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Organochlorine Pesticide Quantification of Otogor Wetland Ughelli Delta for Secondary Schools Cage Aquaculture for Hunger Eradication in Nigeria

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ABSTRACT: United Nations Sustainable Development Goal 2 requires all member Nations to achieve zero hunger by 2030. Agriculture especially aquaculture adopting cage technique has been recognised as a very viable option in achieving this set goal. Aquaculture requires water devoid of pollutants and that underscores the study. This is an ex-post facto research that answered 3 research questions and tested a hypothesis and its focus is on the determination of the organochlorine pesticides content of Otogor wetland for cage aquaculture in secondary schools for zero hunger. To achieve this, Otogor wetland was mapped out into research cells A, B, C, D, E. From each of the cells, water was sampled with clean sampling bottle tied to a graduated string from 5 spots at 10 cm depth. The water samples from each cell were then bulked, a composite drawn, fixed with HNO_3 and stored in ice cooled box for analysis. The analytical standards adopted were USEPA 3570, APHA, Steindwandter and Shufter 1978. The analytical instrument deployed for determination is Agilent 6100 series single quadrupole LC/MS. The mean results of the organochlorine pesticides investigated in Otogor wetland were DDT 1.27±0.21µg/l, heptachlor 3.01±0.45µg/l, a-lindane 0.33±0.09µg/l, adrin 3.52±1.00 µg/l and endrin 0.32±0.11µg/l. The results of the organochlorine pesticides investigated were subjected to test of significance with ANOVA with numerator 4 and denominator 20. The F ratio calculated value is 5.59 while F ratio critical value is 2.87, thus rejecting Ho and accepting Ha. The study thus recommend that cage aquaculture should not be deployed in Otogor wetland with the present pollution status. The pollutants source point should be identified and discontinued and remediation should be commissioned in Otogor wetland to return the wetland to its healthy state to allow for the deployment of cage aquaculture for youths empowerment for zero hunger in Nigeria.

KEYWORDS: Cage Aquaculture, Organochlorine Pesticides, Pollution, Remediation, Zero Hunger.

INTRODUCTION

Hunger eradication has remained an intractable challenge globally with every nation having its share of hungry citizens. The world total population of hungry and malnourished is 795 million (World Hunger Statistics and Food Aid, 2019). According to the United States Department of Agriculture (USDA) (2020) 41 million Americans are in hunger. Fareshare.org (2018) states that 4.7 million people hungry in the United Kingdom, Asia, despite the rapid development and strive to feed its citizens, has 486 million of its people still facing starvation (Food and Agriculture 2020). In Morocco 1.2 million citizens are hungry (Morocco World News 2021) while in Kenya 4.5 million people out of 46 million citizens are facing hunger and are malnourished (Kenya Institute for Public Policy Research Analysis, 2020). Republic of Benin a low income country World Food Programme (WFP) (2020) reports is experiencing food deficit with 1.2 million of its citizens living in hunger while Zimbabwe a country facing worst food crisis in Africa has 3.7 million out of its 14.4 million population in hunger and malnourished (World Food Programme (WFP) 2019). Nigeria according to National Bureau of Statistics (2020), Bergen, (2020), Food and Agriculture Organisation (2019) has 8.5 million of her population in hunger. Vanguard online (2020) puts the Nigeria starving population at 9 million out of 170 million people while international Committee for Red Cross (ICRTC) (2020) states that 8.7 million Nigerians out of 170 million people are malnourished and hungry. For Global Hunger Index (2020) 7.8 million out of 200 million people in Nigeria are without food and are malnourished. Hunger according to Mark (2015) is the feeling of discomfort caused by lack of food. Hunger is the desire, the crave for food. It is discomfort, uneasy sensation caused usually by the lack of food and resulting from stimulation of sensory nerves of the stomach causing contraction and churning movement of the empty stomach (Samie, 2017, Karl, 2018, Obed & Taylor, 2019). FAO (2015) revealed that hunger exist when people lack secured access to sufficient amount of food for normal growth and development. World Food Programme (2020) categorised hunger into undernourishment which is when people do not take enough calories to meet

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physiological needs while malnourishment is inadequate intake of protein, energy and micronutrients, leading to wasting and substantial weight loss.

According to United Nations (2015) eradication of hunger and malnutrition is one of the greatest challenges today in that it is not only the consequences of not having enough or wrong food causing suffering and poor health, hunger also stunt growth process in other areas such as employment and education, thus, affecting economic growth and development of a country.

In 2012, Banki Moon the then secretary of United Nations launched zero hunger which was geared towards ending hunger, eliminating all forms of malnutrition and building inclusive and sustainable food system and in 2015, the United Nations adopted eight (8) Sustainable Development Goals and goal 2 is to achieve zero hunger between 2015 and 2030.

Johnson (2018), Bradson (2019), opined that the world cannot achieve sustainable development goal 2, zero hunger when teeming youths in the world are unemployed. According to International Labour Organisation (ILO) (2018) Food and Agriculture Organisation (2019) 13.1 percent of the youths population in the world representing that is 71 million young people are unemployed. National Bureau of Statistics (2021), Ruwani (2021) revealed that 33.3 percent of Nigeria youths are without employment. International Monetary Fund (IMF) (2020) puts the number of unemployed youths in Nigeria as 35 percent while aljazeera.com states that 35.4 percent of Nigerian young people are without work. United Nation Food and Agriculture Organization (FAO) (2018) declared that change in global agriculture system is needed to feed the 791 million people who are malnourished. Investment in agriculture is expedient to increase the capacity of agricultural productivity and sustainable productive system towards alleviating global peril of hunger (FAO, 2019).

Ofor (2018), Betiku (2020) admonished that the unemployed youths can be engaged in agriculture to achieve zero hunger and reduce youths unemployment. Ukale (2017), Eleagwu (2019) advocated youths engagement in agriculture especially aquaculture. The Federal government of Nigeria in response to calls for youths skill acquisition in agriculture introduced trade curriculum in senior secondary schools in 34 trade subjects including GSM repair, ceramics, block making, animal husbandry and aquaculture. According to Nigeria Educational Research and Development Council (NERDC) (2011) the rationale of trade curriculum is to equip the secondary school graduates with functional skills to survive in the world of work, to reduce youths unemployment and achieve zero hunger in Nigeria.

Adebayor (2016) Abayomi (2015) reiterated that youths should be engaged in aquaculture to solve youths unemployment and achieve zero hunger, while Tijani (2011), Aloba (2016), Mohammed (2015) enjoined youths to venture into aquaculture agriculture adopting cage aquaculture due to it's low investment capital. Cage aquaculture is the process of raising fish in net cages anchored in a natural body of water (Ogwu et al., 2021, Doul, 2021). Uzama (2018), Ogwu and Ebirekata (2021) advised that water analysis should carried out be before deployment of cage aquaculture to avoid pollutants bioaccumulation and biomagnification. Green (2018), Needom (2019) highlighted water pollutants to include microplastics, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), petroleum hydrocarbons, persistent organic pollutant (POPs), furans, heavy metals and pesticides e.g. organophosphate, carbamates and organochlorine. Bioaccumulation is the presence of toxic substances in the tissue of organisms while biomagnification is the tendency for the sbustances to multiply in geometry in the organisms tissue (Mollee 2018, Gumen, 2015). Organochlorines according to United States Environmental Protection Agency (USEPA) (2010) are compounds containing carbon and chlorine atoms used in the manufacture of pesticides. Human exposure to organochlorines have been associated with endometriosis, cancer, infertility, reproductive problems in both male and female (Agency for Toxic Substance and Disease Registry (ASDR), 2015). A wetland (marsh swamp and borg) is areas covered intermittently by shallow water or soil saturated with water most time of the year (Ogwu 2020).

Fish is an important source of protein carbohydrates, fat and minerals (FAO, 2017). Odum (2005) revealed that fishes are reputed to be the cheapest source of good quality protein for a healthy population. Fish production as an enterprise possesses the capacity to contribute significantly to agricultural sector to engage the youths and achieve zero hunger (Osagie 2017). According to Nigeria Bureau of Statistics (NBS) (2020), Nigeria annual fish demand is 2.7 million metric tonnes and its domestic production in 780000 metric tonnes. Nanono (2020) revealed that Nigeria fish demand is 2.8 million metric tonnes but produces 850,000 metric tonnes while Muhammed (2021) puts Nigeria fish demand demand as 3.0 million metric tonnes and its domestic production is 860,000 metric tonnes. The gap between demand and supply is bridged through importation. According to Adesina (2014) Nigeria spends over 100 billion Naira on fish importation while United States Agency for International Development (USAID) (2019) puts the amount of money spent on fish importation at 625 million dollars. Ruwani (2020), Oteriba (2020) surmised that when Nigeria

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imports fish it exports employment and imports unemployment putting zero hunger goal achievement and youth employment in jeopardy.

It is against this background to encourage youths fish production through cage aquaculture to reduce youths unemployment and achieve zero hunger that this study became expedient.

The purpose of this study therefore is to determine the organochlorine pesticides content of Otogor wetlands for its suitability for cage aquaculture by schools for youths empowerment and to achieve zero hunger.

The organochlorine pesticides investigated are dichlorodiphenyltetrachloroethane (DDT), heptachlor, alpha lindane (α-HCH), adrin and endrin.

The study was guided by the following research questions:

1. What are the concentrations of DDT, heptachlor, a-lindane, adrin and endrin in Otogor wetland?
2. Are the concentrations of DDT, heptachlor, alpha lindane, adrin and endrin Otogor wetland within the maximum allowable concentrations for organochlorine in water as recommended by WHO (2014)?
3. Can cage aquaculture be deployed in Otogor wetland?

The study was guided by a hypothesis as thus:

Ho: there is no significant difference between the concentrations of the organochlorine pesticides in Otogor wetland and the WHO maximum permissible concentration of organochlorine pesticides in water.

STUDY AREA

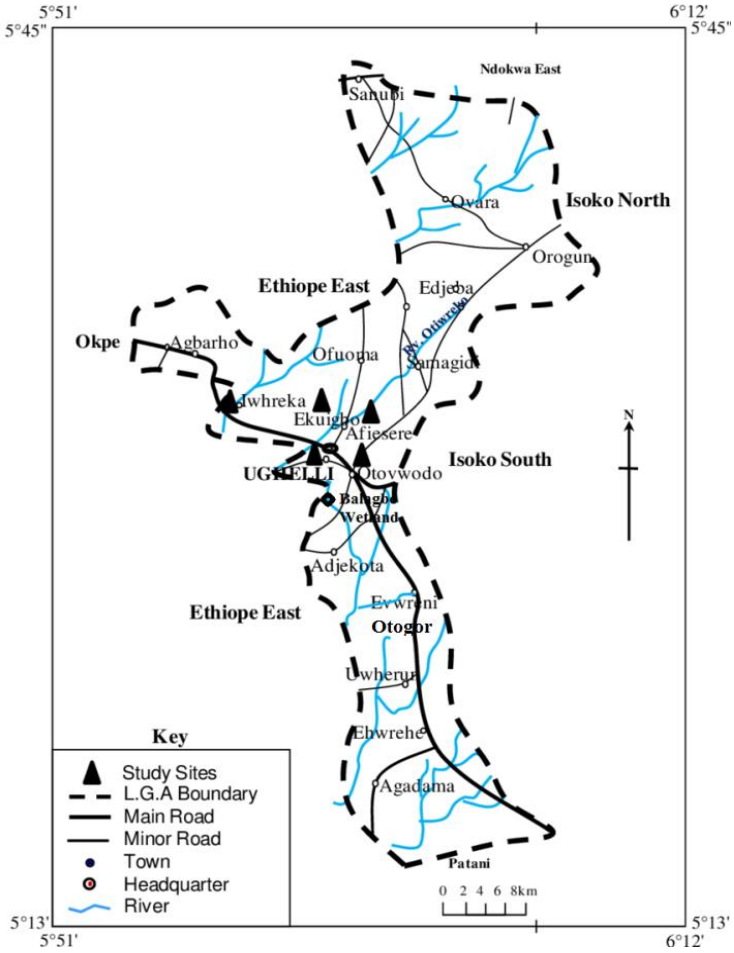

Figure 1: Map of Ughelli showing Otogor
Source: Google map 2022.

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Otogor is an agrarian and fishing town that also practices fish farming in Ughelli South local government area Delta State. It lies within the geographical coordinates of 5.4532°N and 6.0294°E. Otogor has the population of 3532 people (National Population Census 2006). wetland and agrarian settlement, majority of the farmers adopt chemical pest control and this is evident by the presence of backpack sprayer in almost every household, in Otogor. The Otogor wetland is the major recipient of the agricultural wastes through runoffs, flash floods and erosion.

MATERIALS AND METHODS

This study is an after the fact research. Otogor wetland was mapped out into sampling cells A, B, C, D, E (Sowemino, 2020). From each of the sampling cells, 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 cell were bulked, a composite drawn, fixed with nitric acid (HNO_3) (to avoid oxidation) and stored in ice cooled boxes for analysis. The analytical standards adopted are United States Environmental Protection Agency (USEPA) standard 3570, American Public Health Association (APHA) and Steindwandter and Shufter 1978. The analytical instrument deployed for determination was Agilent 6100 series single quadrupole liquid chromatography and mass spectroscopy (LC/MS).

RESULTS

The result of the organochlorine pesticides content of Otogor wetland are as in Table 1.

Table 1: Organochlorine pesticides content of Otogor wetland and WHO maximum permissible concentration in µg/l.

Parameters	Sampling Locations					Mean	SD	WHO/MPE in µg/l
	A	B	C	D	E			
DDT	1.42	.98	1.12	1.36	1.45	1.27	0.21	1.10
Heptachlor	2.30	3.20	3.50	3.12	2.95	3.01	0.45	0.10
a_Lindane	.40	.30	.20	.32	.41	0.33	0.09	0.010
adrin	5.30	2.92	3.00	3.14	3.22	3.52	1.00	0.30
endrin	.20	.48	.22	.36	.33	0.32	0.11	0.002

Organochlorine pesticides content were presented in graph as in in Figure 2.

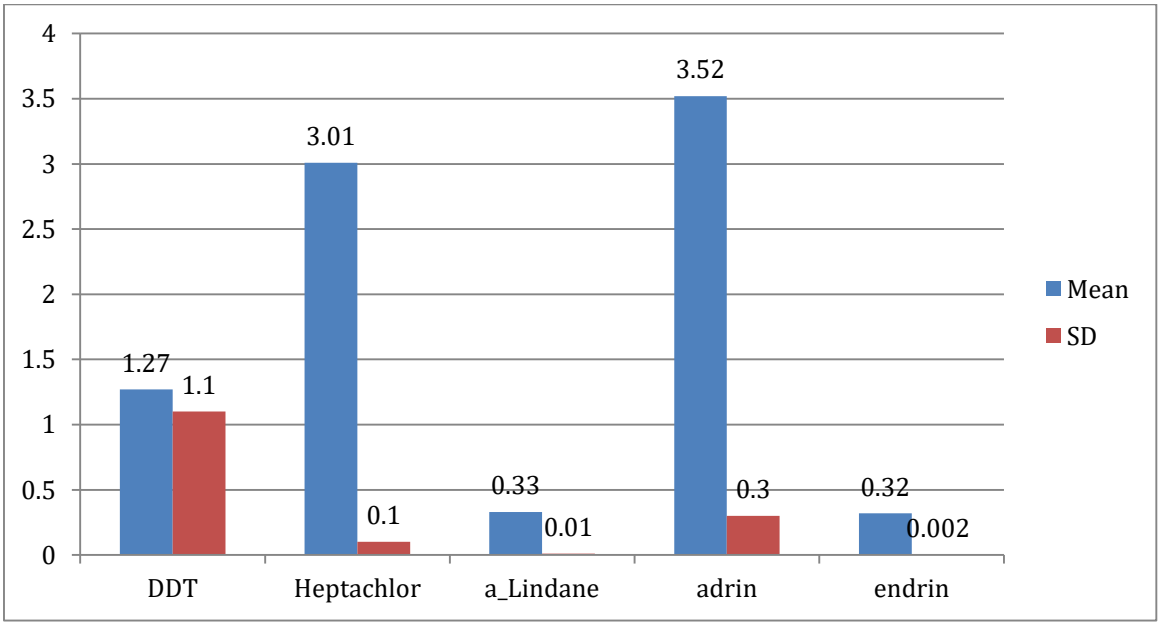

Figure 2. Concentration of the organochlorine pesticides investigated and WHO MPC in µg/l.

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The concentration of the organochlorine in decreasing order are as follows: adrin > heptachlor > DDT > a-lindane > endrin.
The results of the organochlorine pesticides investigated were subjected to test of significance with analysis of variance with numerator 4 and denominator 20 at 0.05 level of significance. The F ratio calculated is 5.59 while the F ratio critical is 2.87; thus rejecting Ho and accepting Ha that there is significant difference in the concentration of the organochlorine pesticides investigated and the WHO maximum allowable concentration for the organochlorine pesticides investigated in water.

DISCUSSION OF FINDINGS OF THE STUDY

The result of the organochlorine pesticides content determination of Otogor wetland revealed the following concentrations. The DDT mean concentration in Otogor wetland is 1.27±0.21µg/l. The WHO maximum permissible concentration for DDT in water is 1.1µg/l. The concentration of DDT in Otogor wetland is higher than the maximum limit recommended by WHO. High concentration of DDT in water has been reported by Anyakora (2018) in Bonny Camp Lagos and Ogunze and Osagie, (2016) in the Ikpoba River Benin City. The mean concentration of heptachlor in Otogor wetland the study revealed is 3.01±0.45µg/l. The WHO maximum allowable concentration for heptachlor in water is 0.10µg/l. the concentration of heptachlor in Otogor wetland is higher than the WHO recommended limit for heptachlor in water. This report is similar to Ozah (2018) who reported high concentration of heptachlor in Ase Creek Beneku Delta State and Ogujimi and Afariogun (2018) who also reported high heptachlor in Olomoge lagoon Badagry Lagos. The concentration of α-lindane in Otogor wetland the investigation revealed is 0.33±0.09µg/l. The WHO maximum permissible concentration for α-lindane in water is 0.002µg/l. The concentration of α-HCH in Otogor wetland is higher than the limit stipulated by WHO for α-lindane in water. Increased α-lindane in water has been reported by Eneagu and Odezu (2016) in Njaaba River Imo State and Ajibola (2012) who reported high a-lindane content in Ogun River Ogun state. The investigation revealed that the mean concentration of adrin in Otogor wetland is 3.52±1.00µg/l. WHO maximum permissible concentration for adrin in water is 0.03µg/l. the adrin in Otogor is higher than WHO acceptable limit. High adrin in water was in the report of Umaru and Abasi (2015) in Gamji River Gombe, also Erike (2015) reported high adrin in Oji River Enugu State. The analysis of Otogor wetland revealed that the mean concentration of endrin is 0.32±0.11µg/l. The WHO maximum allowable concentration for endrin in water is 0.005µg/l. The endrin content of Otogor wetland is higher than WHO maximum allowable concentration for endrin in water. Elevated concentration of endrin in water have been reported by Okon and Udo (2019) in Azumini Blue River Akwa Ibom State. Okpor (2017) also recorded high concentration of endrin in Owesse wetland Kwale Delta state Nigeria.

CONCLUSION

Global hunger crisis is of grave concern to every nation of the world including Nigeria. Achieving zero hunger in 2030 will be a mirage if the teeming unemployed youths are not engaged. Agriculture has been highly recommended as a viable option for achieving youths empowerment and zero hunger including youths aquaculture through less capital intensive cage aquaculture. Water pollution by agriculture and industrial wastes is a great challenge in cage aquaculture development and this underscores the study. The results of this study has revealed that Otogor wetland is polluted with organochlorine pesticides making the deployment of cage culture not to be feasible to avoid health disorders associated with the ingestion of organochlorine pesticides contaminated foods.

RECOMMENDATIONS

Consequent upon the results of the analysis of the organochlorine pesticides content of Otogor wetlands, the study recommends:

1. Cage aquaculture should not be deployed in Otogor wetland in its current pollution status.
2. The pollution source should be identified and plugged.
3. Decontamination program should be embarked upon in Otogor wetland to make it useable for youths cage aquaculture in schools for empowerment and zero hunger in Nigeria.

REFERENCES

1. Aboyomi, S. O. (2015). Solve youths unemployment problem through aquaculture. A keynote address: Fishery Society of Nigeria. Fison. Abuja 2015.
2. Adesina, A. (2014). Fish demand and importation in Nigeria. A ministerial brief, Federal Ministry of Agriculture, Abuja, Nigeria.

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IJCSRR @ 2022
www.ijcsrr.org

3. Agency for Toxic Substances and Disease Registry (2015). Effects of oragnochlorine. A ATSDR publication Georgia Atlanta.
4. Ajibola, L. O. (2012). Evaluation of the pesticide loadings of Ogun River, Ogun State. *Journal of Environmental Monitoring*, 14(4), 201-208.
5. Anyakora, C. A. (2015). Organochlorine pesticides content of Lagos Lagoon, Bonny Camp, *scientia* 14(2), 62-69.
6. Bank. M. (2012). Millennium development goals: evaluation report. A UNO report Washington DC, USA.
7. Bergen, S. A. (2020). Hunger and malnourishment in Nigeria. Https://www.hungerandnourishmentinNigeria.com. Retrieved January, 2022
8. Branson, C. (2019). How can sustainable development goal 2 be achieved? https://howcansdg2beachieved.com. Retrieved February 2021.
9. Doul, M. C. (2021). Youths aquaculture adoption in rural region. *Asia Journal of Marine Biology*, 17(3), 90-98.
10. Eneagu, M. and Odezu, F. O. B. (2016). Organochlorine content of Njaaba River, Imo Nigeria. *Asia Journal of Marine Chemistry* 24(3), 99-103.
11. Erike, B. C. O. (2015). Organochlorine pesticide content of Oji River, Nigeria. *Euroasia Journal of Environmental Management*, 28(3), 98-105.
12. Food and Agricultural Organisation (2019). Hungry and malnurished in the sub Saharan Africa. FAO Publication, Rome Italy.
13. Food and Agriculture Organisation (2019). Food security: how have we fared. A FAO report, Rome Italy.
14. Food and Agriculture Organization (2017). Health benefits of fish. A FAO publication, Rome Italy.
15. Global Hunger Index (2020). The world and food security. https://www.worldfoodneed.com. Retrieved January, 2022.
16. Green, O. A. (2015). Pollution chemistry of Olomoge Lagoon Badagry Lagos. *Journal of Environmental Monitoring* 18(2) 91-97.
17. Gumen, F. O. (2015). Analysis of the microplastic content of Ogun River, ogun state. *Journal of Marine Pollution* 20(3), 41-49.
18. International Committee for Red Cross (2020). Insurgency in the northeast and hunger rate in Nigeria ICPC Publication, Geneva Switzerland.
19. International Labour Organisation (2018). The world and unemployment. ILO Publication, Geneva Switzerland.
20. International Monetary Fund (2020) Unemployment in the sub-Saharan aFrica. IMF publication Washington DC, USA.
21. Johnson, A. (2018). United Nation sustainable development goals and youths' unemployment. https://www.sustainabledevelopmentgoalsandunemployment.com retrieved February 2022.
22. Jones, A. (2020). American hunger rate. https://www.fareshare.org. retireved February 2022.
23. Karl, P. (2018). Definition of hunger. https://wwwdefinitionofhunger.com Retrieved February, 2022.
24. Kenya Institute for Public Research Analysis (2020). The hunger and malnourished in Kenya . https://www.kenyahungerandmalnurishedpublicpolicyresaerch.org. Retrieved January 2022.
25. Mark, R. (2015). Hunger Defintion. https://hungerdef.com. Retrieved February 2022.
26. Molee, J. C. (2018). Organochlorine pesticide content in Africa giant frog (*Bufo bufo*) in Niger Delta. *Journal of Ecology and Toxicology* 14(2), 205-210.
27. Morocco world new (2021). The hunger rate in Morocco. https://www.morocoworldnews.org. retrieved February 2022.
28. Muhammed, A. (2021). Nigeria fish demand and production. A ministerial brief, Federal ministry of Agriculture, Abuja, Nigeria.
29. Muhammed, A. A. (2015). Cage aquaculture in south west Nigeria. *Journal of Agriculture and Marine Science 8(3), 32-39.*
30. Nanono. S. (2020). Fish demand and local production. A ministerial breif. Federal Ministry of Agriculture, Abuja, Nigeria.
31. National Bureau of Statistics (2020). The hunger rate in Nigeria. NBS Publication, Abuja Nigeria.
32. National Population Commision (20206). Nigeria population. NNPC publication, Abuja.
33. Needon, S. S. (2019). Heavy metals content of Omambala River, Anambra Nigeria. *Journal of Environmental Pollution* 20(5), 130-137.

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DOI: 10.47191/ijcsrr/V5-i3-34, Impact Factor: 5.825
IJCSRR @ 2022
www.ijcsrr.org

34. Nigeria Educational Research and Development Council (2012). Nigeria trade and entrepreneurship curriculum for senior secondary schools. NERDC Publication, Abuja, Nigeria.
35. Nigeria National Bureau of Statistics (2020). Fish demand and importation. A NBS Publication, Abuja, Nigeria.
36. Nigeria National Bureau of Statistics (2021). Unemployment rate in Nigeria. A NDS publication, Abuja, Nigeria.
37. Obed, J. and Taylor, C. (2019). The world and food needs. https://www.worldfood.com.
38. Odum, C. F. (2008). Fish, Fishery and rural economy of the south south Nigeria. *Journal of Social Sciences*, 10(2), 103-110.
39. Ogunjimi, A. and Aforogin, B. A. (2018). Polyaromatic hydrocarbon and persistent organic pollutants content of Olomoge Lagoon Badagry Lagos. Elsevier, 177: 346-352.
40. Ogunze, J. N. and Osagie, P. C. (2018). Evaluation of organochlorine pesticides concentration in Ikpoba River, Benin City, Nigeria. Science Direct Jouranl, 15(3), 126-131.
41. Okon, S. T. and Udo, P. S. (2019). Organochlorine pesticides loading of Azumini blue river, Akwa Ibom Nigeria. *Environmental Poll.* 16(4), 90-96.
42. Okpor, S. U. (2017). Organochlorine pesticide evaluation of Owesse Wetland, Kwale Delta Nigeria. *Journal of Environmental Management and Poll.* 41(2), 52-49.
43. Oteriba, M. A. (2020). Nigeria fish importation and unemployment. Lagos Oteriba Economic consultant Ltd.
44. Ozah, P. C. N. (2018). Pollution chemistry of Ase creek Beneku, Delta Nigeria. Chemosphere, 117, 441-446.
45. Ruwani B. (2021). Unemployment in Nigeria. Lagos: Financial Derivatives Ltd Publication.
46. Samie, S. (2019). Hunger definition. https://www.lexica.definition.com
47. Sowemino, A. A. (2020). Sampling and sampling technique in hydrobiology. Lagos: Obadie Publisher Ltd.
48. Tijani, M. O. (2011). Cage aquaculture adoption in Niger state. *Journal of Extension Agriculture* 6(4), 125-132.
49. Umoru, Q. B. and Abasi, Z. A. (2015). Pollution status of Gamji River, Gombe State. *Journal of Poll. And Toxicol.* 34, 61-68.
50. United National Organisation (2015). Sustainable development goals. A UNO Publication Washington DC, USA.
51. United State Agency for International Development (2020). Fish importation in Sub saharan Africa. A USAID publication, Washington DC, USA.
52. United State Department of Agriculture (USDA) (2020). World hunger rate. A USDA Bulletin Washington USA.
53. United State Environmental Protection Agency (USEPA) (2010). Effects of organochlorine on human health: A USEPa publication Washington DC USA.
54. Uzama, N. (2018). Pollution chemistry of Ofiki River, Ekiti, Nigeria. *Journal of Chemical Society of Nigeria* 15(4), 112-118.
55. World Food Programme (2020). Hunger rate in Benin Republic. WFP Publication Rome Italy.
56. World Hunger Statistics and Food Aid (2018). World Statistics of the hungry and malnourished. A publication of World Food Aid (WFA) Rome, Italy.
57. World Food Programme (2019). Hunger rate in Zimbabwe. WFP Publication Rome Italy.
58. Ogwu, C. and Ebireketa, E. E. (2021). Organochlorine pesticides content analysis of Ubeji wetland Warri south Delta Nigeria for cage aquaculture adoption. *International Journal of Research in Applied Natural and Social Sciences* 9(7), 1-8.
59. Ogwu, C., Okeke, M. and Okonji, A. O. (2021). Organochlorine pesticides content determination of Atuh wetland Ugiliamai for pen aquaculture in schools: As a tool for revolution education in Nigeria. *International Journal of Engineering Science and Invention* 10(1), 47 – 52.
60. Ogwu, C. (2020). Quantification of organochlorine pesticides content of Okumesi River Ebedei Uno Delta for cage aquaculture in schools: a pathway for youths empowerment and poverty eradication in Nigeria. *International Journal of Curriculum and Pedagogy* 6(2), 133-139.
61. Adelabu, J. P. (2016, 7 May). Aquaculture and youth empowerment in Nigeria. Punch News, p. 45 – economy.
62. Oghenegare, A. C. (2020, 16 May). Hunger rate in the north east Nigeria. Vanguard News p. 52 – Economy.
63. Ofor, C. C. (2018 6 June). Youths unemployment and vocational and technical education. Vangaurd News p. 5 – Economy.
64. Aloba, C. N. (2016, 7 June). Youths aquaculture using cage culture. Vanguard p. 50 – Economy.

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IJCSRR @ 2022
www.ijcsrr.org

65. Betiku, S. C. (2020, 10 August). Solve youth unemployment through TVET. Guardian News p. 62 – Economy.
66. Eleagwu, J. (2019, 8 September). Youths unemployment and agriculture. Punch News p. 42 – Economy.
67. Osagie, S. T. (2017 7 November). The place of fish in Nigeria Economy. Guadian News p. 53 – Economy.

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