Strengthening Fisheries and Aquaculture through Climate-Smart and Gender-Sensitive Approaches in Nigeria

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ABSTRACT

Climate change is a reality that is experienced in different parts of the world. For this reason, a review was conducted to understand how fisheries and aquaculture can be promoted using climate-resilient and gender-inclusive measures. Nigerian fisheries and aquaculture sub-sector has high potential for development but is already experiencing climate change impacts like flooding and extreme droughts. The sector needs to play its role in contributing to the food, nutrition and livelihood security of the people of Nigeria. Developing climate-smart approaches with a gender-balanced perspective is key to ensuring success in mitigation of its effects. For this to be possible, the challenges limiting the growth of the sector must be addressed by the policy makers, researchers, and other stakeholders. Women need to be given the right space to play their roles in the fisheries and aquaculture sector just like the men. This will require some institutional framework and support on the part of the government to be achieved. If these are done fisheries and aquaculture will achieve the desired growth envisaged in the Code of Conduct for Responsible Fisheries and National Aquaculture Strategy.

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INTRODUCTION

The fisheries and aquaculture sector is a very important component of the food production systems in every society striving towards achieving the UN Sustainable Development Goal on food security. This article is significant to the achievement of six goals within the Sustainable Development Goals (SDGs).The time is tickling based on the fact that 2030 is very close and there is the need to speed up with the actions that will lead to the achievement of the goals.

Therefore, programs and initiatives geared towards ecosystem restoration and food security have the imperative of inclusion of some aspects of fisheries and (or) aquaculture to be holistic and cost-effective. Under circular economy, the sector is very useful in the transformation of some agricultural and food processing wastes into useful resources for further food production while its own waste becomes useful in agriculture (Bosma and Verdegem, 2011; Dawood *et al*., 2018). Some of them can easily be cultured on wastes from different human domestic and industrial activities, especially food-processing wastes.

The term fisheries connote fish (or shellfish) and all activities associated with managing it and making it available for human consumption. This essentially refers to fishes in the wild or what is alternatively called capture fisheries. The capture fisheries sector focuses on harvesting, landing, storage and (or) processing and the logistics that ensure the fish reaches the consumers. Aquaculture on the other hand refers to the farming or husbandry of aquatic organisms: fish, shellfish, plants, etc. (Pandey and Shukla, 2005)

Fish provides not only proteins of high value but are source to a wide range of essential micronutrient minerals, vitamins and essential fatty acids (Highly Unsaturated Fatty Acids-HUFAs) very essential for human health (FAO, 2012). Fish is readily digestible and utilizable by human body, making it suitable for complimenting the high carbohydrate diets in most in most developing countries (FAO, 2008). Fish have all the essential amino acids required by the body. On the average, it provides 20-30 kilocalorie per person per

day (WHO, 2011). The fisheries sector contributes 3-4.5% of the gross domestic product (GDP) in Nigeria and constitutes 50% of animal protein consumption (Federal Ministry of Agriculture and Rural Development [FMARD], 2008: Onada and Ogunlola, 2016). Fish consumption per caput is 7.5kg in Nigeria (FMARD, 2008) while the global average is 20.2kg (FAO, 2022). Nigeria spends approximately one billion dollars annually in the importation of a million metric tons of fish to augment the local production deficits (Obasi *et al*., 2017). The fisheries and aquaculture sub-sector employed one million one hundred and ninety thousand persons as at 2016, with women and youths involving more in the postharvest value chains (Subasinghe *et al*., 2021)

Climate-smart fisheries and aquaculture techniques are those production techniques that result in minimal harm to the ecosystem thereby ensuring the sustainability, diversity and resilience of the system without undermining the socioeconomic system. It is an adaptation to climate change and should result in lower emission intensities per output (Onada and Ogunlola, 2016).

Gender-sensitive approach implies measures or practices that will ensure that there is a balance of both male and female genders in the fisheries and aquaculture sub-sector. This becomes necessary given earlier reports indicating that different parts of both the fisheries and aquaculture value chain are being dominated by the male gender (Giwa *et al*, 2017; Unah *et al*., 2017; Subasinghe *et al*., 2021).

Climate change is the alteration of the pattern of the climate of a place over a given period of time: usually ten years and above. Recent weather events like changes in hydrological regime, drastic change in weather condition, reduction water levels, heavy windstorms, excessive sunshine, increased incidences of flooding and drought are being linked to climate change (Onada and Ogunlola, 2016). This review is thus aimed at exposing the adaptation strategies needed to cushion the negative effects of climate change. This will be covering those needed for fisheries and aquaculture as well as issues of gender inclusivity.

Climate-Smart Fisheries Approach

Federal Department of Fisheries (FDF, 2021) noted that climate change will affect fisheries strongly given that it will have impact on fishes on which fisheries depend. It is envisaged that artisanal fisheries which currently accounts for 85% of local production (Obasi *et al*., 2017) will be affected through multiple weather events like windstorms, rising sea levels, warming that lead to migration and (or) extinction of some economic species (Evulobi, 2015) near the coast which may impede the capacities of the communities to operate. Warming is also expected to lead to more stratification of inland lakes leading to anoxic hypolimnion and ultimate fish kills (FDF, 2021). Already, reports on Nigerian coastal waters indicated that some of the economic species of fish: croakers, soles, catfish and groupers are overfished and that revenue of the fishermen have been dwindling due partly to unregulated industrial fishing in the inshore waters against the law. This is in addition to the challenge of unlicensed foreign fleets operating illegally in Nigeria's territorial waters and landing our fishes at foreign ports for importation back to Nigeria (Jim-Saki *et al*., 2017; Obasi *et al*., 2017). Already, the Nigerian fisherfolks are grappling with lack of institutional support, good roads, storage and processing facilities and poor logistic infrastructure that has limited distribution of many commercial species to the south (Unah *et al*., 2017; Subasinghe *et al*., 2021). These challenges are expected to be exacerbated by the impact of climate change; but can be addressed if some climate-smart measures are taken.

Climate-smart approach to fisheries is based on the Ecosystem Approaches to Fisheries (EAF) which is derived from the Code of Conduct for Responsible Fisheries (CCRF). It outlines the following principles in relation to the ecosystem:

1. 'Management measures should not only ensure the conservation of target species but also species belonging to the same ecosystem.
2. States should facilitate consultation and effective participation of all stakeholders.
3. All critical habitats such as wetlands, mangroves, reefs, lagoons, nursery and spawning areas should be protected and rehabilitated.
4. States should ensure that fishery interests are taken into account in the multiple uses of coastal zones and are integrated into coastal area management.
5. States should promote responsible development of aquaculture including evaluation of the effects on genetic diversity and ecosystem integrity.
6. States should establish effective procedures to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic and social consequences' (Staples and Funge-Smith, 2009).

Climate-smart fisheries will then involve using harvesting techniques that are safe to the environment, use of gears that exclude non-target species and sizes to minimize bycatch, fishing populations at rates less than or within the established maximum sustainable yields. It will also entail adopting transportation means with the least climate impact in delivery of the landed fish. Similarly, storage

and processing facilities ought to deploy the best procedures and technologies that promote minimal emission of greenhouse gases like the carbon II oxide, carbon IV oxide and chlorofourocarbon (CFC) coolants.

In this regard, trawling, use of sea rakes, use obnoxious chemicals in fishing and other related destructive fishing techniques are discouraged. Operators of fishing fleets are to use nets of appropriate mesh sizes. Governments are expected to develop plans of action for reducing bycatch, incidental catch of seabirds, conservation and management of sharks, management of fishing capacity, stop all forms of illegal, unreported and unregulated fishing (Staples and Funge-Smith, 2009). Processing technologies that use charcoal or firewood are, also, discouraged because they lead to deforestation.

Climate-Smart Aquaculture

Aquaculture in Nigeria is still in its early stages of development with a contribution of only six percent to the local fish production (Obasi *et al*., 2017) and only two groups of fish, catfish and tilapia, being cultured in the output ratio of 6.5:1 respectively; and most of the farms located mainly in the southwest (Subasinghe *et al*., 2021). Given this backdrop, it is imperative that its development be conducted in accordance with the CCRF to ensure sustainability and climate-resilience.

The CCRF principles relating to aquaculture says that:

1. States should produce and regularly update aquaculture development strategies and plans to ensure that aquaculture development is ecologically sustainable and to allow rational use of resources shared by aquaculture and other users.

2. States should ensure that the livelihoods of communities and their access to fishing grounds are not negatively affected by aquaculture developments.

Estimated potential of aquaculture production per annum in Nigeria is 2.5 million metric tons (FMARD, 2008) but it currently accounts for a local annual production of 6% of the approximately one million metric tons from the fisheries and aquaculture sector, whereas local fish demand stands at two to three million two hundred thousand metric tons (Obasi *et al*., 2017; Chukwunonye and Amaechina, 2022). Aquaculture, although currently low, can serve as a strong livelihood enhancement sector and can also play key role in food security if well developed. Given that the capture fisheries is dwindling (FMARD, 2008; Obasi *et al*., 2017), it remains an important path to achieving the sustainable development goals earlier mentioned. It is commendable that some states like Delta, Lagos, Oyo, Rivers and Ogun have value chain clusters in the fish farm villages and/or large concentrations of farms either established by the government or through private and public partnerships. Aquaculture remains the among the fastest growing food sub-sector with a growth of 4.6% between 2010 and 2020 (FAO, 2022). Some of the challenges with aquaculture production which are also opportunities for investments are: availability and accessibility to better farming practices, availability of inputs: quality fish seed and feed. Accessibility of finance is also a limiting factor (Subasinghe *et al*., 2021)

Nigeria has an aquaculture development policy as enshrined in FMARD (2008) which states: 'The Nigerian National Fisheries Policy is to achieve increased domestic fish production from all sources on a sustainable and renewable basis to the level of self-sufficiency and fish export in the medium to long term'. Given the challenges highlighted above, it remains unclear how much is being implemented particularly in recognition of the guidelines given in the CCRF.

As at 2008, Nigeria had about 2600 fish farms producing mainly catfish and tilapia (FMARD, 2008). It is now not very clear how many farmers are being affected by climate change. Certainly, many during the 2012 and 2022 flooding events on the Benue-Niger trough and its tributaries must have lost not just their stocks worth millions of Naira but also their production infrastructure. Same is also the case for the northern part of Nigeria where relatively longer droughts are being experienced. Without enabling environment, the effect of these factors can be more challenging, especially for small-holder farms. Hence the strategies for climate change adaptation should start with an enabling environment created by Government.

Adaptation strategies include: use of tarpaulin or plastic tanks (this last better if protected from extreme solar irradiation) during dry seasons, adjusting stocking time to when the stock can better adapt to climate impacts, erection of shades over ponds to for temperature control, installation of boreholes or digging of wells during dry periods, well designed drainage systems to guard against flooding (Onada and Ogunlola, 2016), planting of trees near pond areas to trap excess nutrients in percolating water, use of probiotics to minimize use of antibiotics, reduction in fishmeal dependence of feed production, improving water efficiency through intensification, improving productivity through enhancement of periphytic community in ponds and aeration (Bosma and Verdegem, 2011; Dawood *et al*., 2018), location of farms far from the floodplains or flood-prone areas, use of solar-powered smoking kilns, electric powered kilns or gas operated kilns rather than charcoal to reduce carbon fingerprint and deforestation. For farms located in zones of relatively cold weathers like Jos and Manbila Plateaus, greenhouses can be constructed for the farm where possible to ensure temperature control.

For farms having tendency of discharging wastes into the environment, it is imperative that wastes are treated in line with extant standards before being discharged to minimize pollution and alteration of environmental quality. For maximal returns to the investor

and a reduction of environmental footprints, polyculture, integrated culture and aquaponic systems should be implemented. This is because they are amenable to efficient use of resources and lesser waste generation just like it is with use of floating feeds (Bosma and Verdegem, 2011).

Gender Approach to Fisheries and Aquaculture

Studies have tried to interrogate the issue of gender participation in fisheries and aquaculture. Unah *et al*. (2017) noted that fish distribution channels in Lagos are dominated by the males. The prefarmgate value chain of aquaculture is male dominated with a large proportion of then having tertiary education suggesting that the value chain is knowledge-intensive (Subasinghe *et al*., 2021). A study in Ijebu-Ode, Ogun State showed that the fish farms were male dominated to the tune of 70% (Giwa *et al*., 2017). A study to ascertain the specific activities involving the females showed that they are involved in the area of sorting, processing and sale of processed fish in the artisanal fisheries (Nwezza *et al*., 2017: Subasinghe *et al*., 2021). Ikeobasi and Opara (2017) noted that women's participation in aquaculture is livelihood-driven; and their involvement is in mainly in marketing, processing and routine pond management in descending order of importance, far fewer numbers were involved in breeding, harvesting, feed production and pond construction, probably because of the labour-intensive and (or) technical nature of these activities.

In general, challenges that must be addressed to mitigate lopsided participation of both gender in fisheries and aquaculture are highlighted below. In artisanal fishery, a lot of manual labour is required and this limits women. Also, lack of organized cooperative societies, household chores, education and technical know-how are impediments to women's full participation. In aquaculture, inadequate capital, land and high cost takeoff infrastructure for fish pond establishment, high cost of feed, dominance by spouse, inadequate technical-know, omission of women in planning, implementation and monitoring of conservative initiatives are major problems as well (Ekprikpo and Chidinma, 2021).

Extension workers should be detailed to assist the fisher folks especially women to organize themselves into cooperative societies to be able to take advantage of the numerous benefits from it. The aspect of household chores can be mitigated through proper understanding between spouses and a willingness to complement each other depending on the family priorities.

Institutional Support Needed

There is the need for the regulatory agencies to ensure strict adherence to the CCRF in Nigeria. Practical efforts should be made to ensure that the livelihoods of the artisanal fisher folks are protected. The fishermen should form nationwide associations that will draw public attention to their plights. The Nigerian Navy and the maritime wing of the Nigeria Police should improve on security efforts in the region to guarantee that industrial fishing operates strictly beyond 13 nautical miles as stipulated in the law. Processing technologies with less carbon fingerprints like solar-powered fish drying kiln, electrically operated fish drying oven and gas-powered fish drying kilns should be introduced with government giving accessible incentives for their adoption in processing facilities. Complicit members of the regulatory teams should be fished out and disciplined if necessary to ensure that there will be no breach of Nigeria's territorial waters by foreign fishing fleets. In line with goals of the code, demersal fishing should also be conducted in such a manner as to preserve the ecological integrity of the sea bed. There should be regular coordinated monitoring of our inland fisheries and activities around the various water bodies to ensure that overfishing, pollution and other environmentally degrading practices are minimized.

Government should add incentives that can boost participation in aquaculture through providing basic amenities; particularly, storage and logistic facilities (Unah *et al*., 2017) to ensure the fish reaches the consumer in good condition. Such laudable government programs like the anchor borrowers' program and others can be upscaled to accommodate a reasonable percentage of smallholder aquaculturists. Researchers should conduct reviews to make available to the actors the best practices. Public-Private Partnerships in floating feed mills development can be established to enhance feed efficiency in farms (Subasinghe *et al*., 2021).

Adult education programs should be organized in the fishing communities as this is key to ensuring they have the basic communication skills that will help in their business, special training programs can be targeted at women in fisheries and aquaculture to fill relevant skill gaps. To ensure that women can have access capital to establish farm government can develop special grants to encourage their participation, banks can be given special credit facilities by Central Bank of Nigeria dedicated to ensuring their participations in the preharvest and postharvest value chains. Governments should build more fish farm villages with equal opportunity for access. Concerning issues of spouse dominance, reorientation programs can be conducted through a concerted effort of the Federal Department of Fisheries and National Orientation Agency on the importance of men allowing their wives to freely venture in business. Regular success stories of women in different areas of fisheries should be compiled and used as audiovisuals to encourage men in this regard over time. Government should employ women in different levels of policymaking, implementation and monitoring to enhance inclusivity.

CONCLUSION AND RECOMMENDATION

Fisheries and aquaculture industry are an indispensable part of the food sector ensuring cheaper protein availability for human nutrition, income generation and waste management. The sector can perform optimally if given the enabling environment; it can provide job and food. Responsible fisheries in the face of climate change involves different practices that are geared towards ensuring that the ecological, social and economic systems are sustained. There is the need for fisherfolks enlightenment on the issues of climate smart system and gender inclusiveness for sustainable fisheries and aquaculture value chain diversity. We recommend that the government should create the strong institutional framework needed to drive this change.

REFERENCES

Bosma, R.H. and Verdegem, M.C.J. (2011). Sustainable aquaculture in ponds: principles, practices and limits. *Livestock Science, 139*, 58-68.

Chukwuone, N. and Amaechina, E. (2022). Fisheries performance in Nigeria in comparison with some African countries. *In*: Stakeholders seek new policy in fisheries and aquaculture sector. Retrieved 27/02/2023 from https://www.environewsnigeria.com/

Dawood, M.A.O., Koshio, S., Abdel-Daim, M.M. and Doan, H.V. (2018). Probiotic application for sustainable aquaculture. *Reviews in Aquaculture*, doi: 10.1111/raq.12272.

Ekprikpo, W. and Chidimma, P. (2021). Constraints limiting women performance in aquaculture in Nigeria. *Proceedings of the 36th Annual Conference of the Fisheries Society of Nigeria*, 753-756.

Evulobi O.O.C. (2015). Effects of global warming on the freshwater ecosystems: A library review, University of Jos, 65p.

FAO (2008) State of the world fisheries. Rome: Food and Agricultural Organization of the United Nations.

FAO (2012). Summary of SOFIA Report. www.seafish.org/media. accessed 24/2/2023.

FAO (2022). State of the World Fisheries and Aquaculture. Rome: Food and Agricultural Organization of the United Nations, 266p.

FDF (2021). Effects of climate change on fisheries and aquaculture. https://fdf.fmard.gov.ng/2021/10/21/effect-of-climate-change-on-fisheries-and-aquaculture/ accessed 26/2/2023

FMARD (2008). Nigeria National Aquaculture Strategy. Abuja: Federal Ministry of Agriculture, 24p.

Giwa, E.J., Jim-Saki, L.O., Obatola, P.O., Ebohon, J.O. and Erule, O.O. (2017). Socioeconomic analysis of fish farming in Ijebu-Ode Local Government Area, Ogun State, Nigeria. *Proceedings of the 32nd Annual Conference of the Fisheries Society of Nigeria*, 380-385.

Ikeobasi, J. and Opara, J.Y. (2017). Evaluation of women's roles in aquaculture production in Rivers State. *Proceedings of the 32nd Annual Conference of the Fisheries*, 426-428.

Jim-Saki, O.L., Ogunbadeyo, H.K., Obatola, O.P., Tanko, A.A., Giwa, E.J. and Opeyemi E.O. (2017). Maximum Sustainable Yield (MSY) of artisanal fishing in marine waters of Nigeria. *Proceedings of the 32nd Annual Conference of the Fisheries Society of Nigeria*, 284-287.

Nwezza, S.N, Jim-Saiki, L.O., Obatola, P.O., Una, R.L., Obasi, E.U. and Adeyemo, A.M (2017). Women participation in coastal artisanal fishing in Badagry, Lagos State. *Proceedings of the 32nd Annual Conference of the Fisheries Society of Nigeria*, 422-425.

Obasi, E.U., Jim-Saki, O.L., Unah, L.R., Nwezza, S.N. and Oyewo, O.O. (2017). A comparative assessment (overview) of Nigeria's fish production and demand. *Proceedings of the 32nd Annual Conference of the Fisheries Society of Nigeria*, 268-270.

Onada, O.A. and Ogunlola, O.S. (2016). Climate-smart Aquaculture: A sustainable approach to increasing fish production in the face of climate change. *International Journal of Aquaculture and Fishery Sciences*, 2(1): 012-017. http://dx.doi.org/10.17352/2455-8400.000013 Pandey, K. and Shukla, J.P. (2005). Fish and Fisheries. New Delhi: Rastogi Publications.

Subasinghe, R., Siriwardena, S.N., Byrd, K., Chan, C.Y., Dizyee, K., Shikuku, K.…Phillips, M. (2021). Nigeria fish futures. Aquaculture in Nigeria: Increasing Income, Diversifying Diets and Empowering Women. Report of the scoping study. Penang, Malaysia: World Fish. Program Report 16, pp. 94.

Staples, D. and Funge-Smith, S. (2009). *Ecosystem approach to fisheries and aquaculture: Implementing the FAO Code of Conduct for Responsible Fisheries.* FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2009/11, 48 pp.

Unah, L.R., Jim-Saki, O.L., Obasi, E.U., Nwezza, S.N. and Oyewo, O.O. (2017). An inventory of fish distribution channels in Lagos State. *Proceedings of the 32nd Annual Conference of the Fisheries Society of Nigeria*, 366-370.

WHO (2011). Protein requirements: Report of a Joint FAO/WHO Expert Group, FAO and WHP, Switzerland.