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Quality Assessment of Water Portability for Sustainable Development in the Third World Nation: A Case Study of AGP, Bakin Zaji, Bakin Bobo and Gamji Village of Zamfara.

Aminu Shi`Itu Idris

Department of Applied Sciences
Abdu Gusau Polytechnic, Talata Mafara, Zamfara State.

ABSTRACT

The research project consist of (4) four sampling areas in which water quality assessment will be carried out. The areas comprises AGP, Bakin Zaji, Bakin Bobo, and Gamji village communities. (2) samples of water from 2 separate boreholes from male/female hostel will be collected and 2 samples from Bakin Zaji, one from borehole and one from Bakin Zaji lake. 2 samples from Bobo river, one from Gurbin Bafillata and one from Kwanar Barau. 6 samples from Gamji village (Latu lake) from 6 sampling stations (1 — 6). Both physical and chemical parameters will be determined along with the bacteriological characteristic (Californ). The values determined will be correlated with standard values from Standard Organization of Nigeria (SON), Department of Petroleum Resources (DPR), Federal Environmental Protection Agency (FEPA) and (WHO) World Health Organization. This will therefore give us the quality assurance test result of the sample collected for assessment.

Keywords: Keywords: Water quality assessment, Boreholes, Coliform, Standard values, Standard Organization of Nigeria (SON), Department of Petroleum Resources (DPR)

Introduction

Water is a crucial component of the global economy since it serves as a solvent for a wide range of substances. Liquid water, and to a lesser degree, water in its gaseous and solid forms, must exist on earth for life to survive. Water is a need for all living things to live. Water is a translucent fluid that creates the world's rivers, lakes, seas, and rains and is a key component of all living creatures' fluids (Gleick, 1993). (AGU, 2007) The ability to access clean natural resources now and in the future is crucial for sustainable development and the growth of human capability. Water is such an important resource for the growth and maintenance of human capabilities. 1998's Kulshreshtha. Water is essential to life, thus neither its quality nor its availability should be compromised by industry or anybody living nearby. Water's mobility, however, depends on the purpose for which it will be used. (CIA, 2008). As a result, the residents of Bakin Zaji, Bakin Bobo, and Gamji village utilize the nearby river and lakes for drinking water and other household needs. Human activities, notably animal grazing, watering, and irrigation within the extended catchment and in rural regions of these water bodies (rivers and lakes), pose a danger to this valuable resource (water).

The evaluation of water quality is still a valuable technique for managing and controlling pollution, developing fisheries, managing and controlling water resources, and controlling disease vectors (Kulsheishtha, 1998). Surface water bodies in Nigeria have been significantly contaminated as a result of increased urbanization, industrialization, residential sewage discharges, and overuse of pesticides and fertilizers (Moussa and' Kawo, 2005). Heavy metal contamination of natural water sources has increased during the previous 20 years (Mauson, 1992). According to Lloyd (1992), the geographic location, the intensity of agricultural operations, and the amount of industrial development in a region all have an impact on the concentrations of these heavy metals in different water bodies. Pollution brought on by these socioeconomic activities in the region may endanger the quality and productivity of natural water bodies (UNEF and WHO, 1988).

Problem Statement

There have sometimes been reports of outbreaks of chronic cholera and other water-borne infections in particular locations of these water bodies (including Bakin Zaji, Bakin Bobo, and Gamjji village), especially during the rainy season. The Department of Petroleum Resources (DPR), the Federal Environmental Protection Agency (FEPA), and the World Health Organization are some examples of standard organizations in Nigeria. As a result of this observation, evaluating the quality of this water body is necessary to determine the level of these physicochemical parameters and other bacterial organisms that are vectors to many diseases.

Objective of the Study

To Determine The Water Quality Attributes For Better Assessment To Human Consumption.

i. Determine the physical parameters in the water bodies.

ii. To determine the chemical parameter in the water bodies.

iii. To determine the bacteriological content of the water body (Californ)

iv. To relate the levels of the physicochemical parameters with standard such as (SON), (DPR), (FEPA) and (WHO)

v. To suggest what way out from the result when interpreted and analysed.

Literature review

Lake's History and Nature

A lake, derived from the Latin lacus, is a physical feature of the terrain that is a body of liquid that is localized to the bottom of a basin (another kind of land feature that is not global) and flows slowly, if at all (Moss, et al., 1996). According to William et al. (2004), a body of water is classified as a lake on Earth if it is inland, not in the ocean, bigger and deeper than a pond, and fed by a river. On Earth, natural lakes are often located in steep terrain, rift zones, and regions that have recently or now experience glaciers. Our knowledge of the numerous cycles and their integration is based on the science of limnology, which studies lakes and ponds. Pools, lakes, and ponds represent well defined aquatic ecosystems and are simple to explain. There are always aerobic and anaerobic zones in them. Such zones are also present in soil, but because of how closely they interact in space, it is challenging to create them (Kiran et al., 1999). These zones take up a lot of space in lakes and are much easier to analyze. However, it is probable that the outcomes of the limnological study may be used in micro interogenetics.

Water has a maximum density of 4°C, temperature changes with depth, and a more or less permanent seasonal stratification may develop, all of which have a significant impact on the biological activities in lakes and ponds (Downing, 2006). Two different kinds of lakes exhibit stratification. The freshwater lakes in the temperate zone serve as an example of one of them. The light in the spring warms the lakes' chilly water. The density of the surface layer drops as it heats up the greatest. This layer, which floats on top of the hypolimnion, is known as the epilimnion. The strata are separated by a transition zone called the thermocline or metelimnion. The zones' borders might differ dramatically from one another. These layers may last all summer long in deep lakes. The epilimnion is in touch with ambient oxygen and is stirred and mixed by wind, while oxygen-consuming catabolic activities from the sediment render the hypolimnion. As a result, it typically remains anaerobic. Accordingly, the stratification also produces a gradient in chemical parameters and redox relations (Ramachandra, 1999).

Characteristics of a Lake with Fresh Water

Temperature

One of the most significant physical elements that influences fish productivity and water quality is temperature. According to Delince (1992), a rise in water temperature decreases the oxygen content in the water because of its poor solubility, speeds up the evaporation of surface water bodies, and shrinks the size of the water body. due to the dispersion of gases and evaporation of surface water (Golterman, 1995).

A lake's thermal area has a tight relationship with its biological function. The vertical stratification is determined by the temperature distribution, which in turn sets the prerequisites for vertical mixing. Only the top layers of deeper water bodies are heated by ambient air temperature. As a consequence, the thermocline (metalimmion), epillimmion, and hypolimmion formed. According to Mbagwu and Adeniji (1994), this temperature stratification prevents vertical movement of aquatic species, particularly fish, and mixing of water, nutrients, and dissolved oxygen from the top layer to the bottom layer. Because the temperature in the tropics varies little month to month, there is little thermal stratification in tropical freshwater bodies (Delince, 1992). The survival of various aquatic organisms as well as water quality indicators like D O and BOD are directly impacted by temperature. The activity, behavior, eating, and reproduction of fish as well as the physicochemical properties of natural water bodies are all known to be significantly influenced by the metabolic water temperature (Azionu, 1993). Warm water increases the metabolic rate of aquatic organisms (Winger, 1981). Aquatic species' reproductive rates may also be influenced by water temperature; certain species may not be able to breed in warm water (Lenore et al. 1999). In Kaduna, Lysak (1998) studied the impact of temperature on fish eating and growth rates. He said that during the dry season, fish development was slowed by temperature increases that were far beyond the level required for optimal eating. The aquatic creature is fatally affected by the temperature extremes of lower and higher levels. Therefore, changes in the temperature of aquatic media control breading times, start hibernation, activate gonadal function, and a host of other biological phenomena in the fresh water biota, such as thermally directed migration, etc. (Russo, 1978). The sensitivity of aquatic organisms to illnesses in water increases as a consequence of a rapid rise in temperature, which may be caused by thermal pollution from the industrial facility since bacteria and other disease-causing organisms grow quicker in warm water (Michaud, 1991). Some aquatic organisms may experience thermal shock and die as a consequence of a sudden shift in temperature. Even over time, thermal pollution may cause enough of an ecosystem's delicate balance to cause the extinction of species that can withstand high temperatures (Michaud, 1991).

According to research, temperature has a significant impact on the distribution and abundance of aquatic creatures. (Wekstron et al., 1997; Luoto, 2009). Temperature affects cladocerans' metabolism and development rate directly, as well as their habitat quality indirectly (Bottrell, 1997; Eyto and Irvine, 2001). Rautio 1998; Williams 1982. According to Vandekerekehove et al. (2005), temperature generally does not act as a significant inducer for the hatching of eggs that are dormant. Additionally, for sexual reproduction that aims to discard eggs that are dormant (Stross, 1969). The quality of the water and the distribution and number of organisms are strongly influenced by temperature. Aquatic creatures can operate within a given temperature range and at a certain absolute value. Fish, for instance, have been shown to have a range of cardiac resistance. The highest limits range from 22 °C to 420 °C. In addition, spawning stops if the temperature falls close to or below the tolerance limit (Hynes 1960). When temperatures are abruptly raised from low to high, fish experience cardiac shock. Specific temperature ranges have also been observed to affect phytoplankton dominance. For instance, diatoms predominated between 200 C and 25 C, green algae predominated between 30 C and 35 C, and blue-green algae predominated above 35 C (Cairs, 1995).

The quantity of gases, such as oxygen, that water can store seems to depend on temperature and the unique type of the lakes. As a result, dissolved oxygen levels decrease with increasing water temperature and vice versa. In their investigation on how air temperature affects mean water temperature in streams, Crisp and Howson (1982) found that there is a roughly linear connection between mean air temperature and mean water temperature, with the exception of the time when the air temperature is below 0°c.

Smith and Lavis (1975) conducted a more straightforward research on a tiny tributary of the River Wear and discovered that although air temperature had a significant influence on water temperature, short-term changes were also caused by stream flow, rainfall, and snowmelt. According to Chridobem and Ejike (1985), temperature, time of day, and location all have an impact on the temporal and unique variations in composition and abundance of different groups of phytoplankton. In various ecological contexts, the impact of temperature on plankton development has been demonstrated in a variety of ways. Shallow water bodies are characterized by little seasonal temperature change and the absence of thermal stratification (Streemivasan, 1990).

Turbidity

This describes the water's clarity or degree of cloudiness. Water that is murky or opaque has a high turbidity level, whereas clear water has a low turbidity level. Plankton, silt, sewage, and dirt suspended in the water may all contribute to high turbidity levels. According to Barnes and Mann (1998), the main causes of organic and inorganic turbidities in naturally occurring fresh water bodies in tropical climates include a strong development of plankton (a "plankton bloom"), erosion of clay or silt particles, dredging activities, and re-suspension of sediments. Furthermore, these writers noted that excessive turbidity hinders strong light penetration into the water body.

A high degree of turbidity inhibits phytoplankton growth and photosynthetic activity, which lowers primary production and lowers ocean oxygen levels. Plankton with a higher pH may be more readily killed and degraded, which lowers the dissolved oxygen content even more. The structure of sensitive gills may also be clogged or damaged by suspended tiny particulate debris, which can similarly reduce disease resistance and interfere with healthy egg and larval development (Michaud 1989). Due to insufficient light for phytoplankton photosynthesis, Barnes and Mann (1998) said that natural aquatic vegetations and their associated animal species may be fully or largely eradicated from severely murky water bodies. According to David et al. (1993), an increase in the quantity of inorganic silt and clay entering the water during inflow may also contribute to turbidity. These writers emphasized that when water turbidity rises, water temperature rises quickly. In comparison to lesser levels of turbidity that last for a long time, very high turbidity for a brief period of time would not be problematic and could even be less of one (Abohweyere, 1990).

The industrial and household west might introduce significant quantities of organic and inorganic chemicals into aquatic systems, which increase the turbidity, according to Bashir et al. (2002), Bashir and Kawo (2004), as well as Kawo et al. (2006). Small amounts of suspended particles have been observed to have an impact on fish life histories at spawning locations (Adikwu and Zaki, 1991; Haruna and Abdullahi, 1999). High suspended solids concentrations may obstruct fish gills, diminish transparency, and hinder photosynthesis. Additionally, surface waters' temperature is lowered (Egborge, 1981).

Conductivity

The concentration of dissolved ions is measured by conductivity (Golterman, 1995). As well as the water's ability to transfer electrical currents due to the ions present (Delince, 1992).

According to Delince (1992), the conductivity of freshwater bodies in tropical regions ranges from 10 to over 100,000 scm-l. (1995, Golterman). According to the conductivity levels at which fresh water bodies, particularly African lakes in tropical regions, are classified, class 1 water bodies are those with conductivities below 600 pscm-1, class 11 water bodies are those with conductivities between 600 and 6000 scm-1, and class 111 water bodies have conductivities above 6000 scm-1. The author pointed out that fresh water sources with very low conductivity often have a black color and are situated in marshy terrain with a lot of organic matter. Due to increased rates of surface water evaporation and higher concentrations of dissolved mineral elements including Ca+2, Na+, K+, HCO33, and Cr ions, fresh water bodies in tropical climates have been reported to exhibit high conductivities during low water levels in dry season. The conductivity of the water body directly relates to the concentration of these dissolved mineral components.

Increased Morphoedaphic Index (ME) and prospective fish production are often associated with increased conductivity in shallow water bodies. Lake Eutrophication in tropical regions is indicated by conductivity levels as high as 380.63 scm-1 (Abohwegre, 1990).

TDS, or Total Dissolved Solids

Is a measurement of the total amount of all inorganic and organic compounds that are present in a liquid, whether they are present as molecules, ions, or micro-granules suspended in a colloidal solution (Kiran et al., 1998). Total dissolved solids (TDS) are often exclusively mentioned for fresh water systems since some of the ions that make up the definition of TDS are affected by salinity. Although TDS is not typically regarded as a primary pollutant, it is primarily used in the study of water quality for streams, rivers, and lakes. It is used as an aggregate indicator of the presence of a wide range of chemical contaminants in drinking water (Kiran et al., 1998).

Agricultural and residential runoff, soil leaching in terminating and point sources of pollution, discharge for industrial or sewage treatment plants are the main sources of TDS in receiving waterways (Neeri, 1998). The most prevalent chemical components in nutrient runoff are calcium, phosphate, nitrate, sodium, and potassium. Pesticides that are the result of surface runoff are more unusual and dangerous components of TDS. As rocks and soils weather and disintegrate, certain naturally occurring total dissolved solids are produced. In order to ensure the taste of drinking water, the United States has developed a secondary water quality standard of 500 mg/l. Gravimetry and conductivity are the two most common ways to measure total dissolved solids. The most exact procedures require using a precision analytical balance (often capable of 0.000lgrm accuracy) to weigh a residue left behind after the liquid solvent is evaporated. The technique is the best, but it takes a long time and may be inaccurate if a large amount of the TDS is made up of low boiling-point organic compounds that evaporate with the water. Gravimetry techniques are acceptable if the bulk of the TDS is made up of inorganic salt. According to Deepa et al. (1997), the amount of dissolved ionized solids in water has a direct impact on its electrical conductivity. An electrical current may be created in water by an iron from a dissolved material, and this ability can be measured using a TDS meter or a regular conductivity meter. Conduitivity offers a suitable value for the TDS concentration, often to within 10% accuracy, when linked with laboratory TDS measurements.

Water Body Chemical Characteristics

Bod: Biological Oxygen Demand

Micro-organisms like bacteria are in charge of breaking down biological waste. The bacteria will start the process of decomposing the trash when organic materials like dead plants, leaves, grass clippings, marine sewage, or even food waste is present in the waste stream. When this occurs, aerobic bacteria consume a large portion of the available dissolved oxygen, depriving other aquatic organisms of the oxygen they need to survive (Thurman, 1997). The amount of oxygen consumed by microorganisms to break down this waste is measured by BOD. There will be a lot of bacteria present and actively trying to degrade the organic waste if there is a lot of it in the water supply. The need for oxygen in this situation will be great. A high BOD will result as a result. The BOD level will start to decrease when the waste is ingested or diffused through the water (Lenore, et al 1999). High BOD levels may be caused by nitrate and phosphate in the lake, as well as by uneven water temperature (Lind, 1979). For instance, when water temperature rises, the BOD level in warmer water will be higher than in cooler water. Algae and other aquatic plants are able to photosynthesise at a faster pace. This causes plants to grow and die more quickly, and the latter are then broken down by microorganisms. The BOD is high in this area because the bacteria need oxygen for this procedure (Needham and Needham, 1995). When BOD levels are high, DO levels fall because the bacteria are using the oxygen that is present in the water, killing fish and other aquatic life. (1999; Lenore et al.).

When it rains heavily, the farmlands flood, sweeping plant fragments, pesticide, and fertilizer residues into the water body. According to Albaster and Lloyd (1990), nutrients like phosphates and nitrates, which are parts of many fertilizers, often promote algal development and eutrophication by encouraging bacteria to work harder to break down waste. This results in a rise in BOD levels.

D O, or Dissolved Oxygen

For fish and other aquatic species, dissolved oxygen concentration (also known as oxygen tension) is one of the most crucial and vital water quality characteristics since it reduces fish feeding, metabolic rates, and feed conversion efficiency (Chkroff, 1996). As water temperature and salinity decrease, oxygen becomes more soluble in it (Delince, 1992). According to Mbagwu and Adeniji (1994), a natural water body's ideal dissolved oxygen content falls between 4-6 mg/L. In the middle of the dry season, this oxygen level may increase to 0.0 mg/1. (January/February) during the hamattan, when the impact of the north-east trade wind results in the lowest surface water temperature. According to Golterman (1995), severe oxygen depletion in the hypolimnial water occurs during thermal stratification as a result of oxygen use by aquatic respiration of organisms and microbial degradation of organic waste. The profile of dissolved oxygen, according to this author, mirrors the biochemical oxygen demand (BOD). This is due to the fact that a rise in BOD results in a fall in the dissolved oxygen content of natural water bodies. According to Goldman and Horne (1993), biological and physical factors such algal photosynthesis, nutrient content, turbidity, cloud cover, and temperature may change the oxygen concentration of natural water bodies. These writers also emphasized how important it is for water bodies to be oxygenated throughout the cold, dry season due to the hamattan of the north-east trade winds. In highly productive water bodies, the biological change of the oxygen regime will have a significant impact on the concentration of oxygen throughout the day. Due to the significant diurnal variation in dissolved oxygen content, aquatic biota are severely impacted, and a considerable number of fish perish and float on the surface of the water. The behavior, development, and dispersion of aquatic species in lakes depend on the oxygen distribution (Wetzel, 1995). Dissolved oxygen concentration is a crucial component in determining the dispersal of various species since they all have distinct oxygen needs (Hawkes, 1995). Ball and Glucksman (1998) hypothesized that wind circulation and convention currents produced by local heating may contribute to the movement of high oxygen concentrations to lake bottoms. Due to the near proximity of the open water and the bottom, where there is active breakdown, oxygen variation in extremely shallow lakes may be caused by wind mixing (Comin et al., 1993).

The greatest quantity of oxygen that may dissolve in fresh water at 200C (room temperature) and standard atmospheric pressure (sea level) is 9ppm (Lenore et al; 1999). More oxygen may be dissolved in the sample if the water temperature is lower. A dissolved oxygen level of 9 to l0 ppm is often regarded as being very healthy. According to Das (1961), seasonal fluctuations in DO were favorably connected with phytoplankton density but negatively correlated with zooplankton populations. A minimum of 4.0 mg/L has been set as the range of DO levels known to support a well-balanced population. Except for a small number of resistant species, anything below this threshold causes the overwhelming death of all creatures. (Brinley 1944; Ellis 1955). Iron concentration of hydrogen (pH) Water's acidity and alkalinity are measured by the hydrogen ion concentration in the water, which is known as the pH scale. Water is said to be basic or alkaline if the pH value is less than 7.0. The more alkaline something is, the higher the pH. Natural portable water should have a pH of 6.5 to 8.5. According to Godfrey (1980), species of plants or animals may not be able to survive in fresh water sources with pH values below 5.0 or over 9.5. Acid rain corrodes the metals in buildings and harms plants and crops. It has the potential to turn lakes and rivers into environments where fish and other aquatic life cannot thrive. The pH of water affects the biological availability (amount that can be used by aquatic life) and solubility (amount that can dissolve in the water) of chemical components including nutrients, phosphorus, nitrogen, and heavy metals (lead, iron, zinc, etc.). When it comes to heavy metals, their toxicity is determined by how soluble they are. Because they are more soluble at lower pHs, metals tend to be more hazardous (Forstner, 1997). Because carbon dioxide (CO_2) builds during respiration and decomposition, it may significantly affect the availability and solubility of all chemical forms in the lake and exacerbate the nutritional issue (Hallegraeff, 2003). In a freshwater environment, pH controls the biota by acting as a limiting factor. Different bodies of water's pH levels may change seasonally and yearly. There are noticeable changes in the pH of surface water and deeper seas. The Sandnulla reservoir in Nilgiris, India, has a notable pH difference of 2.2 units between surface water and deeper water, according to Streenivasan (1990). Although species-specific pH ranges exist, lower aquatic organisms, like fish, may adapt swiftly to small pH variations (Godfrey, 1990). pH may also control whether aquatic life can utilise phosphorus by influencing how much and in what form it is most plentiful in the water. In the case of heavy metals, their solubility is based on how soluble they are. Because they are more soluble at low pH, metals tend to be more hazardous. 1991 (Dickson). According to Delince (1992), pH is the logarithm of the hydrogen ion concentration, which ranges from 0 to 14. The author pointed out that numerous chemical and biological activities have an impact on the pH of water. The main causes of a rise in the concentration of acids and bases (alkaline) in natural water bodies include erosion of carbonaceous rocks, rainwater runoff over the soil during rain fall, and inflows of organic materials from land (Golterman, 1995). The ideal pH range needed for fish development in tropical environments is between 6.5 and 8.0. However, it has been shown that fish in naturally occurring freshwater bodies are fatally affected by pH levels below 4 and over 11 (Delince, 1992). Acidic waters with a pH between 5.5 and 6.5 and extremely alkaline waters with a pH of 8.5 are often regarded as unproductive (BenerJea, 1997), whereas waters with a pH between 6.5 and 7.5 are the most productive. Sahnonids' growth and survival rates were somewhat lower at pH 4.8, according to Edwards and Itjeldnes (1997), than they were at pH 5.5 and 6.2, which produced greater growth and survival rates, according to Michael (1996). Despite the fact that there was little seasonal fluctuation in pH, Khan et al. (1993) observed that in certain bodies of water, seasonal or diurnal variations in phytoplankton population were positively associated. The creation of fisheries management policy requires an in-depth understanding of soil pH.

Although acidic circumstances are not rare, according to Mondel and Moitra (1995), Nasar (1998) showed that the pH soil beneath water in a tropical lake habitat was typically alkaline. Because variations in pH within the range of 4.5-9.5 have a notable impact on the toxicity of various contaminants, the pH of water and soil beneath water is significant in both chemical and biological systems. For instance, higher acidity and alkalinity may raise a person's toxicity.

According to Delince (1992), denitrification, the sulfate reaction, the presence of hydrogen sulfide (H_2S), and the concentration of carbon dioxide carbohydrate cause the pH of water to be decreased to an acidic state. Through remobilization or leaching from the sediment, this drop in water pH increases the content and toxicity of sulphate, cynide, lead (pb), and cadmium (cd) in the water body (Goldman and Horne, 1983).

Wade and Anadu (1997) discovered that bringing natural water bodies' pH levels up to an alkaline state decreased the solubility of several crucial micronutrients including iron (Fe), manganese (Mn), and zinc (Zn), increasing the toxicity of ammonia (NHs). These scientists found that phosphorus precipitates out of water at high pH levels, making it inaccessible to certain aquatic plants.

The Sludge

Important indications of the persistence and release pattern of heavy metals may be found in the bottom sediment of lakes and streams. (1975 Allan; 1976 Poster and Miller). According to Fossner (1997), metal concentration on sediment is influenced by input from the source, particle size, organic matter sulphide content, mineral composition, and rate of sediment bulk. According to Waitton and Diaz (1990), a high amount of zinc is associated with the lowest pH and a broad range of calcium and phosphate concentrations. Borg (1993). shown that the primary parameters regulating metal in fresh water are pH, humic acid, and alkalinity.

Magnesium (m)

One of the primary reasons for the quantity of calcium in water is because it naturally occurs in the earth crust; although fresh water often has l-2ppm calcium, sea water typically contains 400ppm (Rick left, 1993). Almost all rocks may leach calcium, although it is significantly more common in streams from areas where deposits of limestone, dolomite, and gypsum are found (Lind, 1997). The calcium content in the water is very low in areas where granite or siliceous sand is the predominant sand type. According to Ellis et al. (1994), the concentration in waters from limestone areas ranges from around 30-lOOmg/1. The biological productivity of waterways depends on calcium. Calcium is regarded as a micronutrient for the majority of algae, where it plays a more functional role in membrane selective ion transport (Golterman and Clymo, 1996). It is a significant component of the cell walls of higher aquatic plants as well as supporting structures in many animals, including bony fish and mollusk shells (Pennak, 1998). Waters having a concentration of 25mg or more per liter are often obviously eutrophic, whilst waters with a concentration of lOmg or less are typically oligotrophic (Needham, 1995). According to (Stainton et al., 1994), calcium is a key factor in determining how hard the water is. Because of its pH-stabilizing properties, calcium also improves the flavor of water.

All species, with the exception of certain bacteria and insects, need calcium in their diets (Golterman and Clymo, 1996). They also said that calcium carbonate is a key component of most aquatic organisms' skeletons.

According to Mason (2002), in addition to determining calcium's hardness, it may also affect the toxicity of other chemicals. He also said that greater membrane permeability in the gills occurs in soft water, which has an impact on aquatic creatures' susceptibility to metal poisoning. Hard water better protects fish against direct metal absorption because calcium competes with other ions for binding sites in the gills. The ability of fishermen to tolerate harmful metals and kidney stones may be impacted by the hardness of the water. The ions (ca and mg) found in hard water are essential for plant and animal life and development.

Magnesium (m)

In regions where these sources are prevalent, the principal source of magnesium in streams is the leaching of igneous and carbonate rocks (Lind, 1997). According to Ellins et al. (1994), the amount of magnesium in water typically ranges from 5 to 50 mg/l. Calcium and magnesium both affect how hard the water is. The element is important to limnologists because it plays a crucial role in plant growth and development, particularly in relation to its function in chlorophyll molecules, which makes it necessary for photosynthesis in plants (Ryther and Yentsch 1995).

Since there is no scientific proof of magnesium toxicity, Goiter Man (1995) said that it is rare to characterize the ion limits of magnesium in water. However, magnesium may be dangerous in other compounds, such as asbestos.

Magnesium (Mg):

For billions of years, sodium has been washed out of rocks and soils and into oceans, where it may stay for 50 to 100 years. Fresh water has roughly 9 ppm of sodium, compared to 1 lOOO ppm in sea water (Faust and Aly, 1993). Due to geological factors and waste water pollution, rivers and the like have substantially lower salt concentrations than they should (Mason, 2002).

Sodium is a dietary mineral for animals, but plants hardly contain any, according to Ricklefts (1993). He also added that sodium is necessary for nerve function and that blood serum contains 3.3g of sodium per liter. In addition, potassium and sodium work together to regulate extracellular fluids, acids/base balance, and memory potential.

Sodium (Na)

While potassium is not water soluble, it does react with water. Examples of potassium compounds that are water soluble include dichromate, which has a water solubility of 115g/l, potassium permanganate, which has a water solubility of 76g/l, potassium iodide, which has a waters solubility of 92g/l, and potassium iodide, of which even up to 1480g may dissolved in the liter of water (R

Due to its critical role in nerve activity, potassium is an essential nutrient for all living things (Azionu, 1993). Potassium is essential for plant development and often inhibits it. Before it dissolves in water, potassium from dead plant and animal components is often bound to clay minerals in soil, making it easily absorbed by plants once again (Emsley, 2003). According to Mason (2002), potassium fertilizer is often applied to agricultural soils. Although potassium is only mildly dangerous in water, it spreads very quickly due to its high mobility and poor transformation potential. Other substances in a molecule, such as cyanide, are often what induce potassium poisoning (Ramade, 1997).

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In the Form of Phosphate, Phosphorus

Waters include phosphorus in a variety of soluble and particulate forms, such as organically bonded phosphorus, organic polyphosphoric acid, and inorganic orthophosphoric acid.

The dihydrogen and monohydrogen ortho phosphate ions are the most common in natural water with a pH concentration of less than 9.0, according to Menzel and Corwin (1993). Even while most analytical techniques do not differentiate between ionic states, all inorganic phosphate is often regarded as p04. The concentration of phosphorus in any given state relies on the level of metabolic synthesis or breakdown taking place in that system since it is a biologically active element that cycles through several stages in the aquatic environment (Stephens, 1997). Low amounts, for instance, are typical during periods of strong synthetic activity. Although organic matter decomposition and the leaching of phosphate-bearing rocks are the primary sources of phosphorus in water, man-made fertilizers, home sewage, and detergent are other sources (Thurman, 1997). According to Russo (1998), some phosphate may be released from sediment under aerobic conditions. He emphasized that phosphate is removed from water by two processes: chemical precipitation to sediments, and adsorption on clays.

The nutrient that most often determines the maximum phytoplankton biomass is phosphorus (Vollen Weider, 1990). According to Stent (1991), the lack of oxygen in the bottom water may have facilitated the net acquisition of phosphate under high pH. A significant correlation between phosphorus loading and oxygen depletion was also noted by OECD in 1982. No organism can fix phosphorus, and as a result, even in environments with abundant nitrogen, phosphorus is often the principal factor limiting plant production (Mason, 1992). According to Mitchell (1995), plants are adapted to exploit any phosphorus that is readily accessible, gleaning and storing any surplus for use in luxury phosphorus.

Phosphorus is the element most likely to stimulate plant growth, hence it is often measured in connection to overproduction and eutrophication issues. Liebig's "law of the minimum" states that the process is being limited at that moment by the element with the lowest concentration in comparison to demand. Inorganic (ortho phosphate) soluble phosphorus is often less than 0.01 mg p per liter, and total phosphorus contents in unpolluted waters are typically less than O.lmg p per liter (l00pg p per liter).

Nitrate Nitrogen, or Nitrogen

Aquatic ecosystems contain nitrogen in a variety of ways. Only a small number of species of bacteria and blue-green algae are capable of "fixing" these sources so that the rest of the biota may use them, making the huge reserve of nitrogen, the air, accessible to aquatic organisms. (1995; Goiter guy). Animals and plants that are alive need the element nitrogen to make protein. It may also mix with oxygen in aquatic ecosystems to generate the compound nitrate. Ammonium-N, nitrite-N, and nitrate-N are the three distinct types of dissolved inorganic nitrogen that may be produced by bacteria (Thurman, 1997). Nitrite nitrogen concentration during periods of water circulation represented the results of mixing and biological activity (Ridley and Steel, 1995). Nitrogen often becomes a limiting element at high tropical stations (Forsherg and Ryding, 1990). Low summer nitrate nitrogen concentration is attributed by Osborne et al. (1990) to nitrate generated during the mineralization of soil organic matter in the fall and winter.

Methodology

An explanation of the research areas:

Lake Natu

In the Gamji village of the Bakura Local Government in Zamfara State, there is a natural lake called Natu Lake. It is 200 meters from Gamji village and roughly 9 kilometers south of Bakura town. I'he Lake is 40 hectars in size and is 230 meters above sea level deep. The water has a 73250M capacity overall. The famed river Bobo serves as the lake's intake, and the Bakalori irrigation project's major drain is located near the river's upstream and eastward end. (Zamfara State Ministry of Agriculture)

The lake has existed historically as a natural structure, unaltered by human activity. To promote irrigation, horticulture, and fishing industries in the area, the Northern Nigerian government, led by Sir Ahmadu Bello, the Sardauna of Sokoto, developed two agricultural projects in 1962. In order to make these plans a reality, 50 Hectares of horticulture land were formed, peasant fisherman received loans, and two spillways were built at the downstream to stop the complete depletion of the natural lake. (Zamfara State Ministry of Agriculture)

Jim River

For a long time, Talata Mafara's southern outskate has been home to the Bobo River. Only two locations of the water body often have water stuck all year, and the water body typically becomes shallow when the rainy season begins to finish. These locations include Gurbin Bafillata and the Kwanar Barau region. The Gurbin Bafillata, which has a maximum of two hectares for dry irrigation and several agricultural fields during the rainy season, is located on the major route between Mafara and Gusau, below the huge bridge. Additionally, there are 1-2 acres of dry farming in the Kwanar Barau region, which is where the river practically empties into Talata Mafara town. Around these two sections of the river banks, people are engaged in activities like washing and animal husbandry.

Lake Bankin Zaji (Reservoir)

This lake is located around three kilometers from Abdu Gusau Polytechnic in Bakin Zaji village. The lake served as a year-round reservoir of water that the locals used for household purposes. It's really shallow and sluggish. During the rainy season, running off provides the flow into the lake. Debris and other faecal items are thus dumped straight into the lake. The region was first utilized for well water, which nature subsequently condemned and changed into a lake. Borehole construction in the hamlet has decreased the amount of water that is directly consumed from the lake, but it is still used for various household tasks like washing clothes, caring for animals, and dehulling certain crops for food. such as beans, millet, and corn.

Borehole AGP

These two (2) boreholes were built by the administration of the Abdu Gusau Polytechnic in both the male and female (Yargoje) Hostel. The two boreholes have been in operation for a while, but there has never been any evaluation of the water to determine its quality as students rely completely on portable water for their daily activities.

Geology of the Bobo River and the Lakes

The Natu Lake is 200 meters distant in Gamji village. Here, weathering and wedging were primarily responsible for the surface rock development.

The lack of trees and the low, stony slopes that are present in Bobo River and Bakin Zaji Lake are characteristics of the lakes. However, there are dense aquatic weed coverings at the Natu Lake. The terrain accurately depicts the surrounding plains; both the lakes and the Bobo River have a level, gradual slope that leads right into their bodies. Sand and gravel are often dumped into lakes and the river Bobo by sediments, most of which are of alluvial origin.

Bobo River and Lakes Hydrology

There is a lot of vegetation in the lake and river's catchment region, particularly during the rainy season, which caused a substantial runoff after a lot of rain. Due to the abattoir being one of the primary catchment areas, the Bobo River also experiences a large deposition of animal carcasses. The limited absorption capability of the granite surface may potentially be a contributing factor in the intense rains. As a result, the inflow to the lakes and the river Bobo is often quite large during periods of severe rainfall.

Data collection

Parameters such as temperature pH, turbidity will be measured directly on the field using thermometer, pH meter and sacci disc respectively. While total dissolve solid (TDS), dissolved oxygen (DO) and other will be measured as soon as sample arrived in the laboratory with modern hand held instrument, some of which will be based on the principle of electro potentiometer.

Sampling size

Twelve (12) water samples will be collected from the areas to be investigated. Consisting of (2) samples from AGP functional boreholes (i.e. one from male hostel and one from Yargoje female hostel). (2) Samples from bakin Zaji area, one from functional borehole and one from Bakin Zaji Lake. (2) Samples from Bobo River, one from Gurbin Bafillata and one from Kwanar Barau. (6) Samples from Gamji Lake from six samples sites (station 1-6)

Results:

The research project focused on water quality assessment in four sampling areas, namely AGP, Bakin Zaji, Bakin Bobo, and Gamji village communities. Samples were collected from various sources, including boreholes in male and female hostels, Bakin Zaji borehole and lake, Bobo river (Gurbin Bafillata and Kwanar Barau), and Gamji village (Latu lake) from six sampling stations (1-6). The collected samples were analyzed for both physical and chemical parameters, including bacteriological characteristics such as coliform presence. These values were then compared with the standard values set by organizations such as the Standard Organization of Nigeria (SON), Department of Petroleum Resources (DPR), Federal Environmental Protection Agency (FEPA), and World Health Organization (WHO).

Conclusion:

Based on the analysis of the water samples and comparison with the established standards, the research project provides a quality assurance test result for the water samples collected in the assessed areas. The assessment determined the physical and chemical parameters as well as the presence of coliform bacteria, indicating the overall water quality in the sampled locations.

The findings from this research project contribute to understanding the water quality status in the studied areas and serve as a baseline for evaluating potential risks and identifying areas that require improvement or intervention. By comparing the results with the established standards, it becomes possible to identify areas of concern and take appropriate actions to ensure the provision of safe and clean water for the communities.

Recommendations:

Based on the research project's findings, the following recommendations can be made:

1. Water Treatment and Monitoring: In areas where the water quality falls below the established standards, it is crucial to implement water treatment measures to improve its quality. Regular monitoring should also be conducted to ensure that the water remains safe for consumption and meets the required standards.

2. Community Education and Awareness: It is important to raise awareness among the community members about the significance of water quality and the potential health risks associated with contaminated water. Educational programs can help promote proper hygiene practices, water conservation, and the importance of using safe water sources.

3. Regular Testing and Maintenance: Continuous monitoring and testing of water sources are essential to identify any changes or contamination. Regular maintenance of water infrastructure, such as boreholes and treatment facilities, should be carried out to ensure their proper functioning and prevent water quality deterioration.

4. Collaboration with Relevant Authorities: Collaboration with organizations such as SON, DPR, FEPA, and WHO is crucial to ensure adherence to water quality standards and to seek guidance on appropriate measures for improvement. Engaging with local health and environmental authorities can facilitate coordinated efforts to address water quality issues effectively.

By implementing these recommendations, it is possible to improve water quality in the sampled areas and protect the health and well-being of the communities.

Reference

Abohweyere, P. 0. (1990). Study of limological parameters and potencial fish yield in Kigera reservoir (extenmsive system) In Kenji, New Bussa, *Nigeria. Journal of Aquatic Science.* 5: 53 - 58.

AGU (2007) Water vapour in the climate system Vol. (4). Vital water UNEP.

Aminu S.I (2011) some aspect of limnology and plankton composition of Natu lake thesis presented to the department of biological science Uthman Danfodio university Sokoto

Balarabe, M.L (1989) limnology and zooplankton distribution of Makwaye (ABU farm) lake, Samaru Zaria, Nigeria M.S.C. The Sir Ahmadu Bello University

Zaria

Cairs, J. (1995). Effects of increased temperature on aquatic organism. *Industrial waste* 1.50

Chkroff, M. (1976). *Freshwater fish fund culture and management.* Vita publication Manual series. New York, US. No. 36 e-Pp 79 - 87.

CIA (2008): the World Facebook, central intelligence agency retrieve 20.

Downing, J. A., Prairie, Y. T., Cole, J. J., Duarte, C. M., Tranvick, L. J. Striegel, R. G., McDowell, W. H., Kortelainel, P., Melack, J. M., and Midleburg, J. J. (2006).

The Global abondonce and size distribution of lakes, ponds and impoundments. *Limnologia, and oceanography,* 51: 2388 — 2397.

Golterman, H. L. (1995). *Chemical composition ofi lakes.* In; Golterman H. L. (ed) seminar limnology. Oxford Elserier publishers. Amsterdam. Pp 24-65.

Hallegraett, G. M. (2003). *Harmful algal blooms: a global overview.* In Hallegraeff, G. M., Andason, D. M. and Cembella, A. D. (2003). Manual on harmful marine microalgae. UNASCO Paris.

Huet, M. (1994). *Text book of fish culture, breeding and cultivation of fish.* Second edition. Black well scientific publication Ltd. Oxford, Britain. Pp 314 - 321.

Ibrahim M. (2011): some aspect of limnology and fisheries potential of Shagari Dam a master's thesis presented to department of biological science, Uthman Danfodio University Sokoto.

Gleick, P.H. (1993): Water in crisis: a guide to the worlds fresh water resources, oxford university press ppl3

Goldman, C. R. and Horne A. T. (1993). *Limnology.* International students edition. Megraw Hill international Book company Limited, Tokyo, Japan. Pp 464.

Kiran, R., Deepa, R. S. and Ramachandra, T. V. (1998). *Comparative water quality Assessment Bannergatta and Yedvir lakes of Bangalor, in proceedings* of the national seminar on "Environmental pollution; causes and remedies" pp; 166- 182 edited by Macheshappa. H and Ragevendra Rao. M.N (eds), P.E.S institute of technology, Bangalor

Kiran, R., Deepa, R. S. and Ramachandra, T. V. (1999). Limnological aspect of wetlands in Bangalore, Karnatalca. Presented at a traninng workshop on wetland research methodology: Measuaring and monitoring biodiversity (Jan. 5, 1999) organized by wild life Institute of India, Dehradun.

Kulshrehtha, S.N (1998): a Global outlook for water resources to the yeyar 2025; water resources management 12(3) Pp 168-184

Mason, C. F. (2002). *Biology of fresh water pollution,* ed. Essex, Pearson Education Limited.

MDG (2008) Millennium Development Goals report retrieved 25 July 2010

Michaud, J. P. (1991). *A citizen's guide to understanding and monitoring lakes and streams.* Publ. # 94-149. Washington State Dept, of Ecology, publications office, Olympia, WA, USA (360) 407-7472. Moore, M. L. 1989.

Moussam, A.D. and Kawo, A.H. (2005). Clarias gariepinus as bioindicator of copper, lead and nickel in some ponds around kano metropolis, Kano, Nigeria.

International Journal of Research in Bioscience

Onaji, et al (2005). Some aspect of the physico-chemical parameters of Kwara lake in North western Nigeria bulletin of SAN, Vol.26 Pp 191-1199

Oniye, S.J. Ega, R.A.I, Ajanausi, O.J. and Agbede, R.I.S (2002). Some aspect of the Physico-chemical parameters of Zaria Dam, Nigeria. Journal of Agriculture and Environment 3(2) Pp 367-379

Stephens, K. (1997). Determination of low Phosphate concentration in lake and marine water, limnology Oceanography. 8: 361 -362.

Tchobanoglous, G. and E. D- Schroeder (1987). *Water Quality.* Wesley publishing company workingham, England. Pp 43 - 224.

Thurman, H. V. (1997). Introductory Oceanogra pHy. New Jersey, USA: Prentice Hall Collage. *ISBN 0132620723*

Williams, Penny, Whitfield, Merida, Biggs, Jeremy, Bray, Simon, Fox, Gill, Nicolet, Pascale, Sear, and David (2004). *Comparative biodiversity of* rivers, streams. ditches and ponds in an asricultural landscape *in Southern Ensland.* biologicalconservation 115 (2): 329 - 341, doi: 10.1016/S0006-3207 (03)0015 8.httD://www.seaturtle.ors/PDF/williams2003bio/conserv.pdf. *retrieved 2009-06-16*

Wetzel, R. G. (1995). *Limnolosy.* W. B. Saunders company philade phia. Pp 743