ANCIENT SOCKEYE SALMON

Work Project for Suttle Lake

Suttle Lake Limnology for Hydrological Parameters from Arctic Buoy Monitoring of Atmosphere & Water units

by

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INTRODUCTION: HISTORY OF ANCIENT SOCKEYE SALMON

Oregon's historically had two sockeye salmon (Oncorhynchus herka) populations that were located in different locations in the geographical regions of the state. One population existed in the eastern part of the state in a lake region that is found in the upper Grand Round River Basin in the Wallowa mountain environment. The second population was located in the Deschutes River Basin and occupied the Cascade mountain region of the Metolius River and its tributes of small creeks and springs.

The principal spawning and growth habitat occurred in Suttle Lake.

However, the travel of young migrants to the Pacific Ocean for adult growth was severely impacted by barriers on Lake Creek in the 1930's and the human needs for electrical power for home building and with industrial development for lumber. Consequently, the fishery recreation and food industry needed these adult salmon to help maintain these activities for the growth of the central Oregon region. Therefore, the State populations and state agencies began the development to restore the lost of these adult salmon by a redevelopment program utilizing the coordination of the Federal agencies of US Forestry, Portland General Electric Co. The Confederated Tribes of Warm Springs Reservation and State agencies of Oregon Fish and Wildlife and Several public, and private enterprises in joint partnerships to help maintain the long-term goals of sustaining the passage of other fisheries occurring in the Deschutes River Basin such as spring chinook salmon, steelhead trout, kokanee trout, and other wildlife. HLAAF became one these joint partnerships by accepting the responsibility of helping Oregon agencies in understanding the population of food species that lived in Suttle Lake at this period of time.

CONTENTS

INTRODUCTION: HISTORY OF ANCIENT SOCKEYE SALMON 1

CONTENTS 2

WHY THE NEED FOR THE LIMNOLOGICAL INFORMATION ON SUTTLE LAKE 3

DATA... 4

CHARTS... 5

GLOSSARY... 10

WHY THE NEED FOR THE LIMNOLOGICAL INFORMATION ON SUTTLE LAKE

The requirement for both the re-establishment of sockeye salmon and other fish populations is dependent upon knowing what the aquatic ecosystems and wetland environmental habitats can furnish these fish species in sustaining a good life needed in future populations. Both marine migratory species and freshwater species must have enough food to eat and healthy environs free of disease so that their bodies can grow into large adults which aid reproduction of the species for the future years. Our HLAAF project purchased an Arctic type of buoy monitoring system that give us data on the both the atmospheric conditions surrounding the lake and the chemical and physical conditions of the water that the spawning adults need in order to place the fertilized eggs under the rocky terrain which allows the egg to grow into a fish embryo or alevin that can emerge from spaces in the rocky terrain to gain access to the microscopic food for them to eat.

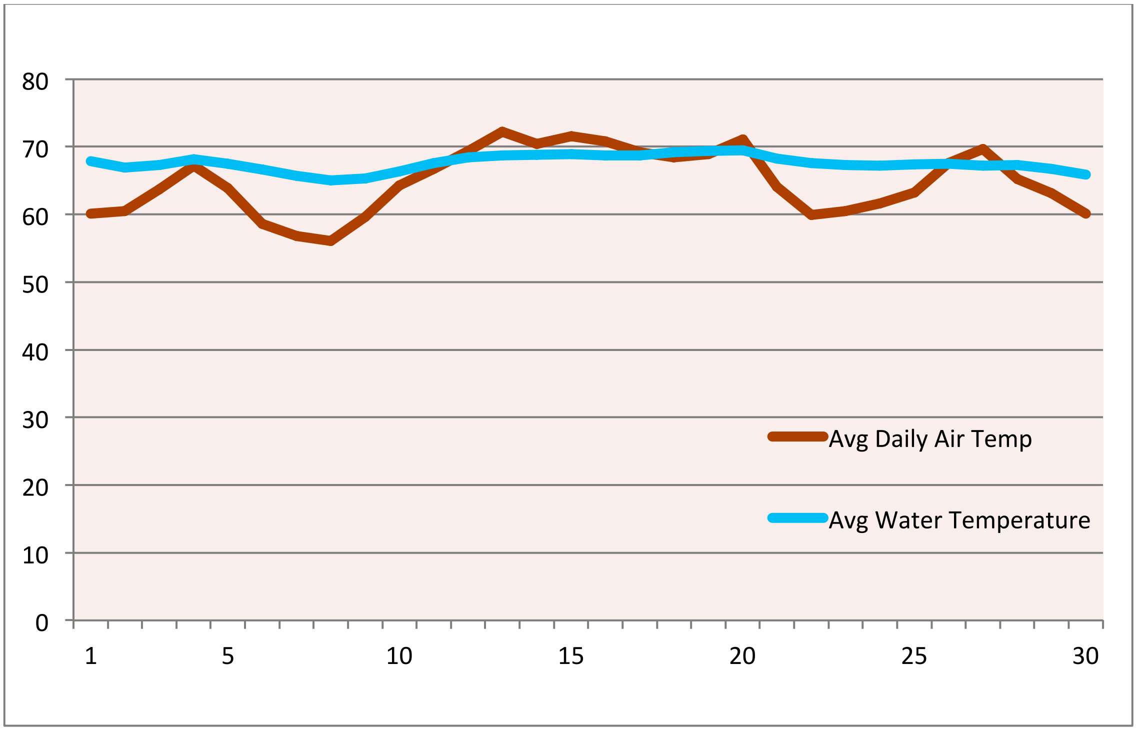
The major food sources are microscopic in size and type. Algal species can use sun light to make their growth through the conversion of light energy by cellular chloroplasts(energy manufacture) and make energy units (ATP) for growth and excrete the CO2 coupled with excretory product cytochrome a. Small fish can eat these algae for their bodies' carbohydrates, fats, and proteins for their energy need to make body tissues and organs. These same algae furnish other types of predators such as crustacean shrimp and other crabs etc. which become food for the growth of small fish into larger juveniles that travel migratory routes to the Pacific ocean for predation of other fish or large crabs, squid, and octopus etc. to become large adults that can return home for reproduction purposes that maintains the genetic program for sustaining the population of fish of the future.

DATA

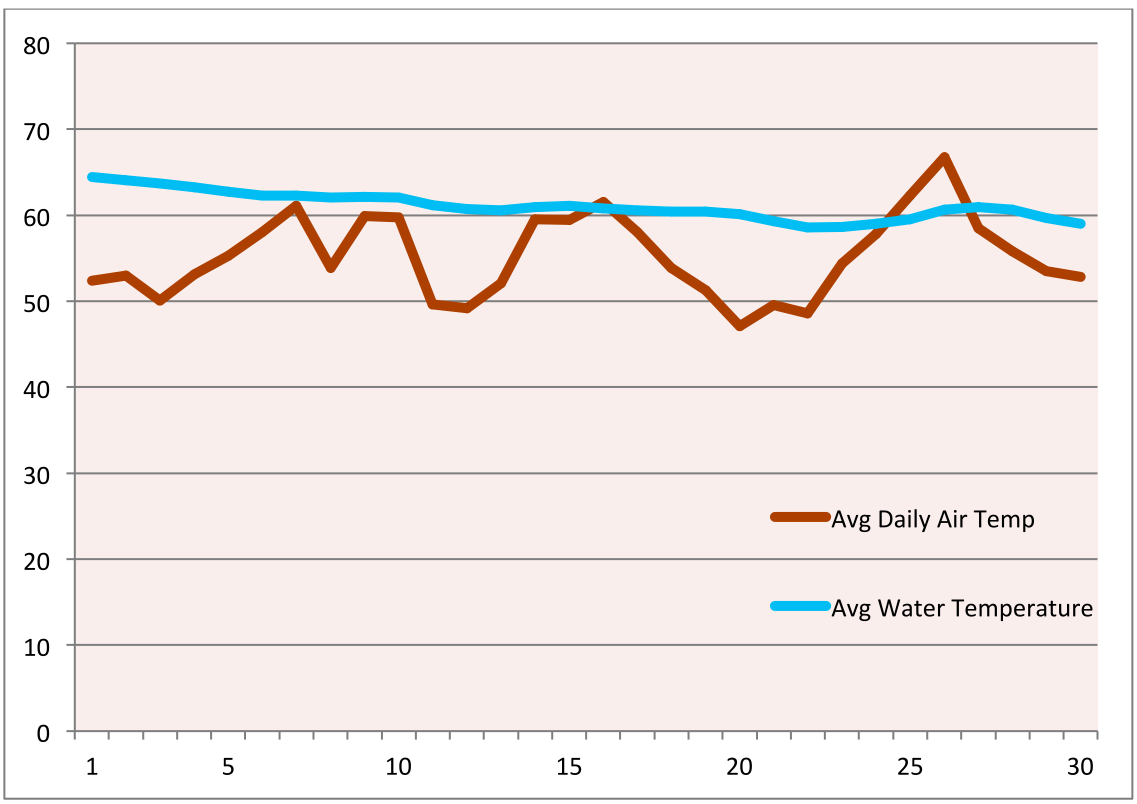
Typical monitoring data from the buoy is captured every three hours by the sensors and saved in the data logger. It is then relayed via cellular transmission to the HLAAF computer which we can display in a number of ways using Microsoft Excel or Fondriest's iChart software. These charts help show the factors which make up the growth pattern over time and will be compared/correlated to population counts as we make trawls for animal and plant life periodically.

The following pages show the typical graphs of the information that constitutes the Atmospheric conditions occupying the growth period occurring with time from the months of April throughout the summer and ending in the fall when temperatures turn cold and stop swimming and water movement of the food species. The data collection season this year was short due to delays in receiving a completed arctic unit that was functional from our suppliers which were: Hach OTT Company and Fondriest Environmental Company.

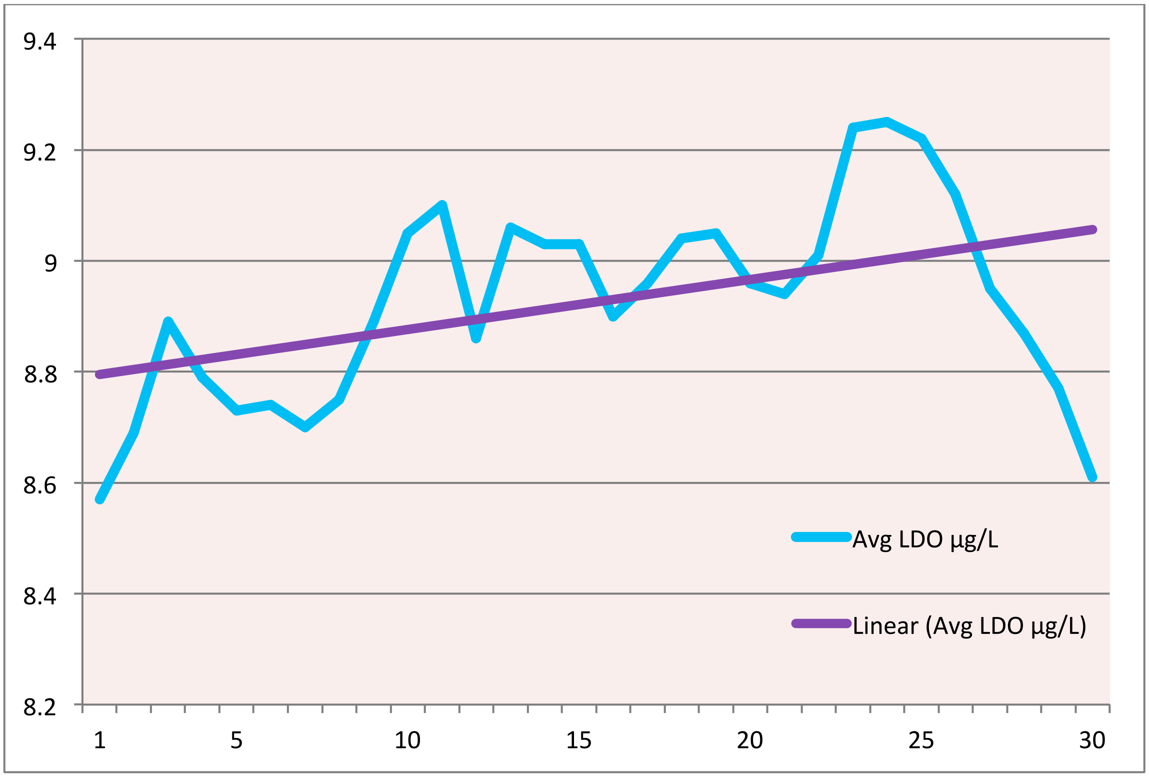
CHARTS



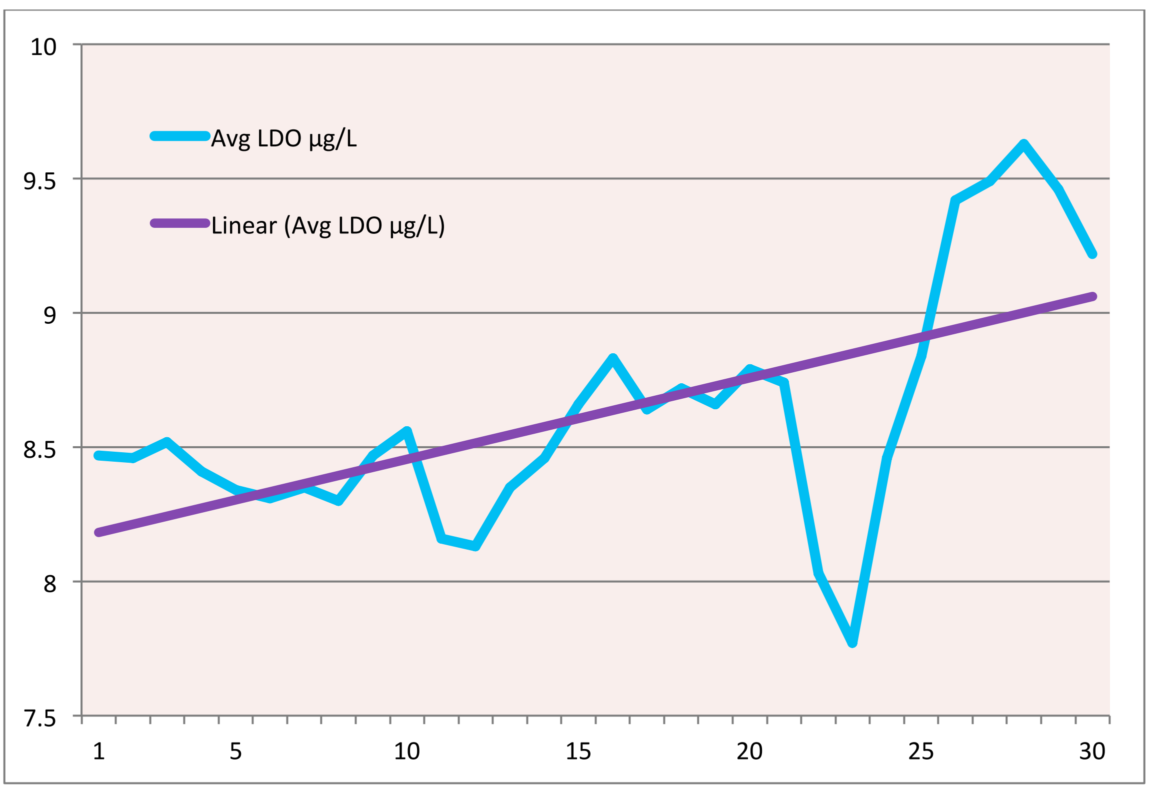
Suttle Lake daily temperature variations August 1 – 30, 2016



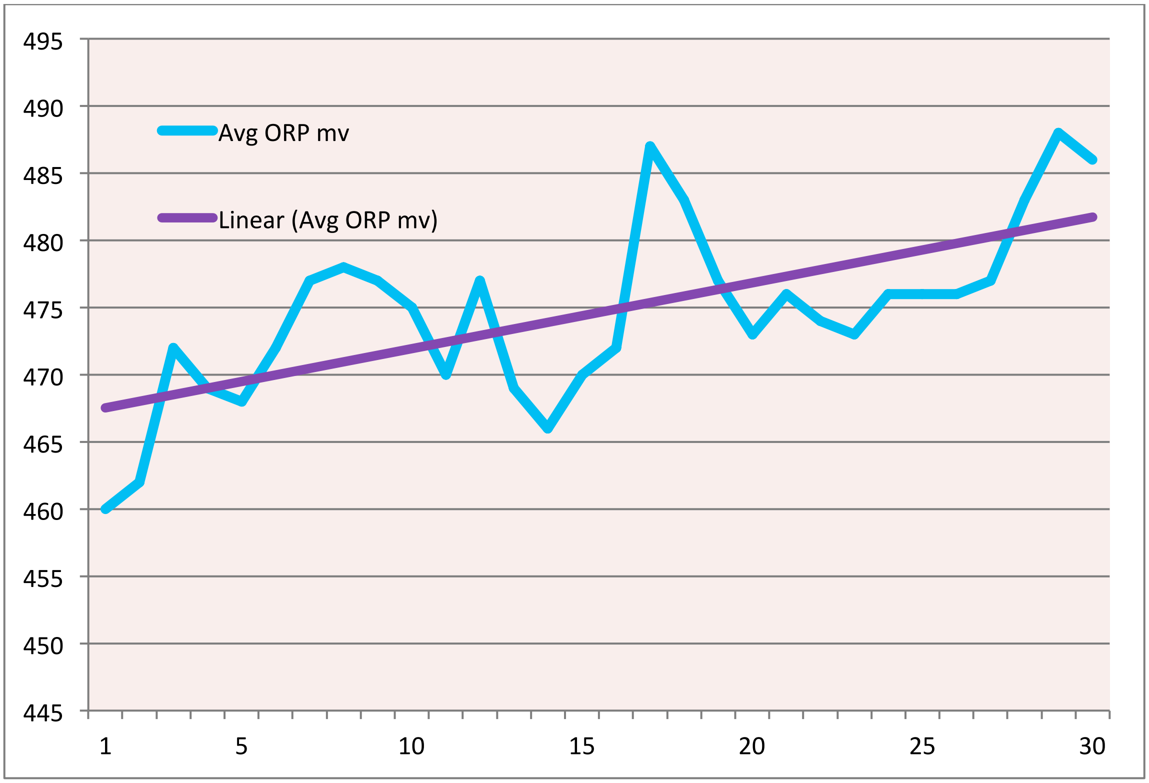
Suttle Lake daily temperature variations September 1 – 30, 2016



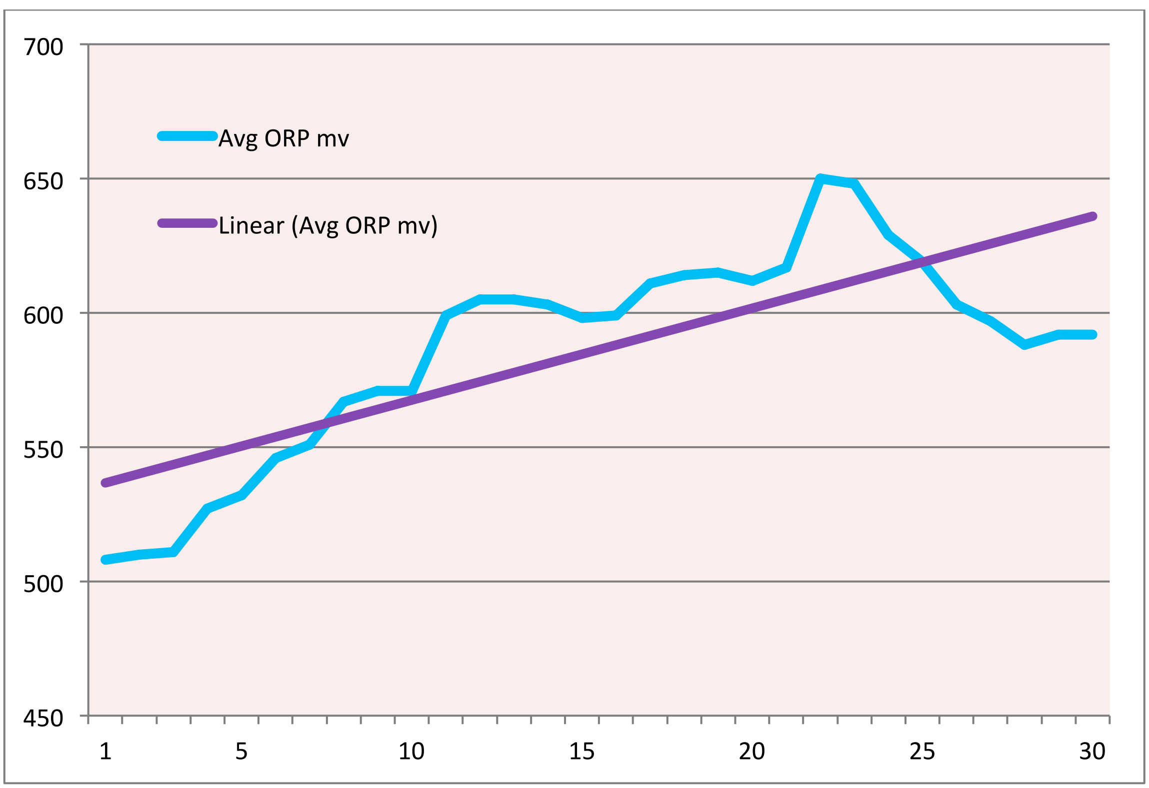
Suttle Lake Luminescent dissolved oxygen August 1 – 30, 2016



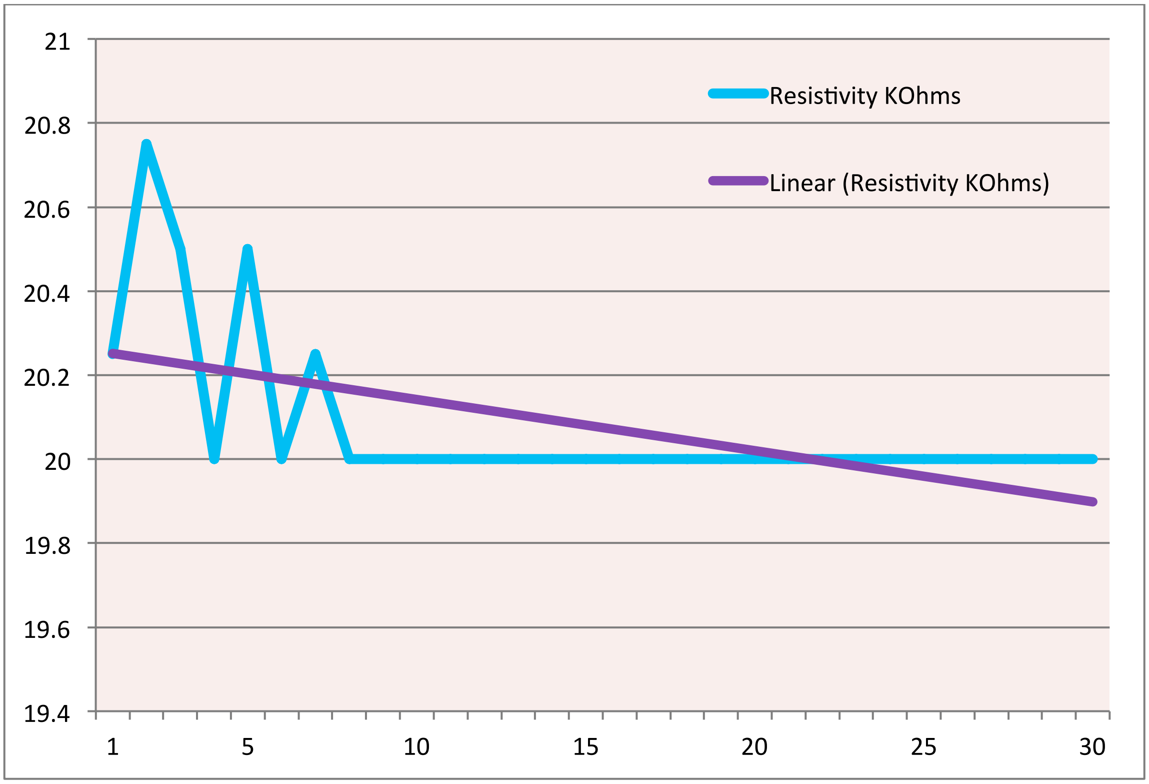
Suttle Lake Luminescent dissolved oxygen September 1 – 30, 2016



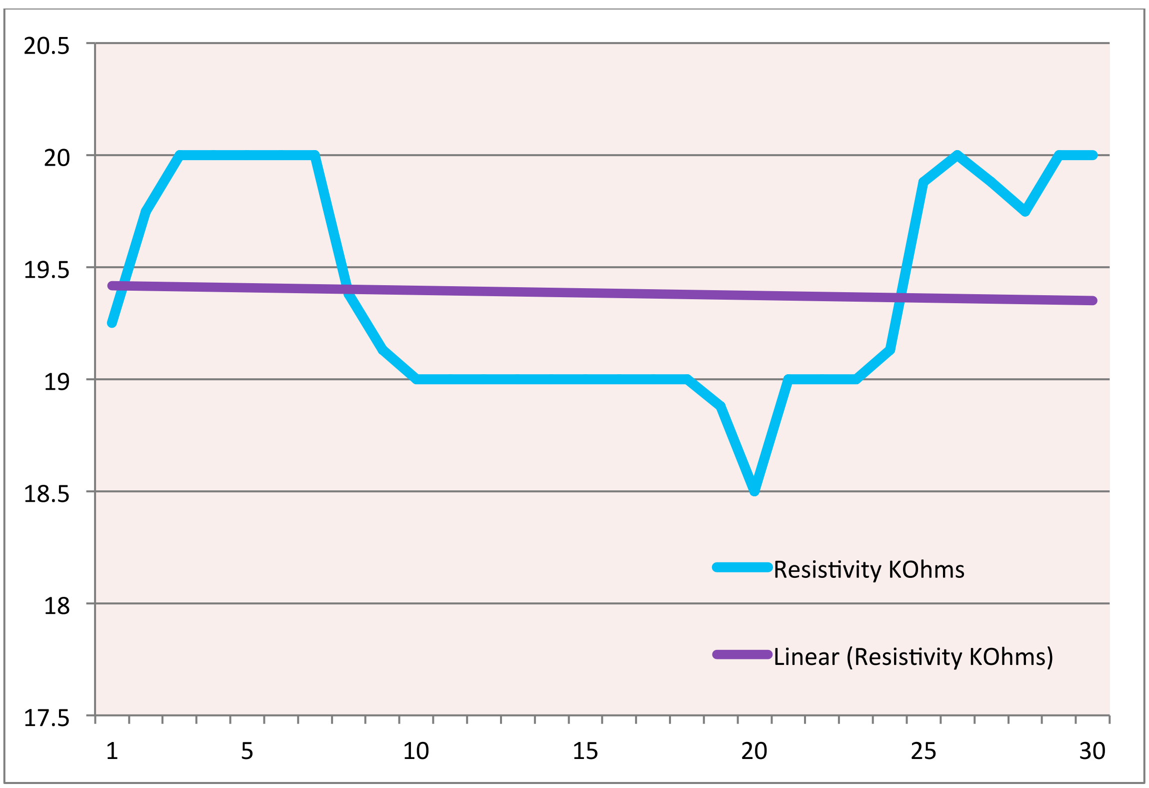
Suttle Lake Oxidation reduction potential August 1 – 30, 2016



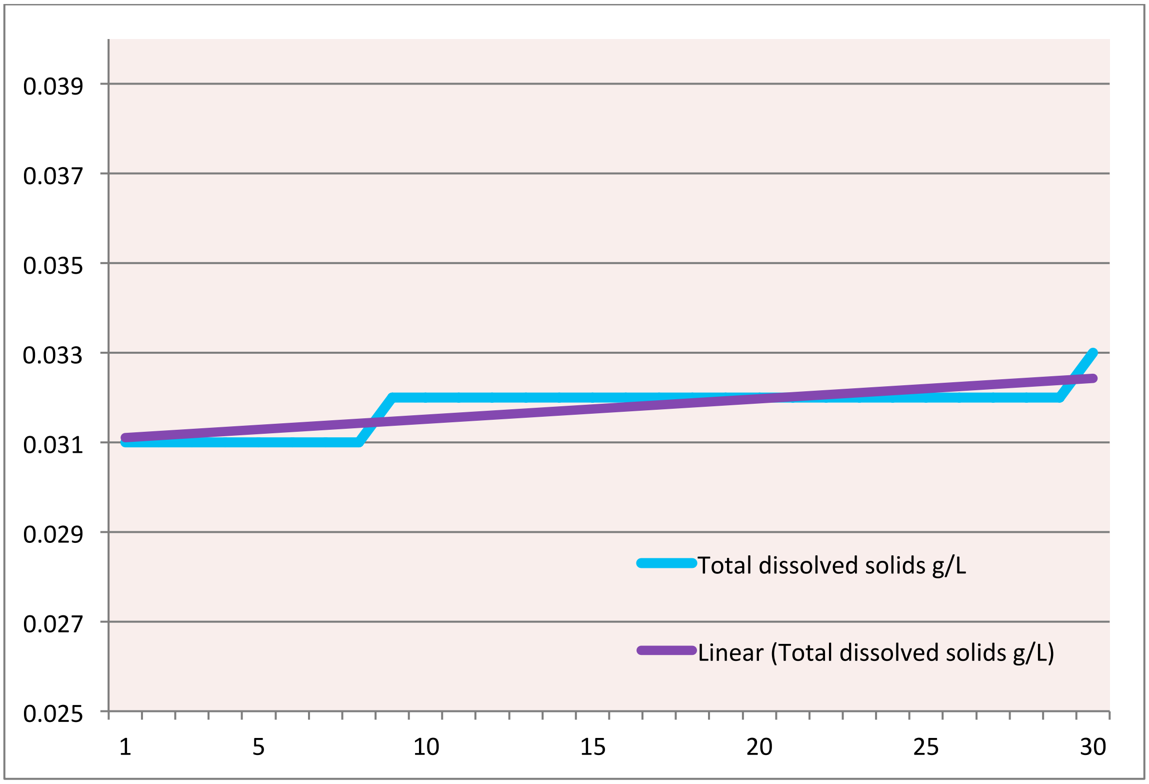
Suttle Lake Oxidation reduction potential September 1 – 30, 2016



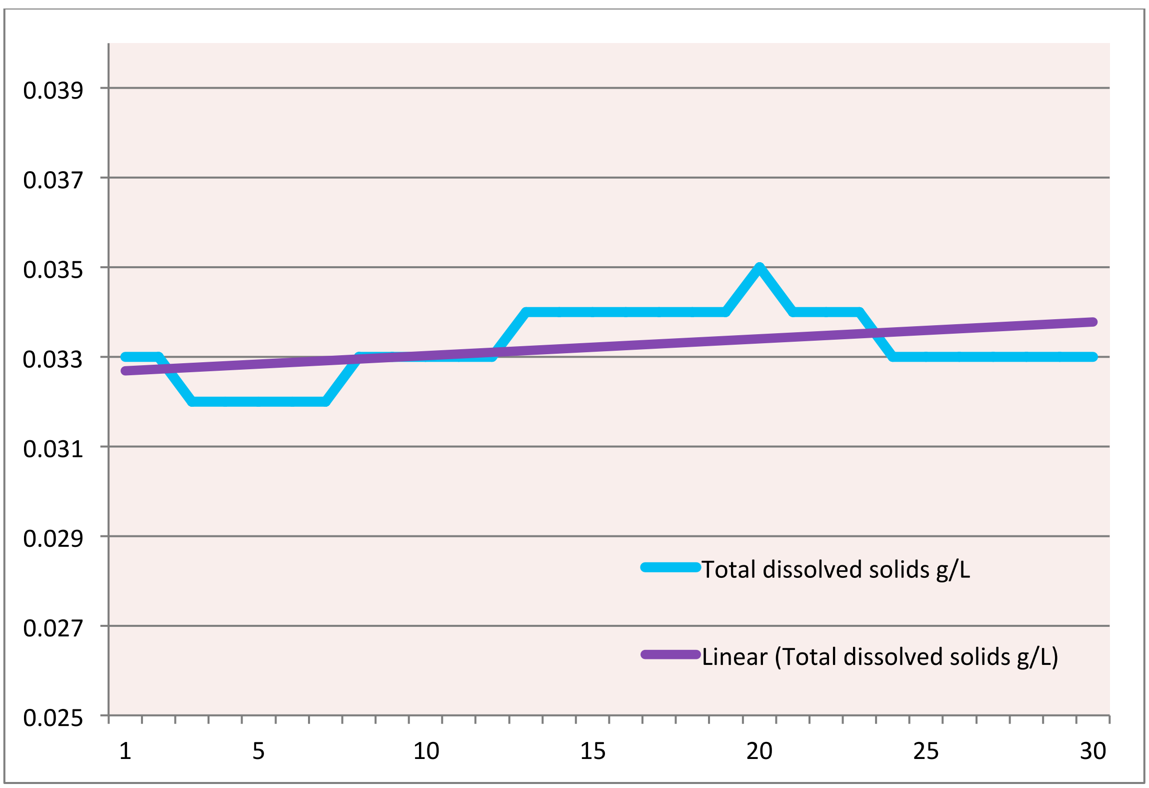
Suttle Lake Resistivity August 1 – 30, 2016



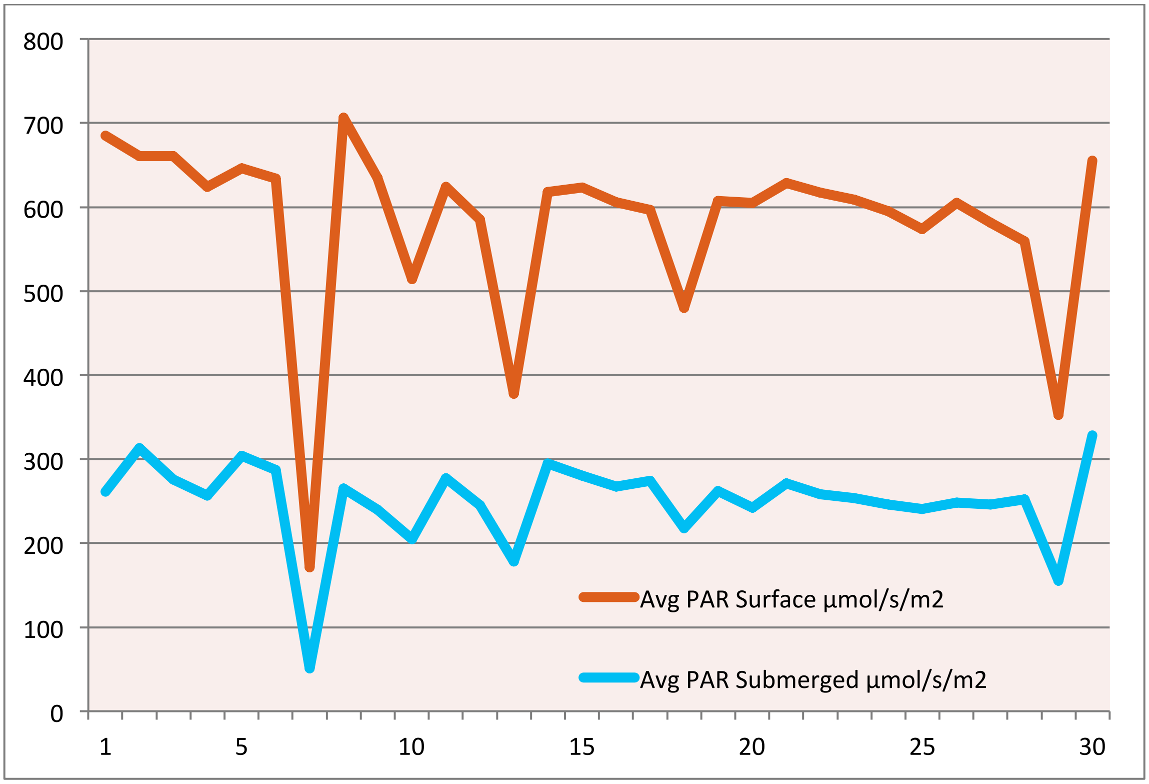
Suttle Lake Resistivity September 1 – 30, 2016



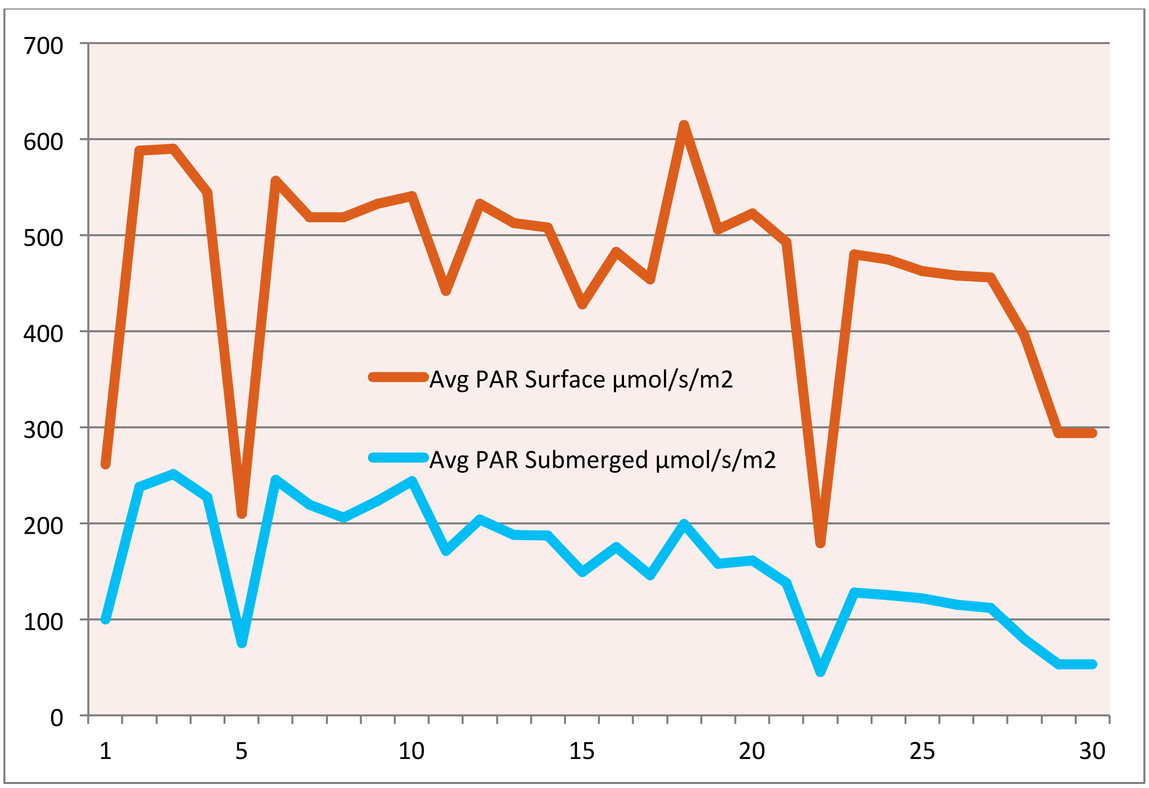
Suttle Lake Total dissolved solids August 1 – 30, 2016



Suttle Lake Total dissolved solids September 1 – 30, 2016

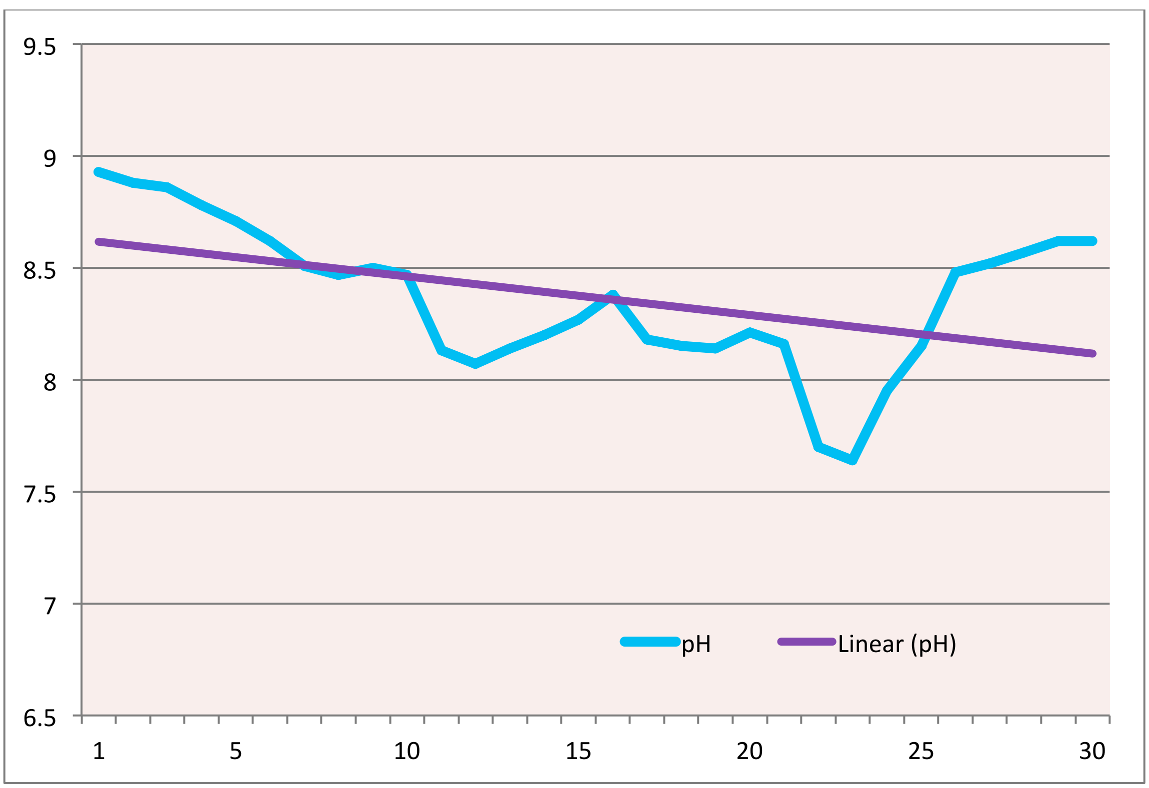


Suttle Lake Photosynthetically Active Radiation surface vs submerged August 1 – 30, 2016

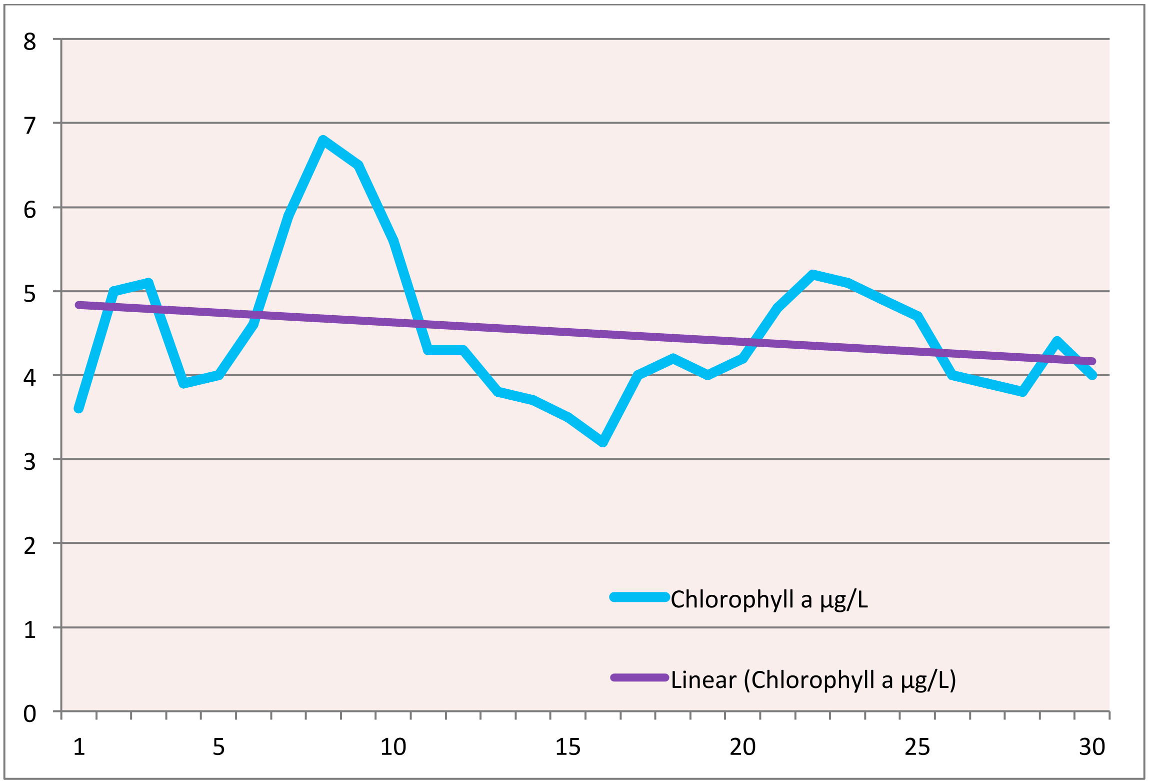


Suttle Lake Photosynthetically Active Radiation surface vs submerged September 1 – 30, 2016

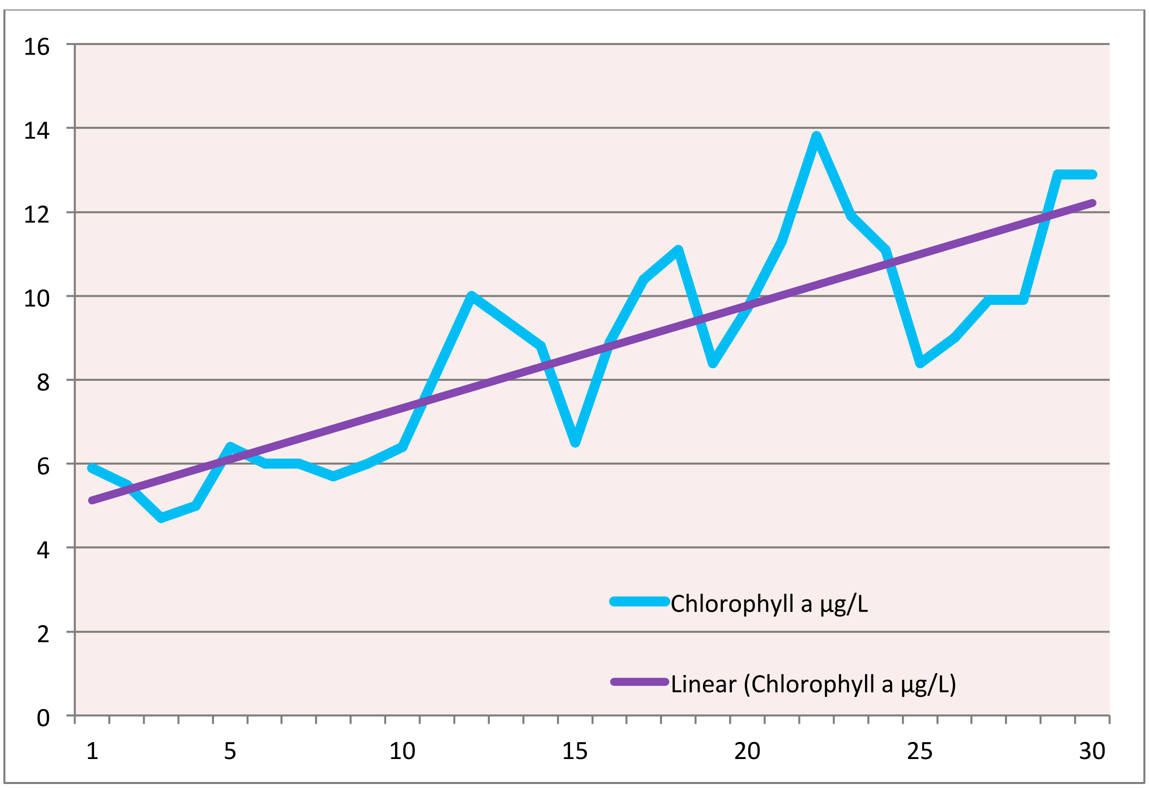
Suttle Lake pH August 1 – 30, 2016



Suttle Lake pH September 1 – 30, 2016



Suttle Lake Chlorophyll a August 1 – 30, 2016



Suttle Lake Chlorophyll a September 1 – 30, 2016

GLOSSARY

Luminescent dissolved oxygen (LDO) A method of measuring dissolved Oxygen. This instrument is equipped with a measuring LED that emits a pulse of blue light and a photo diode as a light detector. The instruments are also equipped with a sensitive luminescent coated spot that is exposed to the sample.

The measuring LED emits a pulse of blue light which irradiates the back of the oxygen sensitive spot. The coating material reacts with luminescence and emits a pulse of red light where the intensity and time delay are measured.

When oxygen is present in the sample water and contacts the coating, the intensity and time delay of the luminescent light emission are changed.

The more oxygen molecules come into contact with the coating, the lower the intensity and the shorter the duration of the red radiation. These changes in the profile curve are used to determine the measurement.

Oxidation reduction potential (ORP) is a measure of the tendency of a chemical species to acquire electrons and thereby be reduced. Reduction potential is measured in volts (V), or millivolts (mV).

Resistivity is the reciprocal of conductivity and either may be used to inexpensively monitor the ionic purity of water. Resistivity or conductivity of water is a measure of the ability of the water to resist or conduct an electric current. The ability of water to resist or conduct an electric current is directly related to the amount of ionic material (salts) dissolved in the water.

Total dissolved solids (TDS) Dissolved ionic material is commonly referred to as total dissolved solids or TDS. Water with a relatively high TDS will have a low resistivity and a high conductivity. The opposite is true for water with low TDS. “Dissolved solids" refer to any minerals, salts, metals, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water.

Photosynthetically Active Radiation (PAR) is the amount of light available for photosynthesis, which is light in the 400 to 700 nanometer wavelength range. PAR changes seasonally and varies depending on the latitude and time of day.

Levels are greatest during the summer at mid-day. Factors that reduce the amount of PAR available to plants include anything that reduces sunlight, such as cloud cover, shading by trees, and buildings. Air pollution also affects PAR by filtering out the amount of sunlight that can reach plants.

pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water.

Chlorophyll a is an essential measure of the existence of phytoplankton. Phytoplankton can be used as an indicator organism for the health of a particular body of water. Monitoring chlorophyll levels is a direct way of tracking algal growth. Surface waters that have high chlorophyll conditions are typically high in nutrients, generally phosphorus and nitrogen. Measurements by the sensor are compared to grab samples taken during the season to get a direct correlation to cellular masses in the water.