Milkfish, *Chanos chanos*

A candidate species for open water stock enhancement with potentiality in augmenting fish production

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Introduction

Chanos chanos commonly known as Milkfish, a euryhaline benthopelagic, amphidromous, tropical species under the order Gonorynchiformes is a monotypic species from the family Chanidae, inhabiting marine as well as brackish waters. Milkfish is mostly found in offshore marine waters and shallow coastal embayment; reported to very often enter into estuaries and freshwater streams. In reef-associated coasts or islands, they occur as small to large schools. Milkfish is considered the national fish of the Philippines and locally known as 'Bangus'. It is considered delicious, can grow fast, and tolerate wide ranges of salinity.

Culture of milkfish in brackishwater ponds and pens is an age-old practice and mainly followed in the countries like Philippines, Taiwan, Indonesia, and pacific

Milkfish produced in a brackishwater farm using hatchery produced seeds

island countries. During the year 2014, global milkfish production was 10 lakh MT, and the main contributors were Philippines, Taiwan, and Indonesia. In Indian open waters, Milkfish is available in almost all the brackishwater lagoons and estuaries along both the east and west coasts of India. Culture of milkfish is done mainly in brackish water, coastal, and estuarine water bodies in a traditional way. Culture of milkfish mainly depends on natural seed resources, and is not done in an organized manner due to the non-availability of quality seeds. Recently ICAR-CIBA successfully bred and standardized breeding techniques of milkfish. In India, as per the report of MPEDA (1997) at least 20 million, wild-caught seeds of the species are collected every year from the natural water bodies for farming purposes which is considered one of the reasons for the depletion of natural population stocks. Present status of Milkfish fishery in India is discussed in this communication along with the management strategies for its improvement.

Distribution

Milkfish is distributed in the Indo-Pacific region along the continental shelves and around islands, where temperatures are higher than 20°C. It is available in the Red Sea and South Africa to Hawaii and the Marquesas, north to Japan, south to Victoria, Australia and in the Eastern Pacific region like San Pedro, California to the Galapagos.

Important distinguished characters

Milkfish is considered as a large and long-lived species and is the only living species from the family Chanidae.

The taxonomic position of milkfish is as below:

Phylum	:	Chordata
Class	:	Actinopterygii
Order	:	Gonorynchiformes
Family	:	Chanidae
Genus	:	Chanos
Species	:	Chanos chanos

The main distinguishing features of milkfish are:

- Dorsal spine: 2, Dorsal soft rays: 13 - 17; Anal spines: 2, anal soft rays: 8 - 10; Vertebrae: 46 (Fig. 1)
- Body somewhat compressed and elongated, mouth is small and toothless
- An adipose layer on the eyes
- Single dorsal fin about mid-level of the body
- Caudal fin large and deeply forked
- No scutes on the belly, branchiostegal rays 4
- Cycloid scales
- Body olive green dorsally, flanks silvery, unpaired fins with dark margins

Food and feeding habits

There are few reports available on the food and feeding habits of Milkfish studied in Indian waters and it was found to be mostly a planktivorous fish. During its larval stages, milkfish mainly feeds on diatoms and copepods

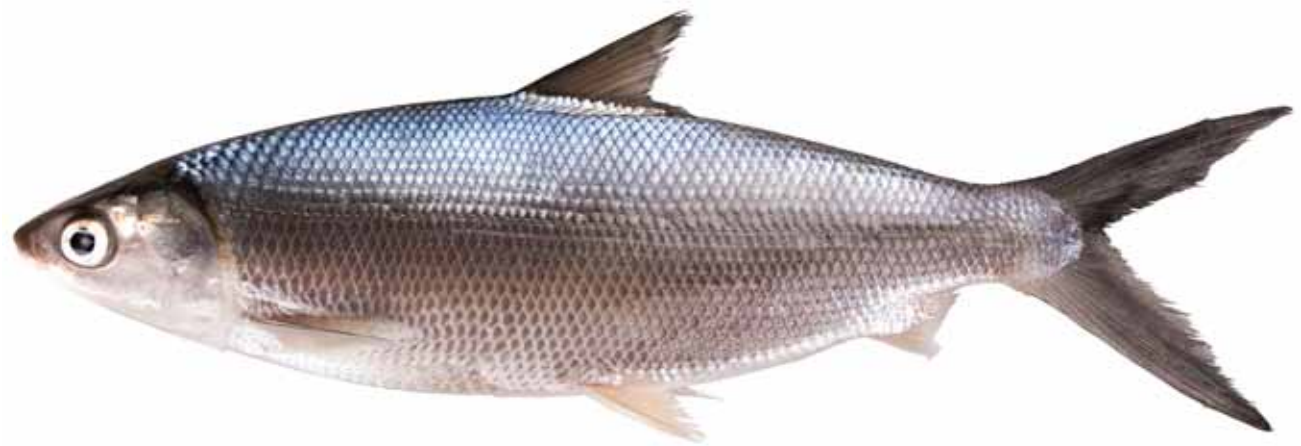

Fig. 1: Milkfish, Chanos chanos

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while in the fingerling stage, they feed on diatoms, copepods, and to a great extent on algae. Adults feed on diatoms, copepods, larval bivalves, Lucifer, Mysis, etc. Other studies reported that while fry and fingerlings also fed on on blue-green algae, detritus, and occasionally on nematodes and crustacean larvae in addition to diatoms; juveniles were found to feed mainly on blue-green algae, green algae, and diatoms (39.18%), algae (39.14%), detritus (17.94%), nematodes (0.65%), crustacean larvae (1.78%), and miscellaneous items (1.31%) in a study conducted in the stocks of Gosthani estuary of India.

Reproductive biology

Sex ratio and maturity: Sexes are separate in the milkfish, but sexual differentiation could be done once they reach adult stages only. In the anal region, males have 2 external openings and for females 3 (in some cases females maturing for the first time may have 2 openings). In the same age group, males are slightly smaller than females, and in the case of sex ratio, males are dominant over females. In Indian waters, size at first sexual maturity was reported to be at 108 - 114 cm in males and 110 cm for females. A total of five gonadal maturity stages were recognized for milkfish, viz., immature, developing, mature, gravid, and spent stages. The ripe ovaries are reported to be bright yellow owing to the yolk-laden eggs. The ripe ova are spherical and translucent, without oil globules, and contained finely divided yolk. The eggs measured an average of 0.8 mm in diameter.

Fecundity and spawning

Milkfish is found to be a high fecund species. The fecundity of milkfish was reported to be around 1.9 to 2.0 million eggs, and sometimes also from 2 to 5 million in numbers. As per the ova diameter frequency, milkfish reportedly spawn once a year. Based on the occurrences of fry in the natural environment, the spawning months of milkfish were observed from February to May. Other studies conducted in Mandapam in Tamil Nadu indicated that milkfish could also breed from November to December in the area, based on the presence of fry and spent fishes. Based on the continuous occurrences of the fry from February-March to October, the researchers have also opined that individual milkfish might be spawning independently, and they could have prolonged breeding seasons.

Open water milkfish fishery in India

In India, Milkfish is usually caught from almost all the brackishwater lagoons and estuaries such as Chilka Lake, Subarnarekha estuary, Mahanadi estuary, Godavari estuary, Krishna estuary, Cauvery estuary etc. It is mostly caught using gill net or entangling net (Fig. 2) besides barrier traps (Fig. 3) in lagoons like Chilka.

Rushikulya estuary in Odisha is one of the major sources of milkfish and shrimp seeds. Three peaks are observed here for milkfish seed availability; during August, September, and April. The seeds collected are mainly used for small scale brackishwater aquaculture.

In the year 1969, a total milkfish production of20 metric tons was reported from the Pulicat Lake against

Fig. 2: Harvest of milkfish from an Indian estuary along with other commercially important species using gill net

Fig. 3 Barrier trap 'Khonda', the fishing gear for catching Milkfish from Chilka

a production of 7 metric tons in 1967. A preliminary survey of Lake Vembanad during 1973 indicated that milkfish was found to be one of the major commercially important species along with prawns, mullets, *Lates calcarifer*, etc. Production of 626 kg of milkfish was also being reported from the Manakudy estuary, Tamil Nadu during the year 2010 - 2012. A study on the diversity of finfish larvae in Vellar estuary of southeast coast of India from 2001 to 2002 indicated that milkfish larvae were well distributed in the estuary along with larvae/juveniles of 44 other fish species.

Milkfish was reported to be one of the major candidate species for commercial fishery in the Chilka Lagoon before 1980s, and thereafter was found to be consistently declining. It was almost missing from the systems during the eco-degradation periods. Opening of the new mouth of Chilka lagoon led to the re-appearing of this fish in the Lagoon fisheries system. During a recent study by ICAR-CIFRI (2011-2017), an annual average Milkfish landing of 4.43 t was observed which was valued at about Rs. 4.68 lakhs. Milkfish was reported to be found earlier in Hooghly-Matla estuary, Krishna estuary, Muthupet estuary, Pulicat Lake, Narmada estuary, etc. in mentionable quantities. However, habitat degradation, pollution, construction of barrages, etc. significantly reduced the abundance of milkfish in the estuarine systems of India.

Culture aspects

Milkfish can be cultured in different brackish water culture systems for a period of 6 to 12 months, depending upon the preferred harvestable sizes. The following culture methods are usually practiced for Milkfish culture.

Pond culture

Milkfish is usually cultured traditionally in brackish water ponds, especially in the bheris of West Bengal, Chilka Lagoon of Odisha, Pokkali fields of Kerala, and in the Ghazni of Karnataka and Goa. Such types of farming practices mainly depend on natural seed collections. Monoculture of milkfish (Fig. 4) can also be done in existing fish farms or unused shrimp farms at different stocking densities ranging from 5,000 to 15,000 nos./acre with an approximate final harvest quantity of 1 - 3 tons/acre/crop.

Polyculture of milkfish along with other cultivable brackish water species is gaining importance in recent years. Milkfish can be farmed suitably with mud crab,

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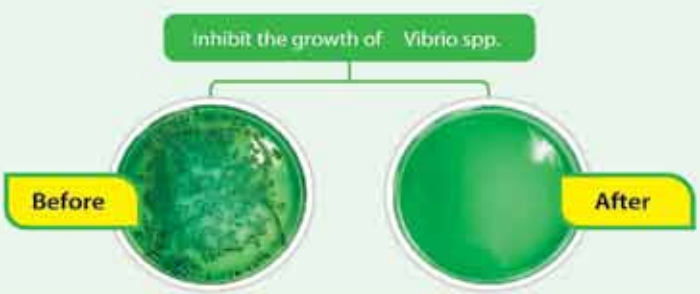

3. DECREASE AMMONIA CONTENT

Prevent the accumulationof toxic substances such as NH_3, NO_2, etc.

4. IMPROVE WATER COLOR

Improve water color regulate the algae and bacteria balance in water, turning your pond from green to clear

5. ESTABLISH BALANCED POND BACTERIA SYSTEM

Compete nutrition with vibrio and inhibit them to grow. Provide nutrition for probiotics in the pond, to establish a well-balanced farming system.

6. INCREASE AQUACULTURE PRODUCTION

Good quality of water prevents fish/prawn infections, making high profit of production

* COMPOSITION:

Bacillus spp. > $1x10^{11}$ cfu/kg

(Bacillus subtilis, Bacillus amyloliquefaciens, Bacillus licheniformis)

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pearl spot, shrimp, mullets, etc. in moderately high saline waters. In low saline waters it can be farmed with carps, tilapia and freshwater prawn.

In intensive farming, milkfish are cultured with the help of paddle-wheel aerators, regular feeding, and water exchange facilities. Production of 4 - 6 tons/ha/year to 12 - 15 tons/ha/year could be achieved with a stocking density of 8,000 - 12,000 nos./ha to 30,000 nos./ha in pond conditions with the stocking of fingerlings/ juveniles of 7 - 15 cm body size.

Cage culture

Milkfish can also be cultured in small cages in shallow waters along the coastal bays with a water depth of up to 2 meters. With a stocking density of 5 - 30 fingerlings/m^3 at a stocking size of 40 - 60 g body weight, and daily supplementary pellet feeding @ 3 - 5% of the body weight can yield a biomass of around 10 - 20 kg/m^3 of the cage area.

Pen culture

Milkfish can also be cultured in pen aquaculture systems in the estuaries/ bheris having a minimum water depth of 1 m and water areas of 5,000 - 10,000 m^2 having high natural productivity. In such pens, milkfish can be stocked @ 30,000 - 40,000 nos./ ha of 40 - 60 g of body size, once or twice in a year. In natural stocking conditions, milkfish feed on naturally available lab-lab (algal mat) and at high stocking densities, they have to be provided supplementary feeding. A production of 10 - 12 tonnes/ ha of milkfish could be achieved.

Way forward

Lack of data on adult milkfish in the natural environment in Indian waters is the major constraint to have a better understanding of the biology of the species. The occurrences of milkfish fry in different seasons along the Indian coastline led us to believe

Fig. 4 Sampling of Milkfish in a monoculture pond in Andhra Pradesh

that it has more than one breeding season. Further studies on biological aspects of this species are most essential in the present scenario. Even today brackishwater aquaculture of milkfish is mainly dependent on natural seed collections, despite standardisation of its artificial breeding protocol. The adverse effects of natural seed collections from certain areas year after year with possible impact on the stock status of the species in such ecosystems need to be studied properly for sustainable management of the fishery. Further, milkfish is found to be a reliable candidate species in brackish water aquaculture due to its euryhaline nature, and it has ready markets at both national and international levels for seeds as well as processed products. Therefore, uninterrupted seeds production in hatchery systems and its proper supply

Fig. 5 Barrier trap 'Khonda' in Palur canal hindering free migration of Milkfish to Chilka from the sea and vice versa

needs to be assured both from the government and private sectors, to make both milkfish fishery and aquaculture production more sustainable.

Considering the highly migratory behaviour of Milkfish, its smooth entry to the lagoon water is crucial for its sustainable fishery. For example, the decline of milkfish fishery in Chilka Lagoon was somewhat revived with the artificial opening of the new lake mouth. However, there are other factors as well that are responsible for its sustainable fishery like the nature of fishing gears being operated in the lake as well as in the entry channel, environmental

parameters, etc. It is mostly caught by gill net and net-lined barrier trap (locally known as Khonda) from Chilka water. Catch structure analysis by two types of gear revealed that the length of most of the Milkfish is below the length of the first maturity. Also, indiscriminate use of fishing gears in the migratory route was found to be the main hindrance to the entry of milkfish to the Chilka Lagoon (Fig. 5). By restricted use of such types of nets in the channel mouth as well as in the migratory route during migration period might regenerate the milkfish fishery in the systems.

As the production of milkfish from the Indian estuarine systems decreased gradually over the years, and its breeding technique has already been standardised, necessary efforts may be initiated for stock enhancement in estuarine habitats (including lagoons like Chilka, Pulicat, Vembanad, etc.) through ranching programmes.

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