Recent developments on non-conventional fish culture media in Nigeria

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Abstract
Isolated successes have been recorded in fish farming in some African countries with observable potentials in Nigerian marine waters. In Nigeria, aquaculture is a recent development and it has been practiced in conventional culture media, which are land borne while non- conventional ones are mainly water borne. The need to use non–conventional culture media is based on the constraints encountered by using the conventional culture media. The fish farms constructed in the 1950's were constructed in isolated and far away from home locations hence, theft was rampant in these poverty sticken localities. Cultural land acquisition practices entrenched in the society also makes it difficult for non –indigenes, the youths and the poor who are interested in fish farming to acquire land for their fish culture projects. The acquisition of the technical know- how requires the full and consistent support of government and financial institutions for bridging the deficiency between the supply and the demand of fish in the country. Both convectional and non –convectional culture media struggle with such constraints as in availability of good feeds, inadequate quantity and quality supply of fingerlings to stock the media, and largely the under utilization of available water resources in Nigeria. Several countries in Asia and other parts of Africa have succeeded in improving the fish production and protein intake of their populations through the utilization of cheaper non- conventional culture media like the homestead pond, pens and cages. Nigeria can also do the same if the challenges and constraints highlighted are tackled.

Key Words: Fish farming; non- conventional; culture media; fish supply and demand gap

Introduction

In Africa, some successes have been reported on fish farming in countries like Ivory Coast (Lake Kossou), Tanzania (Lake Victoria), and in Egypt. Nigerian marine waters totaling 25.6m ha, fresh waters about 12.5m ha, and a coastline of approximately 800km provide immense oppor-tunities for fish production through the use of cages, pens and other enclosures (Otubusin, 1986). Nigeria could be self sufficient in fish production and in fact be a major exporter of fish. Yet the country is a major importer of some 700,000 tons of fish annually. It is believed that Nigeria could save $US 2 billion in 5 years if importation is substituted with domestic production which totals some 450,000 tons per year (Technical note #6, Farming Nigeria's Waters (2005).

Aquaculture in particular is a recent development in Nigeria. It became prominent in the last 50 years to augment the declining fish catch from the open costal and continental waters of the country's waterways. Fish farming has grown rapidly in the last ten years in an effort to bridge the deficit of 1.0 million metric tons of the national fish demand – supply gap, (Akinyemi,1998).

Fish farming is practiced in different culture media and can be classified into two major types according to their geographical locations: -

Geophore or land-borne fish culture media. They include barrage (or embankment ponds, contour (or excavation) ponds; raceway ponds, tidal ponds, weir ponds; paddy ponds; beels, fish tanks; fish troughs; fish tubs, fish vats, and recently finger ponds (Roland *et al.* 2005).

Aquaphore or water borne fish culture media they include fish pens (such as traditional Akadja); fish cages; fish pots; fish lanterns, fish pockets etc. Adekoya *et al.* (2004).

Geophore and Aquaphore fish enclosures can further be re-classified into conventional or non-conventional culture media. The conventional structures are the commonly used forms and they include all forms of ponds and beels while the non-conventional fish enclosures embrace the fish tanks, fish troughs, tubs, vats plus the aquaphore fish enclosures such as fish pens, cages creels, pots, lanterns, and pockets (Olukunle, 2000). However, they are all creations of human's imaginations and handy works but they are constructed to increase fish production and to improve income of the

poor mostly in developing countries. They could be simple or complex e.g. cages could be constructed with only polystyrene nettings as in hapa nets used for raising fry to fingerlings. They could be complex and technologically structured as steel framed cages used in raising table fish in developed countries like Britain, Japan and U.S.A. They could be local when bamboo sticks are used for the frames or foreign when the steel frames are imported.

For the purpose of this paper, three non-conventional enclosures will be highlighted fish tanks, fish pens, and fish cages.

Need for non-conventional fish culture media in Nigeria

The utilization of earthen ponds for the production of freshwater fishes for indigenous and exotic species (*Clarias* and tilapia) and (carps) respectively had been the practice in Nigeria from as early as the 1950s. Olukunle 2000. However, from 1970 – 2000 it was observed that fish farming activity declined and this trend was attributed to various reasons. The most conspicuous are theft, scarcity of and limited access to land especially within the urban, peri-urban areas and lack of technical know-how. (Olukunle, 2000, Ilozumba, 2000 and Krishen Rana *et al.* 2005).

Theft of fish from fish farms was made easy by the location of farms in isolated areas far away from towns or villages, the absence of any form of security; location of markets anywhere thus making security checks difficult (Olukunle, 2000). In spite of these constraints, observed increases in the number of homestead fish farms from 3 in 1994 to over 50 in 2000 in Oyo State, Nigeria. Krishen Rana *et al.* (2005) reported the culture of large catfish in urban and peri-urban zones by local residents including civil servants, teachers, engineers and trained unemployed youth. These self-made fisher folks developed home-grown tanks and other technologies to farm catfish semi-intensively or intensively in small land areas and around cities such as Lagos, Ibadan, Ilorin, Patani. These aforementioned authors noted that many of these entrepreneurs are women with no previous knowledge of aquaculture but they developed an enthusiasm to learn.

Scarcity of land and legal tussle on land is a major constraint on the spread of fish farming especially in the urban and peri-urban areas of Nigeria. However, the use of non-convectional fish media such as homestead fishponds, pens/akadja on open reservoirs are probable solutions to these problems. Individuals, companies and even governments e.g. Lagos State Government in New Age (a Daily News Paper) on Thursday March 24, 2005 web site *www.newage-online.com* published the replication of Homestead Fish Farm estate in two senatorial districts on, a 24 hectares land. This government encouraged interested members of the public to apply for land allocation to site a farmhouse, 6 production ponds per farm unit with capacity for producing 18 tones of fish per production cycle and ample car space, provision of electricity, road, water, fencing of the area for security and against damage. It was reported that this effort reduced the fish importation bill of ₦30 billion in 2002 and ₦39 billion in 2004 in the country. They added that over 2,500 families had embraced the initiative.

Technical know-how

This is the bane of this project initiative. However, it has been documented in Otubusin (1986), Olukunle (2000) that fisher folks interested in fish farming at their backyard should contact Departments of Fisheries in Universities; River Basins Agricultural Development Project (ADP); Offices of State and Federal Ministry of Fisheries. Workshops are constantly being organized by these Agricultural Units and even Churches to enlighten would-be aqua culturists especially women. For an example, the author participated in a workshop organized by the Methodist Church of Nigeria Women Section, at the Institute of Church and Society with a visit to the Fish Farm of the University of Ibadan in April 2000. A lecture was given to a group of youths at a Baptist Church in University of Ibadan. A site was also assessed for a fish-farming project at an Anglican Church, in Ibadan, Nigeria.

Prospect

Individuals as reported by Otubusin (1986), Olukunle (2000); Ilozumba (2000), IFAD (2002) (unpublished) and Krishen Rana *et al.* (2005) have highlighted the prospect of cage, pen and homestead ponds. These structures can be sited on reservoirs in case of the first two structures and at the backyards of interested members of the

society for the homestead ponds. Such interested people include women, retirees, and unemployed youths. Olukunle (2000) was written as a reference book for the young aspiring aqua culturist. Krishen Rana *et al.* (2005) wrote an article to encourage African fish farmers in urban and peri-urban zones in Sub-Saharan Africa to produce large fresh catfish for feeding the cities at economic rate even, if only in niche markets in homestead ponds. Homestead ponds have the advantage of providing security for the fish stock and more efficient management practices because of proximity to the homes of the owner. It provides jobs for unemployed men, women, youth and retirees.

The average protein intake of Nigerians is approximately 44.1g/caput/day as against 67g/caput/day recommended by FAO. Ezeagu (1999) Fish productions from homestead ponds have the potential of improving the protein intake of the members of their families and eventually the nation. The economic benefits of backyard fish farming venture can hardly be quantified until an economic of scale is applied. If at least 0.50% of the estimated Nigeria population of 120 million is encouraged to be involved in homestead fish farming with each household producing 100kg of fish per cycle/year, the total production of approximately 0.6m tones represents more than 50% of the deficit in the National domestic Fish Demand. Other prospects include reducing Nigeria's dependence on foreign fish supplies and reducing the cost of fish in the market. The resultant effect is the preservation of our foreign exchange and jobs for the youth. Most Nigerians have few recreational activities: backyard fish farming is potentially a good relaxation outlet at the owner's backyard.

The advantages of cages, pens and enclosures discussed by Otubusin (1986) compared the conventional known method of fish culture in ponds with the non-convectional methods. He concluded that the major positive points in favor of non-conventional fish culture media include the utilization of existing water bodies as compared to the difficulty of buying a piece of land, which requires initial large investment. These culture media permit higher stocking density of fish, which affords production of large fish of more uniform size than the pond system especially in Tilapia monoculture. These culture media are environ-mentally friendly thus improving the sustainable yield of the natural environment. The farmer therefore can have a regular income and is able to have complete control over his modules of cages in reservoirs under unfavorable weather. He can move the modules of cages to a safe shelter until the bad weather subsides.

Constraints

The major constraints of these non-conventional fish culture media are the initial capital investment to construct the frame of the cages, the pens, the solid walls of the homestead ponds and the technical know-how.

Many financial institutions are reluctant to finance aqua cultural projects (Person. Comm.). They see fish farming as a risky investment since the fish stock is hidden. Many of their field staff have limited knowledge of Aquaculture Management. The insurance companies are very wary to stand security for aquatic based investment like homestead fish farming, cage and pen fish cultures. There are many "quack aquaculture management consultants" parading as experts. However, the technical know-how in fish farming is gradually being developed through learning on the job. The ADP in most of the States especially in the South West of Nigeria. Ogun and Oyo States have strong extension services. They organize workshops, lectures and visits for their Extension officers who in turn take the newly acquired knowledge to farmers, supervise them and see that the new technologies are applied appropriately. The State and Federal Fisheries Departments have superintendents who act as field officers helping the fisher folks. Some Universities have Fisheries Departments where students are taught courses in Fisheries Management. The 4th year is spent partly on the freshwater and Marine Research Institute like Kainji Lake Research Institute, New Bussa and Nigerian Institute of Oceanography for Marine Fisheries (NIOMR), Lagos respectively.

There are other constraints like the unavailability of good fingerlings to stock these culture media. Absence of good quality and quantity water restricts the operation of these media during the dry season especially earthen ponds when the underground water table is low. Nigeria is criss-crossed by a high network of rivers and streams and the underground water supply available (about 7 x 10^6 km^3) is under utilized (Falaye, 1986). All

these sources of water highlighted can be modified appropriately for fish farming. Dams can be constructed on rivers to form reservoirs of water: underground water can be pumped up through deep wells and boreholes but the cost is higher than what an average fisher folk can afford without help from financial institutions, governments or at least cooperative societies.

Challenges

Several countries in Asia like Cambodia (Kampuchea) later Thailand, Indonesia (Java Island), the Philippines have long history of cage and pen fish culture. Production of different fish species ranging from yellow tail and common carp in floating cages placed along rivers rich in nutrients from sewage. Production ranges from 200kg of carp in 4 months without additional feeding to commercial cage and pen fish production of carnivorous fishes like *Lates calcarifa* (sea bass) in Thailand in Lakes Laguna and Bunot. Annual yields of 25,000 to 30,000 tones of milk fish was reported in the Philippines (Otubusin 1986).

In Nigeria, (Otubusin 1986) reported trial cage culture by an FAO Consultant in 1974. He reported great potential for aquaculture in Kainji Lake. The challenge from this is that there are many lakes in Nigeria such as Lake Chad, Asejire, (Person. comm.) which can be utilized for cage and pen fish production. The Ministry of Agriculture Fisheries Department Oyo State in 1983/84 did a trial cage, pen and Akadja Project on Asejire. The cage Project was ruined by a storm just before the harvest, which was preceeded, by theft. The Akadja project yielded several kilograms of 500 – 1kg sized tilapia mostly. This project ended up in a court case because the consultants (Fishermen Native of Benin Republic) wanted an unreasonable portion of the harvest. The challenge is that the local Consultants on the Akadja or any aqua cultural project should be adequately remunerated to pass on their technical as well as indigenous know-how to the fisher folks.

IFAD through Federal Ministry of Fisheries sponsored a cage culture project in the South West of Nigeria using Oyo State and Ogun State ADP experts in 2000- 2002. This project highlighted the following challenges that

1) Local materials e.g. Bamboo for frames can be utilized plus polystyrene netting of corresponding appropriate net mesh size. Establishment of net making industries will reduce cost on importation of artificial netting materials.
2) Appropriate nutrient rich feeds at affordable cost must be available to support these special culture projects economically. Large-scale production of fish feed cheaply and locally must be a accorded due priority.
3) Juveniles of catfish not less than 10g and Tilapia 5g must be stocked not fry of 0.5 – 1g therefore hatcheries and nurseries must be established all over the country.
4) Cages and pens must be protected from poaching. Cooperatives members need be organized to put security in place.
5) The technical know-how must be transferred through continuous field trials and production until the local fisher folk grasp the appropriate ways of handling the cage/pen culture.
6) Finally the initial funding must be from the private financial institutions and cooperatives. The government needs to assure these institutions through continuous educatio the need for their support or else the local people who are mostly illiterates can hardly grasp the technicalities of the financial management involved.

Conclusion

The utilization of homestead/backyard fish farming is gaining recognition and spreading fast. Like the cage and pen fish culture, the enthusiasm need be sustained through the education of the masses, the provision of juveniles/fingerlings in adequate proportions, the right size and nutrient rich cheaper feeds. The positioning of the concrete ponds at the backyard of the owner poses no security risks. Presently, the imported feeds available are too expensive fo fish production based on them to be cos effective. The summary is for loc entrepreneurs to take up the challenge manufacturing nutrient rich but chea feeds that will encourage large s commercial fish production.

Many hatcheries and table producers are experimenting recirculatory systems. The evaluation of water quality enhancing technology re that very few (1) in (8) farms are ab sustain their continuous use Akinwole (The advice/challenge is that the goverr

should ensure reliable electricity supply as well as lowering the cost of maintaining a stand-by generator to support the system if need be. The cost of fuel must be reduced to encourage entrepreneurs invest in this field.

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