Quality Monitoring of the Surface Water Bodies on the Southern Nicoya Peninsula

PROJECT DESCRIPTION

The objective of this project is to understand the water quality of the rivers in this area and, in this way, detect possible sources of pollution. Based on this data, our other water conservation projects will be strategically defined to prioritize and address the most critical issues.

The parameters that are being monitored align with the Bylaw for the Evaluation and Classification of the Quality of Superficial Water Bodies No. 33903-MINAE-S which include the classification of rivers as well as additional parameters which provide important information for decision-making.

MONITORED PARAMETERS

- Oxygen saturation percentage
- Biochemical Oxygen Demand
- Ammoniacal Nitrogen
- Turbidity
- Temperature
- pH
- Faecal coliforms
- Ammonium
- Phosphate
- Conductivity
- REDOX Potential

SAMPLING EQUIPMENT

- YSI professional plus multi-parameter probe
- YSI 9300 photometer

Quality Monitoring of the Surface Water Bodies on the Southern Nicoya Peninsula: Parameters

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OXYGEN SATURATION PERCENTAGE

This is the dissolved oxygen reading in mg / L divided by 100% of the dissolved oxygen value for water (at the same temperature and air pressure). Dissolved oxygen is essential for life to exist in surface water, since it depends on plants, animal species, and microorganisms that inhabit it. This chemical compound is transferred from the atmosphere to the water, so concentrations can vary over time (Bell, 2011), the concentration of oxygen in the water cannot be less than 5 mgO2 / l, since, below this value, the ecosystem biota can present reproductive and growth problems (Hocking, 2006).

BIOCHEMICAL OXYGEN DEMAND

BOD measures the amount of oxygen consumed in the biochemical degradation of organic matter through aerobic biological processes (mainly by bacteria and protozoa). It represents an indirect measure of the concentration of organic and inorganic matter that is degradable or biologically transformable. It is used to determine water pollution. When BOD levels are high, dissolved oxygen levels will be low, since bacteria are consuming that oxygen in large quantities. With less oxygen available in the water, fish and other aquatic organisms have less chance of survival. (UNA, 2010).

AMMONIACAL NITROGEN

Under normal conditions, the source of ammoniacal nitrogen in surface water comes from the natural degradation of organic matter present in nature. It is one of the transitory components in water because it is part of the nitrogen cycle and it is influenced by biological activity. The additional contributions of ammoniacal nitrogen that alter the normal concentrations of this nutrient, imply a detrimental alteration of the environment into which they are discharged, causing, among other consequences, the decrease in the levels of dissolved oxygen in rivers, which is consumed in the processes bacterial degradation of ammoniacal nitrogen. Provoking an anoxic environment, thus triggering a series of chemical and microbial reactions that result in decreased water quality, death of species that inhabit the site, among other consequences.

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TURBIDITY

The turbidity of the surface water is mainly due to the action of inert matter like the material produced by the erosion of rocks, which gives a great contribution to its development. This is appreciated by the presence of particles of clay, lime, sand, as well as their mixture; which, when accumulated, generates a series of colloidal systems that do not allow light to pass through, thus reducing the transparency of the water (Vargas, 2004). However, the turbidity is not only developed by the action of external agents to the channel, since it can be generated by the resuspension of the river bed due to rain, which increases the speed and flow of the river (Montoya, et all, 2011).

Like inert matter, microorganisms also play a fundamental role in water turbidity. An example of this is phytoplankton, a plant of microscopic proportions which, when entering the flowering stage, can generate a large population capable of preventing light from entering the lower layers of the liquid layers, causing a series of effects on the health of aquatic ecosystems.

TEMPERATURE

Water temperature also influences the physiological processes of organisms, such as microbial respiration, which is largely responsible for the self-purification that occurs in water bodies (Chapman 1996). High temperatures favor a higher growth rate, which allows a certain type of biota to reach significant populations. Under natural conditions, the temperature of the flowing water varies between 0°C and 30°C; however, the recommended values for the conservation of aquatic life will depend on each particular case, since the temperature depends, among other factors, on: the time of day and time of year, weather conditions, flow and depth of current.

According to Barrantes et al. (1985), in the South Pacific of Costa Rica the annual average temperature varies between 22.5°C and 30.0°C, with maximum values varying from 25.0°C to 32.5°C; and minimum values between 20.0°C and 22.5°C.

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PH

PH is a logarithmic scale that measures the presence of hydronium concentration in a substance (Jenkins, 2009). In general, the pH of surface water ranges between 6.5 and 8.5. It is thanks to these values that another series of chemical reactions, such as reduction-oxidation, can be carried out, in addition to allowing the development of aquatic life and its biological processes (Alfayate, 2008).

In unpolluted river water, pH values vary between 6.0–8.5 and its determination is important, since it has a great influence on many biological systems. Values higher or lower than this, produce limitations in the development and physiology of aquatic organisms in general and in the biota of wetlands in particular.

FAECAL COLIFORMS

This parameter´s group of microorganisms is composed of facultative anaerobic, gram-negative, non-endospore-generating bacilli, as well as the Enterobater group, which includes Escherichia coli and Klebsiella pneumoniae, which is an uncommon pathogen within the intestine, as well as Escherichia coli. The determination procedure is mainly based on the most probable number, however, with the development of technology, new faster and more accurate techniques have been developed, such as the use of EMB agar where the capacity of coliforms to digest substances is measured (Madigan, 2009).

In the case of faecal coliforms and the quality of the water, finding any number of bacteria already indicates water pollution. In the event that the presence of these microorganisms is identified, this value cannot exceed 1 MPN / 100 ml as an arithmetic mean of the samples analyzed for a period equivalent to 30 days (Madigan, 2009).

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AMMONIUM

The presence of ammonia in natural waters is mainly due to the decomposition of the remains of plant or animal tissues, to the excreta that is deposited in river channels; however, nitrifying bacteria are responsible for producing ammonia from the nitrogen present in these wastes, which is diluted and dispersed (Cech, 2009).

PHOSPHOROUS

Phosphorous compounds are plant nutrients and lead to algae growth in surface water. Depending on the concentration of phosphate in the water, eutrophication can occur. Only 1 gram of phosphate-phosphorus (PO4-P) causes the growth of up to 100 g of algae. When these algae die, the decomposition processes result in an oxygen demand of around 150 grams. Critical concentrations for incipient eutrophication are between 0.1-0.2 mg / l PO4-P in running water and between 0.005-0.01 mg / l PO4-P in calm water. Phosphate compounds found in wastewater or discharged directly into surface waters come from: fertilizers removed from the soil by water or wind, human and animal excreta, detergents, and cleaning products.

CONDUCTIVITY

The conductivity of most natural fresh water is between 10µS / cm to 350µS / cm; although it depends on the type of geology. In areas with coastal marine influence, the values can go from 125µS / cm to 2 200µS / cm; while in lakes and reservoirs, conductivities are generally lower (ANZECC 2000).

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REDOX POTENTIAL

The redox potential is a measurement of the activity of the electrons. It is related to pH and oxygen content. It is analogous to pH, since pH measures the activity of protons and the redox potential measures that of electrons. In water, if oxygen is in equilibrium with atmospheric oxygen and the pH is 7, the value is + 0.86 mv at 0 °C and + 0.80 mv at 25 °C. In fresh and marine water, it rarely drops below +0.3 mv except when there is great oxygen shortage.

PARAMETER	NORMAL RANGE
DISSOLVED OXYGEN	(5 A 15) MG/L
BOD	< 3 MG/L
AMMONIACAL NITROGEN	< 0.50MG/L
TURBIDITY	<25 UNT
TEMPERATURE	22,5°C - 30,0°C
PH	6,5 A 8,5
FECAL COLIFORMS	<20 NMP/100 ML
AMMONIUM	≤ 0,2 MG
PHOSPHOROUS	≤ 0,2 MG/L
CONDUCTIVITY	≤ 2 200MS/CM
REDOX POTENTIAL	≤ 0,80MV

For further information, please contact us: kennethwaterkeeper@gmail.com