Freshwater Aquaculture: An Investment Opportunity in the Fishery Resources in North Central Nigeria.

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Abstract
The oil bloom which almost deteriorated agricultural development affected the development of fisheries projects in some parts of Nigeria. Fish remains very significant in the provision of employment; it contributes about 50% of the animal protein intake of the population but less than 4% to the country’s GDP. The estimated national demand for fish is as high as 1.5 million Metric Tonnes and this led to the conclusion by the Federal Department of Fisheries that 1/3 of demand is provided domestically hence, the need to bridged the gap between demand and supply. The North Central States (Nasarawa, Kogi, Niger, Benue, Kwara, Plateau and the Federal Capital Territory (FCT) have the capacity with about 222,518.95 (ha) inland waters for capture and Aquaculture fisheries to produce about 0.6 million MT of fish every year.

Keywords: Aquaculture, Investment and Fisheries Resources.

Introduction
The Nigerian economy depended largely on agriculture till the early 1980s. Changes were brought about by the oil bloom which rapidly deteriorated the sector (Satia, 1990). Fish, the cheapest source of animal protein consumed by the average Nigerian accounted for about 50% of total protein intake, Ayinla, (2007). Fish supply in Nigeria is mainly from the capture sector especially the coastal and inland artisanal fisheries. The sector contributes about 85% of total domestic production of which only 2.81% is contributed by the North Central States (FDF, 2007). Nigeria imports about 700,000 Metric tonnes of fish per annum and annual deficit of about one and half million tonnes still exist.

Aquaculture has recently been recognized as an alternative means of increasing domestic fish production. It is estimated to have the potential of contributing between 0.65-1.2 million MT of fish annually from inland fresh water alone (Adewumi, 2007). This situation indeed poses a challenge to all stakeholders including the North Central zone with the option of looking to aquaculture and inland water for increasing domestic fish production. The North central zone has great potentials in fisheries activities with estimated surface Area of 222,000 million (ha) occupied by network of natural lakes, reservoirs and dams with a total of about 480 water area of farm ponds scattered within the zone either partially functional or abundant, (SPFS, 2003).

This paper seeks to show case the Nigeria’s fisheries potentials with a view to providing suggestions and recommendations on prospects for aquaculture development.
Figure 1: Map of Nigeria showing the North Central States including FCT involved in fisheries activities

Availability of Water Body
The North Central States of Nigeria have abundant riverine and lacustrine resources that could be used for aquaculture to support the fisheries sector. River Niger and Benue flow about 1,300 km² and 1,440 km² respectively and are joined by several tributaries from the North, East and West. These are potentials for inland fisheries and aquaculture development. The zone has the capacity of about 222,000 ha of inland water and aquaculture to produce about 0.6 MT of fish every year if the vast inland aquatic resources are fully operational. The Southern part of the country is drained by a series of shorter rivers around the South-West and South-South making it possible for the establishment of fish farms. There is a huge artisanal fishing and aquaculture activities in this coastal areas but may at the long term be constrained due to competition by many industrial and domestic users (FAO, 2004).
Table 1. Inventory of Inland Aquatic Resources (Dams, Reservoirs & Lakes) in North Central Nigeria.

<table>
<thead>
<tr>
<th>State</th>
<th>No. of Fish Farms</th>
<th>Government</th>
<th>Private</th>
<th>Water Area of Farm Ponds (ha)</th>
<th>Estimated surface Area 1-10 (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plateau</td>
<td>18</td>
<td>4</td>
<td>14</td>
<td>186.7</td>
<td>1,138</td>
</tr>
<tr>
<td>FCT.</td>
<td>29</td>
<td>5</td>
<td>24</td>
<td>12.28</td>
<td>326.4</td>
</tr>
<tr>
<td>Kogi</td>
<td>22</td>
<td>1</td>
<td>31</td>
<td>37.12</td>
<td>444</td>
</tr>
<tr>
<td>Kwara</td>
<td>121</td>
<td>1</td>
<td>120</td>
<td>88.85</td>
<td>382.4</td>
</tr>
<tr>
<td>Nasarawa</td>
<td>39</td>
<td>4</td>
<td>35</td>
<td>73.85</td>
<td>1,714</td>
</tr>
<tr>
<td>Niger</td>
<td>29</td>
<td>4</td>
<td>25</td>
<td>52.01</td>
<td>218,195</td>
</tr>
<tr>
<td>Benue</td>
<td>202</td>
<td>1</td>
<td>201</td>
<td>31.01</td>
<td>319.15</td>
</tr>
<tr>
<td>Total</td>
<td>470</td>
<td>20</td>
<td>450</td>
<td>482.31</td>
<td>222,518.95</td>
</tr>
</tbody>
</table>

Source: (SPFS, 2003).

Aquaculture

Aquaculture in Nigeria is receiving a wide recognition as a result of the progressive development in some parts of the country. The total current aquaculture production has leaped from 50,000 MT in 2005 to 85,000MT (FDF, 2007), and demand is expected to continue to grow, hence, areas like the North Central with presently low aquaculture development as shown in figure 1 below needs to be encouraged to invest in the sector.

Figure 2: Contributions of geopolitical zones to domestic fish production in Nigeria (1995-2007)
The total size of fish farms in the zone is estimated at 222,518.95ha FDF (1995-2007), with little intervention from the public sector. The common cultivable species of fish include *Clarias* sp., *Tilapia* and *Heteroclarias* among others as shown below. Fish production systems range from traditional earthen ponds to the intensive concrete ponds. Production systems have been improved to intensive circulation system with biofiltration for ammonia removal to “flow – through” systems where large volumes of water is constantly required. These improved international technologies necessitate more skilled and unskilled employment and brings about higher fish productivity.

**Availability of Seeds**

Before the development of hatchery stations fries, fingerlings and juveniles are collected from wild or open water bodies by artisanal fishermen using baskets, fine mesh nets and cane traps. This is usually easier during schooling. The most preferred species were the *Clarias* or *Heterobranchus* catfish or a cross of these two called a *Heteroclarias”. Tilapias* are believed to be most preferred in the upper scale market in Europe and America. However, fewer of the fish farmers in North Central Nigeria still depend on capture fisheries and these have almost disappeared in South west and South south (Adewumi et al., 2011).

Some cultivable fish species cultured in Nigeria and which are capable of thriving well in the fresh water environment include: *Clarias gariepinus, Clarias Lazera, Heterobranchus sp. Heteroclarias, Tilapia, Oreochromis niloticus, Sarotherodon galilaeus, Sarotherodon melonoplura, Tilapia zilli, Tilapia guineensis, Hereterotis niloticus, Chrysichthys nigrodigitatus, Cyprinus Carpio* etc. Between the 1970s and 80s fish hatchery established in the North Central between 70s and 80s were located in Panyam (Plateau State) for seed multiplication and for skilled manpower requirement. Demonstration centers were also established in Kaduna and Plateau State by the Federal Department of Fisheries assisted by the FAO to service Northeast and Northwest respectively. Some private fish farms inventorised by the aquaculture and inland fisheries projects (AIFP, 2004) had small to medium size hatcheries built beside them and most of them are either poorly managed or abandoned. The abandonment has been largely due to the technical deficiency of the hatchery managers as most of them were either poorly trained or inadequately remunerated or both. The challenge before stakeholders in ensuring filling the gap of fish demand and supply is to revive these hatchery stations with the view to providing enough seeds for fish farmers and investors wishing to venture into aquaculture and stocking of inland waters in the zone with desired species. Investment in the hatchery sector is growing mainly in the South-South and South-West region of the country with the establishment of about 30 more small, medium and large scale water re-circulation and flow-through systems in the area.
Fertilizers and Feeds:
Organic manure is extensively used by fish farmers to enhance pond productivity and plays a greater role in aquaculture development than inorganic fertilizers. Chicken manure is preferred due to its availability within the zone and there is no restriction to its use in fish production. There are other types of manure that are available and the recommended application rates of animal manure in Nigeria are 560-1,630 kg/ha/week, poultry manure 112-224 kg/ha/week and cattle manure at an average of 672 kg/ha/week (Aynla, 2007).
Inorganic fertilizers commonly used in aquaculture in Nigeria include superphosphate, triple superphosphate, urea, Ammonium nitrate, potassium nitrate and potassium sulphate. Phosphate fertilizers are commonly used in ponds because plankton growth is limited by phosphorus. Fertilizer is usually applied at least two weeks after the flooding of a limed pond. It is important to note that inorganic fertilizers are always in short supply because of the high competition with crop production and are expensive.
The availability of organic manure and its low cost within the North Central States is an added advantage to aquaculture development in the zone. Every Nigerian, irrespective of sex, profession and level of education should be encouraged to keep backyard fish farm which may be in the form of tanks or any water holding structure as the process is simple and cheap to practice.

Feeds Ingredients:
Intensive or semi-intensive aquaculture depends on formulated feeds, either as a supplement to natural food generated by high pond fertilization rate or as a complete diet (in mash or wet or dry pellet form). Fish feeds in Nigeria account for approximately 60% of the variable production cost in intensive system in Nigeria (Aynla, 2007). Fortunately, in the North Central, the cost of feeds ingredients is relatively low despite competition from other sectors. Feeds ingredients can either be directly produced by fish farmers or can be bought directly from the producers thereby cutting out the middle man.
The ingredients most commonly used in fish feeds production are as shown below and are available all year round and relatively cheap from October-March and slightly expensive from April-September, this is because of the prevailing agricultural calendar of the northern axis.
Table 2: Availability of local fish feed ingredients.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Availability</th>
<th>Retail price (₦/tone)</th>
<th>Producer price (₦/tones)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White maize</td>
<td>Adequate</td>
<td>100,000</td>
<td>62,500</td>
</tr>
<tr>
<td>Yellow maize</td>
<td>Adequate</td>
<td>125,000</td>
<td>75,000</td>
</tr>
<tr>
<td>Blood meal</td>
<td>Adequate</td>
<td>30,000</td>
<td>12,000</td>
</tr>
<tr>
<td>G/oil seed cake</td>
<td>Adequate</td>
<td>150,000</td>
<td>12,000</td>
</tr>
<tr>
<td>Cotton oil seed cake</td>
<td>Low</td>
<td>175,000</td>
<td>145,000</td>
</tr>
<tr>
<td>Palm kernel cake</td>
<td>Adequate</td>
<td>85,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Soy bean local</td>
<td>Adequate</td>
<td>60,000</td>
<td>55,000</td>
</tr>
<tr>
<td>Fish meal</td>
<td>Low</td>
<td>55,000</td>
<td>45,000</td>
</tr>
</tbody>
</table>

Source: Author’s market survey (2010).

Other cheaper resources not used for human consumption have also been identified, explored and tested as fish feed ingredients, (Ayinla, 2007). However, these non-conventional resources of either plant or animal origin are uncommon in the market. They include, Margot, termites, earthworm, and chicken and toad meal. The rapid growth of commercial fish farming has been mirrored since 2000, most especially in the southern part where high quality fish feeds are now being produced avoiding the price of imported feeds which totaled up to 10,000MT in 2005. Recently, federal government has also put in place intervention program such as the special program for food security (SPFT) with a focus on private sector participation in the promotion of food production (aquaculture inclusive), directing all states of the federation to promote aquaculture in various ways. There are more than 2,600 fish farms and 215 feeds mills in the country with most of them located in the Southern part of Nigeria (AIFP, 2004)

Rice and Fish Farming

Rice is one of the predominant cereal crop produced in the North Central region of Nigeria, this is because of the availability of fertile and vast swampy and meshy land. The Fadama III project being sponsored by the World Bank to encourage all kinds of agricultural farming activities is a step in the right direction to increase rice and fish production in the Northern axis. The (AIFP) and the National Special Program of Food Security (NSPFS) with the Chinese assistance, a North Central State has commenced the integrated farming which has being shown by the (NCRI) to increase rice production by 15% in Niger State. This increased production is accompanied by the 300-400kg/ha/of fish which have high value at N300/kg. If funds can be made available to both fish and rice farmers and 100,000 ha are integrated into rice and fish farming, 35,000MT of fish could be produced, (Abdullahi, 2007). This could create employment opportunities for at least 20,000 farm workers which can also meet up with the yarning
of people’s protein demand, (Abdullah, 2007).

**Processing, Preservation and Marketing**
Processing, preservation and marketing of fish is predominantly carried out by women, whether industrial, artisanal or aquaculture practice. The rapid growth in aquaculture development and common preference evolve, demand is growing for fast food fish dishes and the upper scale market are calling for processed fish filets. At present catfish is largely sold as live fish and they can often be held alive in tubs, jericans or plastic containers of shallow water for long till they are consumed. This has significantly changed the demand for meat both in the lower and upper markets. Women should be exposed to this type of ventures in this zone. They should be equipped with modern gadgets and techniques and also empowered financially to reduce post harvest lost in the fishery industry and poverty in the localities.

**Extension and Training of Personnel**
Technical information for the improvement of the management of aquaculture development as done in many countries should be sought for. Professional organization need to be involve in providing such technical assistance, materials and training of fishermen and government extension staff for retraining of intending aquaculturists.

**Recommendation, Future and prospects.**
- Government should intervene by protecting the available water bodies against pollution and degradation by enacting relevant laws.
- The extension of development programmes in agriculture to fisheries i.e. fishing and fish farming especially as effective extension programme on commercial aquaculture should be encouraged.
- Youths are encouraged to take up fisheries as a profession by providing attractive incentives to boost fish production and be self reliance.
- Government should introduce fisher- based training centre in a central place that will be easily accessible to all concerned within the North Central States.
- Various states government should intervene by providing fishery based infrastructures to support private investors in getting catch or produce to sell locally.
- Create public awareness for aquaculture among banks and other lending institutions to give agricultural loans to credible fish farmers.
- Private sector be encouraged to establish aquaculture feed mills to produce enough feeds for fish annually.
- Establishments of more private fish hatcheries to produce enough fingerlings for fish farmers.
- Suitable inland water body is identified for improved production through management enhancement which will include stocking of desirable species produced in hatcheries.

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