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A CRITICAL EVALUATION OF THE ENVIRONMENTAL IMPACTS OF SOCIO-ECONOMIC ACTIVITIES WITHIN THE LAGOS COAST; A CASE STUDY OF LAGOS LAGOON

By

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Abstract;

Human activities along the coastal wetlands of Lagos state, on the most part have had adverse effects on the wetlands ecosystem. It is sadly ironic that as we have sought to exploit the riches of these habitants, we have unwittingly destroyed them. Unconscious of their fragility, we have, in our attempts to increase productivity has declined in several places. Yet if the burgeoning population of the study area is to be fed supply with protein, we must again utilize these wetlands sustainably.

All the agencies in charge of Lagos coastal Areas, especially Lagos state ministry of environment should be up and doing in their task to keep the lagoon clean and allow it to perform its natural duties. Laws guarding the Lagoon should be obeyed and if not obeyed by companies or individual adequate punishment should be given so such defaulter's. Above all adequate information should be passed across to the society/state stating the effect of the wrong activities going on in the lagoon and how it will affect human life, its environment and the eco system at large.

The coastal areas protection policy should be designed to manage our land-based coastal resources through sustainable development to ensure a balance between growth and environmental integrity.

To accomplish this, the policy establishes minimum standards for the management and sustainable development of coastal lands in unincorporated areas of the province.

Municipal governments would be required to manage growth and development on coastal lands in a fashion consistent with the needs and aspirations of each community. The policy aims to protect local coastal features such as beaches, dunes, and coastal marshes,
while maintaining a commitment to manage the development of coastal areas provincially.

INTRODUCTION

1.0 COASTAL AREAS

Coastal areas are commonly defined as the interface or transition areas between land and sea, including large inland lakes. Coastal areas are diverse in function and form, dynamic and do not lend themselves well to definition by strict spatial boundaries. Unlike watersheds, there are no exact natural boundaries that unambiguously delineate coastal areas.

Human activities along the coastal wetlands of Lagos state, on the most part have had adverse effects on the wetlands ecosystem. It is sadly ironic that as we have sought to exploit the riches of these habitants, we have unwittingly destroyed them. Unconscious of their fragility, we have, in our attempts to increase productivity has declined in several places. Yet if the burgeoning population of the study area is to be fed supply with protein, we must again utilize these wetlands sustainably.

It has been suggested that a distinction be made between the terms ‘coastal zone’ and ‘coastal area’. The term ‘coastal zone’ would refer to the geographic area defined by the enabling legislation for coastal management, while ‘coastal area’ would be used more broadly to refer to the geographic area along the coast that has not yet been defined as a zone for management purposes. In the United States, earlier attention to management in the coastal zone gave rise to the term ‘coastal zone management’ (CZM). As experience was gained of the multifaceted character of many issues and the consequent need to adopt an holistic approach to management, the term was revised to ‘integrated coastal zone management’ (ICZM). This term continues to be used by many authorities, including the World Bank.

In practice, laws concerning coastal management seldom unambiguously or precisely define the coastal zones. Thus, the boundaries of the relevant management area can, and usually do, change over time without regards to the enabling legislation. In addition, few nations have comprehensive coastal zone management policies. As a result, different coastal areas within the same nation can fall under the jurisdiction of different coastal management plans and their boundaries can be variously defined by the prevailing management issues in the locality.

In these guidelines, the term ‘coastal area’ is preferred to ‘coastal zone’ to refer to the geographic entity covered by an integrated coastal management plan. Such coastal management takes place at two levels: the national, or state level, where national goals, strategies, institutional arrangements and legislation may be determined and put into place; and the local, or area, level, where area-specific goals, objectives, plans and their implementation are the focus of attention

The use of integrated coastal management (ICAM) makes explicit the fact that degradation of coastal resources may result from activities outside and within the coastal areas.

1.1 THE STUDY AREA

LAGOS COASTAL AREA.

The Lagos lagoon is one of several lagoon systems in the West African sub region and most extensive. The lagoon is part of the barrier lagoon coasts of Nigeria. The water is shallow and

covers an area of about 208km2 (Ekundayo and Akpata, 1978). The lagoon is fed mainly by the rivers of Ogun, Shasha, Oshun, Agboyi and Majidun; the Ogudu creeks and waters of Epe and Lekki lagoons. The Lagoon empties into the Atlantic Ocean via Lagos harbour. The southern margin of the Lagos Lagoon is bounded by the Five Cowrie Creek, the eastern margin by the Palavar Islands and its northern border by Ikorodu. The lagoon is 40 – 64km long and has two arms; one connects the Lekki Lagoon while the other leads northward into the hinterland (Allen, 1965). The lagoon is shallow with depths of 1.5 – 3m (Ibe, 1988), and made up of muddy and sandy bottom. Its bottom relief is negligible.

Figure 1 Map of Lagos showing the Lagos Lagoon

1.2 Geography of Lagos Lagoon

Lagos Lagoon empties into the Atlantic via Lagos harbour, a main channel through the heart of the city, 0.5 km to 1 km wide and 10 km long. The principal ocean port of Lagos is located at Apapa in a broad western branch off the main channel of the harbour. Another branch off the main channel, narrower and longer, separates Lagos Island from Victoria Island, the broad sand spit which forms the coastline. The city spreads along more than 30 km of the lagoon's south-western and western shoreline. Pollution by urban and industrial waste is a major problem as a large amount of wastewater is released into the lagoon daily. The 11km long Third Mainland Bridge was built off the western shore to by-pass congested mainland suburbs. To its north-east the lagoon is connected by a channel passing south of the town of Epe to the Lekki Lagoon. Narrow winding channels connect the system through a broad band of coastal swamps and rivers, as far away as Sapele, 250 km to the east. The areas west of Lagos Lagoon are not well provided with roads and many communities there traditionally relied on water transport. The Lagos lagoon consists of three (3) main segments namely the Lagos Harbour Segment, the Metropolitan and the Epe Division Segment.

1.3 THE AGENCIES IN-CHARGE OF LAGOS COASTAL AREAS

The National Inland Waterways Authority, the Ministry of Environment, and

Lagos State Environmental Protection Agency.

1.3.1 NATIONAL INLAND WATERWAYS AUTHORITY

The agency managing Lagos coastal area is the National Inland Waterways Authority (NIWA) which was established by Decree No. 13 of 1997 with a clear mandate to manage Nigeria's vast inland waterway resources. The Decree vests in NIWA the power of exclusive management, direction and control on the Nigerian inland waterways. This power is exercised on Nigeria’s 3000km navigable waterways from the Nigeria/Niger and Nigeria/Cameroon borders to the Atlantic Ocean.

With vision to make Nigeria the leader in inland water transportation development and management in Africa, and to provide regulatory, economical and operational leadership in the nation's inland waterways system and develop infrastructural facilities for efficient inter-modal transportation system in line with global best practices that is safe, seamless and affordable.

The objectives of the agency include:

- Improve and develop the inland waterways for safe navigation
- Execute the objectives of national transport policy as they concern inland waterways.

1.3.2 THE MINISTRY OF ENVIRONMENT

The Ministry is charged with the responsibility of providing decent, orderly and reasonable conducive environment for habitable society, as contained in the assignments of Ministerial responsibilities.

To date, the Ministry has displayed total commitment to all its statutory responsibility and inspite of the myriads of environmental problems and rampant cases of illegal developments, the Ministry is never intimidated and thus remains committed to its primary objective of providing a clean and healthy environment conducive for a suitable social and economic development.

1.4 ACTIVITIES WITHIN LAGOS COASTAL AREA.

Some of the activities going on within the Lagos coastal area include:

- Dredging
- Recreation and tourism
- Economic activities
- Waste disposal
- Construction
- Transportation

1.4.1 DREDGING

Dredging is an excavation activity or operation usually carried out at least partly underwater, in shallow seas or fresh water areas with the purpose of gathering up bottom sediments and disposing of them at a different location. This technique is often used to keep waterways navigable.

It is also used as a way to replenish sand on some public beaches, where too much sand has been lost because of coastal erosion

A **dredge** is a device for scraping or sucking the seabed, used for dredging. A **dredger** is a ship or boat equipped with a dredge. The terms are sometimes interchanged.

The process of dredging creates spoils (excess material), which are carried away from the dredged area. Dredging can produce materials for land reclamation or other purposes (usually construction-related), and has also historically played a significant role in gold mining. Dredging can create disturbance in aquatic ecosystems, often with adverse impacts.

Dredging activities in the Lagos harbour is now a yearly event, to maintain the navigable channel as well as combat the coastal erosion of the recreational beach of Victoria Island, Ikoyi Park and Lekki Peninsula.

USES OF DREDGING

- **Capital**: dredging carried out to create a new harbour, berth or waterway, or to deepen existing facilities in order to allow larger ships access. Because capital works usually involve hard material or high-volume works, the work is usually done using a cutter suction dredge or large trailing suction hopper dredge, but for rock works drilling and blasting along with mechanical excavation may be used.

- **Preparatory**: work and excavation for future bridges, piers or docks/wharves, often connected with foundation work.
- **Maintenance**: dredging to deepen or maintain navigable waterways or channels which are threatened to become silted with the passage of time, due to sedimented sand and mud, possibly making them too shallow for navigation. This is often carried out with a trailing suction hopper dredge. Most dredging is for this purpose, and it may also be done to maintain the holding capacity of reservoirs or lakes.
- **Land reclamation**: dredging to mine sand, clay or rock from the seabed and using it to construct new land elsewhere. This is typically performed by a cutter-suction dredge or trailing suction hopper dredge. The material may also be used for flood or erosion control.
- **Beach nourishment**: mining sand offshore and placing on a beach to replace sand eroded by storms or wave action. This is done to enhance the recreational and protective function of the beaches, which can be eroded by human activity or by storms. This is typically performed by a cutter-suction dredge or trailing suction hopper dredge.
- **Harvesting materials**: dredging sediment for elements like gold, diamonds or other valuable trace substances.
- **Seabed mining**: a possible future use, recovering natural metal ore nodules from the sea's abyssal plains.
- **Construction materials**: dredging sand and gravels from offshore licensed areas for use in construction industry, principally for use in concrete. Very specialist industry focused in NW Europe using specialized trailing suction hopper dredgers self discharging dry cargo ashore.

- **Anti-eutrophication**: Dredging is an expensive option for the remediation of eutrophied (or de-oxygenated) water bodies. However, as artificially elevated phosphorus levels in the sediment aggravate the eutrophication process, controlled sediment removal is occasionally the only option for the reclamation of still waters.
- **Contaminant remediation**: to reclaim areas affected by chemical spills, storm water surges (with urban runoff), and other soil contaminations. Disposal becomes a proportionally large factor in these operations.
- **Removing trash and debris**: often done in combination with maintenance dredging, this process removes non-natural matter from the bottoms of rivers and canals and harbours.
- **Flood prevention**: this can help to increase channel depth and therefore increase a channel's capacity for carrying water.
- **Peat extraction**: in former times, so-called *dredging poles* or *dredge hauls* were used on the back of small boats to manually dredge the beds of peat-moor waterways before extracting the peat for use as a fuel. This tradition has now become more or less obsolete and the tools used to do this have also changed significantly.

ENVIRONMENTAL IMPACTS OF DREDGING

Dredging can create disturbance to aquatic ecosystems, often with adverse impacts. In addition, dredge spoils may contain toxic chemicals that may have an adverse effect on the disposal area; furthermore, the process of dredging often dislodges chemicals residing in benthic substrates and injects them into the water column.

The activity of dredging can create the following principal impacts to the environment:

- Release of toxic chemicals (including heavy metals and PCB) from bottom sediments into the water column.

- Short term increases in turbidity, which can affect aquatic species metabolism and interfere with spawning.
- Secondary effects from water column contamination of uptake of heavy metals, DDT and other persistent organic toxins, via food chain uptake and subsequent concentrations of these toxins in higher organisms including humans.
- Secondary impacts to marsh productivity from sedimentation
- Tertiary impacts to avifauna which may prey upon contaminated aquatic organisms
- Secondary impacts to aquatic and benthic organisms' metabolism and mortality
- Possible contamination of dredge spoils sites

The nature of dredging operations and possible environmental impacts cause the industry to be closely regulated and a requirement for comprehensive regional environmental impact assessments with continuous monitoring. As a result of the potential impacts to the environment, dredging is restricted to licensed areas only with vessel activity monitored closely using automatic GPS systems.

1.4.2 RECREATION AND TOURISM

Massive influxes of tourists, often to a relatively small area, have a huge impact. They add to the pollution, waste, and water needs of the local population, putting local infrastructure and habitats under enormous pressure. Overdevelopment for tourism has the same problems as other coastal developments, but often has a greater impact as the tourist developments are located at or near fragile marine ecosystems. For example:

- mangrove forests and sea grass meadows have been removed to create open beaches
- tourist developments such as piers and other structures have been built directly on top of coral reefs
- nesting sites for endangered marine turtles have been destroyed and disturbed by large numbers of tourists on the beaches

Figure 2 **Atlantic Ocean from the Vicinity of Eleko Beach**

The damage doesn't end with the construction of tourist infrastructure. Some tourist resorts empty their sewage and other wastes directly into water surrounding coral reefs and other sensitive marine habitats. Recreational activities also have a huge impact. For example, careless boating, diving, snorkeling, and fishing have substantially damaged coral reefs in many parts of the world, through people touching reefs, stirring up sediment, and dropping anchors. Marine animals such as whale sharks, seals, dugongs, dolphins, whales, and birds are also disturbed by increased numbers of boats, and by people approaching too closely. Tourism can also add to the consumption of seafood in an area, putting pressure on local fish populations and sometimes contributing to overfishing. Collection of corals, shells, and other marine souvenirs - either by individual tourists, or local people who then sell the souvenirs to tourists - also has a detrimental effect on the local environment.

ENVIRONMENTAL IMPACTS OF RECREATION AND TOURISM

Tourism can create great pressure on local resources such as energy, food, land and water that may already be in short supply. According to the Third Assessment of Europe’s environment (EEA, 2003), the direct local impacts of tourism on people and the environment at destinations are strongly affected by concentration in space and time (seasonality).

They result from:

- The intensive use of water and land by tourism and leisure facilities.
- The delivery and use of energy.
- Changes in the landscape coming from the construction of infrastructure, buildings and facilities.
- Air pollution and waste.
- The compaction and sealing of soils (damage and destruction of vegetation).

1.4.3 ECONOMIC ACTIVITIES

Some of the economic/commercial activities at the tributaries of Lagos lagoon include:

-commercial sawmill zone

-fishing

- Sand mining.

COMMERCIAL SAWMILL ACTIVITIES

Ebute Meta is a typical example of such area where the lagoon is being used as a commercial sawmill zone known for residential and commercial activities as depicts in figure 4.

Woods which are used majorly for construction activities are being processed in this area and drift of connected logs are suspended on the lagoon to increase the durability and quality of woods, because the longer it stays in water, the stronger it becomes.

Figure 3 ***TRIBUTARY OF LAGOS LAGOON AT EBUTE META, SHOWING SAWMILL ACTIVITIES***

EFFECT OF SAWMILL ACTIVITIES

One of the sources of organic wastes into the Lagos lagoon system is the waste material from the sawmill industry located along the coast of the Lagos lagoon system. There are about 2150 sawmills at the bank of the Lagos Lagoon (Dosunmu and Ajayi 2002). These wastes are known to be highly destructive to the inhabitants of these coastal areas. Akpata (1980) reported that wood retained for long period in water decayed and released its decomposition products into water. Sawdust which is the waste product from sawing timber is dumped into the Lagos lagoon. The effects of these organic load on the lagoon system have been documented by Akpata (1980); these include reduction in dissolved oxygen content due to the increased organic matter (sawdust), high turbidity, emission of foul odour of hydrogen sulphide, high bacterial and fungal growth, and a blue-black colouration of water as a result of lignin oxidants rendering the aquatic environment unsuitable for aquaculture.

FISHING ACTIVITIES

Due to the level of primary production in the lagoon, it is usually inhabited periodically by fish species of fresh water and marine origins, in search of food and good nursery ground. It has been reported that about 34% of fishes observed in this ecosystem are of freshwater origin and the remaining being marine (Amadi, 1991). Mullets (Mugilidae), sardine and bonga (Clupeidae) were classified as permanent fishes in this habitat (Fagade and Olaniyan, 1974; Amadi, 1990). The fisheries productivity of the Lagos Lagoon system is put above 75 kg/ha/year and the fishermen from the Nigerian coastal lagoon and estuaries contribute more than 50% of the current domestic fish production of about 800,000 metric tons (Onefeghare, 1990). It was also reported that about 28 metric tonnes/ha/year of oysters are produced annually from this ecosystem (Afinowi, 1985). As a result of lagoon's rich fauna, especially in fishes, fishing activities are usually witnessed on a daily basis. Recently, the state government is proposing using the Lagos Lagoon for cage culture as a form of contribution to food security and research. Fish and fisheries products are generally regarded as an important part of a healthy diet. In developing countries, fish and fisheries products apart from being a source of cheap animal protein, are widely consumed as they have high quality protein and other essential nutrients, and are low in saturated fat while containing Omega 3 fatty acids (NSPFS, 2005). In Nigeria, most investigations of the Lagos Lagoon have focused on the sediments and benthic communities (Ajao and Fagade, 1991), the diversity and density of macrobenthic fauna in the western part of the lagoon (Oyenekan, 1975), trend of heavy metals concentrations in Lagos Lagoon (Don-Pedro et al., 2004), the food and feeding interrelationships of the fishes (Fagade and Olaniyan, 1973) and the biology of some fishes and the fisheries (Fagade and Olaniyan, 1974). There is however, a need to update most of these studies and provide current information on the diversity of the edible fishery and the effects of pollutants on the health and abundance of these organisms inhabiting the Lagos

Lagoon. By virtue of its position, the Lagos Lagoon is surrounded by the densely populated (about fifteen million people) and highly industrialized Lagos metropolis, making it a convenient dumping site for numerous industrial and domestic wastes. According to Singh et al. (1995), an estimated 10,000 m3 of industrial effluents are discharged into the Lagos Lagoon per day. Oyewo (1998) estimated levels of heavy metals discharged into drains/canals/streams and subsequently into the Lagos Lagoon as follows: Fe – 161,718 Kg, Mn –205,989 Kg, CO – 15,683 Kg, Zn – 7026 Kg, Cr – 5285 Kg, Pb – 2259 Kg, Ni – 6124 Kg, Cd – 538 Kg and Hg – 278 Kg per annum. These estimates also confirmed that the industries are the major source of metal contaminants in the drains, streams and lagoon, since the graded prominence of metal types was similar in the sampled effluents and aquatic systems. The continued discharge of all sorts of untreated waste materials into the lagoon threatens the state of ecological equilibrium and diversity of fisheries resources in the lagoon (Don-Pedro et al.,

2004; Otitoloju et al., 2007). According to Singh et al. (1995) the use of the lagoon as a dump for waste materials has reduced annual fish production in the Lagos Lagoon by over five folds between 1970 and 1990. It is therefore important for environmental regulatory agencies such as Ministry of Environment and Environmental Protection Agencies (EPAs) to regularly monitor the levels of metals and other contaminants that are being discharged into the aquatic ecosystem which can in turn be accumulated by fisheries resources. The need for the Food and Drug Administration Agencies e.g. NAFDAC in Nigeria to also collaborate with the environmental agencies by monitoring edible fisheries species for their pollutant contents is also required. The results of such measurements when compared against set standards and maximum allowable limits can form the basis for allowing or disallowing the sales and consumption of sea foods based on the level of pollutant accumulated in the body tissues and

therefore help in averting human tragedies such as the Minamata disease in these developing countries.

SAND MINING

Sand mining is a practice that is used to extract sand, mainly through an open pit. However, sand is also mined from beaches, inland dunes and dredged from ocean beds and river beds. It is often used in manufacturing as an abrasive, for example, and it is used to make concrete. As communities grow, construction requires less wood and more concrete, leading to a demand for low-cost sand. Sand is also used to replace eroded coastline.

Another reason for sand mining is for the extraction of minerals such as rutile, ilmenite and zircon, which contain the industrially useful elements titanium and zirconium. These minerals typically occur combined with ordinary sand, which is dug up, the valuable minerals being separated in water by virtue of their different densities, and the remaining ordinary sand re-deposited.

Sand mining is a direct cause of erosion, and also impacts the local wildlife. For example, sea turtles depend on sandy beaches for their nesting, and sand mining has led to the near extinction of ghariyals (a species of crocodiles) in India. Disturbance of underwater and coastal sand causes turbidity in the water, which is harmful for such organisms as corals that need sunlight. It also destroys fisheries, causing problems for people who rely on fishing for their livelihoods.

Removal of physical coastal barriers such as dunes leads to flooding of beachside communities, and the destruction of picturesque beaches causes tourism to dissipate. Sand mining is regulated by law in many places, but is still often done illegally.

Sand mining activities along the Lagos coastal line have been discovered to pose as risk to the lives and property of people of the state; as such activities provide a leeway for possible

overflow of the Atlantic Ocean that can trigger flooding, especially as the raining season gets fiercer.

Villages along the shoreline in Lekki, Badadry and Ojo areas of the state are current locations where sand miners are digging deeper than one metre as stipulated by the state law.

Tedi village, a community located along the shoreline in Ojo Local Government, currently faces such threat. while concerned Lagos State government agencies appeared too busy to closely monitor what was going in this area, the miners, probably partnering with the 'omoniles' (land owners), daily put the lives and property of Tedi community at risk.

EFFECTS OF SAND MINING

The continued sand mining activities along the coastal area, poses grave threat to the pipeline that cuts across the West African sub-region. . If they continue mining sand from the communities in the coastal region, it will affect the livelihood of the residents; it will also affect the stability and integrity of the pipeline.

The waterways stretching from Badagry all the way to Epe is a God's gift to Lagos with a Peninsular in between, a lagoon at the back and the Atlantic in front, it is coastline that many people wish for. Illegal sand mining on the Badagry waterways could aggravate flood disasters in the area and expose the entire state to grave situation.

1.4.1 WASTE DISPOSAL

The tributaries of Lagos lagoon at Oworonsoki, a residential area with open dumpsite on the surface of water causes coastal degradation.

Fig 4 ***TRIBUTARY OF LAGOS LAGOON AT OWORONSOKI SHOWING ABANDONED CANOES AND THE POINT USE FOR REFUSE DUMPING BY THE COASTAL DWELLERS.***

Domestic Wastes: The impact of solid waste disposal into water bodies in the world's two famous mega cities, Jarkata, India and Lagos, Nigeria had been reported in UNESCO (2000), Awosika et al., (2000). Direct discharge of untreated domestic wastes such as kitchen wastes, feces and urine into the Lagos lagoon systems threaten the aquatic ecosystem in many ways. These include causing an increase in the microbial load in these water bodies, nutrient enrichment, pollution of the soil and aquatic environments (Oyelola and Babatunde, 2008) as well as the availability of substratum for bacterial growth. It also causes a reduction in dissolved oxygen level, reduction in the distribution and diversity of organisms and reduction in transparency due to the presence of un-dissolved solids and eutrophication (Harold, 1997). A consequence of the high microbial load on aquaculture is the susceptibility of culture fish to various diseases especially at high stocking densities. The nutrient enrichment of the ecosystem causes phytoplankton and higher aquatic plant bloom. A typical example of this is

the menace of the water hyacinth plant (*Eichorrnia crassipes*) in the entire Lagos lagoon systems. The implication of this for aquaculture is that it depletes dissolved oxygen in the environment which may lead to massive fish kill as a result of asphyxiation. The increased level of un-dissolved solids may lead to a reduction in light in the water body and consequently affect the growth of phytoplankton.

Industrial Wastes: The various waste materials from industries and pollutants found in many of these wastes depend on the type of industry involved in the discharge of the wastes. There are different types of industrial wastes in the Lagos area which are discharged either directly or indirectly into the lagoon systems and their potential threats to aquaculture. These wastes and the resultant pollutants could bring about a reduction in dissolved oxygen levels, eutrophication and increase in temperature. They could also cause increased organic load, increased turbidity as well as cause damage to nursery and spawning grounds. Because of the inability to sort waste at source, household and industrial waste including toxic ones are often handled together leading to soil and ground water pollution (UNESCO 2000). The sewage effluents of soap or detergent industries such as Lever Brothers PLC are rich in Phosphorus, containing about 2½ times as much phosphorus as nitrogen by weight (Law, 1981). When the phosphorus content of water is excessive and the available nitrogen has been completely removed for plant growth, conditions are therefore ideal for the development of nitrogen-fixing populations. Thus, in a natural system like the Lagos lagoon system, excess phosphorus can lead to prolific growth of blue-green algae and bacteria. Blue-green algae are one type of organism which leads to the discoloration and malodorous conditions characteristic of the Lagos lagoon (Akpata, 1980) and this is a condition that is detrimental to the development of coastal aquaculture. Boudouresque, and Verlaque (2002) stated that large numbers of blue-green bacteria produce foul odors and toxic substances that are harmful to marine life. Effects of pesticides, pesticides are chemicals which have a specific toxic action

to which the pest species is particularly sensitive (Zdenka *et al*, 1993). The term "pesticides" is used to include insecticides, acaricides, herbicides, fungicides and algaecides or any other chemical which is used to control unwanted organisms (except bacteria). On environmental grounds, pesticides should be non-persistent to avoid concentration building up in environmental compartments and causing unsuspected side-effects. Osibanjo (2006) stated that the main categories of sources identified were obsolete, discarded and banned PTS/POPs pesticides and PCBs (120,000 MT FAO Estimate), industrial sources (manufacture, mining and electricity), PCBs and dioxins/furans from open/uncontrolled burning of waste. However, some pesticides such as chlorohydrocarbons and other chlorinated hydrocarbons are toxic. These are produced by some companies in Lagos; they are used extensively to eliminate insect pests on crops and mosquitoes in Lagos and it's environment. DDT and its decomposition by-products have probably found their way into the Lagos lagoon system through careless disposal of the containers, accidental discharge from road accidents or factory disasters. Because DDT is not metabolizable, it therefore tends to become more and more concentrated as it is passed to higher levels of the food chain. Thus, grazing phytoplankton accumulates higher concentration of DDT than is found in the phytoplankton that they consume. The top level carnivores such as the carnivorous fish accumulate the greatest amount of DDT, and it is among these organisms that the greatest effects of DDT are found. PCBs have also been identified in water sediments and fish in Niger Delta water namely Ethiope, Benin and Warri Rivers (FOTE,2006). Earlier studies by Osibanjo and Bamgbose (1990) revealed the presence of PCBs in the Nigerian Environment. As at 1970 it had been clearly demonstrated that DDT was directly responsible for reproductive failure in many species of birds and large fish kills throughout the country(Turusov.et.al.2002).

Effects of oil and oil dispersants wastes: Oil is fast becoming one of the most widespread contaminants in the Lagos lagoons. It enters thelagoon from different sources causing various

stresses and disruptions in aquatic life. Basically, oil is a mixture of many compounds, and crude oil contains thousands of different compounds which are toxic to the aquatic organisms; some are soluble in water, some evaporate on the surface, some form extensive and widespread slicks while others settle on the bottom and incorporate large amounts of sand in globules (Laws, 1981). Different types of oil can have different effects of aquatic organisms. Laws (1981) classified the effects of oil into two categories; the first category includes the effects associated with coating or smothering of an organism with oil. The second category of toxic effects involves the disruption of an organism's metabolism due to the ingestion of oil. The incorporation of hydrocarbons into lipid or other tissue in sufficient concentration upsets the physiological activities of the organisms (Chukwu & Odunzeh 2006;Otitoloju 2006). Laws (1981) reported that adult fish are resistant to oil pollution, since their bodies including the mouth and gill chambers are coated with slimy mucus that resists wetting by oil. Longwell (1977), however, found that crude oil and fuel oil are toxic to fish eggs at concentration as low as 0.5 – 10ppm. These problems therefore constitute a threat to the development of coastal aquaculture in Lagos.

Inorganic wastes: Inorganic wastes are introduced into the Lagos lagoon system as a result of industrial and domestic activities. The addition of these inorganic elements like Na, Cl2, K, Ca, Mg, & SO4 could contribute to the percentage change in the concentration of ions in aquatic system and may affect the biology of the system. Some of these wastes are carcinogenic and may accumulate in the tissues of fish and thus be transmitted to man. Heavy metals like mercury, copper, lead, cadmium, chromium and arsenic are toxic even in the smallest form to fish and man (Laws 1981, Oyewo 1998). Fodeke (1975), working on the chemical analysis of Lagos lagoon water, observed that the concentration of some heavy metals at the site of sewage disposal is high: 0.07ppm Hg; 0.008ppm Pb; 0.66ppm Fe; 0.10ppm Cu and 0.03ppm Ni. It was reported that fish caught at the sites of industrial sewage

discharge in the Lagos lagoon had high concentrations of heavy metals in them. These heavy metals are potentially dangerous to aqua cultural fish and man (FAO/WHO, 1972; Okoye et al.,1991)

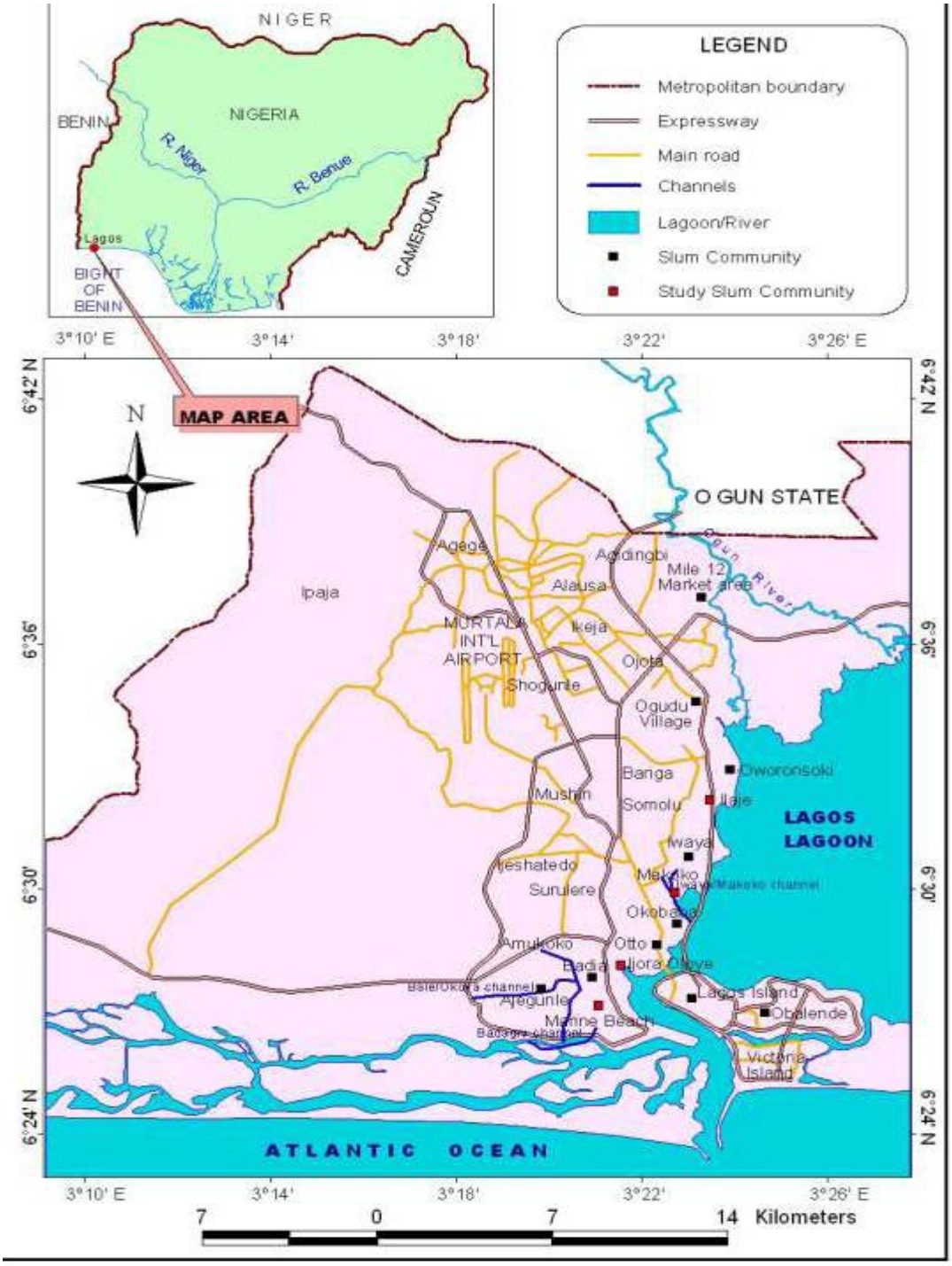

Fig 5; Lagos showing Coastal Slum Communities.

The table below shows the environmental factors and their effect on the coastal zones and threats to aquaculture

Environmental Factors	Threats to Aquaculture
Domestic Wastes	Low dissolved oxygen, death of fish if extreme
Human Excreta	Microbial load, foul-smelling organisms, presence of coliform bacteria e.g., *E. coli*
Detergents	Eutrophication
Pesticides	Accumulation of DDT in aquatic life including
Oil and oil dispersant	fish. Affects breeding and growth of fish.
Inorganic wastes	Disruption of metabolism (affects respiration), toxic to fish eggs
Solid wood wastes	Increase concentration of ions in water; disrupt metabolic functions, carcinogenic, accumulation of metals in tissues of fish, reduction in spawning and poor growth.
Waste heat	Increased organic matter, reduction in dissolved oxygen content, high turbidity, emission of foul odor, bacterial and fungal
Urban development	growth, blue-black coloration of water.
Tourism	Organisms living near their upper temperature limits may be adversely affected. Sand and gravel extraction Release of contaminated
Agriculture	solids, high turbidity, low dissolved oxygen. Conflict of land use suitable for aquaculture for residential quarters and recreation; high

	cost of land. Generates noise and disturbance, affects water quality Run-off of nutrients and fertilizer into water, risk of eutrophication.

Table 1

1.5 CONCLUSION

Human activities along the coastal wetlands of Lagos state, on the most part have had adverse effects on the wetlands ecosystem. It is sadly ironic that as we have sought to exploit the riches of these habitants, we have unwittingly destroyed them. Unconscious of their fragility, we have, in our attempts to increase productivity has declined in several places. Yet if the burgeoning population of the study area is to be fed supply with protein, we must again utilize these wetlands sustainably.

All the agencies in charge of Lagos coastal Areas, especially Lagos state ministry of environment should be up and doing in their task to keep the lagoon clean and allow it to perform its natural duties. Laws guarding the Lagoon should be obeyed and if not obeyed by companies or individual adequate punishment should be given so such defaulter's. Above all adequate information should be passed across to the society/state stating the effect of the wrong activities going on in the lagoon and how it will affect human life, its environment and the eco system at large.

1.6 RECOMMENDATIONS

MAINTAINING THE COASTAL AREA

The coastal areas protection policy should be designed to manage our land-based coastal resources through sustainable development to ensure a balance between growth and environmental integrity.

To accomplish this, the policy establishes minimum standards for the management and sustainable development of coastal lands in unincorporated areas of the province.

Municipal governments would be required to manage growth and development on coastal lands in a fashion consistent with the needs and aspirations of each community. The policy aims to protect local coastal features such as beaches, dunes, and coastal marshes,

while maintaining a commitment to manage the development of coastal areas provincially

A COASTAL AREAS PROTECTION POLICY

How Sensitive Areas will be Protected: The Establishment of Protection Zones

The government should adopt a coastal management approach based on sensitivity to impact. In order to accomplish this, the coastal area has been divided into three sensitivity zone.

Zone A: the areas closest to the water known as the coastal lands core area

Zone B: the areas beyond zone A which provide a further buffer, and

Zone C: the areas beyond zone B that form a transition from coastal to inland areas.

This approach will enable government, development officers, municipal officials and land owners to clearly identify where one zone ends and another begins, and allow for different management of the three zones to reflect sensitivity through zones B and C

Prior to implementation, the policy will propose a review mechanism which uses defined criteria as the appropriate way to assess the varying levels of sensitivity in zones A, B and C

ZONE A – COASTAL LANDS CORE AREA

Zone A, the most sensitive zone, includes beaches, dunes, rock platforms, marshes and dyked lands found between the Higher High Water Large Tide (HHWLT) and the Lower Low

Water Large Tide (LLWLT) plus dunes extending beyond the HHWLT. Due to the extreme sensitivity and the very high risk of danger/damage from storm surges, fewer development activities would be acceptable in Zone A.

Activities that should be acceptable in Zone A:

- The maintenance or enhancement of the coastal features, e.g. sand fencing or planting native dune grasses to protect sand dunes
- Acceptable erosion control structures
- Development associated with access and interpretation for educational or research purposes
- A development or undertaking to protect a coastal feature while providing approved public or private access to a shoreline e.g. a broad walk
- On coastal marshes that have been historically dyked for agricultural purposes:

  -carry out agricultural practices

  -construct agricultural storage buildings for activities related to the use of that land e.g. hay storage

ZONE B – COASTAL LANDS BUFFER AREA

Zone B is the land immediately adjacent to the coastal features. Zone B would consist of an area 30metres landward from the inland edge of Zone A. In the case of coastal marshes, a 30-metre buffer is essential for maintaining the integrity of the marsh while development activities in zone B would continue to have a direct impact on the coastal features and expose people to storm damage, the impacts i most cases would be somewhat less due to the protection afforded by both the natural features and prohibitions in Zone A. As such, a slightly greater range of activities would be acceptable.

Activities that should be acceptable in Zone B:

- All of the activities acceptable in zone A should be accepted in Zone B

- The construction of a new single family residence if it meets conditions related to:

  -existing residence on either side of lot

  -proximity to the boundary of zone A

  -size of structure and

  -ability to meet other regulatory requirements

- The repair, expansion or replacement of existing structures with the following conditions:

  -that this activity is no closer to Zone A, than the existing building

  -that the total increase in size of the building does not exceed 40% of the existing building

ZONE C – COASTAL TRANSITION AREA

A further zone, which will not be part of the initial coastal area protection policy, but will be adopted in the future, is referred to as – Zone C. It would extend from the outside of Zone B landward. The sensitivity to impact, and to storm damage, would vary considerably in Zone C depending primarily on topography elevation, and the erodibility of the land. As such, a precise distance for zone C has not been established at this stage in the development of the policy.

Activities that should be acceptable in Zone C:

- All activities that are acceptable in zones A and B are acceptable in the transition Zone. There will be greater variability in the sensitivity of this zone. Rather than trying to list all the potentially acceptable activities, the activities will be reviewed based on established criteria. There are two basic categories of criteria:

1. The susceptibility for the development to storm surges (In addressing susceptibility to storm surges, elevation, topography and erodibility (geomorphology) are key considerations.), and

2. The biophysical impact on the coastal ecosystem of the development. (In addressing the Impact of the development on coastal ecosystems, issues such as the potential to contaminate

(Hazardous materials storage, septic tanks/sewage), harmful disruption of the habitat, and disruption of natural coastal processes (e.g. littoral drift) are key considerations.)

ACTIVITIES WHICH SHOULD BE PROHIBITED IN ALL ZONES

There are some activities that are inherently unacceptable in any zone, these include:

- Groynes - rigid structures built out from a shore to protect the shore from erosion, to trap Sand or to redirect a current.
- Infilling.
- Dredging, excavation and associated spoil disposal activities except with an Ocean Disposal Permit from the Federal Government.
- Beach quarrying.
- Causeways, where a bridge is a technically feasible alternative.

Government and agencies in-charge of the coastal area management should make has the above suggested policy sustainable and workable, by implementing the policies for each zones

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