D.O. the Limbo

DRAFT

Activity Description
This activity teaches students about the effect of dissolved oxygen on pond water

Take Home Message
Dissolved oxygen is the oxygen that is dissolved in water. Fish, like humans, need oxygen to survive. It is absorbed through their gills.

Massachusetts Frameworks
Life Science

Organisms are adapted to their habitats #5
Food Chains & webs #6

Supplies
- Limbo stick
- Support Posts
- Dread Locks **(DON'T SHARE HATS WITH KIDS TO PREVENT LICE).**
- Extension Cord
- CD player
- Limbo Music
- Salmon colored scenario cards
- Umbrella Stands (fill with water) to hold limbo poles
- Prize – Leis

Set Up-
Set up limbo poles using either sand in buckets, or the umbrella stands. We have just purchased a new limbo pole kit, which has music built into the horizontal limbo pole. Have CD player set up using extension cord, and put in the CD. Wear the dreadlocks hat if you like, and have the scenario cards organized, and leis available for the kids to wear as they do the limbo.

Background Science and Vocabulary

Dissolved Oxygen

Oxygen is present in air all around us and it is critical for survival. Animals that live in the water also need oxygen, and they get it from oxygen that is dissolved in the water. The air we breath is 21% oxygen, but there is only 0.001% (about 3-12 parts per million) of **dissolved oxygen** present in the water. As water temperature decreases water is able to hold more oxygen. Therefore, higher levels of dissolved oxygen are found in the colder waters. So dissolved oxygen concentrations are generally higher in winter and lower in summer, but the final concentration is also influenced by the plants and animals that live in the water. During photosynthesis, plants produce oxygen and, through this process, aquatic plants, including microscopic algae, can increase oxygen concentrations in water. Dissolved oxygen levels increase during sunny days and drop at night because of respiration by plants and animals. Animals like fish take in oxygen from the water, just like humans take oxygen from the air. The oxygen flow in a lake, pond, or estuary is then further complicated by the use of oxygen by bacteria that live in surface water sediments. Bacteria are important for breaking down waste and when they break down the dead fish and plants falling to the sediments, they consume oxygen. Too much waste falling to the sediments, like in systems with too much nutrients, can lead to extremely high oxygen demand and fish kills.

Pond Ecology

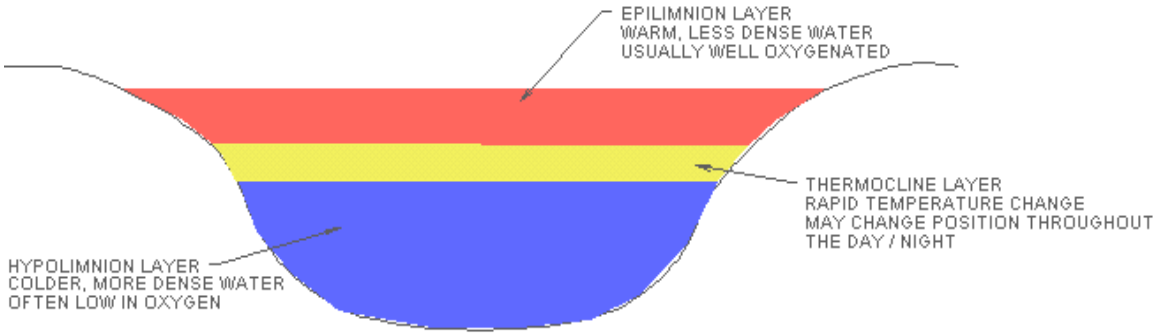
Lake ecosystems are influenced by interactions among the physical features of the lake, such as its shape, strength and direction of wind, air and water temperature, groundwater and surface water inflows and outflows and by chemical and biological interactions between and among the plants and animals in the sediments, water, and atmosphere.

The ecosystems of Cape Cod kettle ponds change through the seasons of the year and from year to year depending on all of the factors above, but temperature changes are a major factor influencing every pond. Beginning in early spring, air and water temperatures begin to rise as the days become longer. If the winds are strong enough, mixing occurs and even temperatures are maintained throughout the water column. Often by summer the warming is intense and the winds are not strong enough, so cooler bottom waters are separated from warmer upper waters. This process is called **stratification**.

The upper, warmer waters continue to warm during the summer. This layer of water is called the **epilimnion**. The cooler, bottom, waters generally maintain a temperature close to the overall temperature of the lake just prior to the onset of stratification. This lower layer is called the **hypolimnion**. The transition zone between these two layers is called the **metalimnion**.

A variety of species utilize the temperature and water quality differences between the layers. The cooler waters can hold more dissolved oxygen, so fish such as trout generally spend more of their time in the hypolimnion. The sediments at the bottom of the hypolimnion are rich in nutrients and usually support catfish and other bottom feeding fish, as well as worms and other creatures living in the sediments. Since rooted aquatic plants and floating algae need light for photosynthesis, they are generally found only in the epilimnion.

As temperatures cool in the fall, the stratification begins to weaken because the temperature differences between the upper and lower layers become smaller. Winds eventually mix the layers, disrupting the stratification, making the water in the lake well mixed again.



Script/Activity Procedure

1. Ask if anyone knows what D.O. might stand for- dissolved oxygen. Explain that dissolved oxygen is the amount of oxygen that is in the water. This is important because fish and life in the water need oxygen just like us. Describe what might cause the oxygen to increase in water (wind, cold weather, photosynthesis during sunny days). Cold water can hold more oxygen than warm water. So, DO levels are higher in winter than in summer. You can explain that when it's sunny, plants give off oxygen. So on sunny days the DO levels go up and at night and on cloudy days the DO levels go down. Then talk about what makes DO levels go down (nutrients in water, hot weather with no wind, algae blooms that die.) Talk about how nutrients can get into the water- fertilizers, pet waste, septic systems, decaying debris. If the D.O. gets too low the fish will die ☹.

2. Ask if anyone has done the limbo before. Explain that this is a different type of limbo though.

3. Ask the students what normally happens in Limbo. Hopefully someone will say the bar moves up and down and you dance with music. Ask the students, "If this is a special kind of limbo how do you think we get the bar to move up and down?"

4. Explain that the bar is the like the amount of dissolved oxygen that is in a pond. The students are the fish and have to make it under the limbo pole in order to survive. Ask the students what they think might lower or raise the amount of dissolved oxygen in the pond for the fish. Examples you are looking for are wind, temperature, plant growth, etc (from above). Give each participant one lei to wear, which they get to keep.

5. After they have an idea of dissolved oxygen and what happens, begin the limbo game.
   - Have the students line up
   - The first student picks a card and reads it out loud.
     - Example question: The neighbor fertilizes his lawn which runs right down to the bay, and then it rains and the fertilizer runs into the bay.
   - Ask them if the DO would go up or down?
     - Based on the card you lower or raise the limbo bar.
   - The students all go through underneath the pole
   - Then the next kid in line, takes a card, and you do it all over again.

6. After it is over, see if anyone can remember why the bar went up and down, and what dissolved oxygen is! Remind them of the name of the activity D. O. (dissolved oxygen) the Limbo.