Name _____ **Date _____**

Lesson 2: Where is the best spot to eat striped bass from the Hudson?

Part 1: In this activity, you will be comparing PCB levels in striped bass found in the Hudson River at the Troy Dam with four other locations in the Hudson in 2011. Here are some questions to get you started.

1. Why might fish found in different parts of the river have different concentrations of PCBs? Please list at least three different reasons:

2. Everyone will compare PCB levels in striped bass sampled from the site farthest north and closest to the source of PCB's in the Hudson (the Troy Dam site, river mile 153) with another site downstream. The sites are listed below.

    a. Catskill (river mile 113)
    b. Poughkeepsie (river mile 76)
    c. Haverstraw Bay (river mile 36)
    d. George Washington Bridge(river mile 12)

    Circle the site you have been assigned *besides* the Troy Dam site. Now, state a hypothesis about how you think the PCB levels might differ in fish between the two locations, and justify your hypothesis. Remember, a hypothesis is a testable statement.

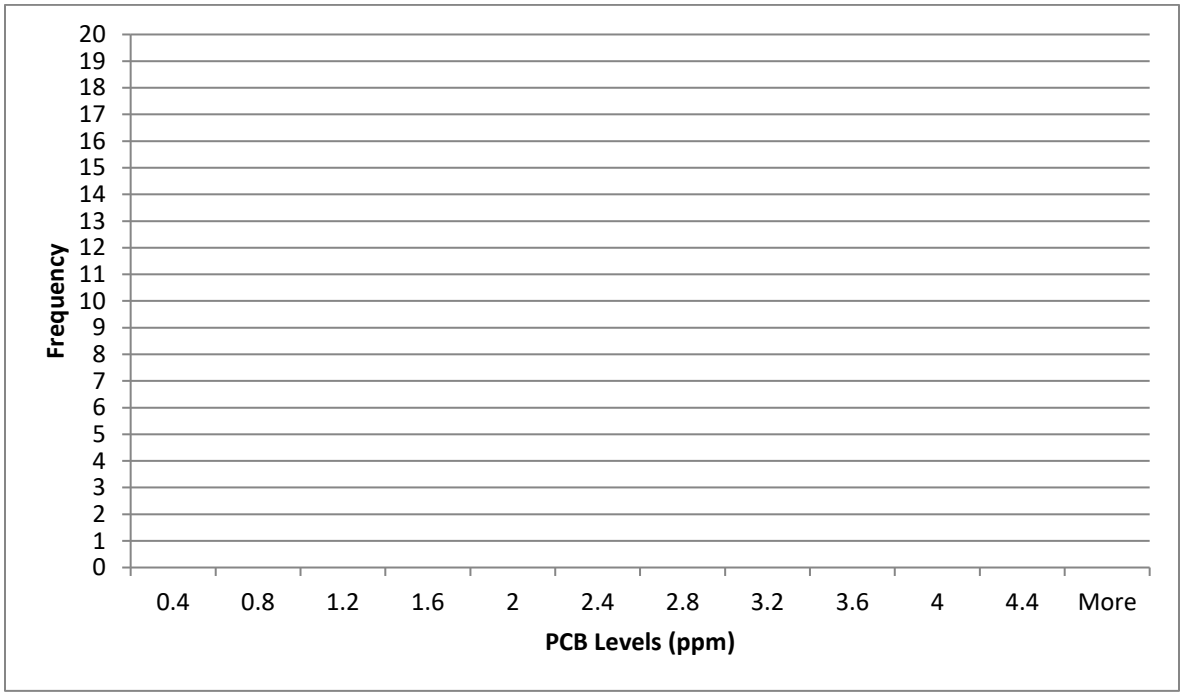
3. Open the excel data file for your location. Each file will have several sheets - one with combined data, and one for each location. Find the average and standard deviation of the total PCB levels in the striped bass at each location for 2011 using formulas in Excel:

Location	Average	Standard Deviation
Troy		
_____		

4. Which location has more variability, based on the standard deviation?

5. Create frequency histograms for the sample from each location, using the same x-axis for each graph. Bins or ranges of PCB levels and frequencies or counts for the Troy data are given to you in the table below. Write the name of your site in the right hand column and the number of fish in that sample within each range of PCBs. Then use the blank graph to make a histogram. Use different colors or patterns to distinguish the two different locations. This will look similar to a double bar graph. *Note: Excel does provide a histogram function, but it may be easier to graph this by hand!*

Bin	*Site:* *Troy Dam*	*Site (fill in):*
	Frequency	Frequency
0-0.4	6	
0.41-0.8	3	
0.81-1.2	3	
1.21-1.6	0	
1.61-2	2	
2.01-2.4	1	
2.41-2.8	0	
2.81-3.2	1	
3.21-3.6	1	
3.61-4	2	
4.01-4.4	0	
More than 4.41	2	



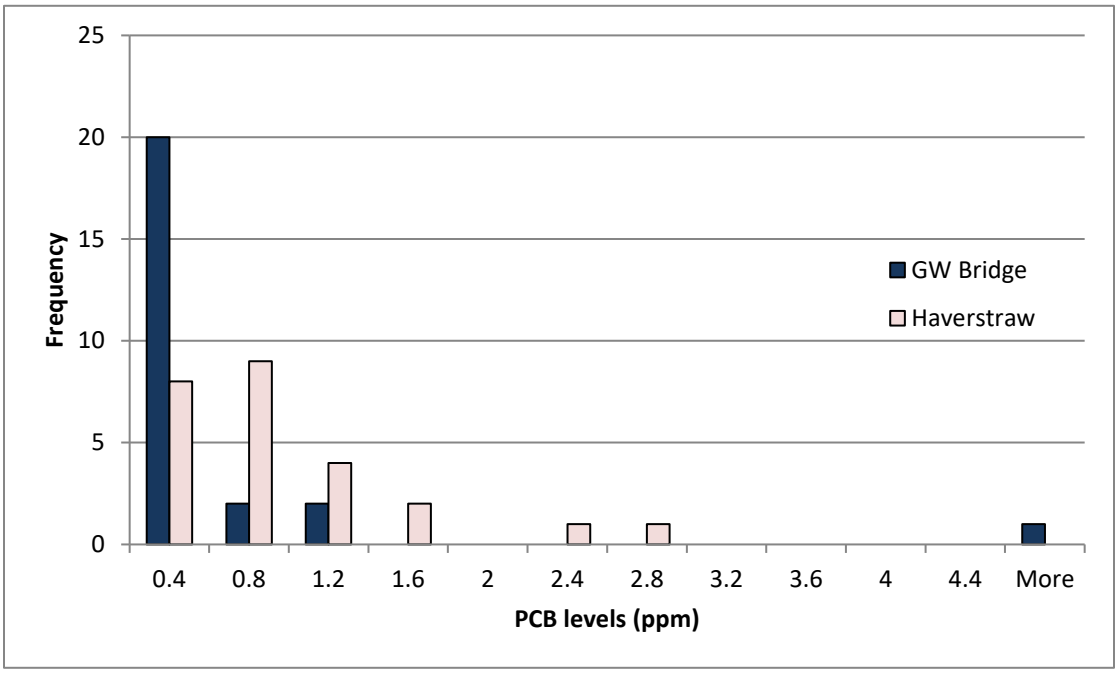
6. Based on the average and standard deviations, and the visual of the histogram, do you think the averages at the two locations are significantly different?
    a. Circle: Yes/No
    b. Why?

7. T-tests can be used to see if the difference between two means is significant. A t-test answers the question "is there more variation between samples than within each sample?" by comparing the means and a measure called variance for each sample, which is similar to (but not the same as) the standard deviation. Now, look at t-test worksheet provided to confirm whether your comparison was significant. Was your hypothesis supported by the t-test?
    a. Circle: Yes/No
    b. Explain.

    c. Share your results with your classmates!

Part 2: Examining Patterns in Space and Time

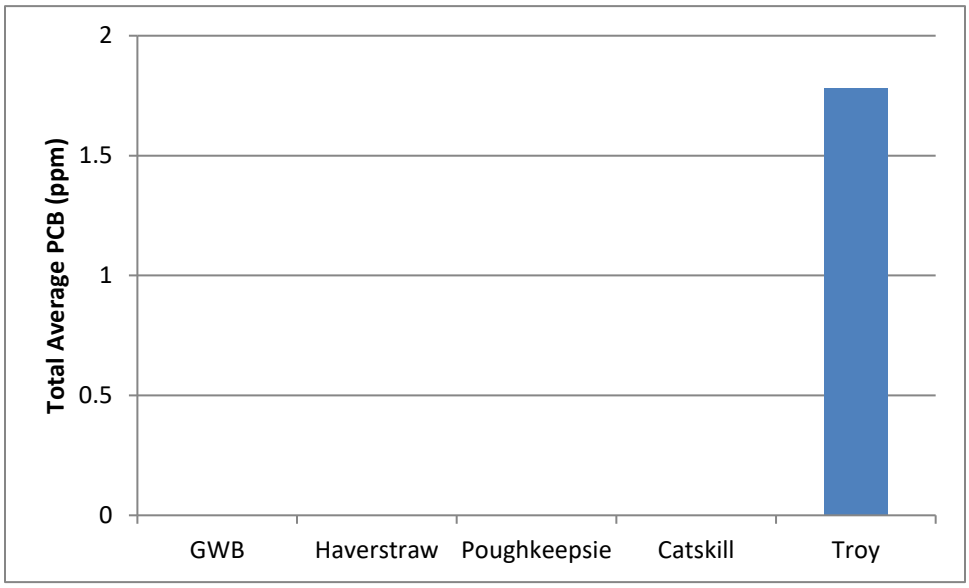
8. Look at the frequency histograms of data from fish sampled at the George Washington Bridge and Haverstraw Bay in 2011. The average PCB levels were 0.729 ppm at Haverstraw Bay and 0.52 ppm at the GW Bridge.



a. Looking at the graph, decide whether you think this difference is statistically significant, i.e., that fish are more contaminated at Haverstraw Bay as compared to the GW Bridge. Why or why not?

b. Then, using the provided t-test worksheet, see if you were correct!

9. Share your average and whether your comparison was significant with the class. Combine the average PCB levels found at each site into the single graph below. Over each mean, indicate in some fashion whether it was significantly different from the Troy site. The Troy site has been added for you.



10. At which location were the striped bass the most contaminated in 2011?

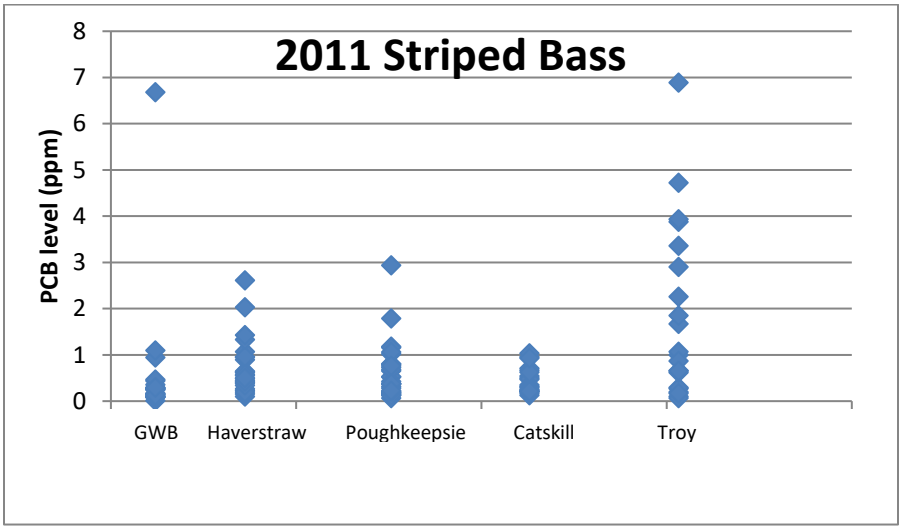
11. At which location were the striped bass the least contaminated in 2011?

12. How did the relationship you saw in your two locations compare with your hypothesis?

13. Make a claim, supported by evidence, about the relationship between location and PCB contamination.

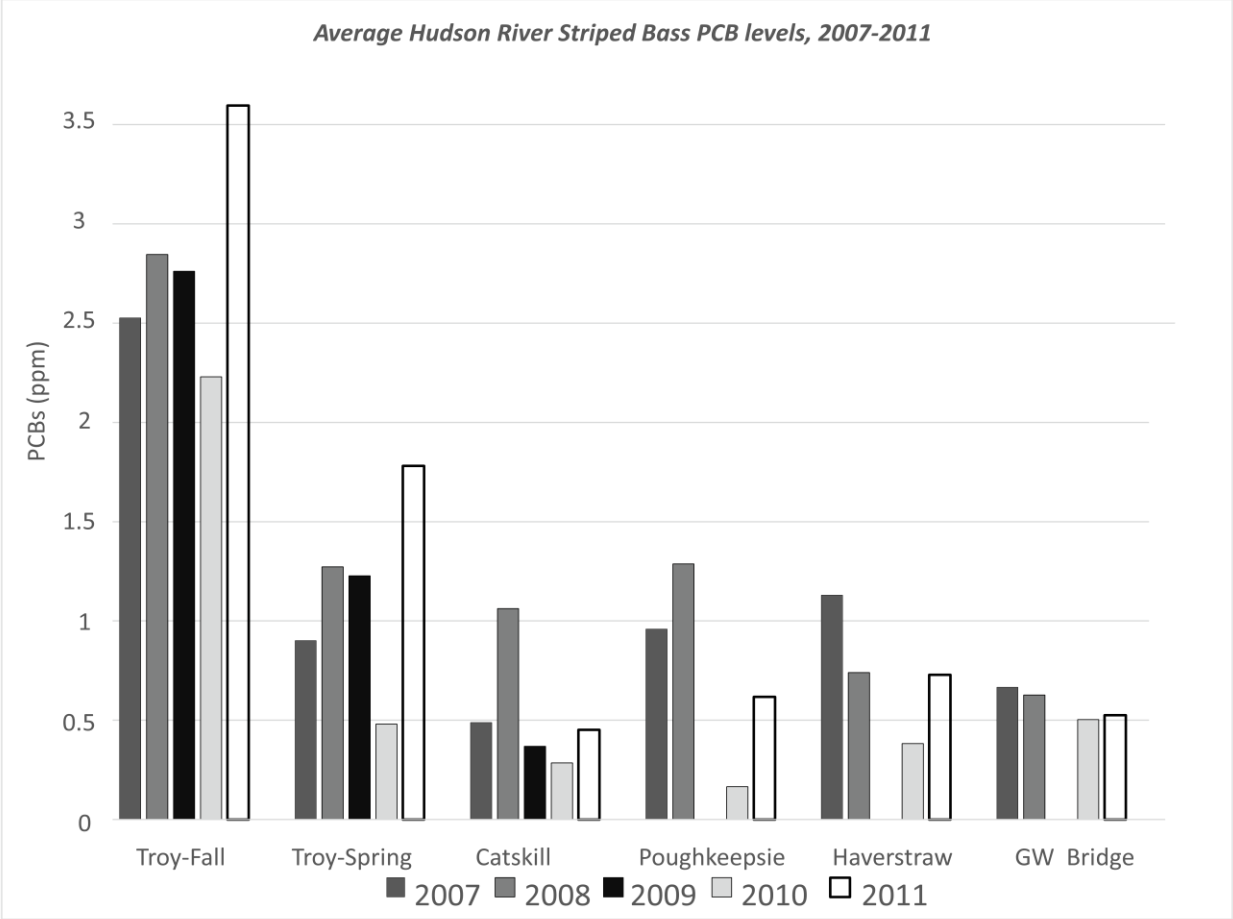
14. At your site, every fish had a different level of PCBs. Why do you think there were differences between the PCB contamination levels in the fish at your site? Include at least two possible reasons.

15. Think about the summary graph of averages you created, and the more detailed graph below (the scatterplot of all 2011 striped bass data). What are you missing when you only see an average? Use the box below to answer.



Location	# samples
George Washington Bridge	25
Haverstraw	25
Poughkeepsie	30
Catskill	20
Troy	31

16. How variable are PCB levels in Striped Bass over several years? Use these summary data to describe the differences between locations



17. If you had to advise a fisherman about eating fish from the Hudson, what would you say? Why?

18. Based on this activity, do **you** feel comfortable eating striped bass from the Hudson River? Why or why not? What else would you like to know in order to make a decision?