Student Guide Activity 7 Dissolved Oxygen and Aquatic Animals

A. How do aquatic organisms get oxygen?

You've seen that even in healthy environment like Cascade Brook, DO levels go up and down. How exactly do the macroinvertebrates and fish living underwater get the oxygen they need?

Aquatic insects and other invertebrates have some interesting ways of getting oxygen. Visit http://www.cals.ncsu.edu/course/ent425/tutorial/aquatic.html to see pictures of four animals, each with a special adaptation for getting or holding onto oxygen:

1. The first picture is of a mayfly larva. Notice how much of its body is covered with gills! Mayfly larvae can only live in streams with water constantly flowing past them. Why do you think they're not able to live in places without flowing water?

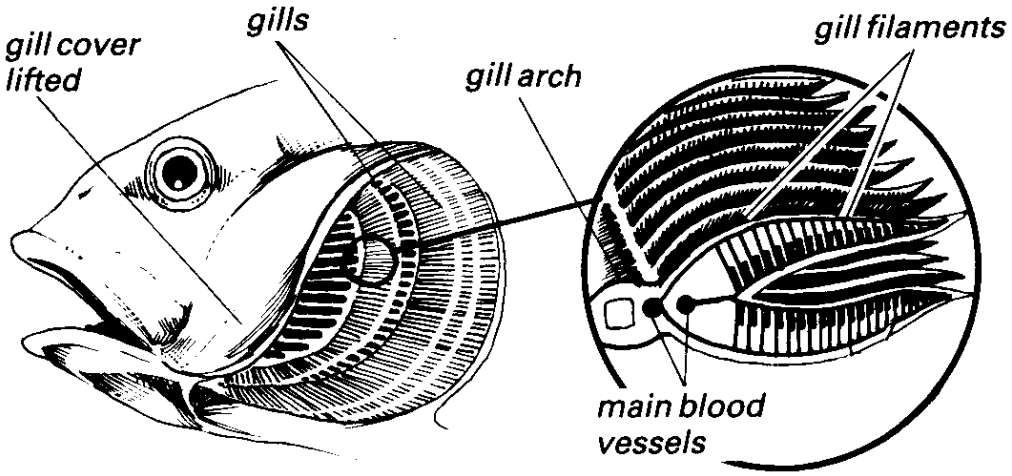
2. The second is a mosquito larva. It has gills too, but it also has something the mayfly larva doesn't have. What is it, and how does it help the mosquito larva live in places with low DO?

3. The third picture shows two diving beetles. Notice that the beetles have something attached to the backs of their wing covers. What is it and how do they use it? Do you think these diving beetles are affected by low DO? Explain.

4. The last picture shows some bloodworms, a kind of aquatic worm that lives in mud with extremely low DO. Unlike most other invertebrates they have blood with hemoglobin. Hemoglobin is what makes our own blood red. In our bodies it is hemoglobin that binds quickly with oxygen in our lungs and stores it in the bloodstream. How do you think hemoglobin helps a bloodworm live where oxygen is scarce?

If you've ever caught or cleaned a fish you probably know what a fish's gills look like. Pull back one of the gill covers behind the fish's eye and you'll see them, deep red and packed with blood vessels. Look closer and you'll see they look a little like rows of delicate feathers.

When water passes through the gills, dissolved oxygen from the water moves across the thin gill membrane into the blood. There it quickly attaches to hemoglobin molecules in the fish's blood and is carried to other parts of the body.



The gills of a fish.

5. How do you think the delicate, featherlike structure of gills helps the fish get large quantities of oxygen from the water?

6. Why do fish either need to swim constantly or gulp water continuously?

B. Cascade Brook DO and Aquatic Life

The chart below shows the level of dissolved oxygen needed by each of the aquatic animals your class has been studying. Let's find out whether the water in Cascade Brook has enough DO for them to live there.

Unless you already have a graph showing DO for the full year at Cascade Brook, make one using the Graphing Tool.

Aquatic Organisms	DO Needed (mg/L)
Macroinvertebrates	
Stonefly larva	5.0
Mayfly larva	5.0
Caddisfly larva	5.0
Hellgrammite	5.0
Dragonfly larva	3.0
Scud (amphipod)	3.0
Whirligig beetle	3.0
Water boatman	3.0
Mosquito larva	1.0
Leech	1.0
Aquatic Worm	1.0

Vertebrates	
Brook Trout	7.0 (needed for spawning)
Black Nose Dace	6.0
Creek Chub	6.0
Northern Two-lined Salamander	5.0

7. Approximately, what is the lowest DO level recorded in Cascade Brook?

8. In which months of the year is DO close to that level?

9. Which animals on the chart would be unable to live in Cascade Brook or would be living under stress because DO is too low for their needs?

10. Which animals would probably be able to survive even lower DO levels?