

Assessment of Catfish Effluents Management in Lagos State, Nigeria

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Abstract- Catfish is one of the major sources of dietary protein in Nigeria. Lagos State is one of culturing areas with abundant fresh water and marine environments. The aim of this study was to evaluate the catfish rearing industry and its effluents management and make appropriate recommendations. Forty fish farms were randomly selected in Lagos State for the study. Questionnaire and in-depth interview were used for data collection on water sources, equipment operations, and waste management. Data collected were analyzed using descriptive statistics. Results indicated that over 80% of water for fish rearing was from shallow wells and 95% of the waste water generated was not treated before disposal into the environment. Effluents disposals employed were open pit (12.5%), drainage canal (32.5%), bare-land (20.0%), stream (22.5%) and re-used on farm (12.5%) and these methods of disposal were not significantly different ($p \leq 0.05$). Only a few farmers carried out simple treatment before disposal namely; infiltration (2.5%) and sedimentation (2.5%). If the effluent management conditions were not improved, it could pose a threat to the environment in the study areas. Pond effluent must be treated before being disposed into the environment and waste water from fish pond effluent should be reused as irrigation water.

Keywords: Assessment, Catfish, Effluents, Lagos state, Management

1 INTRODUCTION

Agriculture is the mainstay of the Nigerian economy employing over 70% of the active labour force (FDF, 2009). The deplorable state of the sector after the discovery of oil has made unemployment soar, however aquaculture though just an emerging sector stands a better chance to reverse this trend and complement other sources of protein which is the major problem of the Nigeria teeming population (Faturoti, 1999). Protein from animal sources is in short supply in Nigeria due to the rapid increase in human population and there is decrease in livestock population due to several factors including diseases, inadequate grazing lands and high cost of exotic animal feeds. Catfish production plays a very important role in Nigeria aquaculture industry given that it is the largest segment of aquaculture in Nigeria. Most catfish are cultured in the southern part of Nigeria, and the industry is economically important to several other states. The most popular species that have been proven as desirable for culture in Nigeria are the *Clarias gariepinus*, *Heteroclaris* spp, and *Heterobranchus* spp (Adekoya et al, 2006).

Faturoti (1999); Ajana (2002); Adamu (2007) reported that the trend on the capture fisheries sector of aquaculture has been experiencing a decline in fish production mostly in developing countries. The natural freshwater ability to sustain aquatic animals is on the decrease as a result of the introduction of anthropogenic pollutants, high oxygen demand, waste and thermal pollution. For example, the metabolic activity of catfish doubles for every 10°C increase in temperature for over 0°C to 35°C, which is also known as the Q₁₀. (Huner and Dupree, 2004). Other factors are specific heat of water, density, viscosity, transparency, turbidity, dissolved oxygen, and temperature all of which are important water quality parameters in assessing the efficiency of fish pond and yield without which the profitability will be in doubt.

The release of hot waste water into receiving streams causes ecological imbalance in the aquatic systems which impacts the water quality negatively and leads to low yield in fish production. There has been an increase in the participation of the private sector in fishing activities with the establishment of viable and functional commercial fish farms. Both public and private fish farms in Nigeria have increased year after year as a result of government intervention. The need for proper disposal of pond effluents is paramount in order to ensure environmental preservation and maintenance of the aesthetic values of the environment. The effects of pond effluents are highlighted by Tucker et al. (2002); Boyd (2000) as follows: It produces offensive odour, impacts on aesthetic value of the environment, reduces dissolved oxygen, pollutes water body and introduces diseases.

Today, there are several fish farms in Nigeria ranging from small domestic fish ponds either in plastic and concrete tanks or earthen ponds to mention a few. Omofunmi (2010); Omitoyin (2007) suggested that public-private partnership should be encouraged to assist individual farmers with fish farming inputs such as feed biomass, fingerlings, animal feeds, access to fund but little has been reported about the technical factors which are core to any aquaculture systems.

Omofunmi et al. (2016) reported that catfish effluent affects both physical and chemical properties of the soil; it contains higher concentration of macro and micro nutrients than that of soil at the disposal sites. The quality of soils at the immediate discharge site appears to be favourable in respect of soil enhancement (Omofunmi, et al., 2016). It has impact on soil quality in the immediate environment of the discharge site. Discharge of untreated wastewater pollutes the soil and surface water and this could be heightened during flooding which is still a menace in Lagos State (Omofunmi, et al., 2016). Flooding could cause the impairment of surface water and the escape of fish which is a great loss to the fishery industry. Furthermore, this has

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led to many pond failures and great loss to fish farmers (Omofunmi, 2010). For example, an uncovered pond has wastewater that is highly concentrated with salts and toxic chemicals and odourous compounds as a result of long exposure to sunlight through evaporation.

However, wastewater from standing water contains nutrients such as nitrogen, phosphorus and potassium that might be reused when biologically converted into compost as soil amendment or directly used as irrigation water for farm land. Moreover, discharging waste with high organic load into surface water encourages eutrophication (Boyd, 1990, 2003, 2005; Boyd et-al., 2008). Only a few of the big commercial fish farms have sedimentation devices (Boyd et al., 2008). Boyd (2003); Boyd et-al. (2008) and Boyd and Hulcher (2001) reported that the farmers are often reluctant to invest in treatments to prevent or mitigate effects unless they benefit directly. The goal of environmental management is to minimize, prevent or mitigate adverse environmental effects of human activities on sustainable use of world resources (Boyd, 2003, Tucker et al., 2002).

For environmental management to be effective, possible adverse environmental impacts of human activities must be identified. Standards must be formulated to specify amounts of change in environmental variables that are permissible without causing unacceptable environmental effects. There are conflicts between the farmers and neighbors especially backyard farming apart from offensive odour and impacts on the aesthetic values of the environment (Miller et al., 2006). The potential impact of effluents from catfish farm on water resources is not well studied in Nigeria. There are no literatures on the catfish effluent management system in Nigeria. Therefore, procedures for regulating, controlling and monitoring the environmental impacts of fish farmer are not well established. The lack of site-specific data on the effluent quality of farms and on their impacts on receiving water bodies is a major constraints on the establishment of such regulatory measures and adaptation of appropriate waste management systems. In many developing nations such as Nigeria, regulations and laws are insufficient to provide adequate protection of the environment and natural resources (Omofunmi, et al., 2016).

In instances where the laws and regulations may be adequate they are not enforced because of lack of funds and adequate manpower. The farmers may not want to treat the effluent because it passes downstream, and treatment will be an added expense that does not contribute to farmer's income. The need for management of pond effluents is necessary for environmental preservation and maintenance of aesthetic values of the environment. The negative impact of catfish effluent in the environment has being reported by earlier researchers, establishment of fish ponds within the living premises has being generating conflicts between the farm owners and their neighbors due to offensive odour and impacts on the aesthetic values of the environment (Boyd, 2000, 2003, Tucker, et al., 2002). Hence, this study was to evaluate the catfish rearing industry and its effluent management and make appropriate recommendations to

improve its production with less environmental negative impact in Lagos State and Nigeria as a whole.

2 MATERIALS AND METHOD

2.1 SITE DESCRIPTION

Lagos State is situated in the South Western part of Nigeria. It spans the Guinea Coast of the Atlantic Ocean for over 180km on the South, from the Republic of Benin on the West and shares boundary with Ogun State in the North and East of Nigeria. It falls within longitudes 030 50'E and 030 38'E and latitudes 060 20'N and 060 18'N. It has a total territorial area of 3,577sq km, about 787sq km or twenty-two percent (22%) flood plain and it is 4.6m above the sea level. Other information is as shown in Fig.1



Fig 1: Map of Lagos State showing the study area

2.2 DATA COLLECTION

Information on the location of fish farms in Lagos State of Nigeria was collected from the Fisheries section of the Ministry of Agriculture, Lagos and other research institutions domicile in Lagos. Fifteen fish farms were used as pre-testing and forty fish farms were randomly selected across the State for the study. The rationale for the choice of ponds for study is as follows: The ponds under investigation were located in the three senatorial districts (twenty local Government areas of Lagos State). After several trips to the ponds under study in dry and wet seasons, questionnaire and on-the-spot assessment were administered to fish farmers. The information contained in the questionnaire covers; year of establishment, sources of water, pond water quality monitored, farm operations, and waste management practice adopted.

2.3 DATA ANALYSIS

The data were analyzed using descriptive statistics and analysis of proportion (chi square method) at 0.05 level of significant.

3 RESULTS AND DISCUSSION

The results of sources of water for pond impoundment, water parameters monitored in the fish farms, procedure for discharge of catfish effluent in the study area and catfish effluent treatment in the study area are presented in Tables 1, 2, 3 and 4 respectively.

3.1 SOURCES OF WATER FOR POND IMPOUNDMENT

The sources of water for fish ponds are shown in Table 1. Majority (80 %) of the source of water used in the farms was Shallow well / Bore-hole. This may be attributed to the following:

- (a) Locations of most ponds / tanks were far from rivers, streams and canals.
- (b) To meet water quantity needed for the farm operations
- (c) To avoid introduction of predators, diseases and pollutants into the fish farms
- (d) For easy access and convenience

Table 1: Sources of water for pond / tank impoundment in the fish farms

Sources of water	Rate of occurrence (%)
Stream	05
Well Borehole	80
Groundwater	15

3.2 WATER PARAMETERS MONITORED IN THE FISH FARM

Majority (75 %) of the water quality parameters in terms of the physical and chemical properties that affect fish growth and yield were not monitored (Table 2). This may be attributed to low turnover from their investment in the study area, lack of environmental monitoring, lack of instrument for in-situ and ex-situ water quality indicators and low income among fish farmers. The problems associated with lack of environmental monitoring operations include the dearth of skilled personnel (such as engineer and aqua culturist), lack of instruments to determine the required parameters, avoiding additional cost of production and some of the fish farms were not for commercial purposes and as such, purchasing the instrument may incur additional cost.

Table 2: Frequency of water parameters monitored in the fish farms

Environmental Parameters	Monitoring frequency (%)			
	Daily	Weekly	Fortnight	Monthly
Water	-----			
DO (mg/l)		12.5		
Transparency (cm)		12.5		
No. Monitored		75		

3.3 PROCEDURE FOR DISCHARGE OF CATFISH EFFLUENT IN THE STUDY AREA

Majority (87.5%) of the farmers discharge their effluent into the environment and the remaining was used as irrigation water source (Table 3). There were no significant different ($p \leq 0.05$) among the values of the methods of discharge of catfish effluent. The result shows that farmers have turned storm drains and surface water into receptacle waste drainage canal and stream. The reasons for this are not far-fetched and may be due to; lack of awareness on the potential danger of untreated effluent to the environment and public health. The fish farmers like most industrialists are conservatives; they provide little or no budget for waste management instead they seek convenient means to avoid cost of waste management systems. Drainage canal and stream were the primary sources of effluents discharges in the study area. This is probably due to the following:

1. Some of the ponds were located near the stream for odour management
2. The fish farmers find it easier and convenient to use existing drainage canal for discharges
3. Very few fish farmers practise integrated farming because few of them use catfish effluent as irrigation water source.
4. It does not require any cost

This finding agrees with Boyd (2003); Boyd et al. (2008) and Boyd and Hulcher (2001) who found that the farmers are often reluctant to invest in treatments to prevent or mitigate effects unless they benefit directly.

Table 3: Procedure for Discharge of Catfish Effluent in the Study area

Effluent	Rate of Occurrence (%)
Open pit	12.5
Drainage canal	32.5
Stream	22.5
Re-used on farm	12.5
Bare land	20

3.4 CATFISH EFFLUENT TREATMENT IN THE STUDY AREA

Majority (95 %) of the farmers discharge their effluent untreated (Table 4). It was observed that ponds that were situated very close to surface water (river) discharge their effluent directly into the surface water. This is not surprising because the surface water gives free and easy access to water and also serves as an easy means of waste water disposal. Above 80% of the respondents responded negatively to treatment facilities while less than 20% agreed to the need for treatment facilities; while very few have started with simple treatments such as sedimentation and simple filtration. The fish farmers were not treating their effluents before discharging into the environment in the study area. This may due to the following reasons:

1. To avoid additional cost of production
2. Lack of facility to treat the effluents
3. Some fish farmers were not aware of the negative effects of pond effluents to the environment
4. The fish farmers assumed that the effluents discharged into environment were very small especially for small scales (subsistence) farming and that the effects are minimal.

This findings support earlier researchers such as Boyd, (2003); Boyd et al. (2008) and Boyd and Hulcher (2001) that the farmers are often reluctant to invest in treatments of their effluent so as to prevent them incurring additional cost of production

The analytical studies revealed that wastewater from fish ponds contained nutrients that can be used for irrigation with treatments such as aeration, sedimentation, to remove odour and suspended solid materials respectively. Furthermore, the questionnaire also showed that technical issues like pond development were still on trial by error method, handled with crude implement and unskilled workers

Table 4: Catfish Effluent Treatment in the Study area

Effluent treatment	Rate of occurrence (%)
Sedimentation	2.5
Filtration	2.5
No Pre-treatment	95

4 CONCLUSIONS AND RECOMMENDATION

This study established a data base on catfish effluents management. Results from this study indicated that

- Borehole was used as source of water
- Only dissolved oxygen and turbidity were monitored and this was done by a few fish farmers
- Majority (95%) of the effluents were discharged untreated through the land disposal and dilution technique.
- There were no significant differences ($p \leq 0.05$) among the values of the methods of discharge of catfish effluent.
- There is little or no awareness of the potential danger of discharging untreated waste water on to the soil and into surface water as currently experienced in Nigeria fish production Industry.
- The cost of making evaluations of activities to determine possible ecological impacts should be the responsibility of the farmers, but governments should provide guidelines describing how an acceptable evaluation is to be conducted, and they should approve the evaluation.
- The farmers should bear the costs of installing management techniques for preventing or mitigating adverse environmental effects, but again, the government should be responsible for approving the mitigating or treatment plan.
- The cost of monitoring on-site environmental variables should be the responsibility of the farmers, but the government should verify the validity of the monitoring effort and determine if compliance with standards is occurring.
- Charges and fines should be introduced to the farmers by waste regulatory agencies for waste water collection, transportation, storage, treatment and ultimate disposal including penalty for defaulters.
- The impact of catfish effluent on environment (soil, water, stream, and river) should be investigated.

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