

AGRICULTURE FOR THE TIME: SOLVING FOOD INSECURITY IN A FRAGILE ECONOMY.

FACULTY OF AGRICULTURE, DELTA STATE UNIVERSITY, ABRAKA, DELTA STATE, NIGERIA.

CHAPTER TWENTY-EIGHT

POTENTIALS OF CULTURE-BASED FISHERIES IN NIGERIA

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Abstract

Nigeria is often referred to as the "land of aquatic splendor" due to the abundance of water bodies. However, due to poor catches from capture fisheries and unfavorable economic realities for aquaculture, providing fish for the country's growing population has been a major challenge. To surmount this challenge, strategies that are less resource-intensive, and relatively easy to transfer and adapt technically have to be developed. One such strategy is to practice culture-based fisheries (CBF) in Nigeria. Culture-based fisheries are essentially a type of extensive aquaculture that takes place in small bodies of water that would not be able to support a subsistence fishery due to a lack of adequate natural recruitment of suitable species. This review provides an overview of CBF. The primary criteria for selecting water bodies for CBF are also discussed. The paper concludes with a presentation of Nigeria's numerous water resources that support CBF development. The sustainable practice of CBF will ensure a consistent supply of diverse fish species to meet Nigerian fish consumer preferences and fish demand.

Keywords: Culture-based fisheries, Natural resources, Stock enhancement, Aquaculture.

Introduction

Nigeria has a diverse range of inland freshwater, brackish water, and coastal environments. Although, it's true extent is impossible to determine because it varies periodically and year to year depending on rainfall (Ita *et al.*, 1985). It has rich and varied fisheries resources of freshwater and marine origin (Bolarinwa *et al.*, 2015), and is the third most biologically diverse country in Africa with about 800 known fish species. Nine of the 36 federal states in Nigeria have a coastline with the Atlantic Ocean (Olaoye and Ojebiyi, 2018). The country's local fish production comes from artisanal fisheries (from coastal and brackish waters and inland lakes, dams, and rivers), industrial marine fishing, and aquaculture. Contribution from the capture fisheries has reached maximum sustainable yield and is currently on a decline due to the failure of the present process of fisheries governance which pose significant threats to the management of fisheries resources. The lack of effective governance has been attributed to outdated, weak, and inappropriate regulations and incoherent policy (Olopade *et al.*, 2017). To this extent, a form of aquaculture is expected to fill the gap between supply and demand.

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The country is the largest aquaculture fish producer in sub-Saharan Africa, accounting for 52% of the total farmed fish production in the region. Nigeria's aquaculture focuses mainly on freshwater fish, with catfish species accounting for 64% of aquaculture production in 2015 (WorldFish, 2018). Nigeria is one of the top aquaculture producers in Africa and the leading producer in Sub-Saharan Africa, with numerous opportunities for large-scale production, and 80% of production is from small-scale farmers who are involved in brackish and freshwater cultivation, except mariculture which has several setbacks (Kaleem and Sabi, 2021). Apart from the major global critiques of aquaculture developments which include; over-intensification (excessive use of primary resources such as land and water), effluent discharge (impacts on waterways and eutrophication), Use of alien species (impacts on biodiversity), excessive use of fish meal and fish oil (uses nearly 65% fish meal); the Nigerian aquaculture industry is facing serious constraints such as high cost of fish seed and feed (Eriegha and Ekokotu, 2017; Eriegha *et al.*, 2022), climate change challenges (De Silva and Soto, 2009; Ovie and Belal, 2019), poor infrastructure, disease outbreaks, unfavorable government policy, and poor pricing policy of finished products (Adedeji and Okocha, 2011). These challenges have made bridging the nation's fish demand and supply a mere mirage. Nigeria now relies heavily on the importation of fish in other to accommodate total fish demand. In 2021 alone, Nigeria spent over N500 billion on fish importation (National Bureau of Statistics). The country's continuous importation of fish portends a colossal loss of foreign exchange earnings, loss of jobs, and deepening of poverty. A good step toward the reduction of fish importation is the complete utilization of the potential of culture-based fisheries in Nigeria.

Culture-Based Fisheries: An Overview

Culture-based fisheries (CBF) are practices to enhance fish stocks in waters that don't have enough natural recruitment to sustain a fishery. CBF practices are usually applied in small water bodies such as village dams and irrigation reservoirs. Fish growth is driven by the natural productivity of the waters. Usually, there is no feeding and the fish are left to forage on natural food supplies. Ownership and management of the stock distinguish CBF as a form of extensive aquaculture. Culture-based fisheries solely or mostly depend on stock. It comprises two phases: a culture phase for producing stocking materials, and a wild (fisheries) phase for the growth of the stocked fish through natural processes of the water body (Thorpe, *et al.* 2011). Thus, it is mainly about stocking fish seed and their recapture on attaining marketable size, after thriving on natural food resources available in the reservoir (Suresh, 2021).

CBF is a secondary user of existing water resources and is non-consumptive of this valuable resource. It is mostly practiced in water bodies that are incapable of sustaining fisheries through natural recruitment (De Silva, 2016). Water bodies selected for CBF are stocked with suitable species at pre-determined stocking rates. The stocked fish live and grow in the water body consuming the naturally produced food organisms in it. The fish are harvested at a suitable time or when the water level recedes. A selected community group, will have ownership of the stock, prepare the water body for stocking, procure seed stock, and care for the stocked fish, in particular by keeping watch over the stock (De Silva *et al.*, 2006, Eriegha *et al.*, 2019).

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Culture-based fisheries are a form of stock enhancement bordering on aquaculture. Fisheries enhancement in a broader sense includes, ranching and/or the introduction of a species that is capable of reproducing in the water body and, with time, forms sufficiently large populations that could be exploited commercially. On the other hand, ownership coupled with the need for some level of caring for the stocked fish makes it a form of aquaculture (De Silva, 2003). CBF offers several advantages over more conventional and intensive forms of aquaculture:

- Simple technology that is easy for farming communities to learn and adopt.
- Very low capital costs, making use of existing infrastructure and natural productivity.
- Contributes to the income, food security, and nutritional status of rural communities.
- Suitable for implementation as a communal activity.
- Sustainable, very low greenhouse gas emission food production, with no external power or feed inputs (NACA, 2000; De Silva, 2015; 2016).

Criteria for Selection Water Bodies for CBF

A step-by-step description of how to develop CBF in Nigeria has been described by Eriegha *et al.* (2019). However, before the establishment of CBF, an array of criteria must be followed to ensure the success of the project. The main criteria for evaluating the suitability of water bodies for CBF are mostly physical and socio-economics (Figure 1). Although, a multiple criteria decision making approach should be adopted to ensure the success of the CBF. Multiple-criteria decision-making approach should be based on several criteria, such as biological productivity, catchment land-use characteristics influencing nutrient enrichment in reservoirs, and socioeconomic factors (Wijenayake *et al.*, 2021). Special attention should be given to the limnological component of the water (Wijenayake *et al.* 2014), predatory pressure (Wijenayake *et al.* 2005), species combination, and stocking density (Wijenayake *et al.*, 2021).

Potentials of Culture-Based Fisheries in Nigeria

Nigeria's rising middle-class and urban population, coupled with the general rise in economic development, has led to rising demand for fish (Kaleem and Sabi, 2021). The country is among the largest fish consumers in the world, with a current yearly domestic fish demand of about 3.6 million metric tonnes. With a total yearly domestic production trailing behind 1.1 million metric tonnes, this leaves a demand-supply gap of about 2.5 million metric tonnes (Ibirogbu, 2022). This huge gap in fish production and supply is enough motivation for the government and private institutions to embrace CBF.

Nigeria is often called the land of aquatic splendor. It has networks of abundant natural water resources (Kaleem and Sabi, 2021). As stated earlier, CBF is best practiced in small water bodies such as dams, and reservoirs. There are huge prospects and potential for the development and growth of CBF in Nigeria, as there are numerous freshwater reservoirs, dams, free-flowing boreholes, and floodplains (Agbelege and Olarewaju, 2010). As of 1985, Ita *et al.* (1985) had already documented 200,000 Ha of a stagnant pool of seasonal rivers, 275,534 Ha of reservoirs, 515,000 Ha of floodplains, and 2.0 Ha of burrow pits. With the increase in population and a corresponding demand for housing, a vast unaccountable mass of burrow pits are scattered across the country (Joseph *et al.*, 2020). Apart from this documentation, new dams are springing up across the country either for energy generation

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or for irrigation. Most of these water bodies that are suitable for CBF are currently not in use. Hence, there will be a reduced conflict of interest among users.

Nigerians prefer a variety of fish species, including *Parachanna obscura* (Snakehead), *Gymnarchus niloticus* (African Trunkfish), *Heterotis niloticus* (African Bony tongue), *Citharinus citharus* (Moon fish), *Chrysichthys nigrodigitatus*, and others (Idodo-Umeh, 2003; Nwachi, 2016). Unfortunately, the supply of these fish species from capture fisheries is grossly inadequate, owing primarily due to destructive fishing practices (Amos and Peter, 2018), and pollution (Eriegha and Sam, 2020). *Clarias*, *Heterobranchus*, and Tilapia have contributed the most fish species to the Nigeria aquaculture industry. The aquaculture industry has yet to make significant advances in the culture and management of these important fish species. The main challenges have been sourcing fingerlings, non-adaptability to artificial conditions, and the inability to accept artificial feeds. Given the foregoing facts, CBF will ensure a consistent supply of diverse fish species to meet consumer preferences as well as the nation's fish demand.

Conclusion

Concerns about aquaculture intensification and competition for primary resources (land and water) have necessitated a strategy for fish production using existing water bodies with minimal external input. Culture-based fisheries play a critical role in augmenting fish production from capture fisheries and traditional aquaculture. Numerous bodies of water in Nigeria have been identified as suitable for culture-based fisheries. Despite this potential, the vast majority of these bodies of water have yet to be used for CBF. Fish production will increase if all of the water bodies identified for CBF are mobilized.

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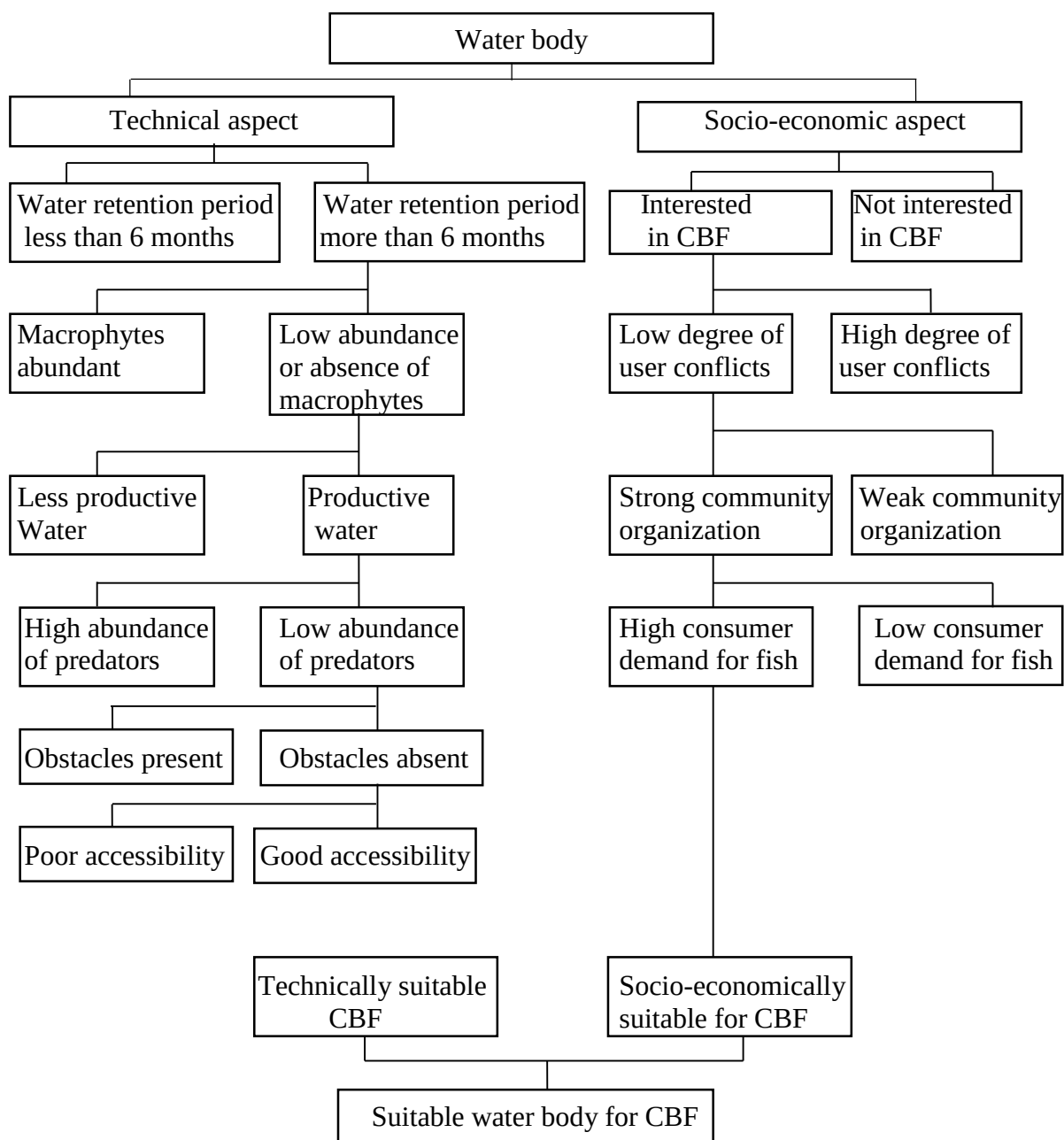


Figure 1: Approach for technical and socio-economical selection of water bodies for CBF development (adapted from De Silva *et al.*, 2006; Eriegha *et al.*, 2019; Wijenayake and Amarasinghe, 2021).

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