

Name _____

Date _____

Water Chestnut Beds and Dissolved Oxygen

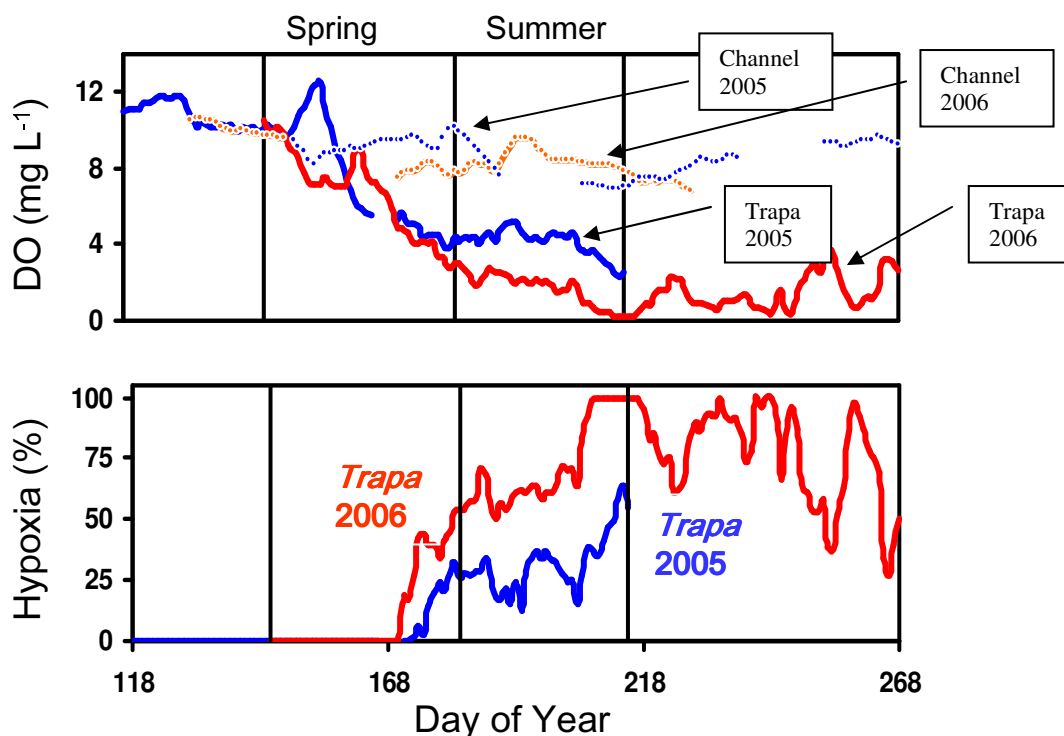
You have now learned a great deal about water chestnut (*Trapa natans*). Scientists continue to study the beds in order to determine when changes occur, how long they remain, and what the impacts may be on the larger ecosystem. The graphs in this activity show results from a study of two water chestnut beds in a shallow area of the tidal Hudson River estuary, Inbocht Bay.



Aerial photo of
Inbocht Bay,
Hudson River, NY

Photo by Kara Goodwin, Cary
Institute of Ecosystem Studies

The beds were sampled using a special device called a “Sonde”, which can be programmed to automatically measure the important water chemistry parameters throughout the day. In this case, the sondes were set up to measure dissolved oxygen in the water chestnut beds every 15 minutes, day and night, for two years (2005 and 2006). However, in 2005, the scientists stopped measuring around day 218 (the middle of August). When the data was analyzed in the fall and winter of 2005, they realized that they needed more data, so they decided to run the experiment again, this time until day 268 (end of September).



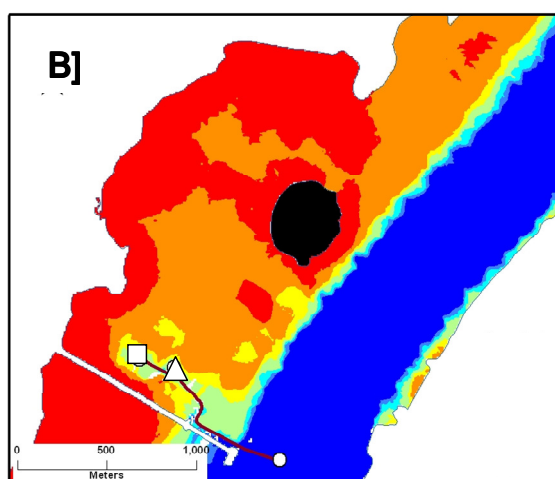
The first graph shows daily mean dissolved oxygen (DO) for 2005 (blue) and 2006 (red) in the deep water main channel of the Hudson (dashed lines) and inside the *Trapa* bed (solid lines) from 11 May through 25 September. The vertical lines break this period into 4 blocks including the spring (25 May -30 June) and summer (1 July -3 August). The x-axis shows day of the year, counted from day 1 as January 1st.

In the second graph, the y-axis shows the percent of time during any given day that the water became **hypoxic**. There are only two lines on this graph, because the main channel never has DO levels that are below 2.5 mg/L (see the first graph). When oxygen concentrations drop below 2-3 mg L⁻¹, we call the water hypoxic. This is associated with negative impacts to sensitive species of fish and invertebrates as well as changes in metal, nitrogen and phosphorus cycling. Below are listed the day-of-year comparison, so that you can see how it matches up with the months.

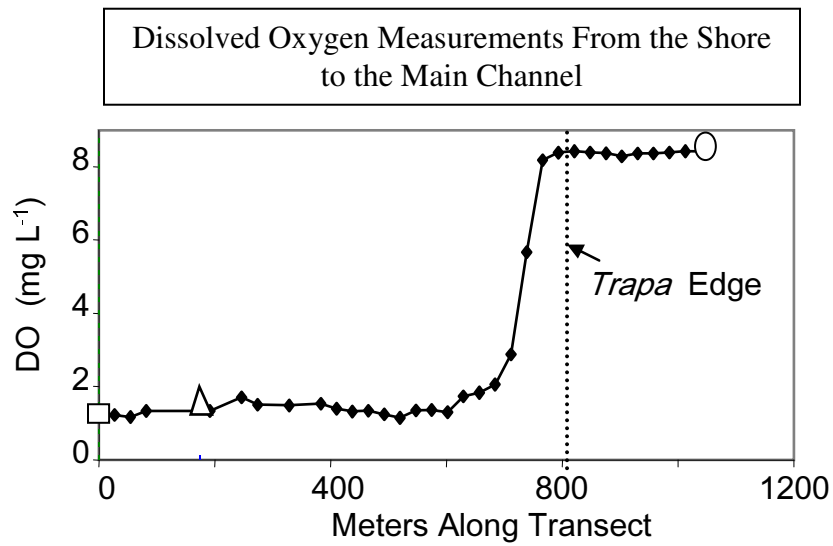
1-Jan	1
1-Feb	31
1-Mar	59
1-Apr	90
1-May	120
1-Jun	151
1-Jul	181
1-Aug	212
1-Sep	243
1-Oct	273
1-Nov	304
1-Dec	334

Based on the information above, please answer the following questions:

1. What is the main difference between the DO levels in the main channel and the *Trapa* beds?
2. What is the average DO level for the main channel during the spring? During the summer?
3. Why do the % hypoxic days increase so dramatically on or around day 168?
4. Why do you think the researchers decided to extend their experiment from 2005 into September? How different were their results? What would you expect if you continued measuring into October or November?
5. Why do you think the main channel never becomes hypoxic?
6. What consequences would the high incidence of hypoxia have for the river ecosystem?



Above (A) is an aerial photo of Inbocht Bay, taken in September of 2006 (mytopo.com). The light green areas are covered by *Trapa*. Figure B) is a bathymetric map of study area, which basically is like an underwater topographic map. Red areas are exposed at a very low tide-blue is the main channel of the Hudson River. The white circle is where sondes were deployed in the main stem during both 2005 and 2006 while the white square and white triangle are the site of the *Trapa* bed deployment for 2005 and 2006, respectively. The red line depicts the path of travel from open waters into the bed. The graph below shows measurements of DO during low tide along a transect from the back of the *Trapa* bed into the main channel of the Hudson River. The white square, triangle and circle are the sites of sonde deployment in summer 2005 and 2006.



1. What is the DO level at the back of the *Trapa* bed, near the shore? How does the DO level change as you move towards to main channel of the Hudson?
2. When does the DO level change dramatically? What do you think causes this change?
3. How do you think this graph would be different if the measurements were taken in April or early May? What about October or November?

References:

Caraco, N. F., J. J. Cole, S. E. G. Findlay, and C. Wigand. 2006. Vascular plants as engineers of oxygen in aquatic systems. *BioScience* 56(3):219-225.