Journal of Sustainable Development and Environmental Protection

Bells University of Technology, Ota.

IERD www.ierdafrica.org Institute for Environment Research and Development

Journal of Sustainable Development and Environmental Protection

The Journal of Sustainable Development and Environmental Protection is a peer-reviewed journal designed to provide information to academia, policy makers, environmentalists and practitioners on new research findings, sustainable policy formulation and development, scientific and engineering breakthroughs in the new and promising developing field of sustainable development. The journal will convey information on theory and practice in the multi disciplinary sustainable development fields including (but is not limited to) environmental sciences, environmental engineering, environmental management, agricultural environment, environmental security, environmental governance, socioeconomic environment, industrial environment and built environment. The journal alignment of theoretical and practice as key to sustainable development.

Journal of Sustainable Development and Environmental Protection is published thrice a year, in February, June and September. The journal is published by Institute for Environment Research and Development and hosted by Bells University of Technology.

Editorial Enquires:

The Editors
Sustainable Development and Environmental Protection Journal
Institute for Environment Research and Development (IERD)
Bells Drive, Benja, Ota, Nigeria.
Phone +234-(1)- 2120630
Mobile +234-(8030 720 3119

ierdafrica@gmail.com
info@ierdafrica.org

Further details on the journal at
http://www.ierdafrica.org

* Volume 1, Number 1 of this publication is exempted to bear the ISSN (International Standard Se
National Library of Nigeria but Volume 1, Number 2 will bear the assigned ISSN as required by th

Table of Content

THE IMPACT OF EXCRETA DISPOSAL INTO LAGOS LAGOON ON THE LAGOON ECOSYSTEM AT IDDO DISCHARGE POINT IN APAPA LOCAL GOVERNMENT AREA OF LAGOS STATE NIGERIA

Ojolowo Saeed Kamaldeen
School of Environmental Planning Urban and Regional Planning Department,
Abraham Adesanya Polytechnic
Ijebu-Igbo, Ogun State. Nigeria.

&

Bolanle Wahab
Faculty of the Social Sciences Urban and Regional Planning Department
University of Ibadan, Ibadan. Oyo State, Nigeria

Abstract
This paper duels on the impacts of raw sewage on the lagoon ecosystems. The result of physiochemical and microbiological tests carried out on fish and sixteen water samples taken from *Iddo* in Apapa Local Government of Lagos State, Nigeria revealed pollution. *E,coli, Proteus sp., Enterobacter sp., Aeromonas sp., Klebsiella sp.,* and *Salmonella sp.* were isolated microorganisms identified in the samples. The quantity of Total Solid (802-2711ppm), Dissolved Solids (550-1990ppm), Biochemical Oxygen Demand (59-140ppm), Level of conductivity (120-500µS), colour (5- 10HU), and Nitrate (23-65ppm) found in the water samples also confirmed that the Lagoon environment is insalubrious.
Finally, conclusion was drawn with the recommendation that sewage should be treated prior to discharge into any sphere of the environment.

1.1 Introduction

Waste, either solid or liquid, is an integral part of man. Its generation and efficient management facilitate social, economic and biological development. Amount of waste generated keep soaring as a result of increasing urban population and consequent rapid urbanization, which, in-turn presents greater challenges for disposal and management. The problem is even worst with respect to non-solid wastes since no city in Nigeria has a sewage system worth its name (Lagos State Ministry of Economic Planning and Budget 2004:9).

The concern of this research is on excreta waste being discharged into the Lagos lagoon in relation to the impact on the lagoon ecosystem. According to Longman Dictionary of contemporary English (2003:474) "excreta is the solid or liquid waste materials that people and animals produce and get rid of from their bodies". Excreta contain enteric organisms such as *Klebsiella spp.*, *Enterobacter spp*. and *E. coli* that are detrimental to the health of fauna and flora when injected.

Lagoon contains brackish water (water that is slightly salty). This water is regarded as one of the most productive aquatic ecosystem in the world, and is of great socio-economic importance (Kiener, 1978 cited in Lalèyè and Moreau, 2005:28). According to Lalèyè and Moreau, (2005:28), Durand *et al* (1994) categorised the fish fauna in West Africa lagoons into (a) the littoral *euryhaline* marine species which come seasonally or accidentally into the lagoon; (b) the estuarine species which live usually in *mixohaline* inland waters; and (c) the continental or inland water species that are only scarcely recorded in the lagoon as they can enter them only when the water became fresh. Out of three hundred and thirty two fish (332) species belonging to the three categories of fish indicated above, seventy-nine (79) species have been identified in the Lagos lagoon (Durand *et*

al, 1994). This is a vindication that Lagos lagoon provides substantial quantity of aquatic foods in the sub-region; however, mutilating its physico-chemical and biological structure portends significant socio-economic and health implications.

Socio-economic activities taking place at the littoral areas of Lagos lagoon encourage human congregation, which in turn engender pollution of all descriptions. However, some points are more populated and received more pollutants than others receive *Iddo* in Apapa Local Government and *Ebute-ero* in Lagos Island Local Government areas are two principal points know for high population concentration. In these two areas, there are excess organic nutrients, because raw human faeces are discharged into the lagoon without treatment. Thus, deterioration of the quality of water ensues and all signs of water pollution are obvious. At *Ebute-Ero* littoral areas, a number of illicit and insanitary toilets known as "overhung latrines" have been constructed, where in shoppers, passers-by, and traders defecate directly into the lagoon under poor hygienic condition.

Lagos residents who intend to dispose of their septic tanks hygienically succeed in polluting the lagoon through excreta waste handlers who dutifully evacuated and discharged feacal effluents into the lagoon without treatment with the use of itinerant tankers. The raw faecal effluent present in the lagoon is oxygen demanding, aerobic (oxygen-requiring) bacteria can only decompose it. The presence of these bacteria in large number perhaps to detoxify excreta waste degenerate water quality by reducing the quantity of oxygen, and therefore, leading to massive demise of aquatic animals.

Untreated excreta wastes contain myriads of disease-causing agents (pathogens) which include bacteria, viruses, protozoa, and parasitic worms that eventually get to biological system of fish and other aquatic animals consumable by man. Through this process, feacal-oral diseases are transferred to man unfettered. WHO, (1992:16) declared that four million infants and adults die every year from diarrhea diseases, largely as a result of contaminated food or water.

Akpata and Ekundayo (1978), Helasi-kun (1981), cited in Ajayi and Akonai (2005:163) asserted that the discharge of raw sewage into the lagoon has important health implications. This insanitary act is facilitating the spread of feaco-orally transmitted sanitation related diseases (op.cit). Infections such as diarrhea, cholera, and typhoid that account for significant mortality are contracted through houseflies, contaminated hands, food, and water, eating and cooking utensils. It is not difficult for edible materials to be exposed to faecal matter in Lagos metropolis, because the polluted lagoon account for more than 70 per cent of fish and other seafoods consumed daily by Lagos residents (op.cit). Therefore, eating fish caught in the polluted Lagos lagoon increases the risk of contracting feaco-oral diseases.

The main thrust of this paper is to examine the ecological impacts of discharging raw sewage into the lagoon with a view to identifying most healthy and sustainable approach.

1.2 The Concept of Ecology

Ernst Haeckel, a German biologist, developed this concept in 1869, but the discipline of ecology was created about 100 years ago by M.I.T chemist Ellen Swallo (Miller JR 1998:95). The word is coined from the Greek *oikos,* "house" or "place to live", and *logos,* "study of". Ecology means the study of how organisms interact with one another and nonliving components of their environment (including such factors as sunlight, temperature, moisture, and vital nutrients) (Miller JR 1998:95). The thrust of the concept is the interactions among organisms, populations, communities, ecosystems, and the ecosphere.

An organism is any form of life, regardless of size and shape. Organisms can be classified into species-group of organisms that resemble one another in appearance, behaviour, chemistry, and genetic endowment. A population consists of all members of the same species occupying a specific area at the same time. Examples are all sunfish in a pond, all white oak trees in a forest, and all people in a country.

The place where a population (or an individual or organism) normally lives is known as its habitat. It may be as large as an ocean or prairie or as small as the underside of a rotting log or the intestine of a termite. Population of all the different species occupying and interacting in a particular place make up a community, or biological community- a complex network of interacting plants, animals, and microorganisms.

An ecosystem is a community of different species interacting with one another and their non-living environment of matter and energy (Miller JR 1998:97). The size of an ecosystem is somewhat arbitrary; the particular system under study defines it. The unit of study may be relatively small, such as a particular stream or field or a patch of woods, desert, or marsh; or the unit may be large, generalized types of terrestrial (land) ecosystems such as a particular type of grassland, forest, desert, or human settlements.

To be sustainable for some specific period, an ecosystem must contain the energy and nutrient resources needed to support its resident organisms and to dispose off and recycle their wastes. All of the earth's ecosystems together make up what we call the *biosphere,* or *ecosphere (*Miller JR 1998:97). For example, a marsh or wetland found between dry land and the open water of a lake or ocean is an *ecotone.*

1.2.1 Components of an Ecosystem

The components have been classified into two parts; (1) biotic, or living, components (plants, animals, and micro-organisms – sometimes referred to as biota; (2) abiotic, or non-living, components (water, air, nutrients and solar energy). Living organisms in ecosystem are usually classified as either producers or consumers, based on how they get food. Producers sometimes called autotrophs (self feeders) make their own food, from compounds obtained from their environment. On land, most producers are green plants, in freshwater and marine ecosystem, algae and plants are the major producers near shorelines; in open water the dominant producers are floating and drifting *phytoplankton*, most of them microscopic. Only producers make their own food; all other organisms are consumers, which depend directly or indirectly on food produced by producers.

1.2.2 Energy Flow in Ecosystem

The basic currency of ecosystem is energy. All organisms, whether dead or alive, are potential sources of food for other organisms. A caterpillar eats a leaf; a robin eats the caterpillar, a hawk eats the robin. When leaf, caterpillar, robin, and hawk have all died, decomposers in turn consume them. As a result, there is little waste in natural ecosystems.

The sequence of organisms, each of which is a source of food for the next, is called a food chain. It determines how energy and nutrients move from one organism to another through the ecosystem. Energy enters most ecosystems as high-quality sunlight, which is converted to nutrients by photosynthesizing producers (mostly plants) (Miller JR 1998:105). The energy is then passed on to consumers and eventually to decomposers. As each organism uses the high-quality chemical energy to move, grow, and reproduce, this energy is converted into low-quality heat that flows into the environment.

Real ecosystems are more complex than this. Most consumers feed on more than one type of organism, and most organisms are eaten by more than one type of consumer. Because most species participate in several different food chains, the organisms in most ecosystems form a complex network of interconnected food chains called a food web.

1.2.3 Relevance of Ecology to the Study

This concept to an extent is relevant to the study in terms of the inextricable links among the components of the urban ecosystem, in which man is a significant and outstanding member. Urban environment makes infinite resources

available to man; these resources are water, vegetables, and marine animals that man either consume directly or processed before consumption. The consumption of these resources provides essential nutrients for human metabolism; however, catabolism takes place within human systems to engender municipal wastes of all descriptions. The indiscriminate discard of municipal wastes into urban environment in excess that cannot be recycled naturally, introduces disease vectors that eventually harm human beings. To maintain a sustainable ecosystems man should argument the natural systems that recycle nutrients for further use by organisms, having known that the rate of wastes generated due to soaring urbanization and industrialization overload the environment.

1.3 Review of Literature

One of the major contaminants of the marine environments as a result of land-based activities is sewage, mainly of domestic, but also, in certain areas, of industrial origin. Urban and industrial wastes are, to a great extent, discharged untreated into creeks, estuaries, lagoon and the immediate inshore areas (WHO, 1992:4).

Of all the cost of urban environmental degradation, damage to human health is by far the highest (Adelegan, 2004:5; Obire and Aguda, 2002:2). The report released by the World Health Organisation in May 1996, estimated that of the 51.9 million worldwide deaths in 1995, about 17.3 million (33%) were due to infectious diseases. In this group of diseases, about 22% (3.75 million deaths) were due to food, water and soil borne agents (Health Stream, 1996:1). Human activities have adversely affected the coastal and marine environments leading to reduction in the amenity value, loss of biological diversity and degradation of the water quality , poor sanitation and negative effects on human health (Ukwe *et al*, 2006:33;Akinpelu,2007:46; Peace,2006:29; and Soyinka, 2007:42). Joshi (2001:1) also asserted that improper waste disposal leads to human health problems, contamination of water supplier, environmental degradation, loss of livelihoods, and unsightly surroundings.

There is a direct link between urban environment degradation and public health considering water related diseases such as diarrhea, dysentery, cholera, and typhoid that are ravaging man (WHO, 2007). Waste is responsible for the transmission of infectious diseases such as cholera, typhoid, dysentery, and diarrhea (Pickering and Owen 1997:187). Approximately 14,000 people die each day from preventable water-borne diseases because of inadequate sanitation and hygiene practices (Wikipedia, 2005:2). This must have prompted Wahab (2004:1) to opine that most of the endemic diseases of Africa are best addressed through sanitation and hygiene.

More than a third of the world's population does not have access to pit latrines or toilets for safe disposal of faeces (Herbert 1994:2). Morgan (1979:16) asserts that only 17 per cent of houses in the Lagos metropolitan area had flush toilets, while 50 per cent has bucket latrines and 26 per cent pit latrine in 1975. This validates the assertion of Akpata (2002:6) that twenty six million litres of feaces were deposited into the lagoon in 1973. Raufu (2006:1) said that recent study revealed that more than 24,000 tones of suspended solids and over 1,700 tones of biodegradable are discharged into the lagoon annually. Pollution by sewage creates a risk of typhoid, paratyphoid, and hepatitis infections, through direct contact and consumption of contaminated seafood.

Biologist contend that eating fish caught in the lagoon these days increases the risk of illness, because the toxic chemical dumped there might have contaminated fish in the lagoon (Raufu

2006:1). Abulude et *al* (2006:38) opined that prawn an aquatic organism might act as toxicant amplifier or making the toxicant available to consumers at dangerously high levels.

The trend is obviously unfettered with extant indiscriminate dumping of waste-liquid and solid-into the public drain and lagoon where fishing activities is a daily chore. Baarschers (1996:153), Wright and Nebel (2002:453) confirmed that raw sewage is often dislodged into surface water without any form of treatment. Miller JR (2000:550) also asserted that in many developing countries and in some developed countries, sewage and water-borne industrial wastes are discharged without treatment into the nearest waterway or into lagoons. Domestic sewage and industrial wastewater containing large quantities of chemical substance drained into rivers without treatment causes serious water pollutions (Yang, 1996 cited in Obire *et al* 2003:1).

The challenges posed by insanitary non-solid waste management in Nigerian cities are grave. This is made worst due to non-existence of sewage system in any of the city; and inaccessibility to excreta disposal system (Linn, 1983:18). National Planning Commission (2004:34) confirmed that Nigerian cities have inadequate systems for the safe disposal and treatment of waste; while Lagos State Ministry of Economic Planning and Budget (2004:10) concluded that water pollution is worst in Lagos city due to unwholesome disposal of solid and non-solid wastes.

Table.1: Sewage Disposal Methods in Lagos

METHOD	%
Septic Tank	10
Pit latrine	55.5
Pail	32.5
Collection stiles	2

Source: Ministry of Economic Planning and Budgets Lagos State (2004:79)

The Graduate School of International and Pacific Studies (2006:4) asserted that Lagos is the world's fastest growing mega city–and the dirtiest. The proportion of household is very high in Lagos City, in the absence of pipe-borne water supply; pit and bucket latrines are the most common toilet facilities in the low income areas (Table1.). Today 30 per cent of urban dwellers-some 450 million people-lacks any form of sanitation (Bartone *et al* 1994:2).

The insanitary disposal of feacal matter into the public drains and lagoons facilitates the introduction of enteric organisms into water bodies. Their presence in large number in water bodies is an indication that it has recently been contaminated by raw sewage. These organisms multiply rapidly, depleting the amount of dissolved oxygen present in the water. It also increases the turbidity of the water, thus reducing the amount of light available for photosynthesis (Andrew and Jackson 1996:282).

Akpata and Ekundayo (1978:48) reported an increase in the number of total coliforms and *E.coil.* in particular when faeces were added to the Lagos lagoon. A 1990 survey estimates that 900 million people are affected by diarrhea, a similar number by roundworm, and about 200 millions suffer from schistosomiasis in the world over (Baarschers 1996:152). Wright and Nebel (2002:395) affirmed that diarrheal diseases (e.g. Cholera, dysentery, Salmonellosis, glardiasis and many viral and bacterial infections), responsible for 2.2million deaths in 1999, have the most link to the environment. Most serious cases are the consequences of ingesting food or water contaminated with pathogens, such as *Salmonella, campylobactor*, and *E. coli* from human wastes.

It is dehumanizing that the sixth most populated city in the world-Lagos-has more than eighty percent (80%) household with pit latrines and pail (table 1) for excreta collection and disposal. Even the few who adopted Septic tank with soak-away pit system have exempted soak-away pit, instead constructed a soil-pipe connecting septic tank to the public drain wherein scum and sometimes sludge are deposited, and finally flow into the lagoon.

1.3 Study Area

The study area is *Iddo* jetty in Apapa Local Government of Lagos State Nigeria. *Iddo* jetty is considered appropriate due to the frequent visitation of itinerant tankers to the jetty to discharge raw faeces. The study was conducted around fifty meters (50m) radius offshore and one hundred meters (100m) radius onshore from point of discharge at "*Iddo"* jetty.

Iddo jetty lies approximately between longitude $3^{0}22^{1}$ E and $3^{0}23^{1}$E, and latitude $6^{0}20^{1}$ N $6^{0}28^{1}$ N. it is located in Apapa local Government of Lagos State. The jetty lies within the Lagos lagoon, which is one of the several lagoon systems in the West African sub-regional and most extensive.

1.4 Methodology

The procedures employed in this study and the approaches to data collections and analysis are presented in this session. The researchers carried out a reconnaissance survey to the study area to be acquainted with activities going on therein with a view to evolving appropriate sampling techniques.

Primary and Secondary data were used in this study. The primary information was obtained from laboratory tests carried out on water and fish samples taken from the site. Secondary data were gleaned from available relevant literature. To generate laboratory data, sixteen (16) sterilized 75cl containers were used to fetch water and two unidentified fishes within fifty meters (50m) radius off shore *Iddo* jetty.

Four water samples were taken from the jetty twice on two different days, on Tuesday 8th May and on Friday 18th May 2007. On each of this day, the samples were kept in cooler containing ice-cubes and taken to Kappa Research Support Services Suit 5 AL-Barakah Plaza, new Bodija, G.P.O Box 12033, Ibadan within four hours. Four principal points were identified offshore at the jetty with the aid of Global Positioning System (GPS). Firstly, at the point where raw faecal effluents were being discharged, this is tagged north; the other points were South, West and East of the first points respectively, at fifty meters interval and ten inches (10 inch) deep into the water. The parameters tested were water temperature, pH, Colour, Conductivity, Suspended Solids, Biochemical Oxygen Demand (BOD), Total Dissolved Solid and Nitrate. Fish and faecal assay were also carried out to test for Total and faecal coliforms on the skin and in the intestinal tract of the fish.

1.5 Analysis and Discussions on Physicochemical and Microbiological Characteristics of Water and Fish Samples.

The WHO standards for measuring the quality of water that is save for drinking is presented in Table.2. This table is employed to compare the results of the laboratory tests for physicochemical and microbiological characteristics of water and fish samples.

Table.2: World health organization standards for drinking water.

Substance	Maximum acceptable concentration	Maximum allowable concentration
Total solids	580mg/L	1,500 mg/L
Colour	5 units	50 units
Turbidity	5 units	25 units
Taste	Unobjectionable	Unobjectionable
Odour	Unobjectionable	Unobjectionable
Iron (Fe)	0.3mg/1	1.0mg/L
Manganese (Mn)	0.1mg/1	0.3mg/1
Copper (Cu)	1.0mg/1	1.3mg/1
Zinc (Zn)	5.0mg/1	15.0
Calcium (Ca)	75mg/1	200 mg/1
Magnesium (Mg)	50 mg/1	150mg/1
Sulphate (SO_4)	200mg/1	400 mg/1
Chloride (C1)	200 mg/1	600 mg/1
Fluoride (F)	0.5 mg/1	1.5mg/1
Nitrate (NO_3)	50 mg/1	100 mg/1
$CaCO_3$	-	120 mg/1
PH range	7.0 – 8.5 mg/1	6.5 – 9.2
Magnesium+sodium sulphate	500 mg/1	1000 mg/1
Phenolic substances`	0.001 mg/1	0.002 mg/1
Carbon chloroform extract	0.2 mg/1	0.5 mg/1
Alky-benzy sulfonates	0.5 mg/1	1.0 mg/1
Lead	-	0.05 mg/1
Arsenic	-	0.05 mg/1
Selenium	-	0.01 mg/1
Chromium	-	0.05 mg/1
Cyanide	-	0.2 mg/1
Cadmium	-	0.01 mg/1
Barium	-	1.0 mg/1

PARAMETERS	WHO/EC GUIDLINE
MICROBIOLOGICAL	
Total Bacterial Count	Max 100 in 1 ml
Coliform bacterial	Nil in 1 mil
Escherichia coli	Nil in 1 mil
Streptococcus faecalis	Nil in 1 mil
Clostridium perfringens	Nil in 1 mil
PHYSICAL	
Colour (Hazen Unit)	5.0
Conductivity (µs)	400
Total Solids (mg/L)	500-1500
Total Dissolved Solids (mg/L)	500
Turbidity (mg/L Sio_2)	10
Odour	Nil
Taste	Unobjectionable/Insipid
CHEMICAL	

Ph	6.5-8.5
Chloride (mg/L)	250 Max
Nitrate (as mg/L $N0_3$)	25-50
Sulphate (mg/L)	200-250 Max
Iron (mg/L)	0.3
Ca (mg/L)	75-200 (Guide=100)
Total Hardness (mg/$CaC0_3$)	100-150. No limit really for drinking water
Mg (mg/L)	30-50
Alkalinity (mg/L Carbonate)	Max 120
Dissolved Oxygen (mg/L)	>75% Saturation
COD (mg/L $KMn0_4$)	2-5

Source: WHO (1963) cited in Ayoade (1988:206).

1.5.1 PHYSIOCHEMICAL CHARACTERISTICS

Table.3 depicts the physiochemical parameters of the lagoon water at *Iddo"* Jetty.

Methodology: Thermometer was used to measure the temperature of water in- situ during water sampling. pH meter at 30°C (room temperature) was employed to read the pH value of the samples. The colour was measured with spectral photometer UNISPEC 23D manufactured by Unicode England, at different wavelengths specified by the manufacturers, while total solids was determined by filling a Petri dish with 10ml of water sample and subsequently placed in an oven at 105^0C for three hours. The sample was then desiccated, subsequently, it was weighed and about 50ml of water sample was added. This process was repeated three times, the first weighing was tagged W1, the second, W2, and the third, W3 to derive % Total solids.

$$\frac{W_3-W_1 \times 100}{W2-W1}$$

Therefore, to obtain part per million (ppm) the result is multiplied by 10,000. Total Dissolved Solids were determined by direct instrumental measurement using TD Scan waterproof manufactured by Eutech Instruments Ltd. Singapore. Conductivity was also measured with conductivity meter produced by Neutech Instruments Company, India. In the case of nitrate, phenol disulphonic acid method was used.

The absorbency of the yellow colour developed by reacting with the nitrate in

Table.3: Physicochemical characteristics of water in *Iddo* jetty.

VARIABLES	IDDO UNTREATED	WHO/EC STANDARD
pH at 30^0C	*7.9-8.5	6.5-8.5
Total Solids (ppm)	**2412-2915	500-1500 (mg/L)
Dissolved Solids (ppm)	**>1990	500 (mg/L)
Conductivity (µs)	**310-510	400µs
BOD ppm at 30^0C	**95-225	50ppm
Colour H.U at pH 7.6	**5-10	5.0 (Hazen Unit)
Nitrate (ppm)	**38-65	25-50 (mg/L $N0_3$)

Legend: Normal = *, Abnormal = **
Source: Fieldwork 2007.

the sample, phenol disulphonic acid was measured with UV spectrophotometer at a wavelength of 410µ, and was related to the concentration of prepared standards. Also, the Biochemical Oxygen Demand (BOD) was derived by incubating sixteen (16) BOD bottles filled with 300ml of water sample at 30° C, the coloured bottles were used to estimate the quantity of BOD available.

1.5.2 **Microbiological Characteristics**

Various species of micro organisms identified in the water samples taken from the site were recorded in Table.4.

Table.4: Microbiological Characteristics of water in *"Iddo"* Jetty.

POINT OF SAMPLING/DATE	MPN Count/100 m1	Microorganism isolated	WHO/EC STANDARD
IDDO			
8/05/2007			
North	1100	E.coli, Enterobacter sp., Aeromonas sp., Salmonella sp.	Nil in 1 m1
South	460	Proteus sp., Enterobacter sp., Klebsiella sp.	Nil in 1 m1
East	1100+	E.coli, Enterobacter sp., Aeromonas sp., Klebsiella sp., Salmonella sp.	Nil in 1 m1
West	120	E,coli, Proteus sp., Enterobacter sp., Salmonella sp.	Nil in 1 m1
18/05/2007			
North	1100+	E,coli, Proteus sp., Enterobacter sp., Aoromonas, Klebsiella sp., Salmonella sp.	Nil in 1 m1
South	120	E,coli, Proteus sp., Enterobacter sp., Aoromonas, Klebsiella sp., Salmonella sp.	Nil in 1 m1
East	210	E,coli, Proteus sp., Enterobacter sp., Aoromonas, Klebsiella sp., Salmonella sp.	Nil in 1 m1
West	53	E,coli, Proteus sp., Enterobacter sp., Aoromonas., Klebsiella sp., Salmonella sp.	Nil in 1 m1

Source: Fieldwork 2007.

Methodology: Most Probable Number (MPN) method was employed to determine the presence of the micro organisms.10ml of the double strength broth was added into 144 screw capped bottles of the same size. Each of the bottles contained an inverted Durham tube used to collect gas. Sterile pipettes were then used to discharge three 10ml samples to 10ml double strength medium; three 1ml samples to 5ml single strength medium; and 0.1ml sample to 5ml single strength medium. The bottles were then incubated at 37^{oc} and examined after 24-48 hours respectively. Acid growth and gas production were observed the number of positive and negative tubes were obtained and compared with table standard. The organisms identified were E.coli, Enterobacter sp. Acromonas sp. Salmonella Sp. Prosteus sp. and klebesiella sp. They are all of enteric origin.

The results of the ascaris (egg) count conducted on water samples taken from the sites is depicted in Table.5.

Table.5: Ascaris count

Point of Sampling and Date	Count per field	WHO/EC STANDARD
IDDO		
8/05/2007		
North	2	Nil per field
South	1	Nil per field
West	11	Nil per field
East	5	Nil per field
18/05/2007		
North	3	Nil per field
South	3	Nil per field
West	15	Nil per field
East	5	Nil per field

Source:Fieldwork 2007.

Methodology: the (egg) count was done by filling 7ml of water sample into eight conical tubes, after which 3ml of ether was added. The tubes were subsequently spun with centrifuge for ten minutes to enable concentration of the samples. 0.5ml of the concentrated sample was pipette and discharged on slide with cover slip before it was placed under the microscope with which the counting was carried out.

The outcome of laboratory tests conducted on 1g of flesh extracted from the two fish samples taken from *'Iddo'* discharge point is presented in Table.6

Table.6: Microbiological Characteristics of fish samples from *"Iddo"* Jetty

Sample	Plate count (cfus/g)	Microorganisms Isolated	WHO/EC STANDARD
1	1×10^{4}	*E.coli; Proteus sp; Enterobacter sp; Aeromonas sp; Klebsiella sp*	Nil in 1 cfus/g
2	1×10^{4}	*E.coli; Proteus sp; Enterobacter sp; Aeromonas sp; Klebsiella sp*	Nil in 1 cfus/g

Source:Fieldwork 2007.

Methodology. The 1g of flesh extracted was macerated in 10ml distilled water and the aqueous extract used in analysis. E. coli, Proteus sp; Enterobactor sp; Aeromonas sp; Klebsiella sp. were isolated in the fish sample.

1.6 Summary

The outcome of the test conducted on water samples from *Iddo* Jetty showed that the pH value (7.9 to 8.9), recorded was still within acceptable standards for normal brackish water environment, but it is tending towards alkaline. Although aquatic organisms can still inhabit the lagoon environment with negligible impacts at present; the intractable discharge of raw excreta portends environmental dangers in close future. Other parameters tested were higher, total Suspended Solids (TSS) recorded ranged from 2412ppm to 2815ppm. Total dissolve Solid (TDS) was higher than 1990ppm. Conductivity was 310 uS to 510 uS; these confirmed that excessive quantity of both suspended and dissolved matter were present in the lagoon, and

thereby made the lagoon water to be turbid, coloured and facilitate abnormal conduction of electricity.

Laboratory tests conducted on water and fish during these quests revealed that the water in the lagoon around the jetty is harmful to aquatic, terrestrial, and arboreal fauna and flora that constitute the lagoon ecosystems. The laboratory analysis revealed that E, coli, Proteus sp; Enterobacter sp; Aeromonas sp; Klebsiella sp; and Salmonella sp. had became inseparable member of the lagoon ecosystems due to contamination by fresh raw faecal effluents.

1.7 Recommendations.

Having established the fact that insanitary disposal of untreated faecal matter into the lagoon have negative impacts on the Lagoon ecosystem and subsequent man, it is human to suggest ways that could facilities proper management of excreta to obliterate environmental impacts associated with raw faecal contamination.

The existing policy guidelines at Federal, State and Local tier of government should be given "teeth" to facilitate coercion and compliance; so as to develop a milieu where preventable diseases would not be a hindrance to socio-economic development. Therefore, fund that supposed to be expended on developmental projects of any kind would not be employed in procuring medications for curing diseases that are preventable. Therefore, we would have abide by the sage that "prevention is better than cure".

Public awareness campaign on the evil of insanitary collection and disposal of faecal matter should be heightened to curb incessant dumping of excreta waste into the lagoon to the tune of causing disease that can impair public health. There is need for government to reinvigorate health professional in charge of preventing disease, especially, Environmental Health Officers. They are generally concerned with public health surveillance and the protection of the environment as it affects health. The reinvigoration of the profession would facilitate proper monitoring of the environment to curb indiscriminate dumping of wastes; and also empower Environmental Health Officers to prosecute any erring resident to serve as deterrent to others.

Sewage treatment plants at Ikeja, Abesan Housing Estate, 1004 Housing Estate, FESTAC Town Housing Estate, and many others in Lagos City that are dysfunctional should be revitalized, so that faecal matter can be sanitarily treated and associated infections obviated. Private investors could also be invited to build sewage treatment plant at *'Iddo'*. This is borne out of that fact that the jetty is the point where the highest volume of raw excreta is being discharged into the Lagos Lagoon

Prior to getting an investor, there is still a provisional way out of discharging raw feacal matter into the lagoon without treatment. There is a canal adjacent The National Art Theater, Iganmu that can be modified to suit deposition of feacal matter, and here feces can be treated biologically before onward release into the lagoon through soil pipes.

Considering our level of economic and technological development, we can still do with the present system of evacuation and discharge of raw feces. That is septic tank with soak-away system and ventilated improved pit latrines. But evacuated feces should be treated either biologically or otherwise prior to discharge into any parts of the sphere.

Conclusion

The results of the physicochemical and microbiological properties of the water samples taken from *'Iddo'* are quite out of range of the Secondary Maximum Contaminant Levels (SMCLs) for aquatic to feed and grow well. The fish samples contain trace of microbiological

substances according to the laboratory tests conducted; by inferences it will also contain physicochemical parameters, which are deleterious to lives. Therefore, the lagoon is polluted. Therefore, consuming any of its food can cause infections in the pray.

References

Abulude, F.O, Fapohunda, O.O, and Awanlemhen, B.E. (2006): "Determination of some Heavy Metals in Procambaris clakii, Palaenon sp., Macrobrachium vollenhoventi and Penaus notail from the Coastel Water of Ondo State, Nigeria". Journal of Animal and Veterinary Advances 5 (1): 38-41.

Adelegan, J.A (2004): "The history of environmental police and pollution of water source in Nigeria (1960-2004): The way forward".www.fu-berlin.de/ffu/akumwelt/bc2004/download/adelegan-f.pdf. 4/18/2005.

Ajayi, A.O. and Akonai,K.A. (2005): :Distribution Pattern of Enteric Organisms in the Lagos lagoon, Nigeria". *African Journal of Biomedical Research,* Vol 8; 163 – 168

Akinpelu,D. (2007): "Environmentalists seek remediation of Apapa canal". *The Punch*. Monday, June 11th. page46.

Akpata, T.V.I and Ekundayo, J.A (1978): Faecal Pollution of the Lagos Lagoon, *Nigerian, Journal of Science,* 12. 39-53.

Akpata, T.V.I., (2002): "aquatic Microbes: Impact on Man and environment". An inaugural lecture delivered at the University of Lagos on 1st July. www.unilag.edu/...

/opendoc.php? sno = 154 and doctype = pdf and decname = aquatic%20 Microbes %20 on % 20 man.3/17/2007.

Andrew, R.W and Jackson, J.M (1996): Environment and Human Impact. England. Longman.

Ayoade, J. O. (1988) *Tropical Hydrology and Water Resources*. London: Macmillan.

Baarschers, W.H (1996); *Eco – facts and Eco – fiction: understanding the environment Debate.* London. Rutledge.

Bartone,C., Bernstein, J., Leitmann, J., and eigen, J. (1994): Toward Environment Strategies for Cities. Washington D.C. World Bank.

Hebert, M.S. (1994): " Sanitation an unmet Challenge" *Dialogue on Diarrhea,* issue no. 57, June-August. 1994. U.K. AURTAG.

Lagos State Ministry of Economic Planning, and Budget. (2004): State of Lagos Megacity and other Nigeria cities, Lagos, Ministry of Economic Planning, and Budget.

Laleye, P.A and Moreau, I. (2005): "Resources and constraints of West African coastal Waters for fish Production". www.worldfishcenter.org/pubs/ghonaproseedings/pdf/session3.pdf.3/17/2007.

Linn,J.F. (1983): *Cities in the Developing World*. Washigton, D.C. World Bank.

Longman. (2003): *Dictionary of Contemporary English.* London. Pearson.

Miller, G.T.JR (2000): *Living in the Environment: Principles, Connections and Solutions.* New York. Brooks.

Morgan, R.W. (1979): "Migration into Lagos State Nigeria" In Udo, R.K (ED), *Population Education Sources Book for sub-Sahara Africa.* London. Heinemann.

National Planning Commission. (2004): "Meeting Everyone's Needs" National Economic Empowerment and Development Strategy (NEEDS). Abuja. National Planning Commission.

Obire,O, and Aguda, M. (2002): "Bacterial Community of Leachate from a Waste-Dump and an Adjacent Stream". *Journal of Applied Sciences and Environmental Management.* Vol. 6, No 2, pp71-75.

Obire, O, Tamundo, D.C, and Wemedo, S.A. (2003): "Physico-Chemical Quality of Elechi Creek in Port Harcourt, Nigeria". *Journal of Applied Sciences and Environmental Management.*Vol.7, No.1. pp43-49.

Peace,D. (2006): " Water transporters link boat mishaps to pollution". *Daily Sun.* Saturday November 11. pg29.

Pickering, T.K and Owen, A.L (1997): *An Introduction to Global Environmental Issues. 2nd edition.* London. Routledge.

Raufu, A. (2006): "Negative echoes from Lagos lagoon". www.ecotopics.com/archives.htm-60k.12/21/2006.7/29/2007.

Soyinka, A. (2007): "Simple hygiene can prevent 45% of recoded deaths" *The Punch.* Wednesday May 30.pg42

The Graduate School of International Relations and Pacific Studies (2006): "The list: The World's Megacities". www.foreignpolicy.com/story/cms.php?Story-id=3504-46k

Ukwe, C.N, Ibe, C.A, Nwilo, P.C, and Huidobro, P.A (2006): "Contribution to the WSSD Targets on Oceans and Coasts in West and Central Africa: The Guinea Current Large Marine Ecosystem Project". *International Journal of Oceanography* Vol.1, No.1 pp21-44.

Wahab, B. (2004): "Africa Traditional Religions, Environmental Health and Sanitation in Rural Communities". *The Environscope. A Multidisciplinary Journal.* Vol.1, No.1pp1-9.

Wright, R.T and Nebel, B.J (2002): *Environmental Science; Towards a Sustainable Future.* London. Prentice Hall Inc.

UNEP (2006): "Pollution of Western Africa's Coastal and Marine Environment" www.grids.no/geo/123.htm. 14/06/2007.

WHO (1992): *Our Planet, Our Health,* Geneva. WHO.

WHO (2007): *Guidelines for drinking-water quality: second addendum.* Vol.1, Recommendations. 3rd ed. Geneva. WHO.

Wikipedia (2005): "Sanitation and Water Supply" http:/en.wikipedia.org/wiki/sanitation3/17/2007