

## Water Quality: Is Our Bay Safe?

Grades 7-10

### Background.

Pollution is change in the estuary environment that has a negative impact on any of the living things in the estuary. The quality of an estuary can be measured by a variety of criteria. These might include the diversity of biota, or chemical properties such as the amount of dissolved oxygen, nitrogen, or phosphorus. It might also be judged by the presence of toxic substances. Another measure for quality is the amount of coliform bacteria present in a sample of the water. Although elevated coliform itself may not be a problem, it is indicative of the presence of other bacteria that do present health problems.

The source of pollution in an estuary can be difficult to pinpoint. Often there are multiple sources such as sewage treatment facilities, industrial waste, and the runoff of excess fertilizers or pesticides from agricultural areas in the watershed. This combination of potential sources makes it difficult for those groups charged with monitoring water quality to be fully effective.

The following activity is designed to be an Internet activity using the DOEE site along with links to other sites concerned with estuary quality and pollution. Some sites are being developed that will report real-time (or nearly real-time) data of factors that affect Narragansett Bay. This activity does use some specific dates in the past on these web sites in order to facilitate the lesson. It is recommended that the links be checked before the students use them in order to determine if more recent data could be useful to the teacher's objectives.

This activity is designed for grades 7-10 but can easily be extended for older and more capable students, or modified for use with students with learning differences.

## Objective

Students will research current estuarine data (for Narragansett Bay). It is presumed that students have learned about the basic causes of pollution prior to starting this activity. Upon completion, students should be able to distinguish which sections of Narragansett Bay are polluted and not to be used for swimming. Further, they will be able to justify their response.

## Procedure

Go to the Department of Environmental Management (DEM) web site and review what sections of the bay have been recently closed to shell fishing

<http://www.state.ri.us/dem/topics/outdoor.htm#marine>.

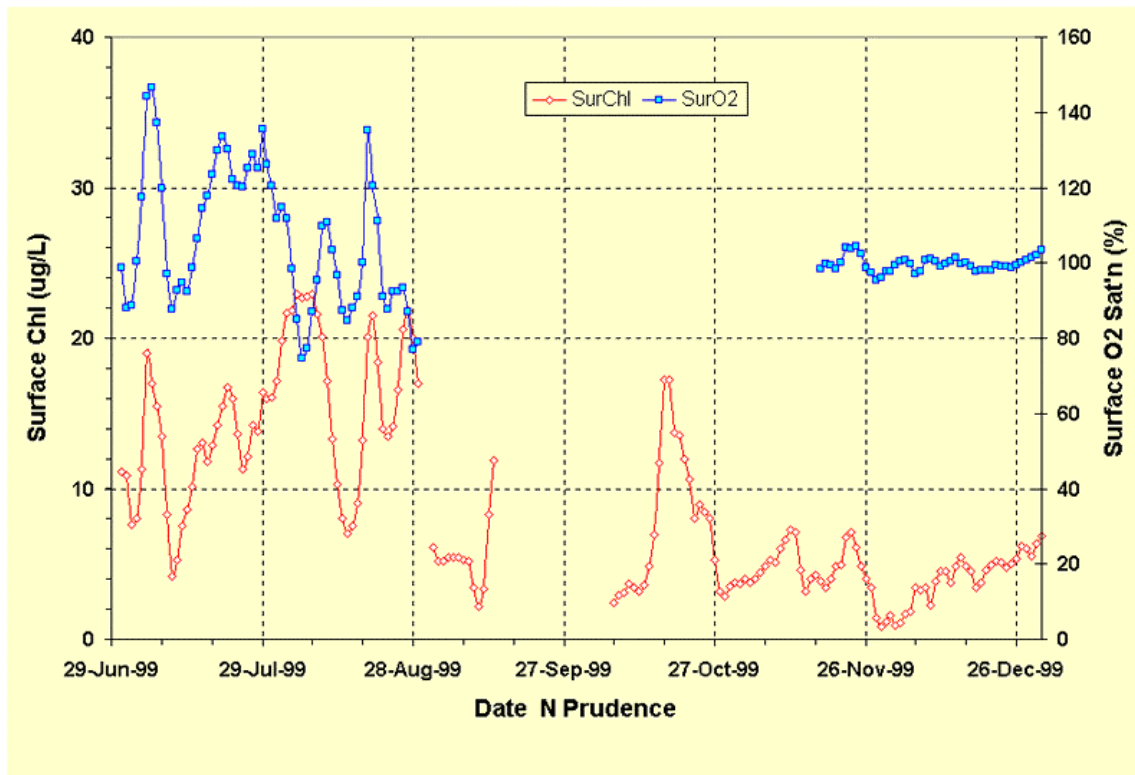
Many species of shellfish are known as filter feeders and as a consequence they often contain pollutants that are present in their habitat. Areas of an estuary that are closed for shell fishing are sure signs that the water there is a problem area.

From the map on DEM's web site, what observations can be made about the location of closures in the Bay?

Why would some areas be closed seasonally? When and why would they be closed?

It has been determined that at times when the quantity of chlorophyll and dissolved oxygen increase sharply, the likely cause for this is a bloom of algae in the surface waters. Look at the graph below which shows some results for surface chlorophyll and dissolved oxygen for part of 1999. This data is from research done by Dr. Dana Kester at the Graduate School of Oceanography at the University of Rhode Island.

<http://www.gso.uri.edu/~dkester/nbay/obsnet.htm>



Graph 1. Surface chlorophyll and dissolved oxygen for the North Prudence buoy.

At what times, if any, does it appear that blooms may have occurred? (If any, give approximate dates.)

Explain if there is a relationship between the line for surface chlorophyll and the line for surface oxygen.

When a bloom does occur in an estuary, what are the likely causes for the growth in chlorophyll and photosynthetic activity?

Let's see how other parties present similar information in a different format. Go to the Narragansett Bay Organization site:

<http://www.narrbay.org/nushuttle/july12/july12.htm>. This site shows a map of Narragansett Bay with various points labeled with abbreviations. Review the site names and note where in the Bay they are located. Choose the July 12, 2000 data and view the graphics shown. Select cross sectional profile of chlorophyll and oxygen.

At which points in the bay are chlorophyll and oxygen levels high on this day?

How does this data for a day in 2000, compare with results that you saw in Dr. Kester's site for time periods in 1999?

Various agencies are responsible for monitoring water quality at beaches to determine if the water is clean enough to be used for swimming. The amount of fecal coliform present in samples is usually the deciding factor in a closure of a particular beach.

Visit the web site [www.health.state.ri.us/beaches/index.html](http://www.health.state.ri.us/beaches/index.html)  
Select Rhode Island's licensed bathing facilities and water quality data.

Click on the letter "O" which will allow you to choose Oakland Beach.

Select "What do these samples mean?"

Briefly describe the sampling process.

What are the water samples tested for?

What is the maximum amount of CFU's considered acceptable for salt water in Rhode Island waters?

Return to the Oakland Beach table. Describe the results for Oakland Beach for the 2000 swimming season.

Specifically, when would you decide not to go swimming at this beach?

Return to the page with the alphabet, select "N" and look at Narragansett Pier Beach and also "S" for Scarborough North. Review both of these for their results from 1996-2001. Note where these are located in the Narragansett Bay area estuary. How do these beaches compare with Oakland Beach?

### Follow up.

Have the students describe where on a map of Narragansett Bay they would choose to swim. Why would they choose these areas? Students could be assessed by giving them data in table or graph form along with other information about a real or fictional estuary. They could then justify their decision to swim there or close the area to swimming, and perhaps shell fishing.

### Resources

Additional data and graphs of Narraganmsett Bay are available at these sites.