WATER WATCH

Nutrients and Chlorophyll

What are *nutrients* and *chlorophyll a* and why do we test for them?

Nutrients

You may have noticed that one of the samples that you collect for the Biscayne Bay Water Watch (BBWW) monitoring program is sent to a certified laboratory for something called nutrient testing. Nutrients, particularly macronutrients – such as nitrogen (N) and phosphorous (P), are key water quality indicators for Biscayne Bay.

Some sources of nutrients include:

- Urban runoff (from streets, lawns, etc.)
- Pet wastes and leaking septic tanks
- Fertilizer and/or manure runoff
- Natural erosion of land that is rich in phosphates and nitrates

Some nutrients are essential for aquatic plant growth—carbon, nitrogen, phosphorus, iron, calcium and silica, to name a few. However, if the level of nutrients that are present are too high, they can have significant negative impacts on a number of things such as aquatic plant growth, oxygen concentrations, and water clarity. Nitrogen and Phosphorus are of important concern because they are essential for the growth of aquatic plants and the concentration of these nutrients in water bodies has increased significantly.

Eutrophication: An increase in the nutrient concentration of a body of water.

One of the conditions that we are very concerned about is something called eutrophication, which occurs when there is an excessive amount of nutrients in the water body. Having too many nutrients, when combined with a number of other factors, can lead to the uncontrolled growth of phytoplankton (*aka* algal blooms). These uncontrolled blooms may prevent light from penetrating the surface of the water, resulting in the death of aquatic plant species. Also, algal blooms tend to quickly deplete the oxygen content in the water when the algae decomposes – creating conditions where there is either little oxygen (hypoxia) or no oxygen present at all (anoxia)! If there is not enough oxygen in the water column, much of the aquatic life (including fish and shellfish populations) may be harmed, leave the area or die; thereby resulting in both ecological and economic damage.

Chlorophyll a

Phytoplankton are single celled marine microorganisms that utilize sunlight to convert carbon dioxide (CO_2) and water molecules into energy and oxygen through the process of photosynthesis. Phytoplankton can be separated into two categories – algae (including microalgae such as diatoms and dinoflagellates) and cyanobacteria (also called blue-green algae), both of which can be found in saltwater environments.

Algae and cyanobacteria both contain chlorophyll, a color pigment that is used as a photoreceptor to absorb solar energy. It also makes these organisms appear green because it absorbs all of the other color wavelengths, while reflecting the green wavelengths. While chlorophyll *a* is one of six types of chlorophyll, it is the one primarily used in photosynthesis and is thus present in all types of photosynthetic phytoplankton. Therefore, the amount of chlorophyll *a* in the water column is in relation to the concentration of algae in the water.

Using chlorophyll *a* as an estimating parameter, we are able to calculate how much algae is in the Bay. Chlorophyll *a* concentrations, in combination with nutrient analysis, are tools that we use to see if there is any indication of an algal bloom or eutrophic conditions. This information can be used by resource managers to asses the current health of Biscayne Bay, track down sources of excess nutrients, as well as to help inform public health officials about the potential for harmful algal blooms.

Image credit: Fondriest