Module 2 ~ A Fish Tale

Talking Points

To accompany ***A Fish Tale*** Presentation
http://plants.ifas.ufl.edu/education/flash/fish/fish_tale.html

For more information about oxygen, photosynthesis, aquatic plants and fish in Florida:

http://plants.ifas.ufl.edu/guide/oxygen.html

http://plants.ifas.ufl.edu/guide/photosynthesis.html

http://plants.ifas.ufl.edu/guide/fiskil.html

http://plants.ifas.ufl.edu/guide/fish.html#aqpltfish

Slide #	Notes
3	This is a good time to introduce the keywords; consider using them as a pre-test exercise for the classroom to assess familiarity with these terms BEFORE the lesson.
4	Our atmosphere is made up of 79% nitrogen, 21% oxygen, and 1% other gases. The oxygen content in our atmosphere is constant; it and doesn't change.
5	Discuss the fact that humans can't breathe underwater without the aid of special equipment such as SCUBA gear. (SCUBA = self-contained underwater breathing apparatus). Discuss which animals CAN breathe (respire) underwater. Do plants? (This will be answered in the lesson)
6	The oxygen content of the water is constantly changing day and night. Ask students if they have any ideas on why oxygen in water would change so much? Can they think of any instances when oxygen would be limited for people in "above-water" environments?
7	All living things in aquatic habitats depend on dissolved oxygen (DO) for survival. Most animals prefer oxygen concentrations of 4-10 ppm (Note: ppm is the same as mg/L). SAMPLE ACTIVITY: do a little lab to show students what mg/L means…for example, show them how many milligrams of a substance will dissolve in 1 liter of water (i.e., to give them a reference.)
8	The amount of DO in the water is affected by five main factors: water temperature, respiration, photosynthesis, decomposition, and water movement (wind, waves, waterfalls, boating activity, etc.) *Note: Respiration will be explained in slide 11.*
9	Warmer water holds less DO than cooler water, so sometimes waters in tropical and subtropical climates have organisms that are better adapted to low DO conditions. This is a great time to introduce animal adaptations to low DO, such as enlarged gills, increased surface area in gills, etc.

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11	*Respiration is the process whereby oxygen is "taken in" by organisms such as fish, amphibians, etc. (and even plants) and carbon dioxide is then released* Respiration occurs in animals ALL of the time; it occurs in plants only at night (when they are no longer photosynthesizing). So, at night, when all animals are respiring and USING oxygen, there is less of it available for "breathing"; therefore, we really need plants to produce ~~it~~ oxygen during the day when they are capable of making their own food with sunlight.	
12-16	Photosynthesis occurs in all plants, algae, and in some bacteria. Oxygen is produced and is released into the water column by submersed plants. This happens only during the day, but it *USUALLY* provides the DO necessary to sustain animals throughout the night. So, on sunny days: **Photosynthesis** >> (exceeds) Respiration = oxygen is abundant. But on cloudy days and at night: **Respiration** >> (exceeds) Photosynthesis and oxygen is used up and less is available to animals.	Slide 11 **For Middle & High School students:** This is a good place to introduce the equation for respiration: Respiration: $6\ O_2 + C_6H_{12}O_6 \rightarrow 6\ CO_2 + E + 6\ H_2O$ Photosynthesis: $6\ CO_2 + E + 6\ H_2O \rightarrow 6\ O_2 + C_6H_{12}O_6$ **Carbon Dioxide + Energy from sun + Water = Oxygen + Glucose**
15	Does anyone see the real fish hiding in the plants?	
16	At "normal" summer temperatures, dissolved oxygen concentrations will generally be high if algae and aquatic plant populations are actively photosynthesizing and producing more oxygen than is being consumed. This usually occurs in the mid to late afternoon. (See graph in the ppt.) Also, if there is not enough wind to mix the water or if plant and animal populations are consuming more oxygen than is being produced, DO concentrations will fall below saturation. That's why the lowest DO levels often occur during the pre-dawn hours (or on cloudy days when there is less photosynthetic activity). Under these conditions, DO concentrations can potentially drop to lethally low concentrations.	
18	When plant populations get out of control (e.g., when invasive plants completely cover the surface of a lake, river, stream, etc.) it prevents sunlight from reaching the submersed plants, thus preventing oxygen from being produced via photosynthesis. An **invasive plant species** is defined as a plant that has been introduced from somewhere else (it's non-native: from another country, state, or region) AND is growing in such abundance that it is causing environmental and/or economic harm (e.g., negatively impacting native plant species and/or wildlife, preventing recreational activities or trade-related navigation, etc.)	
19	Shown here is a pile of dead plants stacked on the shoreline (I.e., invasive plants that have	

	been mechanically harvested from the lake). Ask students to imagine large quantities of dead plant material (detritus) like this dropping to the bottom of a lake, pond or river all at once… creating a huge banquet for bacteria, fungi, and other microorganisms that begin to break down the plant tissue as fast as possible -- to incorporate it into their bodies. As plants die and their tissues decompose, oxygen is used / consumed even more due to the increased activity of the bacteria, etc. Another example: ask students to think about how much oxygen they consume while exercising compared to times when they are just sitting. This will give them a comparison of what happens to the oxygen in a waterbody when all of the microbes "come out to feed in full force!"
20	Lakes that are covered in floating plants and/or algae have trouble maintaining sufficient oxygen levels to support the animals that live here. When combined with hot summer temperatures (which makes less DO available), a fish kill can occur.
21	Plant removal, maintenance, and control measures are performed with care to ensure the safety and survival of animals that inhabit these waterbodies. If an infestation of plants needs to be removed, it must be removed carefully so that a bunch of plants are not all dying at once, increasing the potential for DO levels to drop drastically and suddenly.
22	Wind, wave action, and waterfalls are examples of water movement that increases DO in the water column. The movement helps to increase the diffusion of oxygen from air to water. Can students think of other types of water movement? Have students seen water "fountains" in the middle of a pond in a park? Sometimes, these are installed for reasons other than just aesthetics…
23	Too many plants on the surface can also affect how much oxygen diffuses into the water from the air. If the plants have formed a 'mat' on the surface of the lake, river, etc., then atmospheric oxygen can't penetrate the mat to reach the submersed animals.
24	Under certain conditions, wind can have a negative effect on DO levels. For example, too much wind from storm events, can sometimes churn up the lake bottom, or substrate, and release nutrients and sediment into the water column. This can make the water turbid, and the sudden release of nutrients can sometimes cause an algal bloom. The rapid movement of water at the bottom of the lake to the top can also be harmful because the water at the bottom is often lacking in DO. When the bottom water, which is low in DO, rises to the surface, animals here are sometimes not able to get the oxygen they need to survive.
25	Fish kills can result from low oxygen conditions and are the result of temperature changes, nutrient inputs (runoff, etc.), storm events, etc. …and they can happen very quickly. They are particularly harmful or dangerous for animals that can't swim out of the way, like mussels and other shellfish that may be attached to the substrate, or slow swimmers. For an excellent publication on fish kills, see: http://plants.ifas.ufl.edu/education/misc_pdfs/fish_kill_LR.pdf Things you can do if you observe a fish kill: o Record the day and time you first noticed dead fish o Observe the weather from the past 3 days (temperature, rainfall, cloud cover, wind?)

	○ Record any changes you observe in the color of the lake water (did it change from green to brown or black…which may mean that a lot of organic debris entered the lake after a strong rain storm). ○ Record the type of fish by species name, if possible. ○ Record an estimate of the number of dead fish. ○ Talk to your neighbors; did they notice anything unusual in the past few days? ○ Call the FWC fish kill hotline 1.800.636.0511
26	The majority of fish kills in Florida are the result of natural fluctuations in oxygen concentrations from temperature changes, biological conditions, and changes in light penetration. However, excessive nutrients from fertilizers and runoff can also cause fish kills by promoting sudden algal blooms which cover the surface of the water and prevent sunlight from reaching the bottom…so there are many things that we can do to help (by changing our habits/actions)! Fish can also become stressed from more than one influence and this can make them more prone to disease or parasites, etc.
27	Notice there are many more fish kills in August than in December. Why would there be a fish kill in December when the water is cooler? It could be because the water suddenly got much, much cooler. Example: a winter freeze. Also, notice that the December fish kills are mostly in the southern two-thirds of the state. Why do you think this happened? (It could be due to their intolerance for colder weather/ water temperatures whereas the fish in lakes further north are species that are more cold-tolerant. What type of data would make these maps more meaningful? For more on fish kills in FL, you can go to their website: http://research.myfwc.com/fishkill/ http://research.myfwc.com/fishkill/submit.asp http://research.myfwc.com/features/category_sub.asp?id=1697
31	Review and discuss the ways students can become involved and help "manage" (take care of) their local waters: Water monitoring, bird counting, collecting fishing data, reporting fish kills when you see one, going to meetings to discuss how a lake will be used or to discuss how to handle an invasive plant problem, if there is one etc. (Also, see ***What Makes a Quality Lake*** DVD.)
38-41	Review Guiding Questions with students.