EFFECTS OF ENVIRONMENTAL POLLUTION ON FISHER FOLK ACTIVITIE IN EKEREMOR LOCAL GOVERNMENT OF BAYELSA STATE

A Paper Review

BY

OMULUCHE COLLINS ONYEKACHI

APRIL 2015

Abstract

The very bases of natural resource have been threatened, the fisher folk of this ecosystem have been forced to sniff around and negotiate with endogenous and exogenous forces of livelihood diversity. Thus the present study tried to explore the effect of environmental pollution on inland fisher folk communities in Ekeremor LGA of Bayelsa State. Primary and secondary data sources where used to get viable data from the study area. The results showed that environmental pollution from industrial run off , agricultural chemicals, dredging, toxic chemicals for fishing, indiscriminate dumping of waste in water bodies, fumes from exhaust of automobiles, thermal pollution of water and noise pollution were the major source of pollutant in the study area, which mostly lead to climate change have a range of direct and indirect impacts on marine and freshwater fisher folk, with implications for economies, coastal communities, social biodiversity and sustainability. The effects are: biophysical impacts on the distribution or productivity of marine and freshwater fish stocks through processes such as deoxygenation of water, habitat damage, changes in physiochemical parameters, disruption of the biodiversity and freshwater availability for fishing. Generally, the vulnerability of fishes is likely to be higher where they already suffer from overexploitation or overcapacity.

Keyword: fisher folk, pollution, climate, water bodies.

Introduction

Environmental Pollution Control defines environmental pollution as any activity, by corporations or individuals, which compromises the economic, social, health and/or environment of other persons in a localized area, where the causal link is clearly established. It is important to realise that aquaculture is the first industry to suffer from an inadequate coastal water quality and environmental damage (Olowosegun *et al*,. 2005). The industry is thus very dependent on minimising its own potential pollution, but also the pollution

originating from other human activities like industries or urban runoff. Fisher folk is an individual who uses fishing, raw materials gotten from fisheries and fishing activities as a source of livelihood. Food security in fishing communities will be affected by climate change resulting from environmental pollution through multiple channels, including movement of people to coasts, impacts on coastal infrastructure and living space and through more readily observed biophysical pathways of altered fisheries productivity and availability. Indirect changes and trends may interact with, amplify or even overwhelm biophysical impacts on fish ecology. Non-climate issues and trends, for example changes in markets, demographics, over exploitation and governance regimes, are likely to have a greater effect on fisheries in the short term than climate change and other environmental pollutants. The capacity to adapt to climate change is unevenly distributed across and within fishing communities. It is determined partly by material resources but also by networks, technologies and appropriate governance structures.

Environmental pollution and Climate Change

Patterns of vulnerability of fisher folk to climate change are determined both by this capacity to adapt to change and by the observed and future changes to ecosystems and fisheries productivity. Weather is the temperature, rainfall, humidity etc at a given place and a given time. Climate is the sum of all weather happening over a number of years in specific place. Environmental pollution is the principal cause of Climate change which refers to the short and long term effects on the Earth's climate as a result of human activities such as deforestation and burning fossil fuels such as oil, natural gas and coal. Some of the effect of environmental pollution on the atmosphere which affects the activities of fisher folks are;

- Sea level rise (0.18m-0.59m).
- Increased sea and surface air temperature (1.4 ^{o}C-3.2 ^{o}C).
- Increased intensity of storms (5%-10% increase in intensity).

- Change in weather patterns.
- Increased acidity of the oceans.
- Change in ocean circulation.
- Increase in salinity of the rivers.

All vital functions of fish (feeding, movement, reproduction etc) are water dependent and fish cannot survive without water. Unfortunately, the availability and quality of water have been impacted upon by both natural and man's activities, leading to poor water quality and productivity of aquatic ecosystems (Olowosegun *et al*, 2005). According to FAO (1992), the contamination of the environment from both natural and anthropogenic sources has impacted on the health and economic status of populations. Environmental Pollution has severe impacts on natural fisheries production, which resources have continued to diminish with increasing human population (Olowosegun *et al*, 2005), also reported that in Nigeria, most of the fishing grounds have been rendered unproductive by oil exploration, dredging of some water bodies and dumping of toxic industrial effluents with highly toxic metals. The rapid industrialization, coupled with technological advances in agriculture, have introduced various pollutants (synthetic and organic) into the aquatic ecosystems.

Pollution can also be the introduction of contaminants into the natural environment, which can be in the air, water, soil, etc.There are many types of environmental pollution, they include: air pollution, water, soil, noise, thermal, visual pollution etc.

Air pollution

Is the release of chemicals and particulate into the atmosphere. Common gaseous pollutants include: oxides of carbon, oxides of sulphur, oxides of nitrogen, halogenated hydrocarbon produced by industries, automobiles and man. Air pollution comes from both natural and anthropogenic source. However, human-made pollutants from combustion, construction,

mining, agriculture and warfare are increasingly significant in their contribution to air pollution. Other sources of air pollution are Chemical plants, nuclear waste, coal-fired power plant, oil refineries, petrochemical plants, waste disposal activities, incinerators etc.Air pollution has drastic effect on human-begin and environment and are the major causes of respiratory disease, cardiovascular disease, alimentary infection and most intestinal complications**.**

Water pollution

is the contamination of water bodies example lakes, rivers, oceans, aquifers and groundwater's. It is also the discharge of waste water from commercial and industrial waste into surface water, discharge of untreated domestic sewage and chemical contaminant like toxic heavy metals. This form of environmental degradation occurs when these pollutants are directly or indirectly discharged into water bodies without adequate treatment. water pollution is classified into organic, inorganic and macroscopic pollutants .Organic water pollutant are introduced into water bodies from disinfectants used for purifying water, waste water from food processing plants and hydrocarbons which are used as fuels. The inorganic water pollutants include ammonia from food processing and perseveration plants, chemical waste as industrial waste product, Heavy metals from automobiles etc.

Soil pollution

This is as a result of xenobiotic (man-made) chemicals or other alteration in the natural soil environment. It is mainly caused by industrial activities, agricultural chemicals and improper disposal of waste. Soil pollution are caused by one of the following: accidental spills, acid rain, intensive farming, deforestation, nuclear waste, drainage of contaminated water into the

soil, etc. These polluted soil affect the genetic makeup of the body especially infants, causes congenital illness and chronic health complication. They affect the growth of plants, leads to decrease of soil fertility, emission of toxic dust, etc.

Noise pollution

This is encompasses roadway noise, noise from aircraft, industrial plants and some high-intensity sonar. The effect of noise pollution to man and its environment include: hearing loss, high blood pressure, mental stress, emotional stress, etc

Thermal pollution

This type of pollution result from increase in the surface temperature of natural water bodies beyond its average normal temperature caused by human influence such as discharge of hot and untreated wastes into water bodies, using rivers and streams as coolants for industrial plants and other industrial operation. Thermal pollution of water bodies leads to decreased level of dissolved oxygen content of water which consequently leads to death of aquatic organisms, change in colour of water, stale taste in water and some foul smells in water bodies.

However, aquaculture on a global basis has been reported as one of the fastest growing food production sectors (11.2% per annum in the last decade), providing a significant supplement to and substitute for wild aquatic animals (Howgate *et al*, 2001; Delgado *et al*, 2003).The traditional inland fisher folk in Nigeria which largely depends on extensive use of natural resources at the cost of environment deterioration is now facing strong challenges. The degradation of aquatic resources and environment are major threats to existing and future potential fish production from inland waters and also food security. Sustainability has become vitally important to the future growth of this food production sub-sector and the fisher folk(Howgate *et al*, 2001).Worldwide about 38 million people are estimated to be involved in marine and inland small scale capture fisheries (FAO, 2004).The most important contribution of small scale fisheries to poverty alleviation through role in poverty prevention should be recognized at the present day world. In developing countries, it is noted that fishing and related activities have not generated high economic returns but instead have helped a large majority of households to sustain their livelihoods and have prevented them from falling deeper into deprivation. In Africa, inland fisheries at Malawi provides 70-75 percent of the total animal protein of both urban and rural low income families (FAO, 1996).In Bayelsa State, about twenty percent of total human consumption of animal protein is obtained from the fisher folk activities (MRC, 1997). It is observed that in situations of economically or institutionally restricted access to other capital or production factors, the relatively easy and free access to fishing grounds allows poor people to rely more on the local common resources to obtain the goods and services they need to sustain their livelihoods. In Bayelsa State, many species are now vulnerable, endangered or extinct. Water removal for irrigation and human consumption, deforestation, run off of agricultural chemicals, which are all forms of environmental pollution all reduce water quality and quantity and have great effect on the activities of fisher folk in Bayelsa, Nigeria and Africa. Dams and flood protection schemes

have changed seasonal water flows and obstructed fish migration. The multi-use, multi-user characteristic is a key factor greatly affecting the livelihood of fishing communities through increasing competition for water and coastal resources. The potential impacts of wastes from aquaculture on water column ecosystems is far less studied, presumably because it has been difficult to identify and quantify such impacts (Merceron *et al.* 2002; Soto and Norambuena 2004; Maldonado *et al*. 2005; Dalsgaard and Krause-Jensen 2006). There is thus not sufficient knowledge as to how specific measured environmental variables can reflect potential harmful impacts on open water ecosystems (Duarte et al. 2009). Catches from fisher folk are unlikely to increase and terrestrial food production is limited by the availability of freshwater and arable land, creating a ceiling to global food production. Mariculture, on the other hand, has little demand for freshwater and the demand for space is not an immediate limiting factor, as 70% of the Earth surface is covered by ocean (Duarte et al. 2009).

Traditionally, fishing authorities in the region have managed fishing separate from other sectors. Despite many efforts, fish stocks are still depleting.Table1 enumerates the forms of environmental pollution and its effect on the ecosystem and fisher folks.

Table1 ;Environmental activities and its negative impact on the ecosystem and fisher folk

Activities	**Impact on fisher folk and fishes**
Oil drilling and storage	Seismic surveys damage and chase away fish Pollution (oil spills) kills and damages reefs – no reefs, no fish.
Agricultural production	Compete for space with other coastal development
Coastal development	Sewage and sediment kills reefs, less fish Destroys mangrove, Displaces fisher folk from coastal areas
Quarries	Causes deforestation, which results in soil erosion, sedimentation causes damage to reefs and other habitats of fish
Agricultural waste and run off waste from farmland and industries	Leads to eutrophication, decreased dissolved oxygen and obstructs easy movement by fishers and fisher folk.
Discharge of hot water and waste from industrial plants	Reduces the dissolved oxygen present in waters, leading to

	offensive odour and death of fishes
Human activities(boat with engines, houses, fisher folk, etc)	Increase garbage which gets into the water – plastic bags kill fish and turtles dispose waste into sea, destroy fish traps.
Incomplete combustion of fuels in automobiles and production plants	Increases the P^H of water and increase and kills some weak species of aquatic animals, reduces fertilization of eggs.
Recreation	Anchor on reefs and destroy reefs, disturb fisher folk from catching fish in areas where recreation is taking place

Fisheries' contribution to livelihoods and economic development

The number of people directly employed in fisheries and aquaculture is conservatively estimated at 43.5 million, of which over 90 percent are small-scale fishers (FAO, 2005a). In addition to those directly employed in fishing, there are "forward linkages" to other economic activities generated by the supply of fish (trade, processing, transport, retail, etc.) and "backward linkages" to supporting activities (boat building, net making, engine manufacturing and repairs, supply of services to fishermen and fuel to fishing boats, etc.) (Ihuahi and Omojowo, 2005). Taking into account these other activities, over 200 million people are thought to be dependent on small-scale fishing in developing countries, in addition to millions for whom fisheries provide a supplemental income (FAO, 2005a). Fisheries are often available in remote and rural areas where other economic activities are limited and can thus be important engines for economic growth and livelihoods in rural areas with few other economic activities (FAO, 2005a). Some fisher folk are specialized and rely entirely on fisheries for their livelihood, while for many others, especially in inland fisheries and developing countries, fisheries form part of a diversified livelihood strategy (Allison and Ellis, 2001; Smith, Nguyen Khoa and Lorenzen, 2005). Fisheries may serve as a "safety net" to landless poor or in the event of other livelihoods failing (FAO 2005a).Many small-scale fisher folk live in poverty, often understood as resulting from

degradation of resources and/or from the safety net function of fisheries' for the poorest in society.

Environmental Issues that affect the activities of fisher folk

The fisher folk in most fishing area have suffered the most, because of dwindling catches as requirements for agriculture has been given prime importance rather than fisheries due to environmental pollution(Ihuahi and Omojowo, 2005). The permanent but submersible bunds constructed around the rivers as protection from flooding and the roads constructed in the name of development fragmented the wetland ecosystem into tiny units, disrupting the natural hydrological balance. Most of the rivers, lakes were a large number of the fishes are caught received affluent from chemical and engineering industries, food and drug manufacturing industries and also from paper, rayon, rubber textiles and plywood industries. Indiscriminate application of pesticides, discharge of industrial effluents, lack of adequate sanitation facilities together with the closure of the barrier have aggravated the environmental pollution problems(Howgate *et al*, 2001; Delgado *et al*, 2003). The agricultural developments have resulted in the input of large quantities of agrochemical and pesticides in the Wetland bodies of the major rivers especially in farm land near water bodies. Another source of pollution in the study area is the domestic sewage generated in the urban areas, which enters the rivers, streams and lake directly. Deoxygenation of water bodies, deposition of organics in sediments and input of substantial load of metals are the principal processes in the wetland due to improper methods of waste management and disposal. The high nutrient content associated with sewage is attributed as one of the main causative factors for the high rate of eutrophication in the lake. Excessive growth of aquatic plants when exceeds the supporting capacity of the environment leads to dead plant settlement down and results in siltation and shallowing of the water body. Due to the bacterial decomposition of plant debris there is reduction of dissolved oxygen in water bodies and atmospheric oxygen in the ecosystem.

Authorized and unauthorized sand mining is common in the area of study. The water carrying capacity of the system has been reduced to an abysmal by 0.6 Km^3 with a decline of 78 percent. Deepening of the channel by dredging is an activity which affects environment through biological changes in both terrestrial and aquatic flora due to the regular barrage operation. All these polluting agents have resulted in blanketing the lake with highly nutrient rich, acidic, sand dominated sediments. Metal accumulation is found high in these sediments (Ihuahi and Omojowo, 2005).

Background of Study

Small-scale fisher-folk communities have been adversely affected by environmental pollution, man's activities in the ecosystem and some mega projects outside of the fishery sector, which have focused on increasing production of energy, goods and the development of tourism and infrastructure in coastal areas. This prevailing development direction has yielded very many adverse impacts upon natural resources and the environment, with pollution from waste water drained into the rivers, lakes and many fishing grounds which has greatly affect the livelihood of the fisher folk in Ekeremor Local Government Area. Such problems have resulted from a lack of people's participation in proposing appropriate environmental management, preservation and directions which are sensitive to different local fishing community in the area. The result has been marine and coastal resource management which has not only been inefficient and ineffective, but which has even served to worsen the situation faced by coastal small-scale fisher-folk communities, increasing their insecurities and heightening existing conflicts. Besides these existing problems and issues, natural disasters and the impacts of climate variability and climate change are becoming ever more frequent and destructive, which in turn is affecting the abundance and diversity of plants and animals in the coastal zone. Changes to the topography of the coastal zone caused by continued coastal erosion are increasing the costs of fishery, whilst at the same time the

volume and quality of the catch is decreasing. The food, livelihood and economic security of coastal small-scale fisher-folk communities are all negatively impacted as a result. Exacerbating this situation, past experience has shown that when the coastal zone in impacted by man-made cause and sources of environmental pollution, natural disasters or extreme weather events, small-scale fisher-folk often have difficulty gaining access to fair rehabilitation and compensation in the aftermath(Omuluche et al., 2003).

Area of Study

The survey was carried out in all the major locations of Ekeremor Local Government area of Bayelsa State, Nigeria which includes: Aiegbe, Ndoro, Tarakiri, Isampou, Azagbene, Bakiri, Aleibiri etc. Ekeremor is one of the eight Local Government areas of Bayelsa State. with a population of about 270, 257 people at the 2006 National Census, It borders Delta State and has a coastline of approximately 60km on the Bight of Bonny.53% of its inhabitants are male while 47% are female .Ekeremor LGA is home to members of Ekeremor clan of the ijaw ethnic group. Located between latitude $05.3^{o}\,43^{'}$N and $05^{o}.\,05^{'}$N and longitude $05^{o}\,47^{'}$E and $05^{o}.783^{'}$E .It has a square area of about 1810km ^{2} (700sq m). The study area is characterized by a tropical climate with two distinct seasons: rainy and dry. The rainy season spans from May to October, while the dry extends from November to April. The general temperature trend for the study area is high with negligible diurnal and annual variations. The average monthly temperature in the area ranges from 29 to 34 ºC. A mean annual rainfall of about 2,300 mm have been reported for the area, with annual mean daily relative humidity and evaporation of 86 % and 3.85mm/day, respectively (CRBD, 2008). The regional run-off coefficient of the study area is in the order of 0.21-0.61 and is due to topography and evaporation, (Petters *et al*., 1989).

Aim and Objectives of the study

The aim of this study is to assess the effect of environmental pollution on fisher folk activities in Ekeremor Local Government Area of Bayelsa State, Nigeria .To achieve this aim, the following objectives were pursued;

1) To identify the reasons for the declining biodiversity and consequent impact on sustainability and livelihood of traditional fisher folk Ekeremor LGA.

2) To assess the major sources of environmental pollution on the study area.

3) Analysis of physiochemical parameters in the environment and its relation with environmental pollution.

4) Identification of environmental activities that affect the activities of fisher folk.

5) Effect of environmental pollution on climate and build awareness of climate change impacts on fisheries and potential adaptation actions.

Significant of Study

Traditionally, fishing authorities in the region have managed fishing activity separate from other sectors. Despite many efforts, fish stocks are still depleting. Fisher folks are losing their source of livelihood, raw materials, customers, fishing sites and the natural ecosystem owing to unfavorable change in climate, environment and water bodies. These measures do not take into account that environmental pollution from farm lands, industrial sites, automobiles, waste water from industrial plants, runoff water from farm lands, use of pesticides and fertilizers, deforestation, bush burning, incomplete combustion of fossil fuel could be the major cause of environmental pollution , climate change which have significant impact on the biodiversity and the activities of fisher folk in Ekeremor Local Government of Bayelsa State which may be contributing to the depleting fish stock. There is a need to evaluate the effect of environmental pollution on the study area as to know its impact on the fisher folk and their activities, so as to adopt the best control measure against these problems.

Review of Some Related literature

Harvey and Lee (1982) and Bradley and Morris, (1986) worked on the influence of environmental pollution from toxic metals on river kapuka in Turkey reported the significance of increased metal loadings in aquatic ecosystems coincidental with acidification and concluded that fish population losses were a consequence of reproduction failures arising from both acid and metal stresses which made some fisher folk to migrate to areas with warm ocean current and less polluted for source of livelihood.

Chemical contaminants in aquatic ecosystems which are toxic include inorganic chemicals such as heavy metals (Cd, Hg, Se, Pb etc), organic compounds such as polychlorinated biphenyls, dioxins, insecticides (chlorinated hydrocarbons) and contaminants related to aquaculture such as antibiotics and hormones. GESAMP (1997). These chemical contaminants affect the number of fingerlings and some exotic fish species in Lagos lagoon, locally generated raw materials from the water where cubed down due to environmental pollution .The source of livelihood of the fisher folk in the area was greatly affected which led to unplanned displacement of some fisher folk in the area(GESAMP, 1997; Ademoroti, 1996; FEPA, 2003; WHO, 2004).

Reilly *et al.,* 1997 studied the effect of environmental pollution and chemical health concerns associated with products from aquaculture and the possible risks to consumers in Amapara pond in Ghana. Various chemicals used in aquaculture that are of public health concerns such as chemical fertilizers, chemicals in feed, antibiotics, anti-fungal agents, agro-chemicals and industrial pollutants were highlighted. Health concerns of some pathogenic bacteria and fish-borne helminthes species associated with some specific aquaculture systems such as integrated fish/poultry and fish/livestock farming were also highlighted. The result obtained showed that the concentration of some fish species which have low resistance

(tilapia) to pollution reduced by over 75% and the total daily catch of fisher folk in the area reduced by over 200 tonns.

Distillery waste from the Mc Dowell Company at Varanadu is discharged at large quantity to Vembanad Lake causes a number of ill effects to the locality and also to the fishery resources in the lake. The hot discharge which is acidic in nature results in the breaking up of premature living clam shells. The fisher folk who go down the water for collection of fishes face many health problems like itching of the skin and eye. The fish and prawn also looses its aquatic atmosphere for sustenance due to very low oxygen level caused due to these emissions. The coir factories working in and around the rural and sub urban areas of Alappuzha district discharges their effluents also to the Vembanad Lake and this acts as a major pollutant of the lake resulting in mass mortality of fish. The activities including construction for resort tourism, land reclamation for constructions of houses, agriculture and aquaculture have led to massive destruction of ecosystem by large scale felling of mangrove forests. The excessive weed growth in the lake is also a major threat affecting the fishing and fishery wealth. Excessive weed growth results in lack of oxygen supply and sunlight to the underneath area of the lake and hampers the aquatic productivity. It is also learnt that rowing of crafts are laborious and casting of nets are impossible due to heavy weed infestation. The resort tourism has also affected the life of fisher folk, as these huge resorts and the big walls around it stretching for long kilometers have forbidden the fishermen from many of the services they accessed from the lake. It has been realized that indiscriminate sand mining rampant in the lake have brought major changes in the lake ecology and this has resulted in dwindling fishery wealth. (Howgate *et al,* 2001; Delgado *et al*, 2003)

Quality control in data collection and analysis

The quality controls are based on the rigorous sampling protocols of the BGS G-BASE methodologies (Johnson *et al*., 2005, 2008). Random number lists were used to ensure that spatially correlated anomalies were not an artifact of any systematic bias in Oral sampling and collection of data, solid and liquid preparation or analysis.

Methodology

Based on the background and context of the study area, eight inland fishery villages; Aiegbe, Ndoro, Oporoma, Tarakiri, Isampou, Azagbene, Bakiri, Aleibiri under the jurisdiction of Ekeremor LGA of Bayelsa State were selected for the purpose of the study. The selection of these particular villages were based on certain variables such as the environmental pollution prone areas, occupation, number of fisher folk, species of fish, geographical coverage, resource depletion due to unsustainable fishing and environmental degradation and methods for conservation of resources. The data used to identify the natural process of degradation have been collected from secondary studies. The data on environmental pollution, economic and social factors influencing the sustainability and livelihood issues of the inland fisher folk community has been collected from primary sources. A sample size of 150 respondents has been surveyed for the proposed study. As the environmental pollution issue varies from location to location, each location is bringing about some staggering realities. To bring out the live sustainability issues confronted by the fisher folk population resulting from environmental pollution residing very near to the banks of the lake, rivers and streams, 25 households living in cluster which were fisher folk were selected from each location for an in-depth study. In order to identify and select these locations for their peculiarities, a pilot survey was conducted all along these locations followed by a focus interview and interview with senior fishermen. The focused interview in each location and interview with senior fishermen, secondary data for the study were collected from magazines, journals, published

articles, news papers, published thesis, unpublished data from research institutions, internet sources etc.

Conclusions

Environmental pollution must be understood as part of the larger social framework, as an integral part of social integration, and must be addressed from this perspective. The effect of environmental pollution on the activities of fisher folk in the study area is highly significant. Much can be done at the local level to address the problems of environmental degradation, but local level action will be ineffectual unless it is carried out within a context of supportive institutions at the local, national and global levels, and unless explicit efforts are made to ensure policy coherency at these difficult levels. The strengths and weaknesses of the major types of policy approaches to environmental degradation and the complementarities and contradictions between them**.**

Recommendation

The entry route of most environmental pollution and the mechanism of pollution distribution in water bodies used for economic activities should be thoroughly investigated as the will help to reduce environmental pollution in our local communities.

References

Allison, E. H., Patterson, G., Irvine, K., Thompson, A. B. & Menz, A. 1995. The Pelagic Ecosystem, pp 351-377.

Lindholm, J., Auster, P. & Valentine P. (2004) Role of a large marine protected area for conserving landscape attributes of sand habitats on Georges Bank (NW Atlantic). Marine Ecology Progress Series 269: 61-68.

Adger, W. N. 2006. Vulnerability. Global Environmental Change, 16: 268-281.

Adger, W. N., Hughes, T. P., Folke, C., Carpenter,S. R. & Rockström, J. 2005. Social-Ecological Resilience to Coastal Disasters. Science, 309: 1036-1039.

Allison, E. H. & Ellis, F. 2001. The livelihoods approach and management of small-scale fisheries. Marine Policy, 25(5): 377-388.

Nyaku, R. E; Okayi, R.G; Ataguba, G.A; Mohammed, A. 2007. Diseases associated with Livestock integrated Fish Farming in Nigeria: A Review. In 2007 FISON Conference Proceedings, 12-16th Nov. 2007, Kebbi, Nigeria: 19-23

Ogbeibu A.E; Ezeunara, P.U. 2002. Impact of brewery effluents on the Ikpoba River, using the fish communities as bio-indicators. *Journ. of Aquatic Resources* 17: 35-44

Ohonba, S. I; Oronsaye, J.A.O. 1999. The toxicity of Cadmium to *Oreochromis niloticus* (pisces Cichlidae) fingerlings. *Nigerian Journal of Applied Sciences, Vol.* 17: 91-96

Olowosegun, O. M; Olowosegun,T. Mohammed, H. 2005. A review on the effects of water pollution on fish and the Fishing industry of Nigeria. In 2005 FISON Conference Proceedings, 14-18th Nov.,2005, Port Harcourt, Nigeria; 423-428

Reilly, P.J.A; 1992. Review of the occurrence of Samonella in cultured tropical shrimp. FAO Fisheries Circular No. 851. FAO, Rome. 19pp