Marine Resources Council

INDIAN RIVER LAGOONWATCH FACT SHEET

Water Quality Testing Program

The Indian River Lagoon, stretching 156 miles from Ponce Inlet to Jupiter Inlet, is one of the most diverse estuaries in North America. It is home to more than 4,000 plant and animal species and one-third of the manatee population in the United States. The natural beauty of the Indian River resulted in the lagoon being designated an "estuary of national significance" in 1989.

The Indian River region is also one of the fastest growing areas in Florida in terms of human development. This rapid growth has resulted in increased urban and agricultural runoff resulting in degradation of water quality within the lagoon. This decline in water quality has led to a corresponding decline in habitat for species living in the lagoon.

The *Indian River Lagoonwatch* is part of an overall approach to assess trends and changes in the water quality of the Indian River Lagoon. The program was established in 1989 by the Marine Resources Council, in cooperation of the Florida Department of Environmental Regulation. It is now supported by the Indian River Lagoon Program and the US EPA. The primary goal is to provide the agencies involved in regulating the lagoon with data of known quality for determining long-term seasonal and temporal trends in water quality. The data augment existing "official" monitoring programs by providing data from remote geographic areas of the lagoon and from selected tributaries not routinely monitored. Volunteers also provide more frequent sampling of a larger number of stations to establish response and lag times or to capture short-lived events such as storms. Regulatory changes are currently being imposed to reduce storm water runoff and eliminate sewage discharges to the Indian River Lagoon. Volunteer monitors can document the affect of these changes on the water quality. In addition, a program utilizing citizen volunteers can increase public awareness of water quality problems and aid the general public in gaining knowledge of how water quality problems are identified and addressed.

It is firmly believed that properly trained citizen volunteers can obtain water quality data that is as accurate and precise as that provided by professional organizations. We also believe that the volunteer monitors will be limited only by the analytical methodology available to them. The Marine Resources Council is dedicated to the success of the *Indian River Lagoonwatch*.

What the Water Quality Tests Tell

Temperature is one of the more important parameters to be considered when examining water quality. Many biological, physical and chemical parameters are dependent on temperature and it can dramatically affect the rates of chemical and biological reactions. Some of the more common things which temperature can have an affect upon are: the solubility of chemical compounds in water, the distribution and abundance of organisms, the rate of growth of biological organisms, water density, mixing of water of different densities and current movements. The amount of oxygen that can dissolve in water is dependent upon temperature. The solubility of oxygen decreases as the temperature of the water increases. Temperature, specific gravity, and salinity are also intimately interrelated. For a body of water of given salinity, as the temperature of the water decreases, the specific gravity will increase and the water becomes more dense. Conversely, as the water warms up, the water will expand and the specific gravity will decrease. This can be an important consideration in evaluating the mixing of waters of different densities. Some of these affects are critical in the Indian River Lagoon, others less so

The Indian River Lagoon is generally shallow. Its capacity to store heat over time, therefore, is relatively small. The water temperature of the lagoon will rise sharply during the summer and decrease markedly during the winter. Wind action serves as the most important mixing phenomenon in the lagoon, because it is so shallow. As a consequence, temperatures at the surface and at the bottom tend to be very similar. However, the variance from winter to summer has a profound affect on biological processes in the lagoon.

Salinity is the concentration of salt dissolved in water. It is normally expressed in parts per thousand or the grams of salt per 1000 grams of water sample (ppt, $^{o}/_{oo}$). In a water body influenced by the ocean, such as the Indian River Lagoon, most of the dissolved salt in the water is due to only a handful of sea salt components.

Freshwater contains few salts and thus has low salinity. Drinking water has a Florida DEP limit of sodium chloride salinity of less that 0.5 ppt (410 ppm) Sea water, on the other hand, has an average salinity of 35 ppt (equivalent to about 5 oz. of salt in 1 gallon of water). The Indian River Lagoon is a site of mixing for freshwater and sea water. Since sea water enters the Indian River Lagoon at the inlets, the salinity is highest at those points and decreases as one moves away from the inlets toward the freshwater inputs. The salinity of the lagoon will thus normally vary between 0 and 35 ppt. Since sea water has an average salinity of 35 ppt, on a given day in the lagoon, it is possible to measure a salinity greater than 35. This is because, in some areas, evaporation is a major controlling force for salinity. There is also a trend of increasing salinity at times of the year when little or no rainfall is occurring. One important aspect of salinity is the density difference it causes. Seawater has a higher density than fresh water due to the dissolved salt. Near the mouth of tributaries, such as the Sebastian River, the lighter fresh water of the river will remain at the surface and flow right over the top of the denser saline water, which tends to remain near the river bottom. These waters will ultimately mix, but where that mixing occurs will depend on tides, winds and the volume of freshwater. Immediately after heavy rainstorms, the head of freshwater will push farther out into the lagoon and can cause decreases in the overall salinity in the lagoon.

Probably the most important aspect of salinity with regards to water quality is its affect on aquatic organisms inhabiting the

Indian River Lagoon. Salinity changes can affect the well being and distribution of biological populations. Large freshwater inputs, particularly after rainstorms, can severely hurt clam populations, causing clams to die as well as having adverse affects on growth and spawning. This can cause a severe impact on the clam industry in the Indian River Lagoon.

Dissolved oxygen (DO) is one of the most important indicators of water quality. It is essential for the survival of fish and other aquatic organisms that inhabit the Indian River Lagoon. Oxygen dissolves in surface water due to the aerating action of winds. Oxygen may also be introduced into the water as a by-product of plant photosynthesis. When levels of dissolved oxygen become too low, fish and many other aquatic organisms cannot survive.

The dissolved oxygen test tells how much oxygen is dissolved in the water. However, it does not tell you how much oxygen the water is capable of dissolving at the temperature at which it was measured. When water dissolves all of the oxygen it is capable of holding at a given temperature, the water is said to be 100% saturated. The colder the water is, the greater the amount of oxygen the water can hold. As the water becomes warmer, less oxygen can dissolve in the water. Salinity is also an important factor in determining the amount of oxygen that a body of water can hold. As the amount of dissolved salt in water increases, the amount of oxygen the water can hold decreases. Conversely, as the water becomes more fresh (has lower salinity), more oxygen can be dissolved.

Reduced dissolved oxygen levels are a recurring problem in the Indian River Lagoon. Excessive amounts of nutrients from septic systems or fertilizer are introduced to the lagoon by non-point source septic tank effluent and storm water runoff. This can result in an excessive growth of algae. After the algae complete their life cycle and die, bacteria consume the dead algae. During this decay process, the bacteria also consume the oxygen dissolved in the water. This consumption of oxygen by bacteria can lead to decreases in levels of dissolved oxygen and in some cases can completely strip the water of all dissolved oxygen. This decrease in dissolved oxygen can cause fish kills and death to other aquatic organisms and can cause bad odors; for example, the sulfide odor typical of many areas of the Indian River Lagoon at certain times of the year.

Water clarity is influenced by material that becomes mixed or suspended in water will cause the water to become more turbid and reduce the clarity of the water. Many factors can contribute to decreasing water clarity. During periods of high rain and heavy runoff, silt and sand washed from streets, yards, and construction sites can be carried to the Indian River Lagoon, decreasing water clarity. In shallow areas, winds and boat activity may stir up bottom sediments, contributing to decreased water clarity.

Decreases in water clarity can have a profound affect on penetration of sunlight below the surface of the water. Plants need sunlight in order for photosynthesis to occur. Those plants, which live on the bottom, principally sea grasses, can be particularly affected by reduced penetration of sunlight. If light levels become too low, photosynthesis may stop altogether and the plants will die. This has been a severe problem in many areas of the Indian River Lagoon where decreases in water clarity have completely cut off sunlight to some sea grass beds, causing them to die.

Large amounts of suspended material can also affect other aquatic organisms. Aquatic plants, such as sea grass, produce oxygen for fish and other aquatic life, as well as provide food, shelter, nurseries and habitat. Less sea grass, in turn, means less habitat for other organisms such as fish and shellfish. Large amounts of suspended matter can also clog the gills of fish and shellfish and can potentially kill them directly. The suspended matter also provides a substrate on which micro-organisms can grow. Fish may have trouble finding food in highly turbid water. However, high turbidity may make it easier for smaller fish to hide from predators.

The Secchi disk provides a convenient method for measuring the penetration of light below the surface of the water and thus the limit of visibility of the water. The disk is lowered into the water until it can no longer be seen by an observer at the surface. As the amount of suspended matter in the water decreases, the deeper you will be able to lower the Secchi disk before it is no longer visible. Shallow Secchi disk readings will occur at times when large amounts of suspended matter are present.

pH is an important water quality parameter. The pH affects the solubility of minerals in water. Human activities including chemical spills, agricultural runoff, sewage effluent and soil leaching can all affect the pH of the water. The solubility of trace metals, some of which can be toxic, are affected by changes in pH, generally becoming more soluble as the pH decreases.

The buffering capacity of water or its ability to resist changes in pH is critical to aquatic life. The ability of aquatic organisms to survive greatly diminishes as the pH falls below 5 or increases above 9. Fluctuations in pH can also have adverse affects on other organisms. As the pH decreases to 6 or less, reductions in species numbers can occur and the ability to reproduce can be adversely affected. When the pH drops to 5 or less, species numbers and diversity will be significantly reduced with some species of fish suffering large mortalities. Below a pH of 4, most species of fish are totally eliminated.

The pH in freshwater portions of the Indian River Lagoon where the water is not substantially buffered, the pH may sometimes be as low as 6. In the higher salinity areas of the lagoon where the water is buffered because of the influence of sea water, the pH will be higher with values of around 8.

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