

ICAR-CIBA- Carving a niche for brackishwater species in ornamental fish trade

Krishna Sukumaran, Rekha M.U., Dany Thomas, S.N. Sethi, K.Vasagam, M. Kailasam, K.K. Vijayan
ICAR-Central Institute of Brackishwater Aquaculture, Indian Council of Agricultural Research
75, Santhome High Road, Raja Annamalai Puram, Chennai, Tamil Nadu- 600028

Aquatic ornamental industry is today a multi-billion dollar industry with an estimated value of 15 billion US dollars involving trade in over 5000 species. India is blessed with a rich natural biodiversity of fish species including over 400 ornamental fish. The potential of the ornamental fisheries sector to earn valuable foreign exchange for the country, guarantee employment and support livelihood especially to rural communities and women is universally acknowledged. With an enormous diversity and wealth of fish, India's share in the ornamental fish trade is really very low; below 0.1% of the global trade. Data shedding light on the underutilised potential of a sector so promising stirs unrest and calls upon the different operators of the sector- research organisations, entrepreneurs, nodal agencies, funding agencies to plan and contribute further. Although, repeated emphasis has been drawn on need for the development of the ornamental fish industry, India is yet to come out with a concerted status document reflecting a true, complete and current scenario of our ornamental fish industry. A repository of information on the ornamental species, sources, mode of capture, value, volume, value chain, workforce, domestic operators, exporters and issues of concern is wanting. Today as we speak about further progress to be made for the development of ornamental fisheries in our country, we ought to speak more loudly and act more boldly on the issues of sustainability for the good of all involved in the ornamental fish industry. As we do so we do our bit to conserve our fish, our habitats, protect the long term interests of the different players of the sector and guard the nation's reputation as a responsible and reliable exporter in International ornamental fish industry.

Brackishwater ornamental aquaculture is in its infancy. The merit of the brackishwater ornamental species as being easily adaptable to freshwater, brackishwater and marine as per the requirement of the clientele is

often overlooked. Hence, the fish species are often generalised into freshwater or marine category. ICAR-CIBA has initiated efforts for developing a niche for the brackishwater ornamental species. We hope to guide these formative years of this arm of the ornamental fish sector on the principle of sustainability and profitability. For this, CIBA's road map for the development is i) Concerted efforts on developing captive breeding protocols for indigenous brackishwater ornamental fish species ii) Developing indigenous cost effective and efficient feeds for brackishwater ornamental broodstock, larvae and aquarium fish iii) The research outputs from the captive breeding program to be simultaneously translated into models of livelihood development for rural communities; tribal groups and women; entrepreneurs, and develop suitable location specific and client specific rearing systems iv) Popularisation of the brackishwater ornamental species and awareness of aquarium fish as a popular hobby among the youth and the general public.

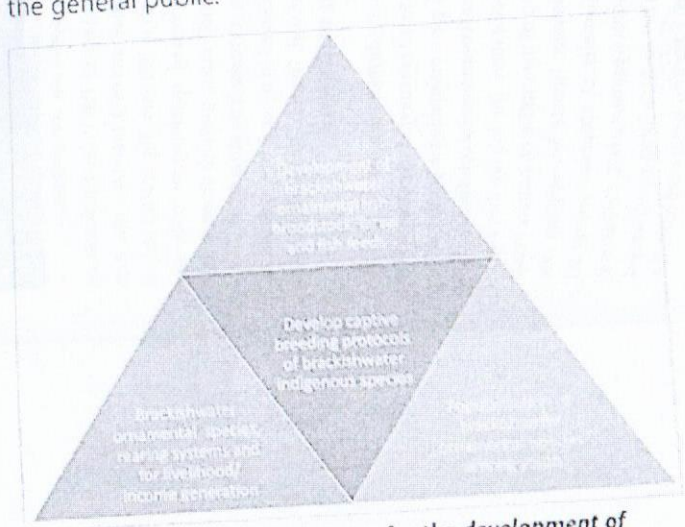


Fig 1. ICAR-CIBA's roadmap for the development of brackishwater aquaculture

Brackishwater habitats are among the most productive environments of our nation supporting an enormous diversity and abundance of species. These habitats offer



a mixture of sub-optimal biotic and abiotic conditions which vary rapidly both spatially and temporally. Hence, the organisms which occupy these habitats are naturally adapted to respond well to environmental stress and disturbances. Euryhalinity is one of the key adaptations which make the brackishwater fish and crustaceans very special. It helps the species to adapt to wide ranges of salinity. In the case of brackishwater ornamental species, this trait can be effectively harnessed and the fish can be stocked in an environment of a desired salinity after the initial acclimatisation phase. More simply said 'brackishwater ornamental fish offer the charm of a marine species at the ease and cost of maintaining a freshwater species'. When planning research strategy for the development of brackishwater ornamental fish species, ICAR-CIBA has focussed its research on the following six ornamental brackishwater fish species; spotted scat, *Scatophagusargus*; silver moony, *Monodactylusargenteus*; orange chromide, *Pseudetroplusmaculatus*; crescent perch, *Teraponjarbua*; Canara pearlspot, *Eetroplus canarensis*; green chromide, *Eetroplus suratensis*.

It is well known that aquaculture supports the production of more than 90% of the freshwater ornamental fish. In USA, one of the largest destinations and markets for ornamental fish, only six among the 20 most popular ornamental fish species are captive bred on a commercial basis- this may be considered a grander reflection of the status of ornamental fish industry globally. Currently, the world market limited in the diversity of captive bred species and those bred in captivity are mostly of the freshwater habitats. The value of an aquarium fish is governed as much by morphometric traits like shape, pattern, colour but also by their survival in the captivity of an aquarium and adaptability to artificial feeds. It has been observed that fish produced under captivity adapt relatively well to an aquaria and survive considerably longer as compared to fish sourced from the wild. International markets are often apprehensive of the fish sourced from the wild as the methods of capture employed could be destructive to the local habitats. To our knowledge; captive breeding protocols of indigenous ornamental species; over 10 marine species; six brackishwater species and few of the freshwater species have reached different levels of success by the research institutes and universities in our

country. Many of these protocols are still to be refined for scaling up the production on commercial levels. Yet without being judgemental, such efforts are to be nurtured and recognised so that Indian ornamental fish industry can stake claim to a more sustainable model based on the captive breeding of a much larger diversity of indigenous species.

i) CAPTIVE BREEDING OF INDIGENOUS BRACKISHWATER ORNAMENTAL SPECIES AT CIBA.

Spotted Scat, *Scatophagusargus*

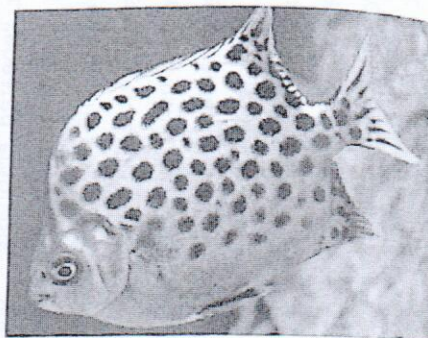


Fig 2. The spotted scat; *Scatophagusargus*

The species belonging to the order Perciformes and family Scatophagidae attains a maximum total length attained by the fish is 380 mm. The spotted scat with its strongly compressed quadrangular body, steep head profile, rounded snout, greenish brown to silvery colouration and spots make it an attractive ornamental fish. The fish is observed to occur in two colour morphs; green scat and red scat. The fish adapts well to aquaria and readily accepts artificial feeds.

CIBA has successfully developed protocols for captive maturation and induced breeding of spotted scat. Brood fish sized 150- 300 g are maintained in ponds and tanks by providing optimal environmental conditions and feed for accelerating maturation. The fish are then used for successful spawning of the captive broodstock through hormonal manipulations. Female fish weighing about 150 g with ova diameter of 400µm are selected and administered hormonal treatments; hCG, 1000 IU per kg and LHRHa, 100 µg per kg. Male fishes are administered the same hormones. Spawning is observed about 90 h



after the first injection. Upto 1 lakh eggs are obtained per spawner. Newly hatched larvae are about 1.6 mm in size. Larvae are reared on rotifers from day 3 to 10, and afterwards with *Artemia* nauplii up to day 25. Fry are then weaned to formulated feed and a fry of marketable size is attained in 25 days.

Moon fish *Monodactylusargenteus*



Fig 3. Moon fish *Monodactylusargenteus*

The moon fish belonging to the order Perciformes and family Monodactylidae are naturally distributed in the Indo-Pacific region. The fish attain a maximum total length of 270 mm. The fish have a compressed body and are bright silver in colour with yellow and dusky dorsal fin tip. Small juveniles are more colourful with yellow over most of their dorsal fin and two vertical black bands over the head. Moonfish easily accept artificial feed in aquariums.

CIBA has standardised broodstock management and induced spawning of moon fish. Mature females above 75 g and oocyte diameter 450 µm are used for induced breeding. For females, LHRHa@ 100 micro-g per kg was standardised as an effective dose for induced spawning. For males half the dose is found to be effective to induce a successful breeding response. Spawning is observed after 36 h of this hormonal administration. The protocols for larval rearing are currently in the process of standardisation.

Pearlspot *Etroplus suratensis*

Pearlspot, belonging to order Perciformes; family Cichlidae are one of the three indigenous cichlids of our country. The fish is distributed in the Indian peninsular region and Sri Lanka. Pearlspot is oval in shape and has grey-green colouration with pearly spots over the body.

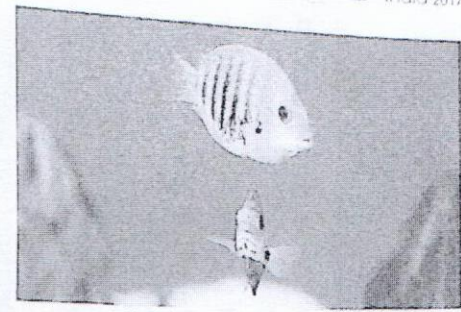


Fig 4 Pearlspot *Etroplus suratensis*

The fish is a popular food fish in Kerala and the juveniles of the species are emerging as an ornamental fish in the markets of other states. The fish is also popular as an ambassador fish of Kerala. Pearlspot exhibits intense parental care of the young ones and interesting behaviour patterns as pairing and territorial defence. The trait is uncommon in other fish species and provides an opportunity to explore the scope for marketing the fish as a "Model Parent Fish" or a "Family Fish" and packaging a pair of pearlspot for special occasions as a "Mother's day" or "Father's day".

The seed production technology of the species in a modular tank based system has been standardised by CIBA. Breeding frequency of pearlspot is optimised through intervention like curtailing of parental care and specialized broodstock feeds. Production of upto 1000 fry per pair per month is observed from the system. Larval rearing is conducted using artemia or starter feeds. Pearlspot larvae are being successfully rearing the by women and tribal groups as a subsidiary homestead activity for generating additional income with the technical guidance from CIBA.

Orange Chromide *Pseudotroplusmaculatus*

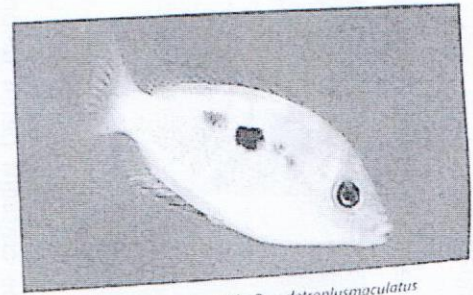


Fig 5. Orange chromide *Pseudotroplusmaculatus*

Scanned by CamScanner



The orange chromide, belonging to order Perciformes; family Cichlidae is endemic to freshwater and brackishwater bodies in the southern India and Sri Lanka. The fish is compressed, oval shaped and yellow to orange in colour. Large black spots are observed on the body. The fish exhibits parental care.

ICAR-CIBA has standardised a breeding model for a pair of orange chromide. The fish were observed to have an average fecundity of 292 and an average breeding interval of 12 ± 2 days. Juveniles were found to attain a mean total length of 45 mm in 75 days. This size is considered to be good for stocking in brackishwater aquarium.

Crescent perch *Teraponjarbua*

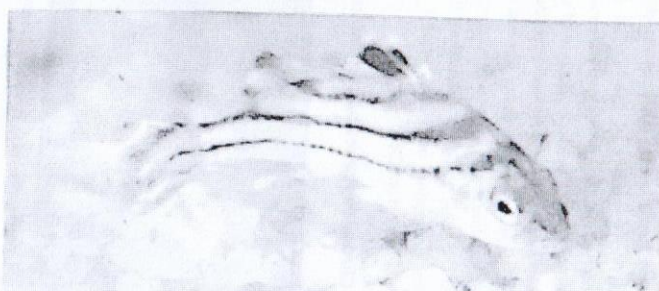


Fig 6. Crescent perch *Teraponjarbua*

The crescent perch belong to order Perciformes and family Teraponidae is distributed in the Indo-Pacific region. The fish has three or four crescent shaped dark brown bands running from the nape to the hind part of the body which earned it the name 'Crescent perch'. Milting males and female with oocyte diameter exceeding 460 μm are used for induced breeding. Hormonal concentration of hCG and LHRHa have been optimised for successful induced breeding. Upto 3 lakhs

larvae are obtained per spawning. Larvae are fed on rotifer *Brachionusplicatilis* and later weaned to artificial feeds.

Canara Pearlsport *Etroplus canarensis*

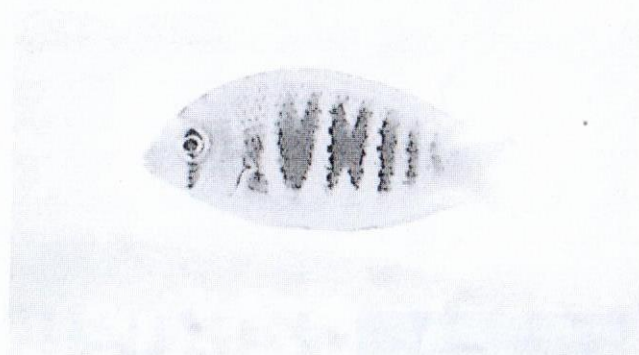


Fig 7. Canara pearlsport *Etroplus canarensis*

Etroplus canarensis, commonly known as Canara Pearlsport /Banded Chromide/ Roman numeral cichlid is an important ornamental fish species listed as Endangered in the IUCN Red list Threatened species 2013.2.(Endangered B1ab(iii)+2ab(iii) ver 3.1). It belonging to order Perciformes; family Cichlidae is endemic to Western Ghats in India and distributed in Kumaradhara and Nethravati Rivers in Karnataka India.

Initiative for breeding Canara pearlsport was undertaken both from the viewpoint of ornamental aquaculture and conservation. At CIBA, the fish were successfully acclimatised to brackishwater aquaria after conducting experiments on salinity tolerance of the species. In the year 2016-17, ICAR-CIBA has successfully captive bred this endangered species through environmental manipulation. This will a major step with regard to the conservation of the species in its wild habitats.

Species	Technology	Method of breeding	Suitable production model
Spotted scat	Standardised, scaling up required	Induced breeding	Hatchery mode- upto 75,000 eggs per spawning (Fish- 200 g)
Silver moony	Induced breeding standardized, research on larval rearing protocols in progress	Induced breeding	Hatchery mode (7500/fish)
Pearlsport	Standardised	Environmental manipulation	Household modular- approx. 1000 fry per month
Orange chromide	Standardised	Environmental manipulation	Household modular-approx 80-100 fry per spawning/parents
Crescent perch	Standardised	Induced breeding	Hatchery mode- upto 3 lakhs eggs per spawning
Canara pearlsport	Standardised	Environmental manipulation	Household modular systems, 50-70 fry/parents per spawning



ii) ORNAMENTAL FEEDS FOR BRACKISHWATER ORNAMENTAL FISH

Advances in feed technology to support different life cycle stages is another critical aspect to enable newer candidate species to be reared in captivity. ICAR-CIBA has developed formulated feeds for brackishwater ornamental fish broodstock, larvae and aquarium fish based on the specific requirement of each stage. Broodstock feeds to optimise reproductive performance of the species is developed. Larval feeds are available in the size range of 200 μm , 300 μm , 500 μm and 800 μm to cater to the needs of different stages of ornamental fish larvae.

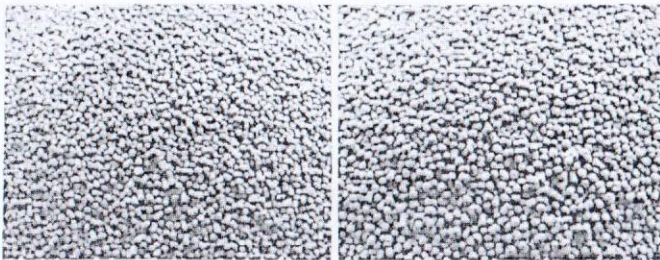


Fig 8 Larval feeds; 300 μm and 500 μm formulated at ICAR-CIBA



Fig 9. Adoption of nursery rearing of ornamental fish as an additional livelihood option for tribal women group Thirvidanthal village at, one of the four village groups involved in the activity

iv) POPULARISING BRACKISHWATER ORNAMENTAL FISH KEEPING AMONG THE YOUTH

Domestic trade in India is witnessing an annual growth rate of 20% and the domestic market for ornamental fish is valued at Rs 20 crores. Our domestic market is currently dominated by more than 300 exotic species. Rising affluence is set to make India the largest consumer market in the coming years. Hence, it is imperative to orient our ornamental fish marketing strategy to cater to the needs of the domestic consumer. Popularising and creating awareness of the indigenous captive bred fish species will be rewarding in terms sustainable development of the indigenous ornamental fish market

DEVELOPMENT FOR RURAL COMMUNITIES, TRIBAL GROUPS AND WOMEN

The research outputs from the captive breeding are being simultaneously translated into models of livelihood development for rural communities, tribal groups and women. For exports of ornamental fish, consistent supply of both quality and volume of fish are critical. For this a cluster based approach may be useful. This model of a nodal hatchery with satellite rearing units is being tested by CIBA. ICAR-CIBA has initiated village based programs; 4 village groups in Tamil Nadu for conducting nursery rearing of hatchery produced larvae and fry. ICAR-CIBA has supported the establishment of the rearing systems; RAS based tank, hapa and trap based systems at each of these villages. Fry of fish are procured at a cost by the village groups, the inputs like feed are supplied by CIBA and the advanced fry or fingerlings produced from the system are marketed to customers.



and avoid havoc created by bio-invasion of escaped exotic fish into our aquatic environment. CIBA has initiated steps to popularise brackishwater indigenous ornamental species among youth especially school children. As a step to popularise the species, school children visiting CIBA have been distributed aquaria for maintaining in their schools. They are also given opportunity for visiting the ornamental fish breeding units, familiarising with the fish species and provided with extension material like pamphlets and posters for their further information.

As a next step forward, ICAR-CIBA intends to scale up and commercialise the production of the brackishwater ornamental species for which the technologies are





Fig 10. Students from different schools distributed given aquarium and brackishwater ornamental fish for popularising fish keeping as a hobby

currently developed. A wide diversity of brackishwater finfish species remain to be explored for their ornamental value; figure 8 puffer, *Tetraodonbiocellatus*, ocellated puffer *Takifuguocellatus*, banded archer fish *Toxotesjaculatrix*, yellow catfish *Horabagrusbrachysoma* to name a few. ICAR-CIBA plans to bring into its fold non-fish ornamental species like brackishwater crustaceans, bivalves and plants. In a long term perspective, captive breeding of an ornamental species is the foundation stone for further development of new varieties to further sustain consumer demand of these species. Colour and body forms of many freshwater fish example guppy, discus, angel fish etc have seen successive changes. This has assured a steady market demand for these species over the past decades. Achieved through a patient, planned and time consuming plan, the selective breeding process proves rewarding for the aquarists or breeders involved. Hopefully, the coming decades will bear testimony to a new variety of spotted scat developed through a well-executed selective breeding program or be awed by the presence of a transgenic orange fluorescent orange chromide exhibited at one of our brackishwater aquaria.

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