

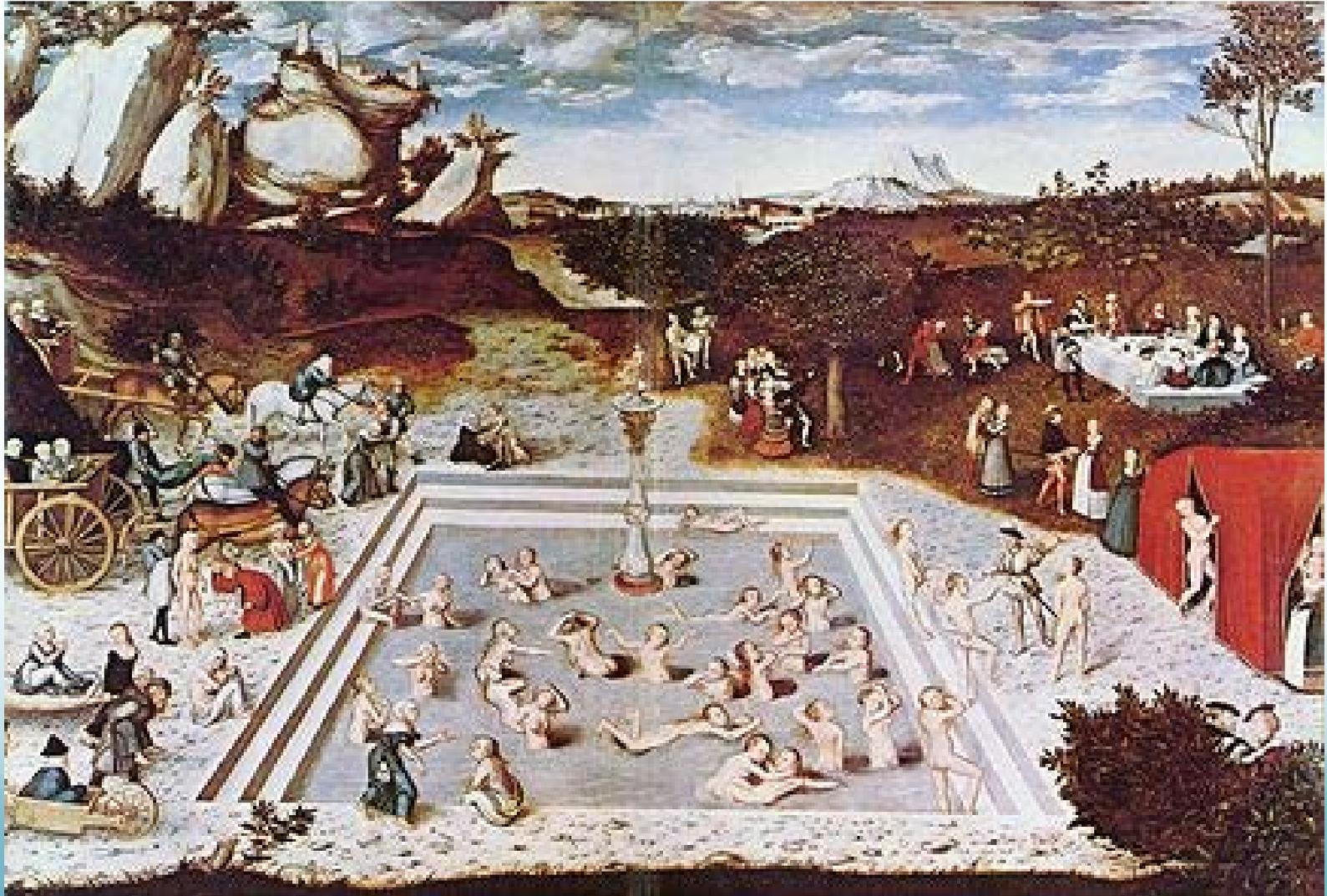
Aerating Ponds

What works and what does not

Presented by

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Magic Fountains!



Aeration is marketed as the cure for all that ails your pond

- Weed Control
- Water clarity/quality
- Fish protection
- Control for biting flies
- Stop algae blooms
- Deter nuisance wildlife



What does aeration really accomplish?

Increasing oxygen in water and pond sediments

- Ensures adequate oxygen for aquatic life
- Promotes aerobic microbe communities
 - Reduces noxious odors
 - Improves nutrient cycling
- Alters reduction-oxidation potential
 - Affects ions and soluble compounds

How much oxygen do fish need?

- Atmospheric oxygen at sea level is 8 mg/L (ppm)
- Most fish thrive at 4 ppm or above (50% atmosphere)
- Stress between 2 ppm and 4ppm
- Below 2 ppm = fish kill

- Hypoxia (low oxygen) is the most common cause of fish kills

First sign of hypoxia: Fish gasping at surface



Fish kills from hypoxia

- Several species killed
- Largest fish suffer first
- Small fish may survive by gulping at the surface
- Problems happen all at once, not over several weeks or months
- Sometimes coincide with rapid change in turbidity or color
- Often follow herbicide treatments as decomposing plants remove oxygen from water

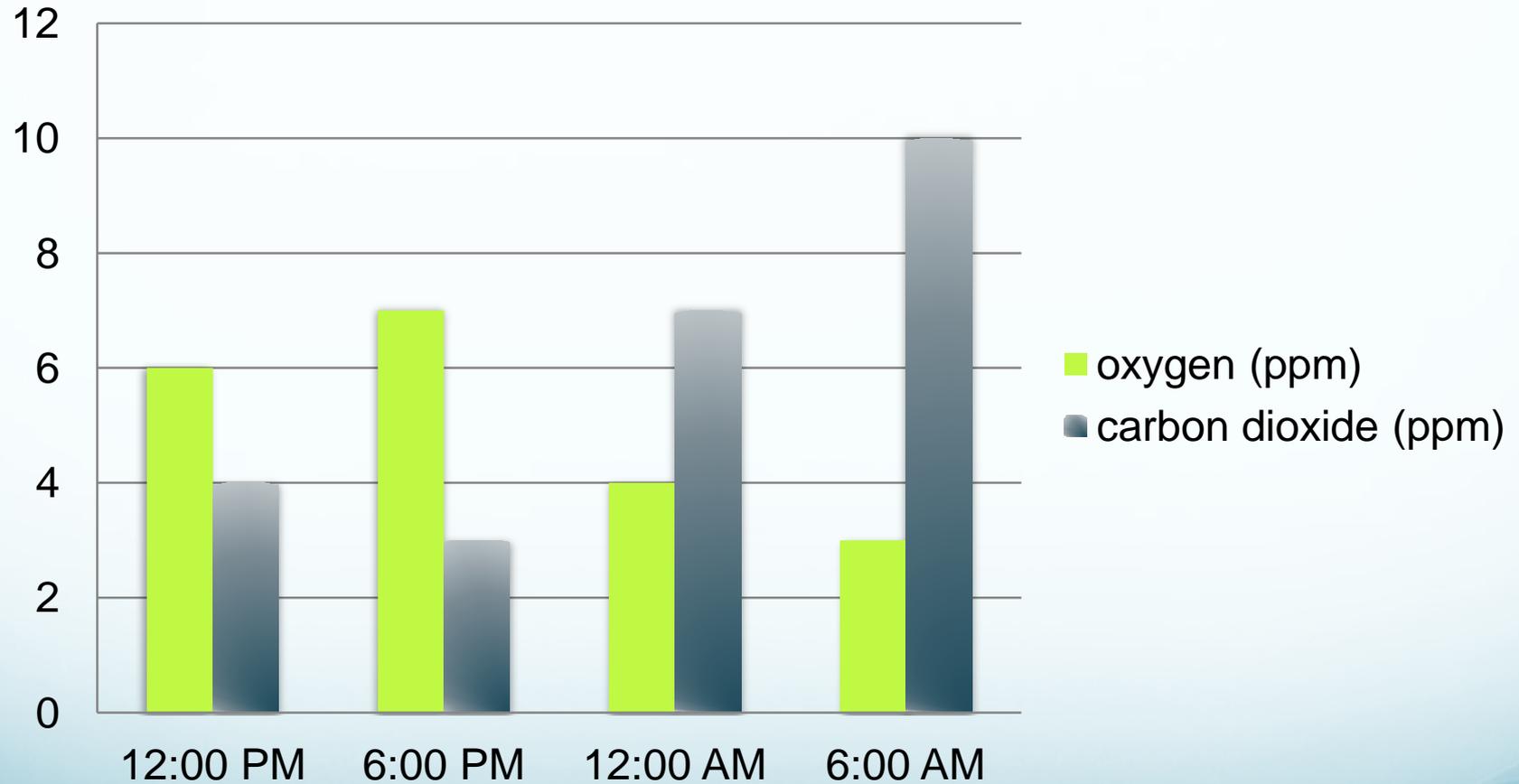
How does oxygen enter water?

- Diffusion from the atmosphere
 - Stable at 8 ppm
- Photosynthesis of phytoplankton and aquatic plants

How does oxygen leave water?

- Diffusion to the atmosphere
 - Stable at 8 ppm
- Consumption by aquatic life
 - All life consumes oxygen (Biological Oxygen Demand)
 - Fish
 - Invertebrates
 - Plankton
 - Microbes

Daily oxygen cycle



Can oxygen ever exceed atmospheric concentration?

- YES!
 - When photosynthesis exceeds BOD, oxygen increases
 - Heavy algae blooms cause super-saturation of oxygen
 - What happens at night when the algae quit producing more oxygen than they consume?
 - What happens when the bloom collapses and aerobic bacteria rapidly reproduce to decompose the algae?
- Super saturation (>8 ppm) often indicates an impending hypoxic event and potential fish kill

Harmful algae bloom



Beneficial plants need oxygen

- Shoreline plants thrive when littoral sediments are oxygenated
- Shoreline plants are important for erosion control, water quality, and wildlife habitat.
- When deprived of oxygen, shoreline plants grow less robust root systems and are not able to control erosion as well.

Stagnancy and Noxious Odors

- Foul odors are from formation of Hydrogen Sulfide
 - Rotten eggs and salt marsh pluff mud
- This results when oxygen is not available in sediments
- Oxygenating bottom water and sediments favors aerobic bacteria over anaerobic, preventing the creation of Hydrogen Sulfide

Oxygenation removes toxins

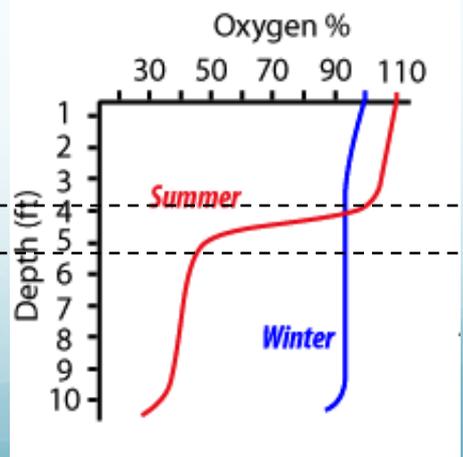
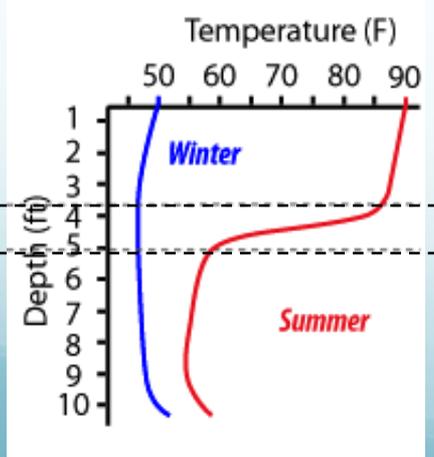
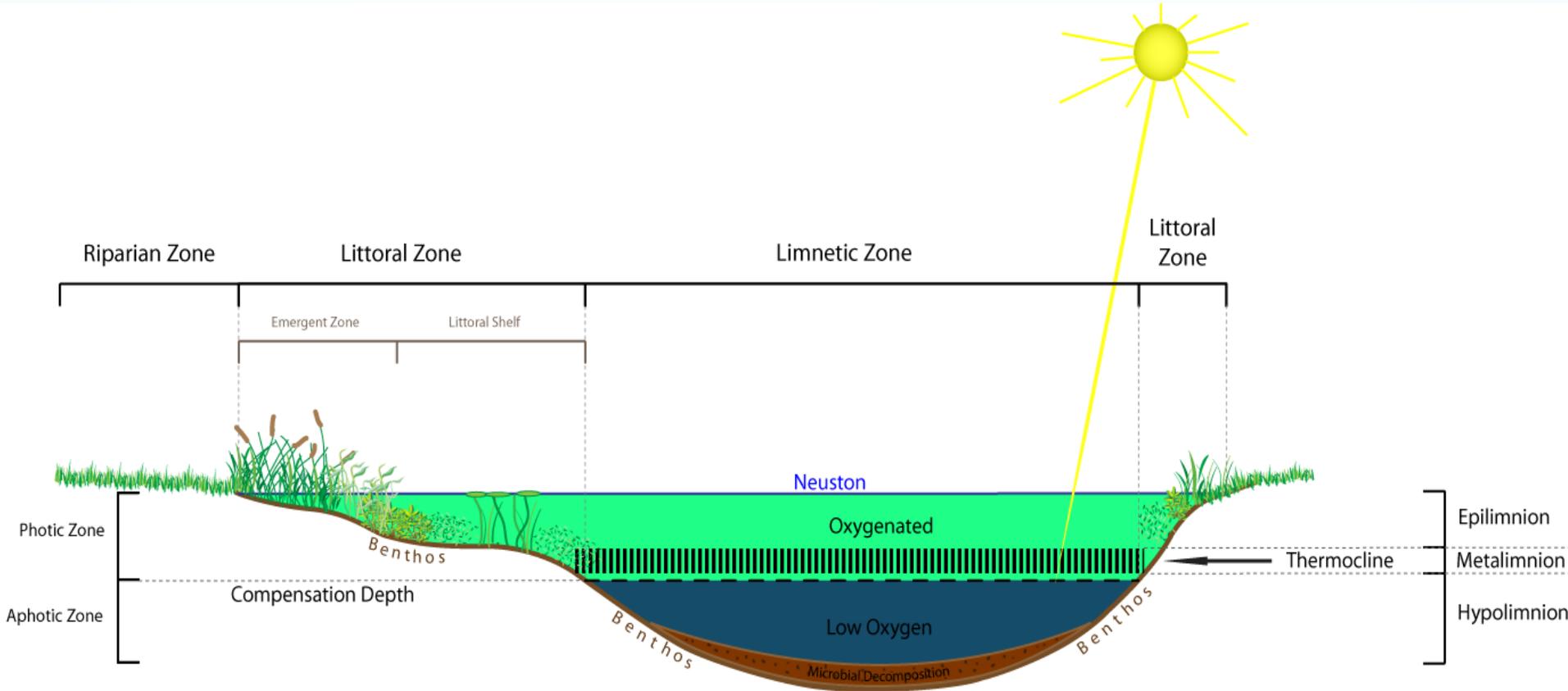
- Some toxins require aerobic bacteria to convert them into less toxic forms
- Ammonia and nitrites excreted by fish and other aquatic animals require aerobic bacteria to convert them to nitrogen gas and nitrates
- Many pesticides are broken down by aerobic bacteria

Oxygenation and nutrients

- Oxygenation may reduce available nutrients in the water
 - Phosphates become bound in sediments as oxygen concentration increases, not available to algae
- Too many factors involved in nutrient cycling to guarantee reduced nutrients
 - Temperature
 - Depth
 - Loading rates
 - Plant/Algal biomass
 - Water chemistry
 - Soil type
 - Wildlife/aquatic animals
 - and more

So...

- Do I need an aeration system?
- If so, what is the best type?



Compensation Depth

Thermocline

Fountains

- Lowest aeration efficiency of all circulation systems
- Circulate surface
- Clog regularly
- Increase evaporation
- Consume energy
- Increase erosion
- Primarily aesthetic



Agitators / De-icers

- More efficient than fountains, not as attractive
- Circulate surface
- Clog, but less frequently
- Lower evaporation loss
- Increase erosion
- Energy and maintenance costs similar to fountains



Diffusion Aerators

- Most efficient (ponds deeper than 8 ft)
- Circulate entire water column
- Very little maintenance
- Low energy cost
- Low evaporation loss
- Noisy compressor (needs insulated cover)



Recap

- Aeration/Circulation provides many benefits but mainly is **insurance against a fish kill**
- Circulation systems do not provide weed control
- Cost effective systems prevent stratifying
- Fountains are mainly aesthetic
- Agitators are most efficient for broad, shallow ponds (more than 200 ft wide and less than 8 ft)
- Diffusion systems are most effective in deeper ponds (>8 ft)

Questions?