



CLIMATE CHANGE IMPLICATIONS FOR THE AQUACULTURE INDUSTRY IN RIVERS STATE, NIGER DELTA, NIGERIA

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Abstract: Rivers State is a coastal community in the Niger Delta Area of Nigeria encompassed by a network of tributaries, inland and the Atlantic Ocean at its Southern tip. The communities of the Rivers State are largely dependent on the coastal wetlands for aquaculture and fisheries activities, which are their main economic activity. Several other economic activities especially oil prospecting and exploration activities by numerous companies, land fills, and reclamation, and human activities such as deforestation of the mangroves of the wetlands among others responsible for global climate change are high in this State. Of recent, certain climate change activities have been observed. Thus a review was carried out to determine the likely implications of climate change on the aquaculture industry, and subsequently the livelihood of the fish farmers, and recommendation/suggestion have been made to this effect. This review is aimed at understanding and creating awareness as regards the climate change implications for the aquaculture industry for all stakeholders in the Rivers State and proffering a solution to this anomaly.

Keywords: Aquaculture, Economic Activity, Climate Change, Niger Delta.

INTRODUCTION

The aquaculture sector supports over 7 million people directly and indirectly and contributes to the livelihood, employment and food security in Nigeria (Akankali and Jamabo, 2012). The total contribution of fisheries and aquaculture to Nigerian economy has been put at about \$ 1 billion per year (FDF, 2007). Aquaculture has grown to be the fastest growing and most highly traded food commodity in Nigeria; it is the largest producer of fish products than capture fisheries in terms of fish consumption (FAO, 2006). Globally, the demand for fish is rising, but there are limited possibilities of increasing production from capture fisheries; thus aquaculture now provides more than 50% of the global supply of fisheries products for direct human consumption. The contribution of Rivers State, Nigeria to aquaculture development

remains insignificant but is increasing significantly presently. The state offers the largest market for fisheries products; and has the capacity to attain the desired fish self-sufficiency within a short of time if the numerous aquaculture potentials which abound the state are adequately utilized. These potentials are estimated at about 2.5 million metric tons of fish annually. The aquaculture sector which has grown now faces numerous challenges including resource conflicts and difficulties in accessing credit, quality seed and feed, and information. The main elements of climate change that could potentially impact on aquaculture production – such as sea level and temperature rise, change in monsoonal rain patterns and extreme climatic events and water stress – are highlighted and the reasons for such impacts evaluated.

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Climate change is projected to impact broadly across ecosystems, societies and economies, increasing pressure on all livelihoods and food supplies, including those in the fisheries and aquaculture sector. Food quality will have a more pivotal role as food resources come under greater pressure and the availability and access to fish supplies will become an increasingly critical development issue. The behavior of the climate system and the processes that cause global warming are well understood and grounded in basic scientific principles. Scientific uncertainty is inevitable with a system as complex as Earth's climate (Aalbersberg and Hay, 1993). However, advancements in measuring, analyzing, and modeling techniques have helped clarify many uncertainties in recent years. As the scientific evidence on rising global temperature became indisputable, skeptics focused their argument on whether human activities are in fact the cause of global warming. They argued that the observed warming could be caused by natural processes such as changes in the energy emitted by the Sun. However, the Sun's influence has been found to have contributed only slightly to observe warming, particularly since the mid-20th century. Thus, there is overwhelming evidence that greenhouse gas emissions from human activities are the main cause of the warming. In its 2007 report the IPCC projected temperature increases for several different scenarios (IPCC, 1996), depending on the magnitude of future greenhouse gas emissions. The IPCC cautioned that even if greenhouse gas concentrations in the atmosphere ceased growing, the climate would continue to warm for an extended period as a result of past emissions, and with more dramatic effects than were observed during the 20th century. If greenhouse gas emissions continue to increase, scientists project severe climate changes. Many elaborate computer models of temperature, precipitation patterns, and atmosphere circulation have been used to study global warming. Based on these models, scientists have made many projections about how global warming will affect weather, glacial ice,

sea levels, agriculture, wildlife, and human health. Many changes linked to rising temperatures are already being observed. A warmer world will be generally more humid as a result of more water evaporating from the oceans. A more humid atmosphere can both contribute to and offset further warming. Storms are expected to be more frequent and more intense in a warmer world. Water will also evaporate more rapidly from soil, causing it to dry out faster between rains. Some regions might actually become drier than before. Overall, higher latitudes are projected to receive more rainfall, and subtropical areas are projected to receive less. Shifting patterns of precipitation will occur. Droughts are projected to become longer and more intense. This paper focuses on the impacts of climate change on aquaculture development in Rivers State, Nigeria; and addresses the possible adaptation and mitigation measures that could be implemented for the industry.

IMPLICATION OF CLIMATE CHANGE ON COASTAL AREAS:

“tomorrows crisis, today impacts on aquaculture”

Aquaculture plays a vital role in boosting rural development and reducing poverty and hunger in Nigeria. The sector provides much needed protein, and nutrients as well as creates jobs for thousands of people in the state. With the high demand of fish protein, their populations are declining. Aquaculture in Nigeria occurs inland and only recently has the coastal region has been the focus of development. Artisanal fishermen and fishing communities in Nigeria had for generations practiced traditional methods of fish culture in tidal pools and floodplains (Dada, 1975; Sagua, 1976). These are extensive systems, which do not conform to the modern perspective of aquaculture and do not contribute any significant role to the national economy. Fish populations are being depleted faster than they are able to restore their number. The banks of the water systems of Rivers state are desirable and ideal locations for people to settle and for mariculture (Alm, et al, 1993). The ecosystem provides



water for drinking, bathing, cleaning, and fishing for the coastal communities.

The marine ecosystem of Rivers state is important in maintaining the temperature of the water because the slightest change in the water temperature could be fatal to certain marine species. Mangrove ecosystem provides shade and habitat for marine species, while reducing fluctuation in water temperature. The state has important ecosystem that needs to be protected, for as it is home to 36 families and nearly 250 species of fish, of which 20 are endemic to the area. With the loss of habitat and the climate getting warmer, little temperature degree is necessary to maintain some of the marine environments. Other than restoring habitat, the problem of pollution can also be reduced. Climate change is having major impacts on biodiversity in Rivers state. Saltwater intrusion puts stress on aquatic vegetation that is very important for life and culture (Blommestein et al, 1996). The impact from saltwater intrusion affects many areas of Rivers state, trees used for house construction, local medicine, food and traditional clothing - are dying from saltwater intrusion as the seawater slowly seeps into the ground. Climate change will impact on water availability, weather patterns such as extreme rain events, and exacerbate eutrophication and stratification in static (lentic) waters. The influence of the former on aquaculture is difficult to project.

Due to the climate change and global warming, changes of weather patterns in some wet areas can become drier. Unexpected drought may lead to the loss of plant species, as well as the fishes. This is a major concern because mangrove forests are an important ecosystem that supports habitats for fish breeding and feeding on aquatic organisms. Fish culture which is predominantly based on species feeding low in the food chain, the greater availability of phytoplankton and zooplankton through eutrophication could possibly enhance production. On the other hand, in coastal and marine cage culture, adaptive measures will revolve around the introduction of improved

technologies that will withstand extreme weather conditions. Sea level rise and increased salt water intrusion in the deltaic areas of the tropics where there is considerable aquaculture facilities is likely to occur. The impacts will involve the movement inland of some cultured fish species which saline tolerant. Aquaculture which is an adaptive measure to provide income and food security, and employment generation will be hindered due to intrusion and frequent coastal flooding. The most important impacts of climate change on aquaculture are considered to be brought about by limitations on fishmeal and fish oil availability (for fish feeds) as a result of a reduction in raw material supplies. Other raw materials might also be affected. The negative impacts are likely to be felt mostly in the temperate regions where the finfish aquaculture is based entirely on carnivorous species. Adaptive measures to counteract these impacts are suggested.

Due to the rising sea level, mangroves in River state will have to retreat inland to survive. Climate change should not be seen as an environmental problem. Local fishermen may face trouble and see their income decline if more coral bleaching occurs in the future (Brown, 1997). Likewise, farmers may find it difficult to have good crops to sell or export if the area is hit with drought or heavy rainfall due to the changing weather patterns (Briguglio, 1993). Much of the fish ecosystem in Rivers state is at a serious risk from inundation, flooding and physical damage. Also infrastructure including, roads, airports and port facilities (all predominantly found on the coastal areas), are in danger of destruction. Such damages will disrupt food and energy supplies. The effect of climate change also causes rising ocean acidity, thus making it more difficult for marine organisms such as shrimps, oysters, or corals to form their shells – a process known as calcification. Many important animals, such as zooplankton which forms the base of the marine food chain have calcium shells. Thus the entire marine food web is being altered – there are



‘cracks in the food chain (Costa et al, 1994). As a result, the distribution, productivity, and species composition of fish production in Rivers state is changing, thereby generating complex and inter-related impacts on the marine systems of the area, that provide habitats and nursery areas for fish. The changing rainfall patterns and water scarcity is impacting on rivers and lake fisheries as well as aquaculture production in Rivers state.

STRATEGIES FOR MITIGATION OF CLIMATE CHANGE

Responding to the challenge of controlling global warming will require fundamental changes in energy production, transportation, industry, government policies, and development strategies around the world. These changes take time. The challenge today is managing the impacts that cannot be avoided while taking steps to prevent more severe impacts in the future. Reducing emissions of greenhouse gases, also called greenhouse gas mitigation, is a necessary strategy for controlling global warming (Bakun, 1993). There are two major approaches to slowing the buildup of greenhouse gases. One is to reduce the consumption of fossil fuels, thereby reducing greenhouse gas emissions. The other is to keep carbon dioxide out of the atmosphere by storing the gas or its carbon component somewhere else, a strategy known as carbon sequestration or carbon capture.

This process of carbon capture can be done in the following ways:

- (1) Preservation and planting of more trees around the environs’ of Rivers state: Trees, especially young and fast growing ones, soak up a great deal of carbon dioxide from the atmosphere and store carbon atoms in new wood.

Forceful injection of carbon dioxide into depleted oil wells, thus forcing the oil out of the ground or sea floor, thus capturing the carbon directly. In 1998 the United States—the world’s single largest contributor to greenhouse gas

emissions—became a signatory to the Kyōto Protocol, for reducing carbon dioxide emissions. The Kyōto Protocol, which expires in 2012, is only a first step in addressing greenhouse gas emissions. To stabilize or reduce emissions in the 21st century, much stronger and broader action is required. The Niger Delta and Rivers S tate in particular should invest in sustainable aquaculture development, which will help in buffering and diversifying economic activities. Programs should be introduced, such as the -funded Coral Reef Targeted Research to provide advice on building resilience and conserving our ecosystems. As a mitigation measure to curtail the contribution of aquaculture to carbon emissions, it is suggested that the consumer is made aware of the carbon emissions associated with various products, in the same way that traceability is indicated. In this context, it is demonstrated that on the whole aquaculture is less energy costly and could contribute to carbon sequestration more than other terrestrial farming systems. The document concludes by reviewing more general policy-oriented adaptation measures that can be implemented regionally, nationally or could be site specific.

REFERENCES

- Aalbersberg, B. and Hay, J. (1993). Implications of Climate Change and Sea Level Rise for Tuvalu. SPREP Reports and Studies Series No. 54, South Pacific Regional Environment Programme, Apia, Western Samoa, 80 pp.
- Akankali, J. A. and Jamabo, N. A. (2012). Effects of flooding and erosion on fisheries resources in Niger Delta, Nigeria. *European Journal of Scientific Research* 90(1): 14-25.
- Alm, A., Blommestein, E. and Broadus, J. M. (1993). Climatic changes and socio-economic impacts. In: *Climatic Change in the Intra-Americas Sea*



- [Maul, G.A. (ed.)]. Edward Arnold, London, United Kingdom, pp. 33 3-349.
- Bakun, A., (1993). Global greenhouse effects, multi-decadal wind trends, and potential impacts on coastal pelagic fish populations. ICES Marine Science Symposium, 195, 316-325.
- Blommestein, E., Boland, B., Harker, T., Lestrade, S. and Towle, J. (1996). Sustainable development and small island states of the Caribbean. In: Small Islands: Marine Science and Sustainable Development [Maul, G.A. (ed.)]. American Geophysical Union, Washington, DC, USA, pp. 385-419.
- Briguglio, L. (1993). The Economic Vulnerabilities of Small Island Developing States. Report to U.N. Conference on Trade and Development (UNCTAD), Geneva, Switzerland.
- Brown, B. E. (1997). Coral bleaching: Causes and Consequences. Coral Reefs, 16, pp. 129-138. Policy issues for sustainable fisheries development in the Caribbean. In: Report and Proceedings of the Meeting on Fish Exploitation Within the Exclusive Economic Zones of the English Speaking Caribbean Countries [Chakalall, B. (ed.)]. FAO Fisheries Report No. 483, Food and Agriculture Organization, Rome, Italy, pp. 1-43.
- Costa, M.J., Costa, J.L., Almeida, P.R and Assis, C.A. (1994). Do eel grass beds and salt marsh borders act as preferential nurseries and spawning grounds for fish? An example of the Mira estuary in Portugal. Ecological Engineering, 3, 187-195.
- Dada, B. F. (1975). Present status and prospects for aquaculture. In: FAO/CIFA Symposium on aquaculture in Africa CIFA/T4, FAO, Rome pp. 79-85.
- Food and Agriculture Organization (2006). Eradicating world hunger-taking stock ten years after the world food summit. The state of food insecurity in the world.
- FDF (2007). Federal Department of Fisheries Statistics, 4th edition, 1995-2007 FDF, Abuja Nigeria.
- IPCC, 1996: Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.J., L.G. Meiro Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 572 pp.
- Sagua, V. O. (1976). Aquaculture and fishery development in Nigeria review. In: Proceedings of the Agricultural society of Nigeria conference, Ile-Ife, Nigeria, pp. 1- 34