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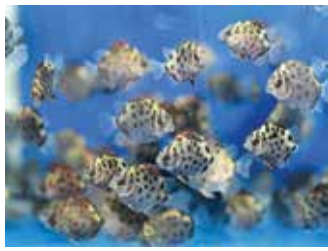
FISH TECH DIGEST

An E-Fisheries Science Quarterly Magazine





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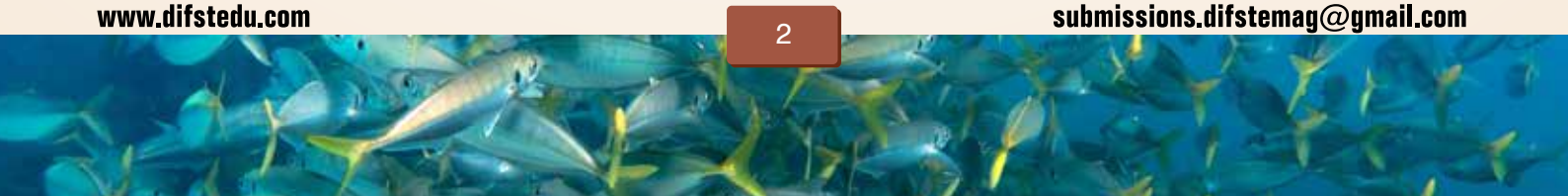
Editor,
Fish Tech Digest



Foreword

It is with immense joy and gratitude to God that I extend my heartfelt greetings to all readers of Fish Tech Digest, a quarterly e-magazine by the St. Devasahayam Institute of Fisheries Science and Technology (DIFST). This magazine is a testament to the innovative spirit and our advancing knowledge and promoting sustainability in fisheries and aquaculture.

The fisheries sector is pivotal in ensuring global food security, enhancing livelihoods, and promoting sustainable aquatic ecosystems. As Chairman of DIFST, I am deeply proud of this initiative, which seeks to bridge the gap between scientific research and practical applications. Fish Tech Digest stands as a platform for sharing insights, innovations, and best practices that will empower students, researchers, fishers and industry professionals alike. This magazine will serve as a beacon of ideas, sharing cutting-edge research, technological advancements, and success stories that can inspire transformative growth in this vital sector.

I commend the editorial team, under the leadership of Prof. S. Felix, for their dedication and effort in crafting a magazine that reflects our mission and vision. Their work exemplifies the spirit of collaboration and academic excellence that defines our institution. I am confident that it will inspire, educate, and serve as a catalyst for growth in fisheries science and technology.

As we launch this magazine, I encourage readers to actively engage with its content, provide feedback, and contribute to its growth. Let us work together to create a sustainable future for the fisheries sector, ensuring that our actions today have a positive impact on generations to come.

May this publication continue to flourish, enlightening minds and fostering sustainable development in this vital field.

Blessings and best wishes,
Most Rev. (Dr.).Nazarene Soosai Th. D.D.D.
Chairman, DIFST
Bishop of R.C. Diocese of Kottar

From the Desk of the Dean

Dear Readers,

Greetings from the DIFST!

In today's rapidly advancing world, the role of technology in agriculture and fisheries has never been more crucial. To ensure that innovations reach their fullest potential, it is imperative for educational institutions, particularly state agricultural universities (SAUs), to actively focus on bridging the gap between laboratory research and real-world application. The dissemination of new knowledge, techniques, and technology must extend beyond academic circles and into the hands of the communities who can truly benefit from them.

*Recognizing this, St. Devasahayam Institute of Fisheries Science and Technology (***DIFST***) is proud to introduce an initiative dedicated to knowledge-sharing and community empowerment: "***Fish Tech Digest"***—an e-magazine focused exclusively on the latest advancement in fisheries science and technology. This digital platform will showcase articles that cover a broad spectrum of topics, including aquaculture, aquatic environment, aquatic animal health, fish processing, fisheries engineering, fisheries economics, fisheries extension and fishing technology, presenting both research-backed insights and practical applications. Each issue will be carefully curated with high-quality articles supported by reliable national and international data, making Fish Tech Digest a trusted source of knowledge in the field.*

Moreover, this e-magazine aims to highlight collaborative efforts within the fisheries sector, drawing contributions from esteemed research institutions, other universities and KVKs (Krishi Vigyan Kendras). We hope to provide a space where the best ideas and practices in fisheries can be shared, with a strong focus on making a positive impact on farming and fishing communities across the state and the nation. Our commitment to this goal is unwavering, as we believe that true progress comes from collective growth and the continuous exchange of knowledge.

Fish Tech Digest is more than just a publication—it is our commitment to serving the community and advancing the field of fisheries science. I look forward to seeing the impactful insights and valuable contributions that will shape each issue, and I am excited for all of you to be a part of this journey.

Thank you for your continued support and engagement.

Warm regards,
S. Felix
Dean, DIFST

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Potential Brackish water Ornamental Fishes and Exploring India's Brackish water Beauty: Diversifying Lesser-Known Ornamental Fishes

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Abstract

This is to highlights the significant contributions of ICAR-CIBA in advancing the breeding and seed production of indigenous brackishwater ornamental fish species. The focus is on species like silver moony, spotted scat, orange chromide, green chromide, and knight goby. Detailed breeding protocols and successful spawning techniques are discussed, emphasizing the importance of innovative approaches in aquaculture. By promoting lesser-known species, this article aims to contribute to biodiversity conservation and sustainable aquarium practices. The potential of other captivating brackishwater species, such as the four-banded tigerfish, green pufferfish, and Tiger dwarf goby, is explored, opening new avenues for ornamental fish culture and conservation.

Introduction

Keeping ornamental fish at home has become one of the most popular hobbies worldwide, with aquarium keeping recognized as the second most popular pastime after photography. The global trade in ornamental fish is a multibillion-dollar industry involving participation from over 125 countries (Raja *et al.*, 2019). The industry is estimated to be worth over US$ 15 billion, with more than 2 billion live ornamental fish traded annually (Satam *et al.*, 2018). Developing nations play a major role in this sector, contributing more than 60% of the global supply. The trade encompasses over 2,500 species, with more than 60% being freshwater and the remainder marine. The ornamental fish industry is predominantly focused on freshwater species, with approximately 15% of the traded species being marine or brackish water, primarily sourced from wild collections (Raja *et al.*, 2019).

With its rich biodiversity, India hosts around 400 native freshwater ornamental fish species and about 700 indigenous marine species (Raja *et al.*, 2019). Freshwater species account for about 80% of the trade, with the remaining 20% coming from marine and brackish waters (Mahapatra, 2018). The ornamental fish sector holds significant potential for generating foreign exchange, providing employment, and supporting livelihoods, especially in rural communities and among women. Despite its vast diversity of ornamental fish, India's contribution to the global trade remains marginal at just 1%. According to an assessment by the Marine Products Exports Development Authority of India (MPEDA, Kochi), there are about one million ornamental fish enthusiasts

within the country. The domestic market is valued at approximately US$ 3.26 million, while export earnings stand at about US$ 0.38 million (Ghosh *et al.*, 2003). The industry experiences an annual growth rate of 14%.

India's rich species diversity, suitable climate, and affordable labour make it an ideal location for ornamental fish farming (Felix *et al.*, 2012). The primary states engaged in this sector include Tamil Nadu, Kerala, and West Bengal (Felix *et al.*, 2012). The Indian ornamental fish market features two main categories: exotic and native species. Exotic varieties dominate the domestic market, comprising 99% of sales, with 288 recorded exotic types present in India. Over 200 of these freshwater species are bred across various regions in the country (Ghosh *et al.*, 2003). Native ornamental fish are primarily exported, with the northeastern states, Andaman & Nicobar Islands, Lakshadweep, and the Western Ghats being rich sources of indigenous species. Approximately 85% of these native species come from the northeastern states, and about 90% are collected and reared for export purposes. Currently, around 100 native species have been designated as aquarium fish (Felix *et al.*, 2012).

The main export hubs in India are Kolkata, Mumbai, and Chennai, with Kolkata handling about 90% of exports, followed by 8% from Mumbai and 2% from Chennai (Ghosh *et al.*, 2003). The industry involves around 4,000 people engaged in breeding, live food collection, trading, and export activities, and there are 20 registered exporters. Despite India's significant native fish diversity, only a small portion is utilized in the domestic ornamental fish trade, which remains largely dominated by exotic species. Although many indigenous species have high potential as ornamental fish, they have not been fully exploited (Singh *et al.*, 2018).

The brackish water aquarium sector remains largely untapped, offering numerous development opportunities. Combining elements of both freshwater and marine ecosystems, brackish water aquariums have the potential to become an engaging and profitable venture. While marine aquariums are known for their vibrant colours, swift movements, and unique marine flora, freshwater aquariums are often highlighted for their landscaping and plant life. However, maintaining marine aquariums is generally considered costly and complex. Brackishwater, as an intermediate ecosystem, can bridge the two worlds by focusing on the salinity tolerance of aquatic life through scientific research. This enables the integration of features from both marine and freshwater environments into a single ecosystem: *the brackishwater aquarium*. Such an aquarium can host a variety of plant and animal species capable of thriving in both freshwater and saline conditions, showcasing the best aspects of all three types of ecosystems.

Brackishwater ornamental fish offer the visual appeal of marine species but come with the affordability and ease of freshwater species. This makes brackishwater ornamental fish rearing a feasible option for small-scale, backyard production systems. Moreover, the cost of maintaining and producing brackishwater ornamental fish is significantly lower than that of marine species, adding to their economic viability.

Captive breeding of Indigenous brackishwater ornamental species at ICAR-CIBA

Recognizing the significance of this opportunity, ICAR-CIBA (Central Institute of Brackishwater Aquaculture) has taken steps to promote brackish water thematic aquariums and specific ornamental species suited to such environments. ICAR-CIBA has successfully standardized the breeding and seed production techniques for six key brackish water ornamental fish species: the silver moony (*Monodactylus argenteus*), spotted scat (*Scatophagus argus*), orange chromide (*Pseudetroplus maculatus*), green chromide (*Etroplussuratensis*), and knight goby (*Stigmatogobius sadanundio*).

i. Silver moony, *Monodactylus argenteus*

The silver moony, a member of the order Perciformes and family Monodactylidae, is naturally found in the Indo-Pacific region. This fish is known for its compressed body and bright silver colouration, accented by yellow and dusky tips on the dorsal fin. Juveniles display more vibrant colouring, with yellow covering most of the dorsal fin and two distinct vertical black bands across the head. In aquariums, silver moony readily accepts artificial feed.

ICAR-CIBA has developed protocols for broodstock management and induced spawning of silver moony (Thomas *et al.*, 2020). Broodstock weighing between 70-100 g is maintained in both ponds and tanks under optimal environmental conditions and fed high-quality feed to promote maturation. Females with ova diameters larger than 500 µm are selected for hormonal treatment using LHRHa, which is also administered to males. Spawning typically occurs 36 hours after hormone injection, yielding between 4,000 to 6,000 eggs per 100 g female. Larval rearing involves feeding with rotifers and Artemia nauplii.

Fig 1. Monodactylus argenteus

ii. Spotted scat, *Scatophagus argus*

The spotted scat, a member of the order Perciformes and the family Scatophagidae, can reach a maximum total length of 380 mm. This ornamental fish is known for its strongly compressed, quadrangular body, steep head profile, rounded snout, and colouration that ranges from greenish-

brown to silvery, accented with spots. The species also exhibits two colour morphs: green scat and ruby/red scat. Adaptable to aquarium environments, spotted scat readily consumes artificial feed.

ICAR-CIBA has developed successful protocols for the captive maturation and induced breeding of spotted scat. Broodstock weighing between 150-300 g are maintained in ponds and tanks under optimal conditions and are provided with high-quality feed to promote maturation. Hormonal treatments are used for inducing spawning. Female brood fish weighing around 150 g with ova diameters of 400 µm are given hormone treatments with hCG (1,000 µg per kg in two split doses) and LHRHa (100 µg per kg). Male fish receive the same hormone regimen. Spawning typically occurs about 90 hours after the initial injection, yielding up to 1,00,000 eggs per spawner.

Newly hatched larvae measure approximately 1.62 mm and are fed rotifers from day 3 to day 10, followed by Artemia nauplii until day 25. The fry are then transitioned to formulated feed, reaching marketable size within 25 days.

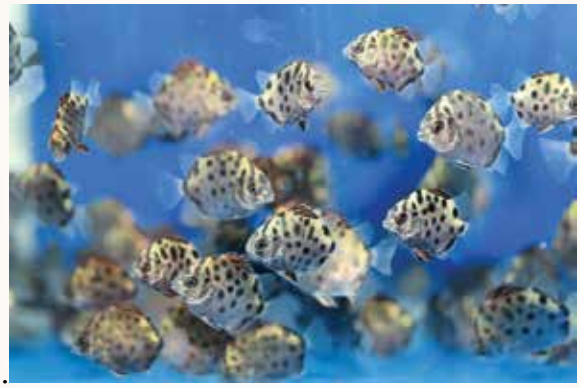

Fig 2. Scatophagus argus

iii. Orange chromide, *Pseudetroplus maculatus*

The orange chromide, part of the order Perciformes and family Cichlidae, is native to freshwater and brackish water habitats in southern India and Sri Lanka. This fish is known for its compressed, oval body shape and bright yellow to orange colouration, accented with large black spots. Notably, the orange chromide exhibits parental care behaviour. ICAR-CIBA has established a standardized breeding model for orange chromides, using pairs for reproduction. The species has an average fecundity of 200 to 300 eggs and a breeding interval of approximately 12±2 days. Juveniles grow to an average total length of 45 mm within 75 days, making them suitable for stocking in brackish water aquariums.

Fig 3. Pseudetroplus maculatus

iv. Pearlspot, *Etroplussuratensis*

The pearlspot, belonging to the order Perciformes and family Cichlidae, is one of the three native cichlid species in India, distributed across the Indian peninsular region and Sri Lanka. This fish is characterized by an oval body with grey-green colouration and distinctive pearly spots. While pearlspot is a popular food fish in Kerala, its juveniles are gaining attention as ornamental fish in other states, and it is also celebrated as an ambassador fish of Kerala. The species is known for its strong parental care and behaviours such as pairing and territorial defence.

ICAR-CIBA has standardized the seed production technology for pearlspot using a modular tank-based system. The breeding frequency is enhanced through interventions like reducing parental care periods and providing specialized broodstock diets. The system has shown production of up to 1,000 fry per pair per month. Larval rearing is carried out using Artemia or starter feeds. Women and tribal communities have been successfully engaged in rearing pearlspot larvae as a supplemental or homestead activity, contributing to income generation with technical support from ICAR-CIBA.

Fig 4. Etroplussuratensis

v. Knight goby, *Stigmatogobius sadanundio*

The knight goby (*Stigmatogobius sadanundio*), a striking member of the family Gobiidae, is commonly known in the aquarium trade as the knight goby or fan dance goby. It is native to South Asia (India, Bangladesh, Pakistan, and Sri Lanka) and Southeast Asia (Thailand, Cambodia, Malaysia, Indonesia, and Singapore), where it inhabits estuarine river zones. This carnivorous fish feeds on fish fry, aquatic invertebrates, and insect larvae, reaching a maximum size of 9 cm. Its grey body is decorated with black spots, and a distinctive blue spot is present on the dorsal fin. Males typically have a more extended dorsal fin, while females are smaller and develop a yellowish, bulging abdomen during breeding.

In captivity, knight gobies spawn in lower salinity conditions. Males and females can be differentiated by examining the genital papillae: elongated and slender in males, and round and button-shaped in females. Before egg deposition, the male and female form a pair and clean the substrate. The female, with a visibly bulging belly, lays between 1,000 and 2,000 eggs per spawn on the cleaned substrate, which the male guards diligently. The fertilized eggs, transparent and oval-shaped, hang by fine threads from the substrate. The male fans the eggs and removes any infected ones to ensure their health. Depending on the water temperature, embryonic development is completed in 2 to 5 days, and the hatchlings measure approximately 2.4 to 2.5 mm in length.

Fig 5. Stigmatogobius sadanundio

Potential brackish water ornamental fish species

i. Four banded tiger fish, *Datnioidespolota*

D. polota, commonly known as the four-banded tigerfish, four-barred tigerfish or silver tigerfish, is a species belonging to the order Perciformes and family Datnioididae. It is distributed in Asia and Oceania, India to Indonesia and New Guinea. It occurs on the northeastern coast of India and Bangladesh also. It is a benthopelagic and tropical fish inhabiting brackish and freshwaters near the coast like mangroves, lagoons, estuaries and lower parts of rivers.

Fig 6. Datnioidespolota

ii. Green puffer fish, Dichotomyctere fluviatilis

D. fluviatilis is known as the green pufferfish that belongs to the order: Tetraodontiformes and the family: Tetraodontidae. It is distributed mainly in South Asia, including India, Sri Lanka, Bangladesh, Myanmar, and Borneo. This species is demersal and found in the tropical region. The juveniles occur in freshwater and adults are found in brackishwater. Moreover, adults usually occur in slow-moving rivers, estuaries, and the upper reaches of backwaters. It prefers shady, marginal areas. It feeds on molluscs, crustaceans and other invertebrates as well as vascular plants and detritus.

Fig 7. Dichotomyctere fluviatilis

iii.*Mangarinuswaterousi*

The genus *Mangarinus* currently includes only one species, *Mangarinuswaterousi Herre, 1943.* This species is found in the tropical waters of bays and estuaries throughout Southeast Asia. The maximum recorded length (Standard Length, SL) for this species is 4.8 cm. It has been observed in shallow waters in the Philippines, Brunei, Thailand, Indonesia, Japan, China (Hong Kong), the Marshall Islands, Fiji, and the Solomon Islands. In India, it has been reported from the Vellar estuary in South India. This species is highly sought after in the ornamental fish trade due to its vivid coloration and distinctive behaviour.

Fig 8. Mangarinuswaterousi

iv. Tiger Dwarf Goby, *Mugilogobiustigrinus*

The *Mugilogobiustigrinus*, also known as the Tiger Dwarf Goby, is a small species of goby found in mangrove creeks and pools of south-eastern Asia. The Tiger Dwarf Goby is characterized by its distinctive physical appearance, including a silvery-gold hue with four complete black bands and two half bands, along with a singular rounded to elongate black spot located at the base of the caudal fin. They are relatively small, with a maximum length of about 2.5 cm. These gobies are fascinating for aquarists who can meet their specific care requirements. They thrive in aquariums with a soft, sandy substrate, rocks, and driftwood to provide hiding places.

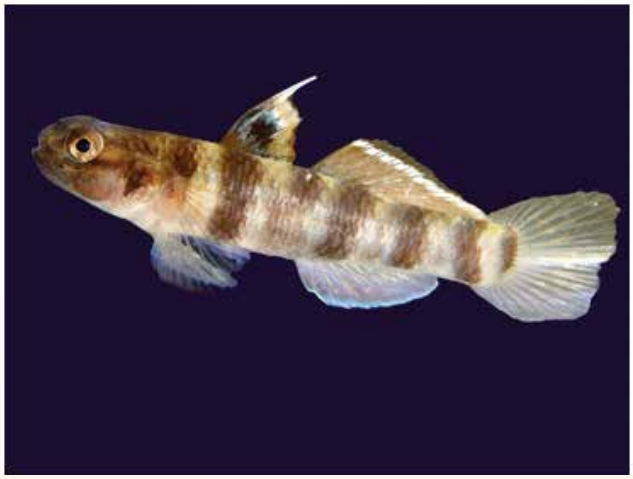

Fig 9. ***Mugilogobiustigrinus***

Conclusion

The technologies developed by ICAR-CIBA are geared towards promoting livelihood opportunities for entrepreneurs, rural communities, tribal groups, and self-help groups (SHGs) across various parts of the country. These technologies have been demonstrated in different states through a Public-Private Partnership (PPP) model. Brackish water ornamental fish rearing is particularly well-suited for adoption as a backyard production system, as the costs associated with maintaining

and producing these fish are lower compared to marine ornamental fish.

To popularize brackish water ornamental fish species and overcome existing challenges, it is important to focus on targeted strategies that support awareness, training, and sustainable practices.

- ❖ Broodstock development, hatchery and seed production technology for the potential species.
- ❖ Availability of quality and affordable feed for farming of different ornamental species. ❖ Comprehensive health management with disease diagnostics and treatment measures for broodfish and larvae.
- ❖ Development of entrepreneurship in brackishwater ornamental fish farming.
- ❖ Establishment of marketing channel and value chain for the new species.
- ❖ Market information and training on marketing intelligence.
- ❖ Ensuring technical assistance for ornamental fish farming from production to marketing level.

ICAR has launched an All-India Network Project on Ornamental Fish Breeding and Culture, a collaborative research initiative focused on developing technologies for breeding, seed production, and culture of freshwater, brackishwater, and marine ornamental species. The primary goal is to ensure the sustainability of the ornamental fish industry.

The ornamental fisheries sector presents a promising opportunity for both rural and urban households to increase their income. ICAR-CIBA plans to scale up and commercialize the production of brackish water ornamental species for which technologies have already been developed. There remains significant potential for exploring a wide variety of brackish water finfish species for their ornamental value. From a long-term perspective, the foundation for the industry's continued growth lies in the successful captive breeding of ornamental species, which will support the development of new varieties and help sustain consumer demand in the ornamental fish market.

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