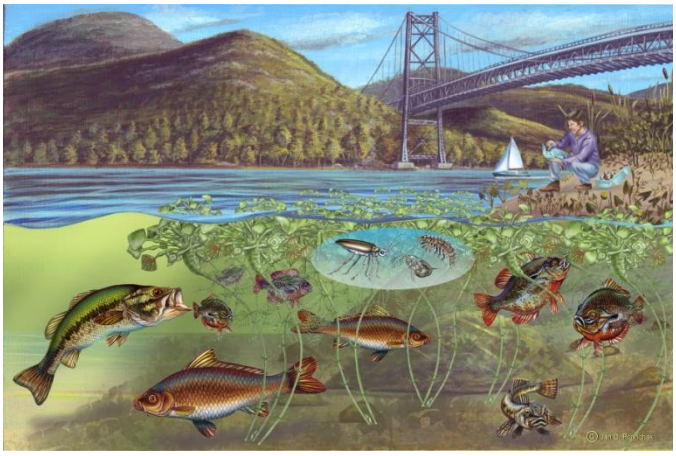
Name _____ Date _____

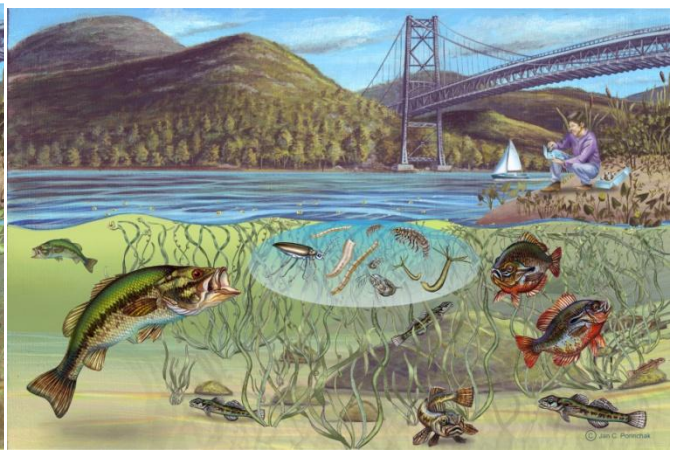
How does water chestnut impact the Hudson River?

Besides being a nuisance for economic and recreational activities, invasive species can cause many fundamental changes to ecosystems, sometimes severely degrading ecosystem health. Scientists at the Cary Institute were interested in learning how the water chestnut invasion in the Hudson River affected the ecosystem. They hypothesized that because the majority of the plant floats on top of the water, it would release most of the oxygen it produced to the air, rather than to the water, and therefore cause strong decreases in water-dissolved oxygen compared with native, submerged plants. Fish and other animals need healthy amounts of oxygen in the water to breathe. When the amount of oxygen in the water gets below ~5mg/L, sensitive fish and invertebrate species become impacted; and when the dissolved oxygen levels drop below 2mg/L, nearly all fish and invertebrate species are impacted.

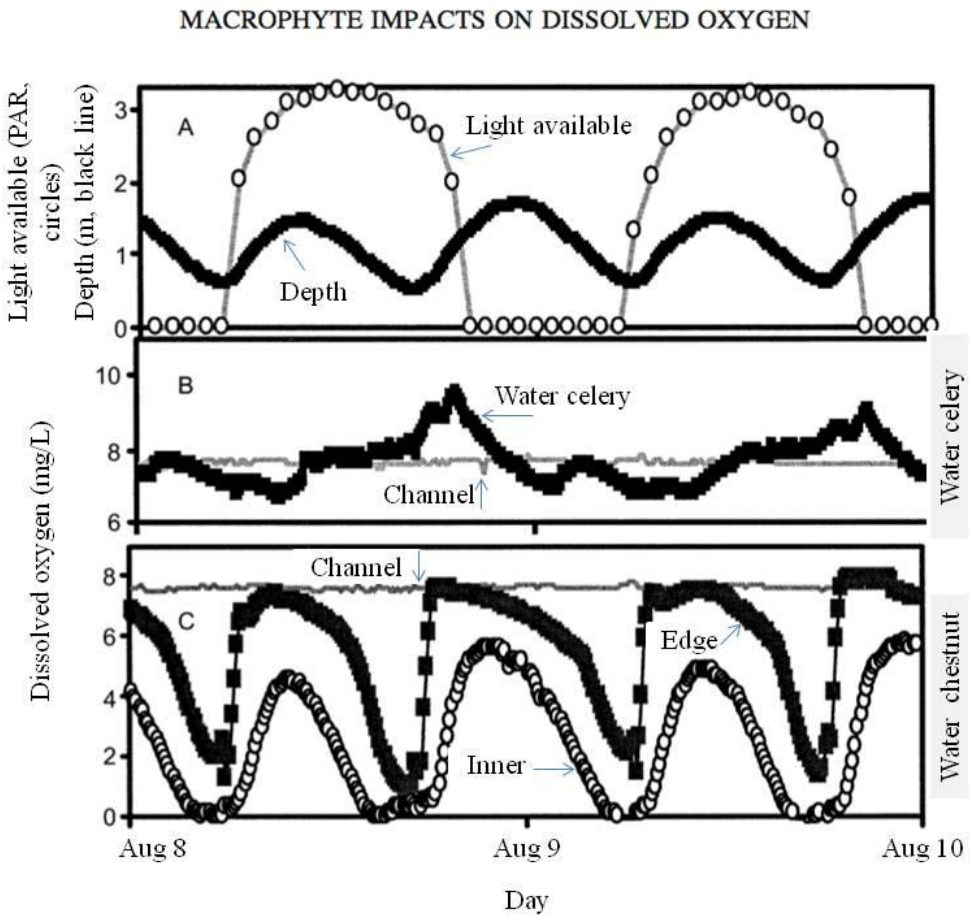
In August of 2000, these scientists decided to measure the changes in the amount of oxygen in the water (dissolved oxygen—a.k.a.—DO) across 2 days in several nearby locations in the Hudson River. The results of their measurements are shown in the series of graphs given you by your teacher. At first glance, these graphs seem complicated, but in this exercise you will break them into parts to better understand what's going on. Follow the instructions, answer the questions, and discuss the answers with your group.



Water chestnut habitat



Water celery habitat



The uppermost graph (graph A, as shown in the upper left corner of the top box) has two curves: the curve with open circles shows changes in light availability underwater across 48 hours, while the solid black curve shows how the river water depth changes across those 48 hours. The scientists who collected this data measured both the changes in light available and the depth of the water throughout the day, because they thought these might be important for understanding how and why DO changes through time.

1. With a colored pencil and a straight edge, draw a vertical line from the tops of the depth curve 'waves' downward through all three boxes in the figure.

2. With a different colored pencil, draw a similar vertical line downward from the bottoms of the depth curve 'waves.'

- How often does the river water depth change throughout a day? Why does it change?

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3. With a pencil, outline and lightly shade the area immediately beneath the sections where light availability is zero.

- Why does the amount of light available change over the course of a day?

_____

- What time of day does this shaded section depict?

_____

The middle graph (graph B) also has two curves, but these curves vary according to the amount of oxygen in the water (DO). The relatively straight, gray curve is labeled "Channel" and shows measurements taken in the river's channel (the middle of the river). The solid black curve shows measurements of DO taken from the middle of a water celery (submerged) plant bed.

- What happens to the DO in the water celery bed during the day? What happens at night?

_____

- Do you see the same 'ups' and 'downs' in the river's channel? _____
- Why would the amount of oxygen in the water (DO) change over the course of a day in the plant beds, but not in the channel?

_____

_____

- Do you see a relationship between the DO in the water celery bed and the tidal cycle? Explain your answer, referencing the graphs.

_____

_____

The bottom graph (graph C) has three curves, the same 'Channel' curve shown in graph B, but also two curves showing DO measurements taken from the middle ('Inner') and 'Edge' of a water chestnut plant bed.

- Given what you've seen and learned about how water chestnut grows in the Hudson, why do you think the scientists measured DO at both the edge and middle of the plant bed?

_____

_____

- How do the DO curves differ between the middle and edge of the water chestnut bed? Include DO concentrations (in mg/L, shown on the left side of the graph) in your answer.

_____

- Do you think it was worth measuring DO in both places? Refer to the graph to explain your answer.

_____

_____

- What evidence do you see that DO in the water chestnut varies with the tidal changes?

_____

- How does dissolved oxygen vary with the day/night transitions, if at all?

_____

Now that you've explored each graph individually, you're ready to compare them. Answer the following questions, using information from the introductory paragraphs, your observations, and answers to previous questions to support your claims.

- When was there the most oxygen in the water in each of the plant beds? Refer to data from Graph A in your responses.

Water celery:_____

Water chestnut:_____

- In which of the plant beds do you think that fish and invertebrate species may sometimes struggle to find oxygen? When would this happen?

Water celery:_____

Water chestnut:_____

- Do you think day/night light availability changes (a.k.a. diurnal cycles) or tidal cycles are more important in determining the amount of oxygen in each of the plant beds? Explain.

Water celery:_____

_____

_____

Water chestnut:_____

_____

_____