

Worksheet 1: Questions for Chesapeake Bay Food Web Before Large-scale Fishing

1) Which organisms are abundant in this ecosystem?

2) Which organisms are rare in this ecosystem?

3) List the producers and consumers in this ecosystem?

4) Find and write out a six step or greater food chain

5) What do the microbes eat? Are they producers, consumers or decomposers?

6) If whales and turtles become rare in this ecosystem what would you expect to happen to the number of jellyfish?

7) If whales, sharks, seals and alligators were removed from the ecosystem what would you expect to happen to the numbers of predatory fish?

- 8) If the oyster population was reduced what would you expect to happen to the quantity of microbes, phytoplankton/algae and detritus?

- 9) Predict how the present day food web will look different than the historic food web.

Worksheet 2: Questions for Chesapeake Bay Food Web with Large- Scale Fishing
Distributed with fig. 2, Chesapeake Bay With Fishing - Today)

- 1) Which organisms are abundant?

- 2) Which organisms are rare or extinct?

- 3) Redraw the food web including only the abundant species? What do you notice?

- 4) How is this food web similar/different to the food web unaffected by people?

- 5) Why do you think jellyfish are now abundant?

6) Why are there fewer predatory fish if there are fewer whales, sharks, seals and alligators?

7) From what you know about the relationship between high levels of nutrients and algae growth, why have the phytoplankton (floating plants or algae) increased?

8) What happened to the sea floor plants? If fewer organisms are eating them, shouldn't their numbers have increased? Why are they rare now? Hint: Like all plants, what do the sea floor plants need to grow? What does nutrient run-off cause to grow that would limit the resource that sea floor plants need to grow? Explain.

9) How does this food web connect to the problem of high nutrient levels in the water? Hint: Oysters filter the nutrients, microbes and phytoplankton from the water? Use the food web to explain what happened to their numbers and why.

10) Based on your answer to question nine make a hypothesis for how fishing of oysters affects nutrient pollution.

11) What type of data would you need to collect in order to test your hypothesis? Hint: You would need to compare historic and present day data on two elements of the ocean. What are those elements?

Worksheet 3: Oyster Catch vs Nutrient Levels in the Chesapeake Bay– Testing the hypothesis that oysters reduce nutrient pollution in the Bay

Plot and connect your data points on one graph:

- 1) Oyster Catch in Relation to Years Before Present
- 2) Nutrient Levels in Relation to Years Before Present

Helpful hints for graphing:

- 1) Years before present should go on the X axis.
 - a. To have enough room use the long side of the graph paper for this axis.
 - b. Begin your graph at 300 years before present to have enough room on your X axis for all your data points.
 - c. Make sure that your increments are consistent, even though you do not have all data points to plot.
- 2) You will need two Y axes with different scales for oyster catch (high of 600,000) and nutrient level (high of 8).
- 3) Use a pencil to plot so that you can erase any mistakes.
- 4) Seek approval from me for your graph plan before you begin graphing.

Years Before Present	Oyster Catch in metric tons	Nutrient Level measured as planktonic/benthic diatom ratio*
1000	No data	1
500	No data	1
300	No data	1
250	No data	2
200	No data	2.5
150	No data	3
130	580,000	3
120	600,000	3
100	480,000	3
70	200,000	3
60	80,000	8
50	40,000	8
40	100,000	8
30	90,000	8
20	80,000	8
10	~0	8
0	~0	8

* This is a ratio between a type of floating algae and a type of sea-floor algae. The ratio has been shown to be a good indicator of pollution levels. Cores of the ocean floor can be collected to measure historical planktonic/benthic diatom (algae) ratios

- 1) What is the independent variable? _____
- 2) What are the dependent variables? _____
- 3) Why do you think nutrient pollution in the bay began to increase about 250 years ago?
Hint: It has to do with the arrival of European settlers

- 4) Nutrient levels hold steady for almost 200 years at three and then suddenly increase to eight 60 years ago. Use your graph to determine what happened to the oyster catch at the same time (60 years ago)? _____

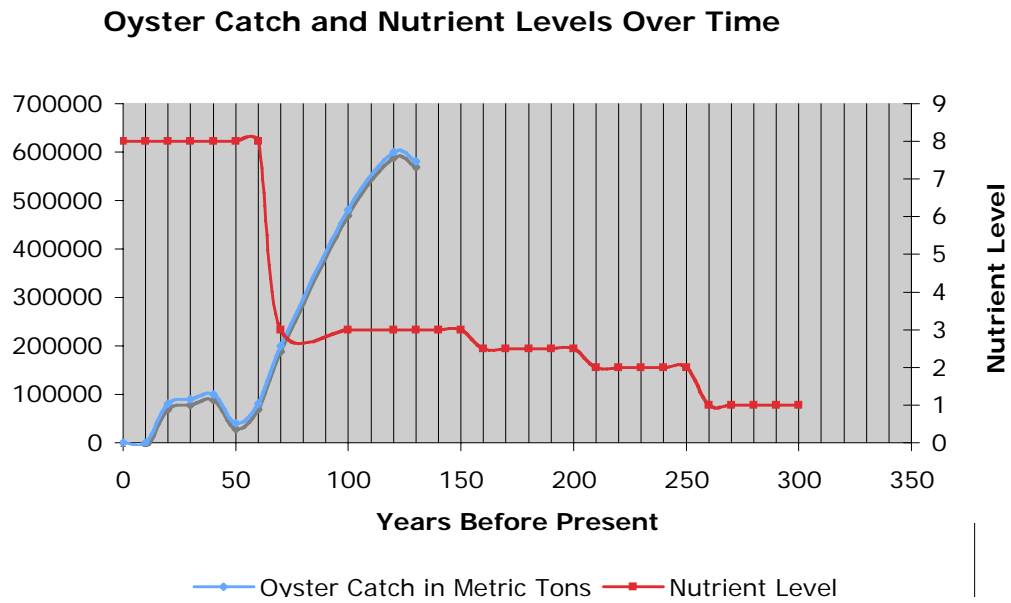
How might the decline of oyster lead to the sudden increase in nutrient levels in the Bay 60 years ago? Use what you know about the role of oysters in the Bay food web to answer this question.

- 5) How does this graph contribute to scientific understanding of the role of oysters in controlling nutrient levels?

- 6) Why are so few oysters being caught today compared to 100 years ago?

- 7) How would you propose to solve the nutrient problem and also help the oyster industry?

Figure 3: Graph of Data From Worksheet 3, Oyster Catch vs Nutrient Levels in the Chesapeake Bay



Worksheet 4: Summary

1) How have humans affected the Chesapeake Bay food web?

2) Explain the role that oysters play in keeping the nutrient levels of the Bay low.

3) Use your food webs and data from part III to list at least five consequences of the altered food web of the Chesapeake Bay.

4) How can understanding historic ecosystem food webs help us understand today's ecosystems?
