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ORGANOCHLORINE PESTICIDES CHARACTERIZATION OF OWESE WETLANDS UTAGBA-OGBE FOR CAGE AQUACULTURE IN SCHOOLS: A TOOL FOR SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

The aspiration of the United Nations in global goals 1 and 2 is to achieve no poverty and zero hunger globally by 2030. The Siamese of poverty and hunger eradication can only be achieved when unemployment is at the barest minimum. Agriculture has been singled out as a vehicle for youth's empowerment, poverty and hunger eradication especially youths engagement in aquaculture deploying cage culture. Good quality water is a factor in aquaculture and this underscores this study. The focus of this study therefore is the determination of the organochlorine pesticides content of Owesse wetlands for cage culture in schools. The design of this study is ex-post facto, the study answered three research questions and tested a hypothesis Owesse wetland was divided into research sites and from each of the research sites, water was sampled with clean plastic sampling bottle tied to a graduated string from 5 spots at 10 cm depth and covered subsurface. The samples from each sites were bulked, composite drawn, fixed with HNO_3 stored in ice cooled boxes for analysis. The analytical standards adopted were APHA, USEPA 3570 and Steindwandter and Shuffler 1978. The analytical equipment deployed for pesticides determination is Agilent 6100 series single quadrupole LC/MS. The mean results obtained from the parameters investigated where DDT 0.77± 0.28µg/l, adrin 2.55±0.32 µg/l, diedrin 1.88±0.l4 µg/l, endrin 1.88±0.38µg/l, and heptachlor 2.61±0.08µg/l. The results of the organochlorine pesticides investigated were further subjected to test of significance with ANOVA with numerator 4 and denominator 20 at 0.05 level of significance. The F ratio calculated is 3.80 while the F-ratio critical is 2.86. This reveals that Ho is rejected which means that the concentration of the organochlorine pesticides investigated were higher than the maximum allowable concentrations for pesticides in water. The study recommends that cage culture should not be deployed in Owesse wetland until decontamination is carried out; it equally recommends that sources of pollution be identified and plugged so as to allow cage culture deployment by the schools for the achievement of SDG goals 1 and 2 in Nigeria.

KEYWORDS: *Agriculture, Sustainable Development*

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INTRODUCTION

Global goals also known as sustainable development goals were adopted by all United Nation states in 2015 as a clarion call for action to end poverty, eradicate hunger, protect the planet and ensure that all people in all places enjoy peace and prosperity by 2030. It is the foundation for today's global framework for international cooperation - the 2013 agenda for

sustainable Development goals (SDGs) (International institute for sustainable development (IISD), 2016). According to Hammand (2016) sustainable development is the organising principles for meeting human development goals while simultaneously sustaining the ability of the natural system to provide the natural resources and ecosystem base upon which the future economy and society will thrive. Russell (2016) described sustainable development as the development that meets the needs of the present without compromising the ability of the future generation to meet their own needs; it is our common future. For Johnson (2015), sustainable development is the organising principle for meeting human Development goals while simultaneously sustaining the ability of the natural system to provide resources and ecosystems services upon which the society depends. Parkinson (2016) reiterated this assertion, that sustainable development is a United Nations programme whose defined mandate is a state of the society where living conditions and resources are used to continue to meet human needs without undermining the integrity and stability of the natural system. It is the development that satisfies the needs of the present without compromising the capacity of the system for future generation needs. It is the balance between economic growth and care for the environment and its social well-being (Derg 2017; Swang 2016; Dusk 2017). According to the United Nations Development Program (UNDP) (2016) sustainable development is a universal call to end poverty, eradicate hunger, protect the planet and ensure people live in peace.

Lafuu (2018), Dankwa (2017), Obongo (2017) in critique of sustainable Development goals opined that sustainable goals are laudable but can only be achieved when both adults and youths of a country are gainfully employed. Rayeju (2015) revealed that the extreme poor degrade the environment by harvesting both mature and immature game, poach ponds with pesticides killing immature and table size fishes, harvesting both ripe and unripe fruits in the wild and practicing unsustainable agriculture. Succinctly put by Amage (2018), Ioyen (2017) Audu (2018), sustainable development may be unachievable in Nigeria at the present rate of youth's unemployment. According to National Bureau of Statistics (NBS) (2020) 23.2 percent of Nigerian youths are unemployed. The International Labour Organisation (ILO) (2019) puts the rate of Nigeria youths without employment at 22.1 percent while Ruwani (2020) revealed that 23.2 percent of Nigeria youths are unemployed.

Okowa (2019), Ogujimi (2018) advised that youth's unemployment can be solved in Nigeria if the youths are engaged in agriculture. This position was equally canvassed by Ojinika (2019), Nwabuoku (2017), Adewale (2019) that Nigerian youth should be enjoined to go into agriculture entrepreneur to reduce the rate of youth's unemployment, while Ogwu (2016), Adepoju (2017), Okowa (2019) admonished the youths to venture into aquaculture agripreneur. Nigeria youths should get involved in aquaculture through cage aquaculture deployment because it is less capital-intensive (Afolabi 2018; Maduka and Okorie 2018). Cage aquaculture involves the growing of fishes in existing water resources while being enclosed in a cage net (Kuz and Cares, 2018).A wetland is an ecosystem that harbours water for at least six months in a year (Joady, 2014).

Afolayan (2016) advised that water analysis should be carried out before cage aquaculture culture deployment for presence of pollutants to avoid bioaccumulation and biomagnification. Water pollutants have been highlighted by Alani (2011), Clark (2015), Anyakora and Coker (2012) to include polychlorinated biphenyls (PCBs), petroleum tar, polyaromatic hydrocarbons (PAHs), heavy metals, dioxins, micro plastics and pesticides such as organophosphate, carbamate and organochlorine so on.

Bioaccumulation refers to how pollutants enter a food chain while biomagnification or bioamplification is the tendency of the pollutants to multiply as they move from one trophic level to the next (Tedd and Jones 2017).

Organochlorines according to the United States Environmental Protection Agency (USEPA) (2012) are compounds containing carbon and chlorine atoms that are utilised in pesticides formulation. Human exposure to organochlorines have been associated with health disorders such as cancer, reproductive problems in both male and female, infertility, endometriosis and so on (Kudis 2013, Liz 2016). Fish is an important component of human dietary requirements. It provides protein, vitamin, minerals and carbohydrates (Ofulue 2012 Adebayo and Suleiman 2014). According to Zaidu (2016) fish is the only means the rural population can meet their daily protein requirements. World Fish Center (2005) revealed that fish has been recognised as a key instrument for increasing productivity, ensuring food security, improving market access for rural poor and strengthening African performance in the global market. According to Audu (2015) Nigeria annual fish requirement is 2.7 million tonnes while the domestic production is 750,000 metric tonnes. Adesina (2014) puts Nigeria annual fish demand at 2.7 million metric tonnes while domestic production is 79,000 metric tonnes. The gap between demand and production has to be bridged through importation. United States Agency for International Development (2016) revealed that Nigeria spends 625 million US Dollar in fish importation while Adesina (2014) stated that Nigeria spends over 100 billion on importing fish. The importation of fish means that the country imports unemployment and export employment (Ruwani, 2018, Audu, 2015). It is against this backdrop that this study became germane.

The purpose of this study is the investigation of the organochlorine pesticides content of Owesse wetlands for its suitability for cage aquaculture in secondary schools for the achievement of the sustainable Development goals 1 and 2 which are zero poverty eradication and hunger eradication in Nigeria by 2030.

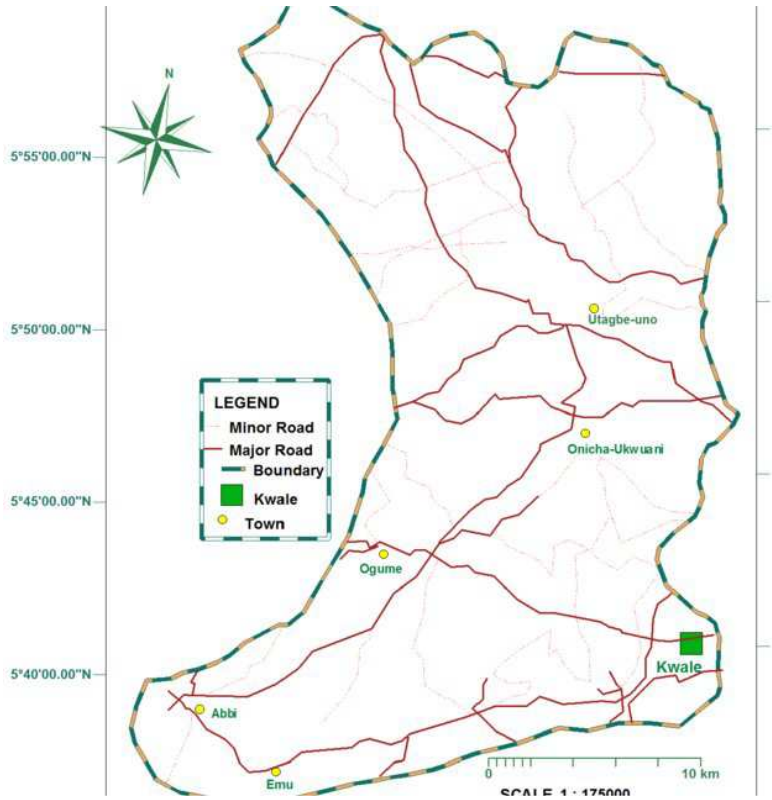
This study was guided by research questions:

- What are the concentrations of DDT, adrin, diedrin, endrin and heptachlor in Owese wetlands?
- Are the concentrations of these organochlorine pesticides within the maximum allowable concentrations for organochlorine pesticides in water?
- Can cage aquaculture be deployed in Owesse wetlands by schools and youths in Utagba-Ogbe and environs?

The study was guided by a hypothesis:

Ho: There is no significant difference between the organochlorine pesticides content of Owesse wetland and the World Health Organisation maximum allowable concentrations for organochlorine pesticides in water.

STUDY AREA



Source: Ezeomedo, Innocent & Egware, Anwuli. (2018).

Figure 1: Map Ndokwa west showing Utagba-Ogbe.

Utagba-Ogbe is semi urban settlement. It is the local government headquarter of Ndokwa West local government area. It lies within the geographical coordinates of 5°41'10" N and 6°24'40"E. The people are agrarians but with the location of the local government headquarters many of the habitants are civil servants. Some are petty traders while others are artisans. Utagba-Ogbe has a population of 170,060 (National Population Commission 2006). Owesse wetlands are located in the northwest of Utagba-Ogbe and it is the recipient of effluent discharges from agricultural activities and artisans wastes.

MATERIALS AND METHODS

The design of this study is ex-post facto. Owesse wetlands were mapped out into research sites A B C D E (Abdulfatai 2015). From each of the research sites, samples were collected with clean plastic sampling bottle, tied to a graduated string from 5 spots at 10 cm depth and covered subsurface. The samples from each site were bulked, a composite drawn, fixed with nitric acid (HNO_3) and kept in ice-cooled boxes for analysis.

The analytical standards adopted where American Public Health Association, (APHA), United States of America Environmental Protection Agency Standard (USEPA) 3570 and Steindwandter and Shufler 1978. The analytical instrument deployed for the determination of the organochlorine pesticides was Agilent 6100 series single quadrupole liquid chromatography and mass spectroscopy (LC/MS).

RESULT

The results of the investigation of the organochlorine pesticides content of Owesse wetlands is as in Table 1.

Table 1: Organochlorine Pesticides Content of Owesse Wetlands and World Health Organization Maximum Allowable Concentrations for Organochlorine Pesticides in Water in µg/l.

Parameters	Research Station					Mean	Std.	WHO MPC µg/l
	A	B	C	D	E			
DDT	0.49	0.96	0.72	0.82	0.86	1.87	0.80	1.10
Adrin	2.00	2.63	2.72	2.79	2.52	2.06	0.68	0.30
Diedrin	2.33	2.10	2.42	2.11	2.32	2.16	0.83	0.05
Endrin	2.00	1.98	2.21	1.22	2.01	1.92	0.87	0.05
Heptachlor	2.52	2.63	2.72	2.64	2.55	2.07	0.72	0.10

The mean results of the parameters investigated were presented graphically with bar chart as in Figure 2

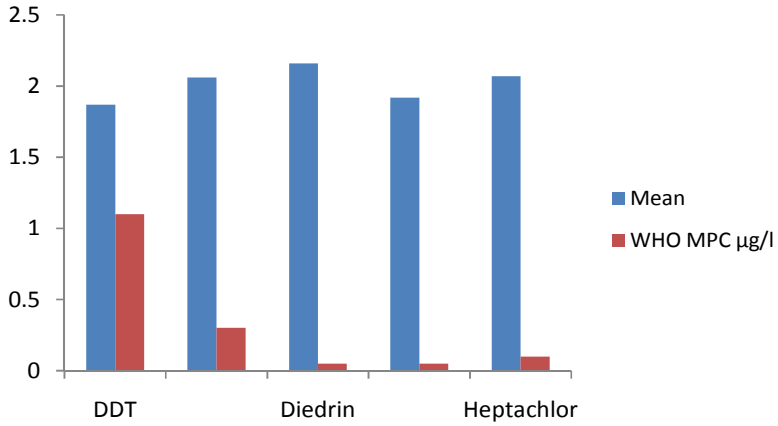


Figure 2: Graphical Presentation of the Mean Concentration of the Organochlorine Pesticides Investigated.

The mean concentrations of the organochlorine pesticides in Owesse wetlands in decreasing order is as follows: heptachlor >diedrin>adrin>edrin> DDT.

Table 2: Analysis of Variance of the Organochlorine Pesticide Content of Owesse Wetlands

Source of Variation	SS	df	MS	F	p-value	F crit
Between Group	3057.233944	4	764.308486	7536.221243	3.80474E-31	2.866081
Within Groups	2.02836	20	0.101418			
Total	3059.262304	24				

The results of the concentration of the organochlorine pesticides were further subjected to test of significance with analysis of variance (ANOVA) with numerator 4 and denominator 20 at 0.05 level of significance. F ratio package value is 3.80 while the F ratio critical value is 2.87. This revealed that Ho is rejected which means that the organochlorine pesticides investigated concentrations are higher than WHO maximum allowable concentration for pesticides in water.

DISCUSSION

Sustainable development goals are aimed at making the world a better place for man by eradicating poverty and hunger which are global goals 1 and 2. Achieving these milestones is only possible when the teeming youths are gainfully employed. Agriculture has been tipped as occupying a vital position in achieving poverty reduction and hunger eradication

especially aquaculture agripreneur deploying cage culture. Good quality water free from toxicants is needed for cage culture and that makes this study imperative.

The results of the water analysis of Owesse wetlands Utagba-Ogbe revealed varying concentrations of the organochlorine pesticides investigated. The main concentration of DDT in Owesse wetlands is 0.77±0.28µg/l. The WHO maximum allowable concentration for DDT in water is 0.10µg/l. The concentration of DDT in Owesse wetland is higher than the WHO allowable limit. Elevated concentration of DDT in water was reported by Ozolua and Osagie (2014) in Ikpoba River Benin City, Imade and Okhia (2018) in Ovia River, Benin City. The mean concentration of adrin in Owesse wetland is 2.55±0.32µg/l while the WHO maximum permissible concentration for adrin in water is 0.03µg/l. The concentration of adrin is higher than the WHO recommended limit for the organochlorine pesticides in water. This report is similar to the reports of Adejumo (2016) who recorded high concentration of adrin in Asa and Agba Rivers in Kwara state and Usman and Yari (2018) who also reported increased concentration of adrin in Gamji River Gombe State. The mean concentration of diedrin in Owesse wetland is 2.56±0.14µg/l and the WHO maximum allowable concentration for diedrin in water is 0.05µg/l. Diedrin mean concentration in Owesse River is higher than WHO maximum allowable concentration for diedrin in water. The result of diedrin concentration in Owesse wetland is in tandem with the reports of Edema (2015) in Bateren River, Warri south Delta State and Ogwu (2019) in Ovevwe wetlands Abraka inland. The concentration of endrin in Owesse wetland the analyses revealed is 1.88±0.38µg/l. The WHO maximum allowable concentration for endrin in water is 0.02µg/l. The mean concentration of endrin is higher than the allowable limit for diedrin in water (WHO, 2014). The result of the investigation of endrin in water is similar to the reports of Donkor (2018) who reported high concentration of endrin in River Ankobra in Ghana. It is however at variance with the reports of Hasford (2019) who recorded low concentration of endrin in Ayensu River Ghana and Opia (2017) who also reported low endrin in Okpai wetlands in Ndokwa East Delta State, Nigeria. The analyses revealed that the mean concentration of heptachlor in Owesse wetland is 2.07±0.72µg/l, the WHO maximum allowable concentration for heptachlor in water is 0.10µgl. The mean concentration of heptachlor in Owesse wetland is higher than WHO permissible limit for heptachlor in water. Increased heptachlor in water have been reported by Adeyanju (2014) in Ero River Ekiti State and Amusan (2017) who reported elevated concentration of heptachlor in Ogbese River in Ondo State.

CONCLUSIONS

The United Nations highlighted 17 goals for the member nations to achieve between 2015 and 2030. Goals 1 and 2 which are eradication of poverty and poverty are only achievable when the majority of the populations of member nations are productive. Unemployment in Nigeria seems intractable and calls for models to surmount the challenge. Agriculture has been favoured repeatedly as a veritable tool for solving youths unemployment problems especially youths aquaculture through cage culture. Pollution of water bodies has posed a hindrance in deploying cage culture hence this study. The result of this study has revealed that Owesse wetland is highly polluted with organochlorine pesticides and this will result in bio accumulation and biomagnification in the fish raised in the wetland and may result in health disorder in the consumer of the produce at harvest. It is incumbent that the use of pesticides be done within the ambit of the world's best practices to avoid degradation of our water sources and ultimately contamination of fishes raised in such water so as to make poverty eradication and zero humber goals enshrined in sustainable development goals 2015 achievable through youths engagement in aquaculture.

RECOMMENDATIONS

Consequent upon the results of this investigation the study recommends that:

Cage aquaculture should not be deployed in Owesse wetland because of the poor pollution status of the wetland.

The source of organochlorine pesticides pollution should be identified and plugged to avoid further contamination.

Remediation and decontamination should be carried out in Owesse wetlands so as to allow for the deployment of cage aquaculture by schools and youths in Utagba-Ogbe and environs for the achievement of the sustainable development goals 1 and 2 which are no poverty and zero hunger in Nigeria by 2030.

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