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Linking Formal and Informal Science For Sustainable Development

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BOOK OF PROCEEDINGS

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NO MAN IS INFERIOR TO ANOTHER MAN
WHATEVER THEIR COLOUR, PLACE OF BIRTH, SITUATION IN LIFE,
THE RELIGION THEY EMBRACE
AND POSITION THEY OCCUPY;
THAT MAN IS NOT SUPERIOR TO WOMAN
AND WOMAN IS NOT SUPERIOR TO MAN
BUT THEY ARE LIKE EQUAL ARMS OF A CROSS,
ONE VERTICAL, THE OTHER HORIZONTAL,
AND SUPPORTING AND SUSTAINING EACH OTHER
IN A STRICTLY DEFINED DIVISION OF LABOUR ORDERING
THAT ANY CLAIM TO SUPERIORITY BY ANY GROUP, RELIGION
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AQUACULTURE - PROMOTION OF RURAL TECHNOLOGY FOR POVERTY ALLEVIATION

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INTRODUCTION

Malnutrition is widespread in Africa particularly among children and mothers who are mostly vulnerable to poor feeding. At one stage or the other, an African child has experienced inadequate protein intake. We have seen malnurished children and even families in our cities and villages. The national food situation in Nigeria is worsening rather than improving, hunger and malnutrition thus increasing. Olayide (1976) reported a daily protein intake of 62g as compared with the recommended minimum 70g in 1974. FAO (1997) as cited by Ezeagu (1999) reported 44.1g as daily protein intake, of greater concern is the small proportion that is of animal origin. (Table 1).

Table 1: The Protein Problem in Nigeria

(a) Protein Consumption in Nigeria (1974)

DETAILA	NIGERIA	RECOMMENDED
Protein (g/caput/day)	62	70
Animal Protein (g/caput/day)	8.4	35
(% of total protein)	13.5	50
Calories (Kcal/caput/day)	2198	2240

Source: Adapted from Olayide, (1976)

(b) Protein Consumption in Nigeria (1997)

DETAILS	NIGERIA	FAO	DEVELOPED COUNTRIES
Protein (g/caput/day)	44.1	67	93.8
Animal protein (g/caput/day)	8.5	39	61.5
(% of total protein)	19.3	57	64.9
Calories (Kcal/caput/day)	2053	2191	3417

Source: Ezeagu, (1999).

FOS (1999) reported that about 66% of the Nigeria population live in low poverty level. There is therefore the need to reduce the poverty level in the country through development of simple technology for fish production and proper management of our fisheries resources which are not only abundant but a key to sustainability of the Nigerian economy. Aquaculture is one of the fastest growing food production system in the world with an annual growth rate of 9 percent per year, total world aquaculture more than doubling by weight from 10.4 to 22.6 million metric tonnes (mmt) and nearly tripling by value from 13.1 to 35.7 thousand million US dollar between 1984 and 1993 respectively (FAO, 1995a) as cited by Albert (1996).

In Nigeria, whereas the agricultural resources are better utilized, the aquaculture resources are underutilized with only 12 percent of its potentials tapped (FAO, 1992). Fish demand in Nigeria based on 1991 census of 88.5 million will be at least 1.6 million metric tonnes by year 2010 (Akinyemi, 1998) while total fish production from all sources was about 300 - 350,000 metric tonnes per annum (Olakin, 1998). Aquaculture production estimate in Nigeria is about 25,000mt (FDF 1994). The implication is that there are still large areas for improvement with improved technological development. Such technology must be simple, easily adoptable at rural level and should be able to eliminate major problems of aquaculture production in Nigeria such as poaching, flooding etc. The aim of this paper is to discuss how women can be involved in fish production through simple technology in order to order to increase their income base and protein intake and that of their families.

System Structure, Construction and Operation

System Structure

Structures to raise fish at the backyard can be of different forms depending on available land and water surrounding the home. If the land is stable and the supply water is fresh i.e. no salt, the structure for culture could be homestead ponds made of

(i) Earthen ponds built up or dug out
(ii) Ponds with concrete wall for stability if unstable due to flooding or loose and sandy soils
(iii) Make-shift containers for economic reasons or lack of space. Examples include fibre-glass disused boats or containers; bathroom tubs; abandoned dug-out or plant canoes; plastic containers; earthen pots etc.

The ponds could be brackish ponds that are inundated as the tides rise and fall or cages submerged, floating rafia, or bamboo cages, pens or "akaja" if the home of the operator is located near or a top water source e.g. the riverine and flood plains of big rivers.

The technology required to build earthen or concrete ponds are available locally with local bricklayers, Fisheries superintendents in Federal, State, Agric. Development Projects all over the country. Plumbers can be called to adapt containers like disused bathroom tubs, plastic, aluminium fibre-glass, plank canoes and containers for use as hatching and nursery tanks to raise eggs of fish to fingerlings/or juvenile or adult fish. Earthen ponds can be dug using manual labour and inserting turn-down pipes for outlets and ordinary pipes or taps for inlets. All these can be done presently with indigenous technical know-how.

The operation of these structures can be picked up from research centres, Universities, Fisheries Departments, Federal, State and ADPs. However the main principle is based on the good management of a combination of the system structures, water supply and application of acceptable balanced protein food.

Hatchery and Table-fish Production Management

Fish reproduce through production of eggs which hatch to form fry (0.01 - 5mm in length). The fry grows to fingerlings with sizes ranging from 5 - 10mm or as long as the mid-finger hence the name. Fingerlings when fed grow to adult. Eggs to fingerlings are raised in intensive care management unit called the hatchery. Like an intensive-care units of an hospital it must contain all facilities to ensure that the baby organism survive. In this case, good quality water with the right pH; temperature, (25 - 31°C); dissolved oxygen above 5mg/l; and low nitrite level. All these criteria can be found in most freshwater sources including tap water which may contain a high level of chlorine. This problem can be removed by allowing the water to be exposed for 24 - 48 hours before usage.

The act of reproduction in fish begins by pairing male and female in an enclosure after inducing ovulation. After about 12 hours when the eggs must have been released and fertilized the fish are removed. The eggs only need fresh water with all the criteria listed above present in the water source. The operator floods the egg with clean overflowing water until the eggs hatch to fries. The fries are now transferred to Nursery tanks and fed with nutritious finely ground and sieved compounded feed or life micro-organisms that can be found in enriched "green water" prepared over a period of 3 - 5 days before the fry are introduced into the nursery ponds. Here they are nurtured for 3 - 4 weeks and are transferred to earthen or concrete production ponds where they are fed with agricultural waste-products, or pelleted feeds to table fish of 500g to several kilograms.

The period of fattening could be as short as 6 months to 1 year.

Fish Stock Management

The quality and quantity of fish you introduce into your ponds will largely influence the growth performance of the fish stock. Therefore use healthy fish, stock obtained from reputable hatcheries. The recommended stocking density i.e. the number of fish per unit area (m^2) or per unit volume (m^3) is determined by the type of culture practice you choose and the type of fish grown. There are 2 types of culture practices

(a) Monoculture i.e the culture of a single type of fish e.g. Catfish.
(b) Polyculture is the culture of 2 or more types of fish together e.g catfish + tilapia and carp.

This culture practice may be carried out in 3 types of systems:-

(i) Intensive i.e high concentration of fish per unit area with artificial feeding.
(ii) Semi-intensive i.e moderate concentration of fish per unit area with little feeding.
(iii) Extensive i.e no feeding, therefore fish should be stocked with low concentration of fish per unit area. Fish are left to feed on natural food organisms in the water.

General Principle for Stocking

This principle assumes that fish does not reproduce during growing period or early like talapia

$$\text{Stocking Rate (how much fish you put in your pond)} = \frac{\text{Growth target (kg)}}{\text{(Individual growth target)}} \quad \text{(Loss or mortality (in Nos))}$$

e.g if you intend growing 500kg of fish each with a final weight of 1kg each with the loss

number approximately = 50%

.. the initial stock rate = $\frac{500}{1}$ + 250

= 750 fingerlings.

Improved Water Management

The main indicators of good quality water for breeding mentioned under hatchery management are required for table-fish production. They are (a) moderate temperature 25 - 31°C for tropical fishes e.g. *Clarias* sp, tilapia and common carp.

When temperatures fall below 25°C it is advisable to stop feeding until temperature rises or feed very little amount. How to know when this critical temperature is reached touch water with your hand if you feel comfortable with it, the likelihood is that the fish will feel comfortable. During harmattan or cloudy raining season, refrain from feeding or feed when the weather is warm. Uneaten food will cause pollution of the water when temperatures are too high. Increase fresh water inflow; cover exposed parts with banana or palm fronds; feed very early (7 - 8.00a.m) in the morning or very late in the evening (6 - 7.00p.m).

Dissolved Oxygen (DO)

The amount of oxygen present or available in water is referred to as Dissolved oxygen. The adequate DO for the tropical fish is in the region of 5 - 8mg/litre. Below this amount stresses the fish. You need to test for adequate DO or look for signs of distresss every morning. When you arrive at your pond in the morning and you suspect low DO i.e when fish come up with mouths opened, spit into the pond. If DO is adequate the spit foam disappears rapidly, if it is not adequate do the following:- sit on the edge of the pond and stir the water with your legs or stir with a stick or palm frond or add fresh water to the pond.

Hydrogen ion Concentration or (pH)

- Adding fertilizer or organic dung to water until green is desirable. In addition liming the pond with lime before impounding with water helps to maintain what is called hydrogen ion concentration within the acceptable limits.

Turbidity

Your pond water should not be too transparent or too cloudy. If it is cloudy by being green it is good but it is not good for fish if it is brownish with suspended particles like mud. Mud does not allow light to penetrate into the pond very well. Use a white coloured tin until it disappears to measure how deep the turbidity in your pond is. You can also deep your hand into the water in the pond until your elbow disappears into the water, then the turbidity is alright at that level. This level must not be less than your elbow.

Nitrite

High concentration of nitrite in ponds usually occur when water is relatively cold during harmattan or at the height of the dry season. It results when eaten food accumulates in the pond and it becomes rotten. When the smells from your pond is like that coming from an unflushed toilet or an open gut or rotten eggs, then its time to increase the inflow of fresh water and open the outlet for spent water.

Fish Feed production, generation and Utilization

Fish Feed Generation

The feed of fish vary from being totally vegetative e.g. grass carp to flesh eating i.e carnivorous fishes e.g. *Lates*. Omnivorous fish species are able to adapt to either and can be domesticated on artificial feeds or pellets e.g. Catfishes. Fishes forage in natural waters for food which consists of microscopic plants, and animals known as phyto and zoo planktons respectively. They graduate to feeding on small aquatic organisms like water crustaceans including shrimps and fish.

In aquaculture, feed can be generated to feed fry/fingerlings to adults by using larvae of organisms like flies, termites etc; agricultural bye-products like poultry waste, oil-seed cakes. All these items supply the much needed protein for fast growth. Energy can be supplied from grains and waste from grains and fermentation processes like brewing. The technology for obtaining the above named feed sources is available in normal agricultural production systems such as integrated fish farming with various agronomy and livestock systems.

Feed Production

In developed countries, the technology of feed production for aquaculture centres on pellet production either sinking or floating. Fishmeal, which forms 30 - 50% of the pellets, is much cheaper and readily available. The converse is the case in a developing country like Nigeria. Fishmeal that is available is expensive and competed for by the poultry industry, hence local production has to be encouraged. The

problem here is the non-availability of waste-fish, which is used for the production of fishmeal. Small sized fish are consumed head and visceral, filleting of fish flesh is not part of our culture, hence there are no waste bones and clinging fish flesh. The lack of cheap fishmeal has directed the research orientation in research institutes and universities in Nigeria towards finding supplementary alternate protein sources. Such sources include plant protein sources like groundnut, soyabeans, sesame seed cakes etc. These authors are very much involved in this aspect. So far, we have not been able to do a 100% replacement because of deficiency of amino-acid sources required by fish in plant proteins. The struggle continues.

Fish Feed utilization

Most fish farms utilize insect larvae-maggots and poultry waste products for raising fry to fingerlings. This is adaptive technology and it is to be encouraged. It has many scientific advantages, less fly menace and wise disposal of agricultural waste products. Research findings to-date has not highlighted known negative influence on such fish flesh or man and no zoological transference of fish disease to man is been implicated.

The using of pellets is advantageous but efforts through research must be directed at reducing cost of production, water environmental pollution. Efforts must also be intensified through extension agents to educate fish farmers in the preparation and utilization of pellets especially in Homestead ponds.

In conclusion, aquaculture, is an aspect of fisheries that has been grossly underutilised. Only 12% of its potential has been utilised in Nigeria (FAO, 1992). Improvement can be achieved in various aspect of fish farming involving culture of freshwater fin fish in homestead ponds and swampy areas not good for agronomy. This will improve the protein intake and income of families. Like in Asian countries, Bagladesh and Thailand, fish feed production technology can be introduced to the rural populace Middendrop (1998), Gasvas, (1994), thus improving the income of the people, availability of fish seeds and improved production of table fish.

Another way of generating income, creating job opportunities and boosting fish and protein production is fish feed production.

Fish processing, marketing of fish and fish products has also been the realm of women, this can be enhanced by earning not only commissions or profit but involving men and women and the nation in foreign exchange earning through the export of such products such as smoked fish, shrimps, ornamental fishes like gold fish, red tilapia etc.

Integrated fish farming is a cost saving device, that augments production of animal protein, it is environmental friendly because it saves the environment from both agricultural and industrial pollution and ensures maximum return on investment. Another area of aquaculture that is underutilized is the sport fishing, sales of equipment and inputs. They are income generating and require little technological input.

Hence, aquaculture is a tool presently underutilised but crying for attention to alleviate poverty, not only among the rural but among the urban populace.

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