfully and efficiently. So that the PWC follows behind the rider's trail allowing the rider all types of freedom even allowing the rider to go under water if they desire. The pilot that is on the Flyboard is in complete control of the navigation while the throttle is controlled by the person in charge of the PWC. The pilot on the Flyboard is secured in by bindings similar to a [wakeboard](#) and the rider is propelled from water jets below the device.¹ The use of a [personal flotation device](#) and helmet is required by rental locations for safety purposes to protect against serious head trauma in the event of the rider impacting the PWC or stationary structures, and to protect the ears from damage and discomfort from impacts with the water.^{[6][7]}

Device power is controlled by a throttle on the PWC. The equipment may be used in two modes: The primary one requires two people, one to control the PWC throttle which regulates the power and height of the rider. The secondary mode relies on an accessory called an Electronic Management Kit (EMK) which allows the rider to control the PWC throttle.^[8]

How high can you fly and how deep can you go under water?

29.5 feet (Some higher, up to almost 50 ft)

How fast can you travel above and underwater with the Flyboard?

18.5 miles per hour. (Some faster)

What is the *minimum* horse power your personal water craft needs to be in order to operate the Flyboard?

100 Horse Power

What is the maximum weight of someone, to be able to fly the Flyboard?

There is no weight restriction to use the Flyboard. For a large person, the more horsepower the Jet Ski will have to be. Example: Someone weighs 255 pounds can fly up to 29.5 feet and travel proximately 18.5 miles per hour, with a 255 horsepower Jet Ski. On a 100 horse Jet Ski that same person can fly up to 13 to 16.5 feet and travel 8 to 10.5 miles per hour.



This is for standard boats, with horizontal propulsion.

Would downward vertical thrust go deeper?

100 HP has been identified as a *minimum horsepower*.

Effective Mixing Depth

Effective mixing depth is the maximum depth at which the engine stirs up the water and, in turn, the lake bottom sediment. The importance of these findings is that power boating in shallow areas on lakes is likely to stir up bottom sediments, decreasing water clarity and releasing nutrients from the lake bottom, which can feed algae blooms.

Effective Mixing Depth by Engine Size

Horsepower	Mixing Depth
10	6 feet
28	10 feet
50	15 feet
100	18 feet

Source: *Lakeline*, December 1991



200+ lbs lifted into the air vertically...

...200+ lbs thrust downward to provide the vertical lift...

(Manufacturers' specs say 500-700 lbs thrust)

...Might that disturb and re-suspend nutrient-rich mucky bottom sediments, upwelling nutrients and reducing light penetration?

...Might that perturb the natural temperature stratification layers?

Where does this thrust go when the rider is taking off?

Research is needed:

- SCUBA video
- NTU and Secchi before/after
- Water Chemistry before/after
- IF adverse impacts are identified there may be methods to mitigate impacts.

Physics 101 "Equal and opposite reaction"

