Journal of Animal Feed Science and Technology 4 (2016) 23-26
DOI: http://dx.doi.org/10.21088/jafst.2321.1628.4116.5

Aquaculture practices: Significance and strategies for increasing fish production

Raj Kumar, Akhil Gupta

Farming System Research (FSR) Centre, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST-J), Chatha, Jammu–180 009 (J&K), India.

Keywords:
Aquaculture
Farming Systems
Composite Fish Culture
Integrated Farming System

Abstract

Fisheries and Aquaculture are playing an important role in addressing nutritional and livelihood security, especially of the rural poor in developing countries. Fish are rich sources of protein, essential fatty acids, vitamins and minerals. The fats and fatty acids in fish, particularly Omega 3 fatty acids, are highly beneficial and difficult to obtain from other food sources. The growing gap between supply and demand globally will impact on the health and nutrition of low income families, unless efforts are made to increase the production to meet the growing demand.

Aquaculture is the culture of Aquatic organisms under controlled conditions. Present concept of aquaculture incorporate culture of all aquatic organisms by following certain management techniques which includes water quality,choice food etc. and to protect them from unwanted predators, diseases, pollutants or any other things which are harmful to them. The aquatic organisms which are normally used for aquaculture for food purpose include fishes, prawns, shrimps, crabs, mussels and some live food organisms like algae and zooplankton.

Introduction

Aquaculture is essentially an Asian farming practice. India is endowed with vast and varied aquatic resources, of which only about 30% is utilized today for aquaculture. Aquaculture is a new name for what once we called 'fish culture'. Aquaculture continues to increase in volume and value of output in many countries of the world, filling the gap between the supply and demand for fish and fishery products, improving nutrition and contributing to the household economy, particularly in rural areas. There is immense scope for the betterment of mankind through aquaculture. Currently, China leads in Aquaculture production in the world followed by India, but the difference in production is almost 8-9 times. In India the Aquaculture average growth rate is about 8%.

Importance of Aquaculture

- Aquaculture has been found to be a productive enterprise compared to traditional agriculture practices.
- In aquaculture practice, fish can be crowded more closely (200/m^2) and grown as in super intensive fish culture practices like water recirculation system due to their three dimensional utilization of the water column. Through such a practice, a fish yield of 25 tons/ha/yr has been recorded.
- As the FCR is known to be 1.5 times more in fish compared to chicken and two times more than in cattle and sheep, fish production in aquaculture by supplementary feed is higher than that of the livestock.
- Aquaculture especially 'Integrated fish farming' with agriculture and animal husbandry is known to be more profitable than agriculture alone.
- Aquaculture gives efficient means for recycling agricultural and domestic wastes, in order to help/ protect our environment
- Many high valued and commercially important items such as prawns, lobsters, frog legs, ornamental fish and many other aquatic organisms helps in

Corresponding Author: Raj Kumar, Assistant Professor (Fisheries), Farming System Research (FSR) Centre, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (SKUAST-J), Chatha, Jammu – 180 009 (J&K), India.
E-mail: rajpaba_fish@yahoo.com

earning good foreign exchange.

- Artificial recruitment in the water bodies by fish seed produced in fish hatcheries through aquaculture (ranching), could certainly add new fishery resources or increase existing fish stocks.
- Aquaculture could help in generating employment for many unemployed and under-employed people. Such a step would help to stop the migration from villages to urban areas.
- From the point of view of human nutrition, the fish food is not only easily digestive but is also rich in essential amino acids like lysine and methionine. The unique poly unsaturated fatty acids (PUFA) namely, eicosapentaenoic acid of fish is known to reduce the cholesterol level of blood and save human beings from coronary disease. Further, vitaminsand minerals are also present in good quantities in fish.

Types of Culture Systems

Aquaculture is conducted in all the three types of aquatic environments:

1. *Freshwater aquaculture:* It involves the culture in the water bodies having salinity level of less than 0.5 parts per thousand (ppt).
2. *Brackish water aquaculture:* It involves the culture in the water bodies having salinity level ranges from 0.5 to 30 ppt, and;
3. *Mariculture or sea farming:* It involves the culture in the water bodies having salinity level of more than 30ppt.

The species of flora and fauna inhabiting the three types of water bodies are accordingly called freshwater species, brackishwater species and marine species. Freshwater which is most extensively used sector of aquaculture, is further divided into two segments.

a) *Cold waters* of higher altitudes having temperature range of Â 18p C and
b) *Warm waters* of plains having temperature range of Ã 18p C

Aquaculture practices in these waters are, therefore, called coldwater aquaculture and warm water aquaculture, respectively. Aquaculture is practiced through various methods. Freshwater aquaculture is carried out in fish ponds, fish pens, fish cages, raceways and on a limited scale in paddy fields. Culture of fishes in ponds is the oldest form of aquaculture.

Different Levels of Aquaculture

Depending on the intensity of operation and degree of management, aquaculture practices are classified into following four operations/levels:-

1. Extensive aquaculture
2. Semi- intensive aquaculture
3. Intensive aquaculture
4. Super intensive aquaculture

Extensive Aquaculture

In extensive level of aquaculture, low stocking densities of 2000-5000 carp fingerlings are used and no supplemental feed is given. Fertilization may be due to stimulate the growth and production of natural food in the water. In such types of culture system, carp culture does not require water exchange during culture period. The ponds used for extensive aquaculture are usually large (more than 100 ha.). The production is generally low, less than 0.5 ton/ha/yr in the case of carps.

Semi-Intensive Level

Semi-intensive aquaculture uses medium size ponds 0.5 ha each with comparatively higher stocking densities than extensive aquaculture (5000-10000 carp fingerlings/ha). Supplementary feeding is done in moderate amounts. In carp culture, water replenishment is done once or twice a month @10%. The production averages around 3-7 tons/ha/yr of carps.

Intensive Level

In intensive level of aquaculture, the pond size is generally small (about 0.2 ha approximately) with very high density of culture organisms i.e. 20000 to 25000 carp fingerlings/ha are stocked. The system is totally dependent on the use of formulated feeds. Feeding of the stock is done at regular intervals. Water replacement under intensive culture is effected on a daily basis. Production under intensive level of aquaculture is much higher, for example, about 12 to 15 tons/ha/year in carp culture.

Super-Intensive Level

Super intensive aquaculture needs running water supply and complete daily water exchange is performed. This system is mostly practiced in cement tanks, fiberglass tanks and raceways etc. which are fitted with high efficiency biological filters for continues recirculation of water. The size of the tank ranges between 50-100m^3. The cultured organisms are fed with high quality formulated feed. The feed is given through demand feeders. The water quality is

regularly monitored with electronic gadgets. Stocking density ranges between 40,000 to 50,000 carp fingerlings/ha. The production ranges between 15-20 tons/ha/yr in case of carps.

Untapped Potential

- Only one third of freshwater aquaculture and 13% of brackish water resources have been utilized for aquaculture
- Average yield – 2.2 tons / ha / yr based on FFDA ponds
- Reservoirs fisheries is highly under-utilized (Av. annual yield – only 20 Kg / ha)
- Semi-intensive primary production based aquaculture of low – valued food fish has the potential to be adopted by millions of small holders
- At micro-level fish and livestock farming are key source of income and buffer against food insecurity

Objectives for Aquaculture Development

- Commercialization of aquaculture for maximization of production
- Food and nutritional security
- Export earnings
- Employment Generation
- Poverty reduction through livelihood development

Important Cultural Practices of Aquaculture

- Composite fish culture
- Integrated farming system
- Raceway culture
- Cage culture
- Pen culture

Composite Fish Culture

A fish pond is a complex ecosystem as the surface is occupied by the floating organisms such as phyto and zoo plankton; the column region has live and dead organic matter sunk from the surface and the bottom is enriched with detritus or dead organic matter. The marginal areas harbor a variety of aquatic vegetation. The different trophic levels of a pond could be utilized for increasing the profitability of fish culture. Keeping this in mind, the concept of Composite fish culture has been developed. The main objective of this culture system is to select and grow compatible species of fish of different feeding habits to exploit all the types of food available in the different nook and corners of the fish pond for maximizing fish production (New 1995, Gupta et al 2011, Gupta et al 2016).The common species of carps having compatibility and different feeding habits and which comes under composite fish culture are Indian major carps such as catla, rohu and mrigal and exotic carps such as common carp, silver carp and grass carp.

Integrated Farming System

Here, otherwise waste output of one enterprise can be utilized as inputs for other enterprise.

- Wastes/by products produced through agriculture are consumed by cattle and fishes and converted to proteins that build up animal flesh.
- Water from fish ponds can be used as inputs for agriculture/horticulture crops as well as for veterinary enterprises. Mud from fish ponds can be utilized as organic fertilizer for agriculture/ horticulture crops.
- All the wastes from veterinary enterprises are utilized as inputs for aquaculture and agriculture.

Cage Culture

Cage aquaculture is a method used for raising aquatic organisms (fish, prawns, molluscs, crabs etc.) within an enclosure, which is installed in suspended state in ponds, reservoirs, lakes, rivers or any other large size water body. In India, it is initiated with the raising of fry (20-25 mm) to advance fingerlings (100-150mm) in water bodies/reservoirs to increase their production. Cages can be of various shapes and sizes. Rectangular cages are however, preferred for easy operation and management.

Pen Culture

Aquaculture in pens implies rising of required aquatic organisms (fish, prawn, molluscs etc.) in an enclosure which is formed by cordoning off areas of an open water body such as inter-tidal areas of the sea or fore shore waters of lakes, reservoirs, river, wet lands etc by net barriers.

Pens are generally constructed on the shore side, in semi-circular, rectangular or square shapes as per the suitability of the site. They are constructed by barricading the other three sides by a wall of nylon netting hung from poles driven to the bottom. The framework is generally made out of bamboo and other

locally available wood.

Raceway Culture

Raceways are designed to provide a flow through system to enable the culture/rearing of much denser population of aquatic animals. An abundant flow of good quality, well oxygenated water is essential to provide respiratory needs and to flush out metabolic wastes, particularly ammonia. Raceways are obviously smaller in size than ponds and occupy much less space. Site selection for a raceway farm has to be done with special care. Naturally the most important consideration is the water supply. The main source of water is springs, streams, deep wells and/or lakes.

Future Needs/Strategies

- Stocking of yearlings / overwintered fingerlings
- Making best use of warmer period
- Periodical harvesting
- Stocking of species in demand and price
- Develop Complementarities among the various farming practices
- Production of low valued carps as well as high valued fish to fulfill the gap between demand and supply
- Strengthening of domestic markets
- Develop Aquaculture as the main source of rural livelihoods and income generation
- Production enhancement through Aquaculture
- Provision of training and education in Aquaculture
- Optimum utilization of resources for sustainable increasing production
- Identification of water bodies/stretches for conservation and replenishment of depleted stocks through ranching
- Restoration and regular stocking of fingerlings in floodplain wetlands and other natural water bodies
- Increase the rearing area by establishing more seed rearing units, pen and cage culture systems
- Strengthening of welfare schemes for the upliftment of community
- Human resource development in the sector

References

1. Gupta A., Sehgal H.S., Sehgal G.K. Low cost diet for monoculture of giant Macrobrachium rosenbergii. Indian Journal of Animal Nutrition. 2011; 28: 54-63.
2. Gupta A., Verma G., Gupta P. Growth performance, feed utilization, digestive enzyme activity, innate immunity and protection against Vibrio harveyi of freshwater prawn, Macrobrachium rosenbergii fed diets supplemented with Bacillus coagulans. Aquaculture International. 2016; 1-14. DOI 10.1007/s10499-016-9996-x.
3. New M.B. Status of freshwater prawn farming: a review. Aquaculture Research. 1995; 26: 1-54.