Cary Institute of Ecosystem Studies

Changing Hudson Project

Name _____ Class_____

Water Quality Testing Data Sheet- Chemical

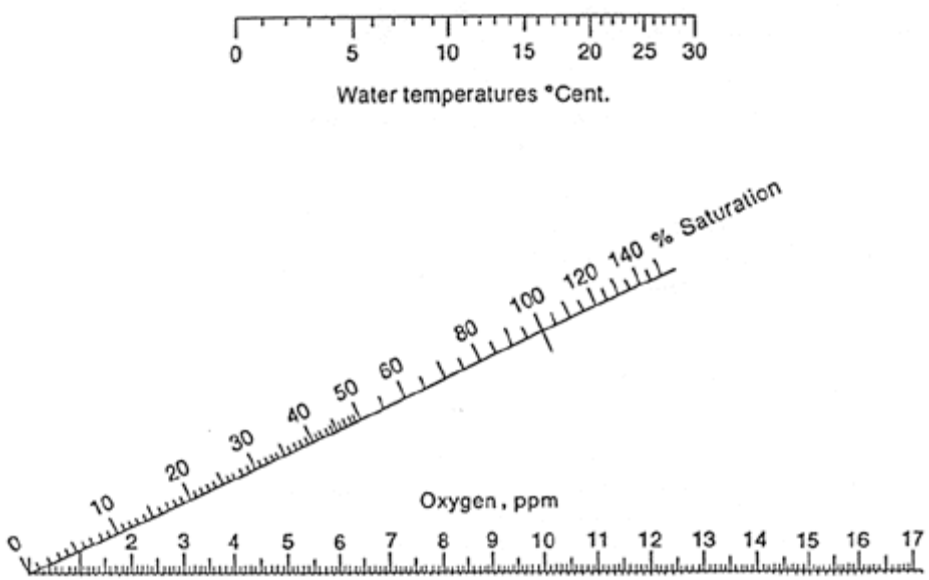
Time of day: _____
Location: _____
Weather: _____ Past 2 days (precipitation events): _____
Air temperature: _____
Observations of the river or stream (water movement, color, etc): _____
_____

Water Chemistry

Test	Equipment used (include brand, ie HACH, Lamotte, or type of equipment: probe, test kit)	Test 1	Test 2	Test 3	Average
Water Temperature					
Dissolved Oxygen (mg/L)					
% saturation					
pH					
Nitrate-Nitrogen (mg/L)					
Phosphate as PO4 (mg/L)					
Turbidity					

Notes:

To calculate percent saturation: find the ppm of oxygen on the lower line and the water temperature on the upper line. Use a straight edge to line up the two readings and record where the straight edge intersects the percent saturation line.



A note about percent saturation: It is possible to get more than 100% saturation. The sample can be supersaturated in an area where there are a lot of plants or algae on a sunny day (due to photosynthetic activity).

Dissolved *Oxygen*

Oxygen is important for many living things and for many of the chemical processes that happen in the water. There are two ways that dissolved oxygen enters water, either from photosynthesis from aquatic plants or through diffusion with the surrounding air. Oxygen is also consumed in the water by respiration of aquatic animals and plants, decomposition of organic matter by microorganisms, and different chemical reactions. When more oxygen is consumed than produced, dissolved oxygen levels in the water will decline. When water has high, relatively stable levels of DO, it is usually considered a healthy ecosystem, capable of supporting lots of different kinds of aquatic organisms. Organisms have to adapt to changing levels of dissolved oxygen, and if these are extreme, it can cause them stress. Low DO (called hypoxic) levels usually indicate pollution or some type of human-caused change, of which there are several major categories:

- organic waste in the form of sewage and animal manure
- nutrients from fertilizers and agricultural runoff
- changing the flow of the water through dams and water withdrawal
- raising the water temperature through the removal of vegetation from stream banks, which increases the water temperature and therefore decreases the dissolved oxygen levels.

Natural processes also affect the dissolved oxygen levels:

- Warm water holds less dissolved oxygen than cold water.
- The lowest levels of DO usually occur in the morning, because photosynthesis stops at night while respiration continues.
- Water at higher altitudes holds less oxygen.
- Fast-moving water generally has more oxygen than still water, because the movement mixes the air into the water. However, if the water is very turbulent, it may hold too much oxygen, causing stress to the aquatic organisms.
- Water with lots of aquatic plants have higher levels of dissolved oxygen, since submerged plants produce oxygen through photosynthesis. Also, as mentioned above, too many plants will ultimately reduce the DO levels, because of either night-time oxygen use by plants or the decay process that consumes oxygen.

For mg/L:

0-2 mg/L: not enough oxygen to support most animals
2-4 mg/L: only a few kinds of fish and insects can survive
4-7 mg/L: good for most kinds of pond animals
7-11 mg/L: very good for most stream fish

For percent saturation:

Below 60%: poor quality, bacteria may be using up the DO
60-79%: acceptable for most stream animals
80-125%: excellent for most stream animals
125% or more: too high

Nitrate

Nitrogen is an essential nutrient for plants and animals, since it is a building block for the proteins that exist in living things. Forms that are common in the environment include **nitrate (NO_3)**, **nitrite (NO_2)**, and **ammonia (NH_3).** We usually measure nitrate when we are testing water quality because it is the most stable form of nitrogen in aquatic systems. Nitrate is found naturally in unpolluted streams and ponds due to the ongoing process of growth and decay, and from inputs from the terrestrial watersheds.

Clean water generally has less than 3 mg/L nitrate-nitrogen. High readings indicate pollution from fertilizer, sewage, or industrial waste. Sewage treatment plant effluent often has discharge with nitrate levels of 30 mg/L NO_3 – N. For other classes of water (fishing, swimming water) the New York government states “none that will result in growths of algae, weeds, and slime that will impair uses”.

Phosphate

Phosphorous is a plant nutrient – it helps plants grow. In natural waters phosphate (PO_4) is the most abundant and stable form of P but organic particles containing P can be important. Natural sources of phosphate include erosion or weathering from phosphate-rich rocks, and recycling of phosphorous from organic matter. In the Hudson, as in many rivers, particulate detritus delivered from tributaries is an important source of phosphorus, as well as tributaries that receive treated sewage. Phosphate is often considered the "limiting factor" in freshwater ecosystems because it is in such short supply, which means that it is the factor that controls how much plant and animal growth can occur.

Clean water has low phosphates, usually between 0.01 and 0.03 mg/l of PO_4. Readings higher than 0.3 mg/l indicate pollution from fertilizer, sewage, industrial waste or detergents and may accelerate the eutrophication process. Waste water is 5 to 30 mg/l phosphate. Drinking water must be less than 0.5 mg/l phosphate, according to federal law.

pH

pH, which literally stands for the 'power of hydrogen', is an important part of water quality. Many fish and invertebrates are sensitive to high (above 9) and low (below 5) pH levels. At low pH levels the bones of fish can become soft and they may be unable to lay eggs successfully. In acidic conditions fish gills become clogged with mucus, making it difficult for the animals to get oxygen into their bloodstream. Sometimes, air pollution can cause precipitation to have a lower than normal pH. The pH of unpolluted rain is about 5, while rain that has become acidic because of pollutants has a range from 3.5 to 4.5. This is called "acid rain". Other substances, like concrete or drain cleaner can cause the pH of water to be very high.

Water with a pH range from 6.5 to 8.6 is best for fish and most invertebrates, and most natural waters fall within this range. Exceptions are bog-dominated lakes which often have a very low pH and some naturally eutrophic systems and inland saline lakes which can have very high pH values. Water with a pH less than 5.0 or greater than 9.0 is harmful for aquatic life, and is usually due to some kind of human input.