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Aquaculture Production in a Malnourished Nation

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Abstract

The past decade has witnessed an increase in awareness, interest and growth in aquaculture in Nigeria. In spite of this misconceptions, about this thriving industry still abound. The aim of this paper therefore, is to review the aquaculture industry in order to bring to the understanding of many the meaning of aquaculture and the various processes and practices involved in aquaculture production. Aquaculture has been defined. A brief history of aquaculture in relation to its history in Nigeria has been discussed. The importance of aquaculture as a valuable source of protein was stressed and various reasons were advanced to show that aquaculture can make unique contribution to human nutrition, especially in developing nations. The systems of fish culture, facilities of fish culture, the characteristics of a culture species and the various practices adopted in the production and management of an aquaculture system have all been discussed. Constraints in to aquaculture production in Nigeria were also considered.

Keywords: Aquaculture production, nutrition, systems liming stocking density, facilities, constraints and practices.

Introduction

Aquaculture or fish culture is the rational cultivation of fish in a confined water area where practices of both aquaculture and animal husbandry are applicable (Kumar, 1992). Accordingly, the soil and water management aspect of aquaculture that involve the application of organic manure and inorganic fertilizers for the production of plankton is basically similar to agriculture while husbandry of fish including feeding, breeding and healthcare is more or less similar to a livestock farming system.

Aquaculture has also been defined as the rearing or husbandry of aquatic organisms under a controlled environment (Landau, 1992). The significance of

this second definition of fish culture or aquaculture lies in the fact that it is not only 'fin fish' that are cultured under aquaculture but several other aquatic organisms (including aquatic plants) such as shellfish (lobsters and prawns), Crustacea (crabs), crayfish, frogs, etc are produced in an aquaculture. Some of these products of aquaculture like lobster and prawns are highly priced luxury foods because they are delicacies, and their culture is well developed and is popular among the developed economies.

The culture of fish in ponds has been practiced for centuries by the Egyptians, Romans, Chinese and the people of indo-pacific region (Huet, 1972). Although aquaculture has been practiced for over 2000 years, the importance of it has only been realised in the face of mounting pressure on land resources and scarcity of animal protein for the ever-increasing human population (Kumar, 1992). Similarly, it is in recognition of the fact that fish provides direct benefit as food and indirect benefit as source of income that the World Fisheries Conference adopted the *programme of action* to promote the role of fisheries in alleviating under-nutrition.

As old as fish farming is, it is alien and relatively new to Nigeria like other African countries, except Egypt where fish is believed to have been cultured in about 2500 B.C. in Ernest, fish culture was introduced in Nigeria after World War II when experimental fish farms were established at Panyam on the Jos plateau and on the island of Buguma in the Niger Delta. However, facilities for fish culture were destroyed during the civil war and such facilities were reconstructed only after the civil war. Fish culture has grown and has become popular in the country as it is already fast becoming a rural industry even in places like Gboko in Benue State of Nigeria where it was not even heard of 20 years ago. Certainly, fish culture is poised to make great contribution to the Nation's food security and malnutrition problem.

The Nutritional Value of Fish and the Contribution Fish Can Make in a Malnourished Nation

The fact that fish is food is not a questionable fact. God created fish among the living creatures of the water (Gen 1:20) and gave it along with "everything that the breath of live is in it" to man as his food (Gen. 1:30). Since time, fish has been food for man. The fact that Jesus fed the multitude with fish (John 6: 8-13) and He Himself ate it after his resurrection to prove to his disciples that He was not a ghost but man (Luke 24: 42) all emphasize the importance of fish as food.

Bardach *et al.*, (1972) avers that neither aquaculture nor other method of food production will be a panacea for human nutritional problems, but all can and must contribute if the scepter of hunger is to be banned. True as this is, aquaculture can make great unique contribution to human nutrition in many parts of the world especially in developing countries for the following reasons:

- Fish is extremely highly prolific and productive. For instance a kilogram of female cultivable carp species yields on average 0.1million eggs, each of which has the potential to become 1kg fish in about a year (Kumar, 1992). No land animal has this magnitude of fecundity.
- Aquatic crops are primary protein crops rather than sources of starchy stable foods (Bardach *et al.*, 1992).
- It is believed that aquatic organisms are better converters of primary foods than ruminants, fowls and even pigs.
- Economically, aquaculture products are low-cost protein rich foods than products of livestock.

Nutritionally:

- Fish is a source of easily digestible high quality animal protein with 16%-20% protein compared to about 12% of egg, 3.5% in milk and 6-8% in rice and wheat (FAO, 1991, Kumar, 1992).
- Fish is high in essential amino acids and polyunsaturated fats, and an excellent source of minerals (Calcium, Phosphorous, and Iron) and vitamins A, D, thiamine and riboflavin (FAO 1991).
- Fish food also plays a role in lowering of blood cholesterol.

Potentials for Aquaculture Production in Nigeria

Anju, (2001) reviewed the inland fishery resources of Nigeria. Accordingly, Nigeria has a total of 19,958,500Ha of total surface area water bodies. These water bodies include rivers, lakes and reservoirs as well as existing fish ponds that were under construction.

Nigeria's culture fish production increased from 5,465 tons in 1986 to 6,622 tons in 1988 with the 1988 production contributing 9.5% to the total aquaculture production in Africa (FAO 1990). If just 10% of Nigeria's aquaculture potentials are harnessed, this level of aquaculture fish production can be raised to 1-2million tons annually. This can be achieved first by stocking specific rivers, lakes and reservoirs with fingerlings produced from fish hatcheries and secondly, through intensive and integrated systems of fish farming.

Facilities for Culturing Fish

ond: Traditionally, the pond is the oldest and most popular facility for fish culture. The pond is an enclosure for holding water and it is either concrete or earthen built. It is most often rectangular in shape and the sizes vary according to the need of the user. Ponds may be drainable or un-drainable and so vary the management practices adopted.

Raceways: Are long concrete or fibre-glass tanks which may measure between 10mx2m and 100mx10m in an area and are supplied with a stream of running water.

Pens: These are enclosures constructed in the open water (Rivers or lagoons) by erecting bamboo poles in the ground at intervals to cover the area intended for fish culture and using nylon net materials to fence the area by covering and tying the net to the poles.

Cage: Cages used for aquaculture are usually made of bamboo or wood planks. Usually happas made of cloth or weak materials are suspended in cages, which are themselves suspended in water using floatation.

Tanks: Are rectangular or square concrete built enclosures used for fish breeding or fry rearing. They are usually fixed with the inlet pipes and water draining outlet pipe.

Rice fields: Shallow square or rectangular earthen built enclosures are constructed in rice fields where rice cum fish culture is carried out.

Fish Culture Systems

Any one of the following systems of fish farming may be adopted depending on the objective of the fish farmer.

Extensive System

In this system when fish are stocked, they are left to the natural carrying capacity of the pond or reservoir. The yield per unit area is low, usually equal to the natural production of the water. It is characterised by low inputs, low stocking density and no supplemental feeding or pond fertilization.

Semi-Intensive System

The semi-intensive system of aquaculture involves the fertilization of the pond with organic manure and inorganic fertilizers occasionally supply of supplemental

feeds, usually in form of kitchen wastes, rice bran, brewery wastes, etc. The yield is higher than that obtained from extensive aquaculture but lower than the yield obtained from intensive fish culture.

Intensive System

The intensive system involves the manipulation of the various physiochemical parameters of the culture medium to ensure maximum yield. It is characterized by heavy inputs (high protein pelleted feeds, fertilizers etc), high density and improved or closed management, all resulting in high yield per unit area.

Desirable Characteristics for Selecting Fish to be Cultured

The desirable characteristics of a fish to be cultured have been identified (Bardach, 1972, Huet, 1972, Kumar 1992).

- High rate of growth
- Easy to breed or rear
- Hardy and resistance to diseases
- Acceptable to consumers
- Efficient conversion of artificial feeds
- High market demand and high price
- Support high population density

No one fish may possess all these characteristics but the one that best meets them could be selected.

Fish Production Practices

Several pond management practices are adopted or employed to make the cultured medium conducive for high fish production.

Water Quality Management

The water that is used for the culture of fish will not give maximum yield if the conditions are not optimum for fish and other aquatic organisms (Huet 1972). This supposes that chemical and physical factors are present at optimum level to determine a good initial production. The most important factors affecting the growth and survival of fish include availability of food organisms (plankton), the influence of naturally occurring chemical substances like Dissolved Oxygen, Ammonia (NH_3), Hydrogen Sulphide (H_2S), Nitrite (NO_2) and PH and the role of physical factors like temperature and turbidity. The importance of chemical factors is due to their lethal or sub lethal effects on cultural organisms and their effect on biological productivity (Onuoha and Nwadukwe, 1987).

It is necessary from the start to make detailed analysis of the chemical and physical parameters in order to determine the quality of water, which will be used on farms and installations. The determination of water temperature, PH and alkalinity is essential and must be carried out regularly.

Fish Seed Production/Procurement

Fish seeds are indispensible ingredients in fish production. Fish farmers can procure their fish seed from a fish hatchery or from wild stock. Fish seeds of catfishes (Clarias/Heterobranchus) can be easily procured from rivers and flooded plains but the genetic quality and the consistency of supply of such fish seeds cannot be guaranteed. This is important because a regular supply of fish seed affect the level at which production can be achieved.

Fish seeds are procured from the hatchery by induced breeding through hypophysation using hormones. The controlled production of fry involves spawning, hatching and rearing. These procedures call for problems, which have to be solved to successfully produce fry (Ayinla and Nwadukwe, 1987). Artificial propagation however, requires technical skills and so it can be easily carried out by untrained farmers.

Supplemental Feeding

In a fish pond system there is availability of natural food nutrients but this is not enough to supply the nutrient requirement for the fast growth of the culture species in order to harvest the target size of fish at the set time. To achieve this, it is necessary to supplement the natural food by supplying artificial feed. In the intensive and semi-intensive culture, supplemental feeding is indispensible. The quantity of feed and the form in which it is offered affect the rate of consumption (Kumar, 1992). Temperature, Dissolved oxygen level, crowding and health condition can also affect the rate of consumption.

Stocking Density

Fish production increases with the number of fish stocked per unit area up to a certain level and then starts to decline. Higher stocking density results in increased total production, as there is better utilization of available food, but in such cases the individual weight and size is reduced. On the other hand, lower stocking density yields larger individual fish. When artificial fish is not used, the total crop becomes dependent on the primary production and in such cases; increase in total production cannot be achieved even when the stocking density is reduced.

Liming

Calcium, an essential nutrient is supplied to pond on application of lime. Lime is is applied in fish ponds to:

- Destroy bacteria, harmful insects and predators
- Increase the alkalinity of pond water by increasing carbon dioxide for photosynthesis
- Increase the pH of pond bottom, which ensures availability of nutrients like nitrates and phosphates
- Clear vegetative humus stains, which affect penetration of light into pond water

Lime is applied by spreading evenly on pond bottom and quantity applied is determined by soil acidity. Commonly used lime include slaked lime ($Ca(OH)_2$, agricultural lime ($CaCo_3$) and quick lime (CaO).

Pond Fertilization

The nutrients required for chemical and biochemical processes in a pond are supplied by the organic and mineral constituents of pond soil. The pond bottom also provides a suitable environment for decomposing bacteria and fungi to break down organic components of pond sediments and release soluble nutrients. The nutrients are often not available in sufficient quantity in the pond and so they are added from external in the form of fertilizers.

Fertilizers used in fish ponds are organic and inorganic fertilizers. The organic manure may be in form of poultry or cow dung. Inorganic fertilizers commonly used in ponds include phosphate, and potassium fertilizers.

Constraints to Aquaculture Production in Nigeria

- Insufficient production of fingerlings of cultivable fish species
- Insufficient and high cost of earth moving equipment
- Inadequate availability and high cost of artificial fish feeds
- Inadequate skilled manpower
- Lack of investment credit facilities
- Lack of marketing facilities

Summary and Conclusion

Attempt has been made to explain what aquaculture or fish culture is all about. The various systems of aquaculture, culture facilities, production and management practices and the constraints to aquaculture in Nigeria have been discussed. The aquaculture potentials of Nigeria have also been discussed. It is

hoped that this paper will help to stimulate interest and further investment in Nigeria.

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