Cary Institute
of Ecosystem Studies

Name _____   **Date** _____

Lesson 1 - Exploring Hudson River PCB Data

Part 1: Background reading. Using the reading, please answer the following questions:

1. What are PCBs, and why are people concerned about them?

> *PCBs are a class of man-made chemicals called Polychlorinated Biphenyls. People are concerned about PCBs because consumption of them has been linked to a number of health effects such as cancer, reduced immune responses, low birth weights and learning disabilities.*

2. Where do most of the PCBs in the Hudson River come from?

> *PCBs in the Hudson come mostly from two plants owned by General Electric where they were used as fire preventatives and insulators*

3. What is The Superfund Act, and why is the Hudson a site?

> *The Superfund Act pays for cleanup of abandoned or uncontrolled hazardous waste sites, and the Hudson was designated as a site because of the PCB contamination.*

4. How do fish get PCBs in their bodies?

> *By eating contaminated plankton through the process of bioaccumulation. The smaller organisms take it up from the sediment.*

5. Where do PCBs generally accumulate in a fish?

> *In the fat cells or lipids.*

6. What factors determine the level of PCBs in a fish? Name at least three:

What it eats
Where it lives
The amount of fatty tissue it has
Its age

7. Compare the levels of PCBs in Hudson River fish with those found in fish from other locations in the United States.

PCBs are higher in the Hudson than other rivers on the East Coast

8. What is the supermarket standard or "acceptable" level of PCBs in a fish for consumption as determined by the Food and Drug Administration?   *2ppm*

9. Explain the process used to sample fish in the Hudson River.

State scientists collect fish from different places in the Hudson and send them to a lab to be analyzed for PCBs

10. Explain how the Hudson is being cleaned up.

The Hudson has been dredged to remove sediment contaminated by PCBs

11. Why will fish in the Hudson River still have PCBs for many years to come?

Because of bioaccumulation, PCBs already in the food web will continue to move through it for many years.

12. Go to http://www.health.ny.gov/environmental/outdoors/fish/hudson_river/ and find out some more specific information about New York, or use the handout provided by your teacher.
    1) For women under the age of 50, and people under the age of 15, how many fish can be eaten safely from the Hudson River south of the Corinth dam?

    None

    2) For men over the age of 15 and women over the age of 50, explain the fish advisory in the county where YOU live:

    This will depend on information specific to the student

Part 2: Exploring Data *Answers to questions 1-7 in this section will depend on student data*

1. Get an envelope with striped bass fish data from your teacher. These are data from one fish collection date in 2008 from Catskill, NY.

2. Sample 3 times from your envelope (which represents the Hudson River). Record the PCB level in each fish and then find the average PCB levels of your three fish in ppm:

    _____ _____ _____

    Average:_____

3. Based on this number, would you say that fish in the Hudson River are above the federal standard for PCBs of 2 ppm? Why or why not?

4. Share your average with the class. Write down all of the other averages found by the other groups, and then find the average of the averages:
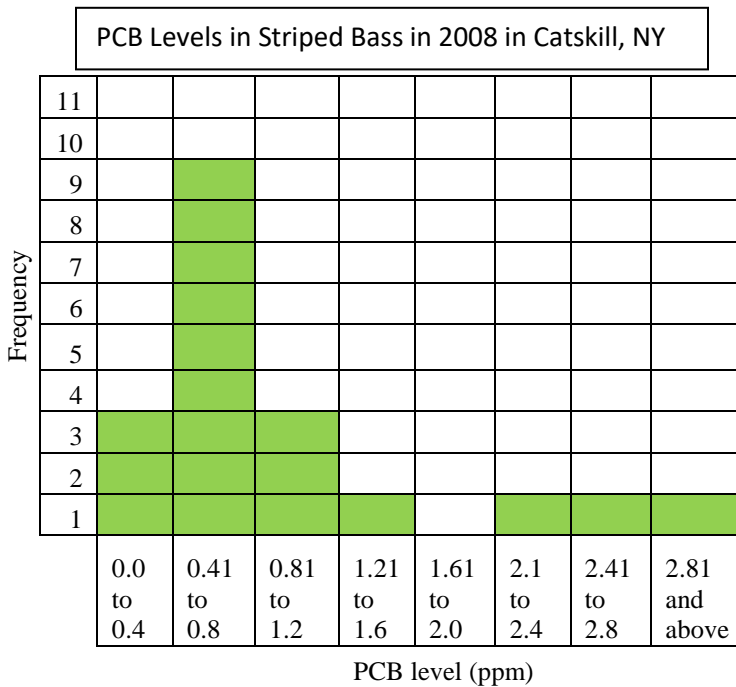
Group	Average
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Class Average	1.09

5. How did your three fish - your sub-sample - compare with the other groups' sub-samples? (Is your average the same as, higher, or lower than the other averages?)

6. How does your sub-sample compare with the class average? (Is it the same as, higher, or lower?)

7. Based on the class average and the small sub-sample averages, would you revise your answer to question #4 about fish being above the federal supermarket standard? Why or why not?

8. Now, create a histogram with all of the data in your envelope. Shade in the boxes above the PCB level for each fish. Label the values that are ABOVE 2.0 ppm so that you know how high the PCB levels are in those fish. Then calculate the average for the entire dataset and mark it's location with an X on the histogram.

PCB Levels in Striped Bass in 2008 in Catskill, NY

| Frequency	0.0 to 0.4	0.41 to 0.8	0.81 to 1.2	1.21 to 1.6	1.61 to 2.0	2.1 to 2.4	2.41 to 2.8	2.81 and above
11								
10								
9		▓						
8		▓						
7		▓						
6		▓						
5		▓						
4		▓						
3	▓	▓	▓					
2	▓	▓	▓					
1	▓	▓	▓	▓		▓	▓	▓

PCB level (ppm)

9. Calculate the probability that you will catch a fish that has a PCB level that is higher than the supermarket standard of 2ppm. Divide the total number of fish by the number over 2ppm:

Number of fish over 2ppm: 3

Total number of fish caught: 19   =   0.16

10. Think again about your answer to #3. Are fish in the Hudson River above the supermarket standard? Explain your answer.

This is a thought question, there is no right answer as long as the student justify their position

11. Look at these data for striped bass that were sampled in the same location but in a different year. Compare the data from the two years. What similarities and differences do you notice (use the box at right)?   The mean for the dataset is 1.06ppm (marked with an "X" below).

PCB Levels in Striped Bass in 2002 in Catskill, NY
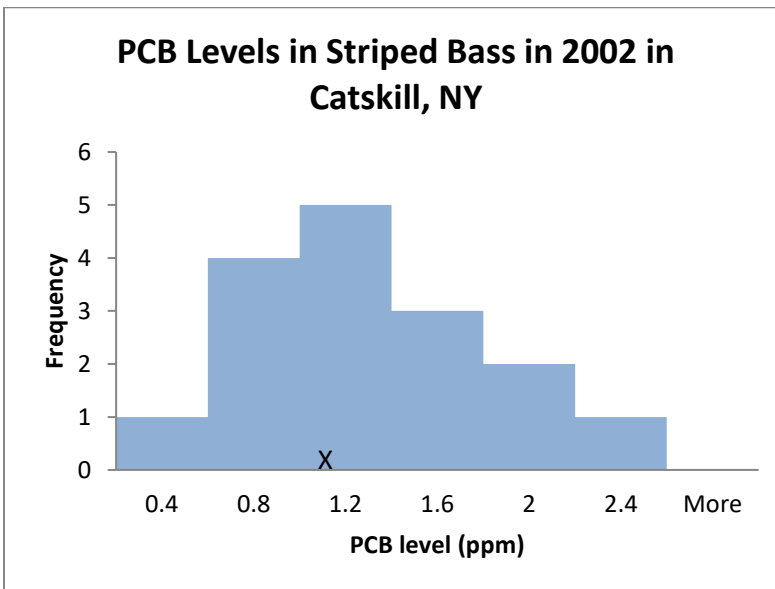
Similarities:

-shape is similar

-means are similar

Differences:

-there are more values closer together in 2008

-the most common value is lower in 2008

-2008 has a more skewed distribution

12. Based on the two graphs, which data set has less variability - or, in other words, in which year are the PCB levels in the fish more similar to one another?

   a. Circle the year: 2008   or   2002

   b. Explain:

2002 has less variability because there is a smaller range of PCB levels in the fish

13. Here is some descriptive information about the two sets of data.

	Sample Size of fish	Average (PCB ppm)	Probability of catching a fish ≥ 2ppm
2002	16	1.06	19%
2008	19	1.09	16%

a. Imagine that you went fishing in 2002, and again in 2008. You caught and ate a striped bass each year. In which year is it more likely that the striped bass you ate had a PCB level that was higher than the FDA supermarket standard of 2ppm? How did you decide that?

In 2002 it is more likely because a higher percent of fish were above the supermarket standard.

14. Let's practice what we've learned with some additional data, from a different location in the river (further north, near Troy, NY).
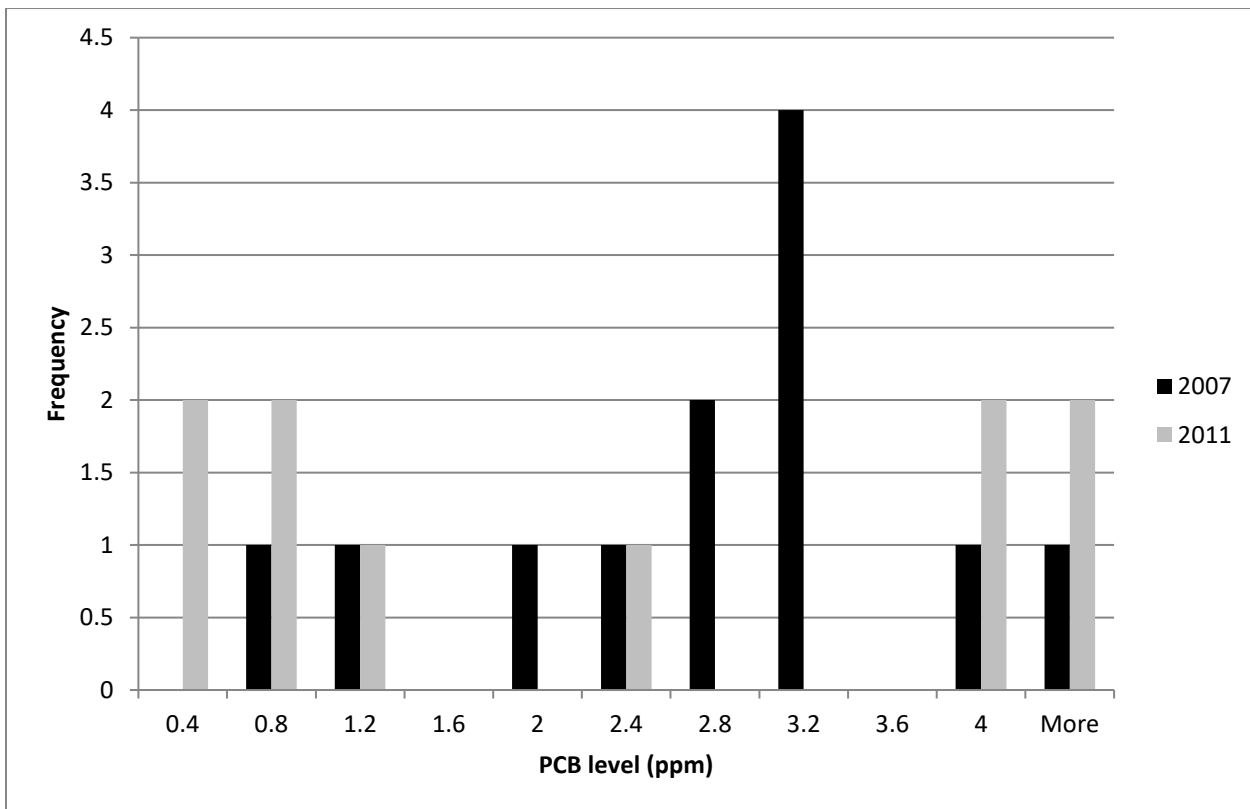
Here are some summary data about these two samples:

	Sample Size of fish	Average (PCB ppm)	Probability of catching a fish ≥ 2ppm
2007	11	2.49	82%
2011	10	2.43	50%

a. Based on this information, which sample has the higher variability? Describe the variability.

2011 has higher variability because it has a bigger range and the sample is more evenly distributed in that range.

b. If you had caught striped bass in both years, and put them in your freezer to eat later, which one would you rather eat - a bass caught in 2007, or one caught in 2011? Why?

In both years, the average is above the supermarket standard, so neither is good to eat. But it's better to eat the one from 2011, because a lower percentage of caught fish are above the supermarket level.

15. How did your answer to question #3,"Are Hudson River fish below the federal standard for PCBs?" change during this activity?

This will depend on the student

16. Based on this activity, would you say it is OK to eat striped bass from the Hudson River? Why or why not? If you are not comfortable, what else would you need to know in order to make an informed decision?

This will depend on the student