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Aquaculture Species Diversification in Odisha: A Short Description

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Abstract

Odisha is one of the important maritime states of India having tremendous reach for fisheries and aquaculture development. The increasing species diversification in freshwater aquaculture is emphasized in current years for realization of higher yield through effective use of niches of the pond environment. Widening of the consumers' choice through production of varied fish protein, species diversification also helps in conservation of the vulnerable species. The present review has described few species in nutshell that can be undertaken in large scale farming under the umbrella of species diversification in Odisha on the basis of market demands, consumer preference, their potential based on the literature.

Introduction

Aquaculture is one of the fastest growing enterprises with varied resources and an important source of food, nutrition, livelihood and income in India. The sector provides livelihood opportunities to more than 25 million fishers directly and indirectly at the primary levels in India. At present, India is the second largest fish producing and second largest aquaculture nation in the world. The fish production in India has registered an average annual growth of 7.53% and stood at all time high of 137.58 lakh MTs during 2018-19. The freshwater aquaculture sector of the countries has witnessed the growth of freshwater aquaculture from backyard farming to commercial fish culture through the diversification of several potential fish species into the culture systems in recent years. Carps, catfish, prawns, molluscs and ornamental fish provide an ultimate goal for diversification of species cultured. Inclusion of some of these species has resulted in greater production and has expanded the species scope for fish farmers and consumers. In addition, new indigenous and some exotic food species can expand the scope of the culture system to increase fish yield and doubling the farmer income.

Odisha is blessed with a rich biodiversity of freshwater resources and suitable agro-climatic conditions for captive breeding and culture of many fishes throughout the year. The state has blessed with 6.85 lakh ha of freshwater resources, 4.18 lakh ha of brackish water sources and 480 kms of coastlines suitable for fish cultivation which can be unfolded it into a sunshine sector. The present annual per capita consumption of fish stands at 15.38 kg and production is 7.59 lakh MTs of the state during 2018-19 (Annual Activity Report, 2020). Also, the state imports fish from neighbour states Andhra Pradesh, West Bengal etc to meet the demand of the people. Therefore, species diversification in culture systems can be one of the major benefits to improve the production output and sustainability in the state. The state has

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come up with various diversification strategies for exploration of diverse aquatic fauna so as to bring several potential candidate species under farming. A few of the species that can be undertaken in large scale farming under species diversification in Odisha are described here on the basis of market demands, consumer preference and their potential based on the literature.

1. Clarias batrachus (Magur)

Carps are the mainstay of Indian aquaculture and three species of Indian major carps, *viz*. catla (*Catla catla*), rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) remains a major aquaculture activity contributing a lion share about 87% of the total Indian aquaculture production (NFDB, 2016). Apart from the carps, aquaculture of various catfish in Odisha is widely spreading as an organized industry due to its lucrative return on investment. Among these, *C. batrachus* is a suitable medium-sized catfish for pond culture, popularly called "magur" in Odisha. Moreover, as a potential fish species in aquaculture, it has gained considerable attention in Odisha. It is considered as a delicious and nutritious among the people of East and North-east India because of its rich lipoprotein content, market demand, good taste and therapeutic value. It fetches a higher market price than carp, which is sold in the range of US$ 4-6 per kg in India. It is stocked at higher densities *i.e*. 5-10 times greater than carp stocking densities due to its hardy and air-breathing nature. Small (0.02-0.1 ha) and shallow (0.75-1.0 m) earthen ponds or cemented tanks with a higher stocking density of 50,000.00-70,000.00 /ha are generally used for grow-out culture of this species in the state. It is an omnivorous fish can be cultured with Indian major carps under polyculture practices. Generally, a bigger sized seed of 3-5g shows good survival and growth during grow-out culture practice. The fish tends to grow to a size of 120-150g in 7-8 months in earthen ponds under semi-intensive culture in Odisha. A few hatcheries have been established including private and Govt. sector in Odisha to produces quality seed to meet the demand of the state.

2. *Heteropneustes fossilis* (Singhi)

H. fossilis commonly known as 'Singhi' or 'stinging catfish' is another air breathing medium-sized catfish for pond culture in Odisha. *H. fossilis* has good consumer preference in Odisha because of its excellent nutritional profile, medicinal value and market value. The species is found mainly in ponds, ditches, bheels, swamps, marshes and muddy rivers while it spawns during the monsoon period. Singhi is omnivorous in feeding habit and can be incorporated in the polyculture system with carps, magur and Anabas than monoculture practice in the state. In monoculture, it grows to a size of 150-200 g in 10-12 month of culture when fed with 30-35% protein feed. However, these potential high valued catfishes (Magur and Singhi) have been preferably cultured in the low cost tarpaulin fish tank than the pond system in the state.

3. *Puntius gonionotus* (*Barbonymus gonionotus*)

Silver barb, *P. gonionotus* (also known as *Barbonymous gonionotus*), is considered as an important aquaculture candidate species for diversification in Odisha. Earlier, the species was introduced in Indian ponds during 1972 from Indonesia as a step towards aquaculture species diversification in the culture system. Incorporation of silver barb into the carp polyculture systems in seasonal ponds of Odisha has increased the overall yield and profit owing to its good taste, compatibility with Indian major carps and high consumer demand. Moreover, ease of reproduction, use of aquatic weed as food sources, and utilizing seasonal ponds for its grow-out culture are some advantages for qualify it to be a potential candidate species for incorporation into the carp polyculture system. Inclusion of Silver barb suitably at 5-15% in the major carp system has shown to relatively higher production level than the carp monoculture system. As these medium carp is marketed at a smaller size (250-300g) in a period of 5-6 months of culture allowing major carps to grow further. The Department of Fisheries, Government of Odisha along with ICAR-CIFA, Bhubaneswar and other recognised hatcheries have been involved in the production of quality seed and its promotion as a candidate species in carp polyculture system as a step towards aquaculture species diversification in the state.

4. *Anabas testudineus* (Kau)

It is an obligatory air-breathing fish, commonly known as ''Kau" as well as popularly known as "Climbing perch". It found in all types of waters of the tropical and subtropical world. It is more prevalent in beels, ditches, swamps, rivers and derelict waters which are regarded as their habitual abode. It gained importance among the consumer due to its flesh quality, restorative values, prolonged freshness out of the water and a precious diet for sick and convalescent. It also contains a high quantity of physiologically available iron and copper essential for haemoglobin synthesis. It is a seasonal breeder and spawns once during the rainy season in the state. Likewise, magur and singhi, these high values fish is also successfully cultured in the low cost tarpaulin fish tank (made of PVC or HDPE tarpaulin sheets) in the state by the progressive fish farmers. The stocking density of 3-6 numbers/m^2 is preferred for the grow-out culture with supplementary feeding at a rate of 3-5% of body weight to achieve better growth and survival. Fish attains the marketable size of about 50-60g in a year. Although the fish has gained considerable attention in Indian market especially in the states of West Bengal, Assam, Tripura, Manipur and Bihar, it is also considerable available in the local markets of Odisha. A few progressive farmers successfully carried out the culture and marketing of this high value fish in the state.

5. Genetically Improved Farmed Tilapia (GIFT)/ *Oreochromis niloticus*

The Department of Fisheries, Odisha in collaboration with the World Fish, Malaysia has introduced this fast growing and hardy GIFT tilapia fish species under fish

species diversification strategy and thus boosting the fish production, exports and farmer income in the state. Tilapia prefers to live in shallow water. It is omnivorous in feeding habit that feeds on phytoplankton, periphyton, aquatic plants, small invertebrates, benthic fauna, detritus and bacterial films associated with detritus. It attains sexual maturity at an age of 5-6 months. However, in populations of tilapia, males grow faster than females. Hence, the monosex population farming of tilapias has gained much attention which is achieved either by manual sexing, direct hormonal sex reversal and genetic manipulation. The GIFT strain was developed to be fast growing and adaptable to a wide range of environments than the parent strain. In Odisha, the monoculture of GIFT was reported to produce a production level of 5-6 tonnes per crop of 4-6 months duration with a stocking density of 5 numbers per m^2 during grow-out culture. Further, tilapia can be successfully culture with major carps at a considerable stocking density in seasonal ponds in the state. Odisha Govt. has followed certain guidelines for responsible farming of GIFT in ponds and cages in the state. Moreover, the Directorate of Fisheries, Odisha, has felicitated 10 progressive fish farmers from Mayurbhanj, Baleswar, Cuttack, Jagatsinghpur and Ganjam districts who have successfully farmed and locally marketed the GIFT during food festival held at Cuttack recently. During 2017-18, the GIFT farming was successfully demonstrated in 33 acres of farms spread over 10 districts of the state under state plan scheme. However, the introduction of this fish in open water bodies such as reservoirs is still under limited scale due to the biodiversity and sustainability concerns. The fisheries department has given all type of financial, technical and market linkage support to farmers through Odisha-World Fish Project. The GIFT seed was procured from MPEDA-RGCA satellite GIFT breeding centre located in Vijayawada, Andhra Pradesh. The farm result and market has resulted in a big positive vibe from farmers to topping up the GIFT farming in the state. The biodiversity and sustainability concerns, appropriate steps can be taken to introduce this fish into the water bodies.

6. *Pangasianodon hypophthalmus* (Striped catfish)

Pangasianodon farming is one of the fastest growing candidates of aquaculture of the world. Since 1960, the farming of this catfish was started; however, it took momentum only in 1996 after the technology for seed was developed. *P. hypophthalmus* is a catfish endemic to the South-east Asian regions with a bulk quantity of production occurring in countries, such as Bangladesh, India, and Indonesia. It was first introduced into India in 1997 from Bangladesh and utilised for culture in the southern and northern states of India, particularly Andhra Pradesh and West Bengal. Now-a-days, the fish has gained attention in aquaculture in Odisha due to its remarkable growth rate and acceptance to artificial feed and this fish is now being formed a major segment in open water bodies mainly reservoirs of the state in cage culture system after the carp farming. Recently, the Department of Fisheries, Government of Odisha in collaboration with various national level fisheries institutes has installed many cages in the state for the culture of this fish and also the promotion of reservoirs fisheries. The size at stocking and optimum stocking density differ according to needs, depending on growth and survival. But, the stocking density for *P. hypophthalmus* range from 500 to 700 numbers/m^3 (20 mm) fry for rearing to fingerlings. However, for grow-out culture, the stocking density is in the range of 60 to 100 numbers/m^3 of fingerlings (50-60 mm) for a period of 7-8 months.

Figure 1: Cage culture of Indian major Carps and Striped catfish (*Pangasianodon hypophthalmus*) in Salia Reservoir of Odisha

7. *Tor mosal mahanadicus* (Mahanadi Mahseer)

Tor mosal mahanadicus is indigenous to the Mahanadi River system and is called as "Mahanadi mahseer". It is considered important as an aquaculture potential species. The mahseer is found to be an omnivorous and benthic feeder and also exhibited slow growth in confined condition (pond culture). Comparative slow growth may be attributed to lack of suitable environment due to higher temperature throughout the culture period. Even though the males attained maturity under confined culture condition, but the females could not attain maturity may be due to lack of proper environmental factors. Thus, further researches have been undertaken by experts from ICAR-CIFA, Bhubaneswar

and Directorate of Fisheries, Government of Odisha to develop the breeding and culture technologies of Mahanadi mahseer fish in captive conditions. Even though a proper package of the practice of the fish is under the experimental stage, but it finds its place in the local markets of Odisha state nearer to the Mahanadi river regions. Some preliminary trial by ICAR-CIFA, Bhubaneswar has evaluated the performance of Mahanadi mahseer under polyculture system along with Indian major carps in pond condition in terms of growth and reproductive maturity. Environmental stresses coupled with the increase in fishing activity, destruction of breeding grounds, low fecundity and higher predation have reduced the abundance and availability of natural stock of mahseers to a very low level. In order to ameliorate this situation, the Government of Odisha has already declared this fish as "State Fish of Odisha" for its conservation and rehabilitation purposes.

Conclusion

The state has blessed with a huge aquatic resource for freshwater fisheries development of the state. However, the present production of the state is far behind the potential production level and only Indian major carps have been the main species in culture systems in Odisha. Thus, diversification of culture systems with the inclusion of new candidate species provides a greater thrust on productivity enhancement in recent years in the state. In recent times, both local and exotic candidate species are being adopted by the farmers due to better return on investment. By encouraging technologies like cage culture in reservoirs with new candidate species of local demand, the productivity of the reservoirs and economic of the farmers of the state can be enhanced to manifold. Even though the Mahanadi mahseer have a potential to be a good candidate species for diversification in the state, but it has not been received much attention in aquaculture. So, proper captive breeding and culture techniques can requisite for long term sustainability of species diversification of the state. The adoption of suitable technology would also need to be focussed upon. Apart from these, several extension activities would help in the awareness of scientific cultivation practices, especially in tribal areas. To achieve this goal, recently Department of Fisheries, Government of Odisha has come up with 'Odisha Fisheries Policy 2015' and several other schemes to make the aquaculture sector of the state to a global standard.

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