Interpreting Your Data

(It is important to note that there are not always answers to some of these systems interaction questions. Suggested way to think about framing answers or further questions are in *italic red*)

Data interpretation is an important part of any data collection program. Learning how to collect the data correctly is important, but analyzing the data for what it is telling us is an important part of the process.

• Start by making sure all the data you have collected is recorded on one simple sheet. This allows you to review all your results quickly and any trends and relationships that exist are more evident.

• Do not forget to look at your physical survey. Physical conditions can have **significant impacts** on the data and will help you in understanding what it all means. Pay careful attention to the weather (both present and prior few days), time of day, tide, time of year, and how these conditions may have contributed to your results.

Some suggestions on how to organize your thinking:

WATER QUALITY SAMPLING:

1. Review your data collection sheets. Be careful when transferring data from individual sheets to poster board and master sheets to avoid posting data in the wrong place, with the wrong decimal location or with incorrect units etc.

2. Look at consistency or trends in the data recorded. **First** examine each individual parameter tested throughout the day looking for any trends within that one parameter. **Next** examine the tests in combination to look for any trends or interrelationships with the tests. Here are some examples…
   a) Does the Dissolved Oxygen (DO) level seem to change during the day? What could cause the DO levels to change during the day?

   PHOTOSYNTHESIS
   Photosynthesis only occurs during daylight – so as the sun rises in the sky photosynthesis causes DO levels to increase in the river.

   Respiration and decomposition occur 24 hours a day consuming oxygen, so very early in the day when there has been no photosynthesis overnight, oxygen levels should be at their lowest. But there are other factors that can be involved as well, read on.

   Tides can have a relationship with DO

   b) How might the physical conditions have affected the results? Did the wind pick up during the testing period? Would this affect the level of DO in the water? Why?
   Oxygen concentrations are higher in air than they are in water. Air is about 21% oxygen, while water is a fraction of 1% oxygen. Where the air meets the water the oxygen molecules in the air dissolve in the water. If you add a lot of wind the mixing of surface waters by wind and waves adds even more DO.

   c) DO is critical for survival of aquatic organisms. Did temperature or salinity affects the level of oxygen in water?

TEMPERATURE

Temp. - As water warms it loses the ability to hold DO – (cold water can hold more of any gas – oxygen is just one of these gases). This is referred to as % saturation. % saturation is important since oxygen can be present in the water but at such a low concentration that it is not useful for sustaining aquatic life.

Temperature and salinity affects the solubility of oxygen in water. The percent saturation chart provided accounts for differences in temperature in determining the level of dissolved oxygen during the day, but is based on a freshwater system, and does not account for differences in salinity. The same DO reading in water that has high salinity will have less available oxygen than in water with low salinity.

d) What about the weather? Rain today or in the last few days?

Rain often means some areas will have issues with Combined Sewage Overflows that can bring excessive loads of nutrients into the system causing a rapid reduction of oxygen. This is not an issue in many areas of the river but being familiar with any CSO outlets in your area can offer clues if you suspect this is an issue in your results.

Rain can also have an influence on salinity levels. Often the effect on salinity is one that is not seen for a day or two since it is a cumulative effect of run off from the larger watershed area.

3. Nutrients - The primary nutrients we are concerned with are nitrate-nitrogen and phosphorous. Nitrates are transported in the Hudson River primarily from organic decomposers and from nonpoint sources – such as fertilizers, wastewater treatment facilities and atmospheric pollution from burning fossil fuels are a few. Nitrate in the form of Nitrogen is an essential nutrient for plants and animals as building blocks for protein. In saltwater nitrogen is considered the limiting nutrient as it is less abundant than in freshwater. In freshwater generally phosphorous is the limiting nutrient.

   Nitrate and phosphate levels should be very low in the river. Natural ranges of nitrates are from 0.1-2.0 mg/L. Readings greater than this could cause an impact, with readings 5.0 mg/L and higher certainly causing an impact. In the summer and early fall high levels of nitrate are taken up by algae as this is the most productive time in the river.

4. Phosphorous enters the river system through weathering and leaching from rocks and natural deposits, and through detritus and decomposition. One contributor in the river systems is industrial effluent and detergent wastewater. Phosphorous levels of 0.03 ppm can contribute to increased plant growth (eutrophication). Total phosphorous levels of 0.1 ppm may stimulate plant growth sufficiently to surpass natural eutrophication rates. How will the levels you are finding affect plant growth?

5. Is the alkalinity reading you are recording typical for saltwater systems (check your chart to see what would be defined as typical for saltwater)? Will this level provide for good buffering?

Saltwater systems tend to range 100-125ppm $CaCO_3$ as the saltwater adds to the buffering capacity. Freshwater has a wider range 20-200ppm $CaCO_3$- 50-200 ppm $CaCO_3$ stabilizes pH in a stream. The lower the alkalinity the less buffering capability there is in the water.

6. Is the pH more acidic or base? (Remember 7.0 is neutral) 6.5-8.2 is considered optimal for most organisms. See chart – If pH is between 6.0 and 6.5 it can be harmful to fish if CO_2 is in excess of 100ppm. Changes in water pH can also affect water organisms indirectly by changing other aspects of the water chemistry. For example metals trapped in sediments are released into the water at lower pH level. Is this the case with your sampling? Do you think acid rain has an impact on the pH of the Hudson River?

Saltwater pH in generally 7.7-8.4
Brackish water is ~ 7.5
Fresh would fall below this
The Hudson River has two terrific buffering agents – the saltwater at the lower end of the river and the limestone content of the Heldeberg Mountains at the upper end of the estuary that work to keep the pH fairly well balanced in the river.

7. Is there data that doesn't seem to fit? Were your collection methods correct? Did you wait the proper time on each test?

   What gaps are there in your information?

8. Compare the results with each of the other stations. Are the results consistent station to station?

9. If comparing data over time do you see differences? Are there seasonal differences in water quality tests? What about levels of salinity? What would account for this?

   Rain and snow melt in spring cause lower levels of salinity.

FISH

1. What water quality conditions do you think might impact the fish sampling?

Low DO levels (<5 mg/l and high or low pH (> 8 and <6.5) could definitely impact what fish lived in the water. Some fish need very high DO levels while some of the bottom dwelling fish can tolerate much lower levels of oxygen. Still others are sensitive to changes in DO, like the Atlantic Menhaden and other herring.

pH can also affect fish species, but it tends to be more stable than DO.

2. Would you expect to find different samples depending on the tide? Why or why not?

While the tides might bring a small difference in salinity to the sampling site it is probably not enough to influence the fish community. There are times, however, where a warm current and a tide might bring in a more southern fish species.

3. How might the habitat affect the benthic community? (level of turbidity?, water temperature? Amount of algae etc.? Open water sampling versus next to a rock wall?

There are specific fish that prefer the rocky shelters to being in the open water. Some fish prefer slow still waters while others have high oxygen needs preferring the fast moving waters. The level of turbidity can have an effect on some species.

4. Would you expect there to be seasonal differences in your sampling? Explain.

Yes. Some species spawn in the estuary and so we would find them in the river only during spawning season, or as young of the year. Sampling in the spring it could be difficult to identify some of the catch since there would be lots of very young fish.

5. Does a single fish family appear to dominate the catch? If so, what might be the cause?

Fish that travel in schools can dominate a catch. Others prefer a certain habitat such as a marsh grass, so if you seine in that area you will catch larger numbers of these. Others prefer a specific salinity. Look at all the descriptors for where you sampled to help in answering this.

6. If you were unable to identify the fish did you provide enough descriptors so that someone might be able to identify it later?

Benthic Sampling:

1. Would the physical conditions impact the benthic macroinvertebrate sampling?

Yes the type of substrate and the salinity can impact what lives in an area.

2. How might the habitat affect the benthic community? (level of turbidity?, water temperature? Amount of algae etc.?

The level of salinity can dictate what type of shrimp, mussel, or if a barnacle lives in an area. Water temperature is also a big factor.

3. Are there seasonal differences in benthic sampling?

Yes there can be seasonal differences since temperature, life cycle can all be influenced.

4. Does a single macroinvertebrate appear to dominate the sample? If so, what might be the cause?

Plant Inventory:

1. Does the plant inventory tell you anything about the salt water level of the water?

Is it salt tolerant, does it like to be totally submerged, does it like to be out of the water at some part of the day.

2. Does there appear to be a balance in the plant inventory or does one species dominate?

3. If one species is dominant does this appear to be a positive ecological balance or an invasiveness?

IS one species invasive? Is one native species used specifically as a habitat by native birds or fish?

4 Other observations -

Further Questions:

1. What further questions arose from your analysis?
2. Are there more detailed studies you would like to conduct?