Analysis of the heavy metals content of the surface water of Ojo L.G.A., Lagos, Nigeria for cage aquaculture in secondary schools

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The unemployment malaise in Nigeria has reached a frightening level, the Federal Government of Nigeria in its effort to reduce this social ill, introduced trade curriculum in 34 skill areas including aquaculture. Good quality water that is, without pollutants is a vital factor and it is given utmost attention in aquaculture schemes. This study therefore investigated the heavy metals content of the surface water in Ojo for their suitability for cage aquaculture. The heavy metals investigated were Zn, Cu, Fe, Hg, Pb, Cr. The research area Ojo was mapped out into five stations. From each of the stations water samples were randomly collected from ten (10) sampling sites, bulked and a composite drawn for analysis. The analytical methods adopted were APHA 3111B (20th edition) APHA 311D (5th edition) and APHA 303C (15th edition). The determination of the metals was done with ATI Unicam High performance liquid Chromatography fitted with ultra-violet florescent detector. The results obtained were, Zn 0.560±0.135, Fe, 0.106±0.087, Hg, 0.000±0.000, Pb, 0.000±0.000, and Cr, 0.000±0.007. These show no significant difference. This reveals that the heavy metals content of Ojo surface water is still within WHO acceptance level. It is therefore recommended that schools located in Ojo area of Lagos should embark on aquaculture using cage method for the inculcation of fishery skills.

Keywords: Water, heavy metals, cage, aquaculture

INTRODUCTION

Fish is an important source of good quality protein required in human diet. Njoku (2000) documented that fish was the highest level of easily metabolizable high quality protein, fat, vitamins and essential amino acids. Foods and Agriculture Organization (2007) reported that fish contributes more than 60% of the world supply of protein.

According to Osagie (2012) and Odalu (2010), Ojikutu and Onuife (2013), Nigeria is a maritime country with a coast line measuring 853 kilometers, fish production as an enterprise possess the capacity to contribute significantly to the growth in agricultural sector. In the views of Ibironke (1999) Nigeria is blessed with inland water mass covering about 12.5 million hectares together with about 20 million hectares of swamps, lagoons and estuaries with varying species of fish. This was corroborated by Abraham (2012). That Nigeria is endowed with 800km coast line, extensive brackish water, lagoons, creeks, rivers and lakes, yet the fish supply in Nigeria is still far below the demand. This is in consonance with the ideas of Giserun (2006) who stated that fish is important as food and source of income to many people in developing countries, its supply in Nigeria in about 750,000metrictonnes as against the demand of 1.5 million metrictonnes. Odum (2005) Ojugo (2010).

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Ojindu (2012) revealed that fish is reputed to be the cheapest source of quality protein for healthy populace, however, in Nigeria, the trend in the past years has shown that fish is fast getting out of rich of people and the daily requirement of 60g per day per person as recommended by World Health Organization may not be realizable.

Obadoni and Odogwu (2013), Dada (2005) reported that the total fish demand in Nigeria is about 1.5 millionmetric tonnes while the current domestic production is 511,700 metric tonnes. The implication of this is that the sharp full between demand and supply is made up with importation.

According to Oota (2012) Nigeria spends ₦100 billion in fish importation annually. This is in tandem with the opinion of Azaka (2013) that Nigeria fish demand stands at 2.66 million metric tonnes, per annum her domestic production is barely 750,000 metric tonnes, the gaps between demand and supply is bridged with importation which runs into several billions of dollars and in the process jobs are exported to the foreign countries. United states Agency for International Development (2010) posited that with the importation of over 750,000 MT of fish by Nigeria, over 600,000 million USD is spent in foreign exchange and thousands of jobs are exported.

The Federal Office of Statistics Abuja (2015) revealed that 24% of Nigeria Youths are unemployed, while Ajago (2013) reported that over 40 million Nigerian youths have no jobs. According to Ochu (2012) human capital development and agriculture have been identified as veritable tools for the attainment of food security, employment generation, wealth creation and rural transformation. Aworanti (2010) stressed that the only way Nigeria can solve the problem of unemployment is by inculcation of creative and entrepreneurial skills in youths for empowerment, sustainable growth and food security. Akinrotimi (2009); Aba (2010); Ibereme and Okpara (2010), advised that teeming unemployment youths could be empowered through the training in employable and entrepreneurial skills such as aquaculture or fish farming. The government of the Federal Republic of Nigeria in response to the “Mantra” of unemployment introduced the trade curriculum in 34 skill areas including fishery in senior secondary schools.

The Philosophy of the trade curriculum as enunciated by Nigeria Education and Research Development Centre (2013) is that at the completion of the 3 years of the senior secondary education, every graduate recipient should have been well prepared for higher education as well as acquired relevant functional trade, entrepreneurship skills needed, for empowerment, for job creation, wealth generation and poverty eradication.

Ajanaku 2012) Ode (2012), Osakwe (2010) suggested that schools situated in wetlands could utilize such water sources, in cage or panaquaculture rather than excavating for earth pond or casting and erecting concrete ponds, especially in areas were land is difficult to access. Obigwe (2013) warned that the quality of water for pen or cage aquaculture should be ascertained for presence of possible pollutants such as heavy metals, polychlorinated biphenyls (PCBs) pesticides persistent organic pollutants (POPs) anions total hydrocarbon content (THC) etc.

Ojo in Badagry division lies between latitude 6°27’0” and 3°13’20” E. It is predominantly wetland with good network of streams and river lets. Thus, has a good potential for fishery and aquaculture. Ojo is highly populated and also the industrial and commercial nerve centre of the division. With high population density and increased proliferation of cottage and mega industries, the surface water of in Ojo stand threatened by effluent discharges, domestic and municipal wastes which may result in bioaccumulation and biomagnification in the fish cultured in such medium.

Ted and Jones (2012) defined bioaccumulation as the accumulation of substances in biological tissues and organisms at all level are susceptible to bioaccumulation. Biomagnification as espoused by United State Environmental Protection Agency (2010) is the increasing concentration of a substance from one trophic level to the next.

Pollution of surface water resulting from effluent discharges from industries and poorly managed domestic and municipal wastes culminating in bioaccumulation and biomagnifications in aquatic bio have been reported in several studies. (Atiakuru, 1997; Balearie, 2004; Biney, 1991; Ogwu, 2012; Ogwu, 2013; Adeyemo, Fernando, 2010; Spiff, 2004; Muwange and Bantenio, 2006; Oguzie, 2009).

A cage aquaculture is the practice of culturing fish in a natural body of water (Olaitan 2000) while Otubin (2012) defined cage aquaculture as the rearing of fish in a cage anchored or suspended in natural surface water. This paper investigates the concentration of heavy metals in the surface water in Ojo area of Lagos for their suitability for cage aquaculture in the secondary schools located in the areas.

**MATERIALS AND METHOD**

The main purpose of this study is to determine and qualify the heavy metals content in the surface water in Ojo for cage aquaculture in the study areas. To achieve the purpose, the study sought to answer the following research questions

1. What is the concentration of heavy metals (Zn, Cu, Fe, Pb, Hg) in the surface water in Ojo L.G.A, Lagos State?

2. To what extent are the concentration of the identified heavy metals tolerable to school aquaculture programmes using WHO standards?
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Table 1. Heavy metal content of Ojo in mg/l

<table>
<thead>
<tr>
<th>N/S</th>
<th>Parameter</th>
<th>Samples Analysis Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>Zn</td>
<td>0.02</td>
</tr>
<tr>
<td>2</td>
<td>Cu</td>
<td>0.07</td>
</tr>
<tr>
<td>3</td>
<td>Fe</td>
<td>0.18</td>
</tr>
<tr>
<td>6</td>
<td>Cr</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note: Mercury (Hg) and Lead (Pb) were not detected in all the stations investigated.

3. What is the implication of the heavy metals concentrations for cage aquaculture in secondary schools in Ojo L.G.A. of Lagos State?

The research design adopted was ex-post facto. The research area Ojo was delineated into (5) five research cells and these were Alaba International market cell, Sabo cell, Jakande Estate, Abule-Aka and Kembiri cells. The heavy metals investigated were zinc (Zn), Cupper (Cu), Iron (Fe), Mercury (Hg), Lead (Pb) and Chromium (Cr). From each of the five sampling cells, water samples were randomly collected with the aid of plastic sampling bottles with graduated strings, at the depth of 10cm. The samples were bulked, a composite drawn and fixed with HNO₃. They were preserved in ice cool boxes with which they were taken to the laboratory for analysis. The map of the study area is shown in Figure 1 above.

Analysis of Samples

The heavy metals content of the water samples were determined with ATIUnicam Atomic Absorption Spectrophotometry (AAS) Model 939 Zn, Cu, Fe,Pb, Cr : APHA 3111B (20th edition) Hg : APHA3112D (15th edition)

RESULTS

Sample Analysis results are presented in table 1.

The result of the laboratory analysis were subjected to statistical analysis with mean, variance and standard deviation and the results are as presented in Table 2

DISCUSSION

The heavy metals investigated and the results show that the mean concentration of zinc in the surface water in Ojo is 0.560mg/l MPC for zinc is 5.0mg/l WHO,
thus zinc concentration is below the Maximum Permissible Concentration. The mean concentration of copper in the area investigated was 0.092mg/l while the WHO/MPC is 1.0mg/l. The mean result of the iron concentration in Ojo surface water is 0.016mg/l, is also below the WHO/MPC of 0.3mg/l. The determination of lead revealed a concentration of 0.000, which show that, the lead content is below the detectable level of instrument deployed in the analysis, the WHO/MPC for lead is 0.05mg/l. Also the mercury determination gave a mean concentration of 0.000mg/l while the WHO/MPC for mercury 0.02mg/l. This is equally with a tolerable level. The results were further subjected to test of significance with F-distribution and t-test at df 5 and 0.05 level of significance. The F-calculated value was 877.34 and table value was 5.050. The t-test calculated value was 0.341 and t-table value was 2.571.

The mean results of all variables determined and the analysis of variance (ANOVA) showed that the concentration of the heavy metals is within the level recommended for aquaculture projects. This results is in agreement with (Bolanle, 2004; Ashaye 2001; Kofoworola 2007; Adeyemi 2011; Atuma 2006) who recorded low concentration of heavy metals in the surface water of various area studied.

The concentrations of the heavy metals investigated clearly revealed that aquaculture activities employing cage pen or happa can be implemented in Ojo area without bioaccumulation of heavy metals. POPs and PCBs. Schools in Ojo area in Lagos state can effectively implement the Nigeria new senior secondary school trade and entrepreneurship curriculum in fishery by deploying cage, pen, raceway or happa methods of aquaculture. This will reduce the cost implication of aquaculture associated with earth and concrete ponds which had hitherto made aquaculture a capital intensive enterprise.

### CONCLUSION

The unemployment situation in Lagos has reached a breaking point with graduates churned out every year without job placement options. This situation has bred a lot of social vices that have plagued this state such as youth restiveness, kidnappings and armed robbery. The only panacea is creation of employment to engage the idle hands through acquisition of vocational skills in agriculture and other skill areas. Fishery is a skill area where a new entrant could venture with little capital especially in cage or pen aquaculture. This study is thus imperative for the success of cage aquaculture for empowering the senior secondary graduates for sustainable development, food security and wealth creation in Lagos state.

The determination of the quality of water utilized in aquaculture is of utmost importance to avoid the death of fingerlings and also to rule out cases of bioaccumulation and biomagnification. The results of the analysis revealed that the concentrations of the investigated heavy metals are within the levels recommended by World Health Organization. It is therefore recommended that schools within Ojo area should embark on cage aquaculture utilizing the surface water within their area to inculcate in the students the skills of fishery. Also individuals living in Ojo area who are unemployed and who may not have initial start off capital for other aquaculture programmes such as earth pond or tarpaulin are enjoined to go into aquaculture through cage aquaculture.

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