

Climate Change Impacts on Coastal Communities: Implications on fishing communities in the Niger Delta, Nigeria

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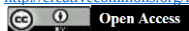
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ABSTRACT

The impacts of climate change are global, yet it varies across region, states and sectors and differs between upland and coastal communities. This underscores the need to evaluate the impacts of climate change in different locations to identify specific effects on environmental, social and economy security of communities as this would help to raise awareness and facilitate suitable sustainable adaptation and mitigation measures to curb the prevailing climate impacts. However, research indicates that there is paucity of studies on assessment of climate change impacts on vulnerable fishing communities in coastal areas in the oil rich Niger Delta region, Nigeria. The aim of this study was to examine the implications of climate change impacts on the livelihoods of fishing communities in Southern Ijaw Local Government Area of Bayelsa state, Niger Delta region, Nigeria. The study used survey research design. Primary data of 384 samples were obtained from four major coastal communities in the study area using structured questionnaires. The communities include Koluama I, Koluama II, Furupa and Ezetu. The data were analyzed using both descriptive and inferential statistical techniques with the support of Microsoft Excel and the Statistical Package for Social Sciences (SPSS). The result shows low awareness and low capacity on climate change adaptation and absence of climate change mitigation measures in the communities. It equally shows that climate change is a threat to food security and livelihoods of fishing communities in the study area but not statistically significant from a location-based perspective which may be due to the study limitations. The study concludes that fishing communities in Southern Ijaw and by extension the Niger Delta are facing profound threats from climate change which have led to substantial declines in fish catch and income, posing a direct threat to the economic stability, food security, and overall well-being of communities.

1. Introduction

Climate change has been increasingly recognized as a global threat with severe impacts on human lives, settlements, ecosystems, biodiversity and livelihoods, particularly in vulnerable coastal areas such as the flat and low land Niger Delta region. For instance, over the years, large population of people living in the coastal areas of the Niger Delta have continue to experience rising sea level, increasing temperatures, changes in precipitation patterns, erosions and other extreme weather events with disastrous effects on aquatic ecosystems and fisher folks (Odubo, 2023). In Nigeria's oil rich Niger Delta region, particularly in Southern Ijaw Local Government Area (LGA) of Bayelsa state, these impacts are very pronounced in coastal and riverine communities that depend on fishing for survival and livelihoods with studies reporting severe disruptions to aquatic ecosystems due to climate-induced changes. Strong wind and storm surge in the area increased risks of accidents at sea and disrupt fishing activities by damage fishing gear leading to lower catches (Okonkwo & Ebinne, 2020). These environmental changes not only threaten the immediate economic stability of traditional fishers but also jeopardize their long-

term sustainability of fishing as a viable livelihood especially in the Southern Ijaw Local Government Area of Bayelsa state that shares boundaries with the Atlantic Ocean including Furupa, Agge, Kolouama communities. These situations have exacerbated poverty, food insecurity, human migration and social vices in the area. Compounding these challenges is the potential lack of awareness and understanding of climate change among fisher folk, which limit their ability to effectively adapt and mitigate it where possible. Without adequate knowledge of climate change and its effects, fishers may struggle to recognize the broader context of the environmental changes they experience, potentially relying on short-term coping mechanisms rather than sustainable adaptation strategies, a trend observed in other coastal communities in Bayelsa state which is the most deltaic state in Nigeria. Furthermore, some local studies in Nigeria indicate that low climate literacy among fishers often leads to ineffective responses to environmental changes, increasing their vulnerability (Oyebola et al., 2018). Furthermore, the specific climate-related challenges, such as flooding, reduced fish stocks, and poor water quality, may disrupt fishing activities to varying degrees, necessitating a deeper understanding of their frequency, severity, and impacts on fishers' operations (Oduniyi & Tekana, 2019).

While some fishers may have adopted adaptation strategies, such as changing fishing schedules or diversifying livelihoods, the effectiveness of these measures remains uncertain, particularly in the face of intensifying climate impacts (Okafor-Yarwood, 2020). Many adaptation strategies in coastal communities in the Niger Delta are temporary and lack support needed to ensure sustainability, leaving fishers vulnerable to ongoing climate stressors. Moreover, the lack of access to climate change information and resources for alternative livelihoods further limits fishers' adaptive capacity. The paucity of comprehensive studies on the effectiveness of these strategies in Southern Ijaw LGA highlights a critical gap in understanding how fishers can build resilience through sustainable practices, particularly in a region where climate change impacts are compounded by other environmental issues like oil spill pollution and gas flaring by multinational oil companies. This study aims to address these gaps by examining how climate change affects the livelihoods of fishing communities, assessing their level of awareness and understanding of climate change, identifying the key climate-related challenges disrupting fishing activities, and evaluating the effectiveness of current adaptation strategies and recommend sustainable adaptation practices.

1.2 Study Aim and Objectives

The specific objective of this study is to examine how climate change affects the livelihoods of fishing communities in Southern Ijaw Local Government Area of Bayelsa state. The objectives of this study include assessing the level of awareness of climate change among fishing folks in the study area, identifying key climate-related challenges disrupting fishing activities in Southern Ijaw area and evaluating the effectiveness of current adaptation strategies and recommending more sustainable options for the fishing communities.

1.3 Geographical location of study area

Southern Ijaw Local Government Area (LGA) is one of the eight LGAs in Bayelsa State, located in the south-south geopolitical zone of Nigeria. It lies within latitudes 4°07'N and 4°42'N and longitudes 5°58'E and 5°97'E (Ejenma et al. 2014). The headquarters is in Oporoma community, situated in the northern part of the LGA. The area covers approximately 2,682 km² and has a population projected at 479,000 as of 2022, based on a 2.5% annual growth rate from the 2006 national population census (Odubo, 2023). Southern Ijaw stretches across the banks of the Nun River, Sagbama and Egbedi creeks, and extends to the Apoi creek and the Atlantic Ocean, with a coastline of about 60 km along the Bight

of Benin (Ejenma et al. 2014). Data were collected in four major communities in Southern Ijaw LGA which were Koluama 1, Koluama 2, Furupa and Ezetu.

1.4 Climate, Soil, and Vegetation

The area has a tropical rainforest climate with two distinct seasons, wet and dry. The rainy season lasts for about seven months, from April to October, while the dry season is between November to March, with a brief dry spell in August (Nwankwoala & Hart, 2023). The region experiences high rainfall, with an annual average of about 4,500 mm, 85% of which falls during the rainy season (Nwankwoala & Omemu, 2019). Temperatures range between 25°C and 32°C. The vegetation in Southern Ijaw is originally rainforest with alluvial soil but has been degraded by human activities such as farming, bush burning, construction, and illegal crude oil refining and oil spills and gas flaring by multinational oil companies. The landscape is dominated by evergreen trees, including oil palm trees and a variety of shrubs.

2.0 Research methodology

This study employed a survey research design, utilizing structured questionnaires to collect data from fishing folks in Southern Ijaw LGA, Bayelsa State. This approach will enable the collection of quantitative data, which will be analyzed to identify patterns and trends. Survey research design is suitable for this study as it allows for the collection of data from a large sample size, increasing the generalizability of the findings.

2.1 Sample Size

Since the actual population of the selected communities is unknown, the sample size for the study was determined using the Cochran formula, which is suitable for large or unknown populations. The required minimum sample size is approximately 384 respondents. This sample was distributed proportionally among the four selected communities.

2.2 Research Instrument

This study employed a structured questionnaire as the primary research instrument. The questionnaire consisted of closed-ended questions aimed at generating quantifiable data. It was carefully designed to collect relevant information on the socio-demographic characteristics of respondents, their awareness and perception of climate change, the impacts of climate change on fishing activities, and the adaptation strategies currently being used by fishing folks. The use of closed-ended questions will support uniformity in responses and enhance the ease of data analysis and interpretation.

2.3 Method of Data Analysis

The data collected from the questionnaire was analyzed using both descriptive and inferential statistical techniques with the support of Microsoft Excel and the Statistical Package for Social Sciences (SPSS). Descriptive statistics such as frequencies, percentages, means, and standard deviations was employed to summarize the socio-demographic characteristics of respondents, their level of awareness and perception of climate change, the perceived impacts on fishing activities, and the adaptation strategies adopted. Inferential statistics, including regression and correlation analyses, was applied to test the research hypotheses and explore relationships between key variables.

3. 0 Results and discussion

3.1 Socio-Demographic Characteristics of Respondents

Across all communities, males represented the majority of respondents. The highest male representation was in Koluama 2 (71.1%), while the lowest was in Furupa (65%). The average male participation across the four communities stood at 67.85%, compared to 32.15% for females. This

suggests a noticeable gender imbalance in favor of male respondents, possibly reflecting social or cultural dynamics influencing participation. The data on age brackets showed that across all communities, the age group 36–45 years was the highest, averaging 25.85%. This was followed closely by the 46–55 age group (23.55%) and the 26–35 bracket (19.93%). The 56–69 age group also had a significant presence (16.78%), while the youngest group (18–25) made up just 6.2% of respondents. The 70 and above category was the least represented, averaging 7.7%.

Table 3.1: Sex and Age Distribution of Respondents

	Koluama 1	Koluama 2	Furupa	Ezetu	Average
Sex of respondents					
Male	68.20%	71.10%	65%	67%	67.85%
Female	31.80%	28.90%	35%	33%	32.15%
Total	100.00%	100.00%	100%	100%	100.00%
Respondents Age Bracket					
18–25	7.10%	5.60%	5%	7%	6.20%
26–35	21.20%	22.20%	18%	19%	19.93%
36–45	24.70%	27.80%	25%	26%	25.85%
46–55	23.50%	23.30%	25%	22%	23.55%
56–69	17.60%	14.40%	18%	18%	16.78%
70 and above	5.90%	6.70%	10%	8%	7.70%
Total	100.00%	100.00%	100%	100%	100.00%

Source: Author’s Fieldwork, 2024.

3.2. Educational Qualification of respondents

Table 3.2 highlights the educational qualifications of respondents across the various communities. The data showed that majority of respondents held secondary school certificates, with an average of 31.7% across the four communities. Koluama 2 had the highest percentage in this category (33.3%), indicating a relatively strong base of basic formal education. Primary education followed, averaging 25.78%, showing that over a quarter of the respondents had only completed basic schooling. Koluama 1 and Koluama 2 had nearly identical figures in this category, both above 28%, suggesting some consistency in foundational education levels. A notable portion of respondents had no formal education, averaging 24.9%. Furupa recorded the highest proportion in this category (31%), which might reflect limited access to schooling in that area. Respondents with vocational or technical education were fewer, with a consistent but low average of 7.08%. Tertiary education was similarly underrepresented, with an average of just 10.58%.

Table 3.2 Educational Qualification of respondents

Educational Qualification	Koluama 1	Koluama 2	Furupa	Ezetu	Average
No formal education	23.50%	18.90%	31%	26%	24.90%
Primary School Certificate	28.20%	28.90%	23%	24%	25.78%
Secondary School Certificate	30.60%	33.30%	30%	33%	31.70%
Vocational/Technical School	7.10%	7.80%	6%	7%	7.08%
Tertiary Education	10.60%	11.10%	10%	11%	10.58%
Total	100.00%	100.00%	100%	100%	100.00%

Source: Author’s Fieldwork, 2024.

3.3 Respondent Years in Fishing

Fig.3.1 shows the number of years fishers have been engaged in fishing in the various communities. The data reveal that the majority of respondents have over 20 years of experience, averaging 39.65%, with Koluama 2 at 41% and Furupa at 36%. Those with 11–20 years of experience account for 30% on average, while the 5–10 years category ranges from 19% in Ezetu to 24% in Furupa, averaging 22.10%. Fishers with less than 5 years of experience are the smallest group, averaging 8.28%, with Furupa at 10% and Koluama 1 at 8.20%.

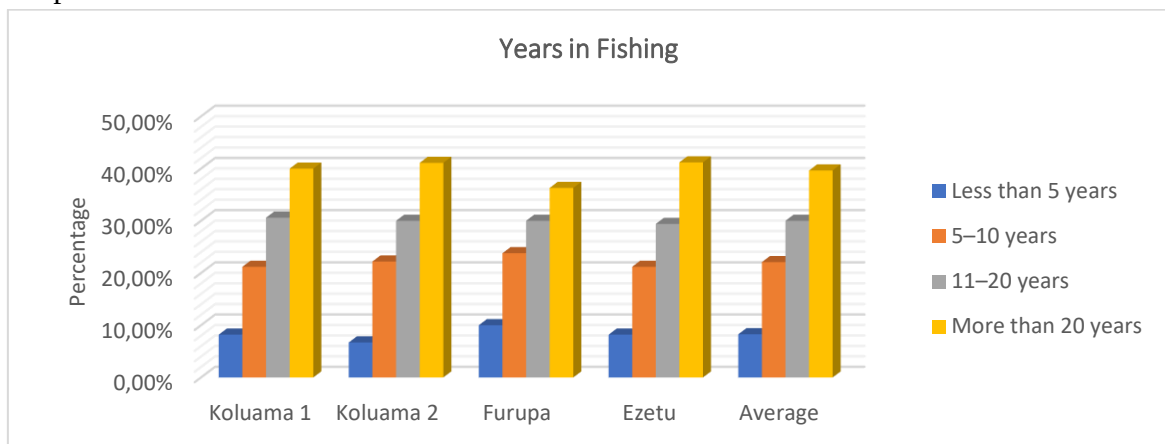


Fig. 3.1: Respondents years of fishing.

Source: Author's Fieldwork, 2024.

3.4 Respondents' Primary Source of Income

Fig. 3.2 highlights the primary sources of income for fishers across various communities. The data indicate that fishing is the dominant source, averaging 64.08%, with Koluama 1 at 64.70% and Ezetu at 62%. Farming ranks second, averaging 11.45%, ranging from 9% in Ezetu to 13% in Furupa. Trading averages 10.65% with Furupa at 13% and Koluama 2 at 8.90%. Business/contractor activities average 7.08%, while civil service and other sources are minimal, averaging 4.15% and 2.63%, respectively.

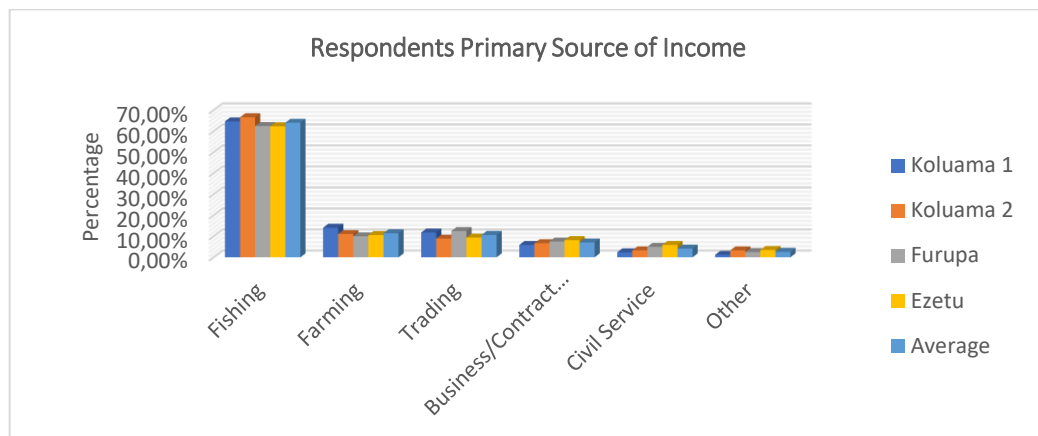


Fig.3.2: Respondents' Primary Source of Income.

Source: Author's Fieldwork, 2024.

3.5 Climate Change Affects the Livelihoods

Table 3.3: Impact of Climate Change on Respondents' Livelihoods

Observation of Changes in Weather/Environmental Conditions	Koluama 1	Koluama 2	Furupa	Ezetu	Average
Yes	88.20%	91.10%	88%	91%	89.35%
No	11.80%	8.90%	13%	9%	10.65%
Total	100.00%	100.00%	100%	100%	100.00%
Environmental Changes Observed					
Increased rainfall	17.71%	17.39%	17.47%	17.36%	17.48%
Flooding	16.41%	15.94%	16.13%	15.89%	16.09%
Sea-level rise	14.06%	14.73%	14.78%	14.43%	14.50%
Saltwater intrusion	10.94%	11.35%	11.02%	11.00%	11.08%
Drought	7.03%	7.73%	7.53%	7.33%	7.41%
Temperature increase	18.23%	17.87%	18.28%	17.60%	18.00%
Unpredictable weather patterns	15.63%	14.98%	14.78%	16.38%	15.44%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Impact on Fishing Activities					
No effect	11.80%	13.30%	17.50%	15.30%	14.48%
Slight effect	35.30%	38.90%	33.75%	36.50%	36.11%
Moderate effect	40.00%	36.70%	35.00%	36.50%	37.05%
Severe effect	12.90%	11.10%	13.75%	11.80%	12.39%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Reduction in Fish Catch					
Yes	70.60%	64.40%	68%	74%	69.15%
No	29.40%	35.60%	33%	26%	30.85%
Total	100.00%	100.00%	100%	100%	100.00%
Causes of Reduced Fish Catch					
Climate change	36.92%	40.62%	39%	39%	38.69%
Overfishing	23.08%	24.48%	24%	24%	23.82%
Water pollution	19.49%	18.75%	19%	20%	19.34%
Government fishing restrictions	12.82%	10.94%	13%	11%	12.12%
Don't know	7.69%	5.21%	5%	6%	6.03%
Total	100.00%	100.00%	100%	100%	100.00%
Effect on Income from Fishing					
Not at all	23.50%	25.00%	23.80%	21.20%	23.38%
Slightly	36.50%	38.40%	36.30%	40.00%	37.80%
Moderately	30.60%	25.60%	30.00%	27.00%	28.30%
Severely	9.40%	11.00%	9.90%	11.80%	10.53%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Author's Fieldwork, 2024.

3.6 Awareness of climate change

Table 3.4: Awareness and Understanding of Climate Change

Respondents Knowledge on the Concept of Climate Change	Koluama 1	Koluama 2	Furupa	Ezetu	Average
Yes	35.30%	35.60%	31%	34%	34.08%
No	64.70%	64.40%	69%	66%	65.95%
Total	100.00%	100.00%	100%	100%	100.00%
Source of Information					
Radio/TV	12.90%	14.42%	12%	15%	13.54%
Social media	5.38%	5.77%	5%	6%	5.42%
Community meetings	26.88%	26.92%	27%	29%	27.48%
NGOs	10.75%	11.54%	11%	11%	11.12%
Government programs	6.45%	4.81%	7%	5%	5.75%
Personal experience	37.63%	36.54%	38%	34%	36.69%
Total	100.00%	100.00%	100%	100%	100.00%
Understanding of Causes					
Not at all	28.75%	25.00%	47.50%	36.25%	34.38%
Slightly	21.25%	22.37%	20.00%	22.50%	21.53%
Fairly	31.25%	32.89%	18.75%	22.50%	26.35%
Very well	18.75%	19.74%	13.75%	18.75%	17.75%
Total	100.00%	100.00%	100.00%	100.00%	100.00%
Belief in Climate Change					
Yes	32.90%	33.30%	31%	33%	32.60%
No	64.70%	61.10%	63%	59%	61.78%
Not sure	2.40%	5.60%	6%	8%	5.63%
Total	100.00%	100.00%	100%	100%	100.00%
Human Contribution to Climate Change					
Yes	38.82%	30.00%	23.75%	29.87%	30.61%
No	45.88%	36.67%	33.75%	36.36%	38.17%
Not sure	15.29%	33.33%	42.50%	33.77%	31.22%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Author's Fieldwork, 2024.

4.0. Summary of key findings

This study examined the challenges of climate change adaptation faced by fishing communities in Southern Ijaw Local Government Area, Bayelsa State, focusing on its impact on livelihoods, awareness and understanding, climate-related disruptions, and the effectiveness of adaptation strategies. The key findings are summarized as follows:

Climate change significantly disrupts fishers' livelihoods, with most (89.35%) observing environmental changes, including temperature increases (18%), increased rainfall (17.48%), flooding (16.09%), sea-level rise (14.50%), and saltwater intrusion (11.08%), leading to a reduced fish catch

(69.15%), primarily attributed to climate change (38.69%), alongside overfishing (23.82%) and pollution (19.34%).

These environmental changes impact fishing activities, with most fishers experiencing a moderate (37.05%) or slight (36.11%) effect, though a minority face severe impacts (12.39%), resulting in a slight (37.80%) to moderate (28.30%) income reduction for most, while 10.53% suffer severe income losses.

Awareness of climate change is limited, with only 34.08% of fishers having heard of the term, relying on personal experience (36.69%) and community meetings (27.48%) for information, while formal sources like radio/TV (13.54%) and government programs (5.75%) are underutilized.

Understanding of climate change causes is poor, with 34.38% having no understanding, 26.35% understanding fairly, and only 17.75% understanding very well; belief in climate change is low (32.60%), with 61.78% skeptical, and only 30.61% acknowledging human contribution, while 31.22% are unsure.

Key climate-related challenges include flooding (17.85%), reduced fish populations (16.20%), riverbank erosion (14.55%), and poor water quality (14.00%), frequently disrupting fishing activities (33.93%), though 40.33% experience these issues rarely, and only 2.30% constantly.

As a result, 57.35% of fishers have adapted by changing fishing schedules or locations, while 42.65% have not, indicating varying levels of adaptive response to these challenges.

Adaptation strategies are widespread, with 69.95% of fishers making changes, primarily through income diversification (27.87%), changing fishing times (24.13%), and shifting locations (21.18%), though only 7.93% have adopted fish farming.

These adaptations are driven by personal decisions (34.13%) and community advice (27.15%), with limited influence from government programs (20.50%) or NGOs (13.18%), and are moderately effective (47.10%), though 23.20% find them ineffective.

Fishers seek support, prioritizing financial assistance (23.40%), training (21.40%), modern equipment (18.86%), and early warning systems (15.58%), but only 31.35% believe government or NGOs can help, with 58.35% being skeptical.

No significant difference was found between communities regarding perceived climate impacts on fishing activities ($p = 0.992$), fish catch ($p = 0.552$), and income ($p = 0.997$). The null hypothesis was not rejected in any of the three tests. Climate change impacts on livelihoods appear consistent across communities and are not statistically significant from a location-based perspective.

5.0 Conclusion

The study concludes that fishing communities in Southern Ijaw LGA, Bayelsa State, face profound challenges in adapting to climate change. These changes have precipitated substantial declines in fish catch and income, posing a direct threat to the economic stability, food security, and overall well-being of these communities, particularly for the minority experiencing severe impacts. The limited awareness and understanding of climate change among fishers, coupled with widespread skepticism about its existence and human causes, critically hinder the adoption of informed and sustainable adaptation strategies, leaving them reliant on experiential knowledge rather than scientific insights that could bolster resilience. While most fishers have applied different adaptation strategies such as income diversification, changing fishing times, and shifting locations, the moderate effectiveness of these measures highlights their inadequacy in fully mitigating the escalating impacts of climate change, especially as environmental stressors intensify. The low adoption of potentially sustainable practices like fish farming further underscores gaps in knowledge, resources, and support. Moreover, the pervasive lack of trust in

institutional support, such as government and NGOs, exacerbates their vulnerability, as fishers feel underserved despite their clear need for financial, educational, and technical assistance. Collectively, these findings reveal a critical need for integrated, community-centered interventions that address knowledge deficits, enhance adaptive capacity, strengthen environmental management, and rebuild trust in institutional frameworks, to ensure the long-term sustainability of fishing livelihoods in Southern Ijaw LGA amidst the growing and multifaceted threat of climate change.

5.1 Recommendations

Promote Climate Literacy: Develop targeted climate education programs in Southern Ijaw LGA, utilizing community meetings and local leaders to improve fishers' understanding of climate change, its causes, and human contributions, thereby encouraging informed adaptation.

Provide Financial and Technical Support: Offer financial grants and loans to fishers in Bayelsa State to invest in modern fishing equipment and flood-resistant technologies, alongside technical training to enhance their adaptive capacity.

Establish Early Warning Systems: Implement early warning systems for flooding and other climate hazards in Southern Ijaw LGA to help fishers prepare and minimize disruptions to their fishing activities.

Support Livelihood Diversification: Facilitate training and resources for alternative livelihoods, such as fish farming and farming, to reduce dependence on fishing and build resilience against climate impacts.

Strengthen Environmental Regulations: Enforce stricter regulations on overfishing and pollution in the Niger Delta, coupled with habitat restoration projects to address reduced fish populations and poor water quality.

Promote Community-Based Resource Management: Encourage collaborative resource management practices among fishers to reduce conflicts over fishing grounds and promote sustainable fishing practices.

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