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Population Growth and Urbanization: The Demographic Influencers of Climate Change and Challenges to Fishing in the Coastal Areas of Taraba State

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Abstract

Climate change as an undeniable global challenge is intricately connected to human activities, with population growth and urbanization emerging as significant contributors to this intricate phenomenon. Nigeria, being the most populous country in Africa, has witnessed substantial population growth and swift urbanization in recent years. While these trends signal societal progress, rising temperatures which drives flooding become inherent challenge, directly affecting fishing business in the riverine areas. Objective of the study is to focus on how population growth and urbanization influence rise of carbon footprint and temperatures as they affect fishing trade. The study adopted a cross-sectional survey design, Taro Yamane's formula was used to generate 400 sample from the total population of 581,000. Two-Way ANOVA was adopted as the statistical tool to test the study's hypothesis. The study revealed that population growth and urbanization have significant influence on higher rise of carbon footprint and temperatures that leads to flooding. As temperatures increase, the window of time when fish are in good condition and abundant enough to harvest is reduced. This leads to a decrease in revenue for fishers and a corresponding reduction in the local economy in Taraba State. The study recommends that there should be promotion of sustainable fishing practices that take into account the effects of temperature rise and population growth. This could involve setting quotas for fish catch, establishing no-take zones to allow fish population to recover, and creating incentives for fishers to adopt sustainable methods.

Keywords: Climate change, Coastal areas, Demographic influencers, Population growth, Urbanization.

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INTRODUCTION

The intricate relationship between population growth, urbanization, and climate change presents a pressing global challenge especially as they affect fishing trade. Consequently, urbanization has intensified, leading to alterations in land use patterns, deforestation, and heightened emissions of greenhouse gases. The expansion of urban areas often occurs at the expense of natural ecosystems, exacerbating challenges such as rising temperatures, altered precipitation patterns, and extreme weather events [13] Urban expansion often induces land use changes, deforestation, and the loss of natural habitats (UN, 2018). These alterations in the landscape contribute to biodiversity loss and disrupt local ecosystems, intensifying the region's vulnerability to climate change impacts [13]. The concentration of population and infrastructure in urban areas heightens susceptibility to climate extremes, such as flooding, heat waves, and extreme precipitation events [13]. Rising temperatures which drives flooding become inherent challenge, directly affecting fishing business in the riverine areas.

Nigeria is a country known for its diverse landscapes and cultural richness, struggles with a significant challenge at the intersection of demographic shifts, urban development, and environmental sustainability. The intricate interplay between population growth and urbanization has become a crucial factor shaping Nigeria's climate change landscape. As the most populous country in Africa, the demographic trends and urban expansion in Nigeria are drawing increasing attention due to their potential impact on the global climate system. Projections from the United Nations indicate that Nigeria's population is poised to reach an unprecedented 398 million by 2050, making it the third most populous nation globally [29] Simultaneously, rapid urbanization is reshaping the country's physical and social fabric, with a notable migration from rural to urban areas, particularly observable in cities like Lagos, Abuja, and Kano [30]. This concurrent process of population growth and urbanization is reshaping land use, energy consumption, and resource utilization, thereby playing a significant role in Nigeria's overall contribution to global climate change. The intricate connections between population dynamics, urbanization, and climate change in Nigeria demand careful examination. While the impacts of climate change are global, understanding the localized nuances and situating them within Nigeria's socio-economic and environmental context is vital for devising effective mitigation and adaptation strategies [1]. Coastal fisheries encounter significant challenges due to climate change. Elevated sea temperatures, ocean acidification, and extreme weather events directly impact fish populations, altering their distribution and abundance [7]. These shifts disrupt established fishing patterns, affecting the livelihoods of coastal communities dependent on specific species. Coastal areas are susceptible to pollution stemming from industrial discharges, agricultural runoff, and plastic waste. Pollutants contaminate water, degrade habitats, and pose risks to fish populations, resulting in diminished fishery yields and threatening the well-being of marine life and human populations [11]

The accelerated urbanization and population growth in Taraba State contribute significantly to increased emissions of greenhouse gases, particularly carbon dioxide (CO2) and methane (CH4) [13]. Taraba State vulnerability to climate change is exacerbated by its rich biodiversity and agricultural significance [13]Over recent decades, Jalingo as the capital of Taraba State has witnessed a surge in population growth and rapid urbanization, triggering concerns about the environmental ramifications. This phenomenon is

particularly evident in Taraba State, where the confluence of population growth and urbanization poses a substantial threat to local and regional climate dynamics as it also affect fishing trade.

It is following from here that this study deem it necessary to explore on population growth and urbanization as the influences of climate change and challenges to fishing in the coastal areas of Taraba State.

OBJECTIVES OF THE STUDY

The specific objective of the study is to determine how population growth and urbanization influence rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State.

Conceptual Clarification and Literature Review

Climate Change:

Climate change denotes enduring modifications in Earth's climate, encompassing prolonged shifts in temperature, precipitation patterns, and atmospheric conditions, primarily propelled by human activities. Climate change signifies substantial and lasting adjustments in Earth's climate, involving variations in temperature, precipitation, and other atmospheric conditions over extended periods [16]. Diverging from natural climate fluctuations, contemporary climate change is predominantly ascribed to human activities, especially the emission of greenhouse gases (GHGs). The principal catalyst for recent climate change is the escalation in anthropogenic greenhouse gas emissions. The combustion of fossil fuels for energy, deforestation, industrial processes, and agriculture emit carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) into the atmosphere, instigating a greenhouse effect that traps heat [16]. Human activities have markedly intensified this inherent greenhouse effect, leading to global warming. The elevation in global temperatures contributes to the dissolution of glaciers and polar ice caps, resulting in sea level rise [16] Instances of extreme weather, such as hurricanes, droughts, and heat waves, become more recurrent and intense, affecting agriculture, water resources, and infrastructure [16] The ramifications of climate change are multifaceted, including biodiversity loss, disruptions in food production, and heightened health risks [16]

Carbon Footprint:

Carbon footprint is a term used to describe the total amount of greenhouse gas emissions produced by an individual, organization, or country. Greenhouse gases, such as carbon dioxide and methane, are emitted as a result of activities like burning fossil fuels, deforestation, and farming. These gases trap heat in the atmosphere, causing the Earth's temperature to rise, which leads to climate change. By understanding and reducing our carbon footprint, we can help to protect our planet and ensure a more sustainable future.

Population Growth:

Population growth stands as a fundamental demographic phenomenon influencing the socio-economic dynamics of nations. Population growth denotes the increase in the number of individuals within a specified geographic area over a defined timeframe. This demographic occurrence is commonly

represented as a percentage, indicating the pace at which a population expands or contracts [6]. The factors contributing to population growth are diverse and encompass elements such as fertility rates, mortality rates, and migration patterns. Elevated fertility rates, particularly in regions with restricted access to family planning services, significantly contribute to population growth [5] Furthermore, advances in healthcare and sanitation, leading to reduced mortality rates, also play a role in population enlargement. Global population growth has demonstrated diverse trends over time. While certain regions continue to undergo rapid population expansion, others are in the midst of demographic transitions characterized by declining birth rates [29]. Notably, Africa has experienced substantial population growth, while certain developed countries are contending with slower growth or even population decline. Population growth carries profound implications for various facets of society, including resource utilization, environmental sustainability, and economic progress. Swift population growth can strain healthcare systems, educational infrastructure, and social services, posing challenges for societies [6] Moreover, it contributes to heightened demand for essential resources like food, water, and energy, impacting environmental dynamics.

Urbanization:

Urbanization involves the progressive concentration of human populations in urban areas, marked by city growth and expansion, along with the associated development of urban infrastructure and services [28] This phenomenon encompasses the migration of individuals from rural to urban settings. The inception of urbanization can be attributed to industrialization, technological progress, and shifts in economic structures. As societies transition from agrarian to industrial economies, there is a discernible shift in population distribution toward urban locales [19]. Key driving forces include economic opportunities, heightened living standards, and improved access to education and healthcare. Urbanization has undergone notable transformations over time, with diverse regions experiencing distinct rates and forms of urban growth. While certain areas witness swift urbanization due to industrial advancements, others may undergo a more gradual process influenced by factors like rural-to-urban migration and natural population growth [27] Urbanization presents societies with both opportunities and challenges. Cities become centers of economic vitality, innovation, and cultural exchange, but rapid urbanization can also give rise to issues such as insufficient infrastructure, housing shortages, and environmental degradation [3] Moreover, it poses challenges to social cohesion and equitable access to resources and services.

LITERATURE REVIEW

The Influence of Population Growth and Urbanization on Climate Change

Climate change as an undeniable global challenge is intricately connected to human activities, with population growth and urbanization emerging as significant contributors to this intricate phenomenon. As the global population continues to grow and cities expand, the environmental footprint intensifies, affecting the climate on both local and global scales. The consistent increase in the global population, projected to hit 9.7 billion by 2050 [29] amplifies the demand for resources and energy. As the population grows, so does the need for housing, transportation, and food production. These necessities often lead to

escalated consumption of fossil fuels, deforestation, and heightened industrial activities, resulting in increased emissions of greenhouse gases [18]. The connection between population growth and climate change becomes evident in the strain it puts on natural resources and the subsequent environmental consequences.

Simultaneously, rapid urbanization adds another layer to the climate change narrative. The United Nations predicts that over 68% of the world's population will reside in urban areas by 2050 [28], driving significant alterations in land use and infrastructure. Urban expansion often translates to increased energy demands, altered transportation patterns, and higher waste generation. The transformation of natural landscapes into urban areas disrupts ecosystems, reducing carbon sinks and exacerbating the urban heat island effect [24]. This transformation significantly contributes to the alteration of regional and global climate patterns.

The combined impact of population growth and urbanization is particularly pronounced in cities. Urban areas, characterized by high population density and concentrated economic activities, become hotspots for energy consumption and greenhouse gas emissions. The concentration of people, industries, and transportation networks amplifies pollution and elevates the vulnerability of urban populations to climate-related hazards [23]. Rising temperatures, extreme weather events, and increased air pollution become inherent challenges, directly affecting the health and well-being of urban dwellers. Sustainable urban planning, the promotion of renewable energy sources, and the implementation of eco-friendly technologies are crucial steps toward mitigating the environmental impact of urbanization [3] Additionally, empowering communities to adopt resilient practices and raising awareness about the environmental consequences of population growth can contribute to sustainable development [12].

Nigeria, the most populous country in Africa, has witnessed substantial population growth and swift urbanization in recent years. While these trends signal societal progress, they also contribute significantly to climate change. Nigeria's population has surged in recent decades, surpassing 200 million people as of 2022 [30]. The annual population growth rate, averaging around 2.6%, places immense strain on the environment as more people require resources such as food, water, and energy [30]. The resultant increase in agricultural activities, deforestation, and exploitation of natural resources to meet the expanding population's demands contribute to greenhouse gas emissions, intensifying climate change [8].

Urbanization, characterized by the migration of people from rural to urban areas, has become a prominent trend in Nigeria. The urban population has burgeoned rapidly, with Lagos ranking among the world's fastest-growing cities [30] The expansion of urban areas results in heightened energy consumption, infrastructure development, and industrial activities, all of which contribute to carbon emissions and environmental degradation [20]. The concentration of industries and transportation hubs in urban centers further amplifies the environmental impact. The rapid urbanization and population growth in Nigeria have led to a surge in energy demand, primarily from fossil fuels. The utilization of coal, oil, and gas for electricity generation, transportation, and industrial processes significantly contributes to carbon dioxide emissions [14]. The insufficient infrastructure for renewable energy sources and reliance on conventional energy sources exacerbate the carbon footprint of urban areas, making them major contributors to climate change.

Population growth drives deforestation as more land is cleared for agriculture, settlements, and infrastructure development. This has severe consequences for the environment, as trees play a vital role in absorbing carbon dioxide and maintaining ecological balance [9]. The reduction in forest cover leads to increased greenhouse gas emissions and disrupts local ecosystems, further contributing to climate change. Tackling the interconnected challenges of population growth, urbanization, and climate change in Nigeria necessitates comprehensive strategies. Investments in sustainable urban planning, promotion of renewable energy sources, and implementation of policies to curb deforestation are essential steps [21]. Additionally, family planning programs to manage population growth, coupled with education on sustainable practices, can help alleviate the environmental impact of rapid urbanization and population growth.

Challenges of Fishing in Coastal Areas as a Result of Population Shift

Coastal regions are vital ecosystems that support a multitude of life forms and serve as the lifeblood for numerous communities engaged in fishing activities. However, these areas are faced with various challenges that significantly impact the fishing industry resulting from an escalating demand for seafood, advancements in fishing technologies, and inadequate fisheries management. The depletion of fish stocks, caused by excessive harvesting, disrupts marine ecosystems' equilibrium and jeopardizes the long-term sustainability of coastal fisheries [22]. Essential breeding and feeding grounds for marine species, such as mangroves, seagrasses, and coral reefs, face threats from human activities like coastal development, pollution, and climate change [17]. The deterioration of these habitats diminishes fishery productivity, contributing to the decline of fish populations.

Coastal fisheries encounter significant challenges due to climate change. Elevated sea temperatures, ocean acidification, and extreme weather events directly impact fish populations, altering their distribution and abundance [7]. These shifts disrupt established fishing patterns, affecting the livelihoods of coastal communities dependent on specific species. Coastal areas are susceptible to pollution stemming from industrial discharges, agricultural runoff, and plastic waste. Pollutants contaminate water, degrade habitats, and pose risks to fish populations, resulting in diminished fishery yields and threatening the well-being of marine life and human populations [11] Ineffective regulations and enforcement in coastal fisheries exacerbate industry challenges. Illegal, unreported, and unregulated (IUU) fishing activities contribute to overfishing, jeopardize biodiversity, and undermine efforts to manage and conserve marine resources [25].

Coastal fishing communities heavily rely on fish stocks for their livelihoods. The depletion of fish populations, caused by overfishing and habitat degradation, leads to economic hardships, food insecurity, and increased vulnerability to poverty for those depending on coastal fisheries [2]. Addressing challenges in coastal fishing necessitates a holistic approach integrating effective fisheries management, conservation strategies, and international collaboration. Sustainable practices, improved regulations, and community engagement are imperative to safeguard the ecological balance of coastal ecosystems and ensure the enduring viability of coastal fisheries. By confronting these challenges, we can strive towards a more resilient and sustainable future for both marine ecosystems and the communities they support.

Theoretical Base

Urban Heat Island (UHI) Effect:

The UHI effect is a well-established theory that describes how urbanization and population growth contribute to climate change within urban settings. This phenomenon is characterized by cities experiencing higher temperatures than their surrounding rural areas due to various factors (Oke, 1982). The UHI effect is primarily driven by altered land use patterns as urbanization progresses, leading to the replacement of natural landscapes with heat-absorbing surfaces like concrete and asphalt. The subsequent rise in temperature is exacerbated by increased energy consumption associated with urban population growth. The demand for electricity, heating, and cooling escalates, resulting in higher greenhouse gas emissions that contribute to both local and global warming (Rizwan et al., 2008). Furthermore, reduced green spaces, which are a consequence of urbanization, result in the loss of shading and evapotranspiration functions performed by vegetation, further intensifying local temperature increases (Arnfield, 2003).

Additionally, the higher density of structures and increased vehicular traffic in urban areas contribute to heat trapping and emissions of greenhouse gases (Streutker, 2003). This not only exacerbates the UHI effect but also has adverse consequences for air quality, energy consumption, and public health (Oke, 1982). To mitigate the UHI effect, strategies such as the incorporation of green spaces, the use of cool roofs, and improved urban planning to reduce heat-retaining surfaces have been recommended (Akbari et al., 2001).

Application of the Theory to the Study

The Urban Heat Island (UHI) effect describes the circumstance where urban areas exhibit higher temperatures compared to their surrounding rural counterparts due to human activities and modifications to the natural environment. UHI contributors include the prevalence of impermeable surfaces, diminished green spaces, and increased human-induced heat sources linked to urbanization.

Jalingo has experienced notable population growth and rapid urbanization recently. The influx of people, fueled by factors such as migration from rural areas and natural population growth, has led to the expansion of the city and heightened demands for infrastructure, housing, and services. Urbanization in Jalingo is marked by the establishment of commercial and residential zones, resulting in changes to land cover and an increase in impermeable surfaces. The urbanization process in Jalingo has substantially contributed to the UHI effect. The proliferation of structures, roads, and asphalt surfaces has replaced natural vegetation, diminishing the city's capacity to absorb and release heat. Additionally, heightened human activities and energy consumption, characteristic of urban settings, lead to elevated temperatures. The cumulative impact of these factors exacerbates the UHI effect in Jalingo, contributing to localized climate changes. The UHI effect, influenced by population growth and urbanization in Jalingo Metropolis, holds broader implications for climate change. Elevated temperatures can amplify heat waves, affect public health, and strain energy demand. Addressing the UHI effect becomes crucial in mitigating the overall impact of climate change in Jalingo. Mitigating the UHI effect in Jalingo necessitates a

comprehensive approach. The implementation of green infrastructure, such as parks and green roofs, can enhance the city's ability to absorb heat and reduce surface temperatures

Environmental Kuznets Curve (EKC) Theory

The EKC theory offers a framework for understanding how population growth and urbanization influence climate change, particularly in the context of economic development. This theory posits that there is an evolving relationship between economic growth and environmental degradation (Grossman & Krueger, 1995). In the initial stages of economic development marked by population growth and urbanization, environmental degradation tends to increase. This is attributed to limited environmental regulations, higher resource consumption, and pollution (Stern, 2004). As countries progress economically, they start to invest in environmental protection measures and cleaner technologies while urbanization continues. During this stage, emissions and pollution may stabilize or even decrease (Grossman & Krueger, 1995).

In advanced stages of economic development, characterized by higher income levels, emissions and pollution tend to decline significantly (Stern, 2004). This shift is attributed to technological advancements, increased adoption of cleaner energy sources, and environmental policies (Kuznets, 1955).

The application of the EKC theory necessitates the implementation of policies and practices that promote sustainable urban development, energy efficiency, and the adoption of clean technologies, particularly during the early stages of urbanization, to facilitate a more rapid transition to the later, more sustainable phases of the EKC (Grossman & Krueger, 1995).

Application of the Theory to the Study

The Environmental Kuznets Curve (EKC) theory proposes that as economies progress, environmental degradation intensifies, but beyond a certain income level, there is a reversal, leading to an improvement in environmental quality. Applying this theory to population growth, urbanization, and climate change in Jalingo Metropolis unveils the evolving environmental impact of economic development. Jalingo has undergone notable population growth and rapid urbanization in recent times. As the population becomes denser, coupled with urban expansion, the demand for resources and energy surges, potentially contributing to climate change.

During the initial stages of development in Jalingo Metropolis, population growth may lead to heightened resource consumption, deforestation, and increased emissions, resulting in a rise in greenhouse gases. This corresponds to the ascending arm of the EKC curve, indicating a positive correlation between population growth and environmental degradation. The urbanization process in Jalingo, characterized by infrastructure development and industrialization, may initially exacerbate environmental stress. Increased energy consumption, elevated emissions, and alterations in land use linked to urbanization may contribute to a deterioration in environmental quality. This aligns with the early phase of the EKC, where urbanization is associated with heightened environmental pressure. According to the EKC theory, there exists a turning point where economic development leads to a decline in environmental degradation. In the case of Jalingo Metropolis, reaching this turning point may involve adopting sustainable urban planning, embracing cleaner technologies, and promoting green initiatives. As the city progresses

economically, there is an opportunity to transition towards more eco-friendly practices, mitigating the environmental impact of population growth and urbanization.

Applying the Environmental Kuznets Curve (EKC) theory to Jalingo Metropolis sheds light on the evolving dynamics of population growth, urbanization, and climate change. Acknowledging the initial environmental challenges associated with development lays the groundwork for implementing proactive mitigation strategies. Sustainable policies and practices, aligned with the turning point indicated by the EKC, can pave the way for a more harmonious relationship between economic growth and environmental preservation in Jalingo Metropolis.

METHODOLOGY

The study adopted a cross-sectional survey design. The rationale for the adoption of this research design was because it enabled the researcher to generate useful data within a short period of time from a sample and as well generalize the research result to the entire study's population. To fully capture the issues in this research work, a methodological triangulation of both primary and secondary methods of data collection, analysis and interpretation were adopted for the holistic capturing of the research issues. Which provide an in-depth understanding on the Demographic factors influencing climate change and fishing challenges in the coastal areas of Jalingo, Taraba State. The study's population comprised all the occupants of the research universe. A multistage sampling technique was adopted. Cluster sampling technique was used to divide the study universe into eleven (11) clusters. Each of the areas was fairly represented in the study. To establish a fair representation, the population distribution of each of the areas was carried out to draw proportional sample out of the 400 samples drawn for the study via Taro Yamane's formula from the total population of 581,000 based on the estimated population projection of the study area as of November, 2022. Two-Way ANOVA was adopted as the statistical tool to test the independent and the dependent variables. The reason for the adoption of this statistical tool was because it dealt with two independent variables and one dependent variable.

RESULTS

Data Presentation, Analysis and Discussion

A total number of 400 copies of questionnaire were administered. However, only 390 copies of the questionnaire were completed and returned. Based on the aforesaid, the analysis was based on the 390 respondents.

Socio-Demographic Characteristics of Respondents

Table 1: Socio-Demographic Characteristics of the Respondents

Age	Frequency	Percentage
18-25	50	13%

26-32	70	18%
33-40	150	38%
41-46	40	10%
47-50	60	15%
51 and above	20	5%
Total	390	100%
Gender		
Male	245	63%
Female	145	37%
Others	0	0
Total	390	100
Religion		
Christian	276	71%
Muslim	114	29%
Total	390	100
Educational Qualification		
No formal education	45	12%
First school leaving certificate	55	14%
Senior Secondary School certificate	100	26%
National Diploma/ NCE	50	13%
Higher National Diploma/ B.Sc Degree	130	33%
M.sc/ PhD	10	2%
Total	390	100%
Marital Status		
Single	12	3%
Married	270	69%
Divorced	45	12%
Widow/widower	63	16%
Total	390	100%
Occupation		
Student	20	5
Civil servant	70	19
Trader/business	120	30
Farmer	110	28
Artisan	44	11
Unemployed	26	7
Total	390	100%

Source: Field Survey, 2023

Table 1 above, indicated that 50 respondents representing (13%) of the study's population age were between the ages of 18-25, 70 respondents representing (18%) of the research population were between the ages of 26-32, 150 respondents representing (38%) of the study's population were between the ages of 33-40, 40 respondents representing (10%) of the respondents were between the ages of 41-46, 60 respondents representing (15%) of the study's population were between the ages of 47-50, 20 respondents representing (5%) of the respondents were between the ages of 51 and above.

On the gender of the respondents, 245 respondents representing (63%) of the research population were male, 145 respondents representing (37%) were female. On the religion of the respondents, 276 respondents representing (71%) of the research population were Christian, 114 respondents representing (29%) were Muslims. On the educational qualification of the respondents, 45 respondents representing (12%) of the research population has no formal education, 55 respondents representing (14%) of the research population were First School Leaving Certificate Holders, 100 respondents representing (26%) of the research population were Senior Secondary School Certificate Holders, 50 respondents representing (13%) of the research population were National Diploma/ National Certificate in Education Holders, 130 respondents representing (33%) of the research population were B.sc Degree Holders/ Higher National Diploma Holders while 10 respondents representing (2%) of the research population were Masters/ PhD holders.

On the Marital Status of the respondents, 12 respondents representing (3%) of the research population were single, 270 respondents representing (69%) of the research population were married, 45 respondents representing (12%) of the research population were divorced while 63 respondents representing (16%) of the research population were widowed/widower. On the occupation of the respondents, 20 respondents representing (5%) of the research population were students, 70 respondents representing (19%) of the population were civil servants, 120 respondents representing (30%) of the population were traders, 110 respondents representing (28%) of the population were farmers, 44 respondents representing (11%) of the occupants of Jalingo Metropolis were artisan, 26 respondents representing (7%) of the study's population were unemployed.

Data Presentation and Analysis

This section of the study examined the influence of population growth and urbanization on climate change as it affect fishing activities in the riverine areas in Jalingo, Taraba State, Nigeria. The cutoff point of the mean value was 3.50. Therefore, the mean value of 3.50 and above indicated acceptance, while the mean value that is less than 3.50 indicated rejection. The study responses which indicated that more people which means more energy consumption leads to greenhouse gas emission and fishing challenges in the riverine areas in Jalingo, Taraba State has the mean value of 4.39, Population growth and urbanization as it affect the rise of carbon footprint and temperatures in Jalingo coastal areas of Taraba State, increases land-based pollution, such as agricultural runoff and sewage, which also impact the health of coastal ecosystems and make them less able to support fisheries has the mean value of 4.41, A decline in the number and variety of fish species due to climate change or warmer coastal temperatures, leads to a decrease in the catch for fishers in Jalingo coastal areas of Taraba State has the mean value of 3.73,

Population growth and urbanization in Jalingo Metropolis exacerbates the effects of climate change, making it more difficult for people to adapt to changing conditions, which also causes the shifts in fish distribution and migratory patterns, that makes it more difficult for fishers to find and catch fishhas the mean value of 3.81, Jalingo, Taraba State is densely populated and urbanized, meaning they require more energy for heating, cooling, and transportation which can leads to higher greenhouse emissions has the mean value of 4.39, Increased waters temperatures, acidification, and extreme weather events directly impact fish populations, altering their distribution and abundance in Jalingo coastal areas of Taraba State has the mean value of 4.43, while the statement that says Climate change as a result of population growth and urbanization causes increased incidence of disease and mortality among fish, leading to a decrease in the number of fish available for consumption and trade has the mean value of 3.57. Above all, the study revealed that population growth and urbanization were responsible for the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State. The result is indicated in the table below:

Table 2. Ratings on the influence of population growth and urbanization on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	X	STD
More people which means more energy consumption leads to greenhouse gas emission and fishing challenges in the riverine areas in Jalingo, Taraba State.	162	174	11	28	25	4.39	.548
Population growth and urbanization as it affect the rise of carbon footprint and temperatures in Jalingo coastal areas of Taraba State, increases land-based pollution, such as agricultural runoff and sewage, which also impact the health of coastal ecosystems and make them less able to support fisheries.	206	154	-	24	16	4.41	.491
A decline in the number and variety of fish species due to climate change or warmer coastal temperatures, leads to a decrease in the catch for fishers in Jalingo coastal areas of Taraba State.	198	174	3	18	7	3.73	1.178
Population growth and urbanization in Jalingo Metropolis exacerbates the effects of climate change, making it more difficult for people to adapt to changing conditions, which also causes the	183	162	-	33	22	3.81	.979

shifts in fish distribution and migratory patterns, that makes it more difficult for fishers to find and catch fish.							
Jalingo, Taraba State is densely populated and urbanized, meaning they require more energy for heating, cooling, and transportation which can leads to higher greenhouse emissions.	162	174	11	28	25	4.39	.548
Increased waters temperatures, acidification, and extreme weather events directly impact fish populations, altering their distribution and abundance in Jalingo coastal areas of Taraba State.	210	156	-	21	13	4.43	.495
Climate change as a result of population growth and urbanization causes increased incidence of disease and mortality among fish, leading to a decrease in the number of fish available for consumption and trade.	190	170	11	18	11	3.57	1.178

Source: Field Survey, 2023

Findings from the table above indicated that all the indicators of population growth and urbanization were accepted with the mean scores of above the cutoff point of 3.50 and the standard deviation ranged from 0.491 and 1.178. This implied that the variables were closely linked.

Hypothesis: Population growth and urbanization have no significant influence on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State, Nigeria

Table 3: ANOVA Test on the influence of population growth and urbanization on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State.

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	159.919	4	39.980	58.323	.000
Residual	105.565	154	.685		
Total	265.484	158			

Source: Field Work, 2023

Table 3 above revealed that Analysis of Variance (ANOVA) was used to ascertain the influence of population growth on climate change in Jalingo, Taraba State. After the analysis, the result revealed the sum of squares of the regression and residual as 159.919 and 105.565 respectively with the P-value of 0.000 which is less than 0.05 at 4 degree of freedom. This means that the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State. Therefore, the researchers reject the null hypothesis that read; “Population growth and urbanization have no significant influence on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State, Nigeria” and accept the alternate hypothesis that read; “Population growth and urbanization have significant influence on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State, Nigeria”.

In sum, the results of the ANOVA test indicated that there is a statistically significant influence of population growth and urbanization on the rise of carbon footprint and temperatures as they affect fishing trade in Jalingo, Taraba State. The "Regression" statistics indicate that population growth and urbanization explains a significant portion of the variance in climate change in Jalingo Taraba State. The large F-value and the associated p-value both support the conclusion that there is a meaningful significant relationship between population growth and urbanization with fishing trade as a result of the rise of carbon footprint and temperatures. This implied that as temperatures increase, the window of time when fish are in good condition and abundant enough to harvest is reduced. This leads to a decrease in revenue for fishers and a corresponding reduction in the local economy in Taraba State

The findings of this study is in line with [7] who asserted that elevated sea temperatures, ocean acidification, and extreme weather events directly impact fish populations, altering their distribution and abundance [7] These shifts disrupt established fishing patterns, affecting the livelihoods of coastal communities dependent on specific species. Coastal areas are susceptible to pollution stemming from industrial discharges, agricultural runoff, and plastic waste. Pollutants contaminate water, degrade habitats, and pose risks to fish populations, resulting in diminished fishery yields and threatening the well-being of marine life and human populations [11] While [25] corroborated that ineffective regulations and enforcement in coastal fisheries exacerbate industry challenges. Illegal, unreported, and unregulated (IUU) fishing activities contribute to overfishing, jeopardize biodiversity, and undermine efforts to manage and conserve marine resources. [2] revealed that coastal fishing communities heavily rely on fish stocks for their livelihoods. The depletion of fish populations, caused by overfishing and habitat degradation, leads to economic hardships, food insecurity, and increased vulnerability to poverty for those depending on coastal fisheries. [23] stated that urban areas are characterized by high population density and concentrated economic activities, become hotspots for energy consumption and greenhouse gas emissions. The concentration of people, industries, and transportation networks amplifies pollution and elevates the vulnerability of urban populations to climate-related hazards. Rising temperatures, extreme weather events, and increased air pollution become inherent challenges, directly affecting the health and well-being of urban dwellers. The study is also in consonant with the work of [8], which revealed that the resultant increase in agricultural activities, deforestation, and exploitation of natural resources to meet the expanding population's demands contribute to greenhouse gas emissions, intensifying climate change [8] The expansion of urban areas results in heightened energy consumption, infrastructure development, and

industrial activities, all of which contribute to carbon emissions and environmental degradation [20]. The concentration of industries and transportation hubs in urban centers further amplifies the environmental impact. The rapid urbanization and population growth in Nigeria have led to a surge in energy demand, primarily from fossil fuels.

The utilization of coal, oil, and gas for electricity generation, transportation, and industrial processes significantly contributes to carbon dioxide emissions [14].The insufficient infrastructure for renewable energy sources and reliance on conventional energy sources exacerbate the carbon footprint of urban areas, making them major contributors to climate change. [9] reiterates that population growth drives deforestation as more land is cleared for agriculture, settlements, and infrastructure development. This has severe consequences for the environment, as trees play a vital role in absorbing carbon dioxide and maintaining ecological balance. The reduction in forest cover leads to increased greenhouse gas emissions and disrupts local ecosystems, further contributing to climate change.

CONCLUSIONS AND RECOMMENDATIONS

Population growth and urbanization in Nigeria are undeniably concomitant to the escalating challenges of climate change. The impacts manifest through heightened energy demand, deforestation, and greenhouse gas emissions. The study's findings revealed the sum of squares of the regression and residual as 159.919 and 105.565 respectively with the P-value of 0.000 which is less than 0.05 at 4 degree of freedom. This implied that population growth and urbanization have significant influence on the rise of carbon footprint temperatures as they affect fishing trade in Jalingo, Taraba State. To foster a sustainable future, Nigeria must adopt a holistic approach that integrates population management, urban planning, and environmentally friendly policies. The intricate relationship between population growth, urbanization, and climate change underscores the urgency for global cooperation in adopting sustainable practices. Balancing the needs of a growing population with environmental stewardship is paramount to ensuring a habitable planet for future generations.

Based on the findings of the study, it is recommended that there should be promotion of sustainable fishing practices that take into account the effects of temperature rise and population growth. This could involve setting quotas for fish catch, establishing no-take zones to allow fish population to recover, and creating incentives for fishers to adopt sustainable methods.

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