

Review

Brackish water aquaculture: a veritable tool for the empowerment of Niger Delta communities

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Accepted 17 January, 2020

Poverty is generally considered as one of the major causes of food insecurity and poverty alleviation is essential in improving access to food. Among countries in the developing world, including Nigeria, the people in the fishing sectors are some of the poorest and most neglected. This is true of the fishers in the Niger Delta Region of Nigeria. Depletion in natural fish stock, lack of development in the oil rich region, neglect of aquaculture industry have led to disintegration of these traditional communities. Hence, there is massive rural migration to the major cities, especially among the young school leavers seeking for greener pastures. Brackish water fish farming as a profitable alternative venture is a veritable tool that can provide food and jobs for teeming youth and women in addition to freshwater fish and crop farming. The coastal communities of the Niger Delta region has remarkable potentials for the development of brackish water aquaculture, but these remain largely undeveloped not only because of the difficult nature of the terrain, but the government as well as the multinationals have not understood and tapped the potential role of brackish water aquaculture in managing the crisis in the Niger Delta. Economic empowerment of restive youths and women through brackish water aquaculture can be achieved through encouragement of personal investments, formation of farmer co-operative societies provision of loans and credit facilities, on-farm training and establishment of brackish water fish farms by multinationals and government, manpower development in techniques for the propagation and culture of brackish water species such as tilapia, mullet, tarpon, oysters etc at centers like the African Regional Aquaculture Centre, Brackish water Research Station, Buguma, Rivers State. The above if carefully assessed and implemented could go a long way in reducing the tension in the region, thereby making it governable and enhancing economic activities which are gradually grinding to a halt as a result of youth restiveness.

Key words: Aquaculture, brackish water, fish, empowerment, Niger Delta.

INTRODUCTION

Brackish water fish farming is a system of aquaculture that focuses on the production of quality fin and shell fish that are found in the creeks, lagoons, and estuaries through rational rearing. It has a capacity of bridging through wide gap between fish demand and supply. According to Ugwumba and Ugwumba (2003), the demand for fish in Nigeria has been on the increase with demand far exceeding supply. Fish production from aquaculture is seen as

the only means to bridge the widening gap between domestic fish supply from depleting return from capture fisheries and demand. Data on domestic fish production in the country show that it ranges between 0.26 and 0.48 million tones per annum (Table 1). Production values is less than 30% of the projected demand; hence the need for increased production to bridge this gap.

Aquaculture is defined as the rearing of fish in artificial or natural bodies of water by manipulation of the environment with the aim of increasing production beyond natural limit. Fish production currently generates less than 3% in aquaculture where as with appropriate promotional

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Table 1. Domestic fish production by sectors (tones).

Year	Artisanal (Coastal and brackish water: lakes and rivers)	Industrial (Commercial trawlers inshore and Offshore)	Aquaculture	Total production
1991	291,286	36,226	15,840	343,352
1992	283,943	39,365	19,770	343,078
1993	201,176	35,644	18,703	255,523
1994	234,601	30,488	18,104	283,193
1995	320,955	33,479	16,619	371,053
1996	309,200	27,244	19,490	355,934
1997	360,220	27,703	25,265	413,188
1998	433,070	29,955	20,458	483,482
1999	426,786	31,139	21,738	479,663
2000	418,069	23,308	25,720	467,098

Source: Federal Department of Fisheries, FDF (2002)

strategies it could match capture fisheries output and cost effectiveness (Jamu and Ayinla, 2003).

Of the different global food production supply systems, aquaculture is generally viewed as an important domestic provider of much needed high-quality animal protein and other essential nutrients generally at affordable prices to the poor segments of the community (Tacon, 2001). Increased production from aquaculture will help combat hunger and malnutrition, which remain one of the most devastating problems facing the majority of the poor in the world. According to WHO (2000) nearly 30% of humanity, including infants, children, adolescent, adults and elderly within the developing countries are currently suffering from one or more of the multiple forms of malnutrition, food insecurity and abject poverty.

Level of poverty and the need for brackish water aquaculture in the region

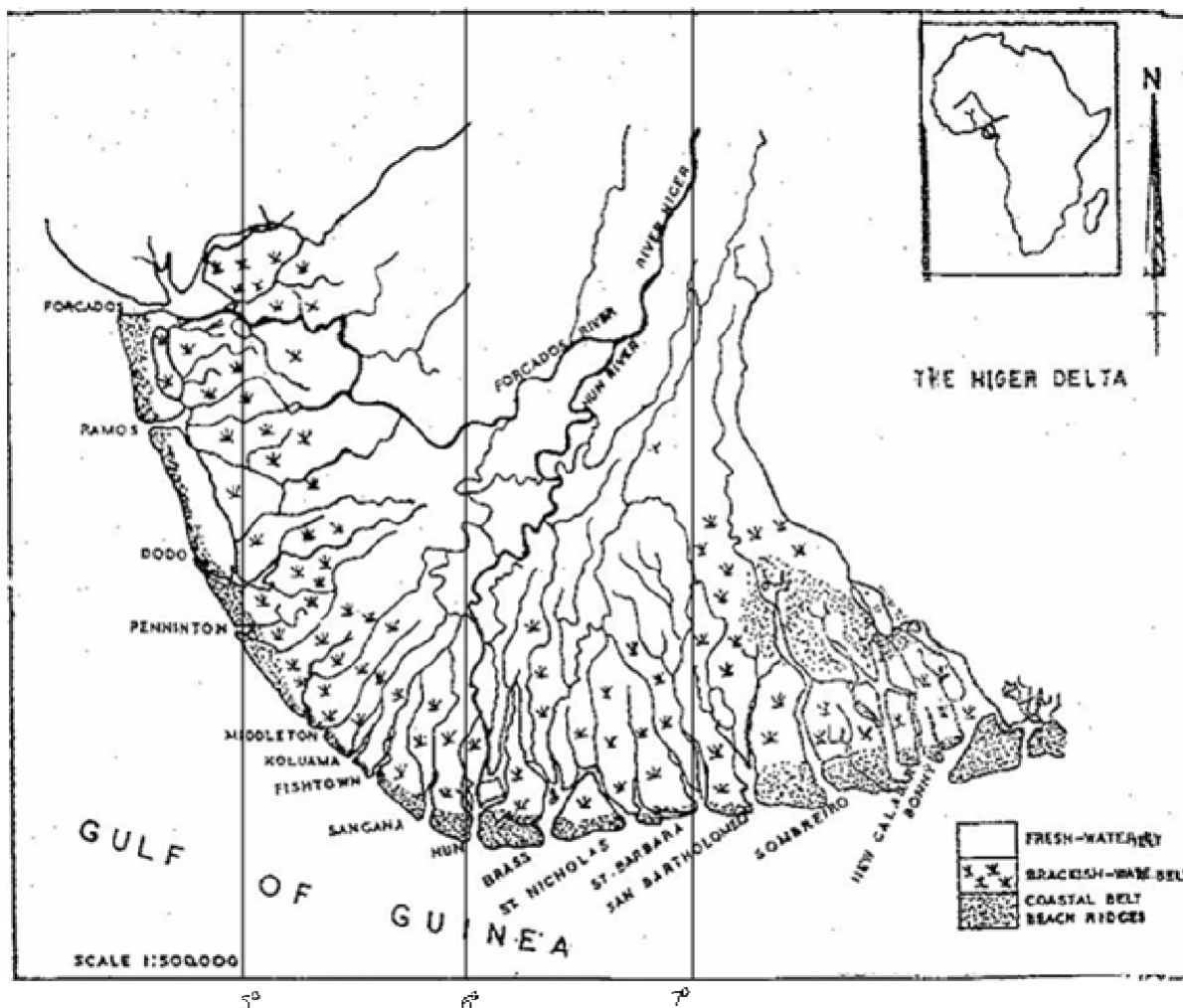
Poverty is generally considered as one of the major cause of food insecurity and poverty alleviation is essential to improve access to food. The World Bank defines poverty as a multi dimensional phenomenon, encompassing inability to satisfy basic need, lack of control over resources, lack of education and skills, poor health, malnutrition lack of shelter, poor access to water and sanitation. Vulnerability to shock, violence and crime, lack of political freedom and voice (World Bank, 2000) . It is estimated that among countries in the developing world, Nigeria inclusive, the people in the fishing sectors are some of the poorest and most neglected. This is true of the fishers in the Niger Delta Region of Nigeria, (Ayinla, 2003). Lack of the development of these oil rich regions, neglect of the aquaculture which should have empowered the people economically improving the living conditions has led to disintegration of these traditional communities. These people living in abject poverty are often times exploited and short change by people who can afford to buy their fish crops, which leads to the disintegration of traditional

communities and increasingly marginalized rural societies. Hence there is massive rural urban migration to the major cities, especially among the young school leavers seeking for greener pastures. Some who choose not to migrate, with a deep sense of marginalization by the government and multinationals react by engaging in antisocial and criminal acts such as oil bunkering, piracy, hostage taking, blowing up of oil pipes leading to spills of various stages. This has created a lot of societal disorder and problems which has degenerated into chaotic situations as the level of agitation and social unrest in the region has risen tremendously in recent times. Every sector of the economy has been adversely affected. There is need for an alternative venture that the people in these regions especially the women and youths living in the coastal areas should profitably engage in. And brackish water fish farming seem to be the best option.

Potential for brackish water fish farming

Brackish water fish farming is a veritable tool that can provide food and jobs for the teeming youth and women in the Niger Delta. The region is naturally endowed with a long coast line bordering the Atlantic Ocean and an extensive network of inland river systems (Okorie, 2003); these and other factors point to the fact that Niger Delta has a remarkable potential for brackish water aquaculture development.

Scott (1966) estimated that there are about 729,000 hectares of saline mangrove swamp suitable for development of commercial fish farming. The Niger Delta region is made up of three of ecological water systems; (Table 2) freshwater; brackish and marine waters (Ezenwa, 2006). Each of these zones has its own, indigenous, culturable fish species and suitable land topography (Ezenwa et al., 1990). There is tremendous potential of aquaculture in this. If it is properly harnessed, can contribute immensely to production of fish in the region. These remarkable potentials for the development of aquaculture



Source: Alagoa 1985

Figure 1. The Niger Delta Terrain.

Table 2. Potential fish production in various water systems in Niger Delta.

Water systems	Potential production
Fresh water aquaculture	500,000 mt/yr
Brackish water Aquaculture	400,000 mt/yr
Marine Aquaculture	300,000 mt/yr

Source: Ezenwa (2006).

remain largely undeveloped because of the difficult nature of the terrain (Alagoa, 1985). The whole area is a maze of creeks, and shallow estuaries interspersed with swamps and sandy ridges reminiscent of vast netting spread out on a flat ground (Figure 1). The creeks and estuaries are the many outlets, through which the vast water of the Niger Benin, Orashi and Sombreiro, Nun,

Andoni, New Calabar, Brass, Fish town, among others. Rivers drain into the Gulf of Guinea and these are surrounded mainly by mangrove swamps (Alagoa, 1985), that are suitable for brackish water fish farming (Table 3). The potential in this area therefore called for sustainable aquaculture development which involves management and conservation of the natural resource base and orientation of technological and institutional changes, in such a manner, as to ensure the attainment and continuous satisfaction of human needs for present and future generations. Such package must of necessity include brackish water fish farming with other agricultural production (Ayinla, 2003).

Important culturable species in brackish water

The choice of species to culture is very important for the

Table 3. Estimated areas of major lagoons, estuaries and lower river sectors that are fringed by mangrove in Niger Delta.

Brackish water system	State	Brackish water area in km ²	
		Based on federal survey maps ^a	Based on radar mosaics ^b
Benin River	Bendel	150	109
Escravos River	Bendel	150	160
Forcados River	Bendel	120	201
Ramos River	Rivers	50	46
Dodo River	River	-	-
Pennington River	Rivers	21	17
Kulama River	Rivers	10	12
Fish town River	Rivers	5	5
Sangana River	Rivers	37	-
Nun River	Rivers	67	52
Brass River	Rivers	94	91
St. Nicholas River	Rivers	44	21
San Barbara River	Rivers	49	48
San Bartholomeo River	Rivers	84	81
Sambreiro River	Rivers	117	132
New Calabar River	Rivers	92	163
Andoni River	Rivers	160	117
Imo River	Rivers	-	51
Kwa Ibom River	Cross River	-	7
Cross River	Cross River	750	510

^aSsentongo et al. (1983) determined areas using Federal survey maps. ^bNduaguba (1983) estimated areas using Side-Looking Airborne Radar Mosaics. Source: Ssentongo et al. (1983).

success of any aquaculture venture (Ugwumba and Ugwumba, 2003). Certain criteria are developed in order to select the species, shell or fin fish that are most suitable for commercial culture in brackish water farms. The species to be cultured must have a high market value, acceptability of artificial feed, tolerance to culture condition in pond and most importantly, regular availability of seeds from the wild for culture. This is the most important factor as techniques of brackish water species propagation in this part of the world is still at its embryonic stage.

Many fin and shell fish species are abundant in brackish water zones of Niger Delta; Table 4 these can be cultured with minimal capital input in most of the coastal communities. According to Deekae et al. (1994). Most of the shell fish production is yet to be developed in commercial scales, as obtained in other countries like China, Indonesia, Thailand, Philippines among others. Hence, the need to focus more on these area, so as to enhance food security and employment opportunities in the region.

Technical and socio-economic considerations in brackish water fish farming

Socio-economic considerations are important when developing brackish water fish farming system (Ranadhir, 1978). The development of brackish water farm in any area depends on the harmonious interactions among

socio-economic conditions, cultural values agricultural production and environmental conditions prevalent in the area. In most parts of the coastal areas of the Niger taken into serious consideration before establishing the Delta there are variations in species abundance and market values (Akinrotimi et al., 2005). This should be taken into serious consideration before establishing the farm. The technical factor of importance in brackish water fish farming is basic understanding of the physical chemical and biological components of the soil and the water body in relation to the fish species. Brackish water fish farming should be constructed on a low-lying tidal mud-flat, to ensure steady exchange of tidal waters between the farm and the adjoining creek, estuary and lagoons (Sengupta, 1978).

The principle of brackish water fish farming mainly lies in allowing the tidal water to enter into the pond and flood it to optimal depth as may be required by the cultured fish and also allow the outflow of the water during low-tide, to a minimum tolerable depth (Akinrotimi et al., 2005). Boosting aquaculture growth through the application of sound technologies and principles is one of the most important ways to reduce rural poverty and attendant social vices. It has been found that higher crop yield reduce both the number of rural poor and severity of rural poverty. But the effects are strong only if certain group of people, that is, women and youth in the community are targeted (Ogun-

Table 4. Culturable fish species in brackish water zone of Niger Delta.

SPECIES	Market value	Availability of seed /fry	Feeding habits	Potential yield
Mullet <i>Liza falcipinnis</i> <i>Liza grandisquamis</i> <i>Mugil cephalus</i> <i>Mugil bananensis</i> <i>Mugil curema</i>	Good	All year round but inadequate	Phytophagous/Detritivorous	Very high yield. Performs well in Poly-culture with catfish, snappers and tarpons Yield = 3000 kg/ha/annum
Tarpon <i>Megalops atlanticus</i>	Low	Seasonal inadequate and	Predatory	Grow fast. Flesh is of poor quality due to intramuscular bones Effective in the control of excess tilapia. Yield = 4542kg/ha/annum
Tilapias <i>Sarotheron melanotheron</i> <i>Tilapia guineensis</i>	Good	All year round and adequate	Phytophagous/Detritivorous	Handy and wide acceptance for culture. Highly prolific with stunted growth. Yield = 4800kg/ha/annum
Catfish <i>Chrysichthys nigrodigitatus</i> <i>Bagus bayad</i> <i>Bagus domae</i>	Very Good	Seasonal inadequate and	Omnivorous	Handy. Grow very slow in culture medium Requires artificial fields and grow well with tilapia/mullets. Yield = 4542 kg/ha/annum.
Snapper <i>Lutjanus goreensis</i> <i>Lutjanus aegenis</i>	Good	Seasonal inadequate and	Predatory	Very good in poly culture with tilapia, control excess tilapia in ponds. Yield = 1412 kg/ha/annum.
Ten pounder <i>Elops lacerta</i>	Low	Seasonal inadequate and	Predatory	Fast growth, flesh is of poor quality due to intra muscular bones, hence low market value. Yields = 4250kg/ha/annum.
Grunters <i>Pomadasys jubelini</i> <i>P. peroteti</i> <i>P. rogeri</i>	Good	Seasonal inadequate and	Predatory	Good predator in brackish water ponds. Yield = 1,412kg/ha/annum.
shell fish Shrimp <i>Peanaeus notialis</i> <i>Peanaeus monodon</i> Oyster <i>Crassostrea gasas</i>	Good Good Very Good	Seasonal inadequate and Seasonal inadequate and	Detritivorous Filter feeder	Culture still experimental Potential culture is very high
Periwinkle <i>Tympanotonus fuscatus</i> <i>Tympanotonus radula</i>	Very Good	Seasonal inadequate and	Filter feeder	Potential culture is very high
Whelk <i>Thais coronata</i> <i>Pugillina morio</i>	Low	Seasonal inadequate and	Predatory	Culture still experimental
Bloody Cockle <i>Anadara (senilia) senilis</i>	Very Good	Seasonal inadequate and	Planktophyagous Filter feeder	Potential culture is very high

(Modified after Ezenwa et al., 1990; Fagade and Ugwumba, 1992; Deekae et al., 1994; Ugwumba and Ugwumba, 2003).

fowora et al., 2004).

Targetted group for empowerment

Most of the poverty alleviation programmes in time past has focused on men and some elites in the communities at the detriment of the women and youth, where as these are in the majority in most communities of the Niger Delta.

In order to have a long term and sustainable impact on alleviation of poverty, the place of women and youth in the communities must be critically analyzed. It has been estimated that women and youth provide some 60 - 80% of agricultural labour force in Africa (Ogunfowora et al., 2004). They play a very significant role in aquaculture, which are often overlooked. Mochi (2003) acknowledged that women and youth are key players in African agricultural sector and their participation is critical to achieving food security and economic well-being. Women often play major role in small-scale fisheries. They are often by tradition the manager of small mixed farms including fish ponds and are also involved in harvesting of shell fishes e.g. periwinkle, oysters among others (Ansa and Bashir, 2007). They are also responsible primarily for the post harvest activities-processing and marketing of fish (FAO, 1991). Women in rural areas, according to Catagay (2001) suffer from poverty in fishing community more than men. The problem of declining fish stock from capture fisheries is often compounded within families. Often fish provides a livelihood for the whole family. A lower catch means less to process and market and none left for the family to eat. There is therefore the urgent need to develop aquaculture more vigorously and also to empower women and youth for active participation.

Empowerment strategies

For any meaningful program to succeed in alleviating poverty in the Niger Delta communities it must cut across all the strata of the society including women and youth empowered. Empowerment of these groups in the area of brackish water fish farming is a very viable instrument that can reduce restiveness and boost fish production in the region as well as the entire Nigeria.

The empowerment may be achieved through one or more of the following:

Personal investment: Although it is a long standing practice, and the most common, however, limited in scope this is because personal and families' financial ability to invest in fish farming is limited, which will inevitably affect the production level. It is an important empowerment tool but limited in scope to turn around the situation.

Formation of fish farmers association: Farmers organize themselves in groups known as cooperative society and associations. These societies are major means of

empowerment strategies throughout the country particular now that the federal government has provided soft loans for investment in various aspects of agricultural investments. However, it has limited application to brackish water fish farming. Of recent fish farming cooperative societies were established for the empowerment of their members. Examples include Kolokuma/Opokuma Farmers Society in Bayelsa State, Opobo fish farmers Association in Rivers State and so many others all over the region.

Access to loans and insurance of farm: Accessibility of loans and credit facilities should be facilitated to finance farming projects. With the high interest rate on agricultural loan in commercial banks, it is not feasible to establish a viable brackish water fish farm. Although the federal government made available loans for agricultural activities, most often collaterals are required for disbursement of such loans. In exceptional cases where collaterals not demanded, farmers are expected to provide a certain percentage of the amount involved in the business. Besides, the loans are most preferably given to those who already have on-going business that wish to expand. Efforts therefore must be made by the government to put in place policies that ensure low interest rates for farmers and extended payback period.

Role of corporate organizations: One of the vital reasons for so much unrest in the Niger Delta region is poverty and lack of employment of women and the young school leavers. Organizations operating in these areas, like oil companies, should provide necessary assistance to youth and women in the establishment and maintenance of brackish water fish farms within and around their various localities. Examples include Green River Project in Rivers, Delta and Bayelsa States, sponsored by Nigerian Oil Company (Agip) to empower the youths and women in fish farming, and Shell Petroleum Development Company (SPDC) agric development projects and youth empowerment through training and establishment of agricultural projects.

Government interventions: Government should establish demonstration farms at local level to serve as pilot schemes for the farmers within the locality. An example is Brackish water Fish Farm at Opobo established by the Opobo/Nkoro Local Government Council, Rivers State.

The government can also intervene through the Nigeria Delta Development Commission (NDDC) since its main objective is the empowerment of youths in Niger Delta Area. Resources should be allocated for manpower development through practical skills acquisition programme, on completion of the programme, participants should be provided with facilities required for fish farming such as ponds, fish seeds and feeds.

Manpower development and training: The African Regional Aquaculture Centre (ARAC) Brackish Water Rese-

arch Station, Buguma, Rivers State is located in the the Niger Delta region. The center has an excellent human resource capacity and facilities to take care of every need in all aspects of brackish water fish farm training including techniques for the propagation and culture of brackish water fish species such as tilapia, mullets, tarpon, catfish, cockles, oysters, periwinkles, shrimps; intensive training on farm design, pond construction, feed manufacture and general fish farm management.

Conclusion

The importance of aquaculture development in sustainable livelihood cannot be over emphasized. It is an important economic venture in terms of employment, food security, enterprise development and foreign exchange earnings and also plays a key role in terms of the livelihoods and nutrition of many people in rural areas Development of aquaculture in the Niger Delta region is an untapped diamond mine that can supply a good percentage of the protein needs of Nigeria that is presently highly dependent on importation of frozen fish. Besides it will provide employment, thus alleviating poverty and enhancing the economic status of the rural populace in the region and reduce to the barest minimum the level of violence from disenchanting youths that is characteristic of the region in recent times

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