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

1) Which organisms are abundant in this ecosystem?
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_____________________________________________________________________
_____________________________________________________________________

2) Which organisms are rare in this ecosystem?
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_____________________________________________________________________

3) List the producers and consumers in this ecosystem?
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_____________________________________________________________________

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

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

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

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

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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?

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_____________________________________________________________________

2) Which organisms are rare or extinct?

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_____________________________________________________________________

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

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_____________________________________________________________________
_____________________________________________________________________

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

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

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

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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.

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_____________________________________________________________________

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.

<table>
<thead>
<tr>
<th>Years Before Present</th>
<th>Oyster Catch in metric tons</th>
<th>Nutrient Level measured as planktonic/benthic diatom ratio*</th>
</tr>
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<tbody>
<tr>
<td>1000</td>
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<td>1</td>
</tr>
<tr>
<td>500</td>
<td>No data</td>
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<tr>
<td>150</td>
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<tr>
<td>130</td>
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</tr>
<tr>
<td>120</td>
<td>600,000</td>
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</table>

* 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

Oyster Catch and Nutrient Levels Over Time

Years Before Present

Nutrient Level

Oyster Catch in Metric Tons — Nutrient Level
Worksheet 4: Summary

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

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

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