

# Climatic Changes and Global Fisheries: The Nigerian Experience

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## **Abstract**

*Climatic change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. Millions of people around the world depend on fish for income and livelihood. Linked to the strong increase in fish production, employment in capture fisheries and aquaculture has grown substantially in the last three decades, with an average rate of 3.6 percent. Climatic changes affects spawning sites of fisheries resulting in the reduction of fish biomass, destruction of coral reefs, distortion of food web and food chain, and the reduction of caught fisheries. Shifts in ocean salinity are occurring, with near-surface waters in the more evaporative regions of most of the world's ocean increasing in salinity, while marine areas in high latitudes are showing decreasing salinity due to greater precipitation, higher runoff, melting ice and other atmospheric processes. Importantly, increase in salinity affects fish spawning site which in turn influences fish population. This will translate to less income for fishers as they record less catch. In an attempt to meet up other social responsibilities, fishers may resort to other more dangerous methods of catching fish like toxic chemicals, explosives and dynamite. Serious sanctions must be put in place to restrain fishers from adopting these dangerous methods of catching fishes while effort must also be intensified to improve aqua culture production.*

**Keywords:** *Climate changes, Fisheries, Nigeria*

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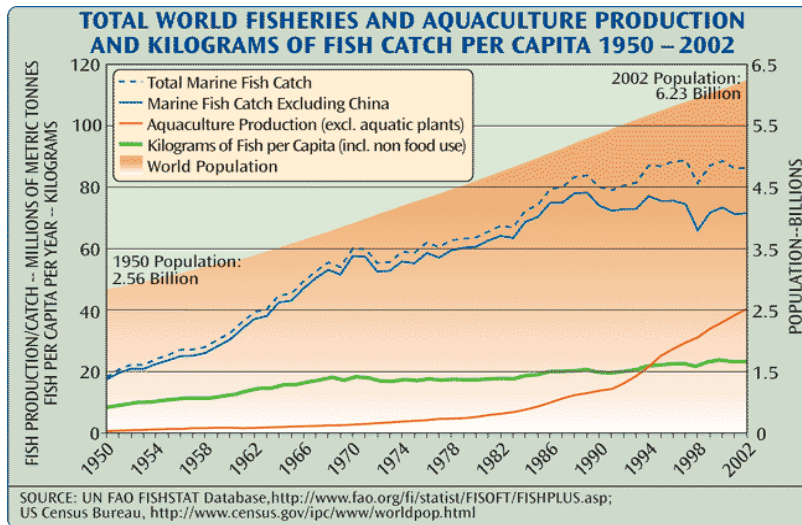
## **Introduction**

The fish sector is a source of income and livelihood for millions of people around the world. Linked to the strong increase in fish production, employment in capture fisheries and aquaculture has grown substantially in the last three decades, with an average rate of 3.6 percent per year since 1980 according to the most recent estimate (Westlund, 2009). In 2008, 44.9 million people were directly engaged, full time or, more frequently, part time, in capture fisheries or in aqua culture. This number represents a 167 percent increase compared with the 16.7 million people in 1980. Employment in the fisheries sector has grown faster than the world's population and employment in traditional agriculture as observed by the United Nation's Food and Agricultural Organization (UN FAO) report, 2010. Majority of fisheries and aqua culturists are in developing countries, mainly in Asia 85.5%, Africa, 9.3%, Latin America, 2.9%, Europe 1.4%, North America 0.7%, and Oceania 0.1%. Studies have shown the relationship between fish production and total world population.

China is the country with the largest number of fishers, representing nearly one third of the total. In 2008, 133 million people were employed as fishers and fish farmers in China. Since 1990, fish farmers have experienced the greatest increase in their numbers, with most of the growth occurring in Asia where the number of farmers increased by 189% in the period 1990-2008. The global fishing fleet is made up of about 4.3 million vessels. About 59% of these vessels are powered by engines. The remaining 41% are traditional craft of various types, operated by sails and oars,

concentrated in Asia and Africa.

Fig.1 shows the total fish production against world population.



. Over concentration in aqua culture without commensurate attention on wild fishes also creates a problem. The aqua culture fish at certain age depends on wild fish fingerlings for food. This will create an imbalance as wild fish stock will not be allowed to grow to maturity. This will mean poor catch for fishers and will frustrate the effort of regional governments in protecting the capture of under aged fishes. Leading countries in wild and aqua culture fishing are as shown in the table.

CAPTURE FISHERIES PRODUCTION – 2000	
COUNTRY	TONNES
1. CHINA	17,000,000
2. PERU	10,700,000
3. JAPAN	5,000,000
4. USA	4,700,000
5. CHILE	4,300,000
6. INDONESIA	4,100,000
7. RUSSIA	4,000,000
8. INDIA	3,600,000
9. THAILAND	2,900,000
10. NORWAY	2,700,000
11. ICELAND	2,000,000
12. PHILLIPINES	1,900,000

Fig 2. Leading countries in capture/aqua fisheries Source: UNFAO fFAO

## **Current Challenges Relating International, Regional and National Fisheries**

The countries in Southern Africa have been mobilizing in the fight against illegal, unreported and unregulated (IUU) fishing. In September 2007, a forum for national heads of operations of monitoring, control and surveillance

(MCS) hosted by Mozambique, considered that illegal fishing should be raised at the highest level with Southern African development community (SADC). Subsequently a ministerial conference was held on 4<sup>th</sup> July, 2008 in Namibia where fisheries ministers from coastal states considered and signed a statement of commitment to stop illegal fishing. Among several resolutions, the ministers committed to close their ports to illegal vessels (Tietenberg, 2006:28). Also at the conference, the ministers of fisheries and marine resources of Namibia, Dr Abraham Iyambo the Namibian minister placed the issue in regional context. "It is not an exaggeration to state that the plague of illegal fishing is one of the largest environmental crimes of our time. We may well be the last generation of decision makers with an opportunity to prevent this scandal and bring to an end the troubling destruction of our oceans and the hardship it brings to people" (FAO report, 2005). As a result of this, countries took actions with vessel arrest, revocation of agreements, enforcing measures on vessels flying their flags and fishing outside of their exclusive economic zones.

Regional cooperation in monitoring and surveillance increased efficiently with joint training at sea and operations between member countries. This resulted for the first time in patrols along the coast of Southern and East Africa and illegal fishing vessels were apprehended and prosecuted owners and vessels confiscated (Grotius, 1916). In early 2009, Mozambique hosted a second regional forum of heads of operations of MCS, where action plans against illegal fishing were identified. Several working groups were set up at the National, regional and international for negotiation on a global port state measure. The action plan was approved in Zimbabwe on 16<sup>th</sup> July, 2010.

Regional and international organizations and partners that have contributed to the Southern African effort led by SADC include: the Indian Ocean Tuna Commission, INFOSA, The IOC, The NEPAD, and The Norwegian Agency for development cooperation, The Pews foundation, The South East Atlantic Fisheries organization, the south West Indian Ocean fisheries commission, stop illegal fishing, and the Swedish international development cooperation agency. Following a year of intense negotiations, the FAO conference in November 2009 approved the agreement on the port state measures to prevent, deter and eliminate illegal, unreported and unregulated fishing. The Agreement as an Article xiv instrument under the FAO constitution.

## **Management and Conservation of Inland Fishery Resources in Nigeria**

Foreign observers frequently comment that fishing in African lakes, rivers and their associated wetlands is usually haphazard. This is due to the fact that there are no laws and regulations controlling the exploitation of the fisheries of most African inland waters. Even where such exist, they are not often enforced. In Nigeria, the management of inland waters is regarded as the exclusive responsibility of the state to which the water belongs. Whereas there is a sea fisheries decree act 1971 as well as the regulations on the exclusive economic zone (EEZ) decree of 1978.

The justification for comprehensive inland fisheries legislation had been advanced by the Federal department of fisheries based on the need to harmonize the administration, management, protection and improvement of the fisheries resources in inland waters including rivers, reservoirs

lakes and their associated wetlands. Fish do not respect state boundaries (Adeniji, 1990:136). Migratory fish often enters channels which pass through more than one state.

Consequently, actions or lack of actions by one state can have a profound effect on the fisheries resources in another state. Migrant fishermen often cross state boundaries using unlawful methods to capture fish and dumping poisonous products in another state, can lead to mass destruction of valuable fishery resources downstream in another state (Ita, 2008:233). This justifies the need for central legislation. Actions for the promulgation of such laws and regulations are yet to materialize. For fish stock to be protected in Nigerian waters, certain factors must be taken into consideration in the fisheries edict and well enforced. The edict reads;

1. A catch of the fresh water fish species not below the size specified,
2. Fix stationary fishing structures across the river for purpose of cultivating, culturing or propagating fish,
3. No person shall take from or destroy any fish within the water bodies by any of the following means;
  - A, the use of any explosive or electricity
  - B. the use of any poisonous or noxious matter
  - C. the use of gillnet or drawn net less than 3in or 7.62cm
  - D. the use of clap net, cast net or any webbing traps of less than 2 inches Or 5.1cm
  - E. lifts net of not less than 5.1inches.

### **Indicators of climatic changes**

Major indicators of climatic change includes,

- 1 Global warming
- 2 Too much rain in an area which have been prone to experience normal down pour
- 3 Scanty rains in areas of normal heavy down pour
- 4 Unexpected rise of abnormal winds and possible effect on aquatic habitat.
- 5 Rise in global ocean temperature
- 6 Increase in carbon dioxide level
- 7 Expansion of sea level and over flooding
- 8 Increase in natural disasters, storms, cyclons, tsunamis, flood, and volcanic eruptions.

### **The International Legal Regimes for Fisheries Management**

The traditional legal framework for the management of the fisheries resources of the oceans was based on the principles of free access to the living resources. The doctrine associated with this approach was the freedom of the high seas which was proclaimed by Hugo Grotius. Grotius sought to establish the inclusive interest of the whole community of the oceans, in opposition to the claims of some states for exclusive rights to area of the ocean. Interest in the ocean at that time was more for navigation and trade. Three nautical miles was widely accepted as the breadth of a state territorial sea, (Grotius, 1916). Freedom of fishing had two implications for the management of fisheries. First, coastal states did not have any right to fisheries resources of the oceans beyond the narrow limits of their territorial seas. Second and more importantly, the system did not promote effective conservation of the living resources of the oceans.

The international response to the growing depletion of the world fisheries stock and the degradation of the habitats has been through adoption of four classes of instruments. Firstly,

globally binding fisheries treaties were adopted to address the conservation and management of fish stocks: second, international framework for the management of tuna and tuna like species was strengthened. Global environmental treaties were adopted that provide useful tools and principles towards sustainable fisheries management. Major challenges facing the sustainable use of marine living resources include;

1. Overfishing with the related issues of resource collapse and endangered species
2. over capacity, with the related issues of subsidies
3. Environmental impacts of fishing
4. Illegal, unregulated and unreported fishing (IUU fishing)
5. Poor selectivity and discarding
6. Absence of ecosystem-based fisheries management.

The four classes of responses do not meet the challenges facing fisheries today. Collectively they provide a very comprehensive framework which requires more effective implementation of the instruments through better coordination between national, regional and global institutions. (Birnie and Boyle, 1999: 436). Several attempts have been made to address these problems through series of conventions. These include;

1. The Geneva Convention on the conservation of the living resources on the high seas 1958. The convention affirmed that "all states have the rights for their nationals to engage in fishing on the high seas," subject to their treaty obligations, the rights and interest of coastal states, and an obligation to co-operate for the purposes of conservation.

2. Laws of the sea convention. This created a comprehensive and multilateral treaty to regulate the use of the sea, one of the fundamental results of the United Nations Conference on the Laws of the Sea (UNCLOS) 111 negotiations and the state practice generated by it, has been the new international law of marine fisheries. The treaty sources for this customary law regime are to be found in part v of the law of the sea convention setting out the exclusive economic zone concept and part VI, section 2 entitled "conservation and management of the living resources of the high seas." (LOS, 1982).

### **Fisheries Management in the EEZ**

The Exclusive Economic Zone EEZ is defined as "an area beyond and adjacent to the territorial sea" which "shall extend beyond 200 nautical miles from the baseline from which the breadth of the territorial sea is measured". Article 56 of the LOS convention governs the jurisdictional competence of the coastal states in the EEZ. This is defined in terms of sovereign rights as opposed to sovereignty. The EEZ has been defined as an inheritance by the coastal states from the rest of the world. Under the new regime of the seas, the world community has willed to the coastal states the bulk of living resources in waters of their shores. With this in mind, the LOS convention outlines details how individual coastal states are to go about fulfilling the expectations placed on them by the world community. The expectations are couched in terms of two obligations (1) conservation; and (2) optimum utilization (Fleischer, 1984: 253)

### **High Seas Fisheries Management under the LOS Convention**

The Law of the Sea convention as contained in part vii, section 2. Article 116 proclaims that all states have the right for their nationals to engage in fishing on the high seas. This right is subject to states treaty obligations with regards to cooperation to conserve straddling stock and highly migratory

species. Following the adoption of the LOS convention, problems of international fisheries came to the fore. Some of the problems can be attributed to the design implementation of the LOS convention especially,

- a) The discretionary nature of conservation requirement in the EEZ in particular, the policy flexibility given to coastal states in determining the allowable catch.
- b) The use of maximum sustainable yield (MSY) as the default biological reference point.
- c) The emphasis placed on the promotion of the optimum utilization.
- d) The lack of clear guidelines on the framework for international cooperation to manage and conserve highly migratory species and straddling stock.

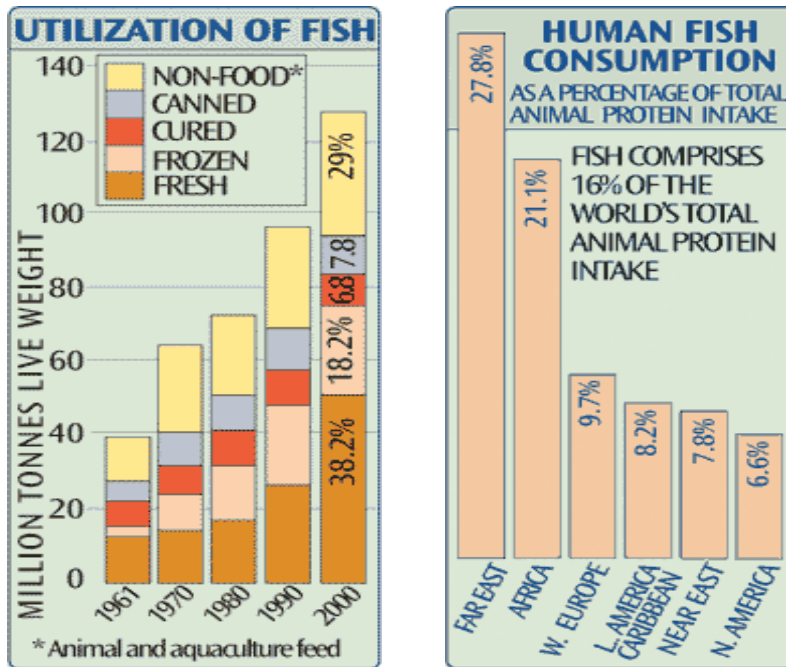
Problems also arose because too much freedom of high seas fishing was left intact by LOS convention. These include registration and re-registration of fishing vessels under flags of convenience and the non participation in fisheries management regimes or opting out of fishing regulations by flag state. Chapter 17 of agenda 21 identified these problems as follows;

- 1) Inadequate monitoring and enforcement of effective conservation measures,
- 2) Unregulated fishing
- 3) Over capitalization
- 4) Excessive fleet size
- 5) Vessels reflagging to escape controls
- 6) Insufficient selective gear
- 7) Unreliable data bases
- 8) Lack of sufficient cooperation between states. (FAO, 1993).

### **Global Effects on Sustainability of Fisheries Resources**

Sustainability of fisheries combines theoretical disciplines such as the population, dynamics of fisheries with practical strategies such as, avoiding overfishing through techniques like quotas, destructive and illegal fishing practices by lobbying for appropriate law and policy, setting up protective areas, restoring collapsed fisheries, incorporating all externalities involved in harvesting marine ecosystem into fishery economics, educating stake holders and the wide public and developing independent certification programs, (Tietenberg, 2006:28). The primary concern around sustainability is that heavy fishing pressure such as over exploitation and growth will result in the loss of significant potential yield. That stock structure will erode to the point where it loses diversity and resilience to environmental fluctuations. That ecosystem and their economic infrastructures will circle between collapse and recovery; with each cycle less productive than its predecessor and the changes will occur in the tropic balance (Hilborn, 2007:8).

**Fig .3 shows fish production against protein consumption**



Global world fisheries are believed to have peaked and began to decline with valuable habitat such as estuaries and coral reefs in critical condition. Current aqua culture or farming of piscivorous fish, such as salmon, does not solve the problem because farmed piscivorous are fed from wild fish such as forage fish. Salmon farming also has major negative impacts on wild salmon. (Juda, 2006:276) The world wide decline of ocean fisheries stocks has provided impetus for rapid growth in fish and shell fish farming. Between 1987 and 1997, global production of farmed fish and shell fish more than doubled in weight and volume. As human population continues to expand beyond 6 billion, its reliance on farmed fish production as an important source of protein would also increase.

Fish are a major source of food protein for billions of people and their domestic animals. Growth in aqua culture production is a mixed blessing. Some aqua culture activities like shrimps and salmon farming creates potential damage to oceans and coastal resources through habitat destruction, waste disposal, exotic species and pathogen invasions, large fish meal and fish oil requirements may further deplete wild fisheries stock.

**Conclusion**

Sustainable management of fisheries cannot be achieved without an acceptance that the long term goals of fisheries management are the same as those of environmental conservation. Fisheries have rarely been “sustainable”. Rather, fishing has induced several depletions, long marked improved technology, geographic expansion and exploitation of previously spurned species lower in the food web with global catches declining since late 1980’s. Continuation of present trend will lead to supply short fall for which aqua-culture cannot compensate. (Gulland, 2001). As aqua culture

continues to increase and intensify, both its reliance and its impact on ocean fisheries are likely to expand even further. The balance between farmed and wild caught fish, as well as the total supply of fish available for human consumption will depend on future aqua culture practices. Technological, management and policy options will sustain production. Temperature and other variations resulting from climatic change will have a strong impact on fisheries and aquaculture, with significant food security consequences for certain populations, Wild capture fisheries are fundamentally different from other food production systems in their linkages and responses to climatic change and in the food security outcomes. Unlike most terrestrial animals, aquatic animal species used for human consumption are poikilothermic, meaning their body temperatures vary according to ambient temperatures. Any changes in habitat temperatures significantly influence their metabolism, growth rate, productivity, seasonal reproduction, and susceptibility to diseases and toxins. In marine waters, climate processes and extreme weather events will increase in frequency and intensity – the most well known of these is the El Niño phenomenon. The ongoing warming of the world's oceans is likely to continue, but with geographical differences and some decadal variability. Warming is more intense in surface waters but is not exclusive to these, with the Atlantic showing particularly clear signs of deep warming. The oceans are becoming more acidic, with probable negative consequences to many coral reef and calcium-bearing organisms. For communities who heavily rely on fisheries, any decreases in the local availability or quality of fish for food or increases in their livelihoods' instability will pose even more serious problems. Fishing communities located in the high latitudes and those that rely on climate change-susceptible systems, such as upwelling or coral reef systems, will have the greatest exposure to climate-related impacts. In addition, fisheries communities located in deltas will be particularly vulnerable to sea level rise and associated risks of flooding, saline intrusion and coastal erosion. At both the local and global levels, fisheries and aquaculture play important roles in providing food and generating income. Some 44.9 million people work directly in the sector, the great majority in developing countries. Adding those who work in associated processing, marketing, distribution and supply industries, and the sector supports several hundred million livelihoods. Aquatic foods have high nutritional quality, contributing 20 percent or more of average per capita animal protein intake for more than 2.8 billion people, again mostly in developing countries. Fish is also the world's most widely traded foodstuff and a key source of export earnings for many poorer countries. The sector has particular significance for small island states.

## **Recommendations**

In the light of the foregoing write up, we recommended as follows

1 Investment in the sector, especially in infrastructure, will need to consider climatic change which will require developing better information on the costs and benefits of protection.

2 Transfer or spread of sector-related risk – from individuals and communities to the state through contingency plans – will be based on specific fiscal provisions but also may be tied to innovations in resource management through which the insured accept responsibilities in exchange for protection.

3 Funding agencies can "climate proof" their approaches and, at the same time, take advantage of new opportunities in the fisheries and aquaculture sector by jointly promoting food security, reducing negative impacts of climatic variability and change, and improving resource management.



4 Well defined sectoral performance criteria need to be set out to bring climatic change threat, risks within normal management practices, public and private sector linkages and partnerships will be essential in developing efficient and effective responses.

5 climatic changes have been known to be primarily caused by energy consumption through fuel, raw material use and production. To this extent, government should device means of increasing taxes of industries that pollutes above the acceptable limit.

6 Government should sponsor research into alternative use of fuel and lubricants to generate energy example, an increase use of bio fuel.

7 Diverse stake holders including consumers, industries and government should be more conscious of the scientific, social, economic and developmental issues related to aquatic value chain. There is a critical need for dialogue and collaboration among industry, government and scientist community.

8 the legislative houses should consider building a legal framework that considers and respond to climatic change threats along with other pressure like overfishing and pollution. This requires effective public, private and NGO partnership.

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