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ORGANOCHLORINE PESTICIDES QUANTIFICATION OF BALAGBE WETLANDS UGHELLI DELTA FOR CAGE AQUACULTURE IN SECONDARY SCHOOLS AS A CATALYST FOR ECONOMIC GROWTH IN NIGERIA

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ABSTRACT

The aspiration of any country is to have a productive population to achieve economic growth. Nigeria's economic growth has been diminished by youths' unemployment and agriculture has been tipped as a veritable tool for solving youths' unemployment problems, especially youths in fish farming deploying cage aquaculture. Good quality water is imperative in aquaculture and this underpins this study. This study was ex-post facto research that answered three (3) research questions and tested a hypothesis and the focus was the determination of the organochlorine pesticide content of Balagbe wetland for cage aquaculture in secondary schools for economic growth. To achieve this, the Balagbe wetland was mapped out into 5 research sites A, B, C, D, and E. Samples were collected from each sampling site, bulked, a composite drawn, and fixed with HNO3, and stored in ice-cooled boxes for analysis. The analytical standards adopted were APHA, EPA 3570 and Steindwandter and Shufler 1978. The analytical instrument employed was Agilent 6100 series quadrupole LC/MC. The mean results obtained from the parameters investigated were: admin 0.68±0.28µg/l, endrin 0.62±0.22µg/l, DDT 1.63±0.19µg/l, heptachlor 1.09±0.52µg/l and beta lindane 1.21±0.40µg/l. The results were further subjected to a test of significance with ANOVA with numerator 4 and denominator 20 at a 0.05 level of significance. The F ratio calculated is 5.32 and F ratio critical value is 3.46. This reveals that Ho is rejected and Ha is accepted. Thus revealing that the Balagbe wetland is polluted by organochlorine pesticides. The study recommends that cage aquaculture should not be deployed in river Balagbe wetland until remediation is carried out as doing so in its present state will be counter-productive in achieving national growth.

Keywords: organochlorine pesticides cage aquaculture, national growth.

1.0 INTRODUCTION

Economic growth is the dream of every nation with different nations having varying economic growth rates. Economic growth according to Samson (2016) is the increase in the real output of the country in a particular span of time while economic development is the increase in the level of production in an economy along with the enrichment of living standards and advancement in technology. Markson (2012) sees economic growth as an increase in the capacity of an economy to produce goods and services compared from one

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period of time to another and it is measured in normal or real terms, the latter of which is adjusted for inflation. Stallman (2016) surmised economic growth as the increase in goods and services produced by an economy over a specific period of time, while Johnson (2019) opined that economic growth is an increase in the number of goods and services produced per head of the population over a period of time. In the views of Betrand (2019) economic growth is the increasing inflation-adjusted market value of goods and services produced by an economy over time and it is conventionally measured by the type and rate of increase in the real Gross Domestic Product. It is the outward shift in the production possibility curve of a country and it is measured by the increase in a country's total output or real gross domestic product (GDP) or gross national product (GNP) (Zudell, 2015). Thompson (2018) revealed that economic growth is the measure of goods and services produced by an economy considered for a specific period of time, and it is an index of measurement of all aspects of the economy which include the income of people of a country, their level of education, access to good quality housing, food, health, transportation and so on. Motelo (2017) declared that for a nation to experience increased economic growth, the citizens must be gainfully employed and productive. This assertion was corroborated by Amage (2016), Odia (2018) stated that economic growth can only take place in a country where youths and adults are gainfully employed. Nigeria's economy cannot witness a growth trajectory with the present rate of youth unemployment (Akinsola, 2015).

According to the Nigeria Bureau of Statistics (NBS) (2021), 33.3 percent youth population in Nigeria are unemployed. International Labour Organisation (ILO) (2021) puts the rate of youth unemployment in Nigeria in 2020 at 35 percent while Plecher (2020) reported 32 percent youth unemployment in Nigeria. United Nations Educational Scientific and Cultural Organisation (UNESCO) (2019), Akeukereke (2010), and Ikeoji (2015) contend that technical and vocational training (TVET) is the master key that can promote youths empowerment, engender peace, achieve economic growth and improvement in quality of life. This position was also adopted by Odezugo (2015), Zulum (2016), and Adetiba (2018) that the youth unemployment problem can be solved in Nigeria through educating youths in technical and vocational training.

The federal government of Nigeria in an effort at scaling down youth unemployment introduced a trade curriculum in senior secondary schools in 2011. The main objective of the trade curriculum according to the Nigeria Education Research and Curriculum Development Council (NERDC) (2011) is to ensure that every secondary school graduate acquires technical skills for self-employment, wealth creation, and national growth. Thirty-four (34) trade subjects were captured by the curriculum and these include photography, block making, GSM repairs, animal husbandry, fish farming (aquaculture), and so on. Jako (2016) and Adio (2012), advised that youths should be engaged in agriculture so as to reduce the rate of youth unemployment. In Nigeria Fajuyi and Aminu (2016), and Ariyo (2018) recommended youth's involvement in agriculture through aquaculture, while Bello (2020), and Italim (2021) advocated youths aquaculture through cage aquaculture because of its low capital outlay. Cage aquaculture is a production technique where fish are raised in a floating cage held in place with an anchor (Korsen, 2019). It involves the growing of fish in existing water sources in a net cage (Tennyson, 2017). Bamgboye (2018), and Ogwu (2020) revealed that cage aquaculture deployment is plagued by problems of water pollution. Alani (2018), and Anyakora (2020) highlighted water pollutants to include persistent organic pollutants (POPs),

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volatile organic compounds (VOCs), polychlorinated biphenyl (PCBs), petroleum tar, heavy metals, microplastics, furans, pesticides e.g. organochlorine, organophosphate and carbamate. Organochlorine pesticides according to the International Union of Pure and Applied Chemistry (IUPAC) (2015) are compounds containing carbon and chlorine atoms that are used in the formulation of pesticides. Howard (2019), and Okuchukwu (2018) posit that organochlorines are deleterious to human health and cause health disorders such as endometriosis, cancer, infertility in both males and females,s and so on. Odafe (2019), and Mohammed (2018) advised that water analysis should be carried out in natural water to be utilized for cage aquaculture to avoid bioaccumulation and biomagnification of pollutants. Donald (2019) defined bioaccumulation as the presence of toxicants in the tissue of organisms while biomagnification is the multiplication of the toxicant in the tissue of the organism from one trophic level to the next; United States Environmental Protection Agency (USEPA) (2015) explained bioaccumulation and accumulation as the accumulation of a substance in biological tissues of organisms with increasing concentrations at varying trophic levels.

Adelugbe (2018) attests that fish is an important source of good protein, carbohydrates, and vitamins in the human diet. Akintuoku (2018) stated that fish is highly relished among people of all classes and ages in that fish is more digestible when compared to beef, mutton, chicken, and bush meat. Onah (2017) opined that fish is the only source through which the rural population can achieve their daily protein intake of 46g for sedentary women and 56g for sedentary men as recommended by the World Health Organisation. According to World Fish Center (2005), fish and fishery have been recognized as a key instrument for increasing productivity, ensuring food security, improving market access for rural poor, and strengthening Africa's performance in the global market.

Nigeria's domestic fish requirement is 2.7 million metric tonnes per annum but it produces only 750,000 metric tonnes (Audu, 2016, Adesina, 2014). United States Agency for International Development (USAID) (2018) revealed that Nigeria spends 624 million USD on fish importation. Adesina (2014) puts the amount of money expended on fish importation at 100 billion Naira annually. When Nigeria spends so much of her foreign exchange on fish importation she exports employment and imports unemployment (Audu, 2016; Oteriba, 2018; Ruwani, 2018).

A wetland according to Ogwu (2021) is an ecosystem that harbors water for three to six months in a year. The focus of this study, therefore, is the determination of organochlorine pesticide content of Balagbe wetland, Ughelli Delta State for Cage aquaculture in schools for youths empowerment as a catalyst for national growth. The organochlorine pesticides investigated in Balagbe wetland are: edrin, adrin, dichlorodiphenyltrichloroethane (DDT), heptachlor, and beta lindane.

The study was guided by the following research questions:

1. What are the concentrations of adrin, edrin, DDT, heptachlor, and beta lindane in Balagbe wetland ?
2. Are the concentrations of adrin, edrin, DDT, heptachlor, and beta lindane within the maximum allowable concentration for organochlorines in water as recommended by World Health Organization (2014)

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3. Can cage aquaculture be deployed by schools and youths in Ughelli for skill acquisition? The study was guided by a hypothesis

2.0 STUDY AREA

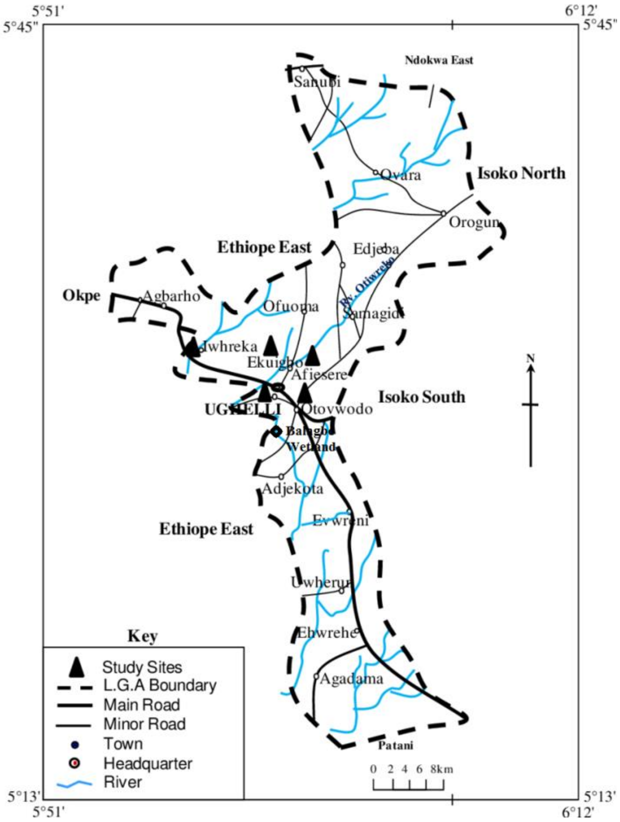

Fig. 1: Map of Ughelli

Ughelli is a suburban town in Delta State, Nigeria. It lies within longitude 9°4'N and longitude 8°43'E. Ughelli has a population of 321,028(National Population Census, (NPC) 2006) and It is made up of a mixed population of agrarians, artisans, Petty traders, and civil servants. The farmers utilize chemical weed and insect pests control in their farms and this is evident in the visibility of the Backpack sprayer that is ubiquitous among farmers in Ughelli. Balagbe wetland is the recipient of effluent discharges from farming activities; these include fertilizers, insecticides, herbicides through runoffs, erosion, and flash floods.

3.0 MATERIALS AND METHODS

Balagbe wetland was mapped out into research sites ABCDE according to Abdulfatai, (2015). From each of the research sites water samples were collected with clean plastic sampling bottles tied to a graduated string from five sampling spots, at 10 cm depth and covered the subsurface. The samples from each site were bulked and composite drawn, fixed with nitric acid (HNO3) and stored in ice-cooled boxes for analysis. The analytical standards adopted were American Public Health Association (APHA), United States Environmental Protection Agency (USEPA) 3570, and Steindwandter and Shuffler 1978. The determination

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of the organochlorine pesticide content of Balagbe wetland was done deploying Agilent 6100 series quadrupole liquid chromatography and mass spectroscopy LC/MS).

4.0 RESULTS

The results of the organochlorine pesticides investigated and WHO maximum allowable concentration are as in Table 1.

Table 1 Organochlorine pesticides in Balagbe wetland and WHO maximum allowable concentration in µg/l.

Parameters	Sampling Locations					$\overline{x}$	SD	WHO maximum allowable concentration
	A	B	C	D	E			
Adrin	0.24	0.97	0.88	0.72	0.61	0.68	0.28	0.30 µg
Endrin	0.99	0.69	0.43	0.51	0.62	0.65	0.22	0.002 µg
DDT	1.92	1.67	1.42	1.51	1.61	1.63	0.19	1.10 µg
Heptachlor	2.02	0.97	0.88	0.78	0.81	1.09	0.52	0.10 µg
Beta lindane (βHCH)	0.98	1.00	1.21	1.91	0.97	1.21	0.40	0.005 µg

Organochlorine pesticides in Balagbe wetland were presented graphically as in Figure 2.

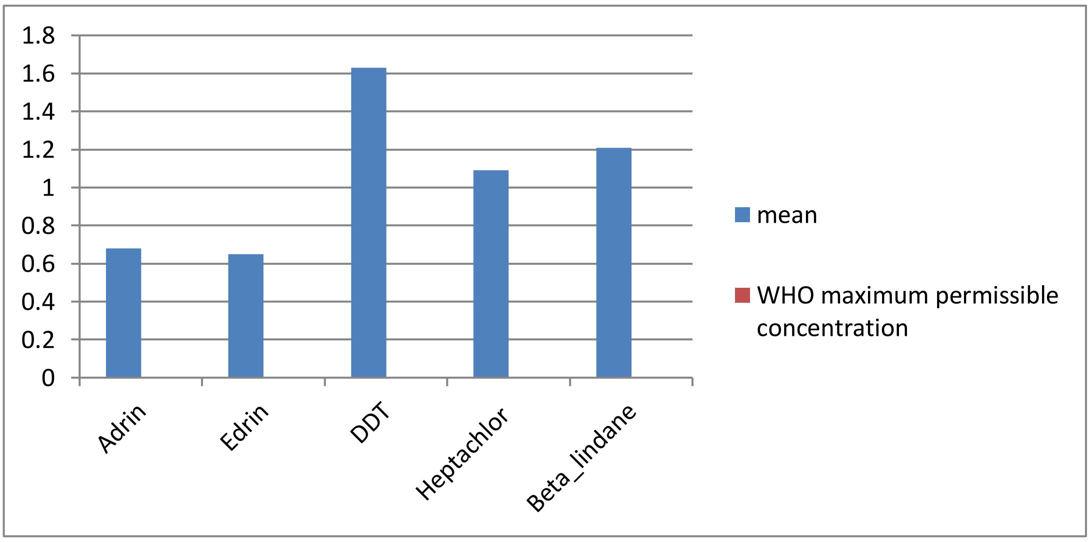

Figure 2: organochlorine pesticides content of Balagbe wetland

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The concentration of the organochlorine pesticides in Balagbe wetland in order of decreasing concentration is as follows; beta lindane > heptachlor > DDT > adrin > edrin

The results of the organochlorine pesticide content in Balagbe wetland were further subjected to a test of significance with analysis of variance (ANOVA) with numerator 4 and denominator 20 at a 0.05 level of significance. The F ratio calculated value is 5.32 while the F ratio critical value is 3.46. This means that Ho is rejected and Ha is accepted, which reveals that there is a significant difference in the concentration of organochlorine pesticides content in Balagbe wetland and the WHO maximum allowable concentration for organochlorine pesticides investigated in water.

5.0 DISCUSSION

The analysis of Balagbe wetland revealed varying concentrations of organochlorine pesticides investigated. The mean concentration of adrin is 0.68 ±0.28µg/l. WHO maximum allowable concentration for adrin in water is 0.30 µg/l. The concentration of adrin in Balagbe wetland is higher than the maximum allowable limit recommended by WHO (2014). High concentration of adrin in water has been reported by Alani (2018) and Anyakora (2020) in Lagos lagoon Bonny Camp and Olomoge lagoon Badagry, Lagos respectively. The mean concentration of endrin in Balagbe wetland is 0.62±0.22µg/l. The WHO maximum allowable concentration for edrin in water is 0.002µg/l. The endrin concentration in Balagbe wetland is higher than the acceptable limit. This report is similar to Akomolafe (2015) who reported high endrin in Ogun River Ogun State and Okeke (2014) who also reported high endrin concentration in Njaaba River in Imo State. The analysis of Balagbe wetland revealed that the mean concentration of DDT in Balagbe wetland is 1.63±1.19µg/l. The WHO maximum allowable concentration for DDT in water is 1.1µg/l. The DDT concentration in Balagbe wetland is higher than WHO limit for DDT in water. High concentration of DDT in water has been reported by Okonkwo and Obi (2015) in Nware River in Imo State and Babatunde (2016) who reported high DDT in Ofiki River Oyo State. The mean concentration of heptachlor in Balagbe wetland the investigation revealed is 1.09±0.52µg/l. WHO maximum allowable concentration for heptachlor in water is 0.10µg/l. The concentration of heptachlor in Balagbe wetland is higher than the limit recommended by WHO for heptachlor. This report is similar to the reports of Obajimi (2018) who reported high concentration of heptachlor in River Ureje in Ekiti state and Bamidele and Atanda (2018) who recorded high heptachlor in Ogbese River in Ogun state. The mean concentration of beta lindane in Balagbe wetland is 1.21±0.40µg/l. Beta lindane concentration in Balagbe wetland is higher than WHO recommended limit for beta lindane in water which is 0.005 µg/l. This result is at variance with the report of Ozah and Osakwe (2017) who reported low beta lindane in Ase Creek but similar to Osadolor (2014) who recorded high beta lindane in Ikpoba River.

6.0 CONCLUSION

Every nation’s inclination is to achieve economic growth and the economic growth rate of a country is predicated on its productive population. Nigerian youths unemployment problem has become seemingly intractable. So many models have however been recommended but agriculture remains most highly rated especially youths aquaculture through less capital-intensive cage aquaculture method. The global issue of marine pollution has made cage culture not readily deployable unless water analysis is embarked upon. The pollution status of

Balagbe wetland is not different from the global phenomenon thus making cage aquaculture not to be implemented in Balagbe wetland unless remediation is carried out. This is because carrying out cage aquaculture enterprise in a polluted water will lead to health complications in the consumers and that will be antithesis towards achieving national growth it was set to achieve.

7.0 RECOMMENDATIONS

Consequent upon the results of the investigation of organochlorine pesticides status of Balagbe wetland, the study recommends that:

1. Cage aquaculture should not be deployed in Balagbe wetland at present pollution status.
2. Pollution source should be identified and discontinued.
3. Remediation of Balagbe wetland should be carried out to return the wetland to its erstwhile pristine health status so as to allow for the deployment of cage aquaculture by youths and schools for national growth in Nigeria.

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