Activity 3.5

Parasites on the Half Shell

- Grade Level
  5-8
- Subject Areas
  Science
- Duration
  One 40-minute class session
- Setting
  Classroom
- Skills
  Interpreting, hypothesizing, correlating, graphing
- Vocabulary
  Protistan, Haplosporidium nelsoni, Perkinsus marinus, prevalence, epizootic
- Correlation with Next Generation Science Standards
  3-LS3-2, 3-LS4-2, 3-LS4-3, 3-LS4-4

Materials:

- ☐ Student Worksheet-Activity 3.5
- ☐ Data set
- ☐ Computer graphing program (optional)

Charting the Course

In the following Data Activity, students become shellfish biologists and examine *P. marinus* disease dynamics at three Delaware Bay oyster bars. Students will correlate their disease data observations with environmental conditions at the site.

Background

During the past four decades Delaware Bay oyster populations have been plagued by two disease-causing protistan oyster parasites. Though quite harmful to oysters, the diseases do not affect humans. The first parasite *Haplosporidium nelsoni,* or MSX first appeared in 1957 and caused severe mortalities of oysters in the higher salinity areas of the bay. Over the following 2 to 3 years the parasite spread and killed 90-95% of the oysters on the lower bay planted grounds and 50% of the oysters in the upper bay seed-beds. Since that time oysters in the bay have developed natural resistance to the disease and at the present time though still present in the Bay MSX does not cause significant oyster mortalities. The second oyster parasite, *Perkinsus marinus* (also called Dermo disease) emerged in the early 1990s and caused severe oyster mortalities in the lower seed-bed area. *Perkinsus marinus* was not new to the Bay as it was first documented in Delaware Bay oysters in the 1950s and since that time had occasionally been found; however, it was not associated with significant oyster mortalities until the 1990s. The intensification of *P. marinus* in the Delaware Bay was coincidental with a northward expansion of the parasite from the Chesapeake Bay to the Damariscotta River in Maine. This expansion was associated with atypically dry and warm weather conditions. Today *P. marinus* remains a significant threat to Delaware Bay oyster populations and causes severe mortalities of oysters in the moderate to high salinity areas of the Bay.

In order to gain a better understanding of the disease and to better manage Delaware Bay oysters, scientists carefully monitor the levels of the disease throughout the Bay. You can't tell if an oyster is infected with the disease just by looking at it, a tissue sample must be analyzed using a special diagnostic assay for an accurate diagnosis to be made. Typically 20 to 30 oysters from a particular site are examined. The percentage of infected oysters in the sample is termed the disease prevalence. Epizootic is the term for an outbreak of a disease in a particular animal population. Epizootiology refers to the sum of factors controlling a particular disease in an animal population. *Perkinsus marinus* prevalence varies seasonally and annually in response to varying environmental conditions. *Perkinsus marinus* prevalence increases during the summer and Fall in response to warm water temperatures and then declines in the winter and spring in response to cooling temperatures. The distribution of the parasite within a particular estuary or tributary varies with salinity—*P. marinus* prevalence is generally higher down bay where higher salinities prevail than upbay where lower salinities are dominant. The disease tends to be more prevalent in drought years when river flows are reduced and salinities increase bay wide than in wet years.

Objectives / Students will be able to:

1. Identify two common oyster diseases.
2. Correlate environmental conditions with disease prevalence.
3. Compare and contrast oyster disease levels between years.

Procedure / Warm Up
Set the stage by posing the question " what might cause the oysters of Delaware Bay to decline?" Introduce the concept of an epizootic. Introduce *Perkinsus marinus* as a protistan disease of oysters, which has severely impacted Delaware Bay oyster populations. If you were trying to manage the oyster resource of Delaware Bay, what might you want to know about the disease?

The Activity [Class Period 1]

1. Divide the class into teams of shellfish biologists charged with studying the *P. marinus* disease in oysters.
2. Each team will receive a data set containing the results of disease, temperature, and salinity samples that were recorded for most months in 2004. 3. The samples were collected at three oyster bars Arnolds, Shell Rock, and New Beds.
3. Students should graph the data (either by hand or using excel if proficient in it).
4. Using their graphs students should:
5. Compare temperature at the three sites.
6. Determine the maximum and minimum temperature for the year and indicate the month in which they occurred.
7. Compare salinity at the three sites, which site had the lowest salinities, which had the highest salinities?
8. Determine the range of salinity at each site.
9. Compare *P. marinus* prevalence at the three sites, which site had the highest and which had the lowest.
10. Determine at what time of the year disease was the highest.

Extensions / Based on their analysis of the data students should speculate on why they saw salinity and disease differences between the sites and why temperature varied little between sites.

Discuss the relationship between temperature and disease levels.

Predict which oyster bar is going to be most impacted by disease.

As shellfish biologists what recommendations might students make to the oyster resource managers and those involved with the oyster fishery.

Student Worksheet Activity 3.5—Parasites on the Half Shell

Name_____**Date** _____

A. Using the chart on the following page and the data in Table 1 draw graphs to compare the monthly prevalence of *Perkinsus marinus,* temperature, and salinity at the oyster bars known as Arnolds, Shell Rock, and New Beds for 2004. Be sure to put a title and labels on your graph.

B. After completing your graph answer the following questions.

1. Compare temperature at the three sites.

2. Determine the maximum and minimum temperature for the year and indicate the month in which they occurred.

3. Compare salinity at the three sites, which site had the lowest salinities, which had the highest salinities?

4. Determine the range of salinity at each site.

5. Compare *P. marinus* prevalence at the three sites, which site had the highest and which had the lowest.

6. Determine at what time of the year disease was the highest.

7. Based on their analysis of the data students should speculate on why they saw salinity and disease differences between the sites and why temperature varied little between sites.

8. Discuss the relationship between temperature and disease levels.

9. Predict which oyster bar is going to be most impacted by disease.

10. As shellfish biologists what recommendations might students make to the oyster resource managers and those involved with the oyster fishery.

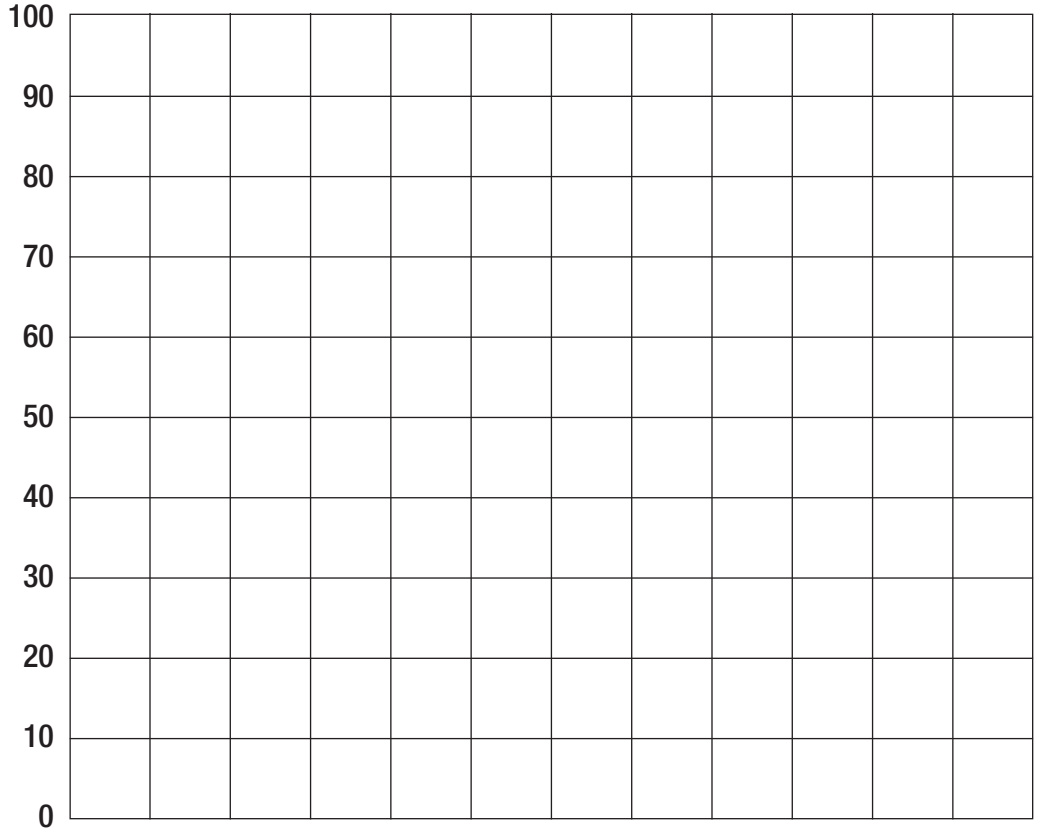
Perkinsus marinus Prevalence (% infected)		Oyster Bar		
Year	Month	Arnolds	ShellRock	New Beds
2004	January			
2004	February			
2004	March	10%	25%	40%
2004	April	0%	15%	35%
2004	May	5%	0%	20%
2004	June	5%	30%	55%
2004	July	5%	30%	50%
2004	August	15%	60%	35%
2004	September	10%	50%	35%
2004	October	5%	60%	65%
2004	November	10%	60%	55%
2004	December	8%	50%	55%

Temperature (°C)		Oyster Bar		
Year	Month	Arnolds	ShellRock	New Beds
2004	January			
2004	February			
2004	March	7.1	6.4	6.5
2004	April	13.8	12.7	13.3
2004	May	23.2	23.5	23
2004	June	24.1	23.6	23.5
2004	July	25.5	25	25.4
2004	August	25.6	25.5	25.8
2004	September	22.1	21.8	22.2
2004	October	16.0	16.0	16.1
2004	November	9.2	9.5	9.5
2004	December			

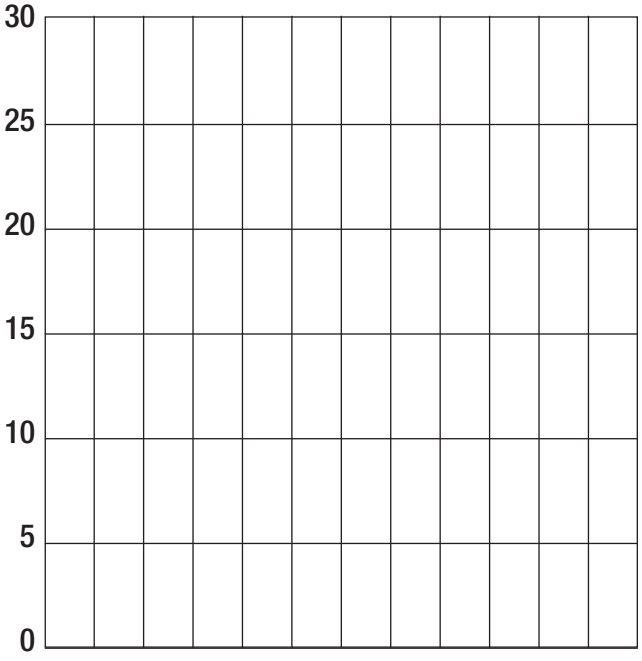
Salinity (ppt)		Oyster Bar		
Year	Month	Arnolds	ShellRock	New Beds
2004	January			
2004	February			
2004	March	7.6	12.9	15.8
2004	April	7.6	12.8	14.8
2004	May	7.1	15.0	16.4
2004	June	10.6	18.3	17.6
2004	July	10.6	16.1	17.1
2004	August	5.0	17.6	12.6
2004	September	0.1	18.7	12.5
2004	October		12.8	16.9
2004	November	3.3	14.5	12.3
2004	December	7.6	14.0	15.8

Student Worksheet Activity 3.5—Parasites on the Half Shell

Perkinsus marinus prevalence



Salinity



Temperature